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Making it personal: breach and private ordering in a contract farming experiment

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Abstract.—Contracts may be subject to strategic default, particularly if public enforcement institutions are weak. In a lab experiment, we study behavior in a contract farming game without third-party enforcement but with an external spot market as outside option. Two players, farmer and company, may conclude a contract but also breach it by side-selling or arbitrary payment reductions. We examine if and how relational contracts and personal communication can support private-order enforcement. Moreover, we investigate whether company players offer price premiums to extend the contract's self-enforcing range. We find mixed evidence for our private ordering hypothesis. Although contract breach can be reduced by relational contracts, direct bargaining communication does not additionally improve the outcome. Price premiums are offered if other enforcement mechanisms are absent, but turn out to be only an "allurement". Most subjects are not willing to sacrifice short-term gains in favor of a well-functioning relationship that (as we show) would be beneficial for both contract parties in the long run.

Keywords: contract farming, private ordering, enforcement, contract breach, economic experiments, relational contracts, communication, price premiums

JEL classification: D02, L14, Q13

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1. Introduction

In the last decades, the use of contracts for governing agricultural supply chains has grown increasingly popular in the developing world. Contract farming, defined as agricultural production and marketing carried out according to some prior agreement between farmer and agribusiness firm (see, e.g., Eaton & Shepherd, 2001; Prowse, 2012), can be seen as one reaction to the ongoing fundamental changes in global agri-food markets. Trade liberalization and agro-industrialization, the proliferation of public and private standards, changing consumer preferences and the supermarket boom in many developing countries have triggered higher degrees of vertical coordination or even integration (Reardon & Barrett, 2000; Reardon et al., 2009). By written or verbal contracts small-scale farmers in low-income countries can potentially be linked to modern supply chains and high-value export markets. Typically, these farmers suffer from severe imperfections in markets for credit, insurance, information, inputs etc. Contract farming arrangements could cushion these failures by including credit or input provision by the buyer into the agreement (Key & Runsten, 1999). However, there are many open questions and potential hurdles that need to be investigated. Numerous studies examine farmers' preferences or motives to participate in contract farming (Masakure & Henson, 2005; Schipmann & Qaim, 2011). Others investigate whether contract agriculture increases revenue or welfare (Bolwig et al., 2009; Bellemare, 2012).

This article is concerned with the problem of strategic contractual default induced by incomplete agreements or institutional failures. Particularly in developing and transition countries, contract farming is subject to poorly functioning legal institutions (FAO, n.d.; World Bank, 2012). Proper public enforcement lacking, "legal centralism" tradition of economics predicts that exchange and investment fail to take place due to the fear of contractual breach and hold-ups. And, as a matter of fact, even if courts are not entirely absent, law suits in the wake of breach in contract agriculture are rather unlikely since transaction costs are prohibitive (Eaton & Shepherd, 2001; Minten et al., 2009).

One solution to this problem of opportunistic behavior suggested by the theoretical, empirical and historical literature on market institutions is *private ordering* (Williamson, 1985; ibid., 2002). That is, instead of relying on public enforcement and formal punishment mechanisms agents attempt to make contracts self-enforcing, use private third parties or apply informal mechanisms based on reputation or repeated interaction to enhance mutual trust *ex ante* and support dispute settlement or retaliation *ex post* (for an overview see McMillan & Woodruff, 2000; Ben-Ner & Putterman, 2001). Although private-order contract enforcement also matters in today's industrial countries, it is perhaps more prominent in Europe of the late medieval times and the Commercial Revolution (see Greif, 1992, for a survey) or in developing and transition economies. For instance in sub-Saharan Africa (Bigsten et al., 2000; Fafchamps, 2004), Vietnam (McMillan & Woodruff, 1999a; ibid., 1999b) or Russia (Hay & Shleifer, 1998) economic activities are crucially supported by long-term relations, reputation mechanisms and social networks.

Fafchamps (1996) categorizes the offender's cost of contract breach in guilt, threat of retaliation and coercive action. Considering their origin, we can interpret these costs as supporting first-, second- and third-party enforcement, respectively. First-party enforcement implies that private ordering can have its roots in a (potential) cheater's other-regarding preferences, moral norms or feelings of guilt. Preferences for honesty, general morality or the intrinsic value of living up to a promise may well convince agents to stick to an agreement (Platteau, 1994). Moreover, the second party (the one cheated on) can threaten with retaliation—usually in terms of terminating the business relationship and harming the offender's reputation, both potentially resulting in suspension of future trade (see, e.g., Klein, 1996; MacLeod, 2007) or social ostracism (e.g., Posner, 1997). Finally, third-party enforcement is accomplished through coercive action by other institutions of public or private order. Obviously, not all third parties necessarily use coercion, as state institutions and some private enforcers outside the law do. Instead, a third party may also provide information or coordinate community responses (McMillan & Woodruff, 2000). Whatever mechanism or institution is being applied, enforcement of contracts and a trustful relationship is said to be achieved when long-term costs of reneging for a party outweigh its short-term benefits.

A growing body of literature addresses contract farming arrangements empirically. In practice, contractual default appears to be an issue for both producer and buyer. Guo et al. (2007) and Guo & Jolly (2008) stress that informal enforcement mechanisms are central to the Chinese agricultural sector and producers' contract performance critically depends on contract design. Beckmann & Boger (2004) find that even if Polish farmers have the opportunity to involve courts, they also consider the indirect costs of doing so. In other words, the value of the affected relationship determines whether punishment is used. Gow & Swinnen (2001) and Gow et al. (2000) present case study evidence for Klein's (1996) *self-enforcing range* (i.e., the extent to which external circumstances may change without making contract breach beneficial) for transition economies. They show how formerly unreliable companies can enhance their trustworthiness through relationship-specific investments, thus making breach more expensive for themselves.

The present study uses an experimental approach to investigate subjects' behavior in a contract farming setting and the effectiveness of private ordering through long-term and personal relationships. We design a novel experimental game that is akin to real-world contract farming arrangements with an outside option in form of an exogenous spot market. Both players, farmer and company, may conclude a contract and breach it by side-selling (farmer) or arbitrarily reducing the promised price *ex post* (company). This way, both players are trustors and trustees at the same time. By using the laboratory, we are able to create a controlled *ceteris* *paribus* environment and disentangle the effects of different enforcement mechanisms, which is hardly possible with the analysis of survey data (see also Just & Wu, 2009). Even though there are some related experiments on contract farming conducted in the field (Torero & Viceisza, 2011; Sänger et al., 2013; Sänger et al., 2014), most experiments on contractual relationships have been run within lab environments. They usually assume the form of trust, principal-agent or gift-exchange games. Many interesting findings shed light on the existence and role of fairness preferences in contractual relations (Keser & Willinger, 2000; ibid., 2007; Fehr et al., 2007), reciprocity (Fehr et al., 1997; Gächter & Falk, 2002) and trust (Bohnet et al., 2001; Ben-Ner & Putterman, 2009), but also on the formation of long-term contracts (Brown et al., 2004; Wu & Roe, 2007) and the impact of communication (Ellingsen & Johannesson, 2004; Charness & Dufwenberg, 2006; Brandts et al., 2014).

We add to this literature by investigating the informal factors influencing contract breach in an experimental setting. Unlike many other studies, we do not focus on moral hazard or adverse selection problems (representing special cases of contractual issues) but on the more fundamental and often neglected "incentive problems associated with getting parties to honor their promises" (Wu, 2014). In particular, we address the following research questions:

- To what extent do relational contracts (in the sense of a repeated game) provide private-order enforcement and are relationships improving when agents can personally bargain about contractual terms and communicate discontent?
- Do company players offer price premiums to increase the self-enforcing range of the contract in highly uncertain environments?
- Who benefits from private enforcement and does trade in general become more efficient?
- In how far is contract performance associated with subjects' honesty preferences and their general guilt proneness?

The remainder of this article is structured as follows. Section 2 explains the experimental game and procedures. Section 3 derives our behavioral hypotheses. Section 4 presents and discusses the experimental results. The last section concludes.

2. An experimental approach to study behavior in contract farming arrangements

2.1 The contract farming game

Our experimental game comprises two marketing channels and, depending on the channel, five potential (decision) stages. These stages are guided by the conceptual framework in Barrett et al. (2012) to ensure that the game closely resembles a real contract farming arrangement. In each of the $T = 15$ trading periods, a player in the role of an agri-business company (*C*) purchases units of an agricultural product, and a player in the role of a farmer (*F*) sells her produce. The product is assumed to be of consistent quality. The two players may agree on a contract or alternatively use the local spot market for exchange.

(1) Pre-harvest phase: contract negotiation

In a first stage, C decides whether to offer F a contract for the purchase of q_h units of F's product. If so, she sets a contract price $p_c > 0$ per unit and the game proceeds to the next stage. In the second stage, *F* decides whether to accept or reject the contract. If *F* accepts, the contract is being concluded. If no offer is made by *C* in the first stage or if *F* rejects the contract offer in the second stage, both players go directly to the spot market, where they buy/sell at an exogenously determined spot market price p_{sm}.

