# Norms and Contracting*

Judd Kessler† Stephen Leider‡

November 13, 2008

**Abstract**

We argue that agents create norms specific to their relationships through the contracts they establish. We build a theory of how the enforceable and unenforceable aspects of a contract determine the norm and how norms impact behavior. We then demonstrate experimentally that even totally unenforceable "handshake" contracts (i.e. contracts with no enforceable restriction on actions) move behavior substantially towards the first best in a variety of games. Additionally, when possible restrictions are weak, a contract with only an unenforceable agreement is often more effective than a contract with only an enforceable restriction. Combining an enforceable restriction with an unenforceable agreement is frequently no more effective (and sometimes strictly less effective) than an unenforceable agreement alone. These results suggest an alternative explanation for contractual incompleteness: establishing a norm can substitute for weak enforceable restrictions without diminishing the effectiveness of contracts.

*We thank Lucas Coffman, Oliver Hart, David Laibson, Muriel Niederle, Florian Englmaier, Alvin E. Roth and seminar participants at Harvard University for helpful comments. The first author thanks the National Science Foundation. The second author thanks the National Science Foundation and the Sperry Fund for financial support.

†Harvard University, 25 Harvard Way, Baker Library 420F, Boston MA 02163, jkessler@hbs.edu

‡Harvard University, 25 Harvard Way, Baker Library 420J, Boston MA 02163, sleider@hbs.edu

# 1 Introduction

Contracts have long been studied as a means of making commitments, establishing payments, and allocating decision and control rights—playing an important role in allowing for more efficient exchanges. Real world contracts, however, are notable for their incompleteness. They tend to be remarkably simple and frequently omit potentially useful and feasible provisions.[1] The literature has proposed many factors that might limit the ability of economic actors to write complete contracts: direct costs of contracting, non-verifiability of outcomes, unforeseen outcomes, and so forth (see Hart (1995) and Tirole (1999) for surveys). While some papers have found that incomplete contracts can be quite efficient in certain cases, in general the literature suggests extensive incompleteness comes at a large cost. So why do we observe so many incomplete contracts in the world? We propose a new reason why incomplete contracts may be so prevalent, namely that contracts *establish the norms that govern a relationship*, and incomplete contracts are sufficient to set high norms.

Many economic actors appear to be inherently concerned with "doing the right thing." Subjects in a variety of laboratory experiments often take actions inconsistent with selfishness. Economists (and other social scientists) have argued that individuals are intrinsically concerned with following some notion of appropriate behavior, and *norms* have been a common means to understand this behavior in an economic context. Most previous research on norms has focused on norms as an external force affecting behavior.[2] We argue that norms can be *endogenous and local to a relationship*, and that the components of a contract—including the unenforceable agreements established during the contracting process—determine the norm for the relationship.

Thus, rather than focusing entirely on the best use of the (limited) enforceable components of a contract, we emphasize the role that completely unenforceable parts of a contract (which

[1] Macauley (1963) is a seminal paper documenting the under-specification of many manufacturing contracts; similarly Carlton (1986) suggests that for many industrial transactions the "contracts specify neither price nor quantity" (see also Lyons (1996) for a survey). Employment contracts often essentially specify only the hours, the duration, and the compensation. Service contracts are often similarly simple (e.g. hourly rate or fixed price contracts), generally not conditioning on potential verifiable information, nor specifying potential specific behaviors (see Eggleston et al (2000)).

[2] See for example Akerlof (1980) for a seminal paper. We discuss this literature further in Section 5.

we call "handshake" agreements) have on behavior. While verifiability or other limitations on contracting may prevent writing a complete enforceable contract, these limitations are unlikely to hinder the ability of parties to create a mutual, unenforceable agreement to take the first best action.[3] In contrast to the standard theory, which assumes that unenforceable components of a contract cannot affect behavior, we find that contracts with handshake agreements that set high norms can be incredibly useful. We demonstrate experimentally that with a handshake agreement, very weak (and even totally unenforceable) contracts can substantially increase the efficiency of individuals' actions. Moreover, establishing a high norm is an effective substitute for an enforceable restriction. This finding can help explain the empirical prevalence of incomplete contracts. If contracts with few enforceable restrictions are easy (and cheap) to write and can substantially increase efficiency, we are likely to observe a significant number of these contracts.[4]

We formalize our conception of norms by developing a model where economic agents receive disutility from violating norms, and the contracts they choose endogenously determine the norm. We show theoretically that across several different games, establishing a high norm (one close to the first best) moves actions towards the first best and increases total utility. Moreover, as agents become more norm sensitive (i.e. they receive greater disutility for violating the norm), the first best is achievable. We then consider two possible assumptions for how contracts determine norms: either norms depend only on the unenforceable "handshake" agreements within the contract or norms depend on both the enforceable and unenforceable aspects of the contract. Under the latter assumption, including enforceable restrictions lowers the norm (compared to a contract with only an unenforceable agreement). This assumption captures the notion, drawn from the literatures on "crowding out" of intrinsic motivation and the "hidden costs of control,"[5] that an enforceable restriction in a

[3]Thus, even if the specific first best action is not known ex ante, the parties can agree to the behavioral maxim to take the first best action when it becomes known.

[4]Our conception of norms as being established in the contracting stage of a relationship differs significantly from the way other papers have suggested that contracts and norms interact. Sliwka (2007) argues that an employer's unilateral contract choice signals her belief about which pre-existing behavioral norm applies for her employees. Hart and Moore (2008) argue that contracts set reference points and that individuals will provide less effort when outcomes differ from these reference points. We discuss these papers and other related literature in Section 5.

[5]Both the "crowding out" (e.g. Gneezy and Rustichini 2000a,b) and the "hidden costs" (e.g. Falk and

contract allows individuals to justify living down to the letter of the contract, rather than fulfilling its spirit. Individuals may see the inclusion of a minimum as implicit permission to take only that action.

Given each assumption about norms, we identify the optimal contract, showing that if the possible enforceable restrictions of the contract are sufficiently weak, then the optimal contract involves establishing a high norm through an unenforceable "handshake" agreement. In these cases, contracts consisting of only an unenforceable agreement can be as efficient as a contract with both a "handshake" and a minimum. If adding an enforceable restriction actually reduces the norm, then a contract that is purely unenforceable can be strictly better than a contract with both enforceable and unenforceable clauses. Our approach allows norms to be a choice variable for agents, raising the question of what the optimal norm is for a given context, as well as the optimality of other institutions (like contracts) with which norms may interact.

To test and identify the interaction between norms and contracts, we conduct an experiment where subjects make simple contracts that consist of only an enforceable minimum action (a "Minimum" contract), only an unenforceable agreement to play the first best (a "Handshake" contract), or both a minimum and an unenforceable agreement (a "Combined" contract), before playing a symmetric game (specifically one of two public good games, a mutual dictator game, or a game of Bertrand competition).[6] We find that across all the games, the Handshake contract substantially increases actions towards the first best. Moreover, in three of the four games, it is significantly more effective than the enforceable Minimum contract (in the fourth game it is equally effective). Additionally, it is equally as effective as the Combined contract in two games, and is strictly superior in a third game. In particular, the Combined contract's ability to establish a high norm explains the substantial majority

Kosfeld, 2006) literatures demonstrate that enforceable control and incentive mechanisms can be detrimental to efficiency; these literatures are discussed further in Section 5. More generally, one might imagine that multiple reference actions could create confusion about what the norm is or otherwise bias the norm. For example, the literature on anchoring (see Kahneman et al (1999) for a survey) has shown that even obviously arbitrary reference values can bias subjects' construction of estimates or expectations. In particular, Robbennoltt and Studebaker (1999) show experimentally that (generally non-binding) limits on punitive damages lead to a significant increase in both punitive and compensatory damages.

[6]Two games (one of the public good games and the Bertrand competition game) exhibit strategic complements, while the other two games are strategically independent.

of its benefit. We also find evidence that the norm is lower under the Combined contract than under the Handshake contract in the Bertrand Game. In contrast to experimental literatures that stress the cost of enforceable components to agreements, we find that adding an enforceable minimum clause to a Handshake contract is not uniformly damaging. Additionally, our results do not depend on only very weak enforceable actions being available; we obtain largely similar results in a condition in which subjects play the mutual dictator and Bertrand games with a substantially higher minimum action.

Our experimental paradigm allows us to directly compare the increase in efficiency from contracts with only enforceable restrictions, with only unenforceable agreements, or with both. We find that the ability very weak contracts to set a high norm plays an important role in their appeal relative to limited enforceable tools. In particular, we find that the Handshake contract does just as well as (and sometimes better than) the Combined contract in most settings. The handshake agreement contributes between 51% and 173% of the efficiency increase of the Combined contract (where percentages greater than 100% indicates cases where the Handshake contract is more efficient than the Combined contract). Therefore, even a small cost of adding an enforceable element to a contract will make incomplete contracts much more appealing.

In addition to providing a new experimental paradigm, results from our experiment allow us to present evidence as to why other models of behavior fail to rationalize our data. We argue that our model, in which agreements determine norms and norms influence behavior, best explains our findings. In particular, we observe a number of subjects choosing not to make Handshake contracts, despite receiving a higher monetary payoff when they have the contract. These subjects choose to take a monetary loss rather than make an agreement that they would ultimately violate. This result lends support to our modeling assumptions that the chosen contract establishes the norm and that individuals receive disutility for violating the norm.

While we have so far been speaking of the unenforceable agreements as "part of the contract"—and for the sake of the experiment the "handshake" agreement is written explicitly in the same manner as the enforceable restriction—it is perhaps somewhat more likely that the verbal negotiations throughout the writing of a contract is sufficient to establish the principles, values, and norms that the economic actors will use to govern their relationship (i.e. the "handshake" agreement). More generally, we envision the contracting phase of a relationship as a reasonable time for the norms of a relationship to be set by the agents.

At times, however, it may be advantageous for the unenforceable "handshake" clauses to be written directly into the contract itself. In particular, if the parties who create the contract, and thus the norm, are not the parties who ultimately fulfill the norm, then codifying the norm within the contract may help communicate the norm to the other parties to the relationship. One potential example of explicitly stating the unenforceable norm governing a relationship can be seen in the Partner's Agreement for Accenture LTD[7] (a large management consultancy firm), where the specification of the partners' duties and obligations are almost entirely described in terms of "principles," such as (emphasis added in all cases):

> §2 The Partners are a group of entrepreneurs who share a *common vision* of improving the way the world works and lives and are committed to each other to achieve enduring economic success, through mutual support and assistance. The Partners are committed to certain *key partnership principles* of mutual respect, a commitment to performance, stewardship, interdependence, honesty and integrity, social responsibility and shared rewards....
>
> §2.3 Each Partner recognizes and understands that at all times the Partners *should act in a stewardship capacity* in respect to the Company and, accordingly, that each Partner has the responsibility for those whose careers are substantially ahead of them to participate to the greatest possible extent in the development of the Company. This *requires constant subordination of personal interests and of maximum financial gains of the individual Partners*. It also recognizes, however, that financial soundness and good income performance are required to make possible such reinvestment in the future and to attract and hold outstanding men and women for future growth.

While these principles may have some enforceable impact in extreme cases, to a large extent they are merely strongly worded rhetorical statements. Yet the partners felt it was sufficiently important to state these principles explicitly in the Partnership Agreement. We

[7] Available at http://contracts.onecle.com/accenture/partners.pma.2001.04.18.shtml. These partnership agreements are generally not made public, so it is hard to know how representative this kind of language is.

argue that this was done to establish the norm for the partnership because it would ultimately affect behavior. While stating the norms explicitly may be somewhat unusual, more generally the rhetorical preamble to contracts may play a similar role. In a similar manner, corporate mission statements and credos, which are considered the basis for corporate culture, might work to establish a norm across an entire organization.

The rest of the paper proceeds as follows: Section 2 lays out our model and presents our theoretical results; Section 3 presents the design of our experiment; Section 4 reports and analyzes the results of our experiment. Section 5 interprets and discusses the implications of our results and how our findings fit into related literatures; and Section 6 summarizes our major conclusions.

# 2 The Model

In this section we sketch a simple model to capture the formation of norms through contracting and to motivate our experiments. For simplicity, we focus on the case where two individuals are in a symmetric relationship and where agreement for any contract must be mutual. This will set aside the issues of distrust and the unilateral imposition of restrictions from the "hidden cost of control" literature. We will begin by fixing the norm and considering comparative statics. We will add contracting in the following section.

Two agents (indexed by $i$ and $j$) simultaneously choose actions $x_i, x_j \in [x_{\min}, x_{\max}]$, yielding material payoffs $\pi(x_i, x_j)$ (where $\pi(x_i, x_j) = \pi(x_j, x_i)$). Let $\hat{x} \in [x_{\text{self}}, x_{\text{FB}}]$ (where $x_{\text{self}}$ is the selfish equilibrium and $x_{\text{FB}}$ is the first best action) denote the norm, which represents the "right," "proper," or "appropriate" action. We assume that norms below the selfish action, or norms above the first best, are simply not credible. To capture the influence of norms on behavior, we will simply assume that in addition to the standard utility for monetary payoffs, an individual receives disutility to the extent that her action $x_i$ deviates from the norm:[8]

$$U_i(x_i, x_j; \hat{x}) = \pi(x_i, x_j) - \frac{\phi_i}{2}(x_i - \hat{x})^2 \text{ if } x_i < \hat{x}$$
$$U_i(x_i, x_j; \hat{x}) = \pi(x_i, x_j) \text{ otherwise}$$

Here $\phi_i$ parametrizes the level of norm-sensitivity (relative to pecuniary motivations).[9] An individual with $\phi = 0$ is a standard selfish money-maximizing individual, while as $\phi \to \infty$ an individual becomes perfectly norm-fulfilling.

We will consider the impact of norms on behavior in the four games we study experimentally:

| | |
|---|---|
| Additive Public Goods Game (APG): | $\pi(x_i, x_j) = \alpha(x_i + x_j) - \frac{1}{2}x_i^2$ |
| Multiplicative Public Goods Game (MPG) : | $\pi(x_i, x_j) = \alpha(x_i * x_j) - \frac{1}{2}x_i^2$ |
| Double Dictator Game (DDG): | $\pi(x_i, x_j) = E - x_i + \alpha * x_j$ |
| Betrand Game (BG): | $\pi(x_i, x_j) = x_i \text{ if } x_i < x_j$ |
| | $\pi(x_i, x_j) = \frac{x_i}{2} \text{ if } x_i = x_j$ |
| | $\pi(x_i, x_j) = 0 \text{ if } x_i > x_j$ |

where $\alpha$ is a parameter capturing the efficiency of the exchange,[10] and $E$ represents an individual's initial endowment in the Double Dictator Game. In the MPG, the DDG, and the BG we will have $x_{\text{min}} = 0$. All four games have a wide divergence between the selfish Nash equilibrium, and the socially optimal action. For the APG, the selfish equilibrium is $x_{\text{self}} = \alpha$, while the first best is $x_{\text{FB}} = 2\alpha$.[11] For the MPG and the DDG, the selfish equilibrium is $x_{\text{self}} = x_{\text{min}} = 0$ and the first best is $x_{\text{FB}} = x_{\text{max}}$. For the BG, there are three selfish equilibria: $x_{\text{self}} = x_{\text{min}} = 0$, $x_{\text{self}} = 1$, $x_{\text{self}} = 2$, and the first best is $x_{\text{FB}} = x_{\text{max}}$. The games notably differ in that the MPG and the BG are games with strategic complements (i.e. an individual's material best response is increasing in the action of the other player),

[8] We choose a quadratic loss function for simplicity, but other functions such as a linear loss function yield similar results.

[9] For simplicity we will assume throughout that $\phi_i$ and $\phi_j$ are common knowledge.

[10] For the APG, $\alpha \in [x_{\text{min}}, \frac{1}{2}x_{\text{max}}]$. For the MPG, $\alpha \in (\frac{1}{2}, 1)$. For the DDG, $\alpha > 1$

[11] Hence for the APG we will focus on norms in that range, i.e. $\hat{x} \in [\alpha, 2\alpha]$

while the APG and the DDG are strategically independent (i.e. an individual's material best response does not depend on the action of the other player).

## 2.1 Effect of the Norm

In anticipation of the possibility of different contracts generating different norms, we now consider the effect of increasing the level of the norm on actions and efficiency.[12] We will start by considering the case where both agents have equal norm sensitivities $\phi_i = \phi_j = \phi$. It is then straightforward to show that for the games with strategic independence (the APG and the DDG) raising the norm increases the equilibrium action and consequently total utility. The desire to meet the norm provides a private motivation to take a more efficient action.

**Proposition 1** *In the APG and the DDG, if $\phi_i = \phi_j = \phi > 0$, for $\hat{x} \leq x_{FB}$, the equilibrium action $x^*$ is increasing in $\hat{x}$, and total utility $U^*$ is increasing in $\hat{x}$. For both games, as $\phi \to \infty$, $\hat{x} = x_{FB}$ achieves the first best (i.e. $x^* \to x_{FB}$).*

**Proof.** See Appendix A for a complete proof. Intuitively, the norm provides an incentive to take a higher action. When the norm increases, players increase their action to reduce the disutility for violating the norm, and the increase in the monetary payoffs yields higher total utility. ■

The games with strategic complements (the MPG and the BG) are similar, however we will now need that the agents are sufficiently norm sensitive (i.e. that $\phi$ is large enough). If agents are not norm sensitive enough then the downward material incentive to undercut the other agent's action makes the equilibrium action, and thus the monetary payoffs, increase slower than the disutility from violating the norm. Additionally, in the case of the Bertrand Game, if $\phi$ is not sufficiently large, the pure strategy equilibrium may not exist (since the monetary incentive to undercut the other agent is too strong).

**Proposition 2** *In the MPG, if $\phi_i = \phi_j = \phi > 0$, the equilibrium action $x^*$ is increasing in $\hat{x}$, and $\exists \bar{\phi}$ s.t. $\forall \phi > \bar{\phi}$ the total utility $U^*$ is increasing in $\hat{x}$. In the BG, if $\phi_i = \phi_j = \phi > 0$,*

[12] To focus on the effect of the norm, we will assume for this section that there are no enforceable restrictions. We will address the effect of the minimum clause in the following section.

*$\exists\bar{\phi}$ s.t. $\forall\phi > \bar{\phi}$, the highest equilibrium action $x^*$ is increasing in $\hat{x}$, and the total utility $U^*$ is increasing in $\hat{x}$. For both games, as $\phi \to \infty$, $\hat{x} = x_{FB}$ achieves the first best (i.e. $x^* \to x_{FB}$).*

**Proof.** See Appendix A for the proof. ■

It is also interesting to examine how effective establishing a norm is when only one of the agents is norm sensitive and the other is selfish (and this is common knowledge). Although the selfish agent will generally have the higher individual utility, we focus on how increasing the norm affects the total utility (i.e. social efficiency) since side payments could be used to redress any disparity.

**Proposition 3** *In the APG and the DDG, if $\phi_i = \phi > 0$ and $\phi_j = 0$, for $\hat{x} \leq x_{FB}$, the equilibrium action of the norm sensitive agent $x_i^*$ is increasing in $\hat{x}$, and total utility $U^*$ is increasing in $\hat{x}$. The action of the selfish agent $x_j^*$ is constant with respect to $\hat{x}$.*

**Proof.** See Appendix A. ■

Similarly for the games with strategic complements we have

**Proposition 4** *In the MPG, if $\phi_i = \phi > 0$ and $\phi_j = 0$, both equilibrium actions $x_i^*$ and $x_j^*$ are increasing in $\hat{x}$, and if $\alpha > \sqrt{\frac{1}{3}}$, $\exists\bar{\phi}$ s.t. $\forall\phi > \bar{\phi}$ the total utility $U^*$ is increasing in $\hat{x}$. In the BG, if $\phi_i = \phi > 0$ and $\phi_j = 0$, $\exists\bar{\phi}_1 > 1$ s.t. $\forall\phi \geq \bar{\phi}_1$ then there exists a pure strategy equilibrium with $x_i^* = \hat{x}$ and $x_j^* = \hat{x} - 1$, and thus both actions are increasing in $\hat{x}$. Total utility is $U^* = \frac{\hat{x}-1}{2}$ and thus is increasing in $\hat{x}$. Additionally, if $\hat{x} \geq 4$, $\exists\bar{\phi}_2 \leq 1$ s.t. $\forall\phi$ where $\bar{\phi}_1 > \phi \geq \bar{\phi}_2$, the lower and upper bounds on the smallest $x_i$ and $x_j$ played in any mixed equilibrium are increasing in $\hat{x}$, and the lower and upper bounds on total utility $U^*$ are increasing in $\hat{x}$.*

**Proof.** See Appendix A. ■

Thus, even when one of the agents is selfish, setting a higher norm increases efficiency. When the game has strategic independence, only the agent's own norm sensitivity matters. In a game with strategic complements, if the selfish player knows (or believes) that the other player is norm sensitive, that is enough to make him (partially) increase his action. Therefore, in our experiment we expect that the handshake contract will have the greatest effect in the multiplicative public goods game (MPG) and the Bertrand game (BG).

## 2.2 Contracting and the Norm

We now add a contracting phase and consider how different contracts establish different norms. We assume that at the beginning of the relationship individuals can agree on a contract, which may include an enforceable minimum action ($x_{\text{enf}}$) and/or an unenforceable agreement about which action to take ($x_{\text{unenf}}$). Since we are focusing on incomplete contracts, we assume that the largest possible $x_{\text{enf}}$ ($\bar{x}_{\text{enf}}$) is smaller than the first best action ($\bar{x}_{\text{enf}} < x_{\text{FB}}$), i.e. while contracts can require "perfunctory performance" there is some amount of natural incompleteness that prevents the contract from requiring "consummate performance." Therefore, there are four relevant classes of contracts: No contract (N), a "Minimum" contract with an enforceable minimum but no promise (M), a "Handshake" contract with an unenforceable agreement but no minimum (H), and a "Combined" contract with both a minimum and a handshake (C). The chosen contract then determines the norm. We will focus on identifying the contract that maximizes total utility, since side payments could equalize any potential imbalances (e.g. between a selfish and a norm sensitive agent).

Since we have established that increasing the norm can increase efficiency and move actions towards the first best, we will restrict focus to the optimal Handshake contract, i.e. where $x_{\text{unenf}} = x_{\text{FB}}$. Similarly, the optimal minimum contract will set $x_{\text{enf}} = \bar{x}_{\text{enf}}$, the highest possible minimum action. For comparison, we will also focus on the Combined contract that combines these two contracts, i.e. $(x_{\text{enf}}, x_{\text{unenf}}) = (\bar{x}_{\text{enf}}, x_{\text{FB}})$.

