

DISCUSSION PAPER SERIES

IZA DP No. 12398

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and Impersonal Business Relationships on  
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**Manuel Múnoz-Herrera**

*New York University Abu Dhabi*

**Ernesto Reuben**

*New York University Abu Dhabi, IZA and LISER*

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IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9  
53113 Bonn, Germany

Phone: +49-228-3894-0  
Email: publications@iza.org

[www.iza.org](http://www.iza.org)

## ABSTRACT

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# **Business Culture: The Role of Personal and Impersonal Business Relationships on Market Efficiency**

In this paper, we study the effects of business culture on market efficiency. We exogenously vary the type of business culture between business-is-business cultures, which consist on impersonal relationships where financial matters are paramount, and business-is-family cultures, which comprise of cohesive personal relationships where financial matters and personal attachments are intertwined. We use a laboratory experiment to assess the effect of business cultures in environments with different degrees of contract enforceability and competition. Our main results indicate that business-is-family cultures are more effective when contracts are unverifiable because they help market participants overcome problems of trust. On the other hand, we find that business-is-business cultures are more effective in competitive settings because they facilitate the severance of ties with unproductive partners.

**JEL Classification:** D91, L22, M14

**Keywords:** business culture, competition, contracts, trust, communication, social ties

**Corresponding author:**

Ernesto Reuben  
New York University Abu Dhabi  
PO Box 129188  
Abu Dhabi  
United Arab Emirates  
E-mail: ereuben@nyu.edu

# 1 Introduction

Business culture, understood as a common set of assumptions about how business relationships ought to be conducted, is often thought to be an important determinant of business success and growth (e.g., Carson 2007).<sup>1</sup> However, studies of how and why business cultures affect economic outcomes are rare in economics. An important dimension of business culture is whether business relationships are more *personal* or *impersonal* (Boschma 2005; Moodysson and Jonsson 2007; Herrmann et al. 2016). At one extreme, we have what one might call purely *business-is-business* relationships, which consist of impersonal interactions where financial matters are the most important consideration and are separate from emotions or personal attachments. At the other extreme, we have business relationships focused on cohesive interactions where financial matters are not independent of personal attachments, and where the latter can supersede the former. We refer to these as *business-is-family* relationships.<sup>2</sup> In this paper, we study the effect of personal and impersonal business cultures on market efficiency in different economic environments.

Are personal or impersonal business relationships more conducive of market efficiency? Arguably, depending on the economic environment, both types of relationships can lead to successful outcomes, as we illustrate with the following two examples.<sup>3</sup>

**Wholesale diamond trade in New York City (Business-is-family):** In the diamond trade in New York City, it is common for merchants to allow business partners to take bags of stones to examine their quality in private, without requiring any contract or formal guarantees. A bag of stones may be worth hundreds of thousands of dollars and could easily be replaced with less valuable stones. Business relationships are embedded within family and communal ties, and entry to outsiders is restricted by referrals from family members. Any digression, including trading with unsanctioned outsiders, often results in the loss of social ties.

**Apple Inc. switches from Qualcomm to Intel (Business-is-business):** For many years, Apple Inc. partnered with Qualcomm for many years as the provider for modems used in the iPhone. Their partnership involved intense coordination and sharing of intellectual property, all mediated with numerous contractual agreements. However, this relationship started to change in 2017 when Intel offered Apple lower prices and contracts with fewer restrictions on the use of

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<sup>1</sup>For instance, searching for “Business Culture” gives more than 4 million hits in Google (May 2019).

<sup>2</sup>Bowles (1998), explaining Max Weber’s account of different market interactions, describes business-is-business settings as portraying “ideal markets” because they are characterized by impersonality, ephemerality of contact, and ease of entry and exit. In contrast, the business-is-family setting is said to be akin to the so-called “communities” that have neither impersonality nor ephemerality.

<sup>3</sup>We took these two examples from Coleman (1988) and Rai and Chatterjee (2017).

patented products. Despite the long and profitable partnership with Qualcomm, Apple switched to Intel starting with the iPhone 7 series. A full switch took place in 2018 when Apple stopped using Qualcomm modems at all.

In addition to highlighting the distinctions between personal and impersonal business relationships, these examples illustrate the difficulty of using field data to identify the effect of business culture on market efficiency, as different business cultures are typically found in different economic environments. For instance, in the diamond trade example, we see that business-is-family relationships coexist with the use of informal contracts. However, it is unclear whether this coexistence occurs because enforceable contracts are difficult to implement in the diamond trade and business-is-family relationships develop because they promote market efficiency in such settings, or it occurs because of other reasons (e.g., social norms or longstanding cultural traditions).

We overcome these difficulties by using a laboratory experiment where we exogenously vary business cultures. More specifically, we study a variation of the investment game (Berg et al. 1995) where players repeatedly play and communicate with each other. We generate a business-is-business culture by allowing players to communicate solely using numeric messages, which can be used to bargain and reach agreements but cannot be used to convey much else. We generate a business-is-family culture by allowing players to communicate via chat, which lets them bargain and agree, but also express emotions and form social bonds. In other words, by varying the communication protocol in otherwise identical situations, we exogenously create more impersonal, purely transactional, relationships, and more personal relationships involving emotions and group identification.<sup>4</sup>

In this paper, we study how impersonal/personal business relationships affect market efficiency by systematically varying two important characteristics of the economic environment. First, we look at whether agreements can be enforced by a third party: binding versus non-binding agreements. Second, we look at the presence or absence of competition.

Our main findings when there is no competition indicate that neither type of business culture has an advantage if agreements are binding. If agreements are non-binding, however, business-is-family has the edge over business-is-business. Even though players do not have problems reaching non-binding agreements with either type of business relationship, there are significantly more violations of the agreements in business-is-business cultures. Thus, suggesting that in economic environments with limited competition but with robust contract enforcement, the type of business culture does

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<sup>4</sup>There is compelling evidence that free form communication (chatting) foments closer emotional interactions (e.g., Bichieri et al. 2010; Andreoni and Rao 2011; Kuwabara 2011; Brandts et al. 2016; Wang and Houser 2019) and enhances group identities (e.g., Chen and Li 2009).

not affect market efficiency. However, if trading depends on trust because contracts are unverifiable, business-is-family cultures promote more efficient agreements and shield businesses from low compliance rates.

With the introduction of competition, we find that business-is-business cultures gain a notable advantage over business-is-family cultures. Irrespective of whether agreements are binding or non-binding, there is a tendency for traders to trade with more productive competitors when interactions are impersonal, which leads to higher surpluses. By contrast, in business-is-family cultures, traders are reluctant to sever relationships with existing partners despite of them being less productive. Consequently, with binding contracts, where there were no differences without competition, the introduction of a competitor leads to higher market efficiency when business relationships are impersonal. With non-binding contracts, even though traders with impersonal business relationships take advantage of better business opportunities, there are no differences in efficiency because they still suffer from lower compliance rates.

Our paper is a contribution to the study of culture and organizations. Empirical work on cultural dimensions and their impact on organizations has been an active field of research (see e.g., Hofstede 1981, 1998; Guiso et al. 2006). A central finding from this line of work indicates that organizations greatly differ in how business relationships take place. While some strive for loosely-knit social relationships, others build for more cohesive and interdependent relationships. Nonetheless, this literature does not provide clear evidence of the way and extent to which business cultures impact economic welfare.<sup>5</sup> In this paper, we propose that different types of business culture can have a differential impact on market efficiency because some types of business cultures promote trust while others promote competition. Hence, depending on the relative importance of these two effects in a particular economic environment, one type of business culture might be optimal.

Our paper also contributes to the literature on the effects of the number of competitors on market efficiency. There are many papers in this literature demonstrating the standard prediction that more competitors lead to more efficient market outcomes in settings with complete contracts (e.g., Huck et al. 2004).<sup>6</sup> Interestingly, although it is not theoretically obvious, the positive effect of a larger number of trading partners has also been found in settings without complete contracts. For example, Huck et al. (2012) report that competition can strengthen compliance rates in settings

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<sup>5</sup>An exception is Meier et al. (2017), who study the causal effect of more trusting business cultures on the degree of specialization within firms. Compared to Meier et al. (2017), we focus on trade between businesses and study different economic environments.

