Experimental Protocol
Bargaining Power in Relational Contracts:
An Experimental Study
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Objectives

The purpose of the study is to explore the consequences for efficiency, cooperation and distribution of trade surplus of shifting power in relational contracts with different enforcement regimes through interventions such as the formation of a bargaining group for the side with less power (sellers) in a market where a group (buyers) has market power.

Theory previously developed in Cordero-Salas (2009) suggests that, depending on the enforcement regime, a shift in market power may not achieve better results for the weaker party because the stronger counterparty may no longer want to continue the relationship. However, such a collapse in good-faith execution of contracts in the light of such a power shift may not occur if other changes, such as the enforcement of some minimum payment for contract participation, take place. Then, following the predictions of this theoretical model we can test the next hypotheses:

H1: The highest quality should be requested in all contracts under all regimes.

H2: Seller deviation from contracted quality should be the greatest under regimes with no bargaining power (BP).

H3: Actual quality chosen should be the greatest under BP.

H4: Contracted price under complete regimes are higher than under incomplete regimes.

H5: Discretionary payments offered will be smaller under BP.

H6: Under BP sellers and buyers share rents more equally than under the other regimes in which seller rents are closer to their reservation payoffs.

H7: Increasing the bargaining power of sellers will reduce the length of trading relationships and total benefits created if no part of the contract can be enforced.

Background and Rationale

Existing literature has studied relational contracts under different enforcement regimes and bargaining power in separate settings. On one hand, literature has looked at market interactions and the existence of relational contracts under different enforcement conditions. Brown, Falk, and Fehr (2004, hereto referred to as BFF) use experimental economics to show how the absence of third party enforceability impacts the nature of market interactions including the initiation of contracts, formation of long term relationships, contract terms and how all these affect efficiency and the distribution of the surplus generated by trading. The experiment simulates firm-worker relationships and they implement three different treatments to test the endogenous emergence of long-term relationships.

Wu and Roe (2007, hereto referred to as WR) also use experimental economics to examine how the nature and efficiency of trade differs across different relational contracting environments. WR's model is based on a buyer-seller relationship, where the buyers offer a contract, which includes a price, P, and a level of quality, Q, to the seller. WR use the same design and implement two treatments from BFF. Additionally, they implement two incomplete contracting treatments in which buyers can adjust prices *ex post*. Theses papers are relevant to this research because they examine cooperation and long-term relationships under different contract enforcement regimes. However, in both papers, they maintain constant bargaining power across treatments. In essence they have an ultimatum game where firms (buyers) offer contracts to workers (sellers) who accept or reject. When a contract is reached parties move on to other stages of the experiments in which they decide to cooperate or not by meeting the contract terms.

On the other hand, two-party bargaining has been studied using experimental economics by implementing games such as the alternating offer game, in which one of the parties first makes an offer and the other party accepts or rejects. If the offer is accepted bargaining is over and each party received what was agreed. If the offer is rejected, the other party makes another offer but the value of any possible agreement shirks by a discount factor. If there is no agreement after several attempts then each player receives a reservation value. Ochs and Roth (1989) used experiments to test the predictions of a theoretical two-party bargaining game. In their design parties have to decide on the division of a pie of 100 chips and authors use different discount factors in the treatments to test theoretical predictions concerning the outcome. The mechanism used to implement bargaining in these experiments is directly related to this research. Though, they do not implement it in a contracting context in which there is enforcement variability.

This literature is relevant for the research question under study; however, literature regarding the effect of shifting bargaining power on relational contracting under diverse enforcement regimes is scarce. This paper will fill this gap and contribute to the literature by testing the hypothesis stated above where market power is shifted in the context of self-enforcing, relational contract theory.

Results from this research are significant because they will provide insight into the economic consequences of shifting market power in relational contracting to draw policy conclusions. Society at large will benefit by addressing issues related to the distribution of wealth and cooperation in market settings characterized by bargaining power imbalances in favor of a few participants and by informal institutions. In this context, it is highly likely that there will be uneven distributions of trading returns. Consequently, poorer households will achieve very little benefit from participating in these markets and may make perpetual the cycle of poverty and lack of upward mobility by not getting enough rents, with which households can use to accumulate wealth and make further investment. Then, this research will enhance social welfare by identifying the effects of policy interventions that attempt to balance market power and increase the remuneration in the markets for weaker parties. We anticipate experimental results to support the hypothesis stated above. A potential pitfall of experiments in economics is that the results found in a laboratory setting may not perfectly transfer to settings outside of the laboratory due to factors that are not replicable in the laboratory.