One possibility is that norms are in fact completely exogenous and would not be affected by the contract at all. In this case, $\hat{x}$ is identical under all of the contracts, and therefore the H and N contracts will be equivalent, and the M and C contracts will be equivalent. Additionally, the M and C contracts will always be at least weakly optimal. Instead, we want to consider different ways that the norm could depend on the contract. To that end, we present two simple ways of modeling how the enforceable and unenforceable aspects of the contract determine the relevant norm. Throughout we will assume that there may exist some pre-existing "default" norm $\hat{x}_0$ prior to the contract. Requiring that $\hat{x}_0 = x_{\text{self}}$ allows us to consider the case where the contract alone establishes a norm. None of our results depend on the level of $\hat{x}_0$. The first way to model the norm would be to assume that only the unenforceable agreements set the norm, or that the norm depends on the *handshake only* (the HO assumption). Then the norms for the four contracts would be:

$$\hat{x}_{\mathrm{N}} = \hat{x}_{\mathrm{M}} = \hat{x}_0 \qquad \hat{x}_{\mathrm{H}} = \hat{x}_{\mathrm{C}} = x_{\mathrm{unenf}} = x_{\mathrm{FB}} \tag{HO}$$

Here there is no tradeoff between including an enforceable restriction on the minimum action and the ability to establish the first best action as the norm. In contrast, we could assume that the norm depends on both the enforceable and the unenforceable clauses (if present). In particular, given the experimental literature on the hidden costs of control and the crowding out of intrinsic motivation, we want to consider the assumption that the ability of the contract to establish a high norm will exhibit *crowding out* (the CO assumption) if the contract also includes a minimum action. In this case, the letter of the contract undercuts the spirit of the contract, in the sense that the contract implicitly allows each party to "only" take the minimum action. This is easy to model by assuming that when one clause is included the norm is equal to that clause and when both clauses are present the resulting norm is the average of the two agreements.[13] Then the norms for each contract would be:

$$\begin{aligned} &\hat{x}_{\mathrm{N}} = \hat{x}_0 && \hat{x}_{\mathrm{M}} = x_{\mathrm{enf}} = \bar{x}_{\mathrm{enf}} \\ &\hat{x}_{\mathrm{H}} = x_{\mathrm{unenf}} = x_{\mathrm{FB}} && \hat{x}_{\mathrm{C}} = \frac{x_{\mathrm{enf}} + x_{\mathrm{unenf}}}{2} = \frac{\bar{x}_{\mathrm{enf}} + x_{\mathrm{FB}}}{2} \end{aligned} \tag{CO}$$

To the extent that we find evidence for the CO assumption, this will suggest that the concerns suggested by the crowding out and hidden cost of control literatures may play an important role in the efficacy of contracts that attempt to both impose enforceable restrictions and establish high norms.

## 2.3 The optimal contract

We now want to consider when each of the contracts will be the optimal contract. To that end, we will assume that $\phi$ is large enough (i.e. $\phi > \bar{\phi}$ for the relevant $\bar{\phi}$ as defined by the previous propositions), that total utility is increasing in $\hat{x}$, and therefore that the Handshake

[13] We use an average for convenience, the intuition would be consistent with any convex combination.

contract with $x_{\text{unenf}} = x_{\text{FB}}$ is indeed the optimal Handshake contract. Then it immediately follows that the N contract is never the optimal contract, since it is equivalent to an H contract with a lower norm.

**Corollary 1** *The H contract is superior to the N contract.*

**Proof.** Follows directly from Propositions 1 to 4 ■

We will also generally expect that as the contract approaches full completeness (i.e. as $\bar{x}_{\text{enf}} \to x_{\max}$), the M contract will be the optimal contract since it will approach the first best.

### 2.3.1 Both agents are norm sensitive

We begin by examining the case where both agents are norm sensitive. If norms are a function of the handshake agreement only, then we can show:

**Proposition 5** *Assume $\phi_i = \phi_j = \phi$, and that norms follow HO. Then for each game $\exists \bar{x}_1$ (with $\frac{\partial \bar{x}_1}{\partial \phi} \geq 0$ and $\frac{\partial \bar{x}_1}{\partial \hat{x}_0} \geq 0$) s.t. if $\bar{x}_{enf} < \bar{x}_1$ then the H and the C contracts are equivalent and are the optimal contracts, and if $\bar{x}_{enf} > \bar{x}_1$ then the M contract is the optimal contract.*

**Proof.** See Appendix A for a complete proof. The intuition is that if the minimum action is large enough, then the M contract generates high actions while avoiding the disutility for violating the norm that the H and C contracts create. This transition point has to occur while the C contract is still slack, since when C binds it yields the same actions as M but has more disutility for violating the norm. The threshold is non-decreasing in $\phi$ (i.e. it takes a more complete contract to be better than the Handshake contract as $\phi$ increases) since increasing $\phi$ leads to higher actions and less norm disutility in the H contract. Similarly, the threshold is non-decreasing in $\hat{x}_0$ since a higher $\hat{x}_0$ increases the disutility for violating the norm in the M contract. One should note that $\bar{x}_1$ is strictly increasing in $\phi$ and $\hat{x}_0$, except in the case of the BG with very large $\phi$. ■

This means that for relatively incomplete contracts (i.e. the highest feasible minimum action is small and far from the first best), the Handshake and Combined contracts will be the optimal contract, and for relatively complete contracts (where the highest feasible minimum action is large and close to the first best), the Minimum contract will be the optimal contract. Therefore, the ability of contracts to set norms for behavior within the economic relationship will be most useful when contracts are weak.

If, instead, the norm depends on both the enforceable and unenforceable clauses, and the enforceable clause leads to crowding out, then the Combined contract will be suboptimal.

**Proposition 6** *Assume $\phi_i = \phi_j = \phi$ and that norms follow CO. Then for each game $\exists \bar{x}_1$ (with $\frac{\partial \bar{x}_1}{\partial \phi} \geq 0$ and $\frac{\partial \bar{x}_1}{\partial \hat{x}_0} = 0$) s.t. if $\bar{x}_{enf} < \bar{x}_1$ then the H is the optimal contract, and if $\bar{x}_{enf} > \bar{x}_1$ then the M contract is optimal.*

**Proof.** See Appendix A for a complete proof. The intuition is the same as in Proposition 5. Note that given CO norms, the C contract is never optimal when both agents are norm sensitive. If the C contract has a slack minimum, then it is dominated by the H contract since that contract will have a higher norm and therefore a higher action and higher utility. If the C contract has a binding minimum then it will have the same resulting action as the M contract, but the agents will have disutility from violating the norm, since the norm will always be larger than the minimum action (unless the contract is perfectly complete). The M contract, however, will have no norm disutility. Also, as before $\frac{\partial \bar{x}_1}{\partial \phi} \geq 0$ will be strict except in the case of the BG with very large $\phi$. ■

### 2.3.2 One norm sensitive agent

For the games that are strategically independent, the comparison of the contracts under the HO assumption when one agent is norm sensitive and the other agent is selfish is quite similar, although the C contract now dominates the H contract since it has the same norm but imposes a minimum action on the selfish agent.

**Proposition 7** *Assume $\phi_i = \phi > 0$, $\phi_j = 0$, and that norms follow HO. Then for the APG and DDG $\exists \bar{x}_1$ (with $\frac{\partial \bar{x}_1}{\partial \phi} \geq 0$ and $\frac{\partial \bar{x}_1}{\partial \hat{x}_0} \geq 0$) s.t. if $\bar{x}_{enf} < \bar{x}_1$ then the C contract is the most efficient contract, and if $\bar{x}_{enf} > \bar{x}_1$ then the M contract is the most efficient contract.*

**Proof.** See Appendix A. ■

For the MPG, due to tractability concerns, we will derive results for the specific payoff parameters we use in the experiment. When one agent is selfish we can see the major difference between the games with strategic complements and the games that are strategically independent. Although one of the agents is selfish, he still has a strategic incentive to raise his action in response to the handshake agreement since the norm sensitive agent will increase his action. If contracts are incomplete enough, then the minimum in the C contract will be slack, and both H and C will be optimal. For intermediate levels of completeness, the C contract is strictly optimal as the minimum action raises the selfish agent's action above that in the H contract and the norm raises the norm sensitive agent's action higher than in the M contract.

**Proposition 8** *Assume $\phi_i = \phi > \frac{49}{32}$ and $\phi_j = 0$, and that norms follow HO. Also assume $x_{max} = 6$ and $\alpha = \frac{3}{4}$. Then $\exists \bar{x}_1$ and $\bar{x}_2$ with $\bar{x}_2 < \bar{x}_1$, $\frac{\partial \bar{x}_1}{\partial \phi} \geq 0$, $\frac{\partial \bar{x}_1}{\partial \hat{x}_0} \geq 0$ and $\frac{\partial \bar{x}_2}{\partial \phi} \geq 0$ s.t. if $\bar{x}_{enf} \leq \bar{x}_2$ the H and C contracts are equivalent and optimal, if $\bar{x}_2 < \bar{x}_{enf} < \bar{x}_1$ the C contract is optimal, and if $\bar{x}_1 < \bar{x}_{enf}$ the M contract is optimal.*

**Proof.** See Appendix A. ■

For the BG, if $\phi$ is sufficiently large then the H and C contracts are clearly optimal, since they can achieve nearly the first best even with a selfish agent. For smaller levels of $\phi$, due to tractability concerns, we will focus on sufficient conditions for H and C to be optimal or for M to be optimal. For intermediate levels of $\bar{x}_{\text{enf}}$ we are not able to order the contracts due to multiple potential mixed equilibria.

**Proposition 9** *Assume $\phi_i = \phi > \bar{\phi}_2$ (as defined by Proposition 4), $\phi_j = 0$, and that norms follow HO. If $\phi \geq \bar{\phi}_1$ (as defined by Proposition 4), then H and C are equivalent and optimal (with M also optimal only if $\bar{x}_{enf} = x_{max} - 1$). Otherwise, $\exists \bar{x}_1$ and $\bar{x}_2$ (with $\bar{x}_1 < \bar{x}_2$, $\frac{\partial \bar{x}_1}{\partial \phi} \geq 0$, $\frac{\partial \bar{x}_1}{\partial \hat{x}_0} \geq 0$, $\frac{\partial \bar{x}_2}{\partial \phi} \geq 0$ and $\frac{\partial \bar{x}_2}{\partial \hat{x}_0} \geq 0$) s.t. H and C are equivalent and optimal if $\bar{x}_{enf} < \bar{x}_1$ and s.t. M is optimal if $\bar{x}_{enf} > \bar{x}_2$.*

**Proof.** See Appendix A. ■

When norms exhibit crowding out and only one agent is norm sensitive, then again there are three regions. For low levels of completeness, the lower norm in the C contract outweighs the minimum imposed on the selfish agent and therefore H is the optimal contract. For intermediate levels of completeness, C is optimal due to the mix of a higher norm than M and the minimum eliciting a higher action from the selfish agent than in the H contract. For large enforceable minimums, the M contract is optimal as usual.

**Proposition 10** *Assume $\phi_i = \phi > 0$, $\phi_j = 0$, and that norms follow CO (Additionally, for the MPG assume $x_{max} = 6$ and $\alpha = \frac{3}{4}$). Then for the APG, the DDG, and the MPG $\exists\tilde{\phi}$ s.t. if $\phi < \tilde{\phi}$ $\exists\bar{x}_1$ (with $\frac{\partial \bar{x}_1}{\partial \phi} \geq 0$) s.t. if $\bar{x}_{enf} < \bar{x}_1$ H is optimal and if $\bar{x}_{enf} > \bar{x}_1$ M is optimal. Otherwise, if $\phi > \tilde{\phi}$ $\exists\bar{x}_1$ and $\bar{x}_2$ with $\bar{x}_1 < \bar{x}_2$, $\frac{\partial \bar{x}_1}{\partial \phi} \geq 0$ and $\frac{\partial \bar{x}_2}{\partial \phi} \geq 0$ s.t. if $\bar{x}_{enf} < \bar{x}_1$, H is optimal; if $\bar{x}_1 < \bar{x}_{enf} < \bar{x}_2$, C is optimal; and if $\bar{x}_{enf} > \bar{x}_2$, M is optimal.*

**Proof.** See Appendix A for the proof. Note that for the APG and DDG $\tilde{\phi} = 0$. ■

Again for the BG we can identify sufficient conditions. As in the other games, when contracts are fairly incomplete, the H contract is best because it has the highest norm, and when contracts are very complete, the M contract is best.

**Proposition 11** *Assume $\phi_i = \phi > \bar{\phi}_2$ (as defined by Proposition 4), $\phi_j = 0$, $x_{max} \geq 6$, and that norms follow CO. If $\phi \geq \bar{\phi}_1$ (as defined by Proposition 4) then H is optimal (with M also optimal only if $\bar{x}_{enf} = x_{max} - 1$). Otherwise, $\exists\bar{x}_1$, $\bar{x}_2$, $\tilde{\phi}$ (with $\bar{x}_1 < \bar{x}_2$, $\tilde{\phi} < \bar{\phi}_1$, $\frac{\partial \bar{x}_1}{\partial \phi} \geq 0$, $\frac{\partial \bar{x}_2}{\partial \phi} \geq 0$, and $\frac{\partial \tilde{\phi}}{\partial x_{max}} < 0$) s.t. H is optimal if $\phi > \tilde{\phi}$ and $\bar{x}_{enf} < \bar{x}_1$ and s.t. M is optimal if $\bar{x}_{enf} > \bar{x}_2$.*

**Proof.** See Appendix A. ■

## 2.4 Summary and predictions

Since in our experiment we will be focusing on the case where contracts are relatively weak (i.e. contracts have a low enforceable minimum), we will generally expect the M contract to be inferior to the H contract. The H contract should be particularly effective in the games with strategic complements (the MPG and the BG), since even selfish participants will have a strategic incentive to at least partially increase their action when they agree to a contract that includes a handshake clause. In contrast, the M contract may perform relatively well compared to the H contract when the default norm is low (since all of the thresholds are increasing in the default norm). Moreover, if norms are a function of both the enforceable and unenforceable clauses, then we may expect the H contract to be superior to the C contract, since in the C contract the enforceable minimum will partially undercut the effect of the handshake, resulting in a lower norm. Comparing the H and C contracts across several games will also provide evidence for how widespread the "hidden costs of control" phenomenon is in contracting environments.

# 3 Experimental Design

In order to test empirically the role of contracts in establishing norms, we designed an experiment where subjects were able to contract before playing a game. Subjects played 10 rounds each of two different games, either the APG and the MPG or the DDG and the BG. The order of the two games was randomized across sessions. In each round, the subjects decided whether or not to "suggest" each of the three kinds of contracts we have been analyzing:

- A Minimum contract, which imposes a enforceable requirement that each subject pick an action no smaller than a specified minimum action.
- A Handshake contract, which consists of an unenforceable handshake agreement that both parties will play the socially optimal first best action.
- A Combined contract, with both an enforceable minimum and a handshake agreement to play the first best.

We had subjects say "yes" or "no" for all three contracts in every period so that we could rule out selection-based effects in our analysis (we generally focus on subjects who requested all three contracts and thus were placed into a particular contract randomly). After the subjects made their choice for each kind of contract, we randomly selected one of the three contracts (or no contract) to be available in that period. The random sequences were constructed so that over the 10 periods the No contract and Minimum contract cases would be selected twice and the Handshake contract and Combined contract cases would be selected three times, in random order. The minimum action was the same for the Minimum contract and the Combined contract, was held constant throughout each game, and was selected to be a fairly weak restriction. Hence we are focusing on relatively weak, i.e. highly incomplete, contracting environments.

After the contracting environment was selected, the contract was imposed if both subjects had requested it. If either subject had not requested the contract, then no contract was imposed. Before choosing their actions, subjects were informed of which contracting environment had been selected, what contracting choice they and their partner had each made for that environment, and what contract was in effect. Subjects then selected their action for the game (subject to any imposed minimum) and guessed what action their partner would take (subjects earned \$0.25 for each correct guess). Finally, subjects were reminded of their own action, informed of their partner's action and informed of both their and their partner's earnings for the period.

To summarize, each round had the following structure (for all games):

1. Subjects are randomly matched in each round.
2. Subjects make contracting choices for all three possible contracts.
3. One contracting environment is randomly selected. The contract is imposed if both subjects want it. The subjects' contracting choices for the selected environment are revealed.
4. Subjects make action choices for the game and guess the action of the other subject.
5. Action choices and payoffs are revealed.

We used the four games described perviously, with the following payoff functions:[14]

[14]Some of the payoff functions were rescaled relative to our general formulations so that expected payoffs would fall into the proper range.

| | |
|---|---|
| Additive Public Goods Game (APG): | $\pi(x_i, x_j) = 10(x_i + x_j) - x_i^2 - 50$ |
| Multiplicative Public Goods Game (MPG) : | $\pi(x_i, x_j) = 3(x_i * x_j) - 2x_i^2 + 25$ |
| Double Dictator Game (DDG): | $\pi(x_i, x_j) = 20 - 2x_i + 6x_j$ |
| Betrand Game (BG): | $\pi(x_i, x_j) = x_i \text{ if } x_i < x_j$ |
| | $\pi(x_i, x_j) = \frac{x_i}{2} \text{ if } x_i = x_j$ |
| | $\pi(x_i, x_j) = 0 \text{ if } x_i > x_j$ |

For all games, each point of payoff was worth \$0.15. One period from each of the two games the subjects played were randomly selected for payment at the end of the experiment. Since quadratic action costs might have been difficult for subjects to calculate, for both the APG and MPG, we provided a payoff table (visible on every screen) showing the payoffs associated with every pair of actions that they and their partner could take in that game.

For the APG, subjects could choose any (integer) action between 4 and 11. The selfish equilibrium action is 5 and the first best action is 10. The minimum action required by the Minimum and Combined contracts was 6. For the MPG, subjects could choose any (integer) action between 0 and 6. The selfish equilibrium is 0 and the first best action is 6. The minimum action required by the Minimum and Combined contracts was 2. For the DDG, subjects could choose any (integer) action between 0 and 10. The selfish equilibrium is 0 and the first best action is 10. The minimum action required by the Minimum and Combined contracts was 1. For the BG, subjects could choose any (integer) action between 0 and 100. The selfish equilibria are 0, 1, and 2 and the first best action is 100. The minimum action required by the Minimum and Combined contracts was 10. For the latter two games, we also ran additional sessions with a higher minimum action: either 3 (in the DDG) or 30 (in the BG) to directly test the effect of different minimums on subject behavior.

# 4 Experimental Results

Sessions were run at the Computer Lab for Experimental Research (CLER) lab at the Harvard Business School using their standard subject pool. The experiment was programmed and conducted with zTree (Fischbacher, 2007). 78 subjects participated in the first wave of sessions, playing the Additive Public Good (APG) and Multiplicative Public Good (MPG) games. 102 subjects participated in the second wave of sessions, playing the Double Dictator Game (DDG) and the Bertrand Game (BG) with the very weak minimum actions. Average earnings in both waves were approximately $20 per subject.

## 4.1 Contracting

[INSERT TABLE 1 HERE]

Table 1 reports the average fraction of subjects in any period who requested each kind of contract in each of the four games as well as the fraction of subjects who requested all three contracts and the fraction that requested none. The vast majority of subjects (at least 80% for every contract in every game) asked for each of the contracts (Minimum, Handshake, and Combined) and generally asked for all of the contracts (at least 70% did this in every game). Even though the Handshake contract had no effect on subjects' choice set, it was just as appealing to the subjects as the enforceable contracts. Additionally, there were no notable trends across periods in the aggregate usage of the contracts (although we will highlight an interesting trend at the individual level for a subset of the participants).

## 4.2 Effectiveness of a Handshake

The reason behind the popularity of the Handshake contract is readily apparent: a handshake agreement is remarkably effective at raising actions towards the social optimum, despite leaving the action space unchanged. In particular, for the relatively weak contracts we consider here, the Handshake contract was generally more effective at increasing actions than the enforceable Minimum contract, as well as being as effective as (or more effective than) the Combined contract.

### 4.2.1 Average Actions

Figure 1 displays the average action (conditional on the contract) of subjects who asked for all three contracts in each of the four games. While we restrict attention to subjects that requested all three contracts in order to rule out differences being driven by selection effects, the results are essentially the same if we include all subjects. For comparability across the games, we have scaled the actions into percentages so that 0% denotes the selfish equilibrium action (5 in the APG, 0 in the other three games) while 100% denotes the socially optimal (first best) action (10 in the APG and DDG, 6 in the MPG, and 100 in the BG). The figure displays the average action for each of the three contracts as well as the condition where no contract was possible. The horizontal bar denotes the minimum action for each game.

[INSERT FIGURE 1 HERE]

The Handshake contract substantially increases the efficiency of subjects actions compared to the case where no contract is possible: it generates an absolute change of between 10 and 22 percentage points of efficiency (a relative increase of 30% to 90%). These differences are significant for all four games (a two-tailed t-test yields $p < 0.01$ for each of the four games). The Handshake contract also yields significantly higher actions than the Minimum contract for the two games with strategic complements, the MPG and the BG ($p < 0.01$ for both games), as well as directionally higher for the DDG ($p = 0.17$). This is not surprising, since as we noted previously, when there are strategic complements even a selfish subject has a strategic incentive to increase his action in response to agreeing to a high norm (if he believes the other subject may be norm sensitive).

Additionally, once the contract includes the handshake agreement to play the first best, adding an enforceable minimum action does not necessarily further increase subjects' actions and can, in fact, decrease them. While the Combined contract leads to significantly higher actions than the Handshake contract in the APG ($p < 0.01$), the actions are not significantly different in the MPG or DDG ($p = 0.97$ and 0.21, respectively) and actions are significantly *lower* under the Combined contract in the Bertrand Game—reducing actions by 7 percentage points ($p = 0.04$). Moreover, for the BG, actions under the Minimum contract are also (marginally significantly) lower than when no contract is available (a difference of 5 percentage points, $p = 0.06$). Hence, in both cases, adding the enforceable minimum to the contract is strictly worse than leaving it out.

[INSERT TABLE 2 HERE]

We confirm these initial impressions by regressing subjects' actions on contract clause dummy variables as well as controls for time trends and treatment and game order within a session.[15] The estimates and the total difference between the Combined contract and the Handshake contract (i.e. the sum of the coefficients for the Minimum dummy and the Combined dummy) are presented in Table 2. We see that the presence of a handshake clause in the contract significantly increases actions in all four games; moreover, the effect is significantly larger than the effect of the minimum clause for the MPG, DDG, and BG (Wald test: $p < 0.01$ for each game). In fact, as we saw from the raw averages, in the BG, introducing a minimum action has a marginally significant negative effect. Lastly, the Combined contract is only significantly better than the Handshake contract in the APG, and is significantly worse in the BG.

### 4.2.2 Distribution of Actions

The impact of the contracts is particularly clear when looking at the distribution of actions. Again, we restrict the sample to subjects who asked for all three contracts and had the contract when it was available.

Figure 2 shows the cumulative distribution of actions for subjects playing under the different contracts in the four games. As we expect from the aggregate data, for the Handshake and Combined contracts the distributions are shifted downward in each game. Additionally, throughout the distribution, the gap between the Handshake/Combined contracts and the Minimum/No contracts is largest in the games with strategic complements (the MPG and BG). Moreover, we see that in each game there is a large mass of actions at exactly the promised action for both the Handshake and Combined contracts—a substantial number of subjects are fulfilling their handshake agreements (24% in the APG, 49% in the MPG, 32% in the DDG, and 20% in the BG). When the contract does not include such an agreement,

[15] We present here a Random Effects specification, but Fixed Effects yield quantitatively similar results. Additionally, while we again focus on subjects who requested all the contracts to avoid problems of selection, the results are the same if we include all observations.

there is either no spike at the first best action (as in the APG or BG) or there is a much smaller spike (in the MPG and DDG).