After the above decisions have been made, both players observe in the third stage the per-unit spot market price p_{sm} determined by a computerized random device. As known to all subjects from the beginning, prices can take (integer) values between 1 and 7 (unless otherwise stated all prices are expressed in experimental currency units). As shown in table 1 a price of 4 is most likely, with a probability of 30 percent.

[Table 1 about here]

(2) Post-harvest phase: contract performance

After observing p_{sm}, in the fourth stage *F* decides whether to comply with the agreement and deliver to *C* or to sell to the spot market instead (side-selling). If *F* delivers, we proceed to the fifth stage, where *C* decides if she pays *F* the agreed-on contract price, p_c, or arbitrarily reduces this price by $p_{default} > 0$. If in the fourth stage *F* decides not to deliver, both *F* and *C* go to the spot market.

There are some additional features associated with the two marketing channels that influence the players' incentives and are crucial elements in real-world contract farming arrangements:

- *Contract*. To distinguish our game from other contract experiments, we introduce a special form of agreement frequently used in agricultural supply chains, the resource-providing contract. Each time a contract is formed *C* bears contracting costs of s and provides *F* with a loan c, which increases *F*'s production capacity from q_l to q_h (with $q_l < q_h$). The existence of this relationship-specific investment in the game is important, since it provides a strong motivation for *F* to accept a contract and enhances her production (as in many real-world arrangements). At the same time, it increases the risk that *C* has to bear. According to the agreement, c has to be paid back at the end of a trading period. If *F* breaches the contract, though, she also refuses to repay c.
- *Spot market*. Each time players use the spot market, they face transaction costs of k_C and k_F (with $k_C, k_F > 0$), respectively. For these costs it is irrelevant if the market is used directly or after non-delivery.

Figure 1 summarizes the timeline of events in our contract farming game.

[Figure 1 about here]

A player's profit is determined by her revenue minus costs and depends on several factors: the quantity sold/bought (smaller for F if no contract is concluded), the price received/paid (through the contract or on the spot market), whether the credit is paid back (i.e., whether *F* delivers her produce to *C* and thus, at the same time, repays the credit) and which marketing channel is being used (resulting in the associated transaction or contracting costs). For *C*, each unit of the purchased produce has a positive value of v (e.g., the marginal revenue when processing the good). The players' general profit functions are as follows.

Company player's profit:

$$\pi_C = \begin{cases} q_h v - q_h p_{sm} - k_C & \textit{if no contract} \\ q_h v - q_h p_c - s & \textit{if both perform} \\ q_h v - q_h p_{sm} - c - s - k_C & \textit{if breach farmer} \\ q_h v - q_h(p_c - p_{default}) - s & \textit{if breach company} \end{cases}$$

Farmer player's profit:

$$\pi_F = \begin{cases} q_l p_{sm} - k_F & \textit{if no contract} \\ q_h p_c - c & \textit{if both perform} \\ q_h p_{sm} - k_F & \textit{if breach farmer} \\ q_h(p_c - p_{default}) - c & \textit{if breach company} \end{cases}$$

In order to play the game in the laboratory, we have to assign parameters to the variables. Table 2 presents the list of all parameters and a brief explanation for a better overview.

[Table 2 about here]

Given these parameters, *C* always buys $q_h = 15$ units, while *F* can only supply this quantity with a contract and accordingly with a credit of $c = 10$. Without contract, *F* can only produce $q_l = 10$ units. In case a contract is offered and accepted, *C* bears the cost of contracting of $s = 10$. All prices per unit are integers and may range from 1 to 7. *C* can *ex post* reduce the contract price arbitrarily by 1 or 2 per unit. On the spot market, *C* faces transaction costs of

$k_C = 40$, whereas F's transaction costs equal $k_C = 10$. C values each unit of the purchased produce with $v = 12$.

Considering the above parameters, we can simplify the profit functions to make the different outcomes of the game easily comparable for both players.

Company player's profit: $$\pi_C = \begin{cases} 140 - 15p_{sm} & \textit{if no contract} \\ 170 - 15p_c & \textit{if both perform} \\ 120 - 15p_{sm} & \textit{if breach farmer} \\ 170 - 15(p_c - p_{default}) & \textit{if breach company} \end{cases}$$

Farmer player's profit: $$\pi_F = \begin{cases} 10p_{sm} - 10 & \textit{if no contract} \\ 15p_c - 10 & \textit{if both perform} \\ 15p_{sm} - 10 & \textit{if breach farmer} \\ 15(p_c - p_{default}) - 10 & \textit{if breach company} \end{cases}$$

We tried to design the stages of our model so as to resemble a real-world contract farming arrangement that yet is not too difficult to be played in the lab by non-experts. Unlike in many other studies, we deliberately use framing and introduce context to make the diverse associations about farmers and agri-business companies part of the experiment. Deploying realistic context, compared to the difficult attempt to eliminate it altogether, may boost the external validity of experimental findings (Loewenstein, 1999) and, not least, supports the subjects' intuitive understanding of the rather complex payoff functions. However, in the instructions and messages displayed on the computer screen we refrain from using strong normative terms, such as "breach", "default" or "perform", and frame decisions and actions neutrally to avoid demand effects.[1]

As mentioned earlier, the decisions are broadly guided by the conceptual framework in Barrett et al. (2012), but also by other academic and non-academic literature on contract farming that inspired and underpins the individual elements of our game. Among others, Rehber

[1] More specifically, we avoided their German equivalents and other terminology that comes with strong negative or positive associations. See appendix for the experimental instructions.

(2007) states that farmers oftentimes only have the option to accept or reject a contract; they have no say in determining conditions. Glover (1984), Key & Runsten (1999) and Masakure & Henson (2005) mention that credit provision, also in-kind, for investing in the farm and enhancing productivity is common and one major motivation for smallholders to participate in contract schemes. This is partly due to the high transaction costs that characterize input and output markets in many developing countries. If agents did not face such high transaction costs (as is the case for more standardized agricultural commodities), contracts would become redundant (Minot, 2007). Although the spot market prices and their probabilities are somewhat arbitrary in our experimental game, producers and processors do experience strong fluctuations also in real-world settings, exposing smallholders and agri-business firms to considerable price risk (MacDonald et al., 2004). Most importantly for the relevance of our experiment, previous empirical work has found strategic contract default from either party to be a frequent problem in contract farming arrangements (Glover, 1984; Minten et al., 2009; Swinnen & Vandeplas, 2010).

2.2 Conditions

Our experiment consists of three conditions that differ with respect to their nature of company-farmer relationships and potential private-order enforcement. First, with the short-term or **classical contract (CC)** we define a baseline as reference point for comparison with the private-order enforcement conditions. Farmer and company players are matched randomly in each period. The counterpart's identity is unknown and there is no possibility to observe past behavior. A subject may interact with the same partner again, but no one knows if and when this will happen. After each repetition (except for the last), a message on the computer screen reminds participants of the following random assignment. With this stranger matching protocol, reputational and relational effects are very unlikely and thus private enforcement mechanisms are largely absent.[2]

Second, we introduce a **relational contract (RC)**. In this condition farmer-company pairs remain steady over the $T = 15$ trading periods, i.e., the experiment is played as a repeated game and every player can observe the other's behavior in this ongoing relationship.[3] Unlike in Brown et al. (2004) and Wu & Roe (2007), relationships in our experiment are exogenous and players cannot change partners. With the spot market they do have an outside option, however, if they do not wish to interact with their particular counterpart.

Our third condition is a **direct bargaining (DB)** treatment. In terms of matching protocol, the DB equals the RC. However, we introduce the opportunity for a more personal relationship and dispute resolution. While rarely mentioned in the theoretical literature, the important role of direct bargaining and personal visits for contract enforcement is extensively discussed in the empirical literature (e.g., Fafchamps, 2004)—either as an *ex ante* mechanism of inspection and information gathering or an *ex post* method of conflict resolution. In our game, before a new period begins, *C* can opt for a "farm visit", which means that *C* and *F* can communicate for 120 seconds in an electronic chat room. Framing this action neutrally as a "visit" comes with the advantage that subjects are free in what they communicate about and we largely avoid demand effects. *C* decides if and when this free-form communication takes place, however it is restricted to one during the entire 15-periods game.

While a comparison between the CC and RC enables us to isolate the impact of relational contracting on contract formation, performance and profits, a comparison between the RC and

[2] Some informal enforcement mechanisms may work nonetheless. It is still possible for *C* to offer attractive contract conditions (we will return to this in section 4.2). If subjects in the CC condition comply in cases where contract breach would be beneficial for them, this may be due to, e.g., guilt-aversion or cognitive constraints (see also section 3.2). We will address guilt feelings and honesty in section 4.4.