Research Design

Subjects will be recruited by email from a list of undergraduate and graduate students from a variety of majors at The Ohio State University. Sixteen subjects will participate in each experimental session. Each participant will receive a $5 show-up fee plus any additional earnings from the experiment. Each experiment is a repeated game of indefinite duration mimicking the theoretical model which is an infinitely repeated

game. That is, subjects play a game with an uncertain number of trading periods. Each experiment continues with a probability δ or terminates with a probability (1- δ), which is determined by a random stopping rule implemented in the program at the end of each trading period. Sessions have different duration due to the probability of termination. However, the experiment is designed so that each game within the same treatment is of equal expected duration. Then, each experimental session may be formed of one long-duration experiment or various short-duration experiments depending on the termination rule. All sessions will last between 120 and 150 minutes depending on the termination rule. The experiments are programmed using Z-TREE software (Fischbacher, 1999) and take place on networked computers enclosed in cubicles to avoid contact between subjects.

The basic experimental platform is based on the design of Brown, Falk and Fehr (2004) and Wu and Roe (2007). Some subjects will be assigned to be buyers and the others to be sellers. . Each buyer is randomly match with one seller, and each pair trade across an uncertain number of periods. Buyers offer contracts to sellers to trade one unit of a good of quality Q, and offer in exchange a compensation scheme that may include a base price, p, and a discretionary payment that depends on the quality delivered, $b(Q)$. Buyer earnings are increasing in quality and decreasing in the compensation scheme; the opposite occurs to seller earnings. In each trading period, subjects can only trade one unit of a good. The price and quality of the good traded will determine how much money each trading party makes during a trading period.

The study is a between-subjects experimental design that consists of 3x3 conditions that varies the bargaining power of sellers and the elements of the contract that are formally enforced. These nine treatments allow examining the consequences of shifting bargaining power in relational contracting in a market where buyers are accustomed to having all of the bargaining power. The three treatment conditions that simulate different enforcement regimes are:

1. Complete contracting enforcement (CE): all conditions of the contract (i.e. fixed component of payment, discretionary payment and quality) are exogenously enforced by the researcher.
2. Partial contracting enforcement (PE): only a fixed component of the payment is exogenously enforced; all other variables in the contract are not enforced.
3. Fully incomplete contracting enforcement (NE): none of the variables specified in the contract are exogenously enforced.

The three treatment conditions to test the shifting bargaining power are:

1. A control treatment (NBP), in which buyer have all market power and make take-it-or-leave-it-offer to sellers.
2. A bargaining treatment (BP):
    a. One that gives **equal** bargaining power (EBP) to sellers by implementing an alternating offers game in the negotiation stage of each trading round.
    b. One that gives **more** bargaining power (MBP) to sellers by implementing an alternating offers game in the negotiation stage of each trading round.

Sixteen subjects will be recruited for each experimental session. Subjects will arrive, check in, read and (if willing) sign the "Consent for Participation in Social and Behavioral Research" form. At check in they will be assigned a random ID number to preserve anonymity. Subjects who show up on time are told that they will receive a show-up fee of $5 payable at the end of the experiment. They will be also given the option of

playing a gamble in which they will get some percentage more or minus the show-up fee depending on the role of a die. Subjects can play the gamble or choose to collect the flat fee. The subject's decision regarding the gamble will reflect their financial risk tolerance, which is a key covariate that might influence their behavior in the trading game and should be collected to properly analyze results.

Each subject will be randomly assigned to a networked computer enclosed in cubicle and be told that they will participate in a computerized trading experiment. The details will be explained and the instructions are read aloud for both buyers and sellers. When instructions are read, subjects do not know whether they have been assigned to be buyers or sellers. Reading instructions will take approximately ten minutes. Subjects will answer a computerized control questionnaire formulated to test for subjects' understanding of the experiments. There will be no time limit imposed on subjects to answer the questions and all subjects will be expected to answer questions pertaining to both buyers and seller. Expected time of completion ranges from 5 to 15 minutes.

The sixteen subjects will be assigned randomly to be sellers or buyers and at this point in the experiment each subject's role is revealed. In addition, subjects will be matched in pairs formed by one seller and one buyer. Each subject has an identification number for the role (IDR), e.g. buyer 1, seller 5, which will be fixed during each contracting game allowing subjects to keep track of trading partners. Subjects will participate in two practice rounds in which no money is earned. Practice rounds have the purpose of familiarize subjects with the computer controls and screens. Therefore, subjects are expected to take longer to complete practice rounds relative to paying rounds.