[INSERT FIGURE 2 HERE]

Comparing the Handshake contract and the Combined contract in the games with strategic independence (APG and DDG) we observe that above the minimum action (20% for APG and 10% for DDG), the two contracts generate essentially the same distribution of actions. The graphs of the cumulative distributions essentially overlay each other. This pattern suggests that the unenforceable handshake agreement succeeds at shifting up the action choices in games without strategic complements. The additional effect of the enforceable minimum is largely to pull actions up at the very bottom of the distribution rather than affecting actions above the minimum. Thus, for these games at least, it does not look like the minimum clause diminishes the ability of the handshake agreement to set a high norm.

In the games with strategic complements (the MPG and BG), however, a different pattern of choices above the minimum action emerges. In the BG, the distribution of actions under the Handshake contract first order stochastically dominates the distribution under the Combined contract ($p = 0.02$).[16] Subjects with the Combined contract choose lower actions in the range above the minimum, suggesting that the addition of the minimum clause to a Handshake contract both raises the level of actions at the low end of the distribution and lowers actions at the high end. We argue that this pattern is present because the addition of the minimum clause generates a lower norm than with a handshake agreement alone. A similar pattern occurs in the MPG, but while the Handshake contract distribution is directionally below the Combined contract distribution at every action, the difference is small and not statistically significant.

#### 4.2.3 Time Trends

Having shown that the Handshake contract substantially increases actions on average, we now want to examine its effects in different periods. As is typical in public good games,

[16] We use the non-parametric test for stochastic dominance from Anderson (1996). We partition the distributions at the quintiles of the combined distribution in order to assure that the cells have sufficiently many observations. The resulting test statistic is $\chi^2(4) = 11.174$.

there is a general unraveling that leads to lower average actions in later periods. While this affects the absolute level of actions, it does not disrupt the relative differences between the contracts. The efficiency increase from the Handshake contract lasts until the end of the experiment. Additionally, since the subjects play all four contracting environments in a random sequence, the fact that even in later periods the effect on actions occurs only when the handshake agreement is actually present indicates that the contract itself is critical for setting the norm rather than merely causing some kind of coordination or demand effect that could spread to the other contracting environments.

[INSERT FIGURE 3 HERE]

Figure 3 presents the average action taken when no contract is available and taken under the Handshake contract, in each game, for period 1 to 5 and periods 6 to 10. The bars are stacked, so the blue bar indicates the average action, as a percent of the social optimum, under No contract and the red area denotes the *increase* in actions for the Handshake contract above the No contract baseline. To avoid selection problems, we again focus on subjects who requested all three contracts.[17] While the absolute level of the actions declines between the first and second half of the experiment for three of the four games, the *difference* between the Handshake contract and No contract remains essentially the same for all four games.

This result suggests that the effect of the Handshake contract in increasing actions in the games is stable over time. This finding bolsters the importance of establishing a norm with a contract. Even if parties learn to take lower actions over time, there may still be a benefit to establishing a norm in the relationship.

#### 4.2.4 Requesting the Handshake Contract

We can also show that the effect of the Handshake contract only occurs when it is actually agreed upon. That is, in order for the norm to be established by the Handshake contract, both parties have to commit to the agreement to take the first best action. Table 3 presents the estimates from regressing a subject's action (in the Handshake contract

[17]The results are the same if we look at all observations.

condition) on dummies for requesting the Handshake contract oneself, seeing that the other subject requested the contract, and the interaction effect (i.e. both request the contract). Additionally, the total estimated effect (i.e. the sum of the coefficients on all three dummies) is presented at the bottom of the table. For none of the games is the effect of the subject or his partner individually requesting the contract significant. Indeed, it is only when both subjects jointly request the contract (and thus an actual agreement is reached) that the Handshake contract increases actions significantly.

[INSERT TABLE 3 HERE]

#### 4.2.5 Controlling for Guesses

We also elicited from subjects guesses of their partner's action. Agreeing to a Handshake contract (compared to No contract being available) has a similar, but larger, effect on guesses than on actions. Rescaled guesses by subjects who requested all three contracts for No contract vs Handshake contract are: APG, 26% vs 63%; MPG, 62% vs 83%; DDG, 27% vs 59%; BG, 59% vs 86% ($p < 0.01$ for all four games). Also, average guesses are higher than realized actions: on average subjects are overoptimistic about their partner's actions.

Using a subject's guess of his partner's action, we can attempt to identify whether subjects are merely reacting (due to strategic motivations or otherwise) to an anticipated effect on their partner's action rather than an internal desire to fulfill the agreement. Table 4 presents the estimates of regressing a subject's action (in the Handshake contract) on a dummy for agreeing to the contract as well as the subject's guess for his partner's action.[18]

[INSERT TABLE 4 HERE]

While subjects' actions are significantly positively correlated with their beliefs about their partners' actions (and as one would expect the coefficient is larger for the games with strategic complements than the games with strategic independence), there is also a separate effect from having the contract. If we compare the direct effect of the contract to the indirect effect from the change in the subject's guess, the direct effect accounts for roughly 30% to 40% of

[18]Since we are focusing on a specific condition, we include all subjects in order to increase our number of observations.

the total effect on actions.

We can also directly compare a subject's action to his guess. In particular, in the MPG and the BG, a subject's guess uniquely defines a selfish best response. In both games, we observe a substantial number of subjects taking actions strictly larger than their selfish best response, indicating some kind of non-strategic motivation to take a high action. In the MPG, 61% of actions are strictly larger than the best response under both the Handshake contract and the Combined contract, 55% of subjects chose an action higher than their best response in the No contract condition, and 50% chose a higher action under a Minimum contract. In the BG, 29% of actions are strictly larger than the best response for the Handshake contract, 31% for the Combined contract, 30% for the No contract, and 38% for the Minimum contract.

In all four games, we also observe that many subjects take actions strictly larger than their guesses. Under the Handshake contract and conditional on the corresponding guess being smaller than the largest individually rational action, 15% of actions in the APG, 40% of actions in the MPG, 14% of actions in the DDG, and 24% of actions in the BG are strictly larger than the guess. The last result about the BG is particularly striking, since if these subjects' reported beliefs are accurate, they are expecting to receive a payoff of zero. We also observe similar numbers of actions that are larger than their guesses, though slightly fewer, under the Combined contract (7% in the APG, 21% in the MPG, 14% in the DDG, and 19% in the BG).

## 4.3 The Role of Norms

Having demonstrated that the Handshake contract substantially increases the efficiency of subjects' actions, we now look for further evidence that the effect of the unenforceable agreements are driven by norms rather than some other effect. In particular, we look for evidence that subjects experience disutility from taking actions that deviate from their agreement.

While we noted previously that in the aggregate the fraction of subjects requesting each contract is quite stable throughout the experiment, in each game there are a substantial fraction of subjects who dramatically decrease their usage of the Handshake contract between the first and second halves of the experiment.[19] Table 5 displays the number of these subjects in each game, their average payoff in the second half with and without the Handshake contract, as well as the average payoff of other subjects with the Handshake contract.

[INSERT TABLE 5 HERE]

Between 9% and 20% of subjects decrease usage of the Handshake contract in each game, decreasing their frequency of requesting the contract between 34% and 54%. However, these subjects are still requesting the Handshake contract in one fifth to one half the periods; therefore we can compare the average payoff of this group in periods when they do not have the contract to periods when the do.[20] If we compare the average payoff of these subjects in periods without the contract to periods with the contract, we see that without the contract subjects earn substantially less: between \$0.93 and \$4.64 less. These subjects could increase their monetary earnings simply by requesting the contract more often and playing the same strategy (conditional on having a contract). Similarly, if we compare the "decreased usage" subjects average payoff without the contract to the average payoff of the other subjects with the contract, the "decreased usage" subjects' payoff is again substantially lower: they earn between \$1.48 and \$2.89 less. Because there are relatively few observations, to test the difference statistically, we convert the earnings within each game to z-scores (so that they will be comparable across games) and pool across games. Among the pooled data, the earnings for "decreased usage" subjects without the Handshake contract are significantly lower than with the Handshake contract ($p = 0.04$) and significantly lower than earnings for other subjects with the contract ($p < 0.01$).[21]

Thus, it seems that these subjects are making a large monetary sacrifice by not requesting the contract. Since having the contract will on average increase the action of the other subject, and because no matter what action an individual intends to take he will receive a higher payoff when the other subject increases her action, there must be something about agreeing the contract itself that these subjects dislike. It is unlikely that the contract choices were mistakes due to incorrect learning. In the first half of the experiment "decreased usage"

[19] There are other subjects who increase their usage of the contract, which is why the average says approximately the same.

[20] Since these subjects are requesting the contract much less often than the other subjects, it is almost always the case that they do not have the contract because they rejected it.

[21] We obtain similar results from a regression with subject random effects and game dummies.

subjects also earned lower payoffs without the Handshake contract than with it ($p = 0.01$). Moreover, the "decreased usage" subjects did not have less accurate beliefs than the other subjects. More specifically, in the second half of the experiment the average difference between subjects' guesses and the actual action of the other subject was not significantly different between the "decreased usage" subjects and the other subjects, either overall in the Handshake condition or specifically for cases without the contract ($p > 0.10$ in both cases).[22]

In all four games, the subjects who decreased usage of the Handshake contract were on average taking higher actions than their partners in the first half of the experiment. The average difference under the Handshake contract (i.e. own action - partner's action) was: APG, 0.91; MPG, 1.17; DDG, 1.85; BG, 3.95. The other subjects were on average taking the same action (or lower) than their partner: APG, −0.14; MPG, −0.08; DDG, −0.48; BG, −0.73.[23] Moreover, recall that in all the games except the MPG, average actions decline over time; this observation is also true for these subjects. The average change in action between the first and second halves under the handshake contract were: APG, −0.82; MPG, 0.83; DDG, −2.94; BG, −9.55. Hence, both the general unraveling over time and the lower actions of their partners pushed these subjects to decrease their average actions under the Handshake contract and thus further increase the gap between their agreement to play the first best and their actual action. The substantial decrease in the frequency of requesting the Handshake contract (despite its monetary benefits)—a reluctance to make agreements from which they would ultimately deviate—is consistent with subjects experiencing disutility for violating the norm established by the agreement.

### 4.4 30% Minimum Condition

Our comparison across games suggests that the Handshake contract is relatively more effective compared to the Minimum contract and/or the Combined contract when the level of the enforceable minimum is small relative to the average action taken when no contract is

[22] To compare across games, we apply the same transformation to guesses as we do to actions so that any differences represent errors in subjects' beliefs.

[23] Within each game, we construct z-scores for the difference (own action - partner's action). Pooling across games, the average standardized difference of the decreased usage subjects is significantly different from zero (two-tailed t-test, $p = 0.04$).

available. Consequently, we conducted a third wave of experimental sessions that replicated the design and procedures for the second wave of sessions (i.e. the DDG and BG games) but set the enforceable minimum for the Minimum and Combined contracts at 30% of the first best (i.e. the minimum actions were 3 and 30, respectively). This will allow us to test whether our results are robust to different levels of the minimum.

A total of 70 subjects participated in the third wave of sessions. Demand for the contracts was quite similar in both the DDG and the BG to the 10% minimum condition (for the 30% DDG, M: 88%, H: 90%, C: 92%, and All: 79%; for the 30% BG, M: 84%, H: 88%, C: 87%, and All: 76%). Figure 4 presents the average action taken (scaled so that 0% represents the selfish equilibrium action and 100% represents the first best) for both the second wave at 10% and the third wave at 30%. In the Double Dictator Game, the overall pattern is quite similar, although (unsurprisingly) the Minimum and Combined contracts yield higher actions with the higher minimum. All three contracts yield significantly higher actions than No Contract (two-tailed t-test: $p < 0.01$ for all three contracts). The M and H contracts are not significantly different ($p > 0.90$), and the C contract leads to significantly higher actions than both the M and H contracts ($p = 0.03$ and $p = 0.06$ respectively). Between the 10% minimum and 30% minimum conditions, the average actions are not significantly different under No Contract or the Handshake contract ($p > 0.40$ for both treatments), while actions are significantly higher under the Minimum contract ($p < 0.01$), and are marginally significantly higher under the Combined contract ($p = 0.06$). Interestingly, if we compare the pattern of actions in the 30% DDG, we see that they look very similar to the pattern in the APG—a game with strategic independence where the minimum action is also larger than the average action under No Contract. In both cases, the Minimum and Handshake contracts yield approximately equal actions, while the Combined contract is superior to both. Thus it is quite clear that the effect of the handshake is relatively low, and the effect of the minimum is relatively high, when the enforceable minimum is high compared to the "default" action (or the "default" norm).

In the Bertrand Game, the relationships between the contracts is essentially the same as in the 10% condition. The M contract is not significantly different from No Contract ($p > 0.20$), the C contract leads to significantly higher actions than both the N and M contracts ($p < 0.01$ in both cases), and the H contract induces significantly higher actions than all three other contracts ($p < 0.01$ in all three cases). Comparing the 10% and 30% conditions, actions are very similar except under the Combined contract where they are somewhat lower in the 30% condition. That difference is statistically significant ($p < 0.01$), while the other three contracting environments do not differ significantly (N: $p > 0.30$, M: $p > 0.30$, and H: $p > 0.16$). Thus it seems that allowing for more complete contracts does not affect the efficiency of the Handshake contract in either game, increases somewhat the efficiency of the Minimum and Combined contracts in the DDG, and has either no effect or a negative effect on those contracts in the BG.

In order to more accurately test for differences between the two versions of the games, Table 6 presents the results regressing subject actions on contract dummies, a dummy for the 30% minimum, and interaction terms for each contract. Under this analysis, we again find that in the DDG increasing the level of the minimum does significantly increase the effect of the minimum clause on actions. However, if we calculate the estimated total difference between the effect of each contract in the 10% condition and the 30% condition, the difference is only significant for the Minimum contract ($p = 0.05$); it is not significant for either the Handshake contract ($p > 0.80$) or the Combined contract ($p > 0.60$). Additionally, with the 30% minimum, the H and M contracts are now not significantly different ($p > 0.70$), while the H and C contracts are significantly different ($p = 0.01$).

In the Bertrand Game, actions are somewhat higher for all treatments in the 30% condition, and the handshake agreement has a somewhat smaller effect on actions (compared to No contract). However, none of the three contracts are significantly different between the 30% condition and the 10% condition (M: $p > 0.20$; H: $p > 0.30$; C: $p > 0.10$). Additionally, the H contract still yields significantly higher actions than the M contract ($p < 0.01$) as well as the C contract ($p = 0.01$). Thus in the BG, increasing the minimum from 10% to 30% does not qualitatively effect our major observations: the Handshake contract significantly increases actions (and efficiency) compared to the No Contract case, and it is significantly better than either the Minimum or the Combined contracts.

We can also examine the entire distribution of actions, presented in Figure 5. As in the 10% condition, having a contract with a handshake agreement shifts the distribution downward, and in both games there are a large mass of subjects taking the first best action under both the H and C contracts. However, there is a striking difference in both games in the comparison between the H and C contracts. In the DDG, while the distribution of actions (above the minimum) were essentially the same for H and C under the 10% minimum, there is now a large gap between them under the 30% minimum. In fact, the Handshake contract now First Order Stochastically Dominates the Combined contract above the minimum (with marginal significance: $p = 0.08$).[24] This implies that, when the minimum is at 30%, adding the minimum clause to the handshake agreement *does* lead to a lower norm (in accordance with the CO assumption). Similarly, while there was a moderate (but significant) gap between the Handshake and Combined contracts in the 10% Bertrand game, there is now a much larger gap between the distributions. As one would expect, the H contract stochastically dominates the C contract above the minimum ($p < 0.01$),[25] again consistent with the CO assumption. Thus it seems that, somewhat paradoxically, a larger minimum leads to a greater crowding out of the norm than a smaller minimum.

Despite these differences, our major results seems quite robust to increasing the strength of the available enforceable contractual tools. Handshake contracts continue to have a substantial effect on behavior, increasing efficiency greatly. While the higher minimums have an increased effect when they bind more heavily (the DDG), they have little effect when they are still largely slack (the BG). Even when they bind heavily, they have a comparable effect on behavior as the handshake agreement alone, and the handshake agreement still appears to contribute substantially to the effectiveness of the Combined contract.

# 5 Discussion

Norms have most often been treated as external rules of behavior (e.g. Akerlof, 1980; Elster, 1989), as a means of equilibrium selection (e.g. Schelling, 1960; Lewis, 1969; Sugden 1989) or as a representation of conformity and peer pressure (e.g. Kandel and Lazear, 1992; Huck et al. 2006). These approaches treat norms as exogenous influences to which people feel beholden, and norm adherence is potentially impacted only by the belief that others will

[24]We use Anderson's non-parametric test for stochastic dominance, as in our previous analysis. While we attempted to again form groups based off of the approximate quintiles of the pooled distribution, the bimodality of the distribution lead to only three groups. The resulting test statistic is $\chi^2(2) = 5.095$.

[25]Grouping by quintiles the test statistic is $\chi^2(4) = 22.495$.

adhere as well (e.g. Lopez-Perez, 2006). In many cases, by treating norms as fixed, it is difficult to distinguish these approaches from more general social preferences. Norms are also generally assumed to be particular to a given economic environment, but in many environments it is unclear what the prevailing norm is or should be. In contrast to the exogenous norm approach, we argue that individuals can establish or modify norms that are specific to them. We find that individuals can establish a norm specific to their individual relationship and that these norms have a significant impact on behavior.

Our experimental results strongly support our argument that the ability to set norms is an important part of the efficacy of incomplete contracts. Taking the estimates from Table 2, we can measure how much of the benefit of the Combined contract is generated by the handshake agreement alone. We divide the estimated coefficient from the handshake agreement by the estimated total effect of the Combined contract to construct an upper bound on the percentage of the effect coming from the handshake (i.e. not deducting any of the substitutability between the handshake and the minimum that the coefficient on the interaction effect represents). For a lower bound, we add the coefficient on the interaction effect to the numerator (i.e. subtracting out all of the substitutability). By this measure, the effect of the handshake agreement on actions represents between 51% to 57% of the effect of the Combined contract in the APG, between 70% to 103% of the effect in the MPG, between 67% to 78% of the effect in the DDG, and between 121% to 123% of the effect in the BG. Thus, merely establishing the norm through the handshake agreement is sufficient to generate most (or all) of the effect of the Combined contract. If we perform the same exercise for the 30% minimum condition (using the estimates from Table 6), then the handshake agreement represents between 27% and 68% of the effect of the Combined contract in the DDG and between 162% and 173% of the effect of the Combined contract in the BG. Thus, even with a much higher minimum, the handshake agreement is still responsible for a substantial fraction of the benefit of the Combined contract (and in fact a larger fraction in the case of the BG). Therefore, it may be that for real-world contracts of similar incompleteness, much of the benefit of these contracts comes from their role in creating strong norms, compared to the effect of their enforceable restrictions. Similarly, our results suggest that fairly incomplete contracts may be quite attractive as compared to more complete contracts that are more costly to write, since weak contracts are able to achieve similar levels of efficiency.

With respect to our motivating theory, our results are also consistent with several of our predictions. The Handshake contract was particularly effective in the two games with strategic complements, as we predicted. Similarly, the Minimum contract was most effective in the APG, where the "default norm" was low (i.e. the average action under No contract was quite low), and was least effective in the BG where the actions without a contract were particularly high relative to the minimum action. When we directly increased the minimum for the DDG and the BG, in the 30% minimum condition, both the Minimum and the Combined contract became relatively more effective in the DDG (as one would expect). In the BG, however, while the Handshake contract was somewhat less effective, the Minimum contract was not changed and the Combined contract was less effective. We also found some evidence that violating the norm generates negative utility, since ten to twenty percent of subjects forego material payoff by not asking for the Handshake contract.

With respect to our two potential modeling assumptions for the norm, that norms depend on the *handshake only* (HO) or that the inclusion of minimums leads to *crowding out* (CO), we find some evidence for both. The two strategically independent games (the APG and the 10% DDG) quite closely match the HO assumption, while the Bertrand Game, a game with strategic complements, quite clearly fits with the CO assumption. The MPG (the other game with strategic complements) is ambiguous, although there is a slight directional effect consistent with the CO assumption. In the 30% condition; however, there was a surprising increase in the extent to which the norm under the C contract was lower than the norm under the H contract. Both the DDG and the BG now fit the CO assumption in this condition with respect to comparing the H and C contracts. The change between the 10% and 30% conditions runs counter to what the model predicts. These results suggest that, in accordance with the intuition of the literatures on the hidden cost of control and the crowding out of intrinsic motivation, in some cases imposing a minimum is detrimental. However, we find that the negative effect of the enforceable clauses is not universal. That said, using the enforceable minimum only generates a benefit in one of the four games in the original experiment, and only one of the two games in the second experiment, suggesting that the benefit of an enforceable clause is also not universal. Thus we can conclude that overall handshake agreements are important means by which contracts can increase efficiency, and that weak contracts with handshakes are often as efficient (or nearly as efficient) as somewhat more-complete contracts. Whether a contract with only a handshake agreement is strictly better than a contract with both a handshake and a minimum, however, depends on the nature of the exchange.

## 5.1 Alternative Explanations

While we have demonstrated that unenforceable handshake agreements have a substantial effect on actions in a way that is consistent with our model of norms, we now wish to consider whether alternative theories of behavior could potentially explain the behavior of subjects in our games. Ultimately, all of the other potential explanations fail because they do not depend on the content of the contract nor do they assume that this content affects utility.

### 5.1.1 Rational Coordination

One potential alternative explanation is that the addition of a contracting phase at the start of our games provides the opportunity for purely rational coordination among selfish individuals. However, all of the games we propose have a unique equilibrium (or a small set of equilibria, with very low actions, in the case of the BG), and so there is no room for coordination to change actions in equilibrium.

In addition, since this explanation is agnostic to what the contract says, any of the three contracts could theoretically facilitate coordination equally well and there would be no reason to observe systematic differences in the effect of the contract.

Finally, there would be no reason for subjects to reject the Handshake contract as we observe many do in the second half of the experiment. In all of our experiments, agreeing to play the first best increases the average action taken by the other player. For any action that the subject intends to take, his material payoff will be higher when his partner takes a higher action.

### 5.1.2 Signaling Altruism

Another alternative explanation is that subjects use the contracts to signal their altruistic type, so that altruistic subjects can separate from selfish subjects. Suppose it was the case that only altruistic subjects chose the Handshake contract. However, the selfish subjects would also want to request the Handshake contract since the selfish subject can mimic the signal of the altruist at zero cost, and selfish subjects would prefer to play with an altruistic subject (because altruists would take a higher action, and therefore the selfish subject would receive a higher payoff). Therefore there is no separating equilibrium, only a pooling equilibrium.

In addition, as before, any of the three contracts could facilitate signaling equally well so we would not expect to find systematic differences between the types of contracts and there is no reason under the signaling altruism story why subjects would reject the Handshake contract in the second half of the experiment.