[3] A limitation of our experimental setting is the finite horizon, *T*, for the long-term relationship, which is likely to produce endgame effects. To control for this, we will often re-run our analysis excluding the final period for comparison.

the DB outcomes helps to understand the additional effect of communication on the self-enforcement of contracts. An analysis of the behavior within the DB condition can reveal if this personal communication device can contribute to strengthening relationships and enforcing promises.

2.3 *Experimental procedures and implementation*

The experiment was carried out in the Göttingen Laboratory of Behavioral Economics in Germany between May and August 2013 and was computerized with the software package z-Tree (Fischbacher, 2007). For the recruitment of participants we used a university subject pool and the ORSEE system (Greiner, 2004). Consequently, the vast majority of participants are students.

Upon arrival, participants received the experiment's written instructions and they were read aloud to them. Subsequently, everyone went to a computer booth and individually answered questions to prove full comprehension of the different decisions and their consequences. Facilitators were on hand to assist with individual queries. Since the number of parameters is large and the payoff functions are rather complex, participants were required to perform several test calculations. Only after everyone had successfully completed the questionnaire, the actual experiment started.[4] The game was played for $T = 15$ trading periods either in the CC, RC or DB condition (between-subject comparison). Afterwards, a post-experimental questionnaire was administered, followed by the participants' individual cash payment. Company players earned EUR 0.01 for each currency unit they earned in the game, farmer players earned EUR 0.02 per currency unit.[5] Both additionally received a show-up fee of EUR 3. On

[4] We have good reason to believe that the level of understanding the game among participants was sufficiently high. In our post-experimental questionnaire, subjects were asked to rate the comprehension of instructions from 0 (very incomprehensible) to 10 (very comprehensible). The mean value in our experiment is 8.14.

[5] We did not want participants to leave the lab with large income differentials contingent on their role. Therefore, the different exchange rates are necessary when we intend to maintain the profit differences in the game. This, however, does not change the players' incentives.

average, a participant in the role of a company made EUR 16 in a session, a farmer player almost EUR 18 (the mean of EUR 17 equals about USD 23 at the time of implementation). A typical session lasted approximately 1.5 hours.

We implemented a total of eleven experimental sessions—five for the CC, three for the RC and three for the DB condition. In each CC session we had 20 participants, while each RC and DB session was attended by 24 subjects. Hence, we have a total of 244 participants with nobody attending more than one session. Each subject is randomly assigned the role of a company or a farmer player at the beginning of the experiment. There is the same number of company and farmer players in a session. With 72 subjects in the RC and DB, respectively, we obtain 36 steady pairs due to a partner matching protocol and thus 36 independent observations per condition. In the CC, however, we use a stranger matching protocol. Unbeknownst to the subjects, we divide a session into two matching groups, containing five company and five farmer players. Matching is only done within a matching group and there is no interaction between groups. By this means, we obtain ten independent observations for the CC.

3. Theoretical predictions and hypotheses

3.1 Subgame perfect equilibrium

To derive our first hypothesis, we determine the subgame perfect equilibrium (SPE) for risk-neutral, rational and selfish agents by backward induction. As participants know that this game has a finite horizon, we can apply the following predictions to every single repetition.

In the final stage, *C* chooses

$$max\{q_h v - q_h p_c - s, q_h v - q_h(p_c - p_{default}) - s\}.$$

Given that $p_{default} > 0$, *C* will always opt for breach and reduce the contract price by the maximum $p_{default}$.

Anticipating this, in the fourth stage, *F* only delivers if her profit from delivery and the following breach by *C* is at least equal to the profit from side-selling. That is,

$$q_h\big(p_c - max(p_{default})\big) - c \geq q_h p_{sm} - k_F.$$

Hence, delivery is guaranteed if the price difference satisfies

$$p_c - p_{sm} \geq max\big(p_{default}\big) + \frac{c-k_F}{q_h}.$$

For our specific parameters, *F*'s delivery constraint is thus

$$p_c - p_{sm} \geq 2,$$

which implies that *F* will comply with the agreement if and only if the contract price is at least 2 above the observed spot market price. Otherwise, she will sell to the spot market instead. Note, *F*'s transaction costs in case of side-selling and the credit non-repayment cancel each other out in this calculation.

In the second stage, *F* always accepts a contract since

$$max\big\{q_h p_{sm} - k_F, q_h\big(p_c - p_{default}\big)\big\} > q_l p_{sm} - k_F$$

with $q_h > q_l$. That is, *F* is always better off receiving the credit, increasing her production capacity from q_l to q_h and then reverting to the spot market (if more beneficial), than directly selling $q_l = 10$ in the spot market.

Considering all of the above, in the first stage, *C* chooses the maximum between her expected payoff without offering a contract ($q_h v - q_h p_{sm} - k_C$) and her expected payoff with contract (taking *F*'s responses into account). Solving this maximization problem for the optimal decision and the optimal choice of p_C is far from being trivial. This is why we provide a numerical solution for our specific parameters in table 3. Accordingly, C maximizes her expected profit if she offers a contract with a price of $p_c = 7$.

[Table 3 about here]

Standard economics hypothesis:

(i) Side-selling occurs if the farmer player's delivery constraint ($p_c - p_{sm} \geq 2$) is not satisfied. The company player, however, will always breach the contract reducing the paid price by the maximum $p_{default} = 2$ when the farmer player delivers.

(ii) Anticipating this, the company player offers the highest contract price of $p_C = 7$ at the beginning of the game.

3.2 Alternative behavioral predictions

The predicted SPE of our stage game theoretically holds true for all repetitions and conditions. Economic theory also starts from the premise that personal communication is merely "cheap talk" and does not change the equilibrium, as promises are not enforceable and both players know that. This, however, does not mean that we in fact expect real subjects to behave that way if selfishness and complete rationality are not common knowledge and if we allow for relational and reputational effects. It remains an empirical question, how long-term relations and personal communication for direct bargaining and coordination influence contract performance, prices and (as a consequence) players' profits.

That is, while our first hypothesis predicts a player's utility to solely depend on her immediate pecuniary payoff, we now consider additional indirect costs of breach and a more complex utility function based on the conceptual framework and notation by Fafchamps (1996; 2004):

$$U_i = \pi_i - G_i(\tau_i, \varepsilon) - P_i(\tau_i, \varepsilon, \theta) - EV_i(\tau_i, \varepsilon) - EW_i(\tau_i, \varepsilon)$$

where $i \in \{C, F\}$, π_i is the player's immediate monetary payoff, G_i the cost of feeling guilty, P_i coercive action, e.g., by state institutions, EV_i denotes the suspension of future trade with this trading partner, and EW_i the damage to the offender's multilateral reputation. These indirect costs depend on the player's type τ_i and the state of nature ε. Coercive action by the state is additionally contingent on the form of contract θ. This general formula, holding for virtually all contractual relationships, can be simplified for our experimental conditions. While third-party coercion P_i is considered impossible (and thus zero), we can also ignore EW_i as former behavior is not observable to players other than the one trading with. In the CC, even EV_i becomes zero. As ε can be considered constant[6], a player i in our contract farming game will maximize her expected utility with respect to π_i, $G_i(\tau_i)$ as well as—in the RC and DB condition—$EV_i(\tau_i)$, contingent on her type τ_i (unscrupulous/honest).

Thus, departing from the standard theoretic predictions, we believe that private enforcement through relational contracts generally works here by influencing the subjects' utility from trade. Previous studies have found that subjects consider the "shadow of the future" and care about their bilateral reputation in contractual relations (e.g., Gächter & Falk, 2002). We build on this literature, investigating whether repetition is a sufficient condition for relationships to work well and analyzing the magnitude of such effects in our contract farming experiment. We expect the direct bargaining communication—by personalizing exchange and facilitating coordination—to further strengthen relationships (e.g., Ben-Ner & Putterman, 2009). If a company player can credibly show that she will pay the offered price, the rate of side-selling could be lowered and both players may move to a more cooperative equilibrium. Hence, we expect to observe fewer dysfunctional relationships and less contract breach in the DB condition.

[6] We interpret ε here as a measure of, e.g., the occurrence of a negative production shock. However, ε does not refer to the stochastic spot market price. While also being an element of the trade environment, spot market prices can be understood as opportunity cost of an agreement and do not influence the ability to comply with the contract terms (only, perhaps, the willingness).

Furthermore, some of the literature emphasizes that contract parties can use price premiums to make agreements self-enforcing if other mechanisms are absent (e.g., Swinnen & Vandeplas, 2011). We hypothesize that this endogenous enforcement device will be used by company players, in particular in the absence of other private-order enforcement mechanisms.

Private ordering hypothesis:

(i) In the RC and DB condition contract breach from either party can be significantly reduced relative to the CC. Moreover, the DB outperforms the RC as it provides additional opportunities for private-order enforcement.

