The role of personal and impersonal relational contracts on partner selection and efficiency

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ABSTRACT

In this article, we use a laboratory experiment to study the effects of relational contracts on market efficiency in environments with different degrees of contract enforceability and market competition. By exogenously varying the communication protocol, we create relational contracts that are more personal or impersonal. On the one hand, personal relational contracts improve efficiency by promoting trust and coordination. On the other hand, impersonal relational contracts increase efficiency by facilitating the severance of trading relationships when more productive competitors enter the market. Therefore, the overall effect on market efficiency depends on the relative importance of competition and agreement enforceability.

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1 Introduction

Markets are often characterized by limited contract enforcement and competition. To safe-guard the continuity of trading partners and ensure compliance with the agreed-upon terms of trade, firms often rely on relational contracts—that is, self-enforcing agreements sustained by the future value of a trading relationship (Bull, 1987; Levin, 2003; Board, 2011; Huck et al., 2012; Macchiavello and Morjaria, 2015). The value of a relationship refers both to the purely material gains it provides as well as personal bonds that might be formed between trading partners (Macchiavello and Morjaria, 2015). The more personal a relational contract is, the more it can promote successful repeated interactions and low inequality in the division of gains (Board, 2011; Carrasco et al., 2019; Barron and Powell, 2019). There is evidence suggesting that relational contracts work well even in competitive markets (Brown et al., 2004, 2012). How-ever, this evidence is based on settings where trading partners are equally productive. Hence, maintaining a successful relationship with a trading partner does not imply a tradeoff between an existing relationship and a potentially more productive one. In settings where competition entails the option to trade with more productive parties, strong personal relational contracts might motivate firms to maintain a trading relationship even if doing so is inefficient.

In this study, we investigate the effects of personal relational contracts on efficiency when more productive trading partners enter a market. We study these effects using a laboratory experiment where we randomly vary the degree to which relational contracts are more *personal* or *impersonal*. More specifically, we study a variation of the trust game (Berg et al., 1995) where players can form relational contracts through repeated play and communication. In some treatments, we generate impersonal relational contracts by allowing players to communicate via numeric messages, which can be used to bargain and reach agreements but do not convey much else. In other treatments, we generate personal relational contracts by allowing players to com-municate via chat, which lets them bargain and agree as well as express emotions, communicate approval and disapproval, and form social bonds. In other words, by varying the communica-tion protocol in otherwise identical situations, we exogenously create more impersonal, purely transactional relationships and more personal relationships involving emotions, social norms, and group identification.[1]

In addition to varying how personal relational contracts are, we also vary two important

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[1]Note that we do not claim that relational contracts or even the degree to which business relationships are personal or impersonal depend solely on the form of communication. Our claim is that varying the form of communication introduces exogenous variation in the type of relational contracts that develop in the laboratory. There is compelling evidence that free-form communication foments closer emotional interactions (e.g., Bichieri et al., 2010; Andreoni and Rao, 2011; Kuwabara, 2011; Brandts et al., 2016a; Wang and Houser, 2019), permits the transmission of social approval and disapproval (see, Xiao and Houser, 2005, 2009), and enhances group identities (e.g., Chen and Li, 2009).

characteristics of the economic environment. First, we vary the amount of competition. Particularly, in *no competition*, players interact with only one trading partner. By contrast, in *competition*, players can choose how much to interact with a trading partner with whom they have a pre-existing relational contract or with a more productive entrant. Second, we vary the extent to which trade agreements can be enforced by a third party. Specifically, with *non-enforceable agreements*, all terms of trade are cheap talk. By contrast, with *partially enforceable agreements*, the terms of trade are enforceable but trade continuity is not, which eradicates non-compliance but allows the switching of trading partners.

With non-enforceable agreements, we find that personal relational contracts perform better than impersonal ones if there is no competition. In this setting, players easily make trading agreements with either type of relational contract. However, agreement terms are more efficient when relational contracts are personal. With the introduction of competition by more productive entrants, there is no longer a difference in efficiency between personal and impersonal relational contracts. This is due to the fact that loyalty toward existing trading partners when relationships are personal reduces trade with more productive entrants, while the breaking of existing (less efficient) ties is more common with impersonal relationships. This reduction implies a loss of efficiency relative to impersonal relationships where such switching is commonplace. In the experiment, this efficiency loss is large enough to completely offset the advantage that personal relational contracts have in compliance with trading agreements.

With partially enforceable agreements, we also find that personal relational contracts have an advantage when there is no competition. This finding suggests that personal relationships can promote additional efficiency even when some level of enforceability is put in place. However, with the introduction of competition, personal relational contracts lead to lower levels of market efficiency than are attainable. Despite the fact that the enforceability of agreements means that trade does not rely on trust, traders with personal relational contracts are more reluctant to sever relationships with existing, less productive partners. This is not the case with impersonal relational contracts, introducing competition by more productive partners results in higher rates of switching when trading relationships are impersonal rather than personal.

Our work contributes to the literature on competition and relational contracts. Particularly to studies that investigate whether there is a negative impact of competition on the formation (Brown et al., 2012) and efficiency (Macchiavello and Morjaria, 2021) of relational contracts. Closer to this study is Macchiavello and Morjaria (2015), who show that in the rose trade in Kenya, exporters prioritize trading with their existing partners when faced with negative supply shocks, which make loyalty costly. Our study complements this line of research by cleanly identifying the impact of relational contracts through the random assignment of traders to either personal or impersonal relationships. This allows us to rule out other explanations for why exporters prioritize trade with existing partners.

This study also speaks to the experimental literature on the effects of communication on behavior in games involving some form of cooperation (for a recent discussion see, Brandts et al., 2019). A consistent finding in these studies is that outcomes are more efficient when communication is available, and all the more so, the more freedom participants have in the way they communicate (see e.g. Xiao and Houser, 2005; Bochet and Putterman, 2009; Andreoni and Rao, 2011; Ben-Ner et al., 2011; Brandts et al., 2016a; Andreoni et al., 2017; Wang and Houser, 2019). Recently, researchers have also started exploring the damaging effects of communication in strategic situations. For example, Cason et al. (2012) show that communication within groups can make competition more aggressive between groups. Similarly, communication among bidders in an auction can result in collusion on lower bids, which decreases efficiency (Agranov and Yarit, 2018). A related study on how communication can constrain efficiency in a social dilemma can be found in Abbink et al. (2022). Unlike in our experiment, they limit communication to a subset of players within the group. This communication structure resulted in players using communication as a way of exploiting non-communicating players. We contribute to this literature by studying the effects of different forms of communication in settings that involve market competition. We show that free-form communication can be detrimental in the presence of competition because it generates a sense of loyalty that limits switching to more productive players.

Finally, our study is related to the literature on social ties (van Dijk et al., 1997, 2002; Kuwabara, 2011; Attanasi et al., 2014; Bault et al., 2017), which proposes that individuals develop affective ties with others as a consequence of their past interaction. Once formed, ties impact the individuals' willingness to reciprocate others' actions as well as their desire for continued interaction. Within this literature, an article that is closely related to ours is Fiedler et al. (2011). In their study, the proposer in a one-shot trust game chooses to trust either a responder with whom she had previously chatted or a stranger with a higher multiplier. Fiedler et al. (2011) observe that proposers favor interactions with responders with whom they had chatted.[2] There are, however, a few important differences between their study and ours. First, in Fiedler et al. (2011), affective ties are formed through communication before participants know what game they will play. In our case, affective ties are formed in the context of a relational contract with a trading partner with whom they interact repeatedly. As such, our experimental design is closer to the settings modeled in theories of affective tie formation (van Dijk et al., 1997; Bault et al., 2017). Second, in our study, players can communicate and repeatedly interact with both competing trading partners. In this respect, we think that our setting more accurately resembles actual trading relationships. Finally, another important difference is that Fiedler

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[2]See Bao et al. (2018) for further evidence of individuals' desire to continue to interact with the same partners and Reuben and van Winden (2008) for evidence of how pre-existing relationships affect individuals' willingness to reciprocate.

et al. (2011) focus on non-enforceable contracts while we look at both non-enforceable as well as partially enforceable relational contracts.

2 Experimental design

2.1 The trust game

In our experiment, we use variations of the trust game (Berg et al., 1995). Participants are assigned to the role of sender or receiver and maintain the same role throughout the experiment. Participants play the same game repeatedly for 10 periods with fixed partners. In the next paragraphs, we describe the different versions of the game.

Competition: One sender and two receivers

Each period of the three-person trust game consists of three or four stages in which a sender interacts with two receivers: an *incumbent receiver* and an *entrant receiver*. The incumbent has a previous history of interaction with the sender, which we will explain in detail later. Receivers compete against each other for the resources the sender has.

All three players start each period of the game with an endowment of 10 units of resources. In the first stage, each receiver independently decides how much to invest in their multiplying technology. We concentrate on the more interesting case where the entrant has a more productive multiplier technology, $m_E = 1 + 0.4 y_E \leq 5$, than the incumbent, $m_I = 1 + 0.3 y_I \leq 4$. Once the investments are made, the resulting multipliers are communicated to the sender.[3]

In periods 1, 4, and 7, there is a second stage in which the sender can communicate with each receiver to make agreements about their subsequent interactions.[4] An agreement consists of the amount the sender agrees to send to a receiver in stage three and the amount the receiver agrees to return to the sender in stage four. Hence, the sender can make up to two agreements: $\{s_I, r_I\}$ and $\{s_E, r_E\}$. Even though agreements are made independently, the sender cannot agree to send a total amount that is more than their endowment, $s_I + s_E \leq 10$.[5] We describe later the precise way in which players communicate, as it varies by treatment.

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[3]By allowing receivers to determine their multiplier prior to the agreement stage endogenously, our design captures a feature common in multiple trading relationships: companies invest in technology or individuals invest in human capital (e.g., education) prior to the establishment of a trading agreement.

[4]As Bochet et al. (2006), we introduce the communication stage every three periods instead of every period so that the experiment does not last too long. The effect of communication has been shown to be strong enough to sustain cooperation even if it does not occur every period (e.g., see Bochet et al., 2006; Koukoumelis et al., 2012).

[5]In line with most trading contexts, an agreement between a sender and a receiver could not depend on the actions of the other receiver.

In stage three, the sender chooses how much to send to each receiver, $s_I, s_E \in [0,10]$: $s_I + s_E \leq 10$, and each receiver gets their respective multiplied amount, $s_I \times m_I$ and $s_E \times m_E$. Finally, in stage four, each receiver decides how much to return to the sender, $r_I \in [0, s_I \times m_I]$ and $r_E \in [0, s_E \times m_E]$.

It is common knowledge to all players that the entrant's multiplier is potentially higher than the incumbent's. Aside from that, all information is kept within the sender-receiver pair. That is, the incumbent (entrant) cannot communicate with the entrant (incumbent) nor observe the agreements or choices made between the sender and the entrant (incumbent).

The sender's earnings in the three-person game are $\pi_S = 10 - s_I + r_I - s_E + r_E$, the earnings of the incumbent are $\pi_I = 10 - y_I + s_I \times m_I - r_I$, and those of the entrant are $\pi_E = 10 - y_E + s_E \times m_E - r_E$. The interaction generates a surplus equal to the multiplied amount sent to each receiver minus the resources invested by the receivers and those sent by the sender: $\omega = s_I \times m_I + s_E \times m_E - (s_I + s_E + y_I + y_E)$. The highest surplus is generated when the incumbent invests nothing, the entrant invests the entire endowment, which produces a multiplier of $m_E = 5$, and the sender sends 10 to the entrant and nothing to the incumbent, producing a total surplus of $\omega = 30$.

No competition: One sender and one receiver

The two-person trust game consists of up to four stages, as the three-person game, in which a sender and a sole receiver interact. At the beginning of each period, both players are endowed with 10 units of resources. In the first stage, the receiver decides how much to invest $y \in [0,10]$ in a multiplying technology $m = 1 + 0.3y$. The resulting multiplier is then communicated to the sender. As in the three-person game, in periods one, four, and seven, there is a second stage. In the second stage, the sender and the receiver have the opportunity to communicate in order to make agreements, $\{s, r\}$, about their subsequent interactions. An agreement consists of an amount s that the sender agrees to send to the receiver in stage three and an amount r that the receiver agrees to return to the sender in stage four. In the third stage, the sender chooses how much to send to the receiver, $s \in [0, 10]$, who receives the multiplied amount $s \times m$. Lastly, in the fourth stage, the receiver learns how much the sender sent and chooses how much to return to the sender, $r \in [0, s \times m]$.

The sender's earnings in the game are $\pi_S = 10 - s + r$, and the receiver's earnings are $\pi_R = 10 - y + s \times m - r$. Their interaction generates a surplus defined as the increase in the sum of payoffs relative to parties consuming their endowment. Thus, the surplus is equal to the multiplied amount sent minus the resources invested and sent: $\omega = s \times m - y - s$. The highest surplus is accrued when the receiver invests, and the sender sends their entire endowment, producing a multiplier $m = 4$ and a surplus $\omega = 20$.