<sup>6</sup>Experimentally, competition has been found to promote efficiency in many markets, including among others, labor markets (e.g., Charness et al. 2011) and markets for innovation (e.g., Aghion et al. 2018). For a recent meta-analysis, see Horstmann et al. (2019).

without contracts, such as in credit markets.<sup>7</sup> However, the interaction of competition and different degrees of contract enforceability has received limited attention. Our findings extend this literature and indicate that the effect of competition in promoting market efficiency is stronger with binding contracts and is further reinforced with impersonal relationships.<sup>8</sup>

Our work contributes, as well, to the experimental study of communication and cooperation. The literature on the effects of communication is extensive and varied (for a recent discussion see, Brandts et al. 2019). Studies within this literature have often focused on dictator games, public goods games, trust games, and coordination games (see for example Xiao and Houser 2005; Bochet and Putterman 2009; Andreoni and Rao 2011; Ben-Ner et al. 2011; Brandts et al. 2016; Andreoni et al. 2017; Wang and Houser 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. We contribute to this literature by studying the effects of different types of communication in settings where there is competition. We show that in the presence of competition, freer communication might be detrimental because it can generate a sense of loyalty that limits competition and therefore lowers market efficiency.<sup>9</sup>

Finally, our paper speaks 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, which in turn impacts the individuals' willingness to reciprocate the subsequent actions of others as well as their desire for future interaction. Within this literature, a paper that is closely related to ours is Fiedler et al. (2011), who study how social ties might limit efficient transactions. In their paper, the proposer in a one-shot trust game chooses between a respondent with whom she has a pre-existing relationship and a stranger with a higher multiplier. Fiedler et al. (2011) observe that proposers favor interactions with respondents with whom they had a pre-existing relationship at the expense of monetary earnings.<sup>10</sup> There are,

<sup>7</sup>Unlike increased competition due to changes in the number of trading partners, increased price competition has been found to have ambiguous effects on efficiency in both markets for experience goods (Huck et al. 2016) as well as credence goods (Dulleck et al. 2011; Mimra et al. 2016).

<sup>8</sup>Another line of inquiry has concentrated on whether incomplete binding contracts crowd out prosocial motivations and lower efficiency (e.g., Bohnet et al. 2001; Fehr and Rockenbach 2003; Falk and Kosfeld 2006). In our study, binding contracts are complete, and therefore, even if the introduction of binding contracts crowds out prosocial motivations, players can always trade efficiently.

<sup>9</sup>A related study on how communication can constrain efficiency in a social dilemma can be found in Abbink et al. (2018). Unlike in our paper, 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.

<sup>10</sup>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

however, several crucial differences between their study and ours. First, social distance in their case is exogenous, as it is built before participants know what game they will play. In our case, a lower social distance emerges endogenously through repeated interaction with a trading partner (as in models of social ties, van Dijk et al. 1997; Bault et al. 2017). Second, in our study, social distance can evolve as players have the option to repeatedly interact with their trading partner’s competitor. We think that our setting more naturally resembles business relationships, which is the type of relationship we are interested in here. Another important difference is that Fiedler et al. (2011) focus on non-binding contracts while we look at both binding and non-binding contracts.

## 2 Experimental design

We use variations of the investment game (Berg et al. 1995) in our experiment. In all cases, participants play the same game repeatedly for ten periods with fixed partners. In the next paragraphs, we describe the different versions of the game.

### 2.1 The 2-person investment game

Each period of the 2-person investment game consists of three or four stages in which a sender and a receiver interact. At the beginning of each period, both players are endowed with ten 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. 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. We describe later the precise way in which players communicate, as it varies by treatment. 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 equal to the multiplied amount sent minus the resources invested in the multiplying technology:  $\omega = s \times m - y$ . The highest surplus is accrued when the receiver invests and the sender sends their entire endowment, producing a multiplier  $m = 4$  and a surplus  $\omega = 30$ .

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reciprocate negatively.

## 2.2 The 3-person investment game

As the 2-person game, the 3-person investment game consists of up to 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,  $m_E = 1 + 0.4y_E \leq 5$ , than the incumbent,  $m_I = 1 + 0.3y_I \leq 4$ . Once the investments are made, the resulting multipliers are communicated to the sender.

In the second stage, the sender has the possibility to communicate separately with each receiver to make agreements. As in the 2-person game, 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,  $s_I + s_E \leq 10$ .<sup>11</sup> Also, as in the 2-person game, the communication stage takes place in periods one, four, and seven.

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 more productive than the incumbent's. Aside from that, all information is kept within the sender-receiver pair. That is, the incumbent (entrant) cannot communicate to the entrant (incumbent) nor observe the agreements or choices made between the sender and the entrant (incumbent).

The sender's earnings in the 3-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 receivers in their multiplying technologies:  $\omega = s_I \times m_I + s_E \times m_E - (y_I + y_E)$ . 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  $\omega = 40$ .

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<sup>11</sup>In line with most business contexts, an agreement between a sender and a receiver could not depend on the actions of the other receiver.

## 2.3 Treatments and hypotheses

Our experimental design focuses on comparing how personal and impersonal business relationships impact market efficiency in different economic environments. To do so, we exogenously vary business cultures in environments that differ in the amount of competition as well as the extent to which contracts are enforceable.

As argued in the introduction, we vary business cultures by exogenously varying how players communicate. In treatments with IMPERSONAL business relationships (business-is-business cultures), 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 minutes. At any point during this time, participants could accept the proposal of their counterpart or make proposals of their own.<sup>12</sup>

In treatments with PERSONAL business relationships (business-is-family cultures), 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. 2016; Wang and Houser 2019).

In the 3-person investment 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. For a detailed illustration, see the experimental procedures in Section 2.4.

In what follows we describe and formulate hypotheses for the four economic environments in which we will assess the effect on market efficiency of personal and impersonal business relationships. The economic environments vary the degree of competition, *No Competition* versus *Competition*, and contract enforceability, *Binding* versus *Non-binding*.

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<sup>12</sup>Accepting a proposal would end the communication stage. However, participants could also leave the communication stage without agreeing by clicking on an exit button.

## No Competition

Our first two treatments are based on the 2-person game, where there is no competition between receivers. In both cases, a sender-receiver pair repeatedly interacts for ten periods with communication every three periods (periods one, four, and seven).

In the treatment with binding contracts, agreements are automatically enforced. 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.<sup>13</sup> In the treatment with non-binding contracts, 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. Our hypothesis for these two treatments is as follows:

### **Hypothesis 1 (*Business culture and contract enforceability without competition*):**

(A) *If contracts are binding, there is no difference in market efficiency between PERSONAL and IMPERSONAL business relationships.* (B) *If contracts are non-binding, PERSONAL business relationships promote higher market efficiency than IMPERSONAL business relationships.*

Consider first the environment with *binding* contracts, where all agreements made are binding and cannot be reneged on by the sender or the receiver. Hypothesis 1A predicts that if the sender and the receiver do not need to worry about enforcing agreements, the type of business culture does not impact their choices. That is, contracts are strong enough to promote market efficiency (as in Brown et al. 2004, 2012), irrespective of how personal/impersonal the relationship is.

In the setting with non-binding contracts, where agreements between the sender and the receiver cannot be enforced, theory using standard assumptions predicts that the receiver does not reciprocate, which results in nothing being sent by the sender and no initial investment by the receiver. However, there is plenty of empirical evidence that people can partly overcome this type of trust problems (Berg et al. 1995), particularly with repeated interaction (e.g., Huck et al. 2012). This evidence has inspired numerous formal theories of prosocial motivations that can explain why individuals trust and reciprocate (see Fehr and Schmidt 2006). Still, these theories do not predict a difference due to communication being personal or impersonal.<sup>14</sup>

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<sup>13</sup>For an agreement to be binding, 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.

