An economic analysis of contract choice, feelings of entitlement and contract enforcement in relationships governed by incomplete contracts

Gerdis Marquardt

Doctor of Philosophy
Economics

THE UNIVERSITY
of EDINBURGH

2016

Declaration

I declare that this thesis was composed by myself and that the work contained therein is my own. No work by any other author has been used without due acknowledgment. This work has not been submitted for any other degree or professional qualification.

Gerdis Marquardt   Edinburgh, 2017

Acknowledgements

officemates for the many, many productive and at times painful hours spent together but also for the craziness and the fun we had over the years. I would like to thank Ibrahim Inal and Alessia De Stefani, with whom I have shared the joy and frustration of the PhD journey from the beginning; Julia Moertel with her infectious good mood, Mark Mitchell, Sikandar Singh Soin, Francesco Trevisan and Mory Clark for their moral support especially during the submission and viva period; and Nancy Arnokourou for always lending an ear. I owe Martina Vecchi for being an incredible friend, colleague, office and flatmate and for always having my back. All of them truly made my time in Edinburgh special.

For always being there for me from afar, I also would like to thank Magnus Wurm and Lars Zeigermann. I owe special thanks to Achim Ahrens, without whom I would not have had the courage to start a PhD and whose support over many years means a lot to me. Lastly, I would like to thank my family.

Abstract

The first chapter of this thesis considers a contractual principal-agent relationship in an unstable environment. The players are uncertain whether repeated interaction is possible. I examine the role that the deliberate choice of an incomplete (non-verifiable and unenforceable) contract plays in signalling stability and trust. In this model, contractors may privately observe shocks that force them to end the relationship after the current period. Complete (verifiable) contracts, which are assumed to be feasible, ensure cooperation in compliance with the contract. With incomplete contracts, the players make themselves vulnerable to exploitation by their partners. But if cooperation occurs notwithstanding, the contractors update their beliefs about each other's willingness to interact again. When the agent observes that her partner and herself are able to continue the relationship, she undertakes a non-contractible, mutually beneficial investment.

The second chapter is based on the theory by Hart and Moore (QJE, 2008) that regards contracts as reference points for feelings of entitlement. Parties' ex post performance depends on whether they receive what they feel entitled to, which is assumed to be the best possible outcome permitted by the contract. Consequentially, there exists a trade-off between contractual flexibility (agreement on a price interval) and rigidity (agreement on a single price). Hart and Moore do not analyse the role that third party contract enforcement plays for parties' feelings of entitlement, shading on performance and contract choice.

I demonstrate that Hart and Moore's results rely on a number of assumptions that can be challenged when incorporating litigation into the model. They assume that trade is voluntary but renegotiation is prohibited. I argue that either trade is voluntary but renegotiation is possible or courts compel parties to trade according to the contract. In the former scenario, fixed price contracts may not act as reference points and the parties feel entitled to the best possible outcomes from renegotiation. In the latter scenario, contracts may act as reference points because of the option of contract enforcement. However, potential flexibility incorporated in the contract is lost.

The third chapter provides an experimental examination of the effect of contract enforcement on contractors' reference points for feelings of entitlement. Previous experiments by Fehr, Hart and Zehnder (AER 2011) analyse and support the theory by Hart and Moore (QJE, 2008) that contracts are reference points. Both theory and experiments ignore the role of contract enforcement for contractors' feelings of entitlement. I replicate and confirm Fehr, Hart and Zehnder's baseline experiment. I also run an additional treatment in which buyers can offer sellers more or less favourable prices than specified in the contract, whereas sellers can request enforcement of contracts as written. I find that contract enforcement matters, without being invoked, for sellers' punishment behaviour through feelings of entitlement. Without explicit contract enforcement, flexible contracts (agreement on a price range instead of a single price) leave sellers feel entitled to the best possible price permitted by the contract. However, buyers rarely offer such a price which leads to disappointment and punishment. With the option of contract enforcement, sellers feel entitled to the price which the court would enforce, even if it is equally unfavourable than in the no court treatment. The presence of the court provides an outside validation for which prices are reasonable and thereby limits disappointment and punishment.

Lay summary

Contracts are inevitably incomplete and cannot perfectly describe and provide for all possible future contingencies. In the most extreme cases, contracts are so incomplete that courts (or other third parties) cannot enforce them because for example they do not recognise a claim or it is unclear what outcome to impose based on the (vague) contract. Other incomplete contracts may clearly define some obligations but leave others unspecified. In general, incomplete contracts leave room for disagreement and exploitation when the contracting partners cannot sue each other for breach of obligations. Many questions then arise, for example, of why agents go through the trouble of writing (incomplete) contracts, what the role of contract enforcing institutions is, how economic relationships can function and how agents behave under contractual incompleteness. This thesis examines some aspects of the effects of contractual incompleteness on bilateral relationships considering different circumstances and different restrictions on contractual completeness.

The first chapter deals with bilateral relationships in unstable environments. The agents are only able to contractually commit to trade today but not in the future. Contractors may experience a shock which forces them to end the relationship. These shocks cannot be observed by the trade partner. I show that deliberately choosing to rely solely on a verbal agreement today (which cannot be enforced in a court) can create trust and indicate stability to the partner. Trust in the relationship leads to more investment and thus better trade

outcomes. Written contracts (which can be enforced in court) ensure compliance with the contract. With verbal agreements on the other hand, the contractors make themselves vulnerable to exploitation by their partners. In case of exploitation, the relationship ends. Cooperation occurs when the contractors are willing to continue the relationship because future benefits from trade are higher than from one-time exploitation. Deliberately offering a verbal agreement is, hence, a sign of trust because contractors who cannot continue the relationship have no incentive to expose themselves to the possibility of exploitation.

The second chapter is based on a theory that regards contracts as reference points for feelings of entitlement (Hart and Moore, QJE, 2008). In this set-up, the seller's cost of production and the buyer's value of the product can vary depending on the circumstances after contract signing. Contracts are incomplete because the cost and value can only be observed by the involved parties, but not the court, and can thus not be part of the contract. The contractors may want to agree on a range of prices in order to be able to later adjust the trading price to the circumstances. However, this can create disappointment when both buyer and seller feel entitled to different prices permitted by the contract. Disappointment may lead to lower performance (which is not specified in the contract) as a punishment of the contracting partner, for example by providing low quality. Consequentially, there exists a trade-off between contractual flexibility (agreement on a price interval) and rigidity (agreement on a single price).

This model does not analyse the role that contract enforcement plays for parties' feelings of entitlement, shading on performance and choice between flexible and rigid contract. I demonstrate in the second chapter of this thesis that the results in the literature rely on a number of assumptions that can be challenged when incorporating litigation into the model. It is assumed, that

the contractors can walk away from trade without repercussion but that renegotiation is prohibited. I argue that either trade is voluntary but renegotiation is possible or courts can compel parties to trade based on the contract. In the former scenario, fixed price contracts may not act as reference points and the parties feel entitled to the best possible outcomes from renegotiation. In the latter scenario, contracts may act as reference points because of the option of contract enforcement but then contracts cannot be flexible.

The third chapter provides an experimental examination of the effect of contract enforcement on contractors' reference points for feelings of entitlement based on the theoretical analysis in the second chapter. Previous laboratory experiments in the literature (Fehr, Hart and Zehnder, AER, 2011) analyse and support the theory that contracts are reference points. Both theory and experiments ignore the role of contract enforcement for contractors' feelings of entitlement. I replicate and confirm the baseline experiment. I also run an additional treatment in which buyers can offer sellers more or less favourable prices than specified in the contract, whereas sellers can request enforcement of contracts as written. I find that contract enforcement matters, without being invoked, for sellers' punishment behaviour through feelings of entitlement. Without explicit contract enforcement, flexible contracts (agreement on a price range instead of a single price) leave sellers feel entitled to the best possible price permitted by the contract. However, buyers rarely offer such a price which leads to disappointment and punishment. With the option of contract enforcement, sellers feel entitled to the price which the court would enforce, even if it is equally unfavourable than in the no court treatment. The presence of the court provides an outside validation for which prices are reasonable and thereby limits disappointment and punishment. These results can inform the discussion on optimal enforcement procedures with regard to limiting disappointment and detrimental punishment behaviour.

Contents

List of Tables

XIV

List of Figures

Chapter 1

Signing incomplete contracts as a signal for trust and stability in an ongoing relationship

1.1   Introduction

Contracts in a functioning legal system are an important tool for governing economic relationships. Explicit and perfectly specified contracts prevent misunderstanding, align expectations about outcomes and ensure mutual cooperation as the breach of a contract can lead to punishment by, for a example, a court of law. However, many economic relationships are in fact based on either vague contracts, which make contract enforcement in courts difficult, or without signing contracts at all. The standard contract theory provides many explanations why it is often not possible to construct complete contracts including all information and perfectly describing future contingencies and actions.[1] However for many economic relationships, simple and low cost con-

---

[1]One explanation for exogenously incomplete contracts lies in the bounded rationality of the contractors. If the parties are not able to perfectly foresee all future contingencies, writing perfectly state contingent contracts is not possible. For example, Tirole (2009) accounts for cognitive limitations. Also, writing complete contracts and monitoring compliance leads to

tracts are available that are sufficient to eliminate incentives to exploit the contract partner. Regardless, they are often not utilised. When the parties deliberately choose not to rely on complete contracts, it indicates that the partners trust each other to follow the agreement without the option to enforce a claim in court. The question arises where this trust stems from.

I address this question by introducing asymmetric information in a relational contract setting. The standard relational contract theory demonstrates that compliance with an incomplete contract comes from repeated interaction. The parties trust each other because they can anticipate that all players' value from continued future trade is greater than the one period benefit of breaching such that cooperation occurs (MacLeod, 2007).[2] In this paper, however, I assume that the parties do not know whether their partner is willing to be part of repeated interaction. Most economic relationships are situated in an ever-changing environment and are prone to shocks. It is not unusual that contractors experience a change in the environment which forces them to end the relationship. Thus, I assume that the parties repeatedly interact unless one party experiences an exogenous, privately observed shock. Will the parties still rely on incomplete contracts even when concluding complete contracts is possible? How does trust develop in such a relationship and how can the parties signal trustworthiness? Are the initiation and the outcome of a relationship influenced by trust?

In this paper, I analyse a contractible exchange between an agent who offers a service and a principal who is paying a reward for receiving it. There is asymmetric information about the stability of parties' environment. The main finding of this paper is that the choice between relying on a complete or an incomplete contract serves as a signal for the ability to continue the relationship.

---

very high transaction cost (Williamson, 1985) such that the contractors agree on less complete contracts, for instance, as in Crocker and Reynolds (1993).

[2]For a review of the literature on relational contracts see Malcomson (2010).

Signalling to be in a stable environment, and thus being trustworthy, is important in this setting as the continuation of the relationship is non-contractible. In many situations, the expectation of continuing a collaboration incentivises the parties to invest in the relationship, for example, by developing better ways of providing a service. Trust in the sustainability of the relationship is important in order to induce this non-contractible, mutually beneficial investment. By offering an incomplete contract, the principal makes himself vulnerable to exploitation by the agent. A principal that has to end the relationship is not interested in the investment and cannot benefit from signalling trustworthiness. He has thus no incentive to make himself vulnerable by relying on an incomplete contract. Therefore, the deliberate choice to rely on an incomplete contract is a credible signal for the ability to continue the collaboration and induces the agent to undertake the non-contractible investment. The setting of this model is such that it can enlighten the interaction between economic players, for instance a firm and its suppliers, which are in a close and dependent relationship and repeatedly exchange as long as possible.

The definition of trust varies across disciplines but also within the economics literature. I follow the definition that trust is the willingness of a player to accept vulnerability although he is not completely sure that the other party will not exploit him. This willingness is based on positive expectations about the integrity of the other party, i.e. its trustworthiness, and leads to risk taking (Vosselman and Meer Kooistra, 2009).[3] In my model, the principal demonstrates that he trusts the agent by making himself vulnerable to exploitation by choosing an incomplete contract. The principal expects that the agent cooperates and that signalling induces the agent to undertake investment. Trust

---

[3]There are also authors that criticise the use of the term trust in economics. Williamson (1993) argues that real trust exists only in personal relationships whereas everything else is calculativeness. He distinguishes between calculative trust, which is based on rational considerations of cost and benefit of trusting, and personal trust, which does not follow concious calculations but is warranted in special relationships. See James Jr (2002) for a survey for the nature of trust in economics.

is usually build up in a costly process. If costs are too high, the interaction can fail regardless of the actual trustworthiness of the parties (Braynov and Sandholm, 2002). In my paper, the principal is not certain that he will not be exploited under incomplete contracts since the agent may observe a shock and breach. If the principal's expectation about the integrity of the agent is low, he is not willing to risk exploitation under incomplete contracts. Hence in very unstable environments, the expectation about parties' trustworthiness is low, investment is not undertaken and surplus is not maximised. I also show that trust is not a guarantee for cooperation because some agents are not trustworthy and exploit trust under incomplete contract. However, trust in my model is not based on the accumulation of knowledge about the partner over several periods as discussed, for instance, in the psychology literature (see for example Kramer (1999)), because the parties' environment can change every period.

Furthermore, I discuss that the importance of trust for the outcome of the relationship influences the principal's willingness to trust the agent. If the non-contractible part of the relationship does not significantly increase the relationship's surplus, the parties prefer to solely rely on complete contracts for the contractible part of the relationship. On the other hand, the more important is the investment for the relationship's payoff, the more willing is the principal to offer an incomplete contract.