2.2 Treatments

Our experimental design focuses on comparing how personal and impersonal relational contracts impact partner choice and market efficiency in different economic environments. To do so, we exogenously vary the intensity of relationships by varying the communication channels. We also vary the level of contract enforceability.

Communication

We vary the relational intensity of interactions by exogenously varying how players communicate. In treatments with IMPERSONAL relational contracts, players communicate by exchanging numeric information using predefined messages. Each message specified how much the sender should send and how much the receiver should return. A participant would make a proposal saying, for example, "The sender sends 10 and the receiver returns 20". These messages convey the necessary information for players to negotiate and reach an agreement but nothing else. The communication stage lasted 3 min. At any point during this time, participants could accept the proposal of their counterpart or make proposals of their own.[6]

In treatments with PERSONAL relationships, in addition to the predefined numeric messages, players could freely communicate with a chat box. Communication was free form, but participants were required not to convey any information that could be used for personal identification (e.g., name, computer number in the lab, etc.) or use offensive language. This form of communication allows participants to convey the necessary information to reach an agreement plus express intentions and affect (Brandts and Cooper, 2007; Brandts et al., 2016a; Wang and Houser, 2019), including the use of verbal sanctions (Xiao and Houser, 2005, 2009) and expressions that foment group identity (e.g., Chen and Li, 2009).

In the competition environment (i.e., the three-person game), the sender could chat and exchange messages separately with each receiver. Receivers could only communicate with the sender and not with each other. Moreover, the communication between the sender and a given receiver was unobservable to the other receiver.

As argued in the introduction, the fact that we use different forms of communication to vary the intensity of the relational contracts exogenously does not mean that we think that this is the main determinant of whether a relationship is personal or impersonal outside the laboratory. We simply think that varying the form of communication is a convenient way to introduce exogenous variation in the intensity of the relationships that are formed in the laboratory.

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[6]Accepting a proposal would end the communication stage. However, participants could also leave the communication stage without agreeing by clicking on an exit button.

Contract enforceability

We vary the level of contract enforceability by exogenously varying whether relational contracts are non-enforceable or partially enforceable.

In economic environments with *non-enforceability*, agreements between the sender and the receivers cannot be verified. That is, after players reach an agreement, they are free to choose how much to send or return, and their choices do not need to be in line with what was agreed on. On the other hand, in treatments with *partial-enforceability*, agreements are automatically implemented. Namely, once there is an agreement on the amounts to be sent and returned, players' choices are fixed until there is a new communication stage.[7] We refer to these types of contracts as partially enforceable because they do not force senders and receivers to choose each other or maintain their interaction over time. That is, continuity of the trading partnership is not ensured, which is of most relevance for the game with competition, where the choice of partners can have large efficiency consequences.

Creating incumbent and entrant receivers

As mentioned above, our main focus is on the effect of relational contracts when senders face a trade-off between trading with the *incumbent receiver*, with whom they share a trading history, and the *entrant receiver*, whose multiplier is potentially higher. To generate this setting in the laboratory, participants first played 10 periods of the two-person game (the no competition setting) and then 10 additional periods of the three-person game (the competition setting).[8] In each trio of the three-person game, the incumbent receiver was the receiver with whom the sender had been previously matched in the two-person game. By contrast, the entrant receiver was a receiver who had been previously matched with a different sender.[9] Before starting the three-person game, senders were informed of the previous history of play of both receivers (i.e., the amount invested, received, and returned in each period of the two-person game). Receivers were informed of the sender's history of play but not of the other receiver's history of play. We

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[7]For an agreement to be enforceable, it had to be entered as such in the computer. If no agreement is entered, players would still interact for the next three periods and were free to choose how much to send or return regardless of their previous communication.

[8]Participants were told that the experiment consisted of two parts. Part one corresponded to ten periods of the two-person game and part two to ten periods of the three-person game. Participants completed part one before they were given the instructions for part two. See Appendix A for details.

[9]Participants were divided into blocks containing a pair A and a pair B (each pair had a sender and a receiver). Pairs were fixed for the first ten periods (two-person game). Then, for the three-person game, pair A was kept fixed while pair B was split. The receiver from pair B joined pair A as the entrant receiver. The sender from pair B continued playing in a different study. For the data analysis of the two-person game, we use data only from pair As so that is it easy to compare their behavior across games. However, our results are the same if we include the data from pair Bs in the analysis of the two-person game.

Table 1. Treatments

Periods in the experiment	Game played	Non-enforceable agreements	Partially enforceable agreements
1 to 10	Two-person	*No Competition & non-enforceability*	*No Competition & partial-enforceability*
11 to 20	Three-person	*Competition & non-enforceability*	*Competition & partial-enforceability*

provided the history of play to reduce differences in the information possessed by the sender about the two receivers.

The different treatments are summarized in Table 1.

2.3   Hypotheses

In what follows, we describe the hypotheses used to guide the empirical analysis. Traditional theory using standard assumptions predicts that parties do not trade when agreements are non-enforceable. However, the empirical literature on relational contracts provides plenty of evidence that people can partly overcome this type of trust problem, particularly with repeated interaction (e.g., Huck et al., 2012; Macchiavello and Morjaria, 2015). Numerous theories of social preferences can explain why trade occurs even though participants are playing a finitely-repeated game with non-enforceable agreements (see Fehr and Schmidt, 2006). However, these theories are silent when it comes to predicting the impact of communication. In particular, to the best of our knowledge, there are no formal theories that predict differences in behavior between free-from and numeric communication.[10] Therefore, we derive our hypothesis based on available empirical evidence. Thereafter, we discuss various reasons justifying the hypothesized treatment differences as well as other effects that we might reasonably expect due to the specifics of our experimental design that are not present in the literature.

The empirical literature generally finds a positive effect of cheap-talk communication on prosocial behavior in numerous settings (Brandts et al., 2019). Communication not only supports prosociality but also reduces the need for enforcement mechanisms such as costly punishment (Bochet and Putterman, 2009; Brandts et al., 2016b). There is evidence that communication has a bigger impact when it can be used to transmit intentions (Mohlin and Johannesson,

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[10]Charness and Dufwenberg (2006) contend that theories of guilt aversion (Battigalli and Dufwenberg, 2007) explain the effect of communication on trust and reciprocity. They assume that the act of communicating and the type of communication (i.e., whether there are promises) increases the senders' expectations concerning the receivers' trustworthiness. In these theories, if receivers anticipate such an effect, they become more motivated to reciprocate the sender's trust. While this argument proposed a mechanism through which communication impacts behavior, it is silent on why communication impacts the senders' expectations in the first place.

2008; Bichieri et al., 2010; Charness and Dufwenberg, 2006) and emotions of satisfaction or discontent, which work as an effective form of sanctions and rewards (Masclet et al., 2003; Xiao and Houser, 2005, 2009; Wang and Houser, 2019). Notably, free-form communication seems to perform better than more restricted communication, such as numeric or predefined verbal messages (see, e.g., Ben-Ner et al., 2011; Bochet et al., 2006; Charness and Dufwenberg, 2010; Cooper and Kuhn, 2014; Brandts et al., 2016a). Hence, the empirical regularities in the literature suggest that there will be more trade in PERSONAL than in IMPERSONAL when agreements are non-enforceable. Our first hypothesis is as follows.

Hypothesis 1 *(Relational contracts and non-enforceable agreements): If agreements are non-enforceable,* PERSONAL *relational contracts lead to higher market efficiency than* IMPERSONAL *relational contracts.*

Hypothesis 1 is based on the argument that more personal communication facilitates trade by increasing the senders' trust in the receiver's compliance with the terms of an agreement. As argued by Andreoni and Rao (2011), this is due to communication leading individuals to consider each other's position more fully, triggering higher degrees of empathy and hence more prosocial motivations (see also Andreoni et al., 2017).

Hypothesis 1 does not distinguish between settings with and without competition. This is because there is not enough empirical evidence about the effects of communication in competitive environments to make this distinction. However, there are reasons to conjecture that the positive effect of personal communication may not materialize when competition is introduced. Uzzi (1996) argues that social ties developed from personal business relationships generate strong feelings of commitment between the involved parties (see also Uzzi, 1999; Lawler, 2001). Similarly, Macchiavello and Morjaria (2015) postulates that relational contracts induce loyalty. This line of argument is the basis for formal models of social ties, which assume that a history of beneficial interaction induces individuals to assign more weight in their prosocial motivations to their trading partners (van Dijk et al., 1997, 2002; Bault et al., 2017).

Recall that we study a situation where a more productive entrant receiver competes with an incumbent receiver who has an established trading relationship with the sender. It is natural to assume that ties developed during the two-person game will carry over to the three-person game. If this is the case, the more successful a previous sender-receiver relationship is, the more reluctant the sender will be to subsequently sever that relationship to trade with the entrant. If Hypothesis 1 holds, then more successful relationships in PERSONAL than in IMPERSONAL when there is no competition would lead to senders favoring the incumbent more in PERSONAL once competition is introduced. Since incumbents are less productive than entrants, favoring the former would be a source of efficiency loss.

Next, we turn to partially enforceable agreements. In this setting, all agreements made are

binding and cannot be reneged on by the sender or the receiver in a given period. The empirical evidence suggests that once contracts are strong enough to prevent infringement of bilateral trade agreements, markets typically converge to full efficiency (e.g., see Brown et al., 2004, 2012). Hence, we do not expect to see differences in market efficiency between PERSONAL and IMPERSONAL in environments with partially enforceable agreements.[11] Our next hypothesis follows.

Hypothesis 2 *(Relational contracts and partially enforceable agreements): If agreements are partially enforceable, there is no difference in market efficiency between* PERSONAL *and* IMPERSONAL *relational contracts.*

Naturally, eliminating the need to foster trust and trustworthiness to enforce trade agreements implies that personal communication does not have an obvious advantage over impersonal communication. Hence, there is little room for the type of communication to matter for efficiency in the absence of competition. With competition, the arguments described above could still apply. Namely, it is possible that more personal communication still produces stronger social ties between the sender and incumbent receivers, resulting in a comparatively lower trade with entrant receivers. The mechanism can no longer be that stronger ties result from a successful trading relationship, which is predicted to be similar across types of communication. Instead, it would have to be that more personal communication alone triggers more empathy and a stronger bond between the sender and the receiver than impersonal communication (Andreoni et al., 2017).

2.4 Experimental procedures

We conducted the experiment in two laboratories, first at the CELSS Laboratory at Columbia University and then at the LINEEX Laboratory at the University of Valencia. We run sessions with all treatments in both laboratories. Participants were all undergraduate students who interacted via computers using z-tree (Fischbacher, 2007). We used standard experimental procedures, including neutrally worded instructions that explained all the steps in the experiment. At the end of the session, participants were paid in cash. Average earnings were around 20 dollars in both laboratories. The instructions for the experiment are available in Appendix A, which include exchange rates and details for each treatment.

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[11]Note that this argument pertains to market efficiency. It does not exclude the possibility that relational contracts affect market outcomes. Specifically, it is possible that they induce differences in returned amounts.

3 Results

The data in our experiment consists of a panel of 200 individuals who repeatedly interact in 100 pairs (*No Competition*). These pairs are subsequently joined by 100 additional individuals to form groups of three players (*Competition*). In total, 49 groups played with non-enforceable agreements, and 51 groups with partially enforceable agreements. In *No Competition*, a single decision is made in each stage (e.g., the amount sent). In *Competition*, two decisions are made in each stage (e.g., the amount sent to the incumbent and the amount sent to the entrant). Therefore, throughout the article, we use random effects GLS regressions to run statistical tests. For variables capturing group-level outcomes (e.g., market efficiency) or individual decisions in *No Competition*, we use the following specification:

$$y_{it} = \alpha + \beta_1 P_{it} + \gamma t + \rho L_i + \mu_i + \epsilon_{it}, \tag{1}$$

where y_{it} is the variable of interest, P_{it} is a dummy variable that equals one for groups in PERSONAL and zero for groups in IMPERSONAL, t is the period number to control for time trends, L_i is a dummy variable that equals one for sessions conducted at LINEEX and zero for sessions conducted at CELSS, μ_i are group random effects, and ϵ_{it} is the error term. For variables capturing individual decisions in *Competition* (e.g., the fraction sent to each receiver), we use instead:

$$y_{it} = \alpha + \beta_1 P_{it} + \beta_2 I_{it} \times P_{it} + \beta_3 I_{it} \times (1 - P_{it}) + \rho L_i + \gamma t + \mu_i + \epsilon_{it}, \tag{2}$$

where, in addition to the variables above, we have I_{it} as a dummy variable that equals one for incumbent receivers and zero for entrant receivers. In this latter specification, β_1 captures differences between PERSONAL and IMPERSONAL for entrant receivers, β_2 captures differences between entrant and incumbent receivers for groups in PERSONAL, and β_3 captures differences between entrant and incumbent receivers for groups in IMPERSONAL. Other comparisons can be made by testing linear combinations of these coefficients. In all regressions, we cluster standard errors on groups.[12] We report *p*-values of two-sided tests in the text and provide all the corresponding regressions in Appendix B.