<sup>14</sup>Charness and Dufwenberg (2006) argue that theories of guilt aversion (Battigalli and Dufwenberg 2007) can explain the effect of communication on trust and reciprocity because the act of communicating can change the players' beliefs, which in these theories results in a change in the players' utility function. We are unaware of a study that evaluates whether different types of communication, be it more personal or impersonal, have a different impact on beliefs.

To the best of our knowledge, there are no formal theories designed to explain differences due to the forms of communication we consider. However, there are good reasons to hypothesize that personal business relationships are better than impersonal ones in fostering market efficiency when contracts are non-binding (Hypothesis 1B). In particular, as argued by Andreoni and Rao (2011), communication that propels individuals to consider each other's position more fully induces higher degrees of empathy, which results in more prosocial motivations (see also Andreoni et al. 2017). We expect that the increased ability to express emotions in PERSONAL will result in more empathy between the sender and the receiver than in IMPERSONAL.

## Competition

We think that the most interesting situation in the context of business cultures and competition is when there is a trade-off between a preexisting business relationship and the arrival of a more productive competitor. For this reason, our second two treatments are based on the 3-person game where an *incumbent receiver*, who already has a shared trading history with the sender, competes with an *entrant receiver*, whose multiplier is potentially higher.

In order to generate this setting in the laboratory, participants first played ten periods of the 2-person game and then ten additional periods of the 3-person game.<sup>15</sup> In each trio of the 3-person game, the incumbent receiver was the receiver with whom the sender had been previously matched (in the 2-person game). By contrast, the entrant receiver was a receiver who had been previously matched with a different sender.<sup>16</sup> Before starting the 3-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 2-person games). Receivers were informed of the sender's history of play but not of the other receiver's history of play. We provided the history of play to reduce differences in the information possessed by the sender about the two receivers. As before, each trio of players repeatedly interact for ten periods with communication every three periods. Our hypothesis for these two treatments is as follows:

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<sup>15</sup>Participants were told that the experiment consisted of two parts. Part one corresponded to ten periods of the 2-person game and part two to ten periods of the 3-person game. Participants completed part one before they were given the instructions for part two. See Appendix A for details.

<sup>16</sup>In each session the number of participants invited was a multiple of eight so that we always had blocks of four pairs (a sender and a receiver in each). Pairs were fixed for the first ten periods (2-person game). Then, for the 3-person game, the first two pairs were kept fixed while the other pairs were split. The receivers from the third and fourth pairs joined the first and second pair as the entrant receiver. The sender from pair 3 joined pair 2 and participated in a different study.

**Hypothesis 2 (*Business culture and contract enforceability with competition*):**

*Market efficiency is higher with IMPERSONAL business relationships than PERSONAL business relationships with both (A) binding and (B) non-binding contracts.*

Hypothesis 2 is based on arguments that contend that social ties developed from personal business relationships can generate a strong sense of commitment between the involved parties (see Uzzi 1996, 1999; Lawler 2001). This line of argument has been formalized by models of social ties that 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). If, as argued above, interaction based on personal business relationships induces stronger feelings of empathy than interaction based on impersonal relationships (Andreoni and Rao 2011), it would be natural to assume that these feelings will carry over from the 2-person to the 3-person game. In other words, we expect senders to favor the incumbent more in PERSONAL than in IMPERSONAL. Consequently, given that incumbents are less productive than entrants, we expect market efficiency in the 3-person game to be lower with PERSONAL than with IMPERSONAL business relationships.

More specifically, although we do not expect differences in market efficiency in the 2-person game in environments with binding contracts (see Hypothesis 1A), we hypothesize that the difference in the way senders and receivers communicate will nonetheless result in more empathetic relationships when business cultures are PERSONAL rather than IMPERSONAL. This difference implies that senders in the 3-person game will transfer more resources to incumbents in PERSONAL, resulting in lower market efficiency (Hypothesis 2A).

In environments with non-binding contracts, higher market efficiency in IMPERSONAL than in PERSONAL in the 3-person games could be due to two reasons. First, as in environments with binding contracts, stronger social ties due to the difference in the communication protocol could result in smaller transfers to the entrant receiver and lower efficiency in PERSONAL. Second, if Hypothesis 1B holds and market efficiency is lower in IMPERSONAL in the preceding 2-person game, then this could encourage the sender in the 3-person game to switch to the entrant receiver, resulting in relatively higher efficiency. Admittedly, the same reasons we used to argue that market efficiency is lower in IMPERSONAL in the 2-person game might still be relevant in the 3-person game. Consequently, even if senders were to switch to the entrant receiver completely, they may fail to fully benefit from trade due to the lower levels of trust inherent in IMPERSONAL business relationships when contracts are non-binding. Thus, reducing the efficiency gap between IMPERSONAL and PERSONAL. Table 1 summarizes our treatments and hypotheses.

**Table 1. Treatments and hypothesized differences in market efficiency**

Periods in the experiment	Game played	Agreements are binding	Agreements are non-binding
1 to 10	2-person	<i>No Competition &amp; Binding</i> H1A: IMPERSONAL = PERSONAL	<i>No Competition &amp; Non-binding</i> H1B: IMPERSONAL < PERSONAL
11 to 20	3-person	<i>Competition &amp; Binding</i> H2A: IMPERSONAL > PERSONAL	<i>Competition &amp; Non-binding</i> H2B: IMPERSONAL > PERSONAL

## 2.4 Experimental procedures

We conducted the experiment in the Columbia Experimental Laboratory in the Social Sciences (C.E.L.S.S.) at Columbia University. 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, points earned during the experiment were converted into money using an exchange rate of 20 points per U.S. dollar. Participants earned around 20 dollars on average. The instructions of the experiment are available in Appendix A.

## 3 Results

The data in our experiment consists of a panel of 120 individuals who repeatedly interact for ten consecutive periods in groups of two players (*No competition*) or three players (*Competition*). Therefore, throughout the paper, we test differences between PERSONAL and IMPERSONAL by running random effects GLS regressions clustering standard errors on groups. We use treatment dummy variables as the independent variables and also include the period number to control for time trends.<sup>17</sup> We report two-sided  $p$ -values in the text and provide all the corresponding regressions in Appendix B.

### 3.1 Binding contracts and no competition

We start by looking at the effect of business cultures on market efficiency when contracts are binding and there is no competition. As our measure of market efficiency, we use the obtained surplus as a fraction of the maximum attainable surplus (i.e.,  $\omega/30$ ). Average market efficiency in *Binding*, depending on the type of business relationship, is seen in Table 2. In addition, the table reports

<sup>17</sup>We also analyzed the data using Wilcoxon-Mann-Whitney tests and group averages as the unit of observation. The regressions' results are consistent with those of the non-parametric tests.

**Table 2. Descriptive statistics with *No competition***

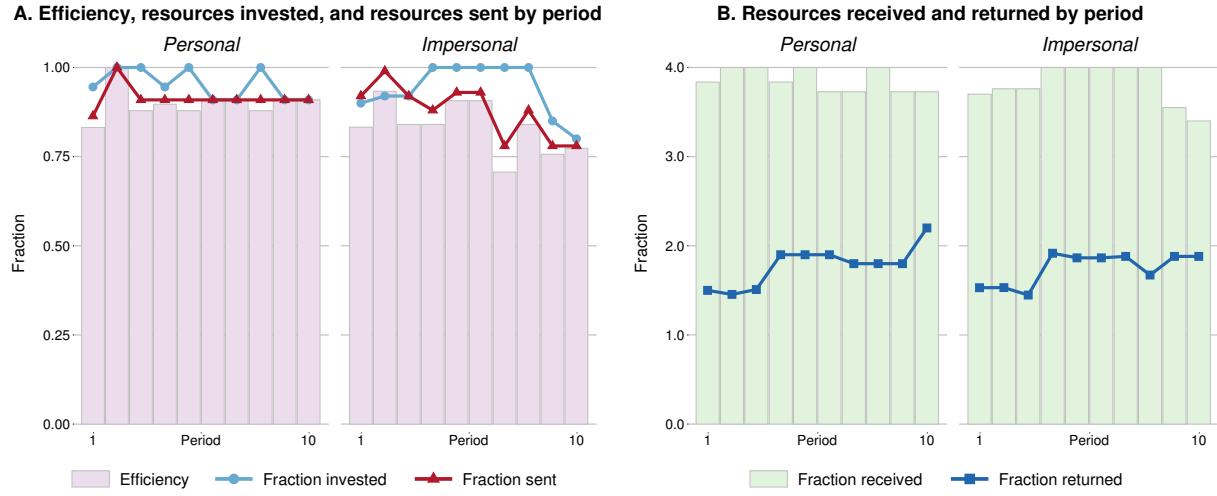
*Note:* Averages across groups and periods. Standard deviations, in parentheses, are calculated using all observations.