Several experimental papers examine the influence of contract choice on trust in a relationship. Chou et al. (2011) find that more complete contracts can undermine trust and cooperation and can reduce relational expectations, subjective satisfaction, and trust and therefore lead to less cooperation than incomplete contracts. Malhotra and Murnighan (2002) find that the use of binding contracts to promote cooperation leads to a reduced likelihood of trust developing because the parties attribute each others' cooperation to the constraints imposed by the contract rather than to the individuals themselves. On the

other hand, using non-binding contracts leads to personal attributions for co-operation and thus to interpersonal trust building. The experiments by Chou et al. (2011) and Malhotra and Murnighan (2002) are based on different set-ups than in my model. However, the intuitions of my model are in line with the findings in the experiments although I do not make behavioural assumptions about trust. I show that trust development with complete contracts is difficult as the parties do not learn about each other's willingness to continue the relationship. The use of incomplete contracts is a signal for trust and trustworthiness and enhances the expectation about the future of the relationship.

The paper by Herold (2010) analyses the interaction of trust and contract choice in a static setting and is closely related to the notions in my paper. The agents are assumed to be either intrinsically motivated (trustworthy) or not. Principals receive private signals about agents' types, which determines their trust. An agent updates his belief about the principal's signal depending on the choice of contractual completeness by the principal and behaves accordingly. Herold (2010) concludes that a principal may prefer a less complete contract over signalling distrust. In contrast to my paper, trust is modeled in a different way as the parties are of different types and the agents desire information about how the principals perceive them. Furthermore, Herold (2010) examines contractual incompleteness in a one-shot game and does not consider the role of trust in an on-going relationship and the impact of contractual incompleteness on relational expectations.

Spier (1992) also considers the signalling function of incomplete contracts in a static setting. The principal is assumed to have private information about his type which is characterised by his productivity. When the principal offers a complete contract, wages are contingent on productivity, whereas they are insensitive to productivity under incomplete contracts. Thus, the principal takes into account the degree of information revelation when choosing a

contract. The analysis by Spier (1992) differs to mine, since in her model the results are driven by considerations of ex ante and ex post transaction costs. Furthermore, she considers a different type of asymmetric information and the motivation of the players to signal and to learn are dissimilar to my model. In Spier (1992), the principal is interested in getting best effort for lowest wage in a single exchange, whereas in my model the principal considers the relation between trust and contract choice in a repeated interaction.

Similarly to my model, several papers explore the deliberate choice of contractual (in)completeness in a relational contract setting as opposed to the models that assume contracts to be incomplete for exogenous reason. However in this literature, the choice is driven by the assumption that explicit contracting is costly. For example, Desrieux and Beuve (2011) examine the choice of contractual incompleteness in repeated interactions under asymmetric information on discount rates and costly contracting. They argue that higher discount rates make relational contracts more stable and result in less investment in contractual completeness. Under asymmetric information on discount rates, the level of contractual completeness evolves over time. As parties cooperate, contracts become more incomplete, whereas they become more complete when hold-up occurs. In contrast, contractual incompleteness in my paper does not stem from contracting cost considerations since I investigate relatively simple but common relationships, in which complete contracts are costless.

Also Kvaloy and Olsen (2009) endogenise the choice of contractual (in)completeness by allowing parties to invest in contract design and show that contractual incompleteness increases with the discount factor. They assume that perfect contractual completeness cannot be achieved for any part of the relationship. My paper in contrast accounts for the fact that some parts can be explicitly contracted. Moreover, Kvaloy and Olsen (2009) interpret the discount factor as a proxy for trust. However in my model, trust is the willingness to

accept vulnerability in order to signal trustworthiness.

Some models also investigate circumstances in which contractual (in)completeness is deliberately chosen in a relational contract settings for different reasons than contracting costs. However, to my knowledge, none of these papers explicitly model the relationship between trust and contractual (in)completeness for repeatedly interacting parties. For instance, Bernheim and Whinston (1998) argue that not contracting on verifiable aspects of performance can be optimal when it improves unverifiable performance by giving the parties more options to punish each other, since punishment can be more easily elaborated under incomplete contracts. Another example is the work by Halonen-Akatwijuka and Hart (2013). They argue that contracts are deliberately incomplete as complete contracts serve as a reference point to what parties feel entitled to.

Outside the economics literature, especially in the management and political science literature, the relationship between trust and contracts has attracted significant attention. Hoffman (2002) argues that trusting relationships cannot evolve with binding commitments, because they make betrayal impossible. Gulati (1995) argues that contracts and trust are substitutes, whereas Poppo and Zenger (2002) reason that they are complements. Mellewigt et al. (2007) argue that it can be both. They identify two functions of contracts – control and coordination. By considering the control function of contracts, trust and contracts can act as substitutes because in the presence of trust less complex contracts are needed and writing more detailed contracts can increase mutual suspicion. However, when considering the coordination function of contracts, trust and contracts can act as complements. The higher the trust, the more willing firms are to communicate or to exchange knowledge, and to consider the interests of partners in their decisions. My model focuses on the control function of contracts. By considering contracts as a commitment device, I show

that under certain circumstances explicit contracts can indeed negatively influence the trust between contractors and thereby the outcome of the relationship. Thus, the intuition developed in my model complements observations from researchers outside the economics literature.

This paper is organised as follows. In section 1.2, the setting and the assumptions of the model are explained. Section 1.3 discusses the decisions and potential equilibria of the model starting with an analysis of the model under the assumption of complete information. Subsequently, all perfect Bayesian equilibria are identified assuming that the parties do not know their partners' state. The arising problem of equilibrium multiplicity is addressed in section 1.3.3. Section 1.4 presents comparative statics and a discussion of the results. The paper ends with concluding remarks in section 1.5.

1.2   The model

Consider a contractual relationship between an agent (hereafter A and her) and a principal (hereafter P and he). Both have a positive, sufficiently large discount factor $\delta > 0$ and interact repeatedly over time. A has a service to offer that requires her to exert effort e. P is willing to pay wage w for receiving the service. Choice variables and outcome in the relationship are binary. A's effort choice, denoted by e', is between exerting positive effort at an exogenously given level, $e' = e$, or zero effort, $e' = 0$. Thus, A simply decides whether to undertake a standardised task or not. Exerting effort creates costs $c(e')$ to A in period t. Not undertaking the task is costless for A, whereas providing the service is costly, such that $c(e) > c(0)$ and $c(0) = 0$. Similarly, receiving effort e' generates benefit $y(e')$ for P in period t. When A exerts positive effort, P's benefits are positive, whereas there are zero benefits from getting no service, such that $y(e) > y(0)$ and $y(0) = 0$.

P pays a wage for receiving the service. Since A is providing a standardised task, I assume that there is a conventional compensation for it and the wage choice is also binary. P decides whether to pay the reward at an exogenously given level, $w' = w$, or not, $w' = 0$. P's payoff function is thus $v = y(e') - w'$, whereas A's payoff function is $u = w' - c(e')$. I also assume that $y(e) > w > c(e) > 0$ such that there exists a contract (w', e') that yields positive payoffs to A and P.

In addition to the contractible effort e, A can also undertake a mutually beneficial, non-contractible investment I, which pays off in the next period. This investment captures all activities that A may undertake in the current period relying on a repeated interaction in the next period. For example, A might find ways of providing the service at lower costs or adjust the service to the needs of P. The choice of investment, denoted by I', is also assumed to be binary. A decides whether to undertake investment at an exogenously given level, $I' = I$, or not, $I' = 0$. The investment is assumed to be non-contractible. P understands that A has an investment opportunity that improves the relationship's surplus, but he cannot observe the specifics and thus cannot explicitly define them in a contract. The investment creates cost $c(I'_t) = I'_t$ to A in period t. In period $t + 1$, the investment from period t increases P's benefits of receiving A's effort e and reduces the cost of providing e for A. In the first period t, cost and benefit from e' are $c(e'_t, 0)$ and $y(e'_t, 0)$, respectively. If the relationship continues, in the following period, cost and benefit depend on the investment decision I'_t made in the preceding period and $c(e'_{t+1}, I'_t)$ and $y(e'_{t+1}, I'_t)$. Investment is assumed to be mutually beneficial such that $y(e, I) > y(e, 0) > 0$ and $c(e, 0) > c(e, I) > 0$ hold. However, investment is not beneficial to either party if no effort is exerted such that $y(0, I) = 0$ and $c(0, I) = 0$. A's choice of investment in period t, I'_t, is observed by P in period $t + 1$, if the parties reach that period.

P's payoffs, in period t and the potentially following period $t + 1$ are

$$v_t = y(e'_t, 0) - w'_t ,$$

$$v_{t+1} = y(e'_{t+1}, I'_t) - w'_{t+1} .$$

A's payoffs in period t and the potentially following period $t + 1$ are

$$u_t = w'_t - c(e'_t, 0) - I'_t ,$$

$$u_{t+1} = w'_{t+1} - c(e'_{t+1}, I'_t) - I'_{t+1} .$$

At the beginning of each period, each party may experience a shock which forces him/her to end the relationship after the current period. I refer to this as his/her state in period t. A has a shock with probability $(1 - \rho)$ and P has a shock with probability $(1 - \theta)$. The probabilities of experiencing a shock are common knowledge and the draws are independent every period. However, the parties can only observe their own shock but not their partner's. If P observes a shock in period t, he is not able to continue the relationship in the next period(s) and is labeled *myopic*. He is still interested in the current period's relationship but will not propose a contract in $t + 1$. If A observes a shock, she will not be able to offer her service in $t + 1$ and is also labeled *myopic*. In contrast, a P that did not observe a shock is referred to as *patient*. He is willing to propose a new contract in $t + 1$ if A has been cooperating in the previous period(s). Similarly, an A that did not experience a shock is labeled *patient* and always accepts a new contract in $t + 1$.[4] If the parties meet in period t, they continue working together unless one party observes a shock and/or behaves

---

[4]When assuming that the draws of observing a shock are independent every period, I consider an environment which can fundamentally change every period. The parties cannot anticipate how it will change. Therefore, they are not more likely to survive the next period based on their survival in the past and thus there is no option to learn about each other's ability to continue. However, note that the parties only continue given that they have survived in the past, because otherwise they would not exist any longer.

non-cooperatively.

In the contracting stage, P proposes (W, E), where W represents wage and E effort, and decides whether to utilise a verifiable contract or to rely on a verbal agreement for this in principle contractible part of the relationship. If P chooses a verifiable contract, compliance with the contract terms is costlessly enforceable in court. A verifiable contract is, in the following, referred to as a *complete contract*. I assume that no party has an incentive to breach the agreement under complete contracts since the punishment is very severe compared to the obligations in the contract. Since the players engage in an uncertain environment, it is likely that signing a contract over multiple periods is not costless. Therefore, I assume that, for contracting to be costless, the parties can only record a contract for the current period. If the parties rely on a verbal agreement, compliance is not verifiable in court since there are no records of a contract. A verbal agreement is henceforth referred to as an *incomplete contract*.[5] The outside option for A is assumed to be zero. Therefore, without loss of generality, I assume that A always accepts any contract that yields at least zero payoff.

The timing of the game is summarised in Figure 1.1. At the beginning of period t, the parties privately observe whether they have a shock or not. In the subsequent contracting stage, P proposes (W, E) and decides whether to utilise a complete or an incomplete contract. A will accept any type of contract that yields at least zero payoff. After the parties have agreed on the contract, P pays the wage w'_t and subsequently A exerts effort e'_t and chooses I'_t. Then, P receives the benefits from A's effort $y(e'_t, 0)$. If both parties comply with the contract and neither party observes a shock in period t, they continue follow-

---

[5]Note that the assumptions that part of the relationship is non-contractible and complete contracts can only be signed for the current period manifest that the contract between P and A is never complete in the strict sense. However for simplicity, in this paper I refer to complete or incomplete contracts only when discussing the contractible part of the relationship, i.e. the exchange of wage for effort. Alternatively, complete and incomplete contracts in this set-up can be regarded as explicit and implicit contracts, respectively.
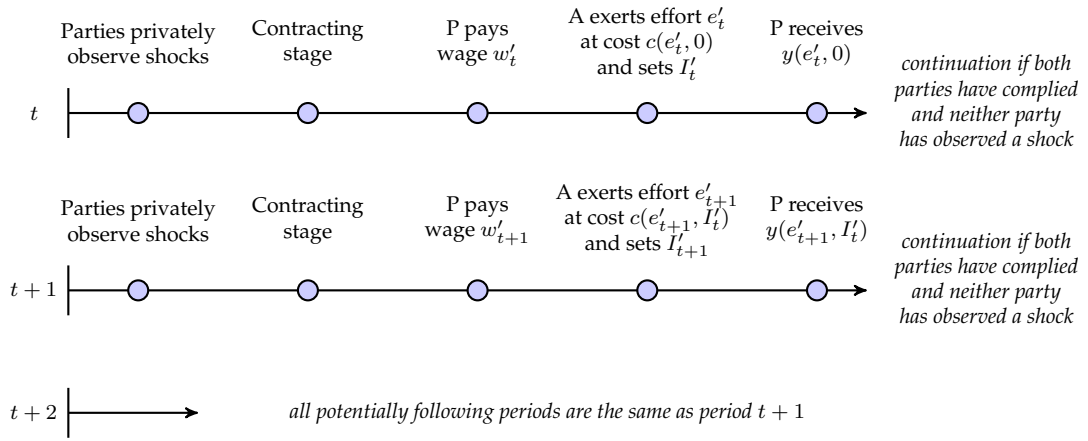
Figure 1.1: Timing

ing the same timing. However in the following period(s), cost and benefit depend on the investment decision made in the preceding period, so $c(e'_{t+1}, I'_t)$ and $y(e'_{t+1}, I'_t)$ in period $t + 1$, for example.