3.1 Relational contracts with non-enforceable agreements

We start by looking at the effect of relational contracts on partner selection and market efficiency when agreements are non-enforceable. First, we report the effects of the type of relational contract when there is competition between receivers. Recall that senders face a trade-off between interacting with their previous partner, the incumbent, and an entrant who is (potentially) more

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[12]We also analyzed the data using Wilcoxon-Mann-Whitney tests with group averages as the unit of observation. The regressions' results are consistent with those of the non-parametric tests.
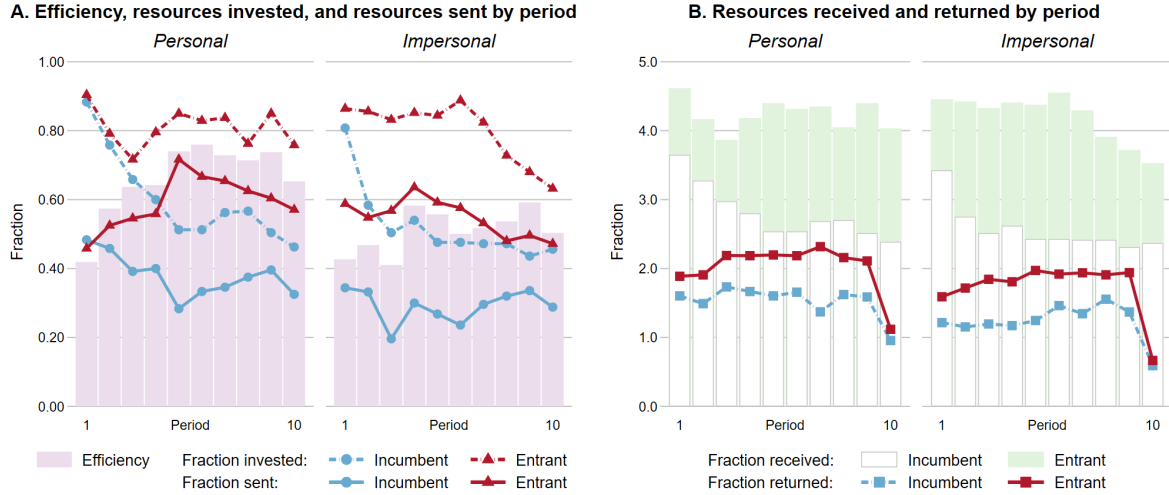
Figure 1. Relational contracts with non-enforceable agreements and competition

Note: Panel A shows the average market efficiency (bars), the fraction of the endowment invested into the multiplier by incumbents (dashed blue line with circles) and entrants (dashed red line with triangles), and the fraction of the endowment sent to incumbents (solid blue line with circles) and entrants (solid red line with triangles). Panel B shows the average multiplier produced by incumbents (white bars) and entrants (green bars) and the amount sent back by incumbents (dashed blue line with squares) and entrants (solid red line with squares) as a fraction of the senders' endowment. The data are from Part 2, but periods are labeled as 1 to 10 for illustrative purposes.

efficient. Then, we look at the part without competition to explore the mechanisms driving the choices made in competition. Throughout, our measure of market efficiency is the total surplus attained by a group in a period as a fraction of its maximum attainable surplus (i.e., $\omega/30$ in *Competition* and $\omega/20$ in *No Competition*). Note that the total surplus includes surpluses generated with the incumbent as well as with the entrant.

Figure 1 depicts the averages of the main variables over the 10 periods. The solid lines in Panel A show the fraction of the endowment sent by the sender to each receiver. The solid blue line with circles corresponds to the fraction sent to the incumbent, while the solid red line with triangles to the fraction sent to the entrant. The dashed lines show the fraction of the endowment invested into the multiplier by the incumbent (dashed blue line with circles) and the entrant (dashed red line with triangles). Finally, the bars illustrate the average market efficiency.

We do not find support for Hypothesis 1. Namely, market efficiency is larger but not statistically different in PERSONAL compared to IMPERSONAL (66% and 51%, $p = 0.19$, Table A1). In section 2.3, we discussed two potential sources of inefficiency. One is the senders' lack of trust, and the other is the persistence of the senders' relationship with the incumbent. In other words, the highest efficiency is obtained if the sender cuts all trade with the incumbent and fully trusts such that only the entrant invests resources in the multiplier and then receives all the senders' endowment. In what follows, we take a deeper look at the behavior of senders and receivers to identify the sources of inefficiency for each type of relational contract.

In PERSONAL, the persistence of the senders' relationship with incumbents is the primary source of inefficiency. We find that despite incumbents not investing as much as entrants (60% vs. 81% of their endowment), they receive almost two-thirds of what the entrant gets from the senders' endowment (38% vs. 60%).[13] On the other hand, there is no mistrust as senders almost always send all their endowment (on average, 97%).

In IMPERSONAL, the efficiency loss due to the senders' relationship with incumbents is lower than in PERSONAL, but mistrust does play a role. Specifically, incumbents invest about half as much as entrants (52% vs. 80% of their endowment) and receive almost half of what entrants receive (29% vs. 55% of the senders' endowment). However, senders send less than their entire endowment (on average 84%).

In other words, the reason that market efficiency is similar with both types of relational contracts is that the higher degree of mistrust in IMPERSONAL is large enough to cancel out the efficiency gains from the weaker relationship between senders and incumbent vis-à-vis PERSONAL.[14]

The difference between PERSONAL and IMPERSONAL is also evident in the agreed-upon terms of trade. Senders in PERSONAL make fewer agreements in general (39% vs. 63%). Conditional on making an agreement, senders in PERSONAL make fewer exclusive agreements with entrants (38% vs. 43% in IMPERSONAL) and more joint agreements with both receivers (41% vs. 31% in IMPERSONAL).[15] Despite these differences, among those that establish agreements, senders comply equally with both receivers on the terms of their agreements in IMPERSONAL (80% vs. 87%; $p = 0.47$, Table A7) and in PERSONAL (87% vs. 91%; $p = 0.48$, Table A7). For a detailed analysis of the agreements made, see Appendix C.

Even though our focus is on the effect of relational contracts on partner selection and efficiency, the amount receivers return to senders constitutes an important part of their interaction. We illustrate this in Figure 1B. The bars portray the average multiplier produced by the incumbent (white bars) and the entrant (green bars), which can be interpreted as the fraction of resources a receiver obtains per unit sent by the sender. In addition, we depict the fraction of

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[13]In PERSONAL, there is a marginally statistically significant difference between entrants and incumbents in the fraction invested and the amount received (respectively, $p = 0.06$ and $p = 0.09$, Table A1), which highlights why maintaining ties with the incumbent in competition hurts market efficiency.

[14]A back of the envelope calculation shows that if senders in IMPERSONAL sent the remaining 16% of their endowment to entrants, then the overall surplus in IMPERSONAL would be 0.8 higher than in PERSONAL.

[15]To test whether the distribution of agreements varies between PERSONAL and IMPERSONAL, we run a multinomial logit regression with four agreement types as the dependent variable: no agreement, an agreement only with the incumbent, an agreement only with the entrant, and an agreement with both. As independent variables, we use a dummy indicating the type of relational contract, the period number, and the laboratory. Subsequently, we test whether the coefficients of the dummy variable are jointly significant. We find that the agreement distributions are significantly different ($p < 0.01$).
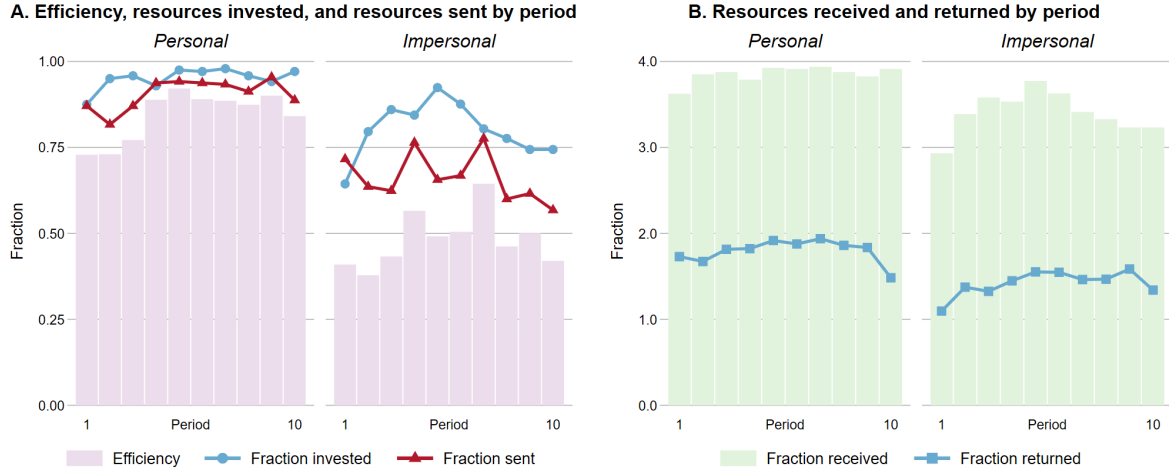
A. Efficiency, resources invested, and resources sent by period

B. Resources received and returned by period

Figure 2. **Relational contracts with non-enforceable agreements and no competition**

Note: Panel A shows the average market efficiency (bars), the fraction of the endowment invested into the multiplier by receivers (blue line with circles), and the fraction of the endowment sent by senders (red line with triangles). Panel B shows the average multiplier produced by receivers and the amount they sent back as a fraction of the senders' endowment (blue line with squares.

resources returned to the sender per unit sent to the incumbent (dashed blue line with squares) and to the entrant (solid red line with squares). The figure reveals that senders receive less per unit sent to incumbents than to entrants in both PERSONAL ($p = 0.03$, Table A1) and, although not statistically significant, also in IMPERSONAL ($p = 0.12$, Table A1).[16] This finding confirms that senders are willing to sacrifice earnings to trade with incumbents.

We summarize the findings for non-enforceable agreements in the following result:

Result 1 (Non-enforceable agreements and competition)
When agreements are non-enforceable and there is competition, personal relational contracts do not result in higher market efficiency than impersonal relational contracts. This is due to two countervailing effects. While personal relational contracts are better at promoting trust than impersonal relational contracts, they increase trade with preexisting partners at the expense of more-productive competitors.

Next, we look at behavior when agreements are non-enforceable and there is no competition. Analyzing this part serves two purposes. First, it allows us to confirm whether the introduction of competition is the reason why market efficiency is similar in PERSONAL and IMPERSONAL. In other words, whether removing the entrant restores the advantage of free-form communication reported in the literature (Hypothesis 1). Second, we can evaluate whether the interaction between the sender and the receiver in the preceding two-person game helps explain the degree to which incumbents are favored under competition.

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[16]Consistent with the literature, we observe a decline in reciprocity in the last period of play (e.g., Huck et al., 2012). Interestingly, this end-game effect seems to be more pronounced for entrant receivers in IMPERSONAL, suggesting that this relationship was sustained more by reputational concerns.

The average market efficiency in *No Competition* is illustrated by the bars in Figure 2A. The figure also includes the fraction of the receiver's endowment invested into the multiplier (blue line with circles) and the fraction of the sender's endowment sent to the receiver (red line with triangles) per period.

In line with Hypothesis 1, senders and receivers in PERSONAL attain higher market efficiency than those in IMPERSONAL (84% vs. 48%; $p = 0.04$, Table A2). This finding confirms that Result 1 can be attributed to the introduction of competition.

The difference in market efficiency between in PERSONAL and IMPERSONAL is caused by a large difference in the fraction of resources invested and sent. Receivers in PERSONAL invest significantly more than their counterparts in IMPERSONAL (98% vs. 80% of their endowment; $p = 0.03$, Table A2) and senders in PERSONAL send significantly more than senders in IMPERSONAL (90% vs. 66% of their endowment; $p = 0.03$, Table A2). The sender's higher trust in PERSONAL is justified as receivers in this treatment returned 1.80 units per unit received (47% of the pie) compared with receivers in IMPERSONAL, who returned only 1.41 units per unit received (41% of the pie; $p = 0.04$, Table A2).[17]

Another way of thinking about the effectiveness of competition is to evaluate whether the total surplus improves with the entrance of a more productive receiver. In PERSONAL, the difference in the total surplus between *No Competition* and *Competition* is only marginally significant (respectively 16.86 and 19.81; $p = 0.06$, Table A6). By contrast, the benefits of competition do materialize with impersonal relational contracts. Namely, the total surplus in IMPERSONAL significantly increases from 9.61 in *No Competition* to 15.28 *Competition* ($p < 0.01$, Table A6).[18]

Next, we study in more detail the extent to which the persistence of trade between senders and incumbents is explained by their interaction in *No Competition*. To do so, we run the regressions with the fraction sent to each receiver as the dependent variable. As independent variables, we include a dummy variable that equals one for incumbent receivers and zero for entrant receivers and the interaction between this variable and the average return per unit sent by a sender-incumbent pair (reciprocity) during *No Competition* (see Table A9). In PERSONAL,

[17]Irrespective of the differences in return rates, removing competition between receivers reduces the senders share of the total surplus by 9 percentage points in PERSONAL ($p < 0.01$) and 5 percentage points in IMPERSONAL ($p < 0.01$, see Appendix C.2). Similar results have been found in Brown et al. (2004, 2012). As in *No Competition*, receivers tend to return less in the last period. The end-game effect seems to be less pronounced with *Competition*. However, this difference may be due to participants understanding that they could interact with the same partner in the final part of the experiment.