	Binding		Non-binding	
	PERSONAL	IMPERSONAL	PERSONAL	IMPERSONAL
Efficiency	0.90 (0.32)	0.83 (0.36)	0.97 (0.18)	0.53 (0.46)
Fraction invested	0.95 (0.20)	0.94 (0.22)	0.99 (0.06)	0.77 (0.30)
Fraction sent	0.91 (0.28)	0.88 (0.29)	0.98 (0.13)	0.65 (0.38)
Return rate	1.77 (0.69)	1.74 (0.46)	1.91 (0.39)	1.52 (0.61)
Agreement rate	0.97 (0.17)	0.83 (0.38)	1.00 (0.00)	0.93 (0.25)
Agreed to send	1.00 (0.00)	0.98 (0.06)	1.00 (0.00)	0.84 (0.22)
Compliance rate	0.91 (0.30)	1.00 (0.00)	1.00 (0.00)	0.79 (0.42)
# observations	110	100	90	100
# groups	11	10	9	10

averages of the amount invested by receivers as a fraction of their endowment, the amount sent by senders as a fraction of their endowment, and the amount returned by receivers as a fraction of the amount sent by the sender. Lastly, the table also contains the fraction of times the sender and receiver reached an agreement in the communication stage, the fraction of the sender's endowment that the sender agreed to send, and the fraction of agreements made for which the agreed amount sent was indeed sent (compliance rate).<sup>18</sup> Average market efficiency over periods is illustrated by the bars in Figure 1A. The figure also includes the fraction of the endowment invested by the receiver into the multiplier (line with circles) and the fraction of resources sent by the sender to the receiver (line with triangles) per period.

In line with Hypothesis 1A, we find that there are no statistically significant differences in market efficiency between PERSONAL and IMPERSONAL when agreements are binding and there is no competition (90% vs. 83% of the maximal surplus;  $p = 0.59$ , Table B1). Given this result, it

<sup>18</sup>Note that we concentrate on the agreed amount and the compliance of the amount sent (and not of the amount returned) because only the amount sent has a direct impact on efficiency.



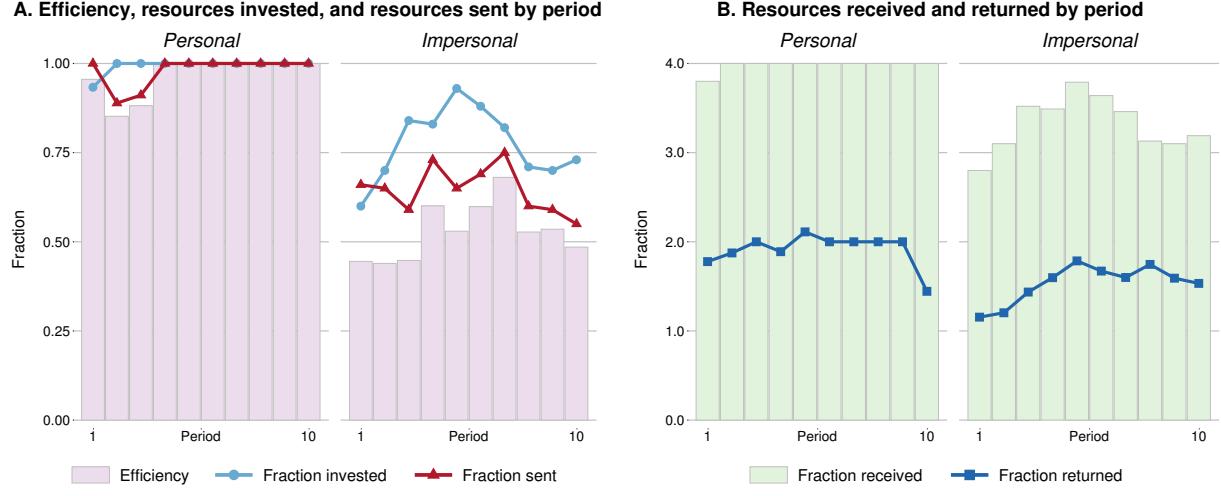
**Figure 1. Effect of business cultures with *Binding* contracts and *No competition***

Note: Panel A shows market efficiency, the fraction of resources invested by receivers, and the fraction of resources sent by senders per period. Panel B shows the received resources per unit sent and the returned resources per unit received per period.

is not surprising that we also do not observe substantial differences in the senders' and receivers' behavior. Receivers in PERSONAL invest 95% of their endowment in the multiplying technology while receivers in IMPERSONAL invest 94% ( $p = 0.80$ , Table B1). After observing the multipliers, senders transferred 91% of their endowment in PERSONAL and 88% in IMPERSONAL ( $p = 0.74$ , Table B1), resulting in high levels of market efficiency in both treatments. Although somewhat different in magnitude, we do not find statistically significant differences between the agreement rate in PERSONAL and IMPERSONAL (97% vs. 83%;  $p = 0.20$ , Table B6).<sup>19</sup> Note that all agreements were made after the receiver invested in the multiplying technology. Hence, this suggests that, in anticipation of establishing a binding contract, receivers invested almost all their endowment even though their investments were not part of the contract.

Even though our main focus is on the effect of business cultures on market efficiency, the amount the receiver returns to the sender constitutes an important part of their interaction. We illustrate this in Figure 1B. The bars show the average multiplier produced by the receiver, which can also be interpreted as the fraction of resources the receiver obtained for every unit the sender sent. In addition, we depict the fraction of resources the receiver sends back to the sender for every unit the sender transferred to the receiver (line with squares). In PERSONAL, receivers returned to the senders 1.77 units for every unit received (44% of the pie) while in IMPERSONAL they returned

<sup>19</sup>In IMPERSONAL, all agreements were made through the contract box and thus were binding. In PERSONAL, 76% of the agreements were made through the contract box while the remaining 24% were expressed solely through the chat and, thus, were not automatically enforced. This behavior explains why, as seen in Table 2, the compliance rate in PERSONAL was not 100%.



**Figure 2. Effect of business cultures with *Non-binding* contracts and *No competition***

Note: Panel A shows market efficiency, the fraction of resources invested by receivers, and the fraction of resources sent by senders per period. Panel B shows the received resources per unit sent and the returned resources per unit received per period.

1.74 units (43% of the pie). There are no significant differences between treatments in the return rate ( $p = 0.96$ , Table B1). Thus, as hypothesized, when contracts are binding and there is no competition, neither efficiency nor the players' behavior is significantly affected by the type of business culture.

### 3.2 Non-binding contracts and no competition

Next, we look at the effect of business cultures when there is no competition and non-binding contracts. Descriptive statistics for this environment are available in Table 2. As Figure 1A, Figure 2A depicts average market efficiency (bars), the fraction invested by the receiver (line with circles), and the fraction sent by the sender (line with triangles) per period.

In line with Hypothesis 1B, when contracts are non-binding, a business-is-family culture leads to higher market efficiency compared to a business-is-business culture (97% vs. 53% of the maximal surplus;  $p < 0.01$ , Table B2). In fact, as seen in Figure 2A, efficiency in PERSONAL reaches 100% after period 4, while in IMPERSONAL, it barely exceeds 60%. Differences in the attained market efficiency are caused by large differences in the amount of resources invested and sent. Receivers in PERSONAL invest significantly more than their counterparts in IMPERSONAL (99% vs. 77% of their endowment;  $p < 0.01$ , Table B2) and senders in PERSONAL send significantly more than senders in IMPERSONAL (98% vs. 65% of their endowment;  $p < 0.01$ , Table B2).