1.3 Decisions and equilibria

Before analysing the equilibria under incomplete information in section 1.3.2, I discuss the optimal decisions by all parties under complete information such that the parties can observe each other's shocks and know whether their partner is able to continue the relationship or not.

1.3.1 Decisions under complete information

Claim 1.1. *The complete contract that P proposes is (w, e).*

If P proposes a complete contract $(0, e)$, A does not accept this contract since her payoffs from this contract are negative, $u = 0 - c(e, 0) < 0$. The complete contract $(w, 0)$ yields negative payoffs for P, since $v = 0 - w < 0$, and he never offers such a contract. The complete contract $(0, 0)$ leads to zero payoffs for both parties. I assume, without loss of generality, that P never offers such a contract because he prefers not to interact with A instead of offering a zero

payoff contract. Therefore, the only complete contract P offers in either state is (w, e) which demands A to exert positive effort $e' = e$ and P to pay positive wage $w' = w$.

Claim 1.2. *If the contract (w, e) is complete and under full information, all parties comply with the agreement. If both parties are patient and the benefits from investment are sufficiently high (condition 1.1 holds), a patient A undertakes investment and chooses $I' = I$.*

If P chooses a complete contract (w, e), compliance with the agreement is costlessly enforced by a court. Since punishment is very severe neither party breaches the contract. Consider the case that a least one party is myopic. The myopic A always chooses $I' = 0$ as she is not able to offer her service next period and thus cannot benefit from investment. If A is patient but P is myopic, A chooses $I' = 0$ because she knows that the relationship will not continue as P is not interested in her service next period. Given that at least one party is myopic, the expected payoffs for P and A, denoted by V and U respectively, are

$$V = y(e, 0) - w \,,$$
$$U = w - c(e, 0).$$

Consider the case where both contractors are patient. They will continue to work together. The contract choice as well as the decisions on investment, wage and effort are identical every period. Also, the probability of shocks is exogenous and draws are independent every period such that the parties do not accumulate knowledge about each other over time. Therefore, I conclude that the setting is stationary and time indices are dropped for the rest of the paper. As enforced by a court, P pays wage $w' = w$ and A exerts effort $e' = e$. A knows that the relationship continues and chooses $I' = I$ when the expected payoff with investment is greater than without investment, $U(I' = I) \geq U(I' = 0)$.

13

This is the case if

$$w - c(e, 0) - I + \frac{\delta}{1 - \delta\theta\rho}[w - c(e, I) - \theta\rho I] \geq w - c(e, 0)\frac{\delta}{1 - \delta\theta\rho}[w - c(e, 0)] ,$$

$$\delta[c(e, 0) - c(e, I)] \geq I . \qquad (1.1)$$

For the rest of the paper, I assume that condition 1.1 always holds. Thus, I consider only relationships in which the investment is beneficial to a patient A such that she always has an incentive to invest when she is certain that her partner is patient and that the relationship continues.

Claim 1.3. *If P offers an incomplete contract, he proposes* (w, e).

As in the previous analysis, I assume, without loss of generality, that P prefers not to interact with A instead of offering a contract that yields zero or negative payoffs with certainty. Therefore, P does not offer $(0, 0)$ and $(w, 0)$. The payoffs are also zero when P offers $(0, e)$ since either A breaches this contract or does not accept it in the first place. Thus, P always proposes (w, e) when he has an incentive to offer an incomplete contract.

Claim 1.4. *With incomplete contracts and under complete information, cooperation does not occur,* $w' = 0$ *and* $e' = 0$, *if at least one party is myopic. When both parties are patient and if future payoffs are sufficiently high (condition (1.2) holds), cooperation and investment arise,* $w' = w$, $e' = e$ *and* $I' = I$.

If P chooses an incomplete contract, compliance with the agreement (w, e) is not enforceable by a court. If P is myopic, A sets $I' = 0$ in both states because she knows that the relationship will not continue and she will not receive the investment benefits. Also since there are no future benefits that she loses when breaching and since the contract is not enforced by court, A sets $e' = 0$. This is anticipated by P and he chooses to pay no wage, $w' = 0$. The same decisions are made if A is myopic and P is patient because the parties are certain

14

that the interaction finishes at the end of the current period. So irrespective of the agreement, the payoffs for both parties are zero with incomplete contracts when at least one party is myopic.

If both A and P are patient in period t, they will exist in the next period $t + 1$ and can potentially interact again. P has to decide whether to offer a complete or an incomplete contract in $t+1$. Consider the case where the parties continue but either party observes a shock in $t+1$. As shown above, P's payoff from offering an incomplete contract, given that at least one party is myopic, is zero under complete information. If a patient P had an incentive to offer an incomplete contract in t, he will switch to a complete contract in $t + 1$ if one partner has a shock in $t + 1$. This is reflected in the following expected payoffs from incomplete contracts. In the current period t, a patient A can exploit a patient P by taking the wage but not exerting effort. She also makes a decision about the investment. The expected payoffs for a patient A depending on her choices are

$$
U(e' = e, I' = I) = w - c(e, 0) - I + \frac{\delta}{1 - \delta\theta\rho}[w - c(e, I) - \theta\rho I] \, ,
$$
$$
U(e' = e, I' = 0) = w - c(e, 0) + \frac{\delta}{1 - \delta\theta\rho}[w - c(e, 0)] \, ,
$$
$$
U(e' = 0, I' = 0) = w \, .
$$

The patient A cooperates and invests, i.e. chooses $e' = e$ and $I' = I$, when working with a patient P if

$$
U(e' = e, I' = I) > U(e' = 0, I' = 0) \, , \text{ thus if}
$$
$$
\delta[w - c(e, I)] > (1 - \delta\theta\rho)c(e, 0) + I \, . \tag{1.2}
$$

Note that I have assumed that condition 1.1 always holds. Therefore, condition 1.2 holds as well. Consequently, I only consider situations where under

complete information and with incomplete contracts, a patient A cooperates instead of taking the wage without exerting effort and also has sufficient incentives to invest. Thus, when both parties are patient and P offers an incomplete contract, the contractors set $I' = I$, $e' = e$ and $w' = w$.

Proposition 1.1. *Under complete information, the myopic P always offers a complete contract. The patient P offers a complete contract to a myopic A, whereas he is indifferent between relying on an incomplete or a complete contract when working with a patient A given that conditions 1.1 and 1.2 hold.*

Since the myopic P's expected payoff is zero with incomplete contracts whereas it is positive with complete contracts, he always chooses to conclude a complete contract. The patient P offers a complete contract if A is myopic, because he will be exploited by her when relying on an incomplete contract. When A and P are both patient and given that conditions 1.1 and 1.2 hold, A cooperates and invests under incomplete contracts. However, cooperation and investment is also achieved under complete contract if both parties are patient. Therefore, the patient P is indifferent between offering an incomplete or a complete contract, when A is patient. Thus in this setting, neither a myopic nor a patient P strictly prefers to offer an incomplete contract and incomplete contracts are irrelevant under complete information.

1.3.2 Potential PBE equilibria under incomplete information

The previous analysis demonstrates that P relies on complete contracts when the parties can observe each other's state. When they have incomplete information, P may deliberately choose an incomplete contract in order to induce investment behaviour. This section analyses under which circumstances either complete or incomplete contracts are chosen, which perfect Bayesian equilibria (PBE) exist and which equilibria can be selected.

The strategies played by P in period t depending on his state $s \in \{\mu, \varrho\}$, where μ represents myopia and ϱ patience, is denoted by $\sigma_P(s)$. The strategies played by A in period t depending on her state $i \in \{\mu, \varrho\}$ is $\sigma_A(i)$. P's contract choice γ is between offering a complete or an incomplete contract such that $\gamma \in \{c, in\}$. A's belief, i.e. the probability that A assigns to P's state s after observing the contract choice γ, is denoted by $\alpha(s|\gamma)$. P's expected payoff depending on his state and his contract choice γ is denoted by V_s^γ.

Separating equilibrium I

Proposition 1.2. *There exists a separating equilibrium where the myopic P offers a complete and the patient P an incomplete contract such that*

$$\sigma_P(s) = \begin{cases} c & \text{if } s = \mu \\ in & \text{if } s = \varrho \, , \end{cases}$$

A's best response depending on her state i is characterised by

$$\sigma_A(\gamma, \alpha(s|\gamma), i) = \begin{cases} \text{if } c & e' = e \text{ and } I' = 0 \quad \text{for all } i \\ \text{if } in & \begin{cases} e' = 0 \text{ and } I' = 0 & \text{if } i = \mu \\ e' = e \text{ and } I' = I & \text{if } i = \varrho \, , \end{cases} \end{cases}$$

and A's corresponding beliefs depending on the contract choice γ are

$$\alpha(s|\gamma) = \begin{pmatrix} \alpha(\varrho|in) \\ \alpha(\varrho|c) \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}.$$

If this equilibrium exists and A's beliefs are as defined above, what is A's best response after observing an incomplete contract? The myopic A sets $e' = I' = 0$ independent from her belief because the contract is not enforced by a

court and she does not lose future payoffs by breaching the agreement. The patient A chooses $e' = e$ and $I' = I$ given that condition 1.2 holds, since she believes that P is patient. If A observes a complete contract, A in either state chooses $e' = e$ as enforced by a court. Since A believes that P is myopic when being offered a complete contract, she chooses $I' = 0$.

A's beliefs are Bayesian by construction and A's strategies are best responses given those beliefs. Hence this is an equilibrium if neither type of P has an incentive to deviate. P follows the assigned strategies as long as the payoff from this is at least as high as with deviation. The myopic P's expected payoffs from offering a complete or an incomplete contract, given the above defined beliefs, are

$$V_\mu^c = y(e,0) - w \, ,$$
$$V_\mu^{in} = \rho y(e,0) - w.$$

The myopic P has no incentive to deviate as $V_\mu^{in} < V_\mu^c$ holds under all circumstances.

Given the above defined beliefs, the patient P's expected payoff depends on whether he observes a shock or not in the next period(s). If the patient P is myopic in the next period, he has no incentive to offer an incomplete contract in the next period since $V_\mu^{in} < V_\mu^c$. Thus, if this equilibrium exists, the patient P switches to a complete contract next period if he observes a shock next period and continues offering an incomplete contract otherwise. The patient P's expected payoff from offering an incomplete or a complete contract this period, given the above defined beliefs, are

$$V_\varrho^c = y(e,0) - w + \frac{\delta\rho}{1 - \delta\theta\rho}(y(e,0) - w) \, , \tag{1.3}$$
$$V_\varrho^{in} = -w + \rho\left[y(e,0) + \frac{\delta}{1 - \delta\theta\rho}[(1 - \theta(1 - \rho))y(e,I) - w]\right]. \tag{1.4}$$

The patient P has no incentives to deviate if $V_\varrho^{in} > V_\varrho^c$. Hence, his incentive compatibility constraint for no deviation is the following:

$$\rho\frac{\delta}{1-\delta\theta\rho}[(1-\theta(1-\rho))y(e,I) - y(e,0)] > (1-\rho)y(e,0) . \qquad (IC_P)$$

If IC_P does not hold, P has an incentive to deviate and separation I (the myopic P offering a complete and the patient P offering an incomplete contract) is not a PBE. If IC_P holds, no P has an incentive to deviate, the assumed beliefs are correct and separation I is a PBE.

Whether IC_P holds, depends on three factors. First, the probability that A receives no shock has to be sufficiently high. When offering an incomplete contract, the patient P risks being exploited by a myopic A. If he expects that the probability that A observes a shock is low, he is willing to take on the risk in order to distinguish himself from a myopic P and thus to induce investment. Secondly, whether IC_P holds depends on the increase in payoff, $(1-\theta(1-\rho))y(e,I) - y(e,0)$, which the patient P can potentially receive in future period(s) when signalling his type and inducing investment. If this increase is not sufficiently high, it is not worth for the patient P to risk exploitation by a myopic A. Note that this depends on the level of I but also on θ and ρ. $(1-\theta(1-\rho))$ includes all states in which the patient P is not exploited by A. Thirdly, IC_P depends on the discount rate, which is assumed to be sufficiently high. So for separation I to be an equilibrium, investment and the future have to be sufficiently important for the patient P and A's probability of shocks has to be sufficiently low.

Separating equilibrium II

Proposition 1.3. *There does not exist a separating equilibrium in which the patient P offers a complete and the myopic P offers an incomplete contract such that*

$$
\sigma_P(s) = \begin{cases} in & \text{if } s = \mu \\ c & \text{if } s = \varrho \,. \end{cases}
$$

If this equilibrium existed, A's corresponding beliefs would be $\alpha(\mu|in) = 1$ and $\alpha(\varrho|c) = 0$. Given these beliefs, what would be A's best response after observing the contract choice? Both A would choose $e' = I' = 0$ with incomplete contracts. Given that she observed a complete contract, A of both types would choose $e' = e$ as enforced by a court. The patient A would set $I' = I$ whereas the myopic A would choose $I' = 0$. This were an equilibrium if neither type of P would have an incentive to deviate given the above defined beliefs. P would follow the assigned strategies as long as the payoff is at least as high as under deviation. P's expected payoffs depending on his state and his contract choice, if the above defined beliefs held, would be

$$
V_\mu^c = y(e,0) - w,
$$
$$
V_\mu^{in} = V_\varrho^{in} = 0 \,.
$$

The patient P would have no incentives to deviate if $V_\varrho^c > V_\varrho^{in}$, which is always the case. The myopic P would have no incentives to deviate if $V_\mu^{in} > V_\mu^c$, which never holds. Therefore, the myopic P would have an incentive to deviate to complete contracts and this kind of separation is not an equilibrium.