[18]The large increase in total surplus is due to the shift of resources to a more productive entrant and an overall increase in trust (the total amount sent increases from 66% to 84% of the senders' endowment). This latter finding is in line with Huck et al. (2012), who also find that competition increases trust in settings without binding agreements.

we find that reciprocity during *No Competition* is positively associated with the fraction sent to the incumbent ($p = 0.07$) and negatively associated with the fraction sent to the entrant ($p = 0.03$). By contrast, in IMPERSONAL, efficiency during *No Competition* is not significantly associated with the senders' sending choice ($p = 0.12$ and $p = 0.56$). These results suggest that models of social ties that model the strength of ties as a function of past interaction (van Dijk et al., 1997, 2002; Bault et al., 2017) might require settings like PERSONAL, where individuals can transmit emotions and social approval.[19]

To further explore the impact of the sender-receiver interaction during *No Competition* on the senders' loyalty toward incumbents, we analyze the content of the chats (in PERSONAL). Specifically, we asked an independent research assistant to code each line of text according to the valence of its emotional content (i.e., whether it is positive, neutral, or negative). We then tested whether the average emotional valence during *No Competition* predicts the average amount sent to the incumbent during *Competition*. We find that positive valence predicts the amount sent to the incumbent ($r = 0.59$, $p = 0.09$), reinforcing the point that communicating emotions is vital for the formation of personal relational contracts.

We summarize these findings in the following result:

Result 2 (Non-enforceable agreements and no competition)
When agreements are non-enforceable and there is no competition, personal relational contracts result in higher market efficiency than impersonal relational contracts. This difference is due to higher trust and reciprocity in personal relational contracts. When relational contracts are personal, more efficient relationships are associated with higher loyalty towards preexisting partners once more-productive competitors arrive.

3.2 Relational contracts with partially enforceable agreements

In this section, we look at the setting where agreements are partially enforceable. In the experiment, this implied that the amounts sent and returned specified in an agreement were automatically implemented for three periods. However, participants could not ensure the permanence of a trading relationship since agreements over a longer time frame were not enforceable. Partial enforceability implies that trust is less important to attain efficient outcomes. However, it is still an open question whether more personal communication increases the loyalty of senders to incumbent receivers. We begin by looking at *Competition* and conclude with *No competition*.

As with non-enforceable agreements, Figure 3A illustrates the average market efficiency (bars), the fraction of the senders' endowment sent to incumbents (solid blue line with circles) and entrants (solid red line with triangles), and the fraction of the receivers' endowment invested

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[19]We obtain qualitatively similar results if we use the average efficiency generated by a sender-incumbent pair during *No Competition* instead of average reciprocity (see Table A5 in the Appendix).
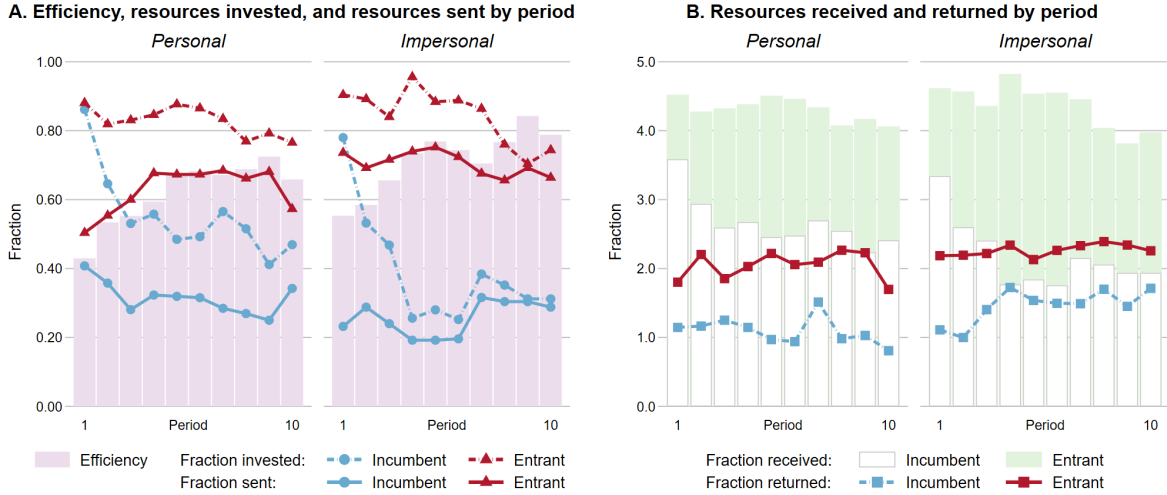
Figure 3. Relational contracts with partially enforceable agreements and competition

Note: Panel A shows the average market efficiency (bars), the fraction of the endowment invested into the multiplier by incumbents (dashed blue line with circles) and entrants (dashed red line with triangles), and the fraction of the endowment sent to incumbents (solid blue line with circles) and entrants (solid red line with triangles). Panel B shows the average multiplier produced by incumbents (white bars) and entrants (green bars) and the amount sent back by incumbents (dashed blue line with squares) and entrants (solid red line with squares) as a fraction of the senders' endowment. The data are from Part 2, but periods are labeled as 1 to 10 for illustrative purposes.

by incumbents (dashed blue line with circles) and entrants (dashed red line with triangles) into the multiplier.

We find that market efficiency is lower, although not statistically significant, in Personal than in Impersonal (62% vs. 71%; $p = 0.75$ Table A3), which does not allow us to reject Hypothesis 2. Taking a closer look at the behavior of senders and receivers, we see that, in both Personal and Impersonal, entrants invest a high fraction of their endowment into the multiplier (82% and 84%, respectively) and are sent a large fraction of the senders' endowment (63% and 71%, respectively). By contrast, while incumbents in Impersonal invest only 39% of their endowment into the multiplier and receive only 25% of the senders' endowment, incumbents in Personal are more involved. They invest 55% of their endowment into their less-efficient multiplier and are sent 32% of the senders' endowment. In other words, the relationship between the sender and the incumbent is a larger source of inefficiency in Personal compared with Impersonal.

The difference between Impersonal and Personal is seen more clearly in the agreed-upon terms of trade. While participants make agreements 64% of the time in Personal and 70% of the time in Impersonal, these agreements involve the incumbents only 9.3% of the time in Impersonal compared with 11.5% of the time in Personal.[20] Notably, in 80% of the cases

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[20]Specifically, in Impersonal, senders agree 47% of the time solely with entrants and 9% solely with incumbents. In Personal, senders agree 44% of the time solely with entrants, 13% solely with incumbents, and 43% with both. These distributions of agreements are significantly different using a multinomial logit regression like the one described in footnote 15 ($p = 0.04$).

where a sender made an agreement with an incumbent, the entrant's multiplier was higher than the incumbent's. Given that here there are no problems of trust, this is the most apparent evidence that some senders are willing to sacrifice efficiency to trade with incumbents. For details on the agreements made, see Appendix C, which shows that the agreed market efficiency is significantly lower in PERSONAL as the sender agrees to send a significantly lower share of the endowment than in IMPERSONAL.

Lastly, we look at the fraction of resources returned by receivers. Figure 3B depicts the average multiplier produced by the incumbent (white bars) and the entrant (green bars) as well as the fraction of resources returned to the sender per unit sent to the incumbent (dashed blue line with squares) and the entrant (solid red line with squares). On average, incumbents return less than entrants per unit sent: 0.95 units less in PERSONAL and 0.82 units less in IMPERSONAL ($p < 0.01$ in both cases, Table A3). Therefore, sending resources to incumbents is not only detrimental to market efficiency but also to the senders' earnings, especially in PERSONAL.

We summarize the finding for partially enforceable agreements in the following result:

Result 3 (partially enforceable agreements and competition)
When agreements are partially enforceable and there is competition, personal relational contracts result in marginally lower market efficiency than impersonal relational contracts. Despite trust being less needed for trade when agreements are partially enforceable, personal relational contracts increase trade with preexisting partners at the expense of more-productive competitors.

As before, we complement this analysis by looking at the case without competition. Figure 4A depicts the average market efficiency in *No Competition* (bars), the fraction of the receiver's endowment invested into the multiplier (blue line with circles), and the fraction of the sender's endowment sent to the receiver (red line with triangles). Figure 4B portrays the average multiplier produced by the receiver (bars) and the fraction of resources returned by the receiver per unit sent by the sender (blue line with squares).

Contrary to Hypothesis 2, we find statistically significant differences in market efficiency between PERSONAL and IMPERSONAL (75% vs. 60%; $p < 0.01$, Table A4). In line with this result, it is not surprising that we also observe substantial differences in the senders' and receivers' behavior. Receivers in PERSONAL invest 88% of their endowment in the multiplying technology while receivers in IMPERSONAL invest 81% ($p < 0.01$, Table A4). Senders transferred 86% of their endowment in PERSONAL and 76% in IMPERSONAL ($p < 0.01$, Table A4). Lastly, although the difference is not statistically significant, receivers returned 1.61 units per unit received (45% of the pie) in PERSONAL and 1.52 units per unit received (44% of the pie) in IMPERSONAL ($p = 0.96$, Table A4). As with non-enforceable agreements, competition between receivers results in senders significantly increasing their share of the total surplus by 9 percentage points
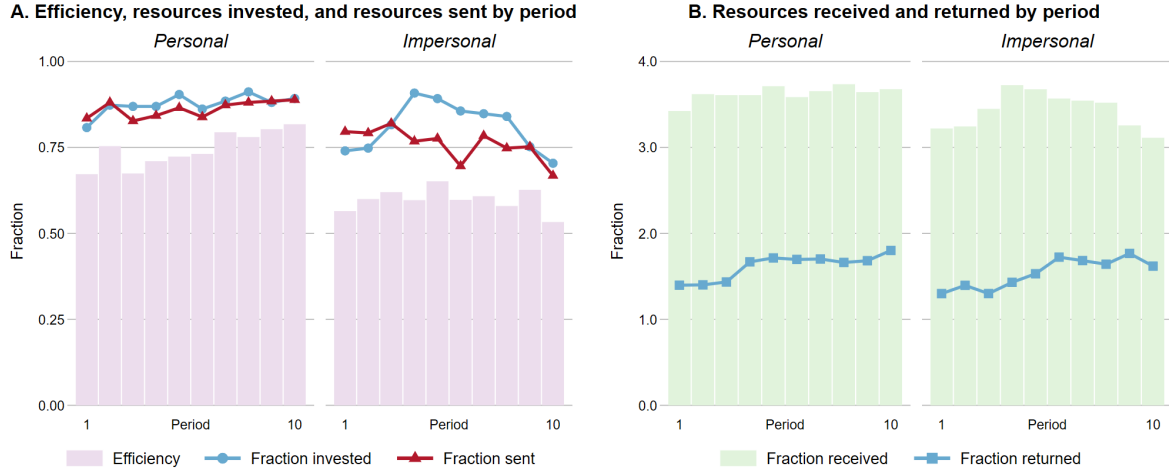
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Figure 4. Relational contracts with partially enforceable agreements and no competition

Note: Panel A shows the average market efficiency (bars), the fraction of the endowment invested into the multiplier by receivers (blue line with circles), and the fraction of the endowment sent by senders (red line with triangles). Panel B shows the average multiplier produced by receivers and the amount they sent back as a fraction of the senders' endowment (blue line with squares).

in PERSONAL ($p < 0.01$) and 8 percentage points in IMPERSONAL ($p = 0.02$).

As before, it is interesting to check whether the type of relational contract affects the impact of competition on the overall surplus. In PERSONAL, we find that the increase in the total surplus from *No Competition* to *Competition* is only marginally statistically significant (from 14.92 to 18.63; $p = 0.06$, Table A6). By contrast, in IMPERSONAL, the introduction of competition by a more productive receiver significantly increases the total surplus (from 11.95 to 21.43; $p < 0.01$, Table A6). Since we found a similar result with non-enforceable agreements, it appears that impersonal relational contracts are better at capturing the benefits of competition irrespective of the level of enforceability.