We take a deeper look at the frequency and type of agreements to understand why personal business relationships result in higher market efficiency. In particular, we evaluate whether differ-

ences in market efficiency are due to: (i) differences in the number of agreements being made (i.e., a bargaining problem), (ii) differences in the efficiency of the agreements that are made (i.e., a trust problem), or (iii) differences in the frequency with which senders comply with agreements (i.e., a cheating problem).

We find that the type of business culture does not affect the making of agreements. Senders and receivers agree 100% of the time in PERSONAL and 93% of the time in IMPERSONAL ( $p = 0.13$ , Table B6). By contrast, there is a significant difference in the type of agreements being made. In PERSONAL, all pairs agreed on senders sending 100% of their endowment. In IMPERSONAL, senders and receivers agreed for senders to send, on average, only 84% of their endowment ( $p < 0.01$ , Table B6). In addition to making less efficient agreements, the fraction of senders who comply with an agreement was significantly higher in PERSONAL than in IMPERSONAL (100% vs. 79%,  $p = 0.02$ , Table B6). In other words, without binding contracts, the lower market efficiency observed with a business-is-business culture is not the result fewer agreements being made, and instead, it is due to a combination of agreements being less efficient and being complied with less often.

To conclude this section, we look at the return choices of receivers. As in Figure 1B, Figure 2B depicts the average fraction of resources received per unit sent (bars) and the fraction of resources returned per unit sent (line with squares) per period. With non-binding contracts, receivers return 1.91 units per unit received in PERSONAL and 1.52 units in IMPERSONAL (48% vs. 38% of the pie;  $p < 0.01$ , Table B2). Hence, when contracts are non-binding, we find that personal business relationships also result in higher levels of reciprocity.

We summarize the findings for environments without competition in the following result:

**Result 1 (No Competition)** *When contracts are binding, there is no effect of business culture on market efficiency. However, when contracts are non-binding, a business-is-family culture significantly increases market efficiency compared to a business-is-business culture.*

### 3.3 Binding contracts and competition

In this section, we report the effects of business culture on market efficiency when there is competition between receivers and contracts are binding. Recall that senders face a trade-off between interacting with their previous partner, the incumbent, and an entrant who is (potentially) more efficient.

With competition, our measure of market efficiency is once again the total surplus as a fraction of the maximum attainable surplus (i.e.,  $\omega/40$ ). The only difference being that the total surplus includes surpluses generated with the incumbent as well as with the entrant. The average market efficiency depending on the type of business culture and the degree to which contracts are enforce-

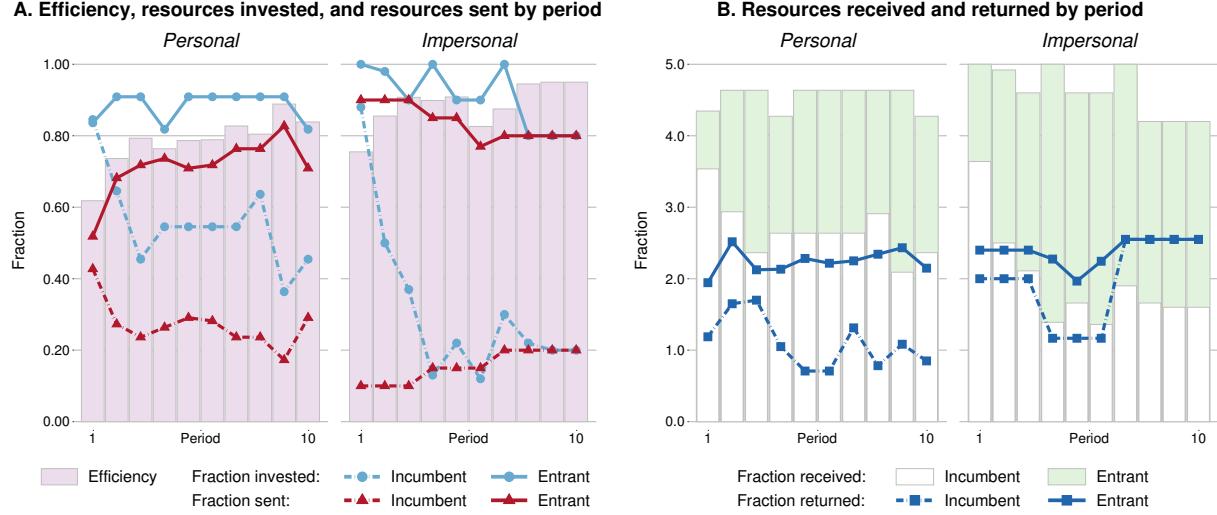
**Table 3. Descriptive statistics with *Competition***

Note: Averages across groups and periods. Standard deviations, in parentheses, are calculated using all observations. Efficiency includes the surpluses generated with both the incumbent and the entrant.

	<i>Binding</i>				<i>Non-binding</i>			
	PERSONAL		IMPERSONAL		PERSONAL		IMPERSONAL	
	Incumbent	Entrant	Incumbent	Entrant	Incumbent	Entrant	Incumbent	Entrant
Efficiency	0.78 (0.20)		0.89 (0.17)		0.75 (0.20)		0.75 (0.31)	
Fraction invested	0.56 (0.50)	0.88 (0.32)	0.31 (0.45)	0.91 (0.29)	0.63 (0.47)	0.81 (0.38)	0.40 (0.45)	0.92 (0.26)
Fraction sent	0.27 (0.34)	0.72 (0.34)	0.16 (0.35)	0.84 (0.36)	0.44 (0.40)	0.55 (0.40)	0.16 (0.23)	0.75 (0.32)
Return rate	1.08 (0.76)	2.24 (0.65)	1.84 (0.97)	2.38 (0.61)	1.60 (0.54)	2.12 (0.86)	1.21 (0.46)	2.03 (0.82)
Agreement rate	0.30 (0.47)	0.76 (0.44)	0.17 (0.38)	0.77 (0.43)	0.59 (0.50)	0.63 (0.49)	0.40 (0.50)	0.77 (0.43)
Agreed to send	0.62 (0.27)	0.82 (0.22)	0.88 (0.27)	1.00 (0.00)	0.74 (0.28)	0.76 (0.25)	0.53 (0.19)	0.89 (0.20)
Compliance rate	0.90 (0.32)	0.84 (0.37)	1.00 (0.00)	1.00 (0.00)	0.88 (0.34)	0.88 (0.33)	0.58 (0.51)	0.87 (0.34)
# observations	220		200		180		200	
# groups	11		10		9		10	

able is seen in Table 3. Table 3 also reports averages of the fraction of the endowment invested by receivers, the fraction of the endowment sent by senders, the fraction of the amount sent receivers returned, the fraction of times an agreement is reached, the fraction of their endowment senders agree to send, and the fraction of agreements senders comply with. To make comparisons easier, all variables (except surplus) are reported separately for the incumbent and the entrant. The average market efficiency over periods is illustrated by the bars in Figure 3A. The figure also shows, for each period, the average fraction of the endowment invested into the multiplier by the incumbent (dashed line with circles) and by the entrant (solid line with circles), and the average fraction of the endowment sent by the sender to the incumbent (dashed line with triangles) and to the entrant (solid line with triangles).

In line with Hypothesis 2A, we find that with competition and binding agreements, market efficiency is significantly lower in PERSONAL than in IMPERSONAL (79% vs. 89%;  $p = 0.05$  Table B3). Another way of looking at the effect of business culture on market efficiency is to evaluate



**Figure 3. Effect of business culture with *Binding* contracts and *Competition***

Note: Panel A shows market efficiency, the fraction of resources invested by incumbents and entrants, and the fraction of resources sent by senders to incumbents and the entrants per period. Panel B shows, for incumbents and entrants, the received resources per unit sent and the returned resources per unit received per period.

whether the introduction of competition and a more productive receiver increased the total surplus. Recall that in *No Competition* the maximum surplus is 30 while in *Competition* it is 40. We observe that in PERSONAL the increase in the surplus from *No Competition* to *Competition* is not statistically significant (from 27.00 to 31.38;  $p = 0.24$ , Table B5), while in IMPERSONAL, the total surplus increases significantly (from 25.01 to 35.48;  $p < 0.01$ , Table B5). Thus, suggesting that the benefits of competition are better captured in business-is-business cultures. Next, we take a closer look at the senders' relationship with the entrant and the incumbent and their behavior to understand why this is the case.