Pooling on writing incomplete contracts

Proposition 1.4. *There does not exist a pooling on incomplete contracts equilibrium such that $\sigma_P(s) = in$ for $s \in \{\mu, \varrho\}$.*

If pooling on incomplete contracts were an equilibrium, A's belief for on-the-equilibrium-path behaviour would be $\alpha(\varrho|in) = \theta$ and $\alpha(\mu|in) = (1 - \theta)$. Given these beliefs, a myopic A would always choose $e' = I' = 0$ with incomplete contracts and $e' = e$ and $I' = 0$ with complete contracts. The patient A's decision with incomplete contracts would depend on θ and with complete contracts on the off-equilibrium-path belief. The myopic P's expected payoff depending on the contract choice would be

$$V_\mu^c = y(e, 0) - w \, ,$$

$$V_\mu^{in} = \rho y(e', 0) - w \, .$$

Hence, $V_\mu^{in} < V_\mu^c$ would always hold, incentivising the myopic P to deviate to complete contracts with which he cannot be exploited by the myopic A. Therefore, pooling on writing an incomplete contract is not a PBE.

Pooling on writing complete contracts

Proposition 1.5. *There exists a pooling on complete contract equilibrium where P's strategy is $\sigma_P(s) = c$ for $s \in \{\mu, \varrho\}$, equilibrium best responses by A are*

$$\sigma_A(c, \alpha(s|c), i) = \begin{cases} e' = e \text{ and } I' = 0 & \text{if } i = \mu \\ e' = e \text{ and } I' = I & \text{if } i = \varrho \, , \end{cases}$$

and A's corresponding beliefs are

$$\alpha(s|\gamma) = \begin{pmatrix} \alpha(\varrho|c) \\ \alpha(\mu|c) \\ \alpha(\varrho|in) \\ \alpha(\mu|in) \end{pmatrix} = \begin{pmatrix} \theta \\ 1 - \theta \\ \lambda \\ 1 - \lambda \end{pmatrix} ,$$

where $\lambda \in [0, 1]$ represents off-equilibrium-path behaviour belief.

Observing a complete contract, the best response for both A is $e' = e$ as enforced by a court. The myopic A always sets $I' = 0$ since she will not be active next period. To identify the patient A's decision on investment, consider the expected payoffs from investing and not investing,

$$U_\varrho^c(I' = 0) = w - c(e, 0) + \frac{\delta\theta}{1 - \delta\theta\rho}[w - c(e, 0)] \, ,$$

$$U_\varrho^c(I' = I) = w - c(e, 0) + \frac{1}{1 - \delta\theta\rho}[\delta\theta(w - c(e, I)) - I] \, .$$

The patient A chooses $I' = I$ if $U_\varrho^c(I' = I) > U_\varrho^c(I' = 0)$, hence if the investment constraint

$$\theta\delta[c(e, 0) - c(e, I)] > I \tag{IC_A}$$

holds. Otherwise, the patient A chooses $e' = e$ and $I' = 0$.

Being offered an incomplete contract, the myopic A's best response is $e' = I' = 0$. The best response for the patient A depends on the expected payoff from cooperating or not,

$$U_\varrho^{in}(e' = 0, I' = 0) = w \, ,$$

$$U_\varrho^{in}(e' = e, I' = I) = w - c(e, 0) - I + \lambda\frac{\delta}{1 - \delta\theta\rho}(w - c(e, I) - \rho I) \, .$$

The patient A chooses $e' = e$ and $I' = I$ if $U_\varrho^{in}(e' = e, I' = I) > U_\varrho^{in}(e' = 0, I' = 0)$, hence if

$$\lambda\frac{\delta}{1 - \delta\theta\rho}[w - c(e, I) - \rho I] > I + c(e, 0) \tag{1.5}$$

holds, which depends inter alia on A's off-equilibrium-path belief that P is patient (λ). Otherwise, the patient A sets $e' = I' = 0$.

To summarise, both A choose $e' = e$ with complete contracts and the myopic P has under no circumstances an incentive to deviate. If IC_A holds, the

patient A chooses $I' = I$ with complete contracts. This is the case if the benefits from investment are very high and/or the probability of P observing a shock is low such that the patient A is likely to receive the investment's benefits. If IC_A holds and the patient A chooses $I' = I$ with complete contracts, no P has an incentive to deviate and pooling on writing a complete contract is a PBE. If IC_A does not hold, pooling on writing a complete contract can still be a PBE. Since the off-equilibrium-path belief that P is myopic $(1 - \lambda)$ could be anything in the interval $[0, 1]$, there always exists such a pooling equilibrium. If IC_A does not hold and the off-equilibrium-path belief is such that condition 1.5 holds, the patient P has an incentive to deviate such that the patient A chooses $I' = I$ with incomplete contracts. If IC_P holds and thus $V_\varrho^{in} > V_\varrho^c$ (i.e. the patient P has an incentive to signal), the patient P can benefit from deviating to incomplete contracts and pooling on writing complete contracts is not a PBE. Therefore pooling on complete contracts is a PBE if either IC_A holds, or if IC_A does not hold and also conditions 1.5 and IC_P do not hold. In the latter case, the off-equilibrium path beliefs are such that the patient A chooses no investment when offered an incomplete contract and the patient P has no incentive to signal.

1.3.3 Comparison of equilibria

The previous analysis examines the equilibria that can potentially be reached by the parties. This section aims at comparing all possible equilibria and addresses the problem of equilibrium multiplicity. Furthermore, intuition for the results are discussed.

Existence of equilibria

As demonstrated before, pooling on incomplete contracts and separating II (the myopic P choosing incomplete, the patient P choosing complete contracts)

will never be an equilibrium, since at least one type of P always has an incentive to deviate.

There always exists a PBE in pooling on complete contracts. If condition IC_A holds, the patient A invests under complete contracts and no P has an incentive to deviate from complete contracts. However if IC_P holds as well, the patient P is willing to signal his type and separation is also a possible equilibrium. Therefore, multiple equilibria, either pooling on complete contract or separation I (the myopic P choosing complete, the patient P choosing incomplete contract) exist. If IC_A does not hold, A's belief regarding off-equilibrium-path behaviour can be such that it sustains a pooling equilibrium irrespective of IC_P. However, given IC_P is and IC_A is not satisfied, separation I can also be an equilibrium (depending on λ). Therefore, there exist multiple equilibria when IC_P holds. If IC_P is not satisfied, the only possible equilibrium is pooling on complete contracts. Table 1.1 provides an overview of the existing equilibria depending on these conditions.

	IC_A does not hold	IC_A does hold
IC_P does hold	Separation and Pooling (w/o I)	Separation and Pooling (w/ I)
IC_P does not hold	Pooling (w/o I)	Pooling (w/ I)

Table 1.1: Existing equilibria

Selection of equilibria

If IC_P does not hold, the only possible equilibrium is pooling on complete contracts. If IC_P is satisfied, separation I and pooling are both possible equilibria and the question arises whether one equilibrium can be selected in this case. If both IC_P and IC_A hold, signalling by P has no effect on patient A's investment

behaviour and none of the equilibria can be selected.

If IC_A is not satisfied (but IC_P holds), whether pooling is an equilibrium depends on the off-equilibrium-path belief λ which influences patient A's investment decision. If the off-equilibrium-path belief is such that condition 1.5 does not hold and the patient A would not invest after observing an incomplete contract, pooling is an equilibrium. Condition 1.5 does not hold if the belief of A that he is working with a patient P is sufficiently low. In order to select one equilibrium, the intuitive criterion by Cho and Kreps (1987) can be utilised. If a deviation is dominated for one of the players but not the other one, this deviation cannot be expected by the player for which it is dominated. It is not in the myopic P's interest to deviate from pooling on complete contracts to incomplete contracts, since he cannot benefit but risks exploitation by a myopic A. The patient P is the only one who can potentially gain from deviation. This should be reflected in the off-equilibrium-path belief. Hence, the most favourable belief following a deviation is $\alpha(\varrho|in) = 1$. Given this off-equilibrium-path belief, the patient A would invest after observing an incomplete contract and the patient P has an incentive to deviate from offering a complete contract. Hence, pooling on complete contracts is not an equilibrium that passes the intuitive criterion given that IC_P does hold and IC_A does not hold. Table 1.2 provides an overview of the selected PBE depending on conditions IC_P and IC_A.

	IC_A does not hold	IC_A does hold
IC_P does hold	Separation	Separation and Pooling (w/ I)
IC_P does not hold	Pooling (w/o I)	Pooling (w/ I)

Table 1.2: Selected equilibria

Discussion

The myopic P has never an incentive to offer an incomplete contract. Thus, the patient P can signal his state by choosing an incomplete contract. He is willing to do so if the patient A is not investing without knowing P's state and if the investment is sufficiently important to him. This is represented by IC_P. If IC_P does not hold, the patient P is not willing to signal. This is the case if either investment benefits are not sufficiently high or the probability of a shock for A, and thus the risk of exploitation with an incomplete contract, is too high. Therefore, if IC_P does not hold and irrespective of his state, P offers a complete contract and pooling is the only sustainable equilibrium.

However, if IC_P does hold, the patient P is willing to signal his state. This is the case if the patient P values the extra surplus from investment and assesses A to be sufficiently trustworthy, i.e. A has a low probability of experiencing a shock. Thus, separation is always an equilibrium given that IC_P holds. If IC_A is satisfied, the probability that P is patient is high and the patient A invests without receiving a signal on P's state. So, the patient P receives investment with a complete contract and pooling on complete contracts is an equilibrium. However, if IC_P holds as well, the patient P is willing to signal his state and separation is also an equilibrium. Since P can choose the contract, it can be expected that in this situation he will offer a complete contract which yields a higher expected payoff than an incomplete contract, $V_\varrho^c > V_\varrho^{in}$, because

$$V_\varrho^c(I' = I) = y(e, 0) - w + (1 - \rho)\frac{\delta}{1 - \delta}[y(e, I) - w] \,,$$
$$V_\varrho^{in}(I' = I) = (1 - \rho)\left[y(e, 0) + \frac{\delta}{1 - \delta}(y(e, I) - w)\right] - w \,.$$

However, I cannot predict that this will happen and separation is a sustainable equilibrium. Note, both types of A receive a higher expected payoff with an incomplete than with a complete contract given IC_P and IC_A hold. The my-

26

opic A has the option to exploit the patient P under incomplete contracts. The patient A knows that she is working with the patient P, undertakes the investment and receives investment's benefits. When offered a complete contract, A cannot infer P's state but if IC_A is satisfied, the patient A makes the investment and risks to do so in vain given P is myopic. Hence, if IC_A and IC_P hold, the patient P faces the risk of exploitation with an incomplete contract, whereas the patient A faces the risk of investing in vain with complete contracts.

1.4   Comparative statics

Which equilibrium P and A achieve, depends on whether conditions IC_A and IC_P hold. This depends in turn on the values of the parameters θ, ρ and I. The following thresholds indicated by θ^* and ρ^* are derived from conditions IC_A and IC_P, respectively:

$$\theta^* = \frac{I}{\delta(c(e,0) - c(e,I))}$$
$$\rho^* = \frac{Z - y(e,0)}{2\delta\theta[y(e,I) - y(e,0)]} - \frac{1 - \theta}{2\theta}$$
$$\text{where } Z = \sqrt{[\delta(1-\theta)(y(e,I) - y(e,0)) + y(e,0)]^2 + 4\delta\theta y(e,0)[y(e,I) - y(e,0)]}\,.$$

The thresholds indicate when the parties are indifferent between acting according to one equilibrium or another. If the probability that P has no shock exceeds θ^*, condition IC_A holds. If the probability that A has no shock is higher than ρ^*, condition IC_P holds.

1.4.1 ρ^* and θ^* thresholds with medium investment level

The ρ^* threshold changes with θ. Since $\frac{\partial\rho^*}{\partial\theta} > 0$, as shown in the appendix, the ρ^* threshold is increasing in θ. The second derivative can be both positive and negative, depending on the parameter values. Also, it can be shown that

$\rho^*(\theta = 1) < 1$ always holds. The θ^* threshold does not depend on ρ. Figure 1.2 depicts the relationship between the ρ^* and θ^* thresholds and the equilibria. Note, the ρ^* threshold is drawn assuming that the parameter values are such that the second derivative is negative.
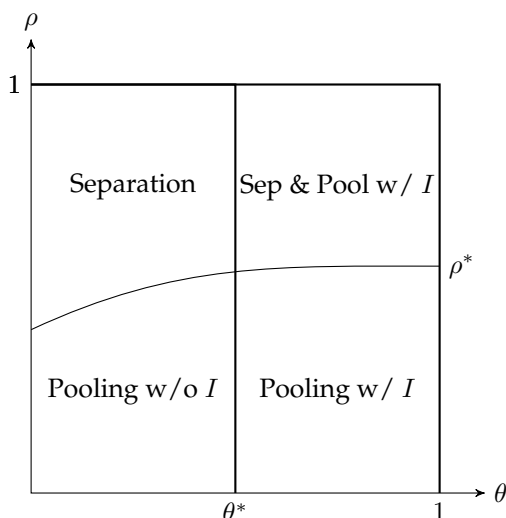
Figure 1.2: Equilibria with medium investment level

1.4.2 Change of ρ^* and θ^* thresholds with investment

As shown above, the probabilities that each party experiences a shock influences the achieved equilibrium. However, the level of investment also effects the equilibrium because investment influences the threshold values. As shown in the appendix, the ρ^* threshold is decreasing in investment, $\frac{\partial \rho^*}{\partial I} < 0$. The slope of ρ^* threshold can be increasing or decreasing in investment. The θ^* threshold is increasing in investment, $\frac{\partial \theta^*}{\partial I} > 0$, under the assumption that the cost function is convex, $\frac{\partial c(e,I)}{\partial I} < 0$ and $\frac{\partial^2 c(e,I)}{\partial I^2} > 0$.