As with non-enforceable agreements, we analyze the degree to which the senders' loyalty toward incumbents during *Competition* is explained by their previous interaction during *No Competition* when agreements are partially enforceable. As before, we do this in two ways. First, by regressing the fraction sent to each receiver during *Competition* on the average reciprocity generated by a sender-incumbent pair during *No Competition* (see Table A9). Here we find that reciprocity during *No Competition* is not associated with the fraction sent to the incumbent ($p = 0.68$) nor with the fraction sent to the entrant ($p = 0.70$) in PERSONAL as well as in IMPERSONAL.[21] Second, by looking at the correlation between the emotional content of chat messages during *No competition* and the amount sent to incumbents during *Competition*. Once more, we find that expressions of positive affect predict the amount sent to the incumbent ($r = 0.63$, $p = 0.05$). These findings emphasize that not only the outcomes of a previous

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[21] Unlike with non-enforceable agreements, with partially enforceable agreements the average efficiency during *No Competition* does not predict sender choices in *Competition* (Table A5 in the Appendix).

interaction matter but also the context in which that interaction took place. In other words, whether a relational contract is personal or impersonal shapes the impact of past trade efficiency on the propensity to keep trading as the market becomes more competitive.

We summarize our last set of findings in our final result:

Result 4 (Partially enforceable agreements and no competition)
When agreements are partially enforceable and there is no competition, personal relational contracts achieve higher market efficiency than impersonal relational contracts. Regardless, when relational contracts are personal, more efficient relationships predict higher loyalty toward pre-existing partners once more-productive competitors arrive.

4 Conclusions

This article studies how relational contracts affect partner selection and market efficiency in environments with varying degrees of agreement enforceability and competition. We do so by exogenously introducing either impersonal relational contracts, where financial matters are paramount, or personal relational contracts, where financial matters and personal attachments are intertwined.

Our main results indicate that personal relational contracts are better at overcoming problems of trust. By contrast, impersonal relational contracts are better at expediting the switch from unproductive partners to more productive competitors. Therefore, in economic environments where trust is essential due to a lack of enforceability and limited competition, personal relational contracts outperform impersonal ones. Conversely, in economic environments where agreements are easily enforced and there is competition, impersonal relational contracts outperform personal ones. In mixed environments, where trust is needed but there is competition, we find that neither type of relational contract outperforms the other as the relative benefits of each type of relationship cancel out.

Our work contributes to research on the effects of free-form communication in environments where contracts are unverifiable. In this line of work, communication is typically reported as having a strong positive effect on efficiency. Our findings show that the effectiveness of communication depends crucially on the presence of competition. Personal relationships limit competition, and therefore, they can be detrimental to overall efficiency in environments where competition can potentially deliver significant efficiency gains (e.g., due to differences in productivity).

As one would expect, some design choices in our study bring about new research questions. For instance, competition in our study is limited to the interaction between one sender and two receivers. Although this is the simplest case in which to conduct our study, it raises the question of how relational contracts influence market efficiency when social networks and markets are

larger. More interestingly, although we study how relational contracts affect market efficiency, we do not study whether the most effective type of relational contract emerges endogenously in different economic environments. In the field, it is not always clear if relational contracts evolve to maximize market efficiency or due to other causes (e.g., sorting according to prosocial motivations, Kosfeld and von Siemens, 2011). Hence a natural question is whether individuals can select the most favorable conditions under which they can trade. In our opinion, the answer is not obvious as there might be non-pecuniary reasons to choose a particular type of interaction, and it is an exciting line of inquiry. Finally, while we find that personal ties can limit competition, participants could not anticipate the arrival of more productive partners in our setting. Hence, we cannot study whether individuals limit the formation of personal ties because they might bind them in the future.

Developing formal models that can capture the effects of social ties on economic interactions will be critical to advance this literature. In existing models (van Dijk et al., 1997, 2002; Bault et al., 2017), social ties are contingent on past outcomes and not on the way agents interact. Our results show that even when successful outcomes are reached, the type of interaction that led to them strongly affects the strength of the social tie.

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Appendix A   Instructions

Below are the instructions for the treatments with non-binding agreements and PERSONAL business relationships (i.e., with free-form communication). Part 1 corresponds to the environment without competition (the two-person game) and Part 2 to the environment with competition (the three-person game). The instructions for the other treatments are similar and are available upon request along with the Spanish translation used for the sessions run at LINEEX.

General instructions

You are participating in a study on economic decision making and will be asked to make a number of decisions. For your participation you will receive a show-up fee of $5. Please read these instructions carefully as they describe how you can earn *additional* money.

All the interaction between you and other participants takes place through the computers. Please do not talk or communicate with other participants in any other way. If you have a question, raise your hand and one of us will help you.

This study is *anonymous*. That is, your identity will not be revealed to others and the identity of others will not be revealed to you.

During the study you will be able to earn points. At the end of the study, points will be converted to dollars at the following rate: *20 points = $1.00*. You will be paid your earnings in cash.

At the beginning of the study, all participants are randomly assigned to one of two roles: *Player A* or *Player B*. You will be informed of your role through the computer screen and you will keep the same role throughout the entire study.

This study is divided in *two parts*. First, we describe the instructions for Part 1. Once Part 1 is concluded, you will receive instructions for Part 2.

Part 1

At the beginning of this part, the computer randomly forms groups of two participants such that each group always has one Player A and one Player B. You will interact with the *same other participant throughout Part 1*. Part 1 consists of *ten rounds*.

Decisions in each round

At the beginning of every round, each participant receives an *endowment of 10 points*. Each round is divided into three steps: (1) Points *invested* by Player A, (2) Points *sent* from Player B to Player A, and (3) Points *returned* from Player A to Player B.

Step 1: Points invested by Player A

Player A starts by deciding how many of the points from his/her endowment he/she wants to invest on the *multiplier*. The amount invested determines a value by which the points sent from Player B to Player A in Step 2 are multiplied (see the explanation below). If Player A does not invest any points, the multiplier is equal to 1, and for every point invested by Player A, the multiplier increases by 0.3 units. The multiplier, depending on the investment made, is shown in the table below.

Points invested by Player A	0	1	2	3	4	5	6	7	8	9	10
Multiplier	1.0	1.3	1.6	1.9	2.2	2.5	2.8	3.1	3.4	3.7	4.0

After Player A makes his/her decision, Player B is told the value of the chosen multiplier.

Step 2: Points sent from Player B to Player A

In this step, Player B can send to Player A any amount of points from his/her endowment. The multiplier chosen by Player A in Step 1 multiplies the points sent by Player B to Player A. For example, if Player A invests 5 points in the multiplier and Player B sends 7 points to Player A, then Player A receives 2.5×7 points $= 17.5$ points. Alternatively, if Player A invests 7 points and Player B sends 5 points, then Player A receives $3.1 \times 7 = 21.7$ points. The amount received by Player A depending on Player A's investment and Player B's transfer are summarized in the table below.

Points invested by Player A on the multiplier

		0	1	2	3	4	5	6	7	8	9	10
	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	1	1.0	1.3	1.6	1.9	2.2	2.5	2.8	3.1	3.4	3.7	4.0
	2	2.0	2.6	3.2	3.8	4.4	5.0	5.6	6.2	6.8	7.4	8.0
	3	3.0	3.9	4.8	5.7	6.6	7.5	8.4	9.3	10.2	11.1	12.0
Points sent	4	4.0	5.2	6.4	7.6	8.8	10.0	11.2	12.4	13.6	14.8	16.0
from Player B	5	5.0	6.5	8.0	9.5	11.0	12.5	14.0	15.5	17.0	18.5	20.0
to Player A	6	6.0	7.8	9.6	11.4	13.2	15.0	16.8	18.6	20.4	22.2	24.0
	7	7.0	9.1	11.2	13.3	15.4	17.5	19.6	21.7	23.8	25.9	28.0
	8	8.0	10.4	12.8	15.2	17.6	20.0	22.4	24.8	27.2	29.6	32.0
	9	9.0	11.7	14.4	17.1	19.8	22.5	25.2	27.9	30.6	33.3	36.0
	10	10.0	13.0	16.0	19.0	22.0	25.0	28.0	31.0	34.0	37.0	40.0

Once Player B makes his/her decision, Player A is told the number of points sent.

Step 3: Points returned from Player A to Player B

In the last step, Player A can return to Player B any amount from the multiplied points. Once Player A makes his/her decision, Player B is told the number of points returned.

Earnings

The earnings, in points, of Player A and Player B in each round are as follows:

- *Earnings of Player A:* 10 (endowment) minus the amount invested on the multiplier (Step 1), plus the amount Player B sends (Step 2) multiplied by the multiplier, minus the amount returned to Player B (Step 3).

- *Earnings of Player B:* 10 (endowment) minus the amount sent to Player A (Step 2), plus the amount returned by Player A (Step 3).

Agreements and Communication

Between Step 1 and Step 2, you and the other participant in your group will be able to *communicate through a chat box*. You will be able to use the chat in rounds 1, 4, 7. In addition, you will also be able to chat after round 10 is concluded. You will be able to chat freely except that you are not allowed to use profanity or offensive language and, in order to maintain anonymity, you are also not allowed to convey any information that could help others identify who you are.

By chatting, you and the other participant in your group can *reach an agreement* on the number of points Player B sends to Player A and the number of points Player A returns to Player B. You will have *three minutes* to agree. Note, however, that agreements are *not binding*. In other words, you and the other participant can nevertheless choose to send/return a different amount of points than the ones you agreed on. The screen where you make an agreement is shown below.

Both participants can enter an amount sent (from B to A) and an amount returned (from A to B). After entering both amounts, click on the *show* button to display the amounts on the screen of the other participant. To confirm a final agreement, both participants must click on the *submit* button. Moreover, for the agreement to be implemented *the amounts submitted by both participants must match*. If there are no proposals, you run out of time before clicking on submit, or the submitted amounts do not match, then both participants are informed that no agreement will be implemented.

After 10 rounds of Part 1, you will receive instructions for Part 2. You might interact with the same group participant in Part 2 as you did in Part 1.

Part 2

Part 2 is similar to Part 1. You keep the same role as in Part 1, and you interact for ten rounds. One important difference is that, in Part 2, you interact in *groups of three*. A group contains either two Players A and one Player B or one Player A and two Players B.

You have been randomly assigned to a group with *two Players A* and *one Player B*. We refer to the three group members as Player A1, Player A2, and Player B. Your group was formed such that Player A1 and Player B *interacted with each other in Part 1* as members of the *same group*. By contrast, Player A2 left his/her group from Part 1 and was randomly assigned to join Player A1 and Player B as the third member of the group. You will be informed of whether you are joining a new group or not through the computer screen, when you are told whether you are *Player A1*, *Player A2*, or *Player B*.

At the beginning of Part 2, all group members will be informed of each other's choices in all of Part 1.

Decisions in each round

As in Part 1, each round of Part 2 is divided into three steps.

Step 1: Points invested by Player A1 and Player A2

As in Part 1, Player A1 and Player A2 decide how many points each wants to invest on their *multiplier*. Unlike in Part 1, the points invested by Player A1 and Player A2 determine their multipliers differently. For every point invested by Player A1, his/her multiplier increases in 0.3 units, and for every point invested by Player A2, his/her multiplier increases in 0.4 units, as shown in the table below.

Points invested by Player A	0	1	2	3	4	5	6	7	8	9	10
Multiplier of Player A1	1.0	1.3	1.6	1.9	2.2	2.5	2.8	3.1	3.4	3.7	4.0
Multiplier of Player A2	1.0	1.4	1.8	2.2	2.6	3.0	3.4	3.8	4.2	4.6	5.0

After Player A1 and Player A2 make their decision, Player B is told the value of the chosen multipliers.

Step 2: Points sent from Player B to Player A

In a similar way as in Part 1, in this step, Player B can send points to both Player A1 and Player A2. The total amount of points sent cannot exceed Player B's endowment. The multiplier chosen by Player A1 and Player A2 in Step 1 multiplies the points Player B sent to each of them specifically. The amounts received by Player A1 and Player A2 depending on their investment and the transfer of Player B are summarized in the tables below.

Points invested by Player A1 on the multiplier

		0	1	2	3	4	5	6	7	8	9	10
	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	1	1.0	1.3	1.6	1.9	2.2	2.5	2.8	3.1	3.4	3.7	4.0
	2	2.0	2.6	3.2	3.8	4.4	5.0	5.6	6.2	6.8	7.4	8.0
	3	3.0	3.9	4.8	5.7	6.6	7.5	8.4	9.3	10.2	11.1	12.0
Points sent	4	4.0	5.2	6.4	7.6	8.8	10.0	11.2	12.4	13.6	14.8	16.0
from Player B	5	5.0	6.5	8.0	9.5	11.0	12.5	14.0	15.5	17.0	18.5	20.0
to Player A1	6	6.0	7.8	9.6	11.4	13.2	15.0	16.8	18.6	20.4	22.2	24.0
	7	7.0	9.1	11.2	13.3	15.4	17.5	19.6	21.7	23.8	25.9	28.0
	8	8.0	10.4	12.8	15.2	17.6	20.0	22.4	24.8	27.2	29.6	32.0
	9	9.0	11.7	14.4	17.1	19.8	22.5	25.2	27.9	30.6	33.3	36.0
	10	10.0	13.0	16.0	19.0	22.0	25.0	28.0	31.0	34.0	37.0	40.0

Points invested by Player A2 on the multiplier

	0	1	2	3	4	5	6	7	8	9	10
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	1.0	1.4	1.8	2.2	2.6	3.0	3.4	3.8	4.2	4.6	5.0
2	2.0	2.8	3.6	4.4	5.2	6.0	6.8	7.6	8.4	9.2	10.0
3	3.0	4.2	5.4	6.6	7.8	9.0	10.2	11.4	12.6	13.8	15.0
4	4.0	5.6	7.2	8.8	10.4	12.0	13.6	15.2	16.8	18.4	20.0
5	5.0	7.0	9.0	11.0	13.0	15.0	17.0	19.0	21.0	23.0	25.0
6	6.0	8.4	10.8	13.2	15.6	18.0	20.4	22.8	25.2	27.6	30.0
7	7.0	9.8	12.6	15.4	18.2	21.0	23.8	26.6	29.4	32.2	35.0
8	8.0	11.2	14.4	17.6	20.8	24.0	27.2	30.4	33.6	36.8	40.0
9	9.0	12.6	16.2	19.8	23.4	27.0	30.6	34.2	37.8	41.4	45.0
10	10.0	14.0	18.0	22.0	26.0	30.0	34.0	38.0	42.0	46.0	50.0

Points sent from Player B to Player A2

Once Player B makes his/her decisions, Player A1 and Player A2 are told the number of points sent to each one of them.