### 5.1.3 Conditional Cooperation

A final alternative explanation is that subjects are conditional cooperators and use the contracts to signal their type. Again, if there are multiple types, there is no separating equilibrium, as every subject will want to signal that they will play a high action in order to increase the action of their partner. Again there will be only a single pooling equilibrium and this pooling equilibrium cannot have actions above the selfish equilibrium.

Moreover, it is again the case that any of the three contracts could facilitate coordination equally well, so we would not be able to explain systematic differences between the contracts. Additionally, no subject would have a reason to reject the Handshake contract in the second half of the game.

Lastly, there is no reason to expect that any conditional cooperators would take actions strictly above their guess of their partner's action. A pure conditional cooperator would want to take the exact same action as his guess, and any self-interested monetary motivations would lead to lower actions. Thus our observation that a substantial number of subjects take actions larger than their stated belief for their partner's action could not be explained by this theory.

## 5.2 Limitations of the Theory

While in our data the importance of the handshake agreement was universal, neither assumption from our theory about the exact form of the norm fit all the games. Therefore, to refine our theory and better predict when enforceable minimums are costly, we want to consider potential explanations for why the norm might be construed differently.

One explanation is that in games with strategic complements subjects must think carefully about what action the other player is likely to choose under the "mixed messages" of having both the minimum action and the handshake action in the contract. The games with strategic complements, however, do not have many subjects playing the selfish equilibrium action even in the Handshake contract, due to strategic incentives. In particular, under the Handshake contract, 31% and 47% of subjects play the selfish action in the APG and DDG (respectively), while only 4% and 1% play the selfish action in the MPG and the BG (respectively).

Another explanation is that when a contract contains both enforceable and unenforceable clauses, the norm is not a convex combination of the two provisions, but that instead heterogeneous individuals choose either the minimum or the handshake to be the relevant norm. This could explain why the 30% minimum is more detrimental to the norm than the 10% minimum, particularly if subjects are more willing to "choose" the minimum as the relevant norm when it is higher. The distribution of actions for the APG and the DDG lend some credence to this kind of model, since the distributions were quite bimodal (especially in the case of the 30% DDG). The vast majority of subjects choose either the smallest possible action (i.e. the minimum action in the case of the Combined contract) or the first best action. The distributions for the games with strategic complements fit this model less well, since many more subjects chose intermediate actions. Such a model would be theoretically much more complicated, since the heterogeneity in the formation of norms would make (higher order) beliefs more important, and would possibly create multiple equilibria. However, such a model is potentially worth considering.

## 5.3 Related Literature

By emphasizing the role that contracts have in establishing norms, our paper is notably related to several recent papers that have explored how contracts interact with norms and perceptions of fairness. In particular, Sliwka (2007) considers how contracts can affect perceptions about the prevailing norm. Sliwka argues that the form of labor contracts chosen by an employer signals her belief about what behavioral norm applies in the population of potential employees.[26] Sliwka assumes an asymmetric relationship where the employer is more knowledgable about norms (and thus in some sense has the unilateral power to set norms) and assumes that the employer may only choose between already existing norms, namely selfishness or fairness. A subset of the employees infer from the employer's choice of an incentive contract (i.e. an enforceable performance-based component) that the prevailing norm is selfishness, while the absence of an incentive contract implies a fairness norm. Thus, the nature of the contract affects the perceived norm. We depart from this literature in a few important ways. We focus on symmetric relationships where both economic agents mutually create the norm through their contract. Rather than an employment context where the employer has effectively unilateral authority to set the contract and where the obligations of the contract (and the norm) fall on the employee, our context gives both parties an equal ability to determine the contract, and thus the norm, and an equal contractual and normative performance obligation.

Our approach is also related to Hart and Moore (2008), which argues that contracts set reference points, and individuals alter their behavior when outcomes differ from these reference points. These predictions are demonstrated experimentally by Fehr, Hart and Zehnder (2008). However, the Hart-Moore approach focuses on cases where there is ex ante uncertainty about the state of the world, and their model assumes that relatively incomplete "flexible" contracts (i.e. contracts that specify a range of possible prices to allow for trade in different states) will generate undesirable behavioral consequences (such as feeling that the allocation is unfair, leading to "shading" effort to provide only "perfunctory" rather than "consummate" performance). "Rigid" fixed price contracts, in contrast, may rule out trade in some states, but eliminate shading of effort. In our approach, behavioral motivations

[26]Sliwka motivates his model as an explanation for the "hidden costs of control" literature, which we will discuss further, where the enforceable minimum action undermines a norm of high effort.

provide a positive pressure for individuals to take actions closer to the first best. Incomplete contracts enhance this positive effect because the particulars of the contract determine the norm. Additionally, while our model is compatible with ex ante uncertainty, we focus on the case of ex ante certainty.

As we indicated previously, we considered the CO assumption that enforceable minimums could detrimentally lead to lower norms because of the literatures on the crowding out of intrinsic motivation and the hidden cost of control. Several experiments (e.g. Gneezy and Rustichini 2000a and 2000b) have shown that the introduction of monetary rewards and/or penalties can diminish individuals' intrinsic willingness to engage in prosocial behavior. The hidden costs literature makes a similar observation relating to control mechanisms in principal agent settings. Falk and Kosfeld (2006) show that when a principal exerts control on an agent by adding a unilateral enforceable minimum to their production options, most agents respond by providing a lower level of production than they would have without an enforceable minimum.[27] Similarly, Fehr, Klein and Schmidt (2007) find that incentive contracts that have a fine that punishes low production yields lower effort than a bonus contract that offers an unenforceable bonus for high production. In addition, Fehr and Schmidt (2007) show that adding a fine to the bonus contract does not increase production, and if the enforceable fine has a cost to execute, the fine lowers total surplus. Similarly, we consider whether extrinsic enforceable controls may crowd out the unenforceable commitment to take the first best action. While these literatures might suggest that the introduction of enforceable minimum actions to a contract would undermine the effectiveness of handshake agreements, we find only mixed results—enforceable minimum actions are harmful in the Bertrand Game, but not otherwise. This suggests that while norms appear to be broadly important, the concerns of the crowding out and hidden costs literatures are not universal in contracting settings.

One possible explanation for the difference of our results from the existing literatures is that the previous experimental paradigms focus on a principal-agent setting where the principal may make unilateral contracting and control decisions that affect the agent. In this case, imposing a minimum action unilaterally is likely to be interpreted as a sign of distrust in the agent. In contrast, our experimental paradigm allows both subjects (with equal

[27] Dufwenberg et al (2006) similarly show that even exogenously imposed minimum actions are detrimental in a Bertrand Competition game.

bargaining power) to mutually set the norms for the relationship and gives both subjects symmetric obligations within the relationship, a context that encompasses many workplace settings as well as joint projects and cooperative agreements. In the context of the previous experimental literature, our results suggest that potential tradeoffs between possible enforceable and unenforceable aspects of the contract may depend fundamentally on the structure of the game.

More generally, our experiment fits within the extensive literature on cheap talk, promises, and other preplay communication. Various forms of preplay communication have been shown to often be helpful in coordination, oligopoly and social dilemma games (see Crawford (1998) for an overall survey as well as Holt (1995, pp 409-411) for a survey of oligopoly games and Ledyard (1995, pp 156-158) for a survey of public goods games). Several experiments have considered a form of preplay communication that is particularly close to our "handshake agreements"—allowing subjects to promise what action they will take (see e.g. Charness and Dufwenberg (2006) and Vanberg (2008)[28]). Our experiment is distinctive, however, in that we allow for both unenforceable communication and/or an enforceable restriction on the action space. The preplay communication literature only considers the former, while the "hidden cost of control" literature only includes the latter. In real world contracting environments, both aspects of the contract will generally be available and potentially desirable. Because we can directly compare the efficiency-enhancement of contracts with only enforceable restrictions, only unenforceable agreements, or both, we are able to identify that the norm creation aspect of very weak contracts plays an important role in their appeal relative to the limited enforceable tools available.

Finally, our approach shares features in common with the organizational behavior literature on "psychological contracts" (see Rousseau (1989) for a seminal paper in this literature, as well as Morrison and Robinson (1997) on psychological contract violation and Rousseau and Parks (1992) who contrast psychological contracts with other forms of contracts), which studies the set of expectations and obligations that a contract creates. Our approach and the psychological contract literature share an emphasis on the beginning of the relationship

[28]Vanberg's paper is particularly interesting in that he demonstrates directly that individuals have a preference for promise keeping per se, rather than behavior being driven by the effect promises have on others' beliefs.

as the time when the beliefs and understandings of each parties obligations and duties. In our case, we focus on the contracting process between the parties—during which the two parties have the opportunity to commit to unenforceable principles that help establish the norm. Similarly, the psychological contract for the employment relationship is generally created during recruitment and interviews (see e.g. Purvis and Cropley 2003). Our approach differs from that of psychological contracts in several respects. The psychological contract literature has generally focused on employment relationships and has largely emphasized the psychological contract as the personal, subjective belief that the employee holds about the employer and employee's obligations. Moreover, the literature has mostly emphasized that the employee's beliefs will generally not accord with the beliefs of the employer, and that these conflicting beliefs and the resulting perceived violations of the psychological contract are at the root of many problems in the employment relation. Our approach does not focus on employment-like relationships, and we focus on clear communication of norms that are mutually established and mutually understood.

# 6 Conclusion

In this paper we argue that contracts establish the norms that govern a relationship and that incomplete contracts are sufficient to set high norms. We show that norms can be established endogenously and can be specific to a particular relationship. We show that contracts can create these norms and do so even when the contracting environment limits agents' ability to write enforceable agreements. In our experiment, we find that very incomplete contracts can substantially affect behavior and increase efficiency. This result suggests a further reason why incomplete contracts might be so prevalent: if incomplete contracts set high norms that increase efficiency, and if adding completeness is costly without much additional benefit, contracts may be left intentionally incomplete.

We develop a model to formalize these intuitions and conduct an experiment to test them. We demonstrate that even perfectly incomplete contracts, consisting of only an unenforceable "handshake" agreement to play the first best, move behavior substantially closer to the social optimum. These Handshake contracts are generally more effective than contracts that only include enforceable restrictions on actions, and are usually as effective—and sometimes more effective—than contracts that include both a handshake agreement and an enforceable minimum. We observe that the handshake agreements do most of the work in increasing efficiency in the Combined contract. We also observe that imposing the enforceable minimum is not as widely detrimental as the "hidden cost of control" literature suggests. We also observe many subjects, at a substantial monetary cost, declining to make handshake agreements that they would ultimately violate, results consistent with our model that contracts establish norms and individuals experience disutility for taking actions that deviate from the norm. Moreover, alternate explanations cannot successfully generate our results.

Having demonstrated the important role of norms and contracts in these simple, symmetric two-person games with no uncertainty, there are at least four fruitful dimensions to develop and extend our results in future research. First, in our experiment, the contracts were presented with the minimum and the handshake agreements fixed and subjects were only able to accept or reject the whole contract. Future experiments could allow subjects to directly negotiate each of these clauses. It would be quite interesting to see whether the benefit of the Handshake contract would be enhanced or diminished when subjects may haggle over the exact unenforceable agreement. Similarly, the minimum clause in the Combined contract may be more detrimental to the norm when subjects must choose it directly. Second, in our current study the same individual makes the norm-establishing agreement and chooses whether to fulfill the agreement. However in many cases, particularly when the parties to a contract are firms rather than individuals, the individual who establishes the contract and the individual who ultimately fulfills the contract may not be the same. Thus it may be important to establish experimentally whether shared payoffs and/or ex ante coordination over the contracting decisions are sufficient to motivate one individual to fulfill the unenforceable agreement established by another individual. Third, we have focused on games without uncertainty, however much of the incomplete contracts literature focuses on uncertainty, and the resulting difficulty in describing the relevant state of the world, as a source of contractual incompleteness. Our intuition about how contracts establish norms can extend to this case: even if they cannot describe ex ante the first best in each state of the world, the contracting parties can agree to the principle that they should take the first best action when it becomes clear what the first best action is. This may be sufficient to establish a norm that will increase the efficiency of the resulting actions, a result that could be tested experimentally. Fourth, we restricted our attention to single dimensional action spaces and thus one simple handshake agreement. If instead the economic interactions are multi-dimensional, it may be interesting to consider what is the optimal mix of enforceable and unenforceable clauses in the contract. In particular, if there are limitations on how many unenforceable agreements an individual will feel beholden to follow (that is if too many different handshake agreements dilute the influence of the norm), then it may be optimal to focus on establishing a norm for the most important dimensions of the relationship and rely on enforceable components of the contract for the other dimensions.

# 7 Appendix A

**Proof of Proposition 1**

**Proof.** *For the APG we have:*

$$U_i(x_i, x_j; \hat{x}) = \alpha(x_i + x_j) - \frac{x_i^2}{2} - \frac{\phi}{2}(x_i - \hat{x})^2$$

This yields the FOC $\alpha - x_i - \phi(x_i - \hat{x}) = 0$ and therefore $x^* = \frac{\alpha+\phi\hat{x}}{1+\phi}$. Taking the derivative with respect to $\hat{x}$ yields $\frac{\partial x^*}{\partial \hat{x}} = \frac{\phi}{1+\phi} > 0$. Note that $x^* \to \hat{x}$ as $\phi \to \infty$, so if $\hat{x} = x_{\text{FB}}$ the first best is possible.

Substituting into the utility function we see that total utility is

$$U^* = \frac{4\alpha^2}{1+\phi} + \frac{4\alpha\phi\hat{x}}{1+\phi} - \left(\frac{\alpha+\phi\hat{x}}{1+\phi}\right)^2 - \phi\left(\frac{\alpha-\hat{x}}{1+\phi}\right)^2 = \frac{3\alpha^2 + \phi\hat{x}(4\alpha - \hat{x})}{1+\phi}$$

where $\frac{\partial U^*}{\partial \hat{x}} = \frac{2\phi(2\alpha-\hat{x})}{1+\phi} > 0$.

*For the DDG we have:*

$$U_i(x_i, x_j; \hat{x}) = (E - x_i) + \alpha x_j - \frac{\phi}{2}(x_i - \hat{x})^2$$

with FOC $-1 - \phi(x_i - \hat{x}) = 0$, impliying $x^* = \hat{x} - \frac{1}{\phi}$. Therefore $\frac{\partial x^*}{\partial \hat{x}} = 1 > 0$. Again we have that $x^* \to \hat{x}$ as $\phi \to \infty$, so if $\hat{x} = x_{\text{FB}}$ the first best is possible.

Total utility is then

$$U^* = 2E + 2(\alpha - 1)x^* - \phi(x^* - \hat{x})^2 = 2E + 2(\alpha - 1)\hat{x} - \frac{2\alpha - 1}{\phi}$$

therefore $\frac{\partial U^*}{\partial \hat{x}} = 2(\alpha - 1) > 0$. ■

**Proof of Proposition 2**

**Proof.** *For the MPG we have:*

$$U_i(x_i, x_j; \hat{x}) = \alpha(x_i * x_j) - \frac{x_i^2}{2} - \frac{\phi}{2}(x_i - \hat{x})^2$$

This yields the FOC $\alpha x_j - x_i - \phi(x_i - \hat{x}) = 0$, which implies that $x^* = \frac{\alpha x_j + \phi \hat{x}}{1+\phi}$. Substituting $x_j = x^*$ yields $x^* = \frac{\phi}{1-\alpha+\phi}\hat{x}$, which means that $\frac{\partial x^*}{\partial \theta} = \frac{\phi}{1-\alpha+\phi} x_{\text{FB}} > 0$. Note again that $x^* \to \hat{x}$ as $\phi \to \infty$, so if $\hat{x} = x_{\text{FB}}$ the first best is possible.

For total utility we have

$$U^* = 2\alpha\left(\frac{\phi}{1-\alpha+\phi}\hat{x}\right)^2 - \left(\frac{\phi}{1-\alpha+\phi}\hat{x}\right)^2 - \phi\left(\frac{1-\alpha}{1-\alpha+\phi}\hat{x}\right)^2 = \frac{\phi^2(2\alpha-1) - \phi(1-\alpha)^2}{(1-\alpha+\phi)^2}\hat{x}^2$$

hence $\frac{\partial U^*}{\partial \hat{x}} = \frac{2(\phi^2(2\alpha-1) - \phi(1-\alpha)^2)}{(1-\alpha+\phi)^2}\hat{x}$ where $\frac{\partial U^*}{\partial \hat{x}} > 0$ if $\phi > \frac{(1-\alpha)^2}{(2\alpha-1)} = \bar{\phi}$. Note that $\bar{\phi} \to 0$ as $\alpha \to 1$, i.e. as the amount of strategic complementarity increases and thus the difference between the other agent's action and the selfish best response decreases.

*For the BG:* We focus on symmetric pure strategy equilibria. There are in fact a set of equilibria where $x^* = \hat{x} - k$ for some k. The equilibrium payoff is $U^* = \frac{\hat{x}-k}{2} - \frac{\phi}{2}k^2$. The two relevant deviations, $x_i = \hat{x}$ and $x_i = x^* - 1$ will put limits on what k can be. To prevent the deviation to $x_i = \hat{x}$ we need $\frac{\hat{x}-k}{2} - \frac{\phi}{2}k^2 \geq 0$ which means we need $k \leq \frac{\sqrt{1+4\phi\hat{x}}-1}{2\phi} = k_{\max} > 0$. To prevent the deviation to $x_i = x^* - 1$ we need $\frac{\hat{x}-k}{2} - \frac{\phi}{2}k^2 \geq \hat{x} - k - 1 - \frac{\phi}{2}(k+1)^2$, or $k \geq \frac{\hat{x}-2-\phi}{1+2\phi} = k_{\min}$. Note that for $\phi \geq \hat{x} - 2$, $k_{\min} < 0$, and therefore $x^* = \hat{x}$ is an equilibrium (and therefore if $\hat{x} = x_{\text{FB}}$ the first best is achievable). Therefore the highest utility equilibrium will have $x^* = \hat{x} - k_{\min} = \frac{2+\phi+2\phi\hat{x}}{1+2\phi}$ if $\phi < \hat{x} - 2$, or $x^* = \hat{x}$ otherwise. Taking the derivative with respect to $\hat{x}$: $\frac{\partial x^*}{\partial \hat{x}} = \frac{2\phi}{1+2\phi} > 0$ if $\phi < \hat{x} - 2$, and $\frac{\partial x^*}{\partial \hat{x}} = 1$ otherwise.

If $\phi < \hat{x} - 2$ the resulting total utility is

$$\begin{aligned} U^* = & \left(\frac{2+\phi+2\phi\hat{x}}{1+2\phi}\right) - \phi\left(\frac{\hat{x}-2-\phi}{1+2\phi}\right)^2 \\ = & \frac{2 - \phi^3 + \phi^2(6\hat{x}-2) + \phi(1+6\hat{x}-\hat{x}^2)}{(1+2\phi)^2} \end{aligned}$$

And thus $\frac{\partial U^*}{\partial \hat{x}} = \frac{2\phi(3+3\phi-\hat{x})}{(1+2\phi)^2}$ where $\frac{\partial U^*}{\partial \hat{x}} > 0$ if $\phi > \frac{\hat{x}}{3} - 1 = \bar{\phi}$. Additionally, $\phi > \bar{\phi}$ is sufficient to ensure that $k_{\max} > k_{\min}$. If instead $\phi \geq \hat{x} - 2$ total utility is $U^* = \hat{x}$, and $\frac{\partial U^*}{\partial \hat{x}} = 1$ ■

**Proof of Proposition 3**

**Proof.** *For the APG we have:*

$$U_i(x_i, x_j; \hat{x}) = \alpha(x_i + x_j) - \frac{x_i^2}{2} - \frac{\phi}{2}(x_i - \hat{x})^2$$
$$U_j(x_j, x_i; \hat{x}) = \alpha(x_i + x_j) - \frac{x_j^2}{2}$$

This yields the FOCs $\alpha - x_i - \phi(x_i - \hat{x}) = 0$ and $\alpha - x_j = 0$, implying $x_i^* = \frac{\alpha + \phi\hat{x}}{1+\phi}$ and $x_j^* = \alpha$. As we showed before, $\frac{\partial x_i^*}{\partial \hat{x}} > 0$, and clearly $x_j^*$ is constant.

To examine efficiency we can look at total utility:

$$U^* = 2\alpha\left(\frac{\alpha + \phi\hat{x}}{1+\phi}\right) + 2\alpha^2 - \frac{1}{2}\left(\frac{\alpha + \phi\hat{x}}{1+\phi}\right)^2 - \frac{1}{2}\alpha^2 - \frac{\phi}{2}\left(\frac{\alpha - \hat{x}}{1+\phi}\right)^2 = \frac{3\alpha^2(2+\phi) + \phi\hat{x}(4\alpha - \hat{x})}{2(1+\phi)}$$

Taking the derivative with respect to $\hat{x}$ yields $\frac{\partial U^*}{\partial \hat{x}} = \frac{\phi(2\alpha - \hat{x})}{(1+\phi)} > 0$ for $\hat{x} < 2\alpha$.

*For the DDG we have:*

$$U_i(x_i, x_j; \hat{x}) = (E - x_i) + \alpha x_j - \frac{\phi}{2}(x_i - \hat{x})^2$$
$$U_j(x_j, x_i; \hat{x}) = (E - x_j) + \alpha x_i$$

with FOCs $-1 - \phi(x_i - \hat{x}) = 0$ and $-1 < 0$, therefore $x_i^* = \hat{x} - \frac{1}{\phi}$ and $x_j^* = x_{\min} = 0$. As before, $x_i^*$ is clearly increasing in $\hat{x}$, while $x_j^*$ is constant.

Total utility is

$$U^* = 2E - \left(\hat{x} - \frac{1}{\phi}\right) + \alpha\left(\hat{x} - \frac{1}{\phi}\right) - \frac{\phi}{2}\left(\frac{1}{\phi}\right)^2 = 2E + (\alpha - 1)\hat{x} - \frac{2\alpha - 1}{2\phi}$$

with $\frac{\partial U^*}{\partial \hat{x}} = (\alpha - 1) > 0$. ■

**Proof of Proposition 4**

**Proof.** *For the MPG we have:*

$$U_i(x_i, x_j; \hat{x}) = \alpha(x_i * x_j) - \frac{x_i^2}{2} - \frac{\phi}{2}(x_i - \hat{x})^2$$
$$U_j(x_j, x_i; \hat{x}) = \alpha(x_i * x_j) - \frac{x_j^2}{2}$$

This yields FOCs $\alpha x_j - x_i - \phi(x_i - \hat{x}) = 0$ and $\alpha x_i - x_j = 0$, therefore $x_i = \frac{\alpha x_j + \phi\hat{x}}{1+\phi}$ and $x_j = \alpha x_i$. Substituting $x_j = \alpha x_i$ into the equation for the norm sensitive agent's action we get $x_i^* = \frac{\phi\hat{x}}{1-\alpha^2+\phi}$ and $x_j^* = \frac{\alpha\phi\hat{x}}{1-\alpha^2+\phi}$. This means that $\frac{\partial x_i^*}{\partial \hat{x}} = \frac{\phi}{1-\alpha^2+\phi} > 0$ and $\frac{\partial x_j^*}{\partial \hat{x}} = \frac{\alpha\phi}{1-\alpha^2+\phi} > 0$.