(ii) The offered contract price in the CC is higher than in the other conditions, as in the absence of other private-order enforcement mechanisms company players offer price premiums to extend the contract's self-enforcing range.

4. Experimental results

4.1 Contract breach and the effectiveness of private ordering

Opportunistic contract breach by farmer players (side-selling) is expected to depend on the contract price-spot market price difference (henceforth CSMD). According to our standard economics hypothesis farmer players breach if the CSMD is smaller than 2. Contract default by the company, in turn, does not depend on other factors and reducing the price by the maximum ($p_{default} = 2$) is a dominant strategy.

Side-selling. On average, side-selling occurs in 44.6 percent of concluded contracts[7] in the CC, in 27.6 percent in the RC and 26.3 percent in the DB. Also, figure 2a suggests that side-selling is significantly more frequent in the CC compared to the RC (*p* = 0.0739) and the DB

[7] A contract was offered on average in 82.5 percent (CC), 83.9 percent (RC) and 81.9 percent (DB) of all trades. These differences are not significant using non-parametric Mann-Whitney U tests. Contract acceptance rates are 94.2 percent (CC), 91.2 percent (RC) and 97.1 percent (DB). Differences between DB and the other conditions are significant on the 5-percent level. The CC–RC difference is not significant statistically.

(p = 0.0427).[8] That is, long-term relationships seem to mitigate contract default from farmers' side in our experiment. However, the possibility for direct bargaining has no additional effect (RC–DB difference: p = 0.8611). This does not change if we exclude the final period from the analysis.

[Figure 2 about here]

Over the 15 periods, there is no clear trend of increasing or decreasing levels of side-selling. Rather, we observe many ups and downs, which are associated with the volatile spot market price and the resulting changes in the CSMD. In the RC and DB condition, side-selling increases towards the end of the game when the relationship becomes less valuable given the weaker "shadow of the future".

However, the positive effect of the long-term relationship on side-selling is likely to be underestimated here. As we will discuss in the next section, the offered mean contract price in the CC is significantly higher than in the RC and DB and side-selling is indeed strongly contingent on the CSMD. This price difference is on average 1.23 in the CC and only 0.18 in the RC (p < 0.0001) and 0.48 in the DB (p = 0.0004). Consequently, we need to apply regression analysis to control for price differences and obtain the real treatment effects.

The first part of table 4 summarizes the results of different probit regression models with *Side-selling* as the dependent variable, which takes the value of 1 if the farmer player breaches the contract and 0 otherwise. The results show that side-selling is significantly more likely in the CC relative to the other conditions. There is no additional treatment effect of the DB, though, suggesting that the long-term relationship is the mechanism at work here. The coefficient of *Period* is positive and significant in all estimated models, indicating that farmer players become less reluctant to breach over time. Column (1) reveals that a farmer player is much

[8] Unless otherwise stated, significance levels refer to two-sided, non-parametric Mann-Whitney U tests based on the session means of all independent observations (i.e., steady pairs or matching groups).

more likely to breach if she suffered from breach by the company player in the previous round (*Lagged breach experienced*). The impact of the difference between contract and spot market price (*CSMD*) is negative and highly significant, as expected. This negative relationship is particularly strong in the CC compared to the other conditions, as contract breach here does not depend on relational and reputational factors, but rather on a pure profit calculus. Interestingly, higher contract price levels generally result in more side-selling. This implies that, holding all other variables (including price differences) constant, the probability of delivery increases with a lower level of offered contract prices.

[Table 4 about here]

As hypothesized in section 3.2, rational and selfish farmer players, expecting the company player to reduce the price by the maximum, will sell to the spot market when the CSMD is below 2. To assess whether farmer players in the experiment consider their delivery constraint, figure 3 displays side-selling as the share of all concluded contracts subject to a certain price difference. Results show that only 55 percent of the farmer players in the CC breach the contract when the CSMD is positive and below 2; in the RC and DB this share is even lower at 17 and 15 percent, respectively. The design of our experiment does not allow to disentangle whether this is due to the farmer players' own dislike of breach, reputation concerns or expectation of how the company will behave in the final stage. But based on our data we can conclude that even in the CC, side-selling is not as frequent as predicted by standard theory.

[Figure 3 about here]

Payment reductions. In the CC, company players are somewhat reluctant to breach during early periods, but almost always reduce the paid price in the second half of the experiment (figure 2b). On the average, they pay 1.65 currency units less than promised. In the RC and DB, subjects behave much more in favor of the relationship, although default still occurs—

particularly in the end, when the value of the relationship tends to fall. Company players reduce the price, on average, by 0.46 in the RC and by 0.53 in the DB in the case of delivery.

As for side-selling, the CC–RC (p = 0.0033) and CC–DB differences (p = 0.0047) are significant, but no additional effect from the direct bargaining communication can be found (RC–DB difference: p = 0.8375). The same picture holds if we exclude the final period from the analysis. Accordingly, company players' breach can also be significantly reduced in long-term relationships.

Probit regression analyses with payment reductions as the binary dependent variable shed more light on what determines the company players' behavior. The second part of table 4 reveals that in all estimated models the occurrence of payment reductions can be decreased in the RC and DB condition relative to the CC, but without an additional treatment effect of the DB. Furthermore, company players' breach slightly increases over time and with rising contract price levels. As for farmer players, a bad experience in the previous period increases the probability of own contract breach significantly (even though the farmer player delivered in the current period). Interestingly, the coefficient of *CSMD* is always positive and significant, indicating that company players are also more likely to breach with an increasing difference between contract and spot market price—even though theoretically the CSMD should not influence their decision. Apparently, we do not only observe strategic default, but also what we interpret as "emotional contract breach": In case of a large positive price difference, company players realize that they could have earned more without an agreement and that the farmer is the main beneficiary of the contract arrangement. As a consequence, they can justify reducing the price arbitrarily (presumably feeling less guilty).

The aggregated results in figure 2b as well as the probit estimations in table 4 treat payment reductions as a binary variable, taking the value of 1 if the company player reduces the paid price (regardless of by how much) and 0 otherwise. According to the subgame perfect equilibrium, the company player will always reduce the payment by the maximum amount of 2, and if a company player considers reputational effects or feels guilty when reneging, she should not breach at all. Indeed, as can be seen in figure 4, across all conditions only a small share of payments is reduced by 1 currency unit, whereas in most of the cases either a zero or a maximum reduction is chosen.

[Figure 4 about here]

Direct bargaining and conflict resolution. Before we turn to the analysis of contract terms, we address the question of why the direct bargaining communication did not additionally improve contract compliance at the aggregate level as expected by our private ordering hypothesis. In the empirical literature, direct bargaining and personal visits are considered one method for contract enforcement, preventing and resolving contractual disputes when public enforcement institutions are weak as is often the case in developing countries (McMillan & Woodruff, 1999a; Bigsten et al., 2000; Fafchamps, 2004). One potential answer to this question can be found in figure 5, which not only depicts the timing of communication, but also the number of company players who did not contact their counterpart at all. We can see that most chats take place within the first periods of the experiment and the number declines in later rounds. This choice indeed makes sense when company players hope to positively influence as many upcoming game periods as possible. Surprisingly, in one-third of the DB relationships no communication took place at all. This is particularly astonishing as communication did not entail any direct costs in the game. Apparently, some company players did not regard one-time communication as a promising means for consolidating the relationship and coordinating exchange.

[Figure 5 about here]

In fact, a closer look at those relationships in which a personal contact was established shows that the effectiveness of communication for reducing contract breach is limited. Comparing the level of contract breach before and after the chat reveals that no significant decrease of side-selling could be achieved ($p = 0.2059$, Wilcoxon signed-rank test). For company players, default even increases after the communication due to the endgame effect in the DB ($p = 0.0606$, Wilcoxon signed-rank test). The latter finding vanishes when we exclude the final period, but a significant impact in the expected direction is not observable for either type of player. However, when we distinguish well-functioning and rather dysfunctional relationships (see section 4.3 and table 6), it is striking that in all well-functioning relations in the DB the company player opted for a chat at a certain point throughout the experiment. We thus can reject the conjecture that individuals refrained from communicating because their trading relationship was already functioning well.

Result 1: *In the CC condition, side-selling is not as frequent as predicted by our standard economics hypothesis. In contrast, payment reductions tend to occur in almost every transaction.*

Result 2: *Contract breach from either side can be significantly reduced by relational contracts, reflecting a repeated game effect. Surprising is, however, that the additional direct bargaining communication does not improve contract compliance. In addition, for one-third of the company players communication did not represent an attractive option.*

Result 3: *We find evidence that company players' default is not only strategic, but also "emotional", i.e., the probability of an opportunistic payment reduction increases with a larger difference between contract price and spot market price.*

4.2 Price premiums as enforcement mechanism

In all three conditions, average contract prices offered by company players are well below the price of 7 suggested by the subgame perfect equilibrium (figure 2c). In the CC, company players offer 5.15 on the average, which is significantly higher than the contract prices of 4.30 offered in the RC ($p = 0.0001$) and 4.57 offered in the DB condition ($p = 0.0016$). Furthermore, the RC–DB difference is also significant at $p = 0.0153$.