In both PERSONAL and IMPERSONAL, entrants invest a high fraction of their endowment (88% and 91% respectively) and receive a large share of the sender's resources (72% and 84% respectively). However, even though entrants are favored in both conditions,<sup>20</sup> the relationship between the sender and the incumbent is a larger source of inefficiency in PERSONAL compared to IMPERSONAL. Recall that the highest market efficiency is attained when the incumbent invests zero and all resources are sent to the entrant. In PERSONAL, this is far from being the case as incumbents invest 56% of their endowment in their less-efficient multiplier and receive 27% of the sender's resources. We observe similar pattern in IMPERSONAL, but it is less pronounced. Namely, incumbents invest only 31% of their endowment and receive 16% of the sender's resources.

<sup>20</sup>Entrants receive a significantly higher fraction of the sender's endowment than incumbents ( $p = 0.01$  in PERSONAL and  $p < 0.01$  in IMPERSONAL, Table B3). Similarly, they also invest a higher fraction of their endowment than incumbents ( $p = 0.06$  in PERSONAL and  $p < 0.01$  in IMPERSONAL, Table B3).

The difference between business cultures in the relationship with the incumbent is seen more clearly in the way agreements are made. In both business cultures, senders and receivers consistently make agreements. Senders make at least one agreement 85% of the time in PERSONAL and 93% of the time in IMPERSONAL. However, there is a notable difference in the type of agreements that are made. In IMPERSONAL, senders never agree with both the entrant and the incumbent: 82% of agreements are solely with the entrant, and 18% are solely with the incumbent. By contrast, in PERSONAL senders do make simultaneous agreements with both: 64% of agreements are solely with the entrant, 11% are solely with the incumbent, and 25% are with both.<sup>21</sup> Notably, in all the cases where a sender made an agreement with both receivers, the entrant's multiplier was higher than the incumbent's. In other words, some senders are clearly sacrificing some efficiency in order to trade with the incumbent.

Finally, we take a look at the fraction of resources returned by receivers. Figure 3B depicts the average fraction of resources received by the incumbent (white bars) and by the entrant (green bars) per unit sent by the sender. This figure also shows, for each period, the fraction of resources returned by the incumbent (dashed line with squares) and by the entrant (solid line with squares) per unit sent by the sender. The figure makes clear that incumbents tend to return less than entrants per unit sent: 1.16 units less in PERSONAL and 0.54 units less in IMPERSONAL ( $p < 0.01$  and  $p = 0.09$  respectively, Table B3). Therefore, sending resources to incumbents is not only detrimental for market efficiency but also for the senders' earnings, especially in PERSONAL. This finding is particularly salient in groups where senders made binding agreements with both receivers. In these groups, for every unit sent, the sender agreed almost always to receive less from the incumbent than from the entrant.<sup>22</sup> Hence, these agreements confirm the extent to which some senders are willing to forgo earnings to trade with their old partner.

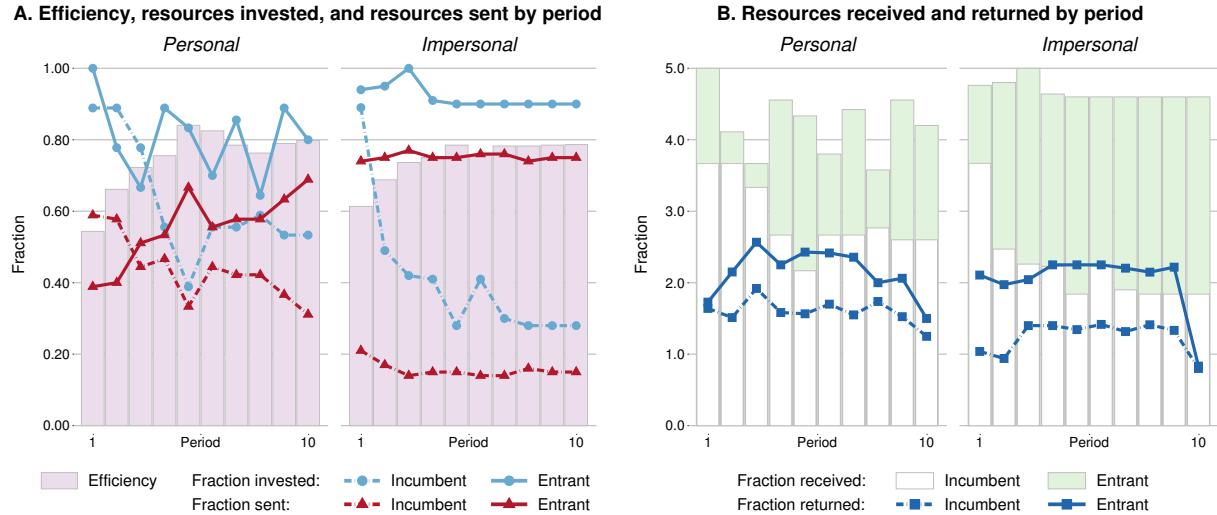
### 3.4 Non-binding contracts and competition

We conclude the results section with the findings from competitive environments with non-binding contracts. Like before, Figure 4 illustrates with bars the average market efficiency over periods. It

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<sup>21</sup>To test whether the distributions of the type of agreements vary between PERSONAL and IMPERSONAL, we ran a multinomial logit regression with a dummy indicating the type of business culture as the independent variable (and controlling period). As the dependent variable, we use the four agreement types: no agreement, an agreement only with the incumbent, an agreement only with the entrant, and an agreement with both. Subsequently, we test whether the coefficients of the business culture are jointly significant. We find that the agreement distributions are indeed significantly different ( $p < 0.01$ ).

<sup>22</sup>In 6 out of 7 cases (86%) where the sender agreed to send to both receivers, the sender agreed to get less per unit sent to the incumbent. In the remaining case (14%), the sender agreed to equal returns.



**Figure 4. Effect of business culture with non-binding contracts and *Competition***

Note: Panel A shows market efficiency, the fraction of resources invested by incumbents and entrants, and the fraction of resources sent by senders to incumbents and the entrants per period. Panel B shows, for incumbents and entrants, the received resources per unit sent and the returned resources per unit received per period.

also shows, per period, the average fraction of the endowment invested into the multiplier by the incumbent (dashed line with circles) and by the entrant (solid line with circles), and the average fraction of the endowment sent by the sender to the incumbent (dashed line with triangles) and to the entrant (solid line with triangles). The findings in this section inform us of the effects of the entry of a more-efficient receiver in trust-dependent settings. Note, however, that one must assess the evidence with caution due to the significant differences in market efficiency between PERSONAL and IMPERSONAL in *No Competition*. That is, the previous relationship between the sender and the incumbent was more successful in PERSONAL than in IMPERSONAL.

The main result with competition and non-binding contracts is that there are no differences in market efficiency between PERSONAL and IMPERSONAL (75% in both;  $p = 0.98$ , Table B4). In other words, we do not find support for Hypothesis 2B. In what follows, we take a deeper look at the behavior of senders and receivers to identify the sources of inefficiency. Comparing investment and sending behavior between PERSONAL and IMPERSONAL without non-binding contracts results in some of the same observations as with binding contracts. Namely, inefficiencies arise because, in spite of the entrants' high investments, senders still send noticeable amounts to the less-efficient incumbents, who in turn invest positive amounts into their multipliers.