Total utility is

$$\begin{aligned} U^* = & \ 2\alpha^2 \left( \frac{\phi \hat{x}}{1-\alpha^2+\phi} \right)^2 - \frac{1}{2} \left( \frac{\phi \hat{x}}{1-\alpha^2+\phi} \right)^2 - \frac{1}{2} \left( \frac{\alpha \phi \hat{x}}{1-\alpha^2+\phi} \right)^2 - \frac{\phi}{2} \left( \frac{(1-\alpha^2)\hat{x}}{1-\alpha^2+\phi} \right)^2 \\ = & \ \frac{\alpha^2(2+3\phi)-(1+\alpha^4+\phi)}{2(1-\alpha^2+\phi)^2} \phi \hat{x}^2 \end{aligned}$$

therefore $\frac{\partial U^*}{\partial \hat{x}} = \frac{\alpha^2(2+3\phi)-(1+\alpha^4+\phi)}{2(1-\alpha^2+\phi)^2} \phi \hat{x}$ where $\frac{\partial U^*}{\partial \hat{x}} > 0$ if $\phi > \frac{(1-\alpha^2)^2}{3\alpha^2-1} = \bar{\phi}$ and $\alpha > \sqrt{\frac{1}{3}}$. Note that as in the symmetric $\phi$ case $\bar{\phi}$ is decreasing in $\alpha$.

*For the BG we have:* First, we can show that the pure strategy equilibrium will exist only for large $\phi$. Suppose $x_i < \hat{x}$. Then in any equilibrium we need $x_j = x_i - 1$. Therefore $U_i = -\frac{\phi}{2}(x_i - \hat{x})^2 < 0$, and thus the norm sensitive agent could deviate to $x_i = \hat{x}$ and increase his utility. So the only possible pure equilibrium is $x_i = \hat{x}$ and $x_j = \hat{x} - 1$. This means that $U_i = 0$, therefore to prevent deviations we need $U_i(\hat{x}-1, \hat{x}-1; \hat{x}) \leq 0$ and $U_i(\hat{x}-2, \hat{x}-1; \hat{x}) \leq 0$. $U_i(\hat{x}-2, \hat{x}-1; \hat{x}) = \hat{x} - 2 - \frac{\phi}{2}(4)$, and therefore we need $\phi \geq \frac{\hat{x}}{2} - 1$. Similarly, $U_i(\hat{x}-1, \hat{x}-1; \hat{x}) = \frac{\hat{x}-1}{2} - \frac{\phi}{2}$ so we need $\phi \geq \hat{x} - 1$. However if $\phi \geq \bar{\phi}_1 = \hat{x} - 1$, $x_i = \hat{x}$ and $x_j = \hat{x} - 1$ is a pure equilibrium with total utility $U^* = \hat{x} - 1$.

For smaller values of $\phi$ only mixed equilibria will exist. Fortunately we can say quite a bit about any such equilibrium. Let $\{(x_{i,1}, p_{i,1}), (x_{i,2}, p_{i,2}), ..., (x_{i,m}, p_{i,m})\}$ denote the norm sensitive agent's mixed strategy (where $x_{i,1} < x_{i,2} < ... < x_{i,m}$), and let $\{(x_{j,1}, p_{j,1}), (x_{j,2}, p_{j,2}), ..., (x_{j,n}, p_{j,n})\}$ denote the selfish agent's mixed strategy (where $x_{j,1} < x_{j,2} < ... < x_{j,m}$).

First, we can show that in any mixed equilibrium with $\phi$ larger than a threshold $\bar{\phi}_2 \leq 1$ and $\hat{x} \geq 4$ the selfish agent cannot take the highest action, i.e. $x_{j,n} < x_{i,m}$. Suppose $x_{j,n} > x_{i,m}$. However, he receives zero utility when he plays $x_{j,n}$ but he could receive positive utility if he played $x_j = x_{i,m}$ instead. Now suppose $x_{j,n} = x_{i,m} = \hat{x} - k$ for some $k \geq 0$. Then to prevent a deviation downward by the selfish agent we need $\frac{1}{2}p_{i,m}(\hat{x} - k) \geq p_{i,m}(\hat{x} - k - 1)$ implying $2 \geq \hat{x} - k$, i.e. the only mixed equilibrium where both agents play the same highest action is one where they mix over $x = 1$ and $x = 2$. The norm sensitive agent has to play only $x = 2$ for the selfish agent to be indifferent between $x = 1$ and $x = 2$. In order to ensure that the norm sensitive agent's utility is at least zero (since he could assure a zero utility by playing $\hat{x}$) we need $2 - \frac{\phi}{2}(\hat{x} - 2)^2 \geq 0$ or $\phi \leq \frac{4}{(\hat{x}-2)^2}$ where $\frac{4}{(\hat{x}-2)^2} \leq 1$ if $\hat{x} \geq 4$. Therefore if $\phi \geq \bar{\phi}_2 = \frac{4}{(\hat{x}-2)^2}$ in any mixed equilibrium $x_{j,n} < x_{i,m}$.

Then it immediately follows that $x_{i,m} = \hat{x}$. When the norm sensitive agent plays $x = x_{i,m}$ his probability of receiving any positive monetary payoff is zero, therefore if $x_{i,m} < \hat{x}$ his payoff would be negative, whereas with $x_{i,m} = \hat{x}$ he can receive a payoff of zero. Additionally, this means that the norm sensitive agent's utility in any mixed equilibrium is zero.

Let $\underline{x}$ be the smallest possible action the norm sensitive agent could take and receive a non-negative utility if the selfish agent took a higher action with probability one. That is, $\underline{x}$ is defined by $\underline{x} - \frac{\phi}{2}(\hat{x} - \underline{x})^2 \equiv 0$ or $\underline{x} = \hat{x} - \frac{\sqrt{1+2\phi\hat{x}}-1}{\phi}$ Therefore since clearly $x_{i,1} \geq \underline{x}$, in any mixed equilibrium we will have $x_{j,1} \geq \underline{x} - 1$, and therefore $U_j = U^* \geq \underline{x} - 1$. Similarly in any mixed equilibrium we will have $x_{j,1} \leq \underline{x} + 1$, and therefore $U_j = U^* \leq \underline{x} + 1$, since if $x_{j,1} > \underline{x} + 1$ the norm sensitive agent could play $x_i = \underline{x} + 1$ and receive a positive utility. Additionally, this means that in any mixed equilibrium we also have $x_{i,1} \leq \underline{x} + 2$, since if $x_{i,1} > \underline{x} + 2$ otherwise the selfish agent would receive higher utility from playing $x_j = \underline{x} + 2$ than playing $x_{j,1} \leq \underline{x} + 1$.

Lastly, since $\frac{\partial \underline{x}}{\partial \hat{x}} = 1 - \frac{1}{\sqrt{1+2\phi\hat{x}}} > 0$, the upper and lower bounds on $x_{i,1}$, $x_{j,1}$ and $U^*$ are all increasing in $\hat{x}$. ■

**Proof of Proposition 5**

**Proof.** *For the APG:* If the M contract has a slack minimum action then it is equivalent to the N contract, which we have already established is inferior to the H contract. Therefore we can focus on the region where M binds, resulting in $U^*_{\mathrm{M}} = \bar{x}_{\mathrm{enf}}\left(4\alpha - \bar{x}_{\mathrm{enf}}\right) - \phi\left(\hat{x}_0 - \bar{x}_{\mathrm{enf}}\right)^2$ if $\bar{x}_{\mathrm{enf}} < \hat{x}_0$ (with $\frac{\partial U^*_{\mathrm{M}}}{\partial \bar{x}_{\mathrm{enf}}} = 2(2\alpha - \bar{x}_{\mathrm{enf}}) + 2\phi(\hat{x}_0 - \bar{x}_{\mathrm{enf}}) \geq 0$), or $U^*_{\mathrm{M}} = \bar{x}_{\mathrm{enf}}\left(4\alpha - \bar{x}_{\mathrm{enf}}\right)$ if $\bar{x}_{\mathrm{enf}} \geq \hat{x}_0$ (with $\frac{\partial U^*_{\mathrm{M}}}{\partial \bar{x}_{\mathrm{enf}}} = 2(2\alpha - \bar{x}_{\mathrm{enf}}) \geq 0$), so the M contract will be most effective for large $\bar{x}_{\mathrm{enf}}$. If $\bar{x}_{\mathrm{enf}}$ is large enough that the C contract also binds, its clear that the M contract will be superior, since it will generate the same action but since it has a lower norm it will have less (or no) disutility for violating the norm. Since the C contract is equivalent to the H contract when slack, we need focus only on the point $\bar{x}_1$ where $U^*_{\mathrm{M}}(\bar{x}_1) = U^*_{\mathrm{H}}$. $\bar{x}_1$ is defined implicitly by $U^*_{\mathrm{M}}(\bar{x}_1) = \bar{x}_1\left(4\alpha - \bar{x}_1\right) = \frac{3+4\phi}{1+\phi}\alpha^2 = U^*_{\mathrm{H}}$ if the resulting $\bar{x}_1 \geq \hat{x}_0$, otherwise it is defined by $U^*_{\mathrm{M}}(\bar{x}_1) = \bar{x}_1\left(4\alpha - \bar{x}_1\right) - \phi\left(\hat{x}_0 - \bar{x}_1\right)^2 = \frac{3+4\phi}{1+\phi}\alpha^2$. Note that by the implicit function theorem if $\bar{x}_1 < \hat{x}_0$ we have $\frac{\partial \bar{x}_1}{\partial \phi} = \frac{\alpha^2 + (1+\phi)^2(\hat{x}_0 - \bar{x}_1)^2}{2(1+\phi)^3(2\alpha - \bar{x}_{\mathrm{enf}})} > 0$ and $\frac{\partial \bar{x}_1}{\partial \hat{x}_0} = \frac{2\phi(\hat{x}_0 - \bar{x}_1)}{2(1+\phi)(2\alpha - \bar{x}_{\mathrm{enf}})} > 0$, and if $\bar{x}_1 \geq \hat{x}_0$ we have $\frac{\partial \bar{x}_1}{\partial \phi} = \frac{\alpha^2}{2(1+\phi)^2(2\alpha - \bar{x}_1)} > 0$ and $\frac{\partial \bar{x}_1}{\partial \hat{x}_0} = 0$.

*For the DDG:* Proceeds as in the APG. $U^*_{\mathrm{M}} = 2E + 2(\alpha - 1)\bar{x}_{\mathrm{enf}} - \phi\left(\hat{x}_0 - \bar{x}_{\mathrm{enf}}\right)^2$ if $\bar{x}_{\mathrm{enf}} < \hat{x}_0$ (with $\frac{\partial U^*_{\mathrm{M}}}{\partial \bar{x}_{\mathrm{enf}}} = 2(\alpha - 1) + 2(\hat{x}_0 - \bar{x}_{\mathrm{enf}}) \geq 0$), or $U^*_{\mathrm{M}} = 2E + 2(\alpha - 1)\bar{x}_{\mathrm{enf}}$ if $\bar{x}_{\mathrm{enf}} \geq \hat{x}_0$ (with

$\frac{\partial U^*_{\mathrm{M}}}{\partial \bar{x}_{\mathrm{enf}}} = 2(\alpha - 1) \geq 0$), so the M contract will be most effective for large $\bar{x}_{\mathrm{enf}}$. Define $\bar{x}_1$ where $U^*_{\mathrm{M}}(\bar{x}_1) = U^*_{\mathrm{H}}$. $\bar{x}_1$ is defined by $U^*_{\mathrm{M}}(\bar{x}_1) = 2E + 2(\alpha-1)\bar{x}_1 = 2E + 2(\alpha-1)E - \frac{2\alpha-1}{\phi} = U^*_{\mathrm{H}}$, i.e. $\bar{x}_1 = E - \frac{2\alpha-1}{2\phi(\alpha-1)}$, if the resulting $\bar{x}_1 \geq \hat{x}_0$, otherwise it is defined implicitly by $U^*_{\mathrm{M}}(\bar{x}_1) = 2E + 2(\alpha-1)\bar{x}_1 - \phi\left(\hat{x}_0 - \bar{x}_1\right)^2 = 2E + 2(\alpha-1)E - \frac{2\alpha-1}{\phi}$. Note that by the implicit function theorem if $\bar{x}_1 < \hat{x}_0$ we have $\frac{\partial \bar{x}_1}{\partial \phi} = \frac{(\hat{x}_0-\bar{x}_1)^2+2(2\alpha-1)}{\phi^3(2(\alpha-1)+2\phi(\hat{x}_0-\bar{x}_1))} > 0$ and $\frac{\partial \bar{x}_1}{\partial \hat{x}_0} = \frac{2\phi(\hat{x}_0-\bar{x}_1)}{2(\alpha-1)+2\phi(\hat{x}_0-\bar{x}_1)} > 0$, and if $\bar{x}_1 \geq \hat{x}_0$ we have directly $\frac{\partial \bar{x}_1}{\partial \phi} = \frac{2\alpha-1}{\phi^3(\alpha-1)} > 0$ and $\frac{\partial \bar{x}_1}{\partial \hat{x}_0} = 0$.

*For the MPG:* Proceeds in the same manner, with $U^*_{\mathrm{M}} = (2\alpha-1)\bar{x}^2_{\mathrm{enf}} - \phi(\hat{x}_0 - \bar{x}_{\mathrm{enf}})^2$ if $\bar{x}_{\mathrm{enf}} < \hat{x}_0$ (with $\frac{\partial U^*_{\mathrm{M}}}{\partial \bar{x}_{\mathrm{enf}}} = 2(2\alpha-1)\bar{x}_{\mathrm{enf}} + 2\phi(\hat{x}_0 - \bar{x}_{\mathrm{enf}}) \geq 0$), or $U^*_{\mathrm{M}} = (2\alpha-1)\bar{x}^2_{\mathrm{enf}}$ if $\bar{x}_{\mathrm{enf}} \geq \hat{x}_0$ (with $\frac{\partial U^*_{\mathrm{M}}}{\partial \bar{x}_{\mathrm{enf}}} = 2(2\alpha-1)\bar{x}_{\mathrm{enf}} \geq 0$), so the M contract will be most effective for large $\bar{x}_{\mathrm{enf}}$. Define $\bar{x}_1$ where $U^*_{\mathrm{M}}(\bar{x}_1) = U^*_{\mathrm{H}}$. $\bar{x}_1$ is defined by $U^*_{\mathrm{M}}(\bar{x}_1) = (2\alpha-1)\bar{x}_1^2 = \frac{\phi\left(\phi(2\alpha-1)-(1-\alpha)^2\right)}{(1-\alpha+\phi)^2} x^2_{\max} = U^*_{\mathrm{H}}$, i.e. $\bar{x}_1 = \sqrt{\phi^2 - \phi\frac{(1-\alpha)^2}{2\alpha-1}}\left(\frac{x_{\max}}{1-\alpha+\phi}\right)$, if the resulting $\bar{x}_1 \geq \hat{x}_0$, otherwise it is defined implicitly by $U^*_{\mathrm{M}}(\bar{x}_1) = (2\alpha-1)\bar{x}_1^2 - \phi\left(\hat{x}_0 - \bar{x}_1\right)^2 = \frac{\phi\left(\phi(2\alpha-1)-(1-\alpha)^2\right)}{(1-\alpha+\phi)^2} x^2_{\max} = U^*_{\mathrm{H}}$. Note that by the implicit function theorem if $\bar{x}_1 < \hat{x}_0$ we have $\frac{\partial \bar{x}_1}{\partial \phi} = \frac{(1-\alpha)\left((3\alpha-1)\phi-(1-\alpha)^2\right)x^2_{\max}}{2(1-\alpha+\phi)^3((2\alpha-1)\bar{x}_1+\phi(\hat{x}_0-\bar{x}_1))} > 0$ (since we have assumed that $\phi > \frac{(1-\alpha)^2}{(2\alpha-1)}$) and $\frac{\partial \bar{x}_1}{\partial \hat{x}_0} = \frac{2\phi(\hat{x}_0-\bar{x}_1)}{2((2\alpha-1)\bar{x}_1+\phi(\hat{x}_0-\bar{x}_1))} > 0$, and if $\bar{x}_1 \geq \hat{x}_0$ we have directly $\frac{\partial \bar{x}_1}{\partial \phi} = \frac{(1-\alpha)\left((3-\alpha)\phi-(1-\alpha)^2\right)x_{\max}}{2(1-\alpha+\phi)^2\sqrt{\phi(\phi-(1-\alpha)^2)}} > 0$ (since we have assumed that $\phi > \frac{(1-\alpha)^2}{(2\alpha-1)}$) and $\frac{\partial \bar{x}_1}{\partial \hat{x}_0} = 0$.

*For the BG:* As before, we will focus on the highest utility equilibrium. If $\phi \geq x_{\max} - 2$, the claim follow immediately with $\bar{x}_1 = x_{\max}$, since the H contract can achieve the first best of $x^* = x_{\max}$. Therefore to prove the claim for smaller $\phi$, assume $\phi < x_{\max} - 2$.

This case proceeds as previously, with $U^*_{\mathrm{M}} = \bar{x}_{\mathrm{enf}} - \phi(\hat{x}_0 - \bar{x}_{\mathrm{enf}})^2$ if $\bar{x}_{\mathrm{enf}} < \hat{x}_0$ (with $\frac{\partial U^*_{\mathrm{M}}}{\partial \bar{x}_{\mathrm{enf}}} = 1 + 2\phi(\hat{x}_0 - \bar{x}_{\mathrm{enf}}) \geq 0$), or $U^*_{\mathrm{M}} = \bar{x}^2_{\mathrm{enf}}$ if $\bar{x}_{\mathrm{enf}} \geq \hat{x}_0$ (with $\frac{\partial U^*_{\mathrm{M}}}{\partial \bar{x}_{\mathrm{enf}}} = 1$), so the M contract will be most effective for large $\bar{x}_{\mathrm{enf}}$. Define $\bar{x}_1$ where $U^*_{\mathrm{M}}(\bar{x}_1) = U^*_{\mathrm{H}}$. $\bar{x}_1$ is defined by $U^*_{\mathrm{M}}(\bar{x}_1) = \bar{x}_1 = \frac{2-\phi^3+\phi^2(6x_{\max}-2)+\phi(1+6x_{\max}-x^2_{\max})}{(1+2\phi)^2} = U^*_{\mathrm{H}}$ if the resulting $\bar{x}_1 \geq \hat{x}_0$, otherwise it is defined implicitly by $U^*_{\mathrm{M}}(\bar{x}_1) = \bar{x}_1 - \phi(\hat{x}_0 - \bar{x}_{\mathrm{enf}})^2 = \frac{2-\phi^3+\phi^2(6x_{\max}-2)+\phi(1+6x_{\max}-x^2_{\max})}{(1+2\phi)^2} = U^*_{\mathrm{H}}$. Note that by the implicit function theorem if $\bar{x}_1 < \hat{x}_0$ we have $\frac{\partial \bar{x}_1}{\partial \phi} = \frac{(\hat{x}_0-\bar{x}_1)^2 + \left(\frac{2\phi(x^2_{\max}-3)-(x^2_{\max}-6x_{\max})-2\phi^3-3\phi^2-7}{(1+2\phi)^3}\right)}{1+2\phi(\hat{x}_0-\bar{x}_1)} > 0$ (since we have assumed that $\phi \in [\frac{x_{\max}}{3} - 1, x_{\max} - 2]$) and $\frac{\partial \bar{x}_1}{\partial \hat{x}_0} = \frac{2\phi(\hat{x}_0-\bar{x}_1)}{1+2\phi(\hat{x}_0-\bar{x}_1)} > 0$, and if $\bar{x}_1 \geq \hat{x}_0$ we have directly $\frac{\partial \bar{x}_1}{\partial \phi} = \frac{2\phi(x^2_{\max}-3)-(x^2_{\max}-6x_{\max})-2\phi^3-3\phi^2-7}{(1+2\phi)^3} > 0$ (since we have assumed that $\phi \in [\frac{x_{\max}}{3} - 1, x_{\max} - 2]$) and $\frac{\partial \bar{x}_1}{\partial \hat{x}_0} = 0$. ■

**Proof of Proposition 6**

**Proof.** It is straightforward to show that C is never optimal. Suppose that $\bar{x}_{\text{enf}}$ is large enough that the minimum action restriction binds for the C contract. Then the M and C contracts will induce the same action, but since $\hat{x}_{\text{C}} > \bar{x}_{\text{enf}}$ for any $\bar{x}_{\text{enf}}$ the C contract will always generate disutility for violating the norm, while the M contract will not. Therefore the M contract is superior to the C contract if the C contract is binding. Now suppose instead that $\bar{x}_{\text{enf}}$ is small enough that the C contract is slack. Then from Propositions 1 and 2 we know that the H contract has higher utility, since it has a higher norm. Therefore the C contract is never the optimal contract.

The threshold $\bar{x}_1$ is proven for each game following the proof for Proposition 5, except that the equations in that proof for "$\bar{x}_{\text{enf}} > \hat{x}_0$" are the relevant equations for all $\bar{x}_{\text{enf}}$. This means that we will have $\frac{\partial \bar{x}_1}{\partial \phi} > 0$ (except for $\phi > \hat{x} - 2$ where $\frac{\partial \bar{x}_1}{\partial \phi} = 0$) and $\frac{\partial \bar{x}_1}{\partial \hat{x}_0} = 0$. ■

**Proof of Proposition 7**

**Proof.** *For the APG:* The C contract is clearly better than the H contract since it leads to the same or higher action by the norm sensitive agent, and a higher action by the selfish agent. Thus we can focus on comparing the M and C contracts. The rest of the proof proceeds as in Proposition 5, with $U^*_{\text{M}} = \bar{x}_{\text{enf}}(4\alpha - \bar{x}_{\text{enf}}) - \frac{\phi}{2}(\hat{x}_0 - \bar{x}_{\text{enf}})^2$ if $\bar{x}_{\text{enf}} < \hat{x}_0$ (with $\frac{\partial U^*_{\text{M}}}{\partial \bar{x}_{\text{enf}}} = 2(2\alpha - \bar{x}_{\text{enf}}) + \phi(\hat{x}_0 - \bar{x}_{\text{enf}}) \geq 0$) and $U^*_{\text{M}} = \bar{x}_{\text{enf}}(4\alpha - \bar{x}_{\text{enf}})$ otherwise (with $\frac{\partial U^*_{\text{M}}}{\partial \bar{x}_{\text{enf}}} = 2(2\alpha - \bar{x}_{\text{enf}}) \geq 0$), so the M contract will be most effective for large $\bar{x}_{\text{enf}}$. As before, if $\bar{x}_{\text{enf}}$ is large enough that the C contract also binds its clear that the M contract will be superior, since it will generate the same action but since it has a lower norm it will have less (or no) disutility for violating the norm. Therefore we need to find the point $\bar{x}_1$ where $U^*_{\text{M}}(\bar{x}_1) = U^*_{\text{C}}$. $\bar{x}_1$ is defined implicitly by $U^*_{\text{M}}(\bar{x}_1) = \bar{x}_1 (4\alpha - \bar{x}_1) = \frac{3+4\phi}{2(1+\phi)}\alpha^2 + \frac{1}{2}\bar{x}_1 (4\alpha - \bar{x}_1) = U^*_{\text{C}}(\bar{x}_1)$, or $\bar{x}_1 (4\alpha - \bar{x}_1) = \frac{3+4\phi}{1+\phi}\alpha^2$ if the resulting $\bar{x}_1 \geq \hat{x}_0$, otherwise it is defined by $U^*_{\text{M}}(\bar{x}_1) = \bar{x}_1 (4\alpha - \bar{x}_1) - \frac{\phi}{2} (\hat{x}_0 - \bar{x}_1)^2 = \frac{3+4\phi}{2(1+\phi)}\alpha^2 + \frac{1}{2}\bar{x}_1 (4\alpha - \bar{x}_1)$ or $\bar{x}_1 (4\alpha - \bar{x}_1) - \phi (\hat{x}_0 - \bar{x}_1)^2 = \frac{3+4\phi}{(1+\phi)}\alpha^2$. Since these are the same equations as in Proposition 5 the results for the derivatives follow in the same manner.