One potential explanation for the higher contract prices offered in the CC is that company players know they can "allure" farmer players with an attractive contract price (i.e., an efficiency premium) and thereby increase the probability of delivery. This is in line with the literature on price premiums in agricultural value chains, arguing that "(m)aking the contract self-enforcing by paying [or offering] an efficiency premium is a rational strategy for the buyer, as it can earn him a better payoff than her outcome when being held up, or upon contract breakdown" (Swinnen & Vandeplas, 2011). As we have shown in the previous section, company players in the CC are also more likely to reduce the price in the end. In the RC and DB condition, in contrast, subjects rather try to stick to what they promise—and thus promise less—in order not to sour the relationship. In fact, once we compare the actual contract prices paid at the end of the period (after potential payment reduction by the company player), we do not find a significant difference between the average price paid in the CC (3.87) and those paid in the RC (4.03) and DB (4.13)[9]. Only the RC–DB difference is significant at $p = 0.0903$. This supports the interpretation that high-price offers in the CC are used as an "allurement tactic" to increase the probability of delivery, given that company players can later breach the contract without fearing consequences.

While all average contract prices are substantially below the maximum, we do find that in the CC and RC prices are rising over time, indicating that company players tend to learn that it is rational to offer higher prices. Wilcoxon signed-rank tests comparing mean prices in periods 1–7 with mean prices in periods 8–15 reveal significant price increases in the case of the CC and RC conditions (CC: $p = 0.0069$; RC: $p = 0.0056$; DB: $p = 0.9037$).

[9] This only takes into account those trades in which a contract was formed and the farmer delivered to the company player.

In the DB somewhat different dynamics are at work and the average contract prices offered do not display a similar increase over time. We believe that this—as well as the higher average contract price offered in the DB relative to the RC—can be ascribed to the direct bargaining communication. As discussed above, most chats were conducted in an early period of a session, providing the opportunity for early coordination and bargaining. During these chats, subjects often tried to negotiate a certain contract price and promised to mutually comply.[10] As a result, the offered prices are already relatively high in the beginning, but do not grow over the course of the game.

Result 4: *In a highly uncertain environment where no relational and reputational capital can be accumulated, company players offer price premiums to increase the contract's self-enforcing range. However, this is only an "allurement tactic" as they do not pay the premium in the end.*

4.3 Who (potentially) benefits from private-order enforcement?

On the average, the profit per period earned by company players amounts to $\pi_C = 82.95$ in the CC, $\pi_C = 89.26$ in the RC, and $\pi_C = 88.40$ in the DB condition. These differences are, however, not statistically significant according to non-parametric tests. This result does not change when we exclude the final period from the analysis.

Table 5, column 1 presents results from a regression analysis taking into account all possible trades. The results reveal that company players generally earn more in a contractual relationship and when long-term relations are possible. Moreover, profits slightly decrease over time. Taking only those trades into account in which contracts were concluded (column 2), we see that company players' profits are by far lower in the CC, as side-selling occurs significantly more often under this condition than in long-term contractual relations. There is no additional treatment effect associated with the DB. Companies' profits increase with a rising CSMD

[10] An overview of all chat messages will be provided upon request.

(again because of the self-enforcing effect). This influence is smaller in the RC and DB, albeit still positive, since here also other mechanisms besides short-term price incentives apply.

[Table 5 about here]

For farmer players, relational contracts seem to have no general positive effect. On the average, they earn $\pi_F = 48.61$ per period in the CC, $\pi_F = 48.51$ in the RC and only slightly more in the DB condition ($\pi_F = 50.69$). As for company players, these differences are not significant using non-parametric tests. This may seem surprising as contract breach by the company player can be significantly reduced in long-term relationships. However, as shown above, prices actually paid to the farmer players in the end do not significantly differ between the CC and the other conditions. Yet, farmer players in the RC and DB are more reluctant to breach and go to the spot market, in cases where this would be more profitable.

The regression results in table 5 confirm our non-parametric test results. We find no statistically significant differences between conditions considering all trades (column 3). The coefficient of the *Contract-dummy* is large and significant as farmer players (by design) earn much more when a contract is formed. Looking only at the trades in which a contract was concluded (column 4), we even find that farmers earn slightly more in the CC compared to the long-term contracts. Profit is marginally rising over time, and a higher CSMD is associated with lower farmer profits, although the latter finding is only significant at the 10-percent level.

Regarding joint profits, we find that efficiency slightly increases with the opportunity for more private ordering. While both players together earn $\pi_C + \pi_F = 131.56$ per period in the CC, they obtain $\pi_C + \pi_F = 137.77$ in the RC and $\pi_C + \pi_F = 139.08$ in the DB, on the average. These differences are not statistically significant and only the CC–DB difference becomes significant (p = 0.0984) when we exclude the last period from the analysis to control for endgame effects.

The regression results in table 5 (column 5 and 6) depict that long-term relationships do lead to significantly higher efficiency—unlike non-parametric tests suggest—once we control for other factors. This holds true for all trades, and even more so when only considering trades in which a contract is concluded. Again, we cannot identify an additional treatment effect for the DB. In general, contracts are associated with higher efficiency in our experiment, which is mostly due to the experiment's design (column 5). Over time, joint profits slightly decrease (as contract breach increases). Also, *CSMD* is positively correlated with joint profits, as a higher price difference reduces side-selling and joint profits are largely determined by company players' payoffs. Analogous to company players' profits, the positive influence of CSMD is greater in the CC (column 6).

Concluding this section on profits and efficiency, table 6 offers a comparison of well-functioning and dysfunctional relationships in our partner matching conditions. The categorization of relationships is based on the definitions stated in table 6. We find that both players, company and farmer, in well-functioning relations earn significantly more than their peers in rather dysfunctional ones, although there is no significant difference in the offered contract prices between well- and less functioning partnerships (RC: $p = 0.8732$; DB: $p = 0.3792$). We further see that not even one-third of the relationships in each condition can be considered well-functioning and, in particular, the DB did not substantially increase this share. It is somewhat unexpected that the opportunity for more coordination and more personal relationships, the direct bargaining communication, was not useful (or was not used) to build better functioning relations.

[Table 6 about here]

The large number of dysfunctional relations may also be due to the quasi-locked-in situation. Unsatisfied subjects cannot switch to other contract partners since our game does not provide a competitive market for contracts with different potential buyers or sellers as, for instance, in

Brown et al. (2004). In the real world, companies have a larger pool of farmers with whom to contract and thus may replace reneging producers in the long run for more reliable suppliers.

Result 5: *Both players earn more within a contractual relationship (which is also due to the experimental design). In our setting, where both players may breach a contract, the company player alone can skim off the benefits from private-order enforcement.*

Result 6: *Both players benefit from well-functioning relationships that are characterized by high contract formation and compliance rates, compared to dysfunctional or short-term relations. However, most subjects do not sacrifice short-term profits on behalf of long-term benefits, challenging the theory of self-enforcing contracts.*

4.4 Compliance, guilt proneness and preferences for honesty

As discussed in the beginning of this article, besides (the fear of) retaliation and the use of third-party contract enforcement, honest behavior and order can also originate in the moral norms within a society and the offender's "cost" of feeling guilty (i.e., first-party enforcement). Platteau (1994) argues that a generalized morality may reduce enforcement costs, and moral norms largely determine the conditions under which honesty is likely to be established and sustained. Hence, besides the potential mechanisms for private ordering incorporated in the different conditions in our experiment, moral norms internalized by the subjects (and learned outside the lab) may explain part of the compliance rate. According to Platteau, there are five such conditions that positively correlate with honesty:

(1) If many individuals generally prefer honesty.

(2) If they trust in others to prefer honesty as well.

(3) If this preference is not readily weakened by bad but strengthened by good experiences.

(4) If offenders are prone to guilt feelings.

(5) If honest individuals sanction offenders, even if they are not directly affected.

In the following, we empirically investigate Platteau's proposition and assess whether honesty in our experiment (i.e., compliance with a contract) is directly correlated with the conditions (1)–(5)[11]. While the dependent variable is based on our experimental data, information on the explanatory conditions is collected through a questionnaire. The questionnaire was administered to all subjects directly after the actual experiment and, among others, contained questions related to honesty preferences and guilt feelings. To increase the reliability of the answers, subjects were again reminded that the evaluation of the data would be completely anonymous. In addition, at the end of the questionnaire they were asked to indicate how honest and complete they would rate their answers. It was conferred that this statement would not affect their payment, but only help us to exclude unreliable observations.[12]

Table 7 displays the results of probit regressions for company and farmer players, respectively. In all regression models we control for cluster-correlated standard errors at the individual subject level. In addition to treatment dummies and other factors from the experiment that may influence contract breach or compliance (see model specifications in section 4.1), we now include questionnaire responses linked to Platteau's five conditions. We can see that the signs and significance levels of the explanatory variables generated in the experiment remain robust (compare section 4.1). Here, we thus focus on the discussion of the seven variables related to honesty and guilt.