After the practice rounds are completed, IDR numbers will be reassigned but each subject remains in the same role. The contracting game will start and each subject will receive a $5 balance in their account equivalent to 350 experimental points. Each contracting game will have an expected number of rounds equal to 5; however, because each experiment will end randomly following a predetermined termination rule, some experiments will be longer than others. If the experiment ends prior to the allotted time for the evening's session, then additional games will be played until the allotted time expires. For each new game, subjects will rematch with a new partner, but will maintain the same IDR number and the same role as buyer or seller. If the experiment is too long, subjects will be asked to come back another day to finish the experiment and will be paid an additional show-up fee. The contracting part of the experiment (including one long experiment or more short experiments depending on the case) will last between 60 to 90 minutes depending on the treatment run (excluding all other activities such as trial periods, instructions and payment).

All buyers face the same payoff parameters:

$$\pi_B = \begin{cases} 10Q - p - b(Q) & \text{if contract was concluded when first offered} \\ (1-\beta)\big(10Q - p - b(Q)\big) & \text{if contract was concluded when counteroffer} \\ 0 & \text{if no contract was concluded} \end{cases}$$

Likewise all sellers face the same payoff parameters :

$$\pi_S = \begin{cases} p + b(Q) - c(Q) & \text{if contract was concluded when first offered} \\ \beta\big(p + b(Q) - c(Q)\big) & \text{if contract was concluded when counteroffer} \\ 5 & \text{if no contract was concluded} \end{cases}$$

where $c(Q)$ denotes the cost of supplying quality for sellers and β is the bargaining power of the sellers. The outside option benefit of a seller who did not trade is 5 while for the buyer is zero. The set of feasible quality levels is given by $\{1, 2,3,4 , \dots \dots ,10\}$ and prices and bonus can be in the set given by $\{1,2, 3..30 \dots ,100\}$. The cost schedule for all sellers is given by $c(Q) = 5Q$ which is shown more specifically in table 1. Since the marginal cost of quality is 5 while the marginal revenue is always 10 then the efficient level of quality is given by Q=10.

Table 1
Cost of Quality Schedule

Quality	1	2	3	4	5	6	7	8	9	10
Cost	5	10	15	20	25	30	35	40	45	50

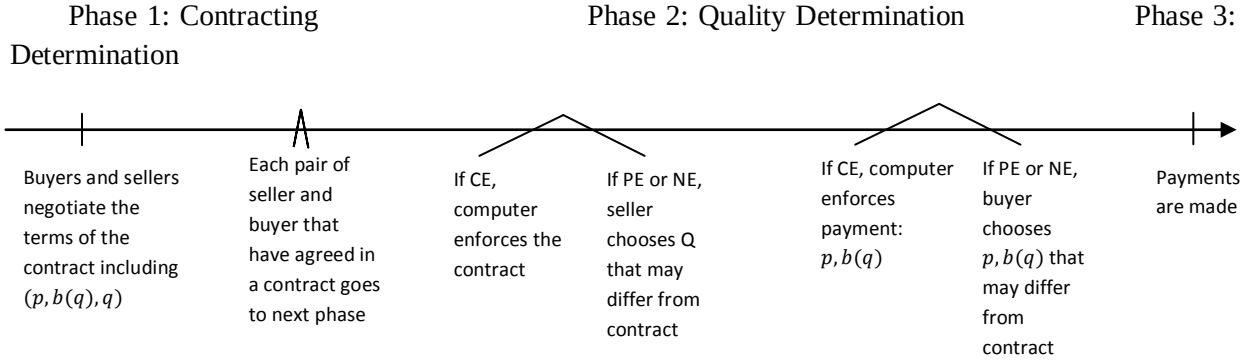
The beta value is equivalent to the discount factor in the alternating offer game with two potential offers (original offer and one counteroffer) which reflects the level of impatience of the player who counteroffer, i.e. sellers. If a buyer gets a counteroffer, he can accept but only receives the profits multiply by $1 - \beta$. However, he can go ahead and reject this counteroffer, and receive his reservation payoff.

Payoff functions, cost schedule, the beta value and the termination rule will be common knowledge. However, only the pair of traders involved in each transaction will be informed about the actual payoffs and quality level delivered.