Step 3: Points returned from Player A to Player B

In the last step, like in Part 1, Player A1 can return back to Player B any amount of the multiplied points he/she has. In the same way, Player A2 can return back to Player B any amount of the multiplied points he/she has. For example, if Player A1 invests 7 points, Player A2 invests 6 points, Player B sends 7 points to Player A1 and 3 points to Player A2, then Player A1 receives 3.1×7 points $= 21.7$ points and Player A2 receives 3.4×3 points $= 10.2$ points. Thereafter, Player A1 can return between 0 and 21.7 points and Player A2 can return between 0 and 10.2 points to Player B.

Earnings

The earnings, in points, of Player A1, Player A2, and Player B in each round are as follows:

- *Earnings of Player A1:* 10 (endowment) minus the amount invested on the multiplier (Step 1), plus the amount Player B sends to Player A1 (Step 2) multiplied by Player A1's multiplier, minus the amount Player A1 returns to Player B (Step 3).

- *Earnings of Player A2:* 10 (endowment) minus the amount invested on the multiplier (Step 1), plus the amount Player B sends to Player A2 (Step 2) multiplied by Player A2's multiplier, minus the amount Player A2 returns to Player B (Step 3).

- *Earnings of Player B:* 10 (endowment) minus the amounts sent to Player A1 and Player A2 (Step 2), plus the amount returned by Player A1 and Player A2 (Step 3).

Agreements

As in Part 1, you will have *three minutes* to make proposals with others between Step 1 and Step 2 in rounds 1, 4, 7, following the same rules as in Part 1.

Player B will be able to make agreements with Player A1 and Player A2. Player A1 and Player A2 will not be able to make agreements between each other.

Appendix B   Regression tables

The data in our experiment consists of a panel of individuals who repeatedly interact for 10 consecutive periods in groups of two players (*No Competition*) or three players (*Competition*). The tables below report the results of random effects GLS regressions with standard errors clustered on groups. In all regressions, we control for time trends within each part of the experiment by including the period number. We include a dummy variable for location to control for the laboratory in which the sessions were conducted. We center the period number on the fifth period (i.e., we subtract five from the period number) in order to interpret the constant as the mean of the dependent variable midway through the experiment (recall that there were 10 periods in each treatment).

Tables A1 and A3 contain regressions testing the effect of relational contracts when there is *Competition*. Table A1 corresponds to the case where agreements are non-enforceable and Table A3 to the case where agreements are partially enforceable. In all regressions, we test the effect of the different types of relational contracts by including a dummy variable identifying PERSONAL. In column I, the dependent variable is *efficiency*, which is $\omega/30$ in this case. In this regression, we use group random effects. For the other dependent variables, we distinguish between the two receivers with a dummy variable identifying the *incumbent* receiver, which we then interact with the type of relational contract. In these regressions, we use individual random effects. In column II, the dependent variable is the *amount invested* by receivers as a fraction of their endowment. In column III, the dependent variable is the *amount sent* by senders as a fraction of their endowment. Finally, in column IV, the dependent variable is the *amount returned* by receivers as a fraction of the amount sent. In column IV, there are fewer observations because senders did not always send a positive amount.

Tables A2 and A4 contain regressions testing the effect of relational contracts when there is *No Competition*. Table A2 corresponds to the case where agreements are non-enforceable and Table A4 to the case where agreements are partially enforceable. In all regressions, the independent variable is a dummy variable identifying PERSONAL. Moreover, we use group random effects. In column I, the dependent variable is *efficiency*, the obtained surplus as a fraction of the maximum attainable surplus: $\omega/20$. In column II, the dependent variable is the *amount invested* by receivers as a fraction of their endowment. In column III, the dependent

variable is the *amount sent* by senders as a fraction of their endowment. Finally, in column IV, the dependent variable is the *amount returned* by receivers as a fraction of the amount sent. In column IV, there are fewer observations because senders did not always send a positive amount.

In Table A6, we test whether competition increases payoffs. Hence, in all regressions, the dependent variable is the total surplus ω (in points). As the independent variable, we use a dummy variable identifying periods with *Competition*, and we use group random effects. The first two columns correspond to groups who played with partially enforceable agreements and either PERSONAL or IMPERSONAL relational contracts. The last two columns correspond to groups who played with non-enforceable agreements and either PERSONAL or IMPERSONAL relational contracts.

In Table A5, we test the impact of efficiency during *No Competition* on the amount sent to incumbents and entrants during *Competition*. The dependent variable is the fraction of the senders' endowment sent to each receiver. In all regressions, we test partner selection by including a dummy variable identifying either the incumbent or the entrant. We also include the average market efficiency for the sender-incumbent pair during *No Competition*, which we interact with the receiver dummy variables. The first two columns correspond to groups who played with partially enforceable agreements and either PERSONAL or IMPERSONAL relational contracts. The last two columns correspond to groups who played with non-enforceable agreements and either PERSONAL or IMPERSONAL relational contracts.

In Table A9, we run similar regressions to those in Table A5. Instead of using the average market efficiency, we use the average amount returned to the sender by the receiver as a fraction of the sender's endowment during *No Competition*. In the first two columns, we use groups who played with partially enforceable agreements and either PERSONAL or IMPERSONAL relational contracts. In the last two columns, we use groups who played with non-enforceable agreements and either PERSONAL or IMPERSONAL relational contracts.

Next, we analyze the effect of relational contracts on the propensity to make agreements, the type of agreement, and the extent to which participants comply with agreements. Each receiver-sender pair could agree in periods 1, 4, and 7. Hence we have three observations per pair. Table A8 contains the regressions for *No Competition* and Table A7 for *Competition*. We also run separate regressions for *Partially enforceable* and *Non-enforceable* agreements. In all regressions, we include dummy variables identifying the type of relational contract (PERSONAL or IMPERSONAL), which we interact with a dummy variable indicating the receiver is the incumbent in Table A7. In columns I and IV, the dependent variable is the *agreement rate*, a dummy variable that equals one if a receiver-sender pair agrees. In columns II and V, the dependent variable is the *compliance rate*, a dummy variable that equals one if the sender sends at least the agreed amount. We concentrate on compliance by the sender since the sender's action has a direct effect on efficiency. Moreover, we restrict the regression to compliance in the period in

which the agreement took place and drop cases where there was no agreement. Also, note that in IMPERSONAL, all agreements were made through an agreement box displayed on the computer screen and were automatically enforced when *Partially enforceable.* In PERSONAL, 24% of the agreements were made solely through the chat and were not entered into the agreement box. These agreements were not automatically enforced, which is why the compliance rate in PERSONAL is less than 100% for partially enforceable agreements (see the regressions in column II). Finally, in columns III and VI, the dependent variable is the *agreed to send rate*, the fraction of the sender's endowment that the agreement stipulates ought to be sent. Once again, we drop cases where there was no agreement.

Table A1. Effect of relational contracts with non-enforceable agreements and competition

Note: GLS regressions with sender-receiver pair random effects and standard errors clustered on groups (in parenthesis). The dependent variable is market efficiency in column I, the fraction invested in column II, the fraction sent in column III, and the fraction returned in column IV. ***, **, and * indicate statistical significance at 0.01, 0.05, and 0.10.

	I	II	III	IV
PERSONAL	0.11	−0.01	0.04	0.26
	(0.08)	(0.08)	(0.09)	(0.17)
Incumbent × IMPERSONAL		−0.28**	−0.26*	−0.30
		(0.10)	(0.12)	(0.19)
Incumbent × PERSONAL		−0.21	−0.21	−0.45*
		(0.11)	(0.13)	(0.21)
Period	0.02**	−0.02***	−0.00	−0.03*
	(0.01)	(0.00)	(0.00)	(0.01)
Location (Spain)	−0.11	0.00	−0.04	−0.12
	(0.08)	(0.05)	(0.03)	(0.12)
Constant	0.50***	0.93***	0.59***	1.94***
	(0.08)	(0.05)	(0.07)	(0.17)
χ^2	10.66**	56.76***	16.92***	13.30**
# Obs.	490	980	980	639

Table A2. Effect of relational contracts with non-enforceable agreements and no competition

Note: GLS regressions with sender-receiver pair random effects and standard errors clustered on groups (in parenthesis). The dependent variable is market efficiency in column I, the fraction invested in column II, the fraction sent in column III, and the fraction returned in column IV. ***, **, and * indicate statistical significance at 0.01, 0.05, and 0.10.

	I	II	III	IV
PERSONAL	0.29*	0.13**	0.21*	0.39*
	(0.14)	(0.04)	(0.10)	(0.19)
Period	0.01	0.00	−0.00	0.00
	(0.01)	(0.00)	(0.01)	(0.01)
Location (Spain)	−0.00	0.01	−0.00	−0.08
	(0.14)	(0.04)	(0.10)	(0.19)
Constant	0.44***	0.78***	0.68***	1.39***
	(0.10)	(0.04)	(0.07)	(0.13)
χ^2	13.99**	18.38***	7.48*	5.63
# Obs.	490	490	490	448

Table A3. Effect of relational contracts with partially enforceable agreements and competition

Note: GLS regressions with sender-receiver pair random effects and standard errors clustered on groups (in parenthesis). The dependent variable is market efficiency in column I, the fraction invested in column II, the fraction sent in column III, and the fraction returned in column IV. ***, **, and * indicate statistical significance at 0.01, 0.05, and 0.10.

	I	II	III	IV
PERSONAL	−0.03	−0.01	−0.08	−0.28
	(0.10)	(0.07)	(0.10)	(0.18)
Incumbent × IMPERSONAL		−0.45***	−0.45***	−0.88***
		(0.11)	(0.14)	(0.20)
Incumbent × PERSONAL		−0.27*	−0.31*	−0.84***
		(0.11)	(0.13)	(0.19)
Period	0.03***	−0.02***	0.00	0.01
	(0.01)	(0.00)	(0.00)	(0.01)
Location (Spain)	−0.21**	−0.00	−0.03*	−0.20
	(0.07)	(0.06)	(0.01)	(0.23)
Constant	0.67***	0.98***	0.72***	2.39***
	(0.06)	(0.07)	(0.07)	(0.22)
χ^2	36.22***	65.86***	29.59***	63.83***
# Obs.	510	1020	1020	645

Table A4. Effect of relational contracts with partially enforceable agreements and no competition

Note: GLS regressions with sender-receiver pair random effects and standard errors clustered on groups (in parenthesis). The dependent variable is market efficiency in column I, the fraction invested in column II, the fraction sent in column III, and the fraction returned in column IV. ***, **, and * indicate statistical significance at 0.01, 0.05, and 0.10.

	I	II	III	IV
PERSONAL	0.31***	0.12**	0.22**	0.19
	(0.09)	(0.04)	(0.07)	(0.10)
Period	0.01	0.00	−0.00	0.05***
	(0.01)	(0.01)	(0.01)	(0.01)
Location (Spain)	−0.15	−0.11*	−0.05	−0.28*
	(0.12)	(0.05)	(0.12)	(0.13)
Constant	0.58***	0.84***	0.75***	1.38***
	(0.14)	(0.05)	(0.11)	(0.15)
χ^2	28.51***	27.79***	16.20***	44.69***
# Obs.	510	510	510	470

Table A5. Effect of efficiency during no competition on the fraction sent during competition

Note: GLS regressions with group random effects and standard errors clustered on groups (in parenthesis). The dependent variable is the total surplus (in points). ***, **, and * indicate statistical significance at 0.01, 0.05, and 0.10.