Figure 1.3 depicts how the thresholds react to a change in the level of investment assuming $c(e, I)$ is convex, $\frac{\partial^2 \rho^*}{\partial \theta^2} < 0$ and $\frac{\partial^2 \rho^*}{\partial \theta \partial I} > 0$. Given the exogenous investment level is very high, as on the right side of Figure 1.3, the θ^* threshold is relatively high. Even if the probability that P is patient is quite high, investment is so expensive that the patient A wants to be certain not to invest in vain

(high θ^* threshold). Since investment is very beneficial, the patient P is willing to signal even if the probability that A has no shock is low (low ρ^* threshold). Hence, separation is the equilibrium reached with most combinations of probabilities to have a shock.

Given that investment level is very low, as on the left side of Figure 1.3, the patient A is willing to invest under complete contract even when the probability that P has no shock is relatively low (low θ^* threshold). The patient P is not willing to risk exploitation and chooses complete contracts even when the probability that A has no shock is relatively high (high ρ^* threshold). Hence, with very low investment and for most combinations of probabilities to have no shock, the parties will reach a pooling equilibrium in which the patient A undertakes investment.
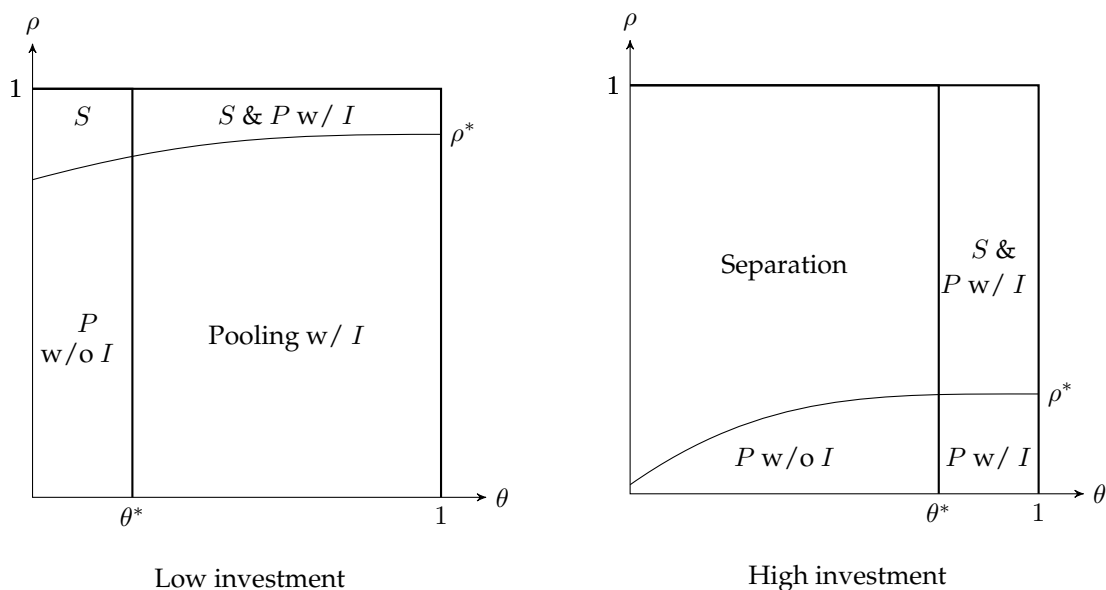
Figure 1.3: Equilibria with low and high investment level

1.4.3 Discussion of the results

To summarise, in this model, A can decide to undertake a non-contractible investment in the current period that increases surplus and payoff for herself and P in the next period. Both parties can experience a shock, which forces them to

stop the relationship after the current period. The myopic A is never willing to invest. The patient A is only willing to invest if he expects the continuation of the relationship. By writing a complete contract, the parties are only able to commit to cooperation in the current period. Furthermore, with complete contracts, the contractors do not gain information about the partner's state since cooperation occurs in compliance with the contract and is not a sign for commitment and cooperative behaviour. So, in order to learn about the state of the partner, the patient parties are under certain circumstances willing to agree on incomplete contracts.

If $\theta < \theta^*$, the belief of A in the patience of P is low. This lack of trust induces the patient A not to invest. If at the same time $\rho > \rho^*$, P has high belief in A's patience and regards A to be trustworthy. The patient P, thus, decides to trust A and offers an incomplete contract. He pays the wage $w' = w$ before receiving effort $e' = e$ and thus makes himself vulnerable to exploitation by A. However, because of this vulnerability, the myopic P would never choose to offer an incomplete contract. Therefore, offering an incomplete contract is a good signal of patience. After the patient P successfully signalled that he observed no shock, the patient A cooperates and invests, i.e. sets $e' = e$ and $I' = I$. However, P's trust will be exploited by a myopic A who chooses $e' = I' = 0$ but receives $w' = w$. If the patient P observes cooperation by A, P offers a contract in the next period according to the same decision rules than in the previous period. The benefits of investment for P occur in the next period if either P offers a complete contract or if he offers an incomplete contract and cooperation occurs again. A receives the benefits of investment in the next period because undertaking effort will be less costly.

If both parties mistrust each other, because the probability that the partner experiences a shock is high, i.e. $\theta < \theta^*$ and $\rho < \rho^*$, the patient P is not willing to risk exploitation and offers a complete contract which leads to no investment

by the patient A.

If P is relatively unlikely to experience a shock, i.e. $\theta > \theta^*$, A's belief in P's patience is high. This trust of A in P leads the patient A to invest without knowing P's state. However, the patient P is not willing to signal his type under this condition if he does not trust A, i.e. if $\rho < \rho^*$. If A trusts P but not vice versa, A is investing and risking to do so in vain. If both trust each other, because the probabilities of observing a shock are low for both contractors, each party is willing to take on risk. The patient A is willing to invest without knowing P's state. The patient P is willing to signal his type and thereby risking exploitation by a myopic A. Under this circumstance, separation and pooling with investment can both be potential equilibria.

The meaning of *low* and *high belief* in the partner's patience depends on the exogenous level of investment, because the θ^* and ρ^* threshold change with I. If the investment level is very high, the patient A is less willing to invest without knowing P's state. For the patient P, however, high investment is very beneficial and he is even more willing to signal his type. So, the higher the investment level, the lower the belief of P in A's patience has to be in order for the patient P to be willing to offer an incomplete contract. Thus, with most combinations of probabilities to have a shock for both parties, separation is achieved under high investment. Also, since under high investment, the patient A is less willing to invest without knowing P's state, the parties will only reach a potential pooling with investment equilibrium if A's belief in P's patience is very high.

Another interesting result is that the ρ^* threshold is increasing in θ. In order for P to be willing to signal his state, he demands A's probability of no shock to be higher if his probability of no shock is higher. Compare P's expected payoff from offering complete and incomplete contracts in the separation equilibrium (equation 1.3 and 1.4). As θ increases, $(1 - (1 - \rho)\theta)y(e, I)$ decreases. Thus, P's

potential benefit from signalling, i.e. the payoff from investment, will decrease as θ increases. If the patient P experiences no shock next period, he will offer an incomplete contract again. However, if A experiences a shock next period and is offered an incomplete contract, he will exploit P. Thus, P receives benefit $y(e, I)$ only with probability $(1 - (1 - \rho)\theta)$ where $(1 - \rho)\theta$ represents the probability that P is patient and offers an incomplete contract but A is myopic and exploits P. If, however, the patient P is more unlikely to be patient next period, he is more likely to offer a complete contract next period and to receive $y(e, I)$ with certainty. Therefore, the more likely the patient P is to be patient next period, the more likely he is to be exploited by A next period and to lose the benefits from investment. Hence, the more likely P is to be patient, the higher A's probability of experiencing no shock needs to be for P to be willing to signal his type. Although in this model the draws are independent every period, there exists a certain dependence between patience in the current period and continuation in future period(s). This is due to the fact that the next period(s) can only be reached if both parties are patient in this period.

1.5   Conclusion

Contractual incompleteness does not only stem from bounded rationality or transaction costs but may be deliberately chosen for various reasons. However, the existing theories on the choice of contractual (in-)completeness do not account for asymmetric information about partner's ability to be in an ongoing relationship and its impact on the sustainability and benefits of a relationship. This paper attempts to fill this gap in the contract theory literature by examining the role that incomplete contracts play in signalling stability and trustworthiness.

This model illustrates the relationship of contract choice and trust as well as

the outcome of the cooperation. Contractual incompleteness is under certain circumstances deliberately chosen and is rather a consequence of relational contracting than a cause of it. If A's trust in P is very high, the patient A invests even with complete contracts and incomplete contracts become irrelevant. It is not a surprising result that pooling on complete contract can be an equilibrium. Given complete contracts are feasible, it is usually expected that parties employ them to avoid exploitation by their partners. The interesting result is that separating equilibria exist as well and that a patient P may deliberately offer an incomplete contract. Given that A does not trust P but P trusts A and investment is sufficiently important for the relationship's surplus, a separation equilibrium, in which the patient P offers incomplete and the myopic P offers complete contracts, is achieved. By offering an incomplete contract, the patient P risks exploitation but facilitates the revelation of his trustworthiness, i.e. his ability to continue the relationship. However, if both parties highly distrust each other, they will not agree on an incomplete contract. Consequently, A will not invest and total surplus is not maximised. This model also illustrates that high beliefs in the trustworthiness of the partner are not a guarantee for cooperation. The myopic A is always able to exploit trust under incomplete contracts, so that cooperation can fail.

These results follow from the model without taking into account agents' motivation. Several authors discuss the impact of explicit incentives on intrinsic motivation as, for instance, Benabou and Tirole (2003). Also, as discussed by Herold (2010), experiencing distrust can make agents react negatively for psychological reasons. In this model, trust is important to induce A to undertake a non-contractible investment. When departing from standard assumptions on preferences and assuming that agents tend to reciprocate negatively when distrusted, this non-contractible investment might not be necessary to show that trust is important in an on-going relationship. Although these issues

are not considered in my model, it can be expected that the impact of trust on the outcome of the relationship would be even greater when taking them into account. Allowing for intrinsic motivation and reciprocity and analysing its influence on the level of effort or investment would be an interesting extension of the model.

Furthermore, the model illustrates how trust building works. If A's belief in P's trustworthiness is not sufficiently high to incentivise her to invest under complete contracts, P decides to facilitate that parties learn about each other's trustworthiness by relying on incomplete contracts. One can interpret the sequential move under incomplete contracts as a gift exchange. The patient P undertakes a costly action only beneficial to A, i.e. pays the wage, in hope that A returns the favour, i.e. exerts effort. When the parties successfully exchange gifts, cooperation continues, otherwise cooperation ends. It is also possible that A has a sufficiently higher belief in the trustworthiness of P than vice versa. In this model, this leads to pooling on complete contracts in which the patient A undertakes investment. However, it is conceivable that the patient A is willing to start the gift exchange and exert effort before receiving wage with incomplete contracts. Thereby, the patient A would reveal she had no shock before learning about P's state. However, this would allow the patient A to get an insight into P's state and she would not risk to invest in vain. Whether the parties would agree on such a timing in certain circumstances is an interesting question for future work.

One limitation of the model lies in the focus on the commitment function of contracts. In my model, wage, effort and investment levels are exogenously given. Contracts can, however, also be coordination devices as discussed by Mellewigt et al. (2007). It would be interesting to allow parties to choose the level of effort, wage and investment and to analyse the decisions of both contractors and the impact of trust on the outcome of the relationship.

Appendix

1.A   Change of ρ^* threshold with θ

The ρ^* threshold changes with θ. In order to determine how it changes, consider the first derivative

$$\frac{\partial \rho^*}{\partial \theta} = \frac{1}{\theta} \left[\frac{y(e,0) - \delta(1-\theta)[y(e,I) - y(e,0)]}{2W} + \frac{1}{2} - \frac{W - B}{2\delta\theta[y(e,I) - y(e,0)]} + \frac{(1-\theta)}{2\theta} \right] ,$$

where $W = \sqrt{[\delta(1-\theta)(y(e,I) - y(e,0)) + y(e,0)]^2 + 4\delta\theta[y(e,I) - y(e,0)]y(e,0)}$.

The ρ^* threshold is increasing in θ if $\frac{\partial \rho^*}{\partial \theta} > 0$, thus if

$$\left[\frac{1}{W} - \frac{1}{2\theta\delta[y(e,I) - y(e,0)]} \right] [W - (1-\theta)\delta(y(e,I) - y(e,0))]$$
$$> \left[-\frac{1}{W} - \frac{1}{2\theta\delta[y(e,I) - y(e,0)]} \right] B .$$

Since

$$[W - (1-\theta)\delta(y(e,I) - y(e,0))] > B ,$$
$$\left[\frac{1}{W} - \frac{1}{2\theta\delta[y(e,I) - y(e,0)]} \right] > \left[-\frac{1}{W} - \frac{1}{2\theta\delta[y(e,I) - y(e,0)]} \right] \text{ and }$$
$$W - (1-\theta)\delta[y(e,I) - y(e,0)] > -\frac{1}{W} - \frac{1}{2\theta\delta[y(e,I) - y(e,0)]} ,$$

$\frac{\partial \rho^*}{\partial \theta} > 0$ always holds and the ρ^* threshold is upward sloping. The second derivative can be both positive and negative, depending on the parameter values.

Also consider the value of $\rho^*(\theta = 1)$:

$$\rho^*(\theta = 1) = \frac{\sqrt{y(e,0)^2 + 4\delta[y(e,I) - y(e,0)]y(e,0)} - y(e,0)}{2\delta[y(e,I) - y(e,0)]} .$$

$\rho^*(\theta = 1) < 1$ as long as $4\delta^2[y(e,I) - y(e,0)]^2 > 0$, which always holds.