In PERSONAL, the senders' relationship with incumbents is the main source of inefficiency. Here, incumbents invest almost as much of their endowment as entrants (63% vs. 81%) and receive almost half of the senders' resources (44% vs. 55%).<sup>23</sup> This effect is sufficiently strong to offset the benefits

<sup>23</sup>In PERSONAL, there is no statistically significant difference between entrants and incumbents in neither the fraction

of having a more-efficient receiver. Specifically, we find that the total surplus in PERSONAL does not change between *No Competition* and *Competition* (from 29.07 to 29.93;  $p = 0.72$ , Table B5).

Like with binding contracts, when contracts are non-binding, we also find that the benefits of competition do materialize in business-is-business cultures. Namely, the overall surplus in IMPERSONAL significantly increases from 15.87 in *No Competition* to 29.86 *Competition* ( $p < 0.01$ , Table B5). This increase is due to a strong relationship between the sender and the entrant: senders send 75% of their resources to entrants, who in turn invest 92% of their endowment. Both these figures are higher than those in *No Competition*, where senders send 65% of their resources and receivers invest 77% of their endowment.<sup>24</sup> This is not to say that the relationship between the sender and the incumbent is no longer a source of inefficiency. Incumbents still invest 40% of their endowment even though they receive only 16% of the senders' resources.

The reason that market efficiency is similar in both business cultures is that senders in IMPERSONAL still exhibit some mistrust. In PERSONAL with non-binding contracts and in both environments with binding contracts, senders' almost always send all their endowment (on average, 99% or more, see Table 3). By contrast, in IMPERSONAL with non-binding contracts, senders send somewhat less (91%). This mistrust is large enough to compensate for the stronger relationship between the sender and the entrant in IMPERSONAL vis-à-vis PERSONAL.<sup>25</sup>

The analysis of the agreements confirms the same pattern: a stronger relationship between the sender and the incumbent in PERSONAL. Namely, although overall agreement rates are similar, senders in PERSONAL tend to make fewer exclusive agreements with entrants (33% vs. 60% in IMPERSONAL) and more joint agreements with both receivers (30% vs. 17% in IMPERSONAL).<sup>26</sup> Moreover, while senders comply less with their agreements with incumbents than with entrants in IMPERSONAL (58% vs. 87%;  $p = 0.09$ , Table B7), they comply equally with both receivers in PERSONAL (88% for both;  $p = 0.86$ , Table B7). Finally, as with binding agreements, we can see in Figure 4B that with non-binding agreements senders also receive back less per unit sent to incumbents than per unit sent to entrants in both PERSONAL ( $p = 0.06$ , Table B4) and IMPERSONAL

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invested nor the amount received (respectively,  $p = 0.33$  and  $p = 0.60$ , Table B4).

<sup>24</sup>These findings are in line with Huck et al. (2012), who also find that competition increases trust in settings without binding contracts.

<sup>25</sup>A back of the envelope calculation shows that if senders in IMPERSONAL sent the remaining 9% of their endowment to entrants, then the overall surplus in IMPERSONAL would be 4.14 higher than in PERSONAL. This difference is about the same as the difference between IMPERSONAL and PERSONAL when there is competition and binding contracts (i.e., 4.10).

<sup>26</sup>We find that distributions of agreements in PERSONAL and IMPERSONAL are significantly different using a multinomial logit regression like the one described in footnote 21 ( $p < 0.01$ ).

( $p < 0.01$ , Table B4). This result confirms once again that senders are willing to sacrifice earnings to trade with incumbents.

We summarize our findings for environments with competition in the following result:

**Result 2 (With Competition)** *Compared to a business-is-family culture, a business-is-business culture facilitates the transition from less-productive incumbents to more-productive entrants irrespective of the contracting environment. When contracts are binding, this results in more efficient outcomes in a business-is-business culture. When contracts are non-binding, market efficiency is similar in both business cultures due to higher trust in a business-is-family culture.*

## 4 Conclusions

In this paper, we have studied how business cultures affect market efficiency. We do so by exogenously varying the type of business culture between *business-is-business* cultures, which consist on impersonal relationships where financial matters are paramount, and *business-is-family* cultures, which comprise of cohesive personal relationships where financial matters and personal attachments are intertwined. We assessed the effect of business cultures in environments with different degrees of contract enforceability and competition.

Our main results indicate that no business culture consistently outperforms the other when it comes to increasing market efficiency. Business cultures characterized by personal business relationships are better at overcoming problems of trust. Impersonal business cultures are better at expediting the switch from unproductive partners to more productive competitors. Therefore, in economic environments where trust is essential due to the lack of contract enforceability and where competition is limited, *business-is-family* cultures outperform *business-is-business*. Conversely, the opposite is true in economic environments where contracts are easily enforced and competition generates substantial efficiency gains. In mixed environments, where trust is unnecessary and competition is absent, or where trust is needed and competition is essential, we find that neither business culture has the edge over the other as the relative benefits of each business culture cancel out.

Our work contributes to the growing body of research on the effects of free-from communication in environments where contracts are unenforceable. 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 importance of competition. If market efficiency requires strong competition between market participants, then personal relationships developed via free-from communication hinders the market's performance. This negative effect of personal ties is

especially salient in environments with binding contracts, where there is little upside to the use of free-form communication.

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 with which we could conduct our study, it raises the question of how business cultures influence market efficiency when social networks and markets are larger. More interestingly, although we study how business cultures affect market efficiency, we do not study whether the most effective business culture emerges endogenously in different economic environments. In the field, it is not clear if business cultures 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 to ask is whether individuals can select the most favorable conditions under which they can trade. In other words, whether they choose the business culture that optimally fits their economic environment. In our opinion, the answer to this question is not obvious as there might be non-pecuniary reasons to choose a particular type of interaction, and it is an interesting line of inquiry. Finally, one of our main results is that the formation of personal ties in business-is-family cultures is a source of inefficiency in competitive environments. In our setting, however, participants were unable to anticipate the arrival of competition. Hence, we cannot study whether individuals understand that a close personal relationship may bind them in the future, and as a consequence, avoid creating such personal ties.

To conclude, we would like to add that a fruitful line of research would be the development of formal models that can capture these effects of social ties on economic interactions. In existing models (van Dijk et al. 1997, 2002; Bault et al. 2017), social ties are contingent on experienced 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 has a strong effect on 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 2-person game) and Part 2 to the environment with competition (the 3-person game) . The instructions for the other treatments are similar and are available upon request.

### 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  $2.5 \times 7$  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
Points sent from Player B to Player A	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
	4	4.0	5.2	6.4	7.6	8.8	10.0	11.2	12.4	13.6	14.8	16.0
	5	5.0	6.5	8.0	9.5	11.0	12.5	14.0	15.5	17.0	18.5	20.0
	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.

**Chat**

Communication is non binding - Round 1

You invested 10 points, so the multiplier is 4.0

Only if You and Player B write the same number of points below, an agreement will take place

Once you are done click on the Submit button.

---

You are Player A  
You can chat with Player B



Remaining Time 178

Proposal of points

	Yours	Player B's
From B to A	0	0.0
From A to B	0	0.0

Show

Submit

## 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
4	4.0	5.2	6.4	7.6	8.8	10.0	11.2	12.4	13.6	14.8	16.0
5	5.0	6.5	8.0	9.5	11.0	12.5	14.0	15.5	17.0	18.5	20.0
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

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  $3.1 \times 7$  points = 21.7 points and Player A2 receives  $3.4 \times 3$  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 ten 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 by including the period number, but we center the period number on the fifth period (i.e., we subtract 5 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 ten periods in each treatment).

Tables B1 and B2 contain regressions testing the effect of business cultures when there is *No competition*. Table B1 corresponds to the case where agreements are binding, whereas Table B2 corresponds to the case where agreements are non-binding. In all regressions, the independent variable consists of a dummy variable identifying PERSONAL (i.e., IMPERSONAL is the omitted category). Moreover, we use group random effects. In column I, the dependent variable is *efficiency*, which is the obtained surplus as a fraction of the maximum attainable surplus:  $\omega/30$ . 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 to the sender as a fraction of the amount sent. Note that in column IV, there are fewer observations because senders did not always send a positive amount to the receiver.