	Non-enforceable		Partially enforceable	
	PERSONAL	IMPERSONAL	PERSONAL	IMPERSONAL
Incumbent	−0.43	−0.36**	−0.30	−0.44
	(0.29)	(0.14)	(0.26)	(0.23)
Entrant × Efficiency in *No Competition*	−0.15	0.06	0.06	0.06
	(0.18)	(0.20)	(0.21)	(0.18)
Incumbent × Efficiency in *No Competition*	0.11	0.28	0.03	0.04
	(0.18)	(0.17)	(0.17)	(0.18)
Period	0.00	−0.01	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Location (Spain)	−0.02	−0.06	−0.03	−0.01
	(0.01)	(0.04)	(0.02)	(0.01)
Constant	0.73***	0.56***	0.61***	0.67***
	(0.15)	(0.12)	(0.16)	(0.12)
χ^2	9.50	37.82***	17.88***	18.80***
# Obs.	480	500	520	500

Table A6. Effect of competition on the total surplus depending on the type of relational contract

Note: GLS regressions with group random effects and standard errors clustered on groups (in parenthesis). The dependent variable is the total surplus (in points). ***, **, and * indicate statistical significance at 0.01, 0.05, and 0.10.

	Partially enforceable		Non-enforceable	
	PERSONAL	IMPERSONAL	PERSONAL	IMPERSONAL
Competition	3.71*	9.47***	2.95	5.66**
	(1.85)	(1.58)	(1.57)	(2.09)
Period	0.54***	0.38*	0.52***	0.26
	(0.14)	(0.19)	(0.15)	(0.14)
Location (Spain)	−2.45	−7.00***	−2.09	−4.41
	(1.60)	(1.82)	(1.42)	(3.01)
Constant	13.47***	14.08***	15.32***	10.85***
	(2.07)	(1.56)	(0.96)	(2.60)
χ^2	19.82***	66.09***	15.88***	10.61**
# Obs.	520	500	480	500

Table A7. Effect of relational contracts on agreements with competition

Note: OLS regressions with standard errors clustered on groups (in parenthesis). The dependent variable is the agreement rate in columns I and IV, the compliance rate in columns II and V, and the agreed to send rate in columns III and VI. ***, **, and * indicate statistical significance at 0.01, 0.05, and 0.10.

	Partially enforceable			Non-enforceable		
	I	II	III	IV	V	VI
PERSONAL	0.09	−0.06*	−0.25**	−0.27*	0.07	0.03
	(0.08)	(0.03)	(0.08)	(0.10)	(0.10)	(0.09)
Incumbent × IMPERSONAL	−0.36***	−0.02	−0.16	−0.16	0.07	−0.28**
	(0.10)	(0.01)	(0.13)	(0.13)	(0.10)	(0.08)
Incumbent × PERSONAL	−0.28*	0.03	−0.17	−0.10	0.06	−0.10
	(0.11)	(0.04)	(0.13)	(0.09)	(0.08)	(0.09)
Period	−0.01	0.01	0.01	0.01	0.02	0.01
	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Location (Spain)	0.29**	0.08*	−0.21*	−0.14	0.06	−0.15
	(0.04)	(0.03)	(0.10)	(0.07)	(0.09)	(0.10)
Constant	0.75***	0.93***	1.00***	0.74***	0.70***	0.78***
	(0.06)	(0.02)	(0.06)	(0.08)	(0.10)	(0.07)
F-value	14.85***	1.73	5.96***	4.68***	1.04	3.59***
# Obs.	306	205	96	294	149	112

Table A8. Effect of relational contracts on agreements with no competition

Note: OLS regressions with standard errors clustered on groups (in parenthesis). The dependent variable is the agreement rate in columns I and IV, the compliance rate in columns II and V, and the agreed to send rate in columns III and VI. ***, **, and * indicate statistical significance at 0.01, 0.05, and 0.10.

| | Partially enforceable | | | Non-enforceable | | |
	I	II	III	IV	V	VI
PERSONAL	0.10	−0.04	−0.02	−0.02	0.11	0.16***
	(0.06)	(0.03)	(0.02)	(0.07)	(0.08)	(0.04)
Period	−0.00	0.01	0.01	0.02	0.01	0.01
	(0.02)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Location (Spain)	0.02	0.05	−0.11***	−0.20***	−0.08	−0.05
	(0.06)	(0.04)	(0.03)	(0.06)	(0.08)	(0.03)
Constant	0.85***	0.97***	1.01***	0.99***	0.85***	0.84***
	(0.07)	(0.02)	(0.02)	(0.04)	(0.08)	(0.04)
F-value	1.08	0.77	5.16***	4.56***	1.59	8.71***
# Obs.	153	140	105	147	124	103

Table A9. Effect of the fraction returned during no competition on the fraction sent during competition

Note: GLS regressions with group random effects and standard errors clustered on groups (in parenthesis). The dependent variable is the total surplus (in points). ***, **, and * indicate statistical significance at 0.01, 0.05, and 0.10.

| | Non-enforceable | | Partially enforceable | |
	PERSONAL	IMPERSONAL	PERSONAL	IMPERSONAL
Incumbent	−0.96**	−0.37	−0.12	−0.65
	(0.32)	(0.23)	(0.46)	(0.37)
Entrant × Return in *No Competition*	−0.23*	0.08	0.06	−0.03
	(0.11)	(0.13)	(0.16)	(0.14)
Incumbent × Return in *No Competition*	0.20	0.16	−0.06	0.10
	(0.11)	(0.10)	(0.14)	(0.14)
Period	0.00	−0.01	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Location (Spain)	−0.02	−0.05	−0.04	−0.02
	(0.01)	(0.04)	(0.02)	(0.01)
Constant	1.01***	0.48***	0.55*	0.76***
	(0.16)	(0.19)	(0.24)	(0.20)
χ^2	23.01***	33.36***	22.14***	23.62*
# Obs.	480	500	520	500

Appendix C   Additional results

C.1   Agreements

All agreements were made in the communication stage in periods 1, 4, and 7. Throughout this section, we report p-values based on the regressions reported in Tables A8 and A7.

Non-enforceable agreements and competition

Figure A1a illustrates the average amount agreed to be sent to the incumbent (blue line with circles) and to the entrant (red line with triangles). Notably, the sender agrees to send significantly more to the entrant than to the incumbent in IMPERSONAL ($p = 0.02$) but not in PERSONAL ($p = 0.28$). We measure the agreed market efficiency as the agreed total surplus divided by the maximum attainable surplus. The agreed total surplus includes agreed surpluses with the incumbent as well as the entrant. The average agreed market efficiency is illustrated by the bars in Figure A1a. The figure shows that despite differences in agreed transfers, the resulting agreed surplus is not different between treatments ($p = 0.63$).

Figure A1b portrays the average multiplier produced by the incumbent (white bars) and by the entrant (green bars). Also, the fraction of resources agreed to be returned to the sender per unit the sender agreed to send to the incumbent (blue line with squares) and to the entrant (red line with squares). The sender agrees to receive back less from the incumbent than from the entrant in both PERSONAL ($p < 0.01$) and IMPERSONAL ($p < 0.01$), possibly as a consequence of having agreed to send less to the incumbent than the entrant.
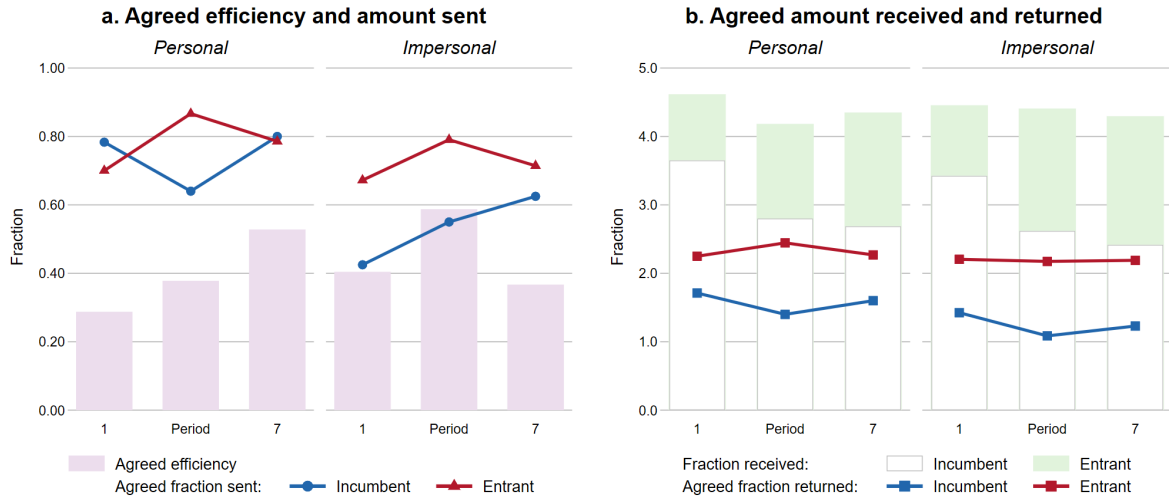
Non-enforceable agreements and no competition

Figure A1c shows the fraction of the senders' endowment agreed to be sent to the receiver (line with triangles) per agreement period. Agreements are more efficient with PERSONAL than IMPERSONAL ($p < 0.01$) and the rate of return agreed upon is also higher for the sender ($p < 0.01$), as seen by the line with squares in Figure A1d.

Partially enforceable agreements and competition

As in Figure A1a, Figure A2a shows for partially enforceable agreements that the level sent in PERSONAL is significantly lower than in IMPERSONAL (21%, $p < 0.01$), even though what the sender agrees to send to the entrant and to the incumbent is not significantly different between IMPERSONAL and PERSONAL. Consequently, the agreed market efficiency is significantly lower in PERSONAL ($p < 0.01$). Moreover, as illustrated in Figure A2b, the rate of return agreed upon is lower for the incumbent than the entrant in PERSONAL ($p < 0.01$) but is only marginally significantly different between receivers in IMPERSONAL ($p = 0.09$).
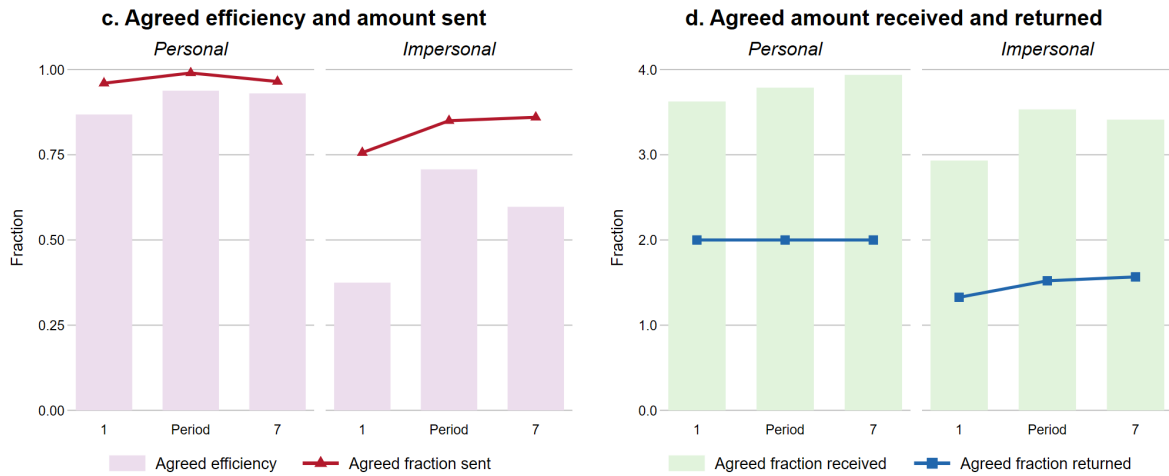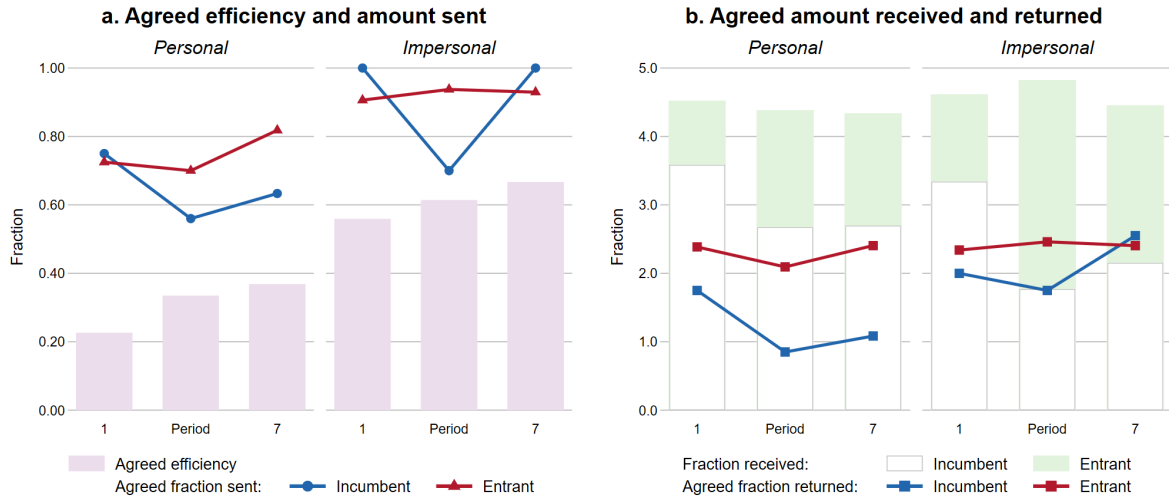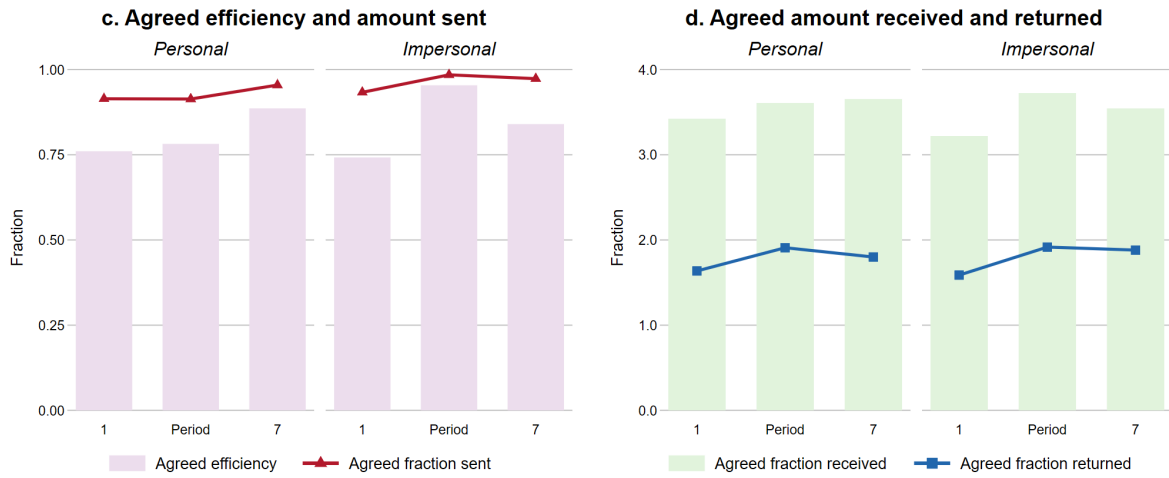
Figure A1. Effect of relational contracts on non-enforceable agreements