[Table 7 about here]

The first variable, *Wallet*, refers to Platteau's condition (1), the individual preference for honesty. We asked subjects to imagine they find a wallet with money and an ID with the owners

[11] Unlike Platteau's argumentation, our investigation is based on the individual level. That is, we are not looking at breach or compliance rates within a session but at the behavior of a subject in a contractual situation, which deviates from Platteau's focus on "society" and breaks his conditions down to the micro level. Therefore, although the five conditions guide our investigation, it is not an evaluation of Platteau's theory in a strict sense.

[12] Subjects were asked to rate the honesty and completeness of their own answers from 0 (very dishonest/incomplete) to 7 (very honest/complete). From our analysis we excluded every subject with a score below 6, that is 13 subjects in total.

address in the streets and no one is around; what is the probability (0–100 percent) that they return the wallet including all money. For both types of players, coefficients are small and insignificant.

The second variable, *Contract breach*, refers to trust in the honesty of others. We asked participants whether they believe that the other participants breached a contract in the game whenever it was beneficial to them and they did not have to fear any consequences. The variable equals 1 if the answer is yes and 0 if it is no. For both players, we find a negative effect on contract compliance, as predicted by theory, but only for farmer players the coefficient is significant at the 10-percent level.

The variables *Negative influence* and *Positive influence* refer to condition (3). We asked subjects if they would break a rule more often (less often) if others in their environment would do the same. Again, both variables are dummies and take a value of 1 if the answer is yes and 0 if it is no. Interestingly, those who consider themselves to be vulnerable to negative influence were less likely to breach a contract in the game, which seems contradictory to theory. However, this is only significant in the case of farmer players. We do not find a significant effect of the variable *Positive influence* for either type of player.

Furthermore, we asked subjects to rate their level of guilt feelings in six fictitious but specific situations from 1 (not guilty at all) to 7 (very guilty). These situations range from canceling a meeting with friends using a false excuse to the theft of money. The variable *Guilt score* is simply the aggregate of these six ratings, without weighting the different situations. Our results do not show a significant relation between a subject's general susceptibility to guilt feelings and contract compliance in the experiment.

Finally, the variables *Sanctioning* and *Receive sanctioning* relate to condition (5). The first is a dummy taking the value of 1 if the subject was willing to anonymously and appropriately punish someone who finds the above-mentioned wallet and does not return the money, and 0 if she would refrain from sanctioning. The latter variable is the subject's expectation of receiving anonymous and appropriate punishment by others if being observed not returning the wallet (probability 0–100 percent). We find that company and farmer players who claim that they would punish dishonest individuals are more likely to comply with a contract in the game, which is significant at the 10-percent level. The regression does not show a significant relation between the breaching behavior in the experiment and the stated expectation of punishment by others.

Result 7: *There is only limited evidence that individuals' honesty preferences correlate with their contract performance in the experiment. We find no impact of the stated guilt proneness on contract compliance.*

5. Conclusion

In this article we have shown how real subjects behave in a contract farming experiment—in which a player is both trustor and trustee—and how behavior changes with the introduction of potential private-order enforcement via relational contracts and the opportunity for direct bargaining communication. Additionally, we investigate if buyers offer price premiums when lacking other formal and informal enforcement mechanisms, and whether contract compliance correlates with subjects' honesty preferences and their general guilt proneness.

We find only mixed evidence for our private ordering hypothesis. Not all of the above results ought to be repeated here, yet three findings are particularly remarkable from our point of view. First, long-term relations do indeed help to mitigate contract breach, but one-time communication or "visits" do not suffice to make them more personal and further improve cooperation. Hence, in respect of contractual self-enforcement, at least this kind of communication appears to be mere "cheap talk" and some subjects seem to anticipate that. Second, contract terms offered to farmer players are more favorable in an environment without reputational effects, but these premiums are not paid in the end. Third, the fact that well-functioning relations pay in the long run but were formed relatively rarely in our experiment does not support the proposition that an agreement readily becomes self-enforcing when short-term profits from reneging are smaller than the loss of future gains.

There is certainly much scope for future research to design new mechanisms and institutions for private (or public) ordering and test their effect on contract enforcement experimentally. In this context, the existence of producer organizations, intermediaries or different contract designs may represent interesting treatments. One variation of our study could be running sessions excluding the final stage (i.e., without possible breach by the company player). If the number of dysfunctional relationships is significantly diminished, compared to what we observe, a possible conclusion would aim at buyers' influential role in determining the outcome of contract farming arrangements and the necessity to police the payment process.

One issue with most laboratory experiments is their use of student subjects mainly from Western, educated, industrial, rich, and democratic backgrounds (usually referred to as the "WEIRD" problem). Future research may also take similar experimental designs to the field and run them in a developing country context with actual farmers. This should then allow deriving more applied policy recommendations to improve contract farming arrangements and the operation of agricultural value chains in practice.

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Figures and tables

TABLE 1.—Spot market prices and their probabilities of occurrence

p_{sm}	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Prob.	.05	.1	.2	.3	.2	.1	.05

TABLE 2.—Experimental parameters

Parameter	**Explanation**
$q_l = 10$	Produced (low) quantity by *F* without contract
$q_h = 15$	Produced (high) quantity by *F* under contract; demanded quantity by *C*
$p_c \in \{1,2,\ldots,7\}$	Price per unit set in the contract
$p_{sm} \in \{1,2,\ldots,7\}$	Spot market price per unit, stochastically determined
$p_{default} \in \{1,2\}$	Arbitrary payment reduction per unit by *C* after *F*'s delivery
$k_C = 40$	*C*'s transaction cost for purchasing on spot market
$k_F = 10$	*F*'s transaction cost for selling on spot market
$c = 10$	Credit provided by *C* to *F*
$s = 10$	Contracting cost paid by *C*
$v = 12$	One unit's value for *C* (revenue per unit)

TABLE 3.—*C*'s expected profits depending on contract price, spot market price and *F*'s predicted behavior

p_c \ p_{sm} *(Prob.)*	**1** (.05)	**2** (.1)	**3** (.2)	**4** (.3)	**5** (.2)	**6** (.1)	**7** (.05)	$E(\pi_C)$
1	105	90	75	60	45	30	15	60
2	105	90	75	60	45	30	15	60
3	155	90	75	60	45	30	15	62.5
4	140	140	75	60	45	30	15	66.75
5	125	125	125	60	45	30	15	74.5
6	110	110	110	110	45	30	15	84.25
7	95	95	95	95	95	30	15	84.5*
No offer	125	110	95	80	65	50	35	80

* highest expected profit for *C*

Notes: For the grey-shaded contract price-spot market price combinations, *F*'s delivery constraint is not realized, which indicates that she breaches the contract. Thus, *C*'s profit is contingent on the spot market price. In the non-shaded areas (excluding "No offer"), *F* is predicted to comply with the contract, and *C*'s profit thus depends on the contract price.

TABLE 4.—Probability of contract breach by farmer and company player

	Dep. variable: Side-selling				Dep. variable: Payment reduction			
VARIABLE	(1)	(2)	(3)	(4) (3) without last period	(5)	(6)	(7)	(8) (7) without last period
CC-dummy	.463** (.205)	1.130*** (.199)	1.378*** (.182)	1.392*** (.190)	1.806*** (.256)	1.637*** (.244)	1.766*** (.304)	1.756*** (.310)
DB-dummy	–.035 (.210)	.100 (.230)	.052 (.207)	.057 (.212)	.191 (.243)	.098 (.249)	.148 (.244)	.161 (.253)
Period	.025* (.015)	.053*** (.010)	.058*** (.010)	.050*** (.012)	.043*** (.016)	.046*** (.013)	.047*** (.013)	.040*** (.014)
Contract price	–.055 (.086)	.108** (.051)	.149*** (.056)	.153** (.063)	.178 (.127)	.251** (.121)	.253** (.123)	.273** (.123)
Lagged breach experienced	1.904*** (.219)				1.300*** (.217)			
CSMD	–.615*** (.072)	–.580*** (.048)	–.415*** (.053)	–.405*** (.055)	.215*** (.061)	.195*** (.048)	.233** (.094)	.249*** (.089)
CSMD × CC-dummy			–.456*** (.079)	–.455*** (.082)			–.091 (.164)	–.111 (.158)
CSMD × DB-dummy			–.062 (.086)	–.061 (.086)			–.050 (.142)	–.068 (.136)
Constant	–1.478*** (.414)	–1.556*** (.266)	–1.729*** (.292)	–1.714*** (.309)	–2.296*** (.589)	–2.280*** (.554)	–2.334*** (.587)	–2.394*** (.581)
N	795	1425	1425	1340	764	939	939	894
Pseudo R^2	.411	.278	.301	.298	.455	.362	.363	.360