*For the DDG:* Again the C contract is clearly better than the H contract, and the rest of the proof proceeds as before. $U^*_{\text{M}} = 2E + 2(\alpha - 1)\bar{x}_{\text{enf}} - \frac{\phi}{2}(\hat{x}_0 - \bar{x}_{\text{enf}})^2$ if $\bar{x}_{\text{enf}} < \hat{x}_0$ (with $\frac{\partial U^*_{\text{M}}}{\partial \bar{x}_{\text{enf}}} = 2(\alpha - 1) + \phi(\hat{x}_0 - \bar{x}_{\text{enf}}) \geq 0$) and $U^*_{\text{M}} = 2E + 2(\alpha - 1)\bar{x}_{\text{enf}}$ otherwise (with $\frac{\partial U^*_{\text{M}}}{\partial \bar{x}_{\text{enf}}} = 2(\alpha - 1) \geq 0$), so the M contract will be most effective for large $\bar{x}_{\text{enf}}$. We find $\bar{x}_1$ where $U^*_{\text{M}}(\bar{x}_1) = U^*_{\text{C}}$. $\bar{x}_1$ is defined by $U^*_{\text{M}}(\bar{x}_1) = 2E + 2(\alpha - 1)\bar{x}_1 = (1 + \alpha)E + (\alpha - 1)\bar{x}_1 - \frac{2\alpha - 1}{2\phi} = U^*_{\text{C}}(\bar{x}_1)$, or

$\bar{x}_1 = E - \frac{2\alpha-1}{2\phi(\alpha-1)}$ if the resulting $\bar{x}_1 \geq \hat{x}_0$, otherwise it is defined by $U^*_{\mathrm{M}}(\bar{x}_1) = 2E + 2(\alpha - 1)\bar{x}_1 - \frac{\phi}{2}\left(\hat{x}_0 - \bar{x}_1\right)^2 = (1+\alpha)E + (\alpha-1)\bar{x}_1 - \frac{2\alpha-1}{2\phi}$ or $(\alpha-1)\bar{x}_1 - \frac{\phi}{2}\left(\hat{x}_0 - \bar{x}_1\right)^2 = (\alpha-1)E - \frac{2\alpha-1}{2\phi}$. Since these are the same equations as in Proposition 5 the results for the derivatives follow in the same manner. ■

**Proof of Proposition 8**

**Proof.** Given $\alpha = \frac{3}{4}$ and $x_{\max} = 6$ then we have $x^*_{i,\mathrm{H}} = \frac{96\phi}{7+16\phi}$ and $x^*_{j,\mathrm{H}} = \frac{72\phi}{7+16\phi} = \bar{x}_2$. Then, if $\bar{x}_{\mathrm{enf}} \leq \bar{x}_2$ the C contract is slack and is therefore equivalent to the H contract. C (and thus H) are then clearly superior to the M contract since both agents take higher actions. If instead $\bar{x}_{\mathrm{enf}} > \bar{x}_2$ C binds for the selfish agent, and we have $x^*_{i,\mathrm{C}} = \frac{\frac{3}{4}\bar{x}_{\mathrm{enf}}+6\phi}{1+\phi}$ and $x^*_{j,\mathrm{C}} = \bar{x}_{\mathrm{enf}}$. In this case both the selfish and norm sensitive agents take higher actions than in the H contract, yielding greater total utility. We then need to find when the M contract supercedes the C contract.

If C binds for both agents then clearly M is superior, conversely if M is slack for at least one agent or if C is slack for both agents then clearly C is superior. Therefore we can focus on the case where M binds for both and C is slack for the norm sensitive agent (i.e. $\bar{x}_{\mathrm{enf}} < \frac{24\phi}{1+4\phi}$). Then we have $U^*_{\mathrm{C}} = 2(3/4)\bar{x}_{\mathrm{enf}}\left(\frac{\frac{3}{4}\bar{x}_{\mathrm{enf}}+6\phi}{1+\phi}\right) - \frac{1}{2}\bar{x}^2_{\mathrm{enf}} - \frac{1}{2}\left(\frac{\frac{3}{4}\bar{x}_{\mathrm{enf}}+6\phi}{1+\phi}\right)^2 - \frac{p}{2}\left(\frac{6-\frac{3}{4}\bar{x}_{\mathrm{enf}}}{1+\phi}\right)^2 = \frac{11\bar{x}^2_{\mathrm{enf}}-16\phi(36-18\bar{x}_{\mathrm{enf}}+\bar{x}^2_{\mathrm{enf}})}{32(1+\phi)}$, and $U^*_{\mathrm{M}} = \frac{1}{2}\bar{x}^2_{\mathrm{enf}}$ if $\bar{x}_{\mathrm{enf}} \geq \hat{x}_0$, or $U^*_{\mathrm{M}} = \frac{1}{2}\bar{x}^2_{\mathrm{enf}} - \frac{\phi}{2}(\hat{x}_0 - \bar{x}_{\mathrm{enf}})^2$. Hence for the former case we have $U^*_{\mathrm{M}} - U^*_{\mathrm{C}} = \frac{5\bar{x}^2_{\mathrm{enf}}+32\phi(18-9\bar{x}_{\mathrm{enf}}+\bar{x}^2_{\mathrm{enf}})}{32(1+\phi)}$. This is positive if $\bar{x}_{\mathrm{enf}} > \bar{x}_1 = \frac{24(6\phi+\sqrt{4\phi^2-5\phi})}{5+32\phi}$. The assumption that $\phi > \frac{49}{32}$ is necessary so that the other root falls in the region where C is slack for the selfish agent, additionally this ensures that $\bar{x}_1$ is in the region where C is slack for the norm sensitive agent. Additionally we have $\frac{\partial \bar{x}_1}{\partial \phi} = \frac{60(40\phi-5+12\sqrt{\phi(4\phi-5)})}{(5+32\phi^2)\sqrt{\phi(4\phi-5)}} > 0$.

If instead $\hat{x}_0$ is larger than the $\bar{x}_1$ as defined above (note that this means $\hat{x}_0 > \frac{14}{3}$) then instead we have $\bar{x}_1$ defined implicitly by $U^*_{\mathrm{M}}(\bar{x}_1) = U^*_{\mathrm{C}}(\bar{x}_1)$, i.e. $\frac{1}{2}\bar{x}_1^2 - \frac{\phi}{2}(\hat{x}_0 - \bar{x}_1)^2 - \frac{11\bar{x}_1^2-16\phi(36-18\bar{x}_1+\bar{x}_1^2)}{32(1+\phi)}$. Additionally $\frac{\partial \bar{x}_1}{\partial \hat{x}_0} = \frac{16\phi(1+\phi)(\hat{x}_0-\bar{x}_{\mathrm{enf}})}{5\bar{x}_{\mathrm{enf}}+16\phi^2(\hat{x}_0-\bar{x}_{\mathrm{enf}})+16\phi(\bar{x}_{\mathrm{enf}}+\hat{x}_0-9)} > 0$. The inequality is demonstrated as follows (given that $\phi > \frac{49}{32}$ and $\hat{x}_0 \geq \frac{14}{3}$). The numerator is cleary positive by the assumption that we are in the case where $\hat{x}_0 > \bar{x}_1$. The denominator is decreasing in $\bar{x}_{\mathrm{enf}}$, and therefore $5\bar{x}_{\mathrm{enf}} + 16\phi^2(\hat{x}_0 - \bar{x}_{\mathrm{enf}}) + 16\phi(\bar{x}_{\mathrm{enf}} + \hat{x}_0 - 9) \geq 5\hat{x}_0 + 16\phi^2(\hat{x}_0 - \hat{x}_0) + 16\phi(\hat{x}_0 + \hat{x}_0 - 9) = 5\hat{x}_0 + 16\phi(2\hat{x}_0 - 9)$, which in turn is increasing in $\hat{x}_0$ so therefore $5\hat{x}_0 + 16\phi(2\hat{x}_0 - 9) \geq 5(\frac{14}{3}) + 16\phi(2(\frac{14}{3}) - 9) = \frac{2}{3}(35 + 8\phi) > 0$. Additionally

$\frac{\partial \bar{x}_1}{\partial \phi} = \frac{16((1+\phi^2)\hat{x}_0^2-36)-32\bar{x}_{\text{enf}}((1+\phi^2)\hat{x}_0-9)+(16\phi^2+32\phi-11)\bar{x}_{\text{enf}}^2}{2(1+\phi)(5\bar{x}_{\text{enf}}+16\phi^2(\hat{x}_0-\bar{x}_{\text{enf}})+16\phi(\bar{x}_{\text{enf}}+\hat{x}_0-9))} > 0$. The inequality is demonstrated as follows. The denominator is positive as shown previously. The numerator is increasing in $\phi$, therefore

$$\begin{aligned}
&16((1+\phi^2)\hat{x}_0^2-36)-32\bar{x}_{\text{enf}}((1+\phi^2)\hat{x}_0-9)+(16\phi^2+32\phi-11)\bar{x}_{\text{enf}}^2 \\
&\geq 16((1+(\frac{49}{32})^2)\hat{x}_0^2-36)-32\bar{x}_{\text{enf}}((1+(\frac{49}{32})^2)\hat{x}_0-9)+(16(\frac{49}{32})^2+32(\frac{49}{32})-11)\bar{x}_{\text{enf}}^2 \\
&= \frac{9}{64}\left(792\hat{x}_0^2-1458\bar{x}_{\text{enf}}\hat{x}_0+\bar{x}_{\text{enf}}(2048+537\bar{x}_{\text{enf}})-4096\right)
\end{aligned}$$

Since we know that $\bar{x}_{\text{enf}} \geq \frac{7}{95}(16+9\hat{x}_0)$ (so that C binds for the selfish agent) and $\hat{x}_0 > \frac{14}{3}$, then $\frac{9}{64}(792\hat{x}_0^2-1458\bar{x}_{\text{enf}}\hat{x}_0+\bar{x}_{\text{enf}}(2048+537\bar{x}_{\text{enf}})-4096)$ is minimized for $\bar{x}_{\text{enf}} = 2378537$ and $\hat{x}_0 = \frac{14}{3}$, equaling $364+\frac{1853}{2864}$. ■

**Proof of Proposition 9**

**Proof.** Recall from Proposition 4 that if $\phi \geq x_{\max}-1 = \bar{\phi}_1$ then for both the H and C contracts $x_i^* = x_{\max}$ and $x_j^* = x_{\max}-1$ with $U^* = x_{\max}-1$ is an equilibrium, therefore the first claim is clearly true since for the M contract $U^* \leq \bar{x}_{\text{enf}} \leq x_{\max}-1$.

Therefore, assume $\phi < x_{\max}-1$ and $\phi > \bar{\phi}_2 = \frac{4}{(\hat{x}_0-2)^2}$ so that the results of Proposition 4 apply for all contracts. Recall that in this case if the minimum action does not bind, then the agents play a mixed equilibrium that yields utility $\in [\underline{x}(\hat{x})-1, \underline{x}(\hat{x})+1]$ where $\underline{x}$ is defined as the smallest action such that the norm sensitive agent would receive non-negative utility if he played that action and the selfish agent played a higher action with probability one (i.e. s.t. $\underline{x}-\frac{\phi}{2}(\hat{x}-\underline{x})^2 = 0$, or $\underline{x} = \hat{x}-\frac{\sqrt{1+2\phi\hat{x}}-1}{\phi}$). In particular we will have $\underline{x}_N = \underline{x}_M = \hat{x}_0-\frac{\sqrt{1+2\phi\hat{x}_0}-1}{\phi}$ and $\underline{x}_H = \underline{x}_C = x_{\max}-\frac{\sqrt{1+2\phi x_{\max}}-1}{\phi}$. However, if the minimum is large enough ($\bar{x}_{\text{enf}} > \underline{x}$) then these equilibria will not be feasible. Therefore define another parameter $\underline{x}'$ as the smallest action such that if the norm sensitive agent and the selfish agent both play that action the norm sensitive agent's utility is non-negative, i.e. $\underline{x}'-\frac{\phi}{2}(\hat{x}-\underline{x}')^2 = 0$, or $\underline{x}' = \hat{x}-\frac{\sqrt{1+4\phi\hat{x}}-1}{2\phi}$), i.e. $\underline{x}'_M = \hat{x}_0-\frac{\sqrt{1+4\phi\hat{x}_0}-1}{2\phi}$ and $\underline{x}'_C = x_{\max}-\frac{\sqrt{1+4\phi x_{\max}}-1}{2\phi}$. Then if $\bar{x}_{\text{enf}} \geq \underline{x}'$ $x_i^* = x_j^* = \bar{x}_{\text{enf}}$ is an equilibrium with utility $U^* = \bar{x}_{\text{enf}}-\frac{phi}{2}(\hat{x}-\bar{x}_{\text{enf}})^2$ if $\bar{x}_{\text{enf}} < \hat{x}$, or $U^* = \bar{x}_{\text{enf}}$ otherwise.

If instead $\bar{x}_{\text{enf}} \in (\underline{x}, \underline{x}')$ no pure equilibria exist (since for any pure equilibrium above $\bar{x}_{\text{enf}}$ the selfish agent would decrease his action, and at $\bar{x}_{\text{enf}}$ the norm sensitive agent would prefer to play $\hat{x}$), however a different set of mixed equilibria are possible. Again let $\{(x_{i,1}, p_{i,1}), (x_{i,2}, p_{i,2}), ..., (x_{i,m}, p_{i,m}$ denote the norm sensitive agent's mixed strategy (where $x_{i,1} < x_{i,2} < ... < x_{i,m}$), and let $\{(x_{j,1},p_{j,1}),(x_{j,2},p_{j,2}),...,(x_{j,n},p_{j,n})\}$ denote the selfish agent's mixed strategy (where $x_{j,1} < x_{j,2} < ... < x_{j,m}$). It is clear that $x_{i,1} = x_{j,1} = \bar{x}_{\text{enf}}$, and by the same logic as in Proposition 4 it must be that $x_{i,m} = \hat{x}$ and $x_{j,n} = \hat{x} - 1$. Therefore $u_i = 0$ and thus total utility $U^* = u_j$. We will now identify some bounds on $U^*$.

First it is clear that $u_j(\hat{x} - 1) < \hat{x} - 1$, therefore $U^* < \hat{x} - 1$. Additionally $u_j(\bar{x}_{\text{enf}}) = \left(1 - \frac{p_{i,1}}{2}\right)\bar{x}_{\text{enf}}$. Since $p_{i,1} < 1$ we also know $U^* > \frac{\bar{x}_{\text{enf}}}{2}$ and since $p_{i,1} > 0$ we know $U^* < \bar{x}_{\text{enf}}$. Therefore if $\bar{x}_{\text{enf}} \in (\underline{x}, \underline{x}')$ we know $U^* \in (\frac{\bar{x}_{\text{enf}}}{2}, min[\hat{x} - 1, \bar{x}_{\text{enf}}])$.

Now we want to show that $\bar{x}_{\text{enf}} < \underline{x}_H - 1 = \bar{x}_1$ is sufficient for H and C to be equivalent and optimal. Since $\underline{x}_H = \underline{x}_C$ if $\bar{x}_{\text{enf}} < \underline{x}_H - 1$, C is clearly slack and therefore equivalent to H. Since $U_H^* \geq \underline{x}_H - 1$ we now simply need to show that in this range any M contract will yield lower utility. If $\bar{x}_{\text{enf}} < \underline{x}_M$ this is clearly true since the M contract will also be slack, and we showed in Proposition 4 that utility was increasing in the norm. For higher $\bar{x}_{\text{enf}}$ we need to consider two cases. First, suppose $\hat{x}_0 \leq \underline{x}_H$. Then in the interval $(\underline{x}_M, \underline{x}'_M)$ where the second class of mixed equilibria apply M will be inferior since $U^*_{\text{M}} < \hat{x}_0 - 1 \leq \underline{x}_H - 1$. Therefore we only need to consider the third region where the equilibrium is $x_i^* = x_j^* = \bar{x}_{\text{enf}}$. If $\bar{x}_{\text{enf}} \leq \hat{x}_0 - 1$ then $ustar = \bar{x}_{\text{enf}} - \frac{\phi}{2}(\hat{x}_0 - \bar{x}_{\text{enf}})^2 \leq \hat{x}_0 - \frac{\phi}{2} < \underline{x}_H - 1$. Therefore the last possible concern is if $\bar{x}_{\text{enf}} \geq \hat{x}_0$, with utility $U^* = \bar{x}_{\text{enf}}$. But then $\bar{x}_{\text{enf}} < \underline{x}_H - 1$ is sufficient for the M contract to yield lower utility than the lowest equilibrium in the H contract. Now consider the second case where $\hat{x}_0 > \underline{x}_H$. Then we must be concerned about one of the mixed equilibria we described above. However, for these equilibria we know $U_M^* < \bar{x}_{\text{enf}}$ therefore $\bar{x}_{\text{enf}} < \underline{x}_H - 1$ is sufficient for H and C to be superior than M. Also, note that we showed in Proposition 4 $\frac{\partial \underline{x}_H}{\partial \phi} \geq 0$ and clearly $\frac{\partial \underline{x}_H}{\partial \hat{x}_0} = 0$ therefore $\frac{\partial \bar{x}_1}{\partial \phi} \geq 0$ and $\frac{\partial \bar{x}_1}{\partial \hat{x}_0} \geq 0$.

For the sufficient condition that M be optimal, we need that the C contract fully binds (i.e. $\bar{x}_{\text{enf}} > \underline{x}'_C$). In this case for both M and C we have $x_i^* = x_j^* = \bar{x}_{\text{enf}}$, however M has a lower norm and therefore higher utility. Thus M is superior to C. Now, to ensure that M is also superior to H, consider two cases. First, if $\underline{x}_H + 1 \geq \hat{x}_0$ then $\bar{x}_{\text{enf}} > \underline{x}_H + 1$ is sufficient for M to be superior to H, since that is in the region where $U_M^* = \bar{x}_{\text{enf}}$ and $\underline{x}_H + 1$ is the largest possible utility for the H contract. Thus in this case $\bar{x}_2 = max(\underline{x}'_C, \underline{x}_H + 1)$. If instead $\hat{x}_0 > \underline{x}_H + 1$ then we need $\bar{x}_{\text{enf}} - \frac{\phi}{2}(\hat{x}_0 - \bar{x}_{\text{enf}})^2 \geq \underline{x}_H + 1$ or $\bar{x}_{\text{enf}} \geq \hat{x}_0 - \frac{\sqrt{1+2\phi(\hat{x}_0 - (\underline{x}_H + 1))} - 1}{\phi}$. Therefore in this case $\bar{x}_2 = max(\underline{x}'_C, \hat{x}_0 - \frac{\sqrt{1+2\phi(\hat{x}_0 - (\underline{x}_H + 1))} - 1}{\phi})$.

Lastly we show that in either case $\frac{\partial \bar{x}_2}{\partial \phi} \geq 0$ and $\frac{\partial \bar{x}_2}{\partial \hat{x}_0} \geq 0$. First, since $\underline{x}'_C = x_{\max} - \frac{\sqrt{1+4\phi x_{\max}}-1}{2\phi}$ we have $\frac{\partial \underline{x}'_C}{\partial \phi} = \frac{1+2\phi x_{\max}}{2\phi^2\sqrt{1+4\phi x_{\max}}} - \frac{1}{2\phi^2} > 0$ and $\frac{\partial \underline{x}'_C}{\partial \hat{x}_0} = 0$. From Proposition 4 we have $\frac{\partial \underline{x}_H}{\partial \phi} \geq 0$ and clearly $\frac{\partial \underline{x}_H}{\partial \hat{x}_0} \geq 0$. Lastly $\frac{\partial}{\partial \phi}\left(\hat{x}_0 - \frac{\sqrt{1+2\phi(\hat{x}_0-(\underline{x}_H+1))}-1}{\phi}\right) = \frac{1+\phi(\hat{x}_0-(\underline{x}_H+1))}{\phi^2\sqrt{1+2\phi(\hat{x}_0-(\underline{x}_H+1))}} - \frac{1}{\phi^2} > 0$ and $\frac{\partial}{\partial \hat{x}_0}\left(\hat{x}_0 - \frac{\sqrt{1+2\phi(\hat{x}_0-(\underline{x}_H+1))}-1}{\phi}\right) = 1 - \frac{1}{\sqrt{1+2\phi(\hat{x}_0-(\underline{x}_H+1))}} > 0$. Therefore since all the arguments are non-decreasing, their maximum is non-decreasing. ■

**Proof of Proposition 10**

**Proof.** *For the APG:* From Proposition 3 for the H contract we have $x_i^* = \frac{1+2\phi}{1+\phi}\alpha$ and $x_j^* = \alpha$. Therefore $U_H^* = \frac{6+7\phi}{2(1+\phi)}\alpha^2$. For the M contract we have $x_i^* = x_j^* = \bar{x}_{\text{enf}}$, with $U_M^* = (4\alpha - \bar{x}_{\text{enf}})\bar{x}_{\text{enf}}$. Then the M contract will be superior to the H contract if $(4\alpha - \bar{x}_{\text{enf}})\bar{x}_{\text{enf}} > \frac{6+7\phi}{2(1+\phi)}\alpha^2$, or $\bar{x}_{\text{enf}} > 2\alpha\left(1 - \frac{1}{2}\sqrt{\frac{2+\phi}{2(1+\phi)}}\right)$. However, as we will see this exact threshold won't be relevant since it will fall in a region where the C contract is superior to both the H and M contracts.

For the C contract we have that $\hat{x} = \alpha + \frac{1}{2}\bar{x}_{\text{enf}}$, therefore when the contract is slack for the norm sensitive agent we have $x_i^* = \alpha + \frac{\phi}{2(1+\phi)}\bar{x}_{\text{enf}}$ and $x_j^* = \bar{x}_{\text{enf}}$. C will be slack if $\bar{x}_{\text{enf}} < 2\alpha\frac{1+\phi}{2+\phi}$. If slack then $U_C^* = \frac{3}{2}\alpha^2 + \left(\frac{4+5\phi}{2(1+\phi)}\right)\alpha\bar{x}_{\text{enf}} - \left(\frac{4+5\phi}{8(1+\phi)}\right)\bar{x}_{\text{enf}}^2$, otherwise if C binds we have $x_i^* = x_j^* = \bar{x}_{\text{enf}}$ and $U_C^* = (4\alpha - \bar{x}_{\text{enf}})\bar{x}_{\text{enf}} - \frac{\phi}{2}(\alpha - \frac{1}{2}\bar{x}_{\text{enf}})^2$. Clearly M is superior to C if C binds. Therefore we can focus on the slack case.