Tables B3 and B4 contain regressions testing the effect of business cultures when there is *Competition*. Table B3 corresponds to the case where agreements are binding, whereas Table B4 corresponds to the case where agreements are non-binding. In all regressions, we test the effect of the different types of business relationships by including a dummy variable identifying PERSONAL. In column I, the dependent variable is *efficiency*, which is  $\omega/40$  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 business relationship. 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 to the sender as a fraction of the amount sent. In column IV, there are fewer observations because senders did not always send a positive amount to the receivers.

In Table B5, we test whether competition increases payoffs. Hence, in all regressions, the dependent variable is the total surplus  $\omega$  (in points). As the independent variable, we use a dummy variable identifying periods with *Competition*, and we use group random effects. In columns I and II, we use data from groups in *Binding* and either PERSONAL (column I) or IMPERSONAL (column II) agreements. In columns III and IV, we use data from groups in *Non-binding* and either PERSONAL (column III) or IMPERSONAL (column IV) agreements. Note that in these regressions, the period variable is controlling for trends within each part of the experiment.

Next, we analyze the effect of business cultures on the frequency and type of agreements as well as their compliance. Recall that each receiver-sender pair could agree in periods one, four, and seven. Hence we have three observations per pair. Table B6 contains regressions for environments with *No competition*, whereas Table B7 contains regressions for environments with *Competition*. We run separate regressions for *Binding* and *Non-binding* agreements. In all regressions, we use a dummy variable identifying PERSONAL. In addition, when there is competition (in Table B7), we distinguish between the two receivers with a dummy variable identifying the *incumbent* receiver, which we then interact with the type of business relationship. In all cases, we use sender-receiver pair random effects. In columns I and IV, the dependent variable is the *agreement rate*, which is a dummy variable that equals one if a receiver-sender pair agrees. In columns II and V, the dependent variable is the *compliance rate*, which is a dummy variable that equals one if the sender sends the agreed upon amount. Recall that we concentrate on compliance by the sender since the sender's action has a direct effect on efficiency. In these regressions, we drop cases where there was no agreement. Finally, in columns III and VI, the dependent variable is the *agreed to send rate*, which is 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. Note that the regression for the agreed to send rate in *Binding* in Table B6 is missing because there is too little variation to estimate it: in PERSONAL all agreements stipulate sending all the endowment while in IMPERSONAL this is the case for 92% of agreements (the remaining 8% stipulated sending 80% of the endowment).

**Table B1. Effect of business cultures with binding contracts and no competition**

*Note:* GLS regressions with group 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 the 0.01, 0.05, and 0.10 levels.

	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>
PERSONAL	0.07 (0.12)	0.01 (0.05)	0.04 (0.11)	0.01 (0.19)
Period	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	0.05*** (0.17)
Constant	0.84*** (0.08)	0.94*** (0.03)	0.88*** (0.07)	1.70*** (0.10)
$\chi^2$	0.59	0.87	1.76	9.98***
# Obs.	210	210	210	193

**Table B2. Effect of business cultures with non-binding contracts and no competition**

*Note:* GLS regressions with group 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 the 0.01, 0.05, and 0.10 levels.

	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>
PERSONAL	0.44*** (0.12)	0.22*** (0.06)	0.33*** (0.10)	0.48*** (0.17)
Period	0.01 (0.01)	0.01 (0.01)	0.00 (0.01)	0.01 (0.102)
Constant	0.52*** (0.12)	0.77*** (0.06)	0.65*** (0.09)	1.42*** (0.16)
$\chi^2$	26.14***	30.40***	20.54***	9.13**
# Obs.	190	190	190	171

**Table B3. Effect of business cultures with binding contracts 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 the 0.01, 0.05, and 0.10 levels.

	I	II	III	IV
PERSONAL	-0.10** (0.05)	-0.02 (0.11)	-0.12 (0.13)	-0.14 (0.20)
Incumbent × IMPERSONAL	— —	-0.59*** (0.15)	-0.68*** (0.20)	-0.87* (0.51)
Incumbent × PERSONAL	— —	-0.33* (0.17)	-0.44** (0.18)	-1.23*** (0.28)
Period	0.02*** (0.00)	-0.02*** (0.01)	0.00 (0.00)	0.01 (0.01)
Constant	0.88*** (0.04)	0.92*** (0.06)	0.84*** (0.10)	2.38*** (0.14)
$\chi^2$	21.36***	48.90***	19.25***	43.30***
# Obs.	210	420	420	255

**Table B4. Effect of business cultures with non-binding contracts 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 the 0.01, 0.05, and 0.10 levels.

	I	II	III	IV
PERSONAL	0.00 (0.11)	-0.11 (0.12)	-0.20 (0.15)	0.10 (0.26)
Incumbent × IMPERSONAL	— —	-0.52*** (0.12)	-0.60*** (0.15)	-0.99*** (0.29)
Incumbent × PERSONAL	— —	-0.18 (0.18)	-0.12 (0.22)	-0.54* (0.29)
Period	0.02*** (0.01)	-0.03*** (0.01)	0.00 (0.00)	-0.04** (0.02)
Constant	0.74*** (0.10)	0.93*** (0.07)	0.75*** (0.10)	1.98*** (0.20)
$\chi^2$	12.47***	36.77***	23.40***	43.30***
# Obs.	190	380	380	251

**Table B5. Effect of competition on the total surplus depending on the business culture**

*Note:* GLS regressions with group random effects and standard errors clustered on groups (in parenthesis). The dependent variable is the total surplus (in points). Columns I and III correspond to PERSONAL while columns II and IV correspond to IMPERSONAL. \*\*\*, \*\*, and \* indicate statistical significance at the 0.01, 0.05, and 0.10 levels.

	Binding		Non-binding	
	I	II	III	IV
Competition	4.38 (3.72)	10.47*** (3.46)	0.86 (2.42)	13.99*** (4.10)
Period	0.41*** (0.16)	0.10 (0.32)	0.60*** (0.21)	0.47 (0.30)
Constant	26.80*** (2.81)	24.96*** (2.46)	28.76*** (0.86)	15.64*** (3.64)
$\chi^2$		7.98**	15.97***	20.67***
# Obs.	220	200	180	200

**Table B6. Effect of business culture on agreements with no competition**

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

	Binding		Non-binding		
	I	II	IV	V	VI
PERSONAL	0.14 (0.11)	-0.11 (0.09)	0.07 (0.04)	0.21** (0.09)	0.17*** (0.06)
Period	-0.01 (0.01)	0.01 (0.01)	0.02 (0.01)	-0.01 (0.02)	0.02** (0.01)
Constant	0.83*** (0.10)	1.01*** (0.01)	0.95*** (0.03)	0.77*** (0.10)	0.85*** (0.06)
$\chi^2$	2.26	2.19	2.28	5.66*	9.29***
# Obs.	63	57	57	55	55

**Table B7. Effect of business culture on agreements with competition**

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

	Binding			Non-binding		
	I	II	III	IV	V	VI
PERSONAL	-0.01 (0.14)	-0.17** (0.07)	-0.18*** (0.05)	-0.14 (0.18)	0.02 (0.13)	-0.11 (0.09)
Incumbent × IMPERSONAL	-0.60*** (0.20)	-0.02 (0.02)	-0.18 (0.16)	-0.37 (0.23)	-0.29* (0.18)	-0.35*** (0.09)
Incumbent × PERSONAL	0.45*** (0.17)	0.05 (0.16)	-0.25** (0.10)	-0.04 (0.23)	-0.02 (0.14)	-0.03 (0.10)
Period	0.01 (0.01)	0.02 (0.02)	0.01 (0.01)	0.00 (0.01)	0.00 (0.02)	0.01 (0.01)
Constant	0.78*** (0.10)	1.02*** (0.02)	1.01*** (0.01)	0.77*** (0.11)	0.86*** (0.11)	0.88*** (0.06)
$\chi^2$	20.63***	9.08*	26.19***	2.66	3.23	17.64***
# Obs.	126	63	63	114	68	68