At the end of each trading period, each participant will be informed about the contract $(p, b(q), q)$ he had concluded, about q delivered, his own payment, as well as about the trading partner's payoff and ID number. Subjects will have a sheet of paper available to write this information down to record own trading history.

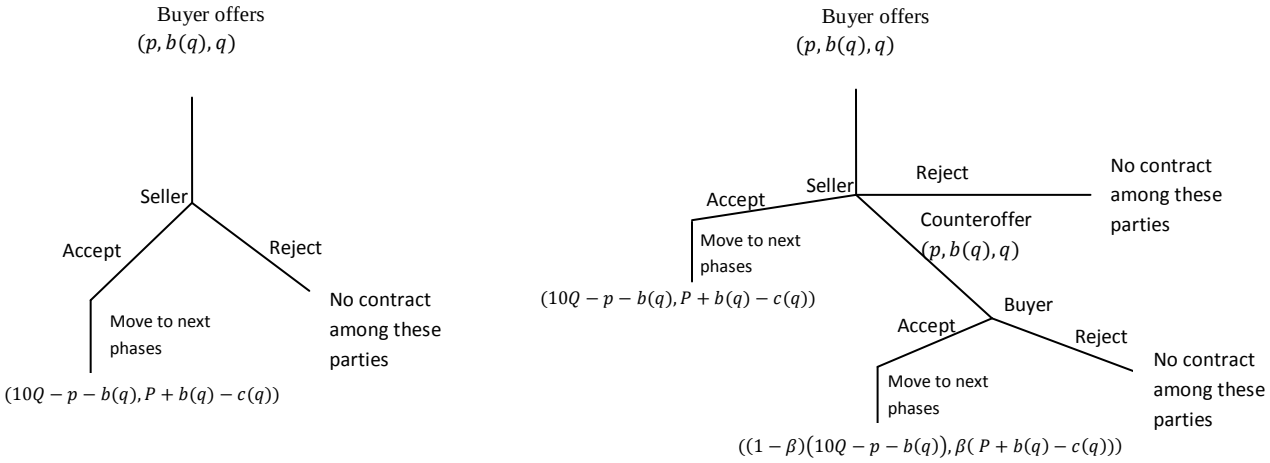
Each trading round in each experiment has three phases: negotiation, quality determination and payment determination. Figure 1 shows phases for all treatments. In the negotiation phase parties negotiate to reach an agreement about the terms of the contract including quality and a payment schedule. In either quality and payment determination phases, depending on the contract enforcement treatments, either the computer enforces some or all contract terms, or subjects have discretion on choosing some or all terms ex-post and that may differ from the contract previously agreed.

Figure 1: Stage game by phases for all treatments



The negotiation phase is different across NBP and BP treatments. Figure 2 shows the sequence of decisions for each treatment. In the NBP treatments (Figure 2a) buyers have all bargaining power by offering take-it-or-leave-it offers. Sellers can only accept the conditions or reject the contract. In this case buyers offer to a seller a contract that may include a desired quality of the good, *Q*; a price for the good, *P*, and a price adjustment, i.e. a bonus $b(Q)\ if\ q \geq Q$. Sellers must either accept or reject the contract as offered. If seller rejects the contract then there is no contract among those parties and therefore no trade between them. If seller accepts the contract, once the agreement is completed then they move to quality and payment determination phases. Depending on the treatment, all, some or none of the variables specified in the contract are enforced exogenously by the computer. If it is a CE treatment, the computer enforced all terms and payments are made. If it is a PE or NE treatment, then quality is discretionary and sellers can choose any quality from 1 to 10; *P* is binding under the PE and the computer will ensure that the price specified is paid, which ranges between 0 and 100; if it is NE then computer does not enforce *P*; after observing the quality buyers may choose to pay any bonus ranging from 0 to 100 if quality meets or exceeds desired quality. If quality falls below desired quality, and it is a NE treatment then buyer can pay a price below the one promised in the contract, which is equivalent to making an ex-post deduction in the price, $d(q) if\ q \leq Q$. Once this process is done, payments are made and each party receives profits shown in figure 2a.