Notes: Table shows results for probit regressions; RC is the omitted condition; robust standard errors (in parentheses) are adjusted for clustering at the independent observation level; *** indicates significance at 1%, ** significance at 5%, and * significance at the 10% level

TABLE 5.—Determinants of profit (in one period)

	Profit company		Profit farmer		Joint profit	
VARIABLE	(1) All trades	(2) If contract	(3) All trades	(4) If contract	(5) All trades	(6) If contract
CC-dummy	–6.419*** (2.164)	–23.082*** (3.220)	–.199 (1.495)	3.610** (1.780)	–6.618*** (1.785)	–19.472*** (2.435)
DB-dummy	–1.113 (2.637)	–3.316 (3.942)	1.458 (1.551)	2.126 (1.881)	.346 (2.345)	–1.190 (3.149)
Period	–.552*** (.170)	–1.088*** (.173)	.133 (.092)	.281*** (.100)	–.419*** (.112)	–.807*** (.122)
Contract-dummy	8.486*** (1.543)		24.228*** (.982)		32.714*** (1.140)	
CSMD		7.179*** (1.517)		–2.085* (1.196)		5.094*** (.677)
CSMD × CC-dummy		5.732*** (1.703)		–1.293 (1.323)		4.439*** (.729)
CSMD × DB-dummy		.867 (2.333)		–.279 (1.687)		.588 (1.069)
Constant	87.184*** (2.269)	98.688*** (3.018)	28.919*** (1.363)	52.547*** (1.543)	116.103*** (1.669)	151.235*** (2.457)
N	1830	1425	1830	1425	1830	1425
R^2	.028	.281	.283	.083	.319	.318

Notes: Table shows results for OLS regressions; RC is the omitted condition; robust standard errors (in parentheses) are adjusted for clustering at the independent observation level; *** indicates significance at 1%, ** significance at 5%, and * significance at the 10% level

TABLE 6.—Well- and less functioning relationships in the RC and DB condition

		well-functioning	**less functioning**	***p* value**
	DEFINITION	Contract formation ≥ 80 % Side-selling ≤ 20 % Default company ≤ 20 %	Contract formation < 80 % Side-selling > 20 % Default company > 20 %	
RC	Number of relationships	10	26	
	Mean profit company	100.67	84.87	0.0005
	Mean profit farmer	55.07	45.99	0.0225
	Mean joint profit	155.73	130.86	< 0.0001
DB	Number of relationships	11	25	
	Mean profit company	97.64	84.33	0.0020
	Mean profit farmer	57.18	47.83	0.0046
	Mean joint profit	154.82	132.16	< 0.0001

TABLE 7.—Probability of contract compliance including data on honesty and guilt feelings

	Dep. variable: Contract compliance	
VARIABLE	(1) Company player	(2) Farmer player
CC-dummy	–1.855*** (.289)	–1.093*** (.206)
DB-dummy	.087 (.234)	–.138 (.221)
Period	–.048*** (.013)	–.057*** (.010)
Contract price	–.215* (.120)	–.114* (.059)
CSMD	–.191*** (.053)	.623*** (.045)
(1) Wallet	.009 (.007)	–.0003 (.004)
(2) Contract breach	–.415 (.292)	–.697* (.397)
(3.1) Negative influence	.370 (.239)	.371** (.166)
(3.2) Positive influence	.287 (.252)	–.110 (.194)
(4) Guilt score	–.015 (.017)	.014 (.013)
(5.1) Sanctioning	.391* (.218)	.289* (.168)
(5.2) Receive sanctioning	.003 (.004)	–.002 (.003)
Constant	1.305 (1.028)	1.718*** (.647)
N	886	1366
Pseudo R^2	.420	.316

Notes: Table shows results for probit regressions; RC is the omitted condition; robust standard errors (in parentheses) are adjusted for clustering at the individual subject level; 13 subjects are excluded here as they indicated a low level of honest and complete answers; *** indicates significance at 1%, ** significance at 5%, and * significance at the 10% level

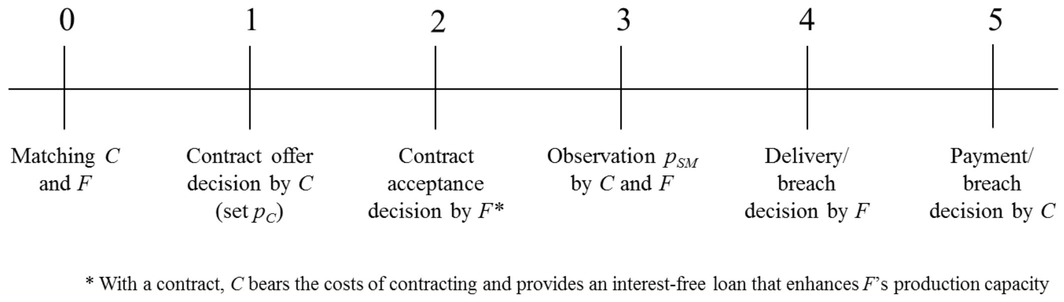


FIGURE 1.—Timeline of events in the contract farming game

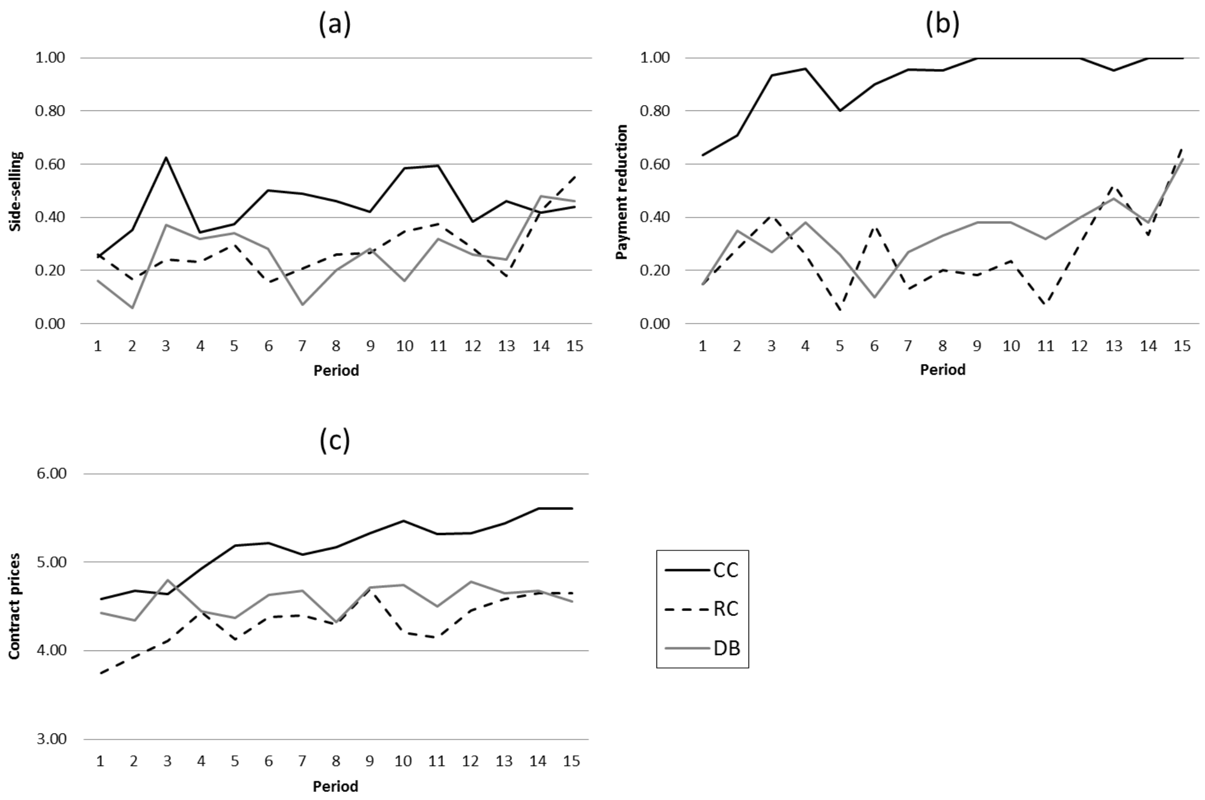


FIGURE 2.—Side-selling (as share of all contracts) by farmer players (a), payment reduction (as share of all payments) by company players (b) and mean contract prices offered (c)