C will be superior to M if $U_C^* - U_M^* = \frac{3}{2}\alpha^2 - \left(\frac{4+3\phi}{2(1+\phi)}\right)\alpha\bar{x}_{\text{enf}} - \left(\frac{12+13\phi}{8(1+\phi)}\right)\bar{x}_{\text{enf}}^2 > 0$, or $\bar{x}_{\text{enf}} < 2\alpha\left(1 - \frac{1}{\sqrt{4+3\phi}}\right) = \bar{x}_2$ (the other root is above $2\alpha$ and therefore not actually a solution). Similarly C will be superior to H if $U_C^* - U_H^* = -\frac{3+4\phi}{2(1+\phi)}\alpha^2 + \left(\frac{4+5\phi}{2(1+\phi)}\right)\alpha\bar{x}_{\text{enf}} - \left(\frac{4+5\phi}{8(1+\phi)}\right)\bar{x}_{\text{enf}}^2 > 0$, or $\bar{x}_{\text{enf}} < 2\alpha\left(1 - \frac{\sqrt{1+\phi}}{\sqrt{4+5\phi}}\right) = \bar{x}_1$. It is straightforward to show that for any $\phi$ $0 < \bar{x}_1 < 2\alpha\left(1 - \frac{1}{2}\sqrt{\frac{2+\phi}{2(1+\phi)}}\right) < \bar{x}_2 < 2\alpha\frac{1+\phi}{2+\phi}$, therefore there is always an interval (in the region where C is slack and containing the point where M overtakes H) where C is optimal. Therefore we have that H is optimal if $\bar{x}_{\text{enf}} < \bar{x}_1$, C is optimal if $\bar{x}_1 < \bar{x}_{\text{enf}} < \bar{x}_2$, and M is optimal if $\bar{x}_{\text{enf}} > \bar{x}_2$. Since this is true for all $\phi$, this means that for the proposition we can set $\tilde{\phi} = 0$. Also, note that $\frac{\partial \bar{x}_1}{\partial \phi} = \frac{1}{2\sqrt{1+\phi}(4+5\phi)^{\frac{3}{2}}} > 0$ and $\frac{\partial \bar{x}_2}{\partial \phi} = \frac{3}{2(4+3\phi)^{\frac{3}{2}}} > 0$.

*For the DDG:* For the H contract we have $x_i^* = E - \frac{1}{\phi}$ and $x_j^* = 0$, yielding $U_H^* = (1+\alpha)E - \frac{2\alpha-1}{2\phi}$. For the M contract we have $x_i^* = x_j^* = \bar{x}_{\text{enf}}$ and $U_M^* = 2E + 2(\alpha-1)\bar{x}_{\text{enf}}$. Therefore M is superior to H if $U_M^* > U_H^*$, or $\bar{x}_{\text{enf}} > \frac{1}{2}E - \frac{2\alpha-1}{4\phi(\alpha-1)}$.

For the C contract, if it is slack, we will have $x_i^* = \frac{1}{2}E + \frac{1}{2}\bar{x}_{\text{enf}} - \frac{1}{\phi}$ and $x_j^* = \bar{x}_{\text{enf}}$. C will be slack if $\bar{x}_{\text{enf}} < E - \frac{2}{\phi}$. Then $U_C^* = \frac{3+\alpha}{2}E + \frac{3(\alpha-1)}{2}\bar{x}_{\text{enf}} - \frac{2\alpha-1}{2\phi}$. If instead C binds then we have $x_i^* = x_j^* = \bar{x}_{\text{enf}}$, and $U_C^* = 2E + 2(\alpha-1)\bar{x}_{\text{enf}} - \frac{\phi}{2}(\frac{E-\bar{x}_{\text{enf}}}{2})^2$. Clearly M is superior to C if C binds.

For C slack, C is superior to M if $U_C^* - U_M^* > 0$, or $\frac{\alpha-1}{2}(E - \bar{x}_{\text{enf}}) - \frac{2\alpha-1}{2\phi} > 0$. This occurs if $\bar{x}_{\text{enf}} < E - \frac{2\alpha-1}{\phi(\alpha-1)}$. C is superior to H if $U_C^* - U_H^* > 0$, or $\frac{\alpha-1}{2}(3\bar{x}_{\text{enf}} - E) > 0$. This occurs if $\bar{x}_{\text{enf}} > \frac{1}{3}E$. Therefore, in order for there to be a region where C is optimal we need $\frac{1}{3}E < E - \frac{2\alpha-1}{\phi(\alpha-1)}$, or $\phi > \left(\frac{2\alpha-1}{(\alpha-1)}\right)\left(\frac{3}{2E}\right) = \tilde{\phi}$. If this is the case then H is optimal if $\bar{x}_{\text{enf}} < \bar{x}_1 = \frac{1}{3}E$, C is optimal if $\bar{x}_1 < \bar{x}_{\text{enf}} < \bar{x}_2 = E - \frac{2\alpha-1}{\phi(\alpha-1)}$, and M is optimal if $\bar{x}_{\text{enf}} > \bar{x}_2$. Note that $\frac{\partial \bar{x}_1}{\partial \phi} = 0$ and $\frac{\partial \bar{x}_2}{\partial \phi} = \frac{2\alpha-1}{\phi^2(\alpha-1)} > 0$. Also note that if $\phi > \tilde{\phi}$ then $\frac{1}{2}E - \frac{2\alpha-1}{4\phi(\alpha-1)} \in (\bar{x}_1, \bar{x}_2)$. If instead $\phi < \tilde{\phi}$ then C is never optimal, and H is optimal if $\bar{x}_{\text{enf}} < \bar{x}_1 = \frac{1}{2}E - \frac{2\alpha-1}{4\phi(\alpha-1)}$ and M is optimal if $\bar{x}_{\text{enf}} > \bar{x}_1$ (with $\frac{\partial \bar{x}_1}{\partial \phi} = \frac{2\alpha-1}{4\phi^2(\alpha-1)} > 0$)

*For the MPG:* Note that the maintained assumption that $\phi > \bar{\phi}$ (so that utility is increasing in the norm for the Handshake contract) in this case means $\phi > \frac{49}{176}$. For the H contract we have $x_i^* = \frac{96\phi}{7+16\phi}$ and $x_j^* = \frac{72\phi}{7+16\phi}$, with $U_H^* = \frac{18\phi(176\phi-49)}{(7+16\phi)^2}$. For the M contract we have $x_i^* = x_j^* = \bar{x}_{\text{enf}}$ and $U_M^* = \frac{1}{2}\bar{x}_{\text{enf}}^2$. Therefore M is superior to H if $\bar{x}_{\text{enf}} > \frac{6\sqrt{\phi(176\phi-49)}}{7+16\phi}$.

For the C contract we have $\hat{x}_C = 3 + \frac{1}{2}\bar{x}_{\text{enf}}$. The minimum will be slack for both agents if $\bar{x}_{\text{enf}} \leq \frac{36\phi}{7+10\phi}$, with $x_i^* = \frac{8\phi(\bar{x}_{\text{enf}}+6)}{7+16\phi}$ and $x_j^* = \frac{6\phi(\bar{x}_{\text{enf}}+6)}{7+16\phi}$. However, from Proposition 4 we know that H will be superior to C in this case. Similarly the minimum will bind for both agents if $\bar{x}_{\text{enf}} \geq \frac{12\phi}{1+2\phi}$, leading to $x_i^* = x_j^* = \bar{x}_{\text{enf}}$. However it is clear in this case that M will be superior to C (since it has no disutility for violating the norm). Therefore we focus on the region where the minimum only binds for the selfish agent, $\frac{36\phi}{7+10\phi} < \bar{x}_{\text{enf}} < \frac{12\phi}{1+2\phi}$. In this region we have $x_i^* = \frac{(3+2\phi)\bar{x}_{\text{enf}}+12\phi}{4(1+\phi)}$ and $x_j^* = \bar{x}_{\text{enf}}$. Then $U_C^* = \left(\frac{11+4\phi}{32(1+\phi)}\right)\bar{x}_{\text{enf}}^2 + \left(\frac{3\phi}{1+\phi}\right)\bar{x}_{\text{enf}} - \frac{9\phi}{2(1+\phi)}$.

For C to be superior to M we need $U_C^* - U_M^* > 0$ or $-\left(\frac{5+12\phi}{32(1+\phi)}\right)\bar{x}_{\text{enf}}^2 + \left(\frac{3\phi}{1+\phi}\right)\bar{x}_{\text{enf}} - \frac{9\phi}{2(1+\phi)} > 0$. For $U_C^* - U_M^* > 0$ at some $\bar{x}_{\text{enf}}$ we need $\phi \geq \phi_2 = \frac{5}{4}$. If $\phi < \phi_2$ then M is always superior to C, and the optimal contract depends only on whether M is superior to H or vice versa. If $\phi > \phi_2$ then C is superior to M if $\bar{x}_{\text{enf}} < \frac{12(4\phi+\sqrt{\phi(4\phi-5)})}{5+12\phi} = \tilde{x}_2$. For C to be superior to H we need $U_C^* - U_H^* > 0$ or $\left(\frac{11+4\phi}{32(1+\phi)}\right)\bar{x}_{\text{enf}}^2 + \left(\frac{3\phi}{1+\phi}\right)\bar{x}_{\text{enf}} - \frac{9\phi}{2(1+\phi)} - \frac{18\phi(176\phi-49)}{(7+16\phi)^2}$. For $U_C^* - U_H^* > 0$ at some $\bar{x}_{\text{enf}}$ we need $\phi > \phi_1 \approx 0.784$ (where $\phi_1$ is defined exactly as the largest root of $539 - 1704\phi - 912\phi^2 + 2816\phi^3$), otherwise H is always superior to C. If $\phi > \phi_1$ then C is superior to H if

$$\bar{x}_{\text{enf}} > \frac{12}{11+4\phi}\left(\frac{\sqrt{\phi(7936\phi^3+17072\phi^2+8248\phi-1617)}}{7+16\phi}-4\phi\right)=\tilde{x}_1$$

For C to be optimal at some point we need $\tilde{x}_1 \le \tilde{x}_2$, or $\phi > \phi_3 \approx 1.29$ ($\phi_3$ is defined implicitly by $\tilde{x}_1(\phi_3)=\tilde{x}_2(\phi_3)$; note that $\phi_3 > \phi_2 > \phi_1$). Therefore for $\phi > \tilde{\phi} = \phi_3$ if $\bar{x}_{\text{enf}} < \bar{x}_1 = \tilde{x}_1$ H is optimal, if $\bar{x}_1 < \bar{x}_{\text{enf}} < \bar{x}_2 = \tilde{x}_2$ C is optimal, and if $\bar{x}_{\text{enf}} > \bar{x}_2$ M is optimal. Also, $\frac{\partial \bar{x}_2}{\partial \phi} = \frac{30(20\phi-5+8\sqrt{\phi(4\phi-5)})}{\sqrt{\phi(4\phi-5)}(5+12\phi)^2} > 0$ if $\phi > \tilde{\phi}$ and

$$\frac{\partial \bar{x}_1}{\partial \phi} = \frac{6(2145280\phi^4+4871232\phi^3+4254096\phi^2+1600060\phi-124509)}{(11+4\phi)^2(7+16\phi)^2\sqrt{\phi(7936\phi^3+17072\phi^2+8248\phi-1617)}} - \frac{528}{(11+4\phi)^2}$$

which is greater than zero if $\phi > \tilde{\phi}$.

If instead $\phi < \tilde{\phi}$, C is never optimal, therefore if $\bar{x}_{\text{enf}} < \bar{x}_1 = \frac{6\sqrt{\phi(176\phi-49)}}{7+16\phi}$ H is optimal, and if $\bar{x}_{\text{enf}} > \bar{x}_1$ M is optimal. Moreover, $\frac{\partial \bar{x}_1}{\partial \phi} = \frac{21(464\phi-49)}{(7+16\phi)^2\sqrt{\phi(176\phi-49)}} > 0$ if $\phi > \bar{\phi}$. ■

**Proof of Proposition 11**

**Proof.** Recall from Proposition 4 that if $\phi > \bar{\phi}_1 = x_{\max}-1$ then $U_H^* = x_{\max}-1$. As before, for M to be equivalent we would need $\bar{x}_{\text{enf}} = x_{\max} = 1$. For the C contract we would have $U_C^* = \hat{x}_C - 1 = \frac{1}{2}x_{\max} + \frac{1}{2}\bar{x}_{\text{enf}} - 1 < x_{\max} - 1$. Therefore C is never optimal.

If instead $\bar{\phi}_1 > \phi > \bar{\phi}_2 = \frac{4}{(x_{\max}-2)^2}$ then $U_H^* \in [\underline{x}_H - 1, \underline{x}_H + 1]$ for $\underline{x}_H = x_{\max} - \frac{\sqrt{1+2\phi x_{\max}}-1}{\phi}$. For the C contract, for either kind of mixed equilibrium (i.e. the kind described in Proposition 4 or the second kind with binding minimum described in Proposition 9) $U_C^* \le \hat{x}_C + 1$. Therefore for H to be optimal it is sufficient for $\bar{x}_{\text{enf}}$ to be small enough that $\hat{x}_C + 1 < \underline{x}_H - 1$ (this ensures that H is superior to M as well, since $U_M^* = \bar{x}_{\text{enf}}$ and $\hat{x}_C \ge \bar{x}_{\text{enf}}$). To ensure that $\hat{x}_C + 1 < \underline{x}_H - 1$ we need $\frac{1}{2}x_{\max} + \frac{1}{2}\bar{x}_{\text{enf}} + 1 < x_{\max} - \frac{\sqrt{1+2\phi x_{\max}}-1}{\phi}$, or $\bar{x}_{\text{enf}} < x_{\max} - \frac{\sqrt{1+2\phi x_{\max}}-1}{\phi} - 3 = \bar{x}_1$. For $\bar{x}_1 > 0$ we need $\phi > \tilde{\phi} = \frac{4(x_{\max}+3)}{(x_{\max}-3)^2}$. $x_{\max} \ge 6$ is sufficient for $\tilde{\phi} \le \bar{\phi}_1$, and $\frac{\partial \tilde{\phi}}{\partial x_{\max}} = -\frac{4(x_{\max}+9)}{(x_{\max}-3)^3} < 0$. Also, $\frac{\partial \bar{x}_1}{\partial \phi} = \frac{2(1+\phi x_{\max}-\sqrt{1+2\phi x_{\max}})}{\phi^2\sqrt{1+2\phi x_{\max}}} \ge 0$.

For M to be optimal we need $\bar{x}_{\text{enf}} > \underline{x}_H + 1 = x_{\max} - \frac{\sqrt{1+2\phi x_{\max}}-1}{\phi} + 1$ and we need the C contract to bind fully, hence we need $\bar{x}_{\text{enf}} > \underline{x}'_C$ (with $\underline{x}' = \hat{x} - \frac{\sqrt{1+4\phi\hat{x}}-1}{2\phi}$ as defined in Proposition 9). With $\hat{x}_C = \frac{1}{2}x_{\max} + \frac{1}{2}\bar{x}_{\text{enf}}$ this means $\underline{x}'_C = x_{\max} - 2\sqrt{\frac{x_{\max}}{\phi}}$. Therefore M is optimal if $\bar{x}_{\text{enf}} > \bar{x}_2 = max[x_{\max} - \frac{\sqrt{1+2\phi x_{\max}}-1}{\phi} + 1, x_{\max} - 2\sqrt{\frac{x_{\max}}{\phi}}]$. We have already shown that $\frac{\partial \underline{x}_H}{\partial \phi} > 0$, and we also have $\frac{\partial}{\partial \phi}\left(x_{\max} - 2\sqrt{\frac{x_{\max}}{\phi}}\right) = \frac{\sqrt{x_{\max}}}{\phi^{\frac{3}{2}}} > 0$, therefore $\frac{\partial \bar{x}_2}{\partial \phi} > 0$. ■

# References


[1] Akerlof, George. "A Theory of Social Custom, of Which Unemployment may be One Consequence." *Quarterly Journal of Economics*, 1980, vol. 94 (4), pp. 749-775.

[2] Anderson, Gordon. "Nonparametric Tests of Stochastic Dominance in Income Distributions." *Econometrica*, 1996, vol. 64 (5), pp. 1183-1193.

[3] Carlton, Dennis. "The Rigidity of Prices." *American Economic Review*, 1986, vol. 76 (4), pp. 637-658.

[4] Charness, Gary and Martin Dufwenberg. "Promises and Partnerships." *Econometrica*, 2006, vol. 74 (6), pp. 1579-1601.

[5] Crawford, Vince. "A Survey of Experiments on Communication via Cheap Talk," *Journal of Economic Theory*, 1998, vol. 78 (2), pp. 286-298.

[6] Dufwenberg, Martin, Uri Gneezy, Jacob K. Goeree and Rosemarie Nagel. "Price Floors and Competition." *Economic Theory*, 2007, vol. 3 (1), pp. 221-224.

[7] Eggleston, Karen, Eric A. Posner and Richard Zeckhuaser. "The Design and Interpretation of Contracts: Why Complexity Matters." *Northwestern University Law Review*, 2000, vol. 95 (1), pp. 91-132.

[8] Elster, Jon. "Social Norms and Economic Theory," *Journal of Economic Perspectives*, 1989, vol. 3 (4), pp. 99-117.

[9] Falk, Armin and Michael Kosfeld. "The Hidden Cost of Control." *American Economic Review,* 2006, vol. 96 (5), pp. 1611-1630.

[10] Fehr, Ernst, Oliver Hart and Christian Zehnder. "Are Contracts Reference Points?" Mimeo, 2008.

[11] Fehr, Ernst, Alexander Klein and Klaus M. Schmidt. "Fairness and Contract Design." *Econometrica*, 2007, vol. 75 (1), pp. 121-154.

[12] Fehr, Ernst, and Klaus M. Schmidt. "Adding a Stick to the Carrot? The Interaction of Bonuses and Fines." *AEA Papers and Proceedings, American Economic Review*, 2007, vol. 97 (2), pp. 177-181.

[13] Fischbacher, Urs "z-Tree: Zurich Toolbox for Ready-made Economic experiments." *Experimental Economics*, 2007, vol. 10 (2), pp. 171-178.

[14] Gneezy, Uri and Aldo Rusticini. "Pay Enough or Don't Pay at All." *Quarterly Journal of Economics*, 2000a, vol. 115 (2), pp. 791-810.

[15] Gneezy, Uri and Aldo Rusticini. "A Fine is a Price." *Journal of Legal Studies*, 2000b, vol. 29 (1), pp. 1-18.

[16] Hart, Oliver. "Firms, Contracts and Financial Structure." Oxford University Press, Oxford, 1995.

[17] Hart, Oliver and John Moore. "Contracts as Reference Points." *Quarterly Journal of Economics*, 2008, vol. 123 (1), pp. 1-48.

[18] Holt, Charlie. "Industrial Organization: A Survey of Laboratory Research." *Handbook of Experimental Economics*, 1995, J. Kagel and A.E. Roth eds., Princeton University Press, pp. 349-443.

[19] Huck, Steffen, Dorothea Kubler, and Jorgen Weibull. "Social Norms and Economic Incentives in Firms." Mimeo, 2006.

[20] Kahneman, Daniel, Ilana Ritov and David Schkade. "Economic Preferences or Attitude Expressions? An Analysis of Dollar Responses to Public Issues." *Journal of Risk and Uncertainty*, 1999, vol. 19 (1), pp. 203-235.

[21] Kandel, Eugene and Edward Lazear. "Peer Pressure and Partnerships." *Journal of Political Economy*, 1992, vol. 100 (4), pp. 801-817.

[22] Ledyard, John. "Public Goods: A Survey of Experimental Research." *Handbook of Experimental Economics*, 1995, J. Kagel and A.E. Roth eds., Princeton University Press, pp. 349-443.

[23] Lewis, David. "Convention: A Philosophical Study." Cambridge: Harvard University Press, 1969.

[24] López-Pérez, Raúl. "Introducing Social Norms in Game Theory." *Institute for Empirical Research in Economics University of Zurich Working Paper Series* ISSN 1424-0459 (2006).

[25] Lyons, Bruce. “Empirical Relevance of Efficient Contract Theory: Inter-firm Contracts.” *Oxford Review of Economic Policy*, 1996, vol. 12 (4), pp. 27-52.

[26] Macaulay, Stewart. “Non-contractual Relations in Business: a Preliminary Study.” *American Sociological Review*, 1963, vol. 28 (1), pp. 55-67.

[27] Morrison, Elizabeth Wolfe and Sandra L. Robinson. “When Employees Feel Betrayed: A Model of How Psychological Contract Violation Develops.” *The Academy of Management Review*, 1997, vol. 22 (1), pp. 226-256.

[28] Purvis, Lynne Millward and Mark Cropley. “Psychological Contracting: Processes of Contract Formation During Interviews Between Nannies and Their ‘Employers’.” *Journal of Occupational and Organizational Psychology*, 2003, vol 76, pp. 213-241.

[29] Robbennolt, Jennifer K. and Christina A. Studebaker. “Anchoring in the Courtroom: The Effects of Caps on Punitive Damages.” *Law and Human Behavior*, 1999, vo. 23 (3), pp. 353-373.

[30] Rousseau, Denise M. “Psychological and Implied Contracts in Organizations.” *Employee Responsibilities and Rights Journal*, 1989, vol. 2, pp. 121-139.

[31] Rousseau, Denise M. and Judi McClean Parks. “The Contracts of Individuals and Organizations.” *Research in Organizational Behavior*, 1992, vol. 15 (1), pp. 1-43.

[32] Schelling, Thomas C. *The Strategy of Conflict*. Cambridge, MA and London, England: Harvard University Press, 1960.

[33] Sliwka, Dirk. “Trust as a Signal of a Social Norm and the Hidden Costs of Incentive Schemes.” *American Economic Review*, 2007, vol. 97 (3), pp. 999-1012.

[34] Sugden, Robert. “Spontaneous Order.” *Journal of Economic Perspectives*, 1989, vol. 3 (4), pp. 85-97.