1.B   Change of ρ^* threshold with investment

In order to find the effect that investment has on the ρ^* threshold, consider the first derivative with respect to I:

$$\frac{\partial \rho^*}{\partial I} = \frac{\frac{\partial y(e,I)}{\partial I} y(e,0)}{2\delta\theta(y(e,I) - y(e,0))^2 W}[W - \delta(1+\theta)(y(e,I) - y(e,0)) - y(e,0)], \quad (1.6)$$

with $W = \{[\delta(1-\theta)(y(e,I) - y(e,0)) + y(e,0)]^2 + 4\delta\theta y(e,0)[y(e,I) - y(e,0)]\}^{\frac{1}{2}}.$

All terms in equation 1.6 are positive and $y(e,I) - y(e,0) > 0$. Thus, $\frac{\partial \rho^*}{\partial I} < 0$ if

$$W - \delta(1+\theta)(y(e,I) - y(e,0)) - y(e,0) < 0 ,$$

$$\text{hence if} \qquad -4\theta\delta(y(e,I) - y(e,0)) < 0 .$$

Since this always holds, $\frac{\partial \rho^*}{\partial I} < 0$ and as investment increases the ρ^* threshold decreases.

A change in investment also effects the slope of the ρ^* threshold. However, $\frac{\partial^2 \rho^*}{\partial \theta \partial I}$ can be positive and negative, depending on the parameter values.

1.C   Change of θ^* threshold with investment

The effect that investment has on the θ^* threshold depends on the first derivative with respect to I:

$$\frac{\partial \theta^*}{\partial I} = \frac{\delta I \frac{\partial c(e,I)}{\partial I} + \delta(c(e,0) - c(e,I))}{[\delta(c(e,0) - c(e,I))]^2} .$$

Assume that $\frac{\partial c(e,I)}{\partial I} < 0$, hence

$$
\begin{aligned}
\frac{\partial \theta^*}{\partial I} &> 0 \text{ if } -\frac{\partial c(e,I)}{\partial I} < \frac{c(e,0) - c(e,I)}{I} \ , \\
\frac{\partial \theta^*}{\partial I} &< 0 \text{ if } -\frac{\partial c(e,I)}{\partial I} > \frac{c(e,0) - c(e,I)}{I} \ .
\end{aligned}
$$

Thus, the effect that investment has on the θ^* threshold depends on the cost function. Assume that $c(e, I)$ is convex, such that $\frac{\partial c(e,I)}{\partial I} < 0$ and $\frac{\partial^2 c(e,I)}{\partial I^2} > 0$, and the θ^* threshold is increasing in investment.

Bibliography

Benabou, R. and Tirole, J. (2003). Intrinsic and Extrinsic Motivation. *The Review of Economic Studies*, 70(3):489–520.

Bernheim, B. D. and Whinston, M. D. (1998). Incomplete Contracts and Strategic Ambiguity. *The American Economic Review*, 88(4):pp. 902–932.

Braynov, S. and Sandholm, T. (2002). Contracting with uncertain level of trust. *Computational Intelligence*, 18(4):501–514.

Cho, I.-K. and Kreps, D. M. (1987). Signaling games and stable equilibria. *The Quarterly Journal of Economics*, 102(2):179–221.

Chou, E. Y., Halevy, N., and Murnighan, J. K. (2011). The Relational Costs of Complete Contracts. *IACM 24th Annual Conference Paper*.

Crocker, K. J. and Reynolds, K. J. (1993). The Efficiency of Incomplete Contracts: An Empirical Analysis of Air Force Engine Procurement. *The RAND Journal of Economics*, 24(1):pp. 126–146.

Desrieux, C. and Beuve, J. (2011). Relational contracts as a foundation for contractual incompleteness. *Economics Bulletin*, 31(3):2030–2040.

Gulati, R. (1995). Does familiarity breed trust? the implications of repeated ties for contractual choice in alliances. *Academy of management journal*, 38(1):85–112.

Halonen-Akatwijuka, M. and Hart, O. D. (2013). More is Less: Why Parties May Deliberately Write Incomplete Contracts. Working Paper 19001, National Bureau of Economic Research.

Herold, F. (2010). Contractual incompleteness as a signal of trust. *Games and Economic Behavior*, 68(1):180 – 191.

Hoffman, A. M. (2002). A conceptualization of trust in international relations. *European Journal of International Relations*, 8(3):375–401.

James Jr, H. S. (2002). The trust paradox: a survey of economic inquiries into the nature of trust and trustworthiness. *Journal of Economic Behavior & Organization*, 47(3):291–307.

Kramer, R. M. (1999). Trust and distrust in organizations: Emerging perspectives, enduring questions. *Annual Review of Psychology*, 50(1):569–598.

Kvaloy, O. and Olsen, T. E. (2009). Endogenous Verifiability and Relational Contracting. *The American Economic Review*, 99(5):pp. 2193–2208.

MacLeod, W. B. (2007). Reputations, Relationships, and Contract Enforcement. *Journal of Economic Literature*, 45(3):pp. 595–628.

Malcomson, J. M. (2010). Relational Incentive Contracts. *Discussion Paper. Department of Economics (University of Oxford)*.

Malhotra, D. and Murnighan, J. K. (2002). The Effects of Contracts on Interpersonal Trust. *Administrative Science Quarterly*, 47(3):534–559.

Mellewigt, T., Madhok, A., and Weibel, A. (2007). Trust and formal contracts in interorganizational relationships – substitutes and complements. *Managerial and Decision Economics*, 28(8):833–847.

Poppo, L. and Zenger, T. (2002). Do formal contracts and relational governance function as substitutes or complements? *Strategic Management Journal*, 23(8):707–725.

Spier, K. E. (1992). Incomplete Contracts and Signalling. *The RAND Journal of Economics*, 23(3):pp. 432–443.

Tirole, J. (2009). Cognition and Incomplete Contracts. *American Economic Review*, 99(1):265–94.

Vosselman, E. and Meer Kooistra, J. v. d. (2009). Accounting for control and trust building in interfirm transactional relationships. *Accounting, Organizations and Society*, 34(2):267–283.

Williamson, O. E. (1985). *The economic institutions of capitalism: firms, markets, relational contracting*. Free Press.

Williamson, O. E. (1993). Calculativeness, trust, and economic organization. *The Journal of Law & Economics*, 36:453.

Chapter 2

Contracts as reference points in the presence of a court

2.1 Introduction

It is widely accepted in the literature that most contracts are incomplete. In fact, why incompleteness arises and how trade relationships can function nevertheless is an extensively examined topic in contract theory.[1] But if contracts are prevalently incomplete, why do parties go to the trouble of writing contracts instead of relying on ex post renegotiation? Hart and Moore (2008) answer this question by arguing that, in trade relationships, contractual terms anchor parties' feelings of entitlement which limits detrimental, non-contractible shading on performance. In this paper, I discuss if and how the reference point for parties' feelings of entitlement depend on the enforcement of the contract in courts. In general, the option to make claims in courts is what makes con-

---

[1]The classic explanation for why incompleteness arises is that parties economise on transaction costs of writing contracts as discussed by Williamson (1985). Also some literature, for example Tirole (2009), argues that parties are boundedly rational and hence not able to describe future contingencies and obligations. Unverifiability of payoff-relevant variables as a cause for incompleteness is discussed by, for instance, Hart and Holmström (1987), Grossman and Hart (1986) and Hart and Moore (1988). With incomplete contracts, long-term relationships can function for instance due to relational contracting; see for example Baker et al. (2002) and Levin (2003).

tracts valuable. Most economics literature, however, assumes that courts cannot enforce incomplete contracts which include unverifiable terms or contractual gaps. In contrast, I argue that courts have to decide on all disputes, supposedly especially if they are related to unverifiable terms. Indeed, the issue of contract interpretation by courts, because contractual gaps exist or terms are vague or ambiguous, is an important part of the legal and law and economics literature.[2] The prospect of resolving potential contractual disputes in courts ex post will presumably influence parties' ex ante incentives to write contracts, the contract design and also parties' feelings of entitlement. In this paper, I intend to analyse this interplay.

For this purpose, I utilise the theory by Hart and Moore (2008) (henceforth HM), which offers a new explanation for contract formation under contractual incompleteness, and introduce a contract enforcing court to the model.[3] HM argue that in a simple trade relationship, i.e. exchange of a good for a price, a contract anchors parties' feelings of entitlement and thus acts as a reference point. Suppose parties have some discretion over performance, they provide full performance only if they feel 'well-treated' with regard to the contract, otherwise they 'shade'. Therefore, an ex ante contract that specifies future trade eliminates 'aggrievement' ex post. Contractual incompleteness arises as the states of nature are unverifiable and thus state contingent contracts are not possible. The state is assumed to affect the seller's cost of production and the buyer's value from the product. Parties can ex ante determine a single trade price and write a rigid contract. Alternatively, contractors can choose to write a flexible contract that bounds but does not fix the price and enables price adjustments ex post. This, however, can cause parties to expect different outcomes within the contract, leading to aggrievement and shading. HM's

---

[2]See for example Katz (2004) and Gilson et al. (2014).

[3]See Walker (2013) for a literature review on a new approach towards the theory of the firm that was initiated by the reference point approach towards contracts by Hart and Moore (2008).

reference point theory has been tested and mainly supported in several experiments by Fehr et al. (2009, 2014) using a similar set-up.

In this paper, I introduce a court to HM's model and allow for ex post renegotiation. If either party does not feel well-treated with the proposed terms, it can take the case to the court. Going to court is costly for both parties. The judge enforces trade and makes a decision on the price based on the contract terms and the observed price offer but without observing the state. I analyse whether and when parties have incentives to claim compliance with the contract in court and how this affects the ex ante contract design.

I analyse how HM's results rely on certain (implicit) assumptions and explicitly include a contract enforcing court into their model. HM assume that trade is voluntary. Thus, either party can walk away from trade and the contract partner has no option to file a lawsuit for contract breach. Nevertheless, renegotiation is ruled out in HM's model. I show that these assumptions are equivalent to a set-up in which a court simply monitors that no trade outside of the contract terms occurs instead of enforcing trade according to the contract. Deviating from HM's assumptions, I show that if trade is voluntary but renegotiation is not prohibited, contracts that fix the trade price ex ante may not act as a reference point. Thus, the parties are indifferent between writing a contract or solely relying on negotiation of the trade terms ex post. However, when parties have the option to take the case to the court, which enforces compliance with the contract, contracts can in fact act as reference points. Additionally, in contrast to HM's findings, parties will not agree on a flexible contract that only determines a price interval in the presence of the court. Hence, parties will not incorporate flexibility into the contract to address uncertainty about the state.

In order to analyse the effect that the presence of a court has on parties' feelings of entitlement and thus their shading decision, behavioural assumptions

are necessary although this restricts the generalisability of the results. In the main part of the paper, I utilise the conservative assumption that court's decision does not change contractors' reference points for feelings of entitlement. In the appendix, I analyse the effects of alternative behavioural assumptions where the contract is not the sole reference point and court's decision affects parties' feelings of entitlement. I find that the results are qualitatively not influenced by these assumptions, but the price at which parties trade is affected.

The potential for renegotiation and hold-up is examined by Hart (2009) in a model based on HM but which allows for high uncertainty about value and cost. He shows that fixed price contracts are valuable in normal times whereas in extreme states hold-up can occur causing deadweight losses. He proposes that indexing the contract price to a verifiable signal related to industry conditions and allocation of asset ownership can reduce hold-up incentives. So, Hart (2009) addresses some of my concerns with HM but does not examine the role of courts. Contract interpretation by courts would be especially interesting in the case of indexation in his model. Renegotiation also plays an important part in Halonen-Akatwijuka and Hart (2013). But they do not discuss interval contracts and also do not examine the effect of courts on reference points and renegotiation. Furthermore, they assume that renegotiation only takes place if the contract price would not allow for mutual beneficial trade. I do not impose this restriction. In their model, contractors feel entitled to a certain share of the surplus from renegotiations but there is disagreement about the reference point for the evaluation of this surplus. If a state arises that is not covered in the contract, parties may choose different verifiable contingencies as the reference point for renegotiation. Thus, parties may sometimes decide to write less complete contracts in order to avoid creating too many reference points.

The novelty of HM's theory is that it explains contract formation in case of contractual incompleteness in a model without ex ante, relationship-specific

investment. In contrast, much of the incomplete contract theory literature focuses on an underinvestment problem and analyses solutions to the hold-up problem.[4] For instance, Edlin and Reichelstein (1996) focus on selfish investment (investment that affects the investor's own profit) and argue that a simple contract that specifies price and quantity achieves first-best efficient investment. In contrast, Che and Hausch (1999) examine cooperative investment (investment that affects the opponent's profit) and find that no contract decreases investment inefficiencies.

Within these frameworks, Willington (2013) analyses the role of an imperfect court assuming that litigation is costly. He argues that courts decide on all disputes, even related to unverifiable terms. If one party claims that the opponent is breaching contractual terms, the court makes a decision on contract breach without additional information about unverifiable variables and independent of whether breach actually occurred or not. If courts decide that a breach happened, parties are not committed to any transaction and the breaching party has to pay liquidated damages as specified in the contract. Willington (2013) shows that in the presence of such an imperfect court a simple contract can achieve first-best in case of unverifiable cooperative investment whereas not always in case of selfish investment. I follow Willington's idea of an imperfect court although I assume a different source of imperfection because I analyse a different type of contractual incompleteness. The court in my paper does not make a decision on the non-contractual term, which is shading in my model as opposed to investment, but on the trade price without observing the

---

[4]For the literature on the underinvestment problem, see, for example, Williamson (1985) and Hart and Moore (1988). Relationship-specific investment is assumed to be unverifiable and is thus not specified in the contract. However, investment decisions take place before state uncertainty is resolved. Due to opportunistic behaviour in ex post negotiations, parties may lose benefits from these investments. Therefore, incomplete contracts result in underinvestment (Edlin and Reichelstein, 1996). Regarding the hold-up problem, for instance, Aghion et al. (1994), Chung (1991) and Nöldeke and Schmidt (1995) propose a solution based on contracts that allocate bargaining power and thus specify the renegotiation game such that parties always renegotiate to the efficient level. See also Buzard and Watson (2012) and Watson (2007) for other approaches.

realised state.