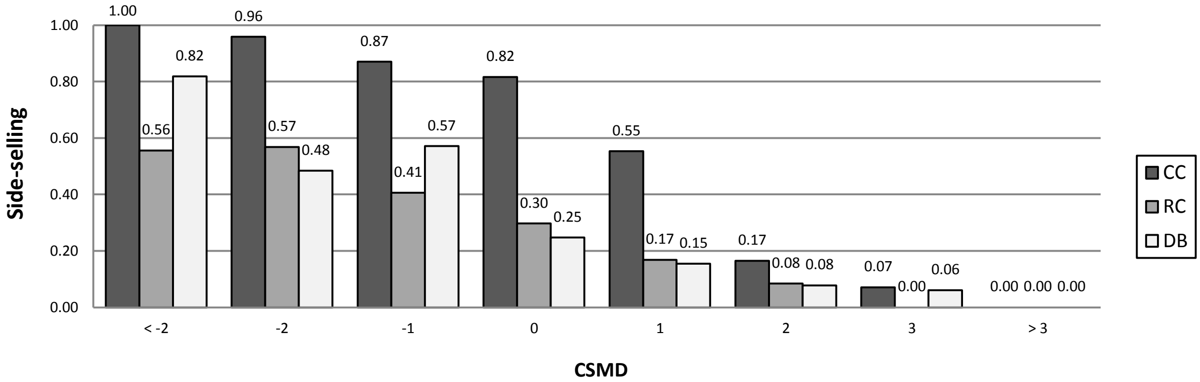


FIGURE 3.—Side-selling (as share of all concluded contracts) conditional on the contract price-spot market price difference (CSMD)

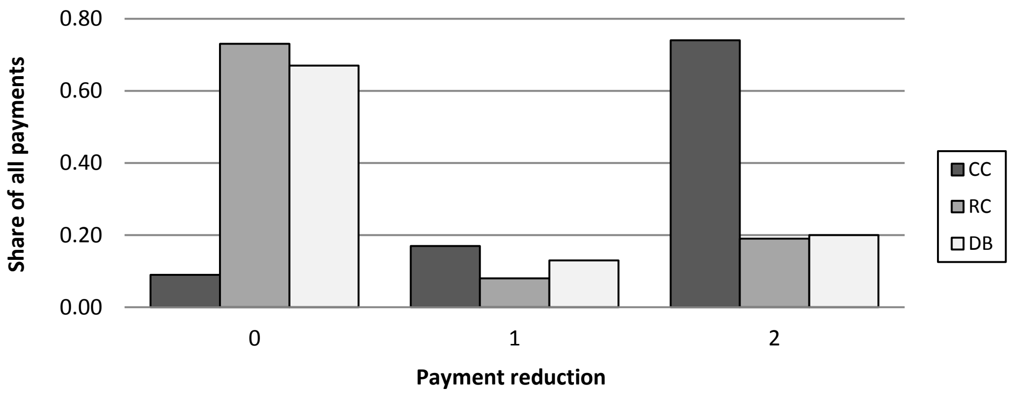


FIGURE 4.—Occurrence of different payment reductions (as share of all payments)

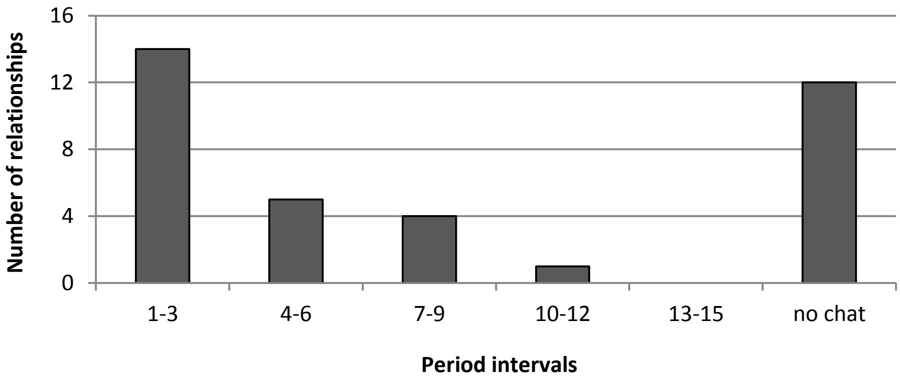


FIGURE 5.—Occurrence and timing of direct bargaining communication in the DB condition

Appendix: Experimental instructions*

We will play a game in which you make decisions and earn real money. How much you earn depends both on your own decisions and the decision of other players. Please do not talk to other participants until the experiment is finished.

In this game you are randomly assigned the role of a **farmer** or a **food company** that purchases agricultural products for processing. Each participant remains in his or her role until the end of the game. In each round, you will be randomly paired with one participant of the opposite role. Consequently, you do not interact with the same player in every round. All participants remain anonymous at all times.

The game consists of **15 repetitions** (periods).

Each period, the farmer produces a certain quantity of a good. The company purchases a certain quantity of the same good. Both have the opportunity to conclude a **contract** on production and trade, in which the company sets a contract price. If a contract is concluded, the company provides an interest-free loan to the farmer, which is invested and increases the farmer's production capacity. Alternatively, the farmer can sell on the **local market** and the company can purchase on this market. In that case, both depend on the stochastically determined market price and both pay so-called transaction costs for using the market.

The Decisions

In each period, the following decisions are made:

1. The **company** decides whether or not to offer the farmer a contract. If so, she sets a **contract price** she is willing to pay the farmer per unit. If no offer is made, both players directly go to the local market.
2. The farmer observes whether or not a contract was offered and, if so, the offered contract price. If an offer was made, the farmer decides about accepting the contract. In that case, the contract is concluded and the farmer increases her production capacity from 10 to 15 units. If she rejects, both go to the local market. There, the farmer sells 10 units, the company purchases 15 units.

* This document is an English translation of the experiment's German instructions used when running a session of the CC condition. The original version and the instructions of other treatments will be provided upon request.

3. The local market price per unit is determined stochastically. It can take a value between 1 and 7 ECU (experimental currency units), while the probabilities of the prices' occurence differ:

A price of **1 ECU** occurs with a probability of **5 %**.

A price of **2 ECU** occurs with a probability of **10 %**.

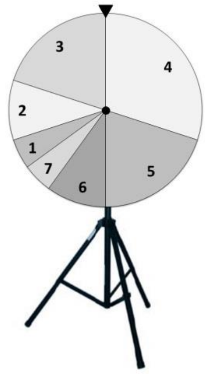
A price of **3 ECU** occurs with a probability of **20 %**.

A price of **4 ECU** occurs with a probability of **30 %**.

A price of **5 ECU** occurs with a probability of **20 %**.

A price of **6 ECU** occurs with a probability of **10 %**.

A price of **7 ECU** occurs with a probability of **5 %**.



4. Both players observe the determined market price. If a contract was concluded, the **farmer** now decides whether she **delivers the quantity** promised in the contract and repays the loan. Alternatively, she can sell everything (15 units) on the local market for the current market price. In that case, the company's loan is not being repaid.
5. If the farmer delivered the promised quantity, the **company** now decides whether she **pays the contract price** as agreed upon. Alternatively, she can reduce this price by 1 or 2 ECU.

For the company, each unit of the purchased good has a **value** of 12 ECU (for processing).

Is a *contract* concluded, the company bears the **contracting cost** (10 ECU) and grants the farmer a **loan** (10 ECU). The loan's repayment upon delivery is stipulated in the contract.

Does the company use the *local market*, she pays **transaction costs** of 40 ECU. Does the farmer use the *local market*, she pays transaction costs of 10 ECU. Here, it does not matter when a player uses the market.

The Payoffs

The **farmer's payoff** in one period consists of the following:

- For units she delivers to the company in accordance with the contract, she receives the contract price, possibly less the company's payment reduction.
- For units sold on the market, she receives the local market price reduced by the transaction cost (10 ECU).
- If she delivers in accordance with the contract, she repays the loan (10 ECU).

The **company's payoff** in one period consists of the following:

- She receives the value of 12 ECU for each unit she purchases (no matter where). Thus, in total she receives 180 ECU.
- For units delivered by the farmer in accordance with the contract, she pays the contract price, possibly less the payment reduction.
- For units purchased on the market, she pays the local market price and her transaction cost (40 ECU).
- If a contract is concluded, she bears the contracting cost (10 ECU) and grants an interest-free loan (10 ECU) to the farmer that is repaid if the farmer delivers.

After each period, farmer and company players are informed about their individual payoffs of the period just completed. Afterwards, a new period with a randomly assigned trading partner begins. On the computer screen, you will obtain an overview of the decisions made in previous rounds.

The game ends after 15 periods and you will get paid. Your total payment results from the ECUs earned in the game (exchange ratio: 1 ECU = 0.02 € for farmer players and 1 ECU = 0.01 € for company players) plus your show-up fee.

Thank you for your participation!