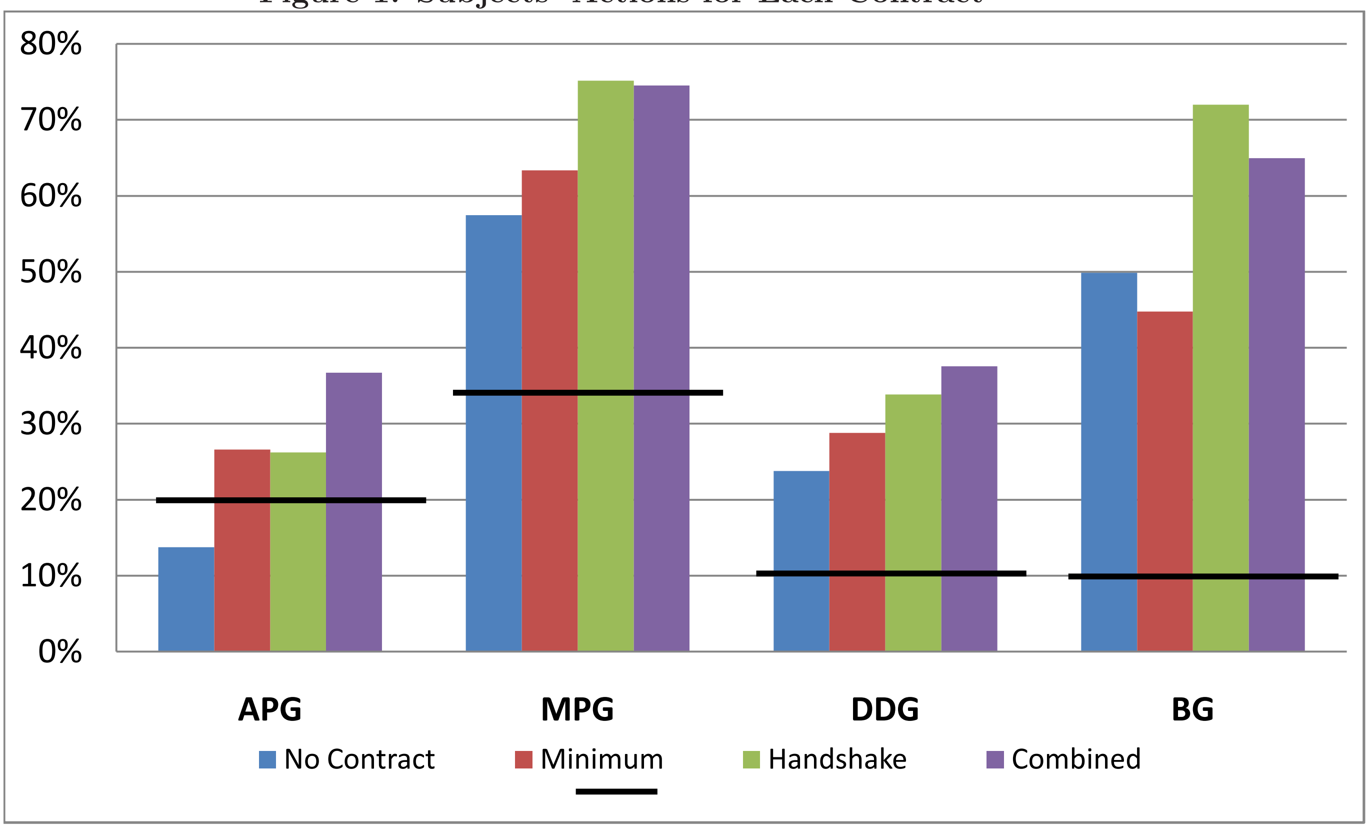
[35] Tirole, Jean. “Incomplete Contracts: Where do we stand?” *Econometrica*, 1999, vol. 67 (4), pp. 741-781.

[36] Vanberg, Christoph. “Why Do People Keep Their Promises? An Experimental Test of Two Explanations.” Mimeo, 2008.

**Table 1: Contract Choices**

| % Request the Contract | APG | MPG | DDG | BG |
|---|---|---|---|---|
| Minimum | 80.51% | 82.56% | 87.00% | 81.88% |
| Handshake | 80.13% | 88.33% | 87.75% | 86.38% |
| Combined | 81.54% | 85.38% | 86.88% | 84.75% |
| Request All | 71.67% | 77.69% | 79.63% | 74.63% |
| Request None | 10.64% | 7.18% | 5.63% | 7.63% |

**Figure 1: Subjects' Actions for Each Contract**



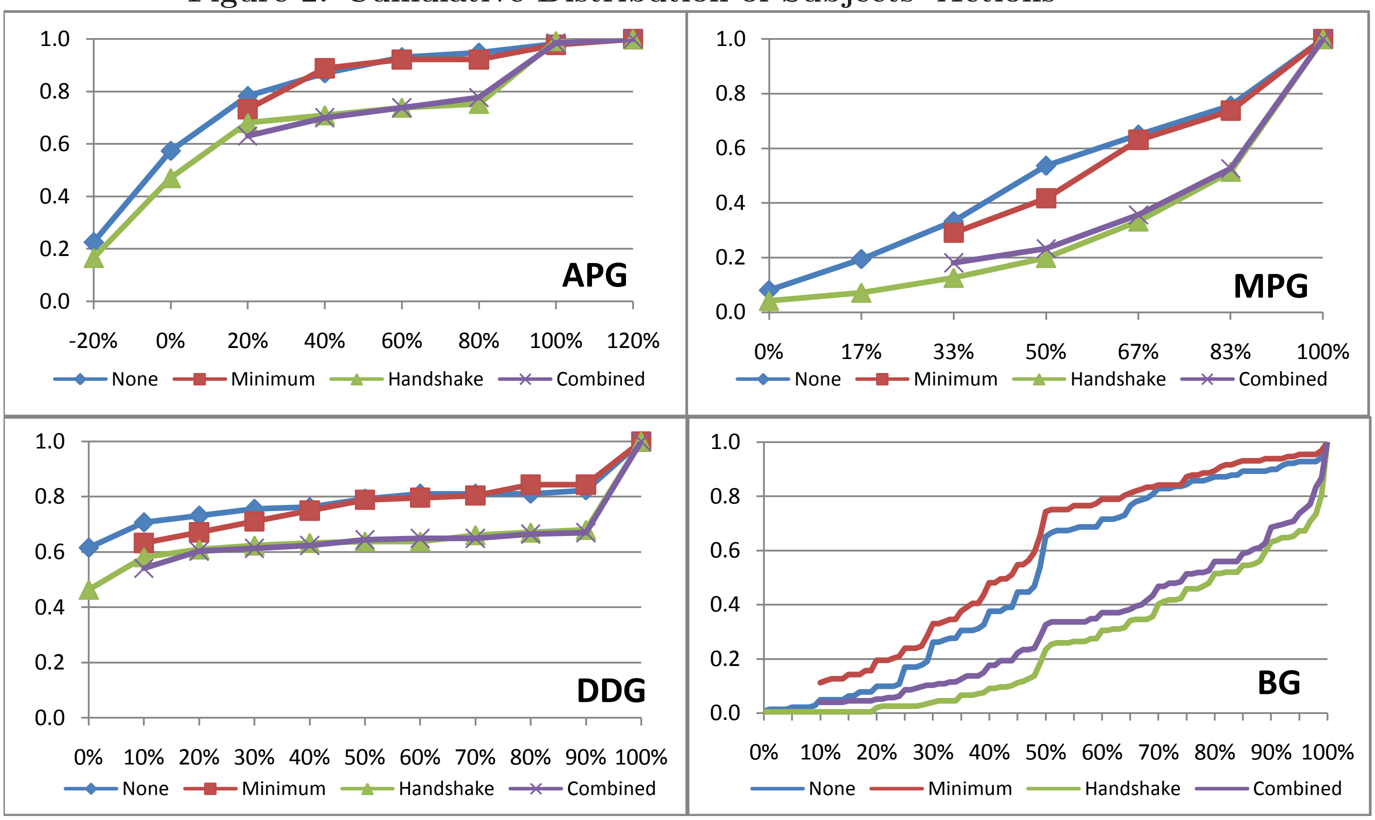

Actions scaled so that 0% denotes the selfish optimum action and 100% denotes the first best action. Only subjects who requested all contracts are included. Horizontal bar denotes the minimum action required by the Minimum/Combined contracts.

Table 2: Effect of Contracts on Actions

| Coefficients | APG (1) | MPG (2) | DDG (3) | BG (4) |
|---|---|---|---|---|
| Reject Contract | -0.00687 | -0.257 | -0.693** | -3.497 |
| | (0.17) | (0.22) | (0.29) | (2.84) |
| Contract w/ Minimum | 0.762*** | 0.379** | 0.675** | -4.545* |
| | (0.16) | (0.17) | (0.27) | (2.36) |
| Contract w/ Handshake | 0.892*** | 1.292*** | 1.571*** | 26.94*** |
| | (0.20) | (0.16) | (0.28) | (2.13) |
| Contract w/ Both | -0.0899 | -0.417** | -0.219 | -0.478 |
| | (0.25) | (0.21) | (0.40) | (3.16) |
| Constant | 6.764*** | 3.087*** | 3.189*** | 58.08*** |
| | (0.29) | (0.33) | (0.53) | (3.65) |
| Period Controls | Yes | Yes | Yes | Yes |
| Session Order Controls | Yes | Yes | Yes | Yes |
| Observations | 559 | 606 | 793 | 732 |
| Number of Subjects | 73 | 69 | 95 | 95 |
| * Total Difference [Combined - Handshake] | 0.672*** | -0.0374 | 0.456 | -5.024** |
| | (0.19) | (0.12) | (0.29) | (2.12) |

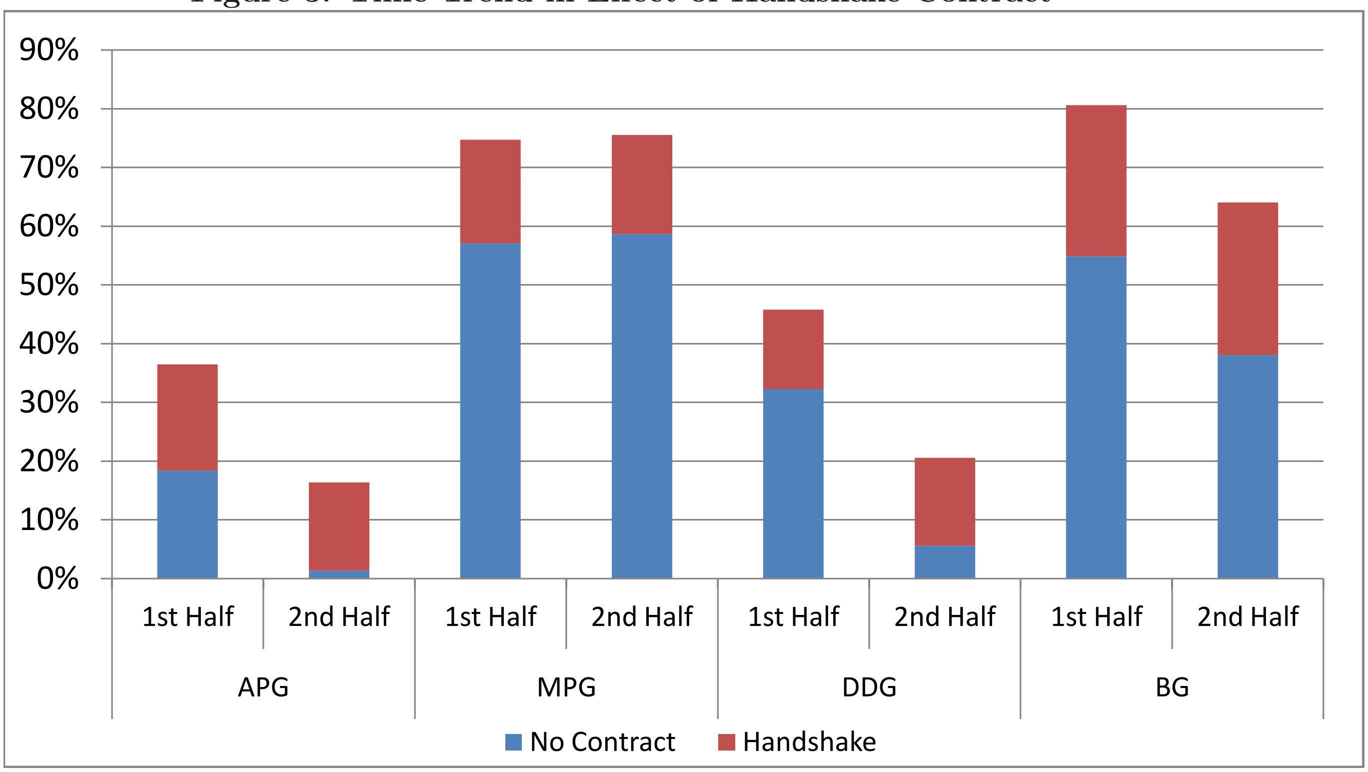
Robust standard errors reported in parentheses. Significance is denoted: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. The specification includes subject random effects, and the observations are restricted to periods where the subject requests all contracts.

**Figure 2: Cumulative Distribution of Subjects' Actions**




Actions scaled so that 0% denotes the selfish optimum action and 100% denotes the first best action. Figure displays the empirical cumulative distribution, for each contract, of subjects' actions, given that they requested all three contracts.

**Figure 3: Time Trend in Effect of Handshake Contract**




Actions scaled so that 0% denotes the selfish optimum action and 100% denotes the first best action. Only subjects who requested all contracts are included. The red portion of the bar indicates the additional increase in the average action for the Handshake contract compared to having no contract available.

Table 3: **Effect of Contract Requests on Actions (Handshake Contract)**

| | **APG** | **MPG** | **DDG** | **BG** |
|---|---|---|---|---|
| **Coefficients** | **(1)** | **(2)** | **(3)** | **(4)** |
| Subject Requests | 0.315 | 0.963 | 0.366 | -5.377 |
| | (0.72) | (0.82) | (0.82) | (6.66) |
| Partner Requests | 0.536 | 1.359 | 0.646 | -7.043 |
| | (0.71) | (0.83) | (0.84) | (6.19) |
| Both Request | 0.467 | 0.536 | 1.455 | 35.56*** |
| | (0.76) | (0.90) | (0.99) | (7.36) |
| Constant | 6.395*** | 1.268 | 1.498 | 77.67*** |
| | (0.74) | (0.82) | (1.70) | (12.5) |
| Period Controls | Yes | Yes | Yes | Yes |
| Session Order Controls | Yes | Yes | Yes | Yes |
| Observations | 234 | 234 | 306 | 306 |
| Number of Subjects | 78 | 78 | 102 | 102 |
| * Total Effect [Both Request] | 1.318* | 2.858*** | 2.467*** | 23.14*** |
| | (0.70) | (0.76) | (0.74) | (5.82) |

Robust standard errors reported in parentheses. Significance is denoted: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. The specification includes subject random effects, and the observations are restricted to periods where the Handshake Contract was available.

**Table 4: Effect of Handshake Contract and Guesses on Actions**

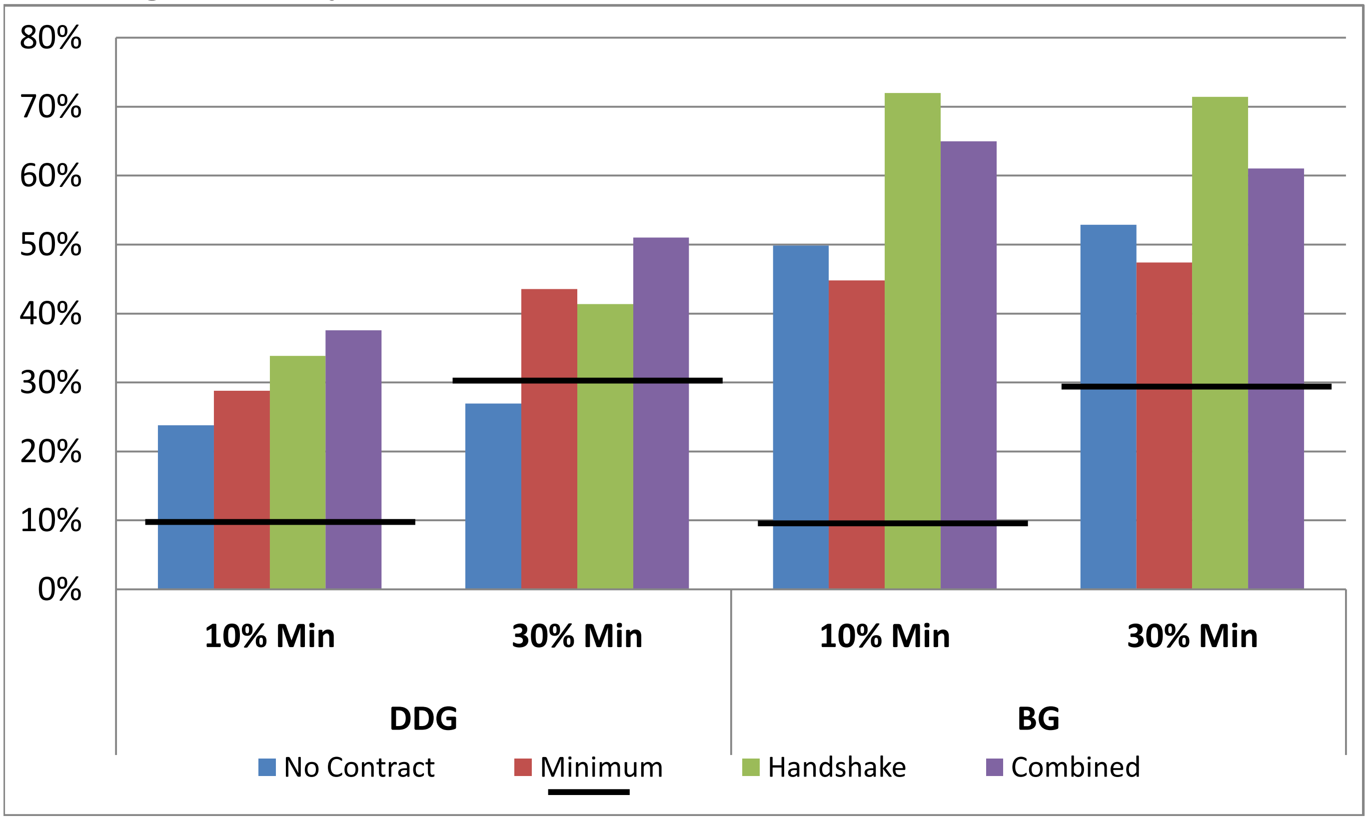
| Coefficients | APG (1) | MPG (2) | DDG (3) | BG (4) |
|---|---|---|---|---|
| Handshake Contract | 0.235 | 0.663*** | 0.841* | 9.403*** |
| | (0.23) | (0.25) | (0.45) | (2.95) |
| Guess of Partner's Action | 0.308*** | 0.672*** | 0.302*** | 0.547*** |
| | (0.061) | (0.059) | (0.062) | (0.066) |
| Constant | 4.447*** | 0.636** | 1.821*** | 29.83*** |
| | (0.65) | (0.32) | (0.70) | (6.41) |
| Period Controls | Yes | Yes | Yes | Yes |
| Session Order Controls | Yes | Yes | Yes | Yes |
| Observations | 234 | 234 | 306 | 306 |
| Number of Subjects | 78 | 78 | 102 | 102 |

Robust standard errors reported in parentheses. Significance is denoted: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. The specification includes subject random effects, and the observations are restricted to periods where the Handshake Contract was available.

**Table 5: Subjects Who Decrease Usage of the Handshake Contract**

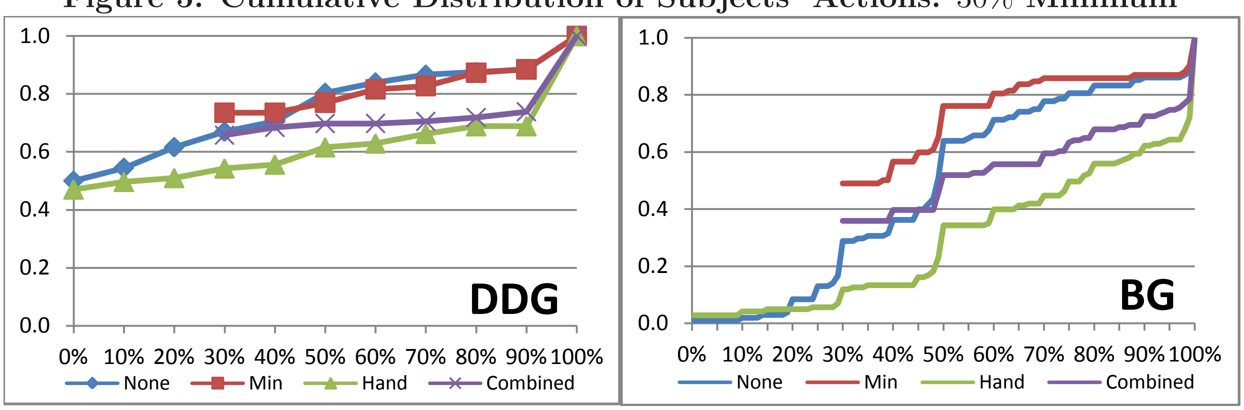
| | # of Subjects Decreasing Usage | Prob. Request Contract (1st / 2nd Half) | Subjects' Payoff (2nd Half) w/o Contract | Subjects' Payoff (2nd Half) w/ Contract | All Other Subj. Payoffs (2nd Half) w/ Contract |
|---|---|---|---|---|---|
| **APG** | 13 of 78 | 65% / 23% | 22.06 | 53.00 | 29.44 |
| **MPG** | 7 of 78 | 74% / 20% | 21.86 | 34.33 | 41.15 |
| **DDG** | 20 of 102 | 88% / 54% | 20.50 | 26.71 | 30.42 |
| **BG** | 16 of 102 | 75% / 40% | 16.13 | 25.20 | 27.20 |

**Figure 4: Subjects' Actions: 10% Minimum versus 30% Minimum**




Actions scaled so that 0% denotes the selfish optimum action and 100% denotes the first best action. Only subjects who requested all contracts are included. Horizontal bar denotes the minimum action required by the Minimum/Combined contracts.

**Figure 5: Cumulative Distribution of Subjects' Actions: 30% Minimum**




Actions scaled so that 0% denotes the selfish optimum action and 100% denotes the first best action. Figure displays the empirical cumulative distribution, for each contract, of subjects' actions, given that they requested all three contracts.

**Table 6: Effect of Contracts on Actions:** 10% **Minimum versus** 30% **Minimum**

| **Coefficients** | **DDG (1)** | **BG (2)** |
|---|---|---|
| Reject Contract | -0.733** | -3.664 |
| | (0.29) | (2.82) |
| Contract w/ Minimum | 0.691** | -4.573* |
| | (0.27) | (2.35) |
| Contract w/ Handshake | 1.558*** | 26.82*** |
| | (0.28) | (2.14) |
| Contract w/ Both | -0.205 | -0.478 |
| | (0.40) | (3.16) |
| Minimum at 30% Treatment | -0.183 | 5.604* |
| | (0.52) | (3.23) |
| Minimum @30% x Reject | 0.181 | -4.221 |
| | (0.50) | (3.97) |
| Minimum @30% x Contract w/ Minimum | 1.076*** | -2.076 |
| | (0.40) | (3.57) |
| Minimum @30% x Contract w/ Handshake | 0.0938 | -8.386** |
| | (0.46) | (3.47) |
| Minimum @30% x Contract w/ Both | -0.788 | -0.650 |
| | (0.59) | (5.16) |
| Constant | 3.682*** | 54.78*** |
| | (0.46) | (3.19) |
| Period Controls | Yes | Yes |
| Session Order Controls | Yes | Yes |
| Observations | 1346 | 1263 |
| Number of Subjects | 159 | 160 |

Robust standard errors reported in parentheses. Significance is denoted: * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$. The specification includes subject random effects, and the observations are restricted to periods where the subject requests all contracts.