The role of an imperfect and costly court is also discussed by Zhang and Zhu (2000) in a simple procurement model where the buyer can behave opportunistically ex post. The court in their model resolves the price dispute on the basis of receiving an informative but noisy signal about quality. They show that as long as court's decision is not arbitrary, first-best contingent contracts are possible. In my analysis, however, court's decision is completely independent of the state and I examine contractors' decision between flexible and fixed price contracts in the presence of such a court.

Furthermore, contract enforcement and, in case of flexible contracts, contract interpretation affect the ex ante contract choice in my model. An array of literature focuses on the relationship between contract writing costs, contract interpretation and contract formation. Shavell (2006) discusses a model without relationship-specific ex ante investment where contractual incompleteness arises from contracting costs. Contract interpretation is beneficial for contractors as it may improve on imperfect contracts but allows for less specific and thus less costly contracts. Furthermore, he finds that the enforcement of contracts as written is inferior to contract interpretation in which the court (sometimes) overrides general terms but interprets specific terms as written. The set-up has similarities to mine as it does not consider investment and the court enforces specific performance but has to identify what specific performance means based on the contract. As opposed to my analysis where contracts are by assumption incomplete, court costs are zero but contract writing costs are positive. This affects the relationship between contract choice and court decision.

Heller and Spiegler (2008) is an extension of Shavell (2006) that focuses on contracts with contradictions, i.e. intersecting events call for different actions. In contrast to my approach, they model a conflict of interest between

contract writer and interpreter and analyse the optimal amount of contradictions. Other literature that endogenises contractual incompleteness based on complexity and cost of writing contracts are for example Battigalli and Maggi (2002) and Kvaloy and Olsen (2009) which, opposed to my paper, do not allow for contract interpretation and assume costless litigation.[5]

The literature on contract interpretation focuses on which rules the court should follow to reach decisions, which breach remedies courts should employ and how interpretation rules affect ex ante contract formation and investment. Schwartz and Watson (2013) discuss the optimal interpretive rule for a legal enforcer who is interested in maximising welfare over the set of contracting relationships. They focus on the trade off between contract writing costs, litigation and efficient ex ante investment. In contrast, I make assumptions about courts' decision rule and analyse the effects on contract choices and behaviour.

Stremitzer (2010) also compares different legal rules and examines their effect on incentives for cooperative investment and trade decisions. He shows that expectation damages induce first-best and contracts are not useless as found in Che and Hausch (1999). The result stems from the assumption that if the court can observe whether trade took place it can verify that quality exceeds a certain minimum threshold. However, reliance and expectation damages are not feasible with unverifiable investment and parties might select specific performance due to lower informational requirements for courts. I do not compare the impact of different breach remedies in this paper but assume that the court enforces specific performance. Expectation damages are not feasible in my set-up with unverifiable states and reliance damages were similar to voiding contracts as there are no reliance expenditures.

---

[5]Battigalli and Maggi (2002) distinguish two forms on contractual incompleteness, discretion (parties' behaviour is not sufficiently specified) and rigidity (obligations are not sufficiently state contingent), and describe the optimal contract. Kvaloy and Olsen (2009) focus on repeated interactions where the principal can invest in the verifiability of agent's actions by drafting the contract such that the probability of verifiability is increasing in the investment in contract specification.

I also do not allow for voiding of the contract. Anderlini et al. (2007) and Anderlini et al. (2011) discuss set-ups where voiding of contracts by a court can be optimal. Anderlini et al. (2007) discuss court's decision of voiding or upholding contracts (but not interpreting them) in case that unforeseen and non-contractual contingencies arise. The possibility of contract voiding is an insurance against occurrence of unlikely states, whereas it lowers ex ante investment incentives. The court in their model can distinguish (but not perfectly observe) normal and exceptional states ex post and voids or upholds the contract based on the severeness of the state. Subsequently, parties can renegotiate. The source of contractual incompleteness, and thus the role of the court, is different in my model. Ex ante contractors know all possible states but states are unverifiable and contracts cannot be state contingent. In Anderlini et al. (2007), the contract does not contingent on all possible states and the court needs to infer the intend of the parties not to follow the contract in extreme states. Anderlini et al. (2011) analyse a setting with ex ante asymmetric information on value and cost of trade among contractors. The court is voiding trading contracts with extreme prices (exceeding an announced price cap) which can induce parties to reveal private information ex ante and thus be welfare enhancing. In my analysis, information is symmetric, so the court's role is not to induce information revelation.

The rest of the paper proceeds as follows. Section 2.2 summarises HM's model and its findings. In section 2.3, I discuss HM's assumptions related to contractual incompleteness and contract enforcement and explain my additional assumptions when incorporating a court to HM's model. Subsequently, I investigate parties' behaviour with different contracts and analyse parties ex ante contract choice by focusing in section 2.4 on HM's contract examples and generalising the results to other possible contracts in Section 2.5. Section 2.6 compares my results with HM's findings and examines how they depend on

different assumptions. The last section concludes. An analysis with alternative behavioural assumptions on contractors' reference points is provided in the appendix.

2.2 Recapitulation of Hart and Moore (2008)

HM consider the relationship between a buyer (henceforth B and he) and a seller (henceforth S and she) who want to trade a good or a service in exchange for money. Initially, at date 0, the parties negotiate about the price and sign a contract. Contract negotiations occur in a perfectly competitive environment for buyers and sellers. At date 1, the contractors face bilateral monopoly and trade.[6] Furthermore, HM assume that information is symmetric, parties are risk-neutral and not wealth constrained. At date 1, any uncertainty from date 0 is resolved.

At date 0, B and S can consent to three possible agreements. They can write a simple contract which is an agreement to trade at a certain price p or a flexible contract which is an agreement to trade at a price in a certain range $[p_l, p_h]$. Alternatively, the parties can decide not to sign a contract and simply reach an "agreement to agree" with the opportunity to renegotiate in the future. HM further assume that B's value, denoted by v, and S's cost, denoted by c, are only observable to both parties but not verifiable to a third party. Thus, B and S cannot write state contingent contracts. Furthermore, it is assumed that trade is voluntary, which means that trade only occurs at date 1 if both parties want it, irrespective of what has been specified in the contract. This assumption raises the question whether simple and flexible contracts can be regarded as binding and the agreement to agree as non-binding. I will get back to this issue later.

---

[6]A possible explanation for the fundamental transformation in the trade relationship could be unmodelled relationship-specific investment.

For the reference point aspect of contracts to matter, HM assume that performance has two parts, a judicially enforceable ('perfunctory performance') and an unenforceable part ('consummate performance'). Thus, trade is only partially contractible. The cost of providing either form of performance is assumed to be the same, hence both parties are initially indifferent between them. However, given this indifference, it can be assumed that the contractors will provide full performance if they feel well-treated and inferior performance if they feel badly treated. HM take the view that parties feel well-treated if at date 1, they receive what they feel entitled to. The sole reference point for these feelings of entitlement is the best possible outcome permitted by the contract. If parties feel badly treated, they are aggrieved and provide only inferior performance, referred to as 'shading'. Aggrievement is measured as the difference between the trade terms that an agent faces versus what (s)he feels entitled to. HM assume that \$ 1 of aggrievement causes a psychic loss of \$ θ, $0 < \theta \leq 1$, to the affected party. This pain is fully transferred back to the party causing it. B and S feel aggrievement in the same way and make the shading decision simultaneously. Shading is assumed to be non-contractible and will not be part of the contractual terms.

Consider the following example where value is $v = 10$ and cost is $c = 0$. At date 0, the parties choose between signing no contract or a simple contract. Without a contract, parties agree to agree later and implicitly consent that trade at date 1 is possible at any price p between value and cost. Eventually, B and S will negotiate to a certain price $\hat{p}$ and trade. The best possible outcome for B from this agreement is to trade at a price $p = 0$ and that is what he feels entitled to. Hence, B is aggrieved by the difference $(\hat{p} - 0)$ and shades by $\theta(\hat{p} - 0)$, which lowers S's payoff. However, S's best possible outcome from this agreement is trade at $p = 10$. S is aggrieved by the difference $(10 - \hat{p})$ and shades on performance by $\theta(10 - \hat{p})$. Thus, B and S's payoffs, U_B and U_S, at

date 1 are

$$U_B = 10 - \hat{p} - \theta(10 - \hat{p})$$

$$U_S = \hat{p} - \theta(\hat{p} - 0) .$$

Consequently, the total surplus W from trade is only given by

$$W = (1 - \theta)10.$$

If the parties agree on a simple contract at date 0, they fix the price p at a level that reflects the competitive environment at date 0. Thus, the contract formation is considered as fair and at date 1 there is no aggrievement and no shading. The surplus from the trade is therefore $W = 10$. In a nutshell, HM argue that simple contracts (i.e. contracts that fix a specific price) anchor parties' feelings of entitlement and thus lead to better trading outcomes.

In order to demonstrate the relevance of flexible contracts consider another example with at date 0 uncertain cost and value, as summarised in Table 2.1.

state	s1	s2
value (v)	9	20
cost (c)	0	10

Table 2.1: Uncertain value and cost example

When signing the contract at date 0, the parties know that at date 1 they can face two different states of nature; s1 and s2. HM assume that value and cost are observable to the contractors but due to the unverifiability of the states, contracts cannot be state contingent. Furthermore, HM assume that trade at date 1 is voluntary but renegotiation does not occur. Under these assumption, "a simple contract [can] achieve first-best if (i) only v varies; (ii) only c varies;

or (iii) the smallest element of the support of v is at least as great as the largest element of the support of c'' (Hart and Moore, 2008). This, however, is not the case in the example presented in Table 2.1. Here, first-best outcomes cannot be achieved by a simple contract because one party always has an incentive to walk away from trade due to the voluntary trade assumption. A flexible contract that specifies the price range $[9, 10]$ can, however, achieve first-best. Since trade is voluntary, S does not feel entitled to $p > 9$ in s1 as B would not trade at a price that is higher than his value from the product. Similarly, B does not feel entitled to $p < 10$ in s2 because the seller would not trade at a price that does not cover her cost of production. In s1, parties will agree to trade at $p = 9$ and in s2 at $p = 10$. Hence, trade occurs in either state without aggrievement and shading.

The timing of the game is summarised in Figure 2.1. The parties meet and decide whether to sign no contract, a simple contract s with p^s or a flexible contract f with $p^f \in [p_L, p_H]$. Then the state of nature is realised. Without a contract, the parties negotiate the pricing terms ex post. With a simple contract, the parties either trade at p^s or walk away from trade, whereas the contractors agree on a price within the price range with a flexible contract. Once the trade terms are specified, both contractors determine their individual degree of shading.

In general, HM argue that the contractors face a trade-off between writing simple and flexible contracts. The latter allow for ex post adjustment of the pricing terms to the realised state of nature but leave room for aggrievement and detrimental shading. The former creates only one reference points for feelings of entitlement but adjustments to the state are ex post not possible.

The parties meet and
agree on no contract
or sign either a simple
contract with p^s,
or a flexible contract
with $[p_L, p_H]$.

The state is
realised.

no
contract

The parties negotiate to a price p
at which they trade and
determine the degree of shading.

simple
contract

The parties either do not trade
or agree to trade at p^s, and
determine the degree of shading.

flexible
contract

The parties agree on a price
$\hat{p} \in [p_L, p_H]$ at which they trade
and determine degree of shading.

Figure 2.1: Timing in HM's model

2.3 Introducing a court to HM's model – assumptions

HM do not explicitly model a court of law and its effect on parties' shading behaviour and contract design decisions. In this section, I first examine how HM's assumptions can be translated into a model that explicitly incorporates a court. Secondly, I explain which additional assumptions about the court are necessary in order to achieve that parties can renegotiate and/or claim compliance with the contract. Thirdly, I discuss additional assumptions about the reference points that I make when incorporating a court to HM's model. If and how the results of HM's model, as summarised above, change depending on these assumptions is discussed in the next sections.

2.3.1 (Implicit) assumptions about contract enforcement in HM's model

Although HM do not explicitly model a court, they make some (implicit) assumptions about a contract enforcing entity. In the following, I will examine

how HM's assumptions translate into a set-up with a court.

The underlying main assumption by HM is that states are unverifiable by third parties. A court is not able to observe which state of nature has occurred. Therefore, the parties cannot write state contingent contracts. This is the basis for the discussion on which contract type, simple or flexible contract, the parties should utilise. But although the court cannot observe the state, it can observe that a contract about the delivery of a product or service in exchange for a price has been signed and whether such trade occurred or not. Thus, HM assume that the delivery of performance is judicially enforceable. However, the level of performance is assumed to be non-contractible either because it cannot be perfectly described or not perfectly observed by a court. Therefore, contracts in this set-up are incomplete because states are unverifiable and shading on performance is non-contractible. The parties can write a contract specifying the delivery of a product in exchange for a price, but the state of nature and shading cannot be part of the contractual terms.