Note: In every agreement period, Panels a and c show the average agreed market efficiency (bars) and the fraction of the senders' endowment agreed to be sent to incumbents (solid blue line with circles) and entrants (solid red line with triangles). Panels b and d show the average multiplier produced by incumbents (white bars) and entrants (green bars) and the amount that was agreed to be sent back by incumbents (dashed blue line with squares) and entrants (solid red line with squares) as a fraction of the senders' endowment.

Agreements with *Competition*

a. Agreed efficiency and amount sent

Personal   *Impersonal*

Agreed efficiency

Agreed fraction sent: ⬤ Incumbent ▲ Entrant

b. Agreed amount received and returned

Personal   *Impersonal*

Fraction received: ☐ Incumbent ▨ Entrant

Agreed fraction returned: ■ Incumbent ■ Entrant

Agreements with *No Competition*

c. Agreed efficiency and amount sent

Personal   *Impersonal*

Agreed efficiency   ▲ Agreed fraction sent

d. Agreed amount received and returned

Personal   *Impersonal*

Agreed fraction received   ■ Agreed fraction returned

Figure A2. Effect of relational contracts on partially enforceable agreements

Note: In every agreement period, Panels a and c show the average agreed market efficiency (bars) and the fraction of the senders' endowment agreed to be sent to incumbents (solid blue line with circles) and entrants (solid red line with triangles). Panels b and d show the average multiplier produced by incumbents (white bars) and entrants (green bars) and the amount that was agreed to be sent back by incumbents (dashed blue line with squares) and entrants (solid red line with squares) as a fraction of the senders' endowment.

Partially enforceable agreements and no competition

Similarly to Figure A1c, Figure A2c reports the characteristics of agreements in *No competition*, but with partially enforceable agreements. It shows that the agreed market efficiency in PERSONAL is significantly higher than in IMPERSONAL ($p < 0.01$), while there are no statistical differences in the agreed amount sent ($p = 0.40$), or, as seen in Figure A2d, the rate of return agreed upon ($p = 0.94$).
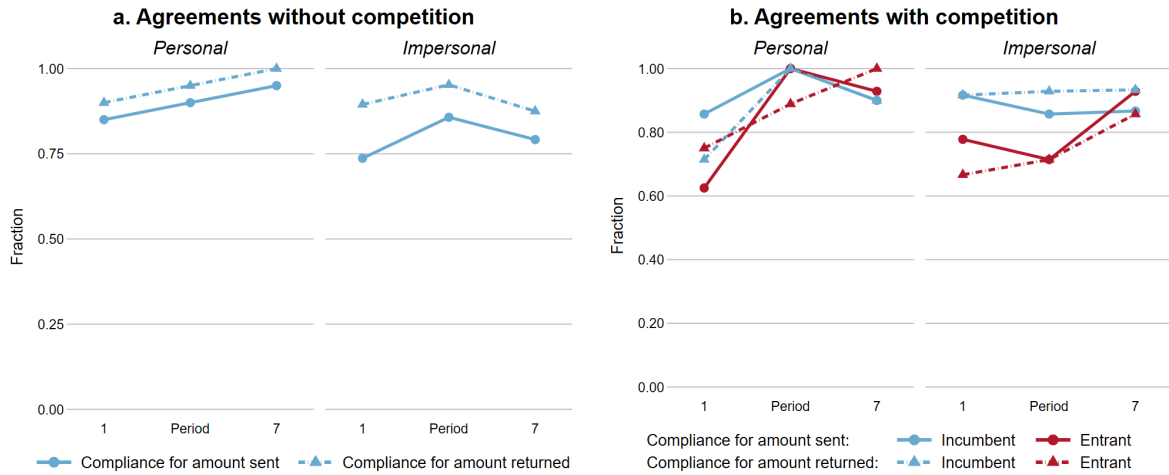
Compliance

Figure A3 reports the level of compliance with the agreements made in *No Competition* (Panels a and c) as well as *Competition* (Panels b and d). Specifically, Panels a and c show the fraction of senders who comply with the agreement by sending the agreed amount (solid blue line with circles) and the fraction of receivers who comply with the agreement by returning the agreed amount (dashed blue line with triangles). Panels b and d show the fraction of senders who comply with their agreement with incumbents (solid blue line with circles) and entrants (solid red line with circles) as well as the fraction of incumbents (dashed blue line with triangles) and entrants (dashed red line with triangles) who comply with the agreement. We restrict this analysis to compliance in the period in which the agreement took place and we drop cases where there was no agreement. Also, note that in IMPERSONAL all agreements are made through an agreement box displayed on the computer screen. In the treatment with partially enforceable agreements, agreements typed into the box were automatically implemented. In PERSONAL, 70% of the agreements were made solely through the chat and were not entered into the agreement box. These agreements were not automatically enforced, which is why the compliance rate in PERSONAL is less than 100% even in the treatment with partially enforceable agreements.

With non-enforceability and no competition, compliance with the agreed amount sent is lower, but not statistically significant, for in IMPERSONAL than PERSONAL ($p = 0.20$). By contrast, the differences in compliance with the agreed amount returned are significantly higher for PERSONAL ($p < 0.01$). Naturally, there are no differences in compliance when agreements are partially enforceable.

With competition, we focus on the differences between the incumbent and the entrant. If agreements are non-enforceable, there are no differences in the senders' compliance with the agreed amount sent to incumbents and entrants receivers in either PERSONAL ($p = 0.48$) or IMPERSONAL ($p = 0.47$). This is to a similar extent the case for compliance with the agreed amount returned ($p = 0.79$ in PERSONAL and $p = 0.08$ in IMPERSONAL). As with no competition, there are no differences in compliance when agreements are partially enforceable.

Non-enforceable agreements

a. Agreements without competition

b. Agreements with competition

Partially enforceable agreements

c. Agreements without competition
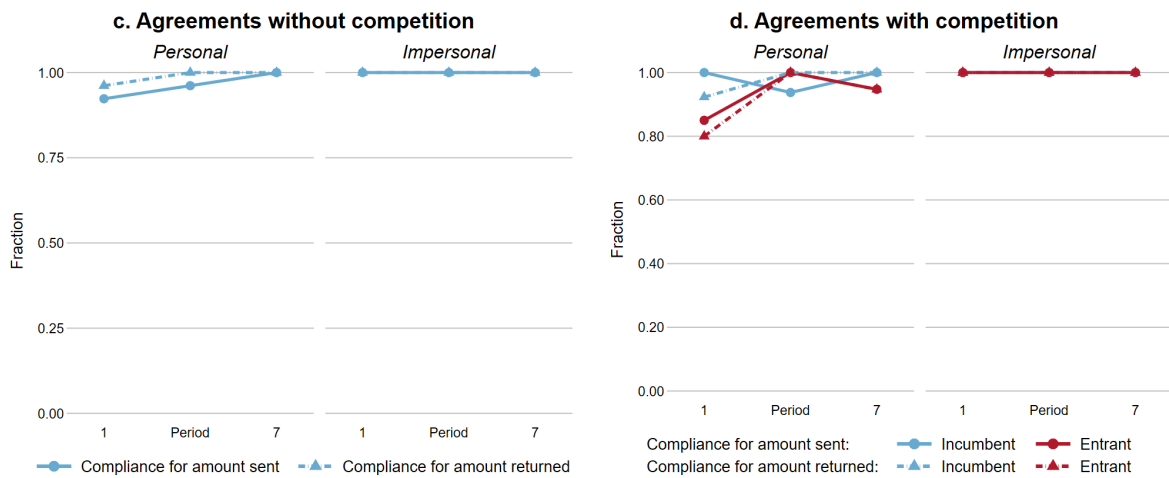
d. Agreements with competition

Figure A3. Compliance with agreements

Note: In every agreement period, Panels a and c show the fraction of senders who comply with the agreement by sending the agreed amount (solid blue line with circles) and the fraction of receivers who comply with the agreement by returning the agreed amount (dashed blue line with triangles). Panels b and d show the fraction of senders who comply with their agreement with incumbents (solid blue line with circles) and entrants (solid red line with circles) as well as the fraction of incumbents (dashed blue line with triangles) and entrants (dashed red line with triangles) who comply with their agreement with the sender

C.2 Distribution of the pie

Figure A4 illustrates the share of the total earnings the sender takes in *No competition* (line with circles) and in *Competition* (line with triangles). Panel a corresponds to the setting with non-enforceable agreements and panel b to the setting with partially enforceable agreements.

We run regressions in line with those reported in Appendix B. The results indicate that competition between the entrant and the incumbent gives an advantage to the sender, who is able to take a larger share of the pie compared to when there is no competition. With non-enforceable agreements, the introduction of competition increases the senders' share of the pie by 5 percentage points in IMPERSONAL ($p < 0.01$) and 9 percentage points in PERSONAL ($p < 0.01$). With partially enforceable agreements, competition increased the senders' share of the pie by 8 percentage points in IMPERSONAL ($p = 0.02$) and 9 percentage points in PERSONAL ($p < 0.01$).
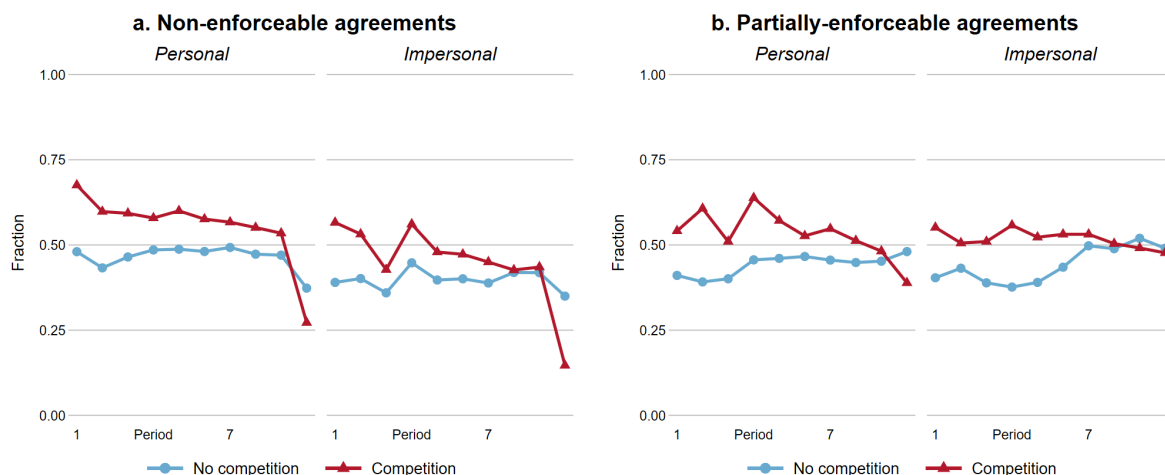

Figure A4. Share of total earnings accrued by the sender

Note: The figure illustrates the share of the total earnings the sender takes in *No competition* (line with circles) and in *Competition* (line with triangles) across periods.

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