Figure 2: Decision sequence in negotiation phase



2a: No Bargaining Power Treatments 2b: Bargaining Power Treatments

Under BP treatments sellers have some bargaining power given by the possibility of making counteroffers. In these treatments buyers offer a contract to his seller including all terms as treatments with no BP. But now, the seller has three possible options: (Accept, Reject, Counteroffer). If a seller rejects then there is no trade between those parties, and the buyer must wait until the next trading round to extend another offer to his seller. If the seller accepts, parties go to quality and price determination phases of the experiment in which the sequence is the same as the NBP treatments. If the seller decides to counteroffer, then this counteroffer goes back to the buyer but now payments are discounted by a factor β, which simulates the level of impatience of the seller and represents her market power. Then, the buyer will have two options: (Accept, Reject). If he accepts then parties move to next phases in the experiment and if he rejects then parties do not reach an agreement and the buyer has to wait until next trading round to offer new contracts to his partner. The seller

has also to wait to the next round to get another offer from his buyer. In both NBP and BP treatments a buyer can make only one offer to his seller.

After each trading period subjects in both roles are asked about if they are satisfied trading with his partner. Trading periods will start over again until the game ends following the termination rule. Once all games are over, subjects will be asked to complete an exit survey including some demographics and a social preferences questionnaire while experiment administrators determine subject payouts. Then, subjects will be paid in another room one at a time to preserve anonymity.

Additional Details

Sample: Each experiment will have five expected trading periods by using a termination rule of $\delta=4/5$ as the probability of continuation and $1-\delta=1/5$ as the probability of termination. Then, each experimental session will potentially have three experiments. Given that the number of buyers and sellers in each experiment is eight of each one, the total number of possible trades per round is eight. This translates into one hundred and twenty potential possible trades per experimental session. We want to enroll 112 subjects per treatment to run a total of 7 sessions per treatment. This number of subjects per treatment will allow us to ensure the ability to robustly test our hypotheses. One thousand and eight subjects will be enrolled for this purpose. We then multiply this number by 1.25 to allow for a 25% subject attrition rate. The final number is one thousand two-hundred and sixty subjects.

Measurement and Instrumentation: The treatment variables are the level of contract enforcement and the bargaining power of the parties. The former will be implemented by exogenously enforcing some or all elements from the contracts by the computer depending on the treatment. The bargaining power will be implemented using three conditions: $\beta=0$ in the no bargaining power treatments (NBP) and $\beta=0.5$ and $\beta=0.75$ in the bargaining power treatments (BP). These values will be included in the parameters of the profit functions in the experiments. The major research questions and hypotheses can be examined by comparing contract terms and market interactions across the NBP and the BP conditions. In addition, cooperation or long-term relations as an effective endogenous mechanism to enforce contracts can be tested by comparing the different enforcement treatment conditions, i.e., CE vs. PE vs. NE.

Detailed study procedures: Detailed procedures are described in the research design. To summarize, subjects will be recruited via email and will participate for a single experimental session (it may last two nights depending on termination rule of the experiment). Each subject will participate for up to 150 minutes and will receive monetary compensation in the form of a show-up fee plus an additional amount depending on each subjects decisions during the experiment. Subjects can withdraw from the study at any time if they decide to. Subjects will be assigned an ID number at the time of check in, and additionally will have a role ID number (IDR) which will be the one used in the experiment. Only the researcher and each subject will know the ID number and other subjects will not be able to identify other participants preserving complete anonymity. Personal information will be stored using ID numbers. Subjects will not face any unusual risk besides the normal ones of computer use. Playing a negotiation and trading game may cause some additional stress and anxiety, which is addressed by explaining to subjects that the information collected in the experiment is not attached to individual information. We also will highlight the possibility of leaving the experiment at any time. There is no threat of any economic loss for any subject. Each experiment will provide a starting balance

of $5 equivalent to 350 experimental points, so subjects do not need to use any own money, including their show-up fee, to participate in the experiment.

Internal Validity: The experiment is designed in a way that all other factors are remaining constant while only enforcement regimes and bargaining power are shifting. Bargaining power will shift for each case of contract enforcement so there is a control treatment for each control enforcement level to draw causal effect on the variables of interest from shifting bargaining power. The design also mirrors real-world situations where some parties have more bargaining power than other and trading occurs under different contract enforcement levels. However, external validity remains a challenge with any laboratory experiment as many factors in non-laboratory settings cannot be represented in the laboratory.

Data analysis: Descriptive statistics and inferential techniques will be used to analyze the data. Non-parametric tests such as Kruskal-Wallis test will allow testing difference of population medians among control and experimental treatments and Mann-Withney test will allow to test significance. Regression analysis that accommodates for repeated observations of the same subject will also be implemented for a more complete analysis.

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