HM's (implicit) court assumption 1. *Contracts are incomplete. The state of nature is unverifiable and state contingent contracts are not possible. The level of performance (shading) is non-contractible.*

The court enforces ex post the delivery of performance in exchange for a price that is in line with the contract terms if an agreement has been reached ex ante. The court does not rule on the level of performance as it is not part of the contract and the court is completely unaware of shading issues. Contract enforcement is costless and occurs automatically.

HM's (implicit) court assumption 2. *The court costlessly and automatically enforces contracts.*

HM's (implicit) court assumption 3. *The court enforces the delivery of performance in exchange for a price that is not violating the contract terms. It does not rule on the level of performance.*

Furthermore, HM assume that trade is voluntary. Combined with the assumption that the court enforces the delivery of performance, this means that the court must be willing to costlessly void contracts if one party demands it. Since states are unverifiable, a court voids a contract without having information on whether this is reasonable or not as it cannot observe contractors' value or cost from trade. HM also rule out renegotiation. This means that no trade occurs after a contract is voided.

HM's (implicit) court assumption 4. *Trade is voluntary. A court costlessly voids contracts if one contractor requests it.*

HM's (implicit) court assumption 5. *Renegotiation is monitored and prohibited by the court.*

2.3.2   Additional assumptions about contract enforcement

By applying HM's assumption to a model with a court, it becomes evident that HM's set-up is not very realistic. In the following, I explain which assumptions I make about the court in order to address some of these issues.

For contract design and the effect of reference points to matter, I keep HM's assumptions about the contractual incompleteness. In general, it seems realistic to assume that in some circumstances contracts cannot be perfectly described unless parties invest in the writing of contracts.[7]

Court assumption 1. *Contracts are incomplete, see HM's (implicit) court assumption 1.*

In contrast to HM, I do not assume that the court enforces contracts automatically without claims being filed. In my model, at date 0, parties contract upon the delivery of performance in exchange for a price. At date 1, parties

---

[7]See for example Shavell (2006), Kvaloy and Olsen (2009), Battigalli and Maggi (2002) for analyses of contractual incompleteness due to complexity and cost of writing contracts.

renegotiate and can either stick to the contractual terms or not. I assume that B makes a first offer for the trade price, denoted by $\hat{p}$. The price offer can be equal or not to the contract price p. S can accept B's price offer, start renegotiation or decide to litigate. Assume that the renegotiated price leads to a 50/50 split of the surplus , i.e. $\hat{p}^n = 0.5(v + c)$. If either party is unhappy with the price at date 1, either $\hat{p}$ or $\hat{p}^n$, (s)he can litigate. The court only becomes active if at least one party files a law suit.

Furthermore, I assume that going to court is costly. Both parties have to pay litigation cost e, for example because they have to prepare for trial and hire a lawyer. Litigation costs have to be paid irrespective of court's ruling. This is close to the system in the US where litigation costs have to be paid by each party individually. In contrast, in the UK the loser has to pay all legal fees including the breach victim's. Who pays the legal fees can also be part of court's ruling in civil law countries (for example Germany). My results do not qualitatively depend on how litigation costs are distributed among the contractors.

Court assumption 2. *The court enforces the contract only if either contractor litigates and both parties pay litigation cost e.*

If a case is submitted to the court, the court observes the contract, the proposed price $\hat{p}$ and the fact that trade has not occurred yet. Given this information, the court has to resolve the dispute. Note that I assume that the court does not consider any additional evidence.[8] For simplification, I assume that the court imposes specific performance, meaning that it enforces the contract as written if possible. In my set-up, one part of the trade is always contracted upon, namely the provision of the good. Hence, I assume that the court always ensures that trade takes place. However depending on the contract choice, the

---

[8]Posner (2005, p. 1598) argues that "party's self-serving testimony that cannot be verified because it concerns his state of mind or a conversation to which the only witness was the other party to the contract [which] disagrees about what was said" should be excluded. In the American system, contractual ambiguities are usually resolved without extrinsic evidence "by making a 'best guess'" (Posner, 2005, p. 1603).

price is up to dispute and the court decides on the trade price. For example, Ben-Shahar (2004) argues that parties are usually compelled by courts to stick to agreements to agree. Some terms are deliberately left incomplete and open for later agreement, such as the trade price with flexible contracts in this set-up, but there is a commitment to be bound to the agreed-upon terms, which is here the willingness to trade.

Court assumption 3. *The court enforces the delivery of performance and makes a decision about the contract price. It does not rule on the level of performance.*

Based on (the interpretation of) the contract, courts have to decide on whether to request specific performance, void the contract or demand breach remedies such as expectation, liquidated or reliance damages. If courts enforce specific performance, either party can demand performance as specified in the contract. Demanding expectation damages means that the breaching party has to pay damages such that the victim of breach is in the position he would have been had the contract been performed. With reliance damages, the breaching party compensates the victim of breach for any expenditures (for example ex ante investment) made in reliance on contract performance (Shavell, 1980). Parties can also specify in the contract liquidated damages, which have to be paid in case of breach (Edlin and Schwartz, 2003).[9]

I assume that the court never voids the contract and that it does not award damages. In practice, the typical default remedy is expectation damages. However, courts can enforce specific performance, especially when damages are inadequate or goods are unique. Courts usually refrain from enforcing contracts as written when specific performance is impossible or would cause severe hardship ('impracticability of performance' and 'frustration of purpose') or the contract is too vague (Avraham and Liu, 2006). Nevertheless, a small risk

---

[9]The optimality of different penalties is, for example, discussed by Edlin and Schwartz (2003) and Liu and Avraham (2012). The impact of breach remedies on investment incentives is analysed by Shavell (1980, 1984), Rogerson (1984) and Schweizer (2012).

is usually not a cause for voiding of contracts (Anderlini et al., 2007). In this example, no unforeseen contingencies arise and parties are ex ante aware of all possible states of nature. Specific performance in this context is thus neither impossible nor especially severe. Also, it is easier for the court to enforce contracts as written than to estimate expectation damages in my set-up as value and costs are unobservable to the court. The restrictions on court's information also make the determination of liquidated damages complicated. Contractors are not allowed to specify damages above "a reasonable ex ante estimation of the promisee's expectation interest [which] thus prohibit penalties"(Edlin and Schwartz, 2003). This would be difficult to prove in court. Furthermore, reliance damages are not relevant in this set-up as enforcing them would have similar effects to the voiding of contracts as the parties do not undertake and need to be compensated for reliance expenditures.

If parties write a simple contract (s) with price p^s, the contract does not leave room for interpretation and I assume that the court enforces the contract price, i.e. $p^s = p_c$.[10] A flexible contract, however, does not clearly specify the price and thus calls for interpretation. I assume that the court randomises within the price range specified in the contract, $[p_l, p_h]$. By doing so, the court takes a relatively neutral position in contract enforcement. In practice, courts follow different approaches in case of incomplete contracts. One is the contra-proferentum penalty price, where the price is set biased against the party who drafted the contract (Posner, 2005, p.1607). Whereas in the pro-defendant gap filling approach, prices are enforced in favour of the defendant. In the legal literature, advantages and disadvantages of either rule are discussed (see, for instance, Ben-Shahar (2004) and Posner (2005)). I do not restrict the model to either approach. The employed rule does not fundamentally change the

---

[10]As Posner (2005, p. 1582) argues: "The defendant may challenge the plaintiff's interpretation of the contract rather than acknowledge the breach, but unless there is a real uncertainty about meaning, the challenge will present no interesting question of interpretation."

results but the enforced price would be in favour of either party. Furthermore, I assume that the court monitors that the parties obey its decision and that the court does not become active if no contract has been signed.

Court assumption 4. *The court enforces the contract as written and never voids contracts. Thus, trade always takes place. The court enforces the contract price p^s when a simple contract s has been signed. If a flexible contract f has been breached, i.e. $\hat{p}^f \notin [p_l, p_h]$, the court randomly picks a price from the contract price range $[p_l, p_h]$. Otherwise, the court enforces the proposed price $\hat{p}^f$.*

2.3.3 Assumptions about reference points

HM assume that the contractors feel entitled to the best possible outcome under the contract. If no contract has been signed, they assume that the parties feel entitled to the best possible outcome from negotiation.

HM's reference point assumption 1. *If a contract has been signed, the contractors feel entitled to the best possible outcome under the contract. If no contract has been signed, both parties feel entitled to the whole surplus from negotiation.*

The presence of the court might affect contractors' reference points for feelings of entitlement. Whichever decision the court reaches, it is debatable how the parties feel towards the court's ruling. It appears reasonable to assume that parties will not be aggrieved when the court enforces simple contracts as written. However, the reference point for aggrievement is not clearly identifiable when the court settles flexible contracts. It is possible that parties regard the original contract as a reference point and B is aggrieved by the difference $(p_c - p_l)$, whereas S is aggrieved by the difference $(p_h - p_c)$. Also, the parties could be pleased that the dispute is resolved by the court, who is due to randomisation not on purpose deciding in favour of either party. Thus, it is imaginable that the parties do not feel any aggrievement after court's ruling

and shading is completely eliminated. Alternatively, parties' reference point could change. It is possible that the contractors regard the at date 1 proposed trade price, $\hat{p}$, as the *new* reference point. Hence, the by the court enforced price, p_c, would lead to aggrievement by B of $\max[(p_c - \hat{p}), 0]$ and aggrievement by S of $\max[(\hat{p} - p_c), 0]$.[11] In the following, I assume that the contractors reference points are solely based on the contract and do not change with or without litigation. In the appendix of this chapter, I provide an analysis using the other assumptions which do not qualitatively change the results.

Furthermore, it is possible that the conditions are such that either party prefers to walk away from the contract at date 1 but that the opponent has no incentives to litigate, because the litigation costs are too high compared to the gains from litigation. In this case the parties will renegotiate in order to receive a positive payoff. I assume that in such a case the parties feel entitled to the best possible outcome from renegotiation because the contractual terms are not realistically achievable.

Reference point assumption 1. *The reference points for contractors' feelings of entitlement are based on the contract and do not change during litigation. If renegotiation occurs, both parties feel entitled to the whole surplus.*

2.4 Contract choice and shading in the presence of the court – HM's contract examples

In the following, I focus on the example from Table 2.1 and discuss how HM's analysis changes in the presence of a court. In this section, I consider the contract examples used by HM. I analyse parties' decisions to shade and to litigate and examine parties' ex ante contract choice. In the next section, I examine

---

[11]If $p_c > \hat{p}$, S receives more than she feels entitled to and does not shade whereas B is aggrieved by the difference. Vice versa if $p_c < \hat{p}$. Thus, only one party shades after court's ruling.

0   1

The parties meet and agree on no contract, or sign either a simple contract with p^s, or a flexible contract with $[p_L, p_H]$.

The state is realised and B offers trade at $\hat{p}$.

→ S walks away.

S accepts. The parties decide on shading and trade at $\hat{p}$.

B bargains, the parties agree on $\hat{p}^n$, decide on shading and trade at $\hat{p}^n$.

B litigates, the court imposes p_c. The contractors decide on shading, pay litigation cost e and trade at p_c.

S litigates, the court imposes p_c. The contractors decide on shading, pay litigation cost e and trade at p_c.

Figure 2.2: Timing in the model with a court

other contract options.

The timing of the game is summarised in Figure 2.2. At date 0, B and S meet and decide whether to sign a simple (s) or flexible contract (f), or to agree on no contract (n). At date 1, any uncertainty is resolved and B offers to trade at $\hat{p}$. Subsequently, there are three options of how the game continues: 1) S can accept the price offer $\hat{p}$, the parties decide on the amount of shading and finally trade at price $\hat{p}$; 2) S can reject the price offer by threatening to walk away and B can response to this by either renegotiating to a new $\hat{p}^n$ or by going to court and have the contract enforced; 3) S can litigate and have the contract enforced. If either party decides to litigate, the court enforces the contract and decides at which price, p_c, the parties must trade. Subsequently, the parties decide on shading, pay litigation cost e and trade at p_c. Note that the litigation costs are paid after parties' shading decisions such that shading is only influenced by the trade price.

Consider no contract. If the parties do not write a contract at date 0, they agree to agree later and implicitly allow for trade to take place at any price

61

between v and c. I assume that the court does not decide on a dispute when no contract has been signed because it does not recognise that either party has a claim. Thus, the parties have to solely rely on bargaining at date 1. The parties may for example eventually agree on a 50/50 split as they are in a bilateral monopoly at date 1, i.e. $\hat{p}^n = 4.5$ in s1 and $\hat{p}^n = 15$ in s2. Both parties feel entitled to the whole surplus and B and S's expected payoffs are

$$E[U_B(\hat{p}^n)] = E[U_S(\hat{p}^n)] = \Pi_1(1-\theta)4.5 + \Pi_2(1-\theta)5 .$$

The expected total surplus is given by

$$E(W) = \Pi_1(1-\theta)9 + \Pi_2(1-\theta)10 .$$

Consider a simple contract with $p^s = 9$. Irrespective of the state of nature, B has three options for his price offer at date 1. He can either offer exactly what is written in the contract ($\hat{p} = 9$), less than what is agreed upon ($\hat{p} < 9$) or more ($\hat{p} > 9$). B has no incentives to offer $\hat{p} > 9$. With a price offer $\hat{p} = 9$, S has no incentive to go to the costly court which would enforce the same price, $p_c = \hat{p} = 9$. In this case, B and S's payoff are $U_B^1(\hat{p} = 9) = 0$ and $U_S^1(\hat{p} = 9) = 9$ in s1 and $U_B^2(\hat{p} = 9) = 11$ and $U_S^2(\hat{p} = 9) = -1$.

If B offers $\hat{p} < 9$, S can litigate. The court would enforce $p_c = \hat{p} = 9$ but litigation cost e have to be paid. Thus, S is indifferent between going to court or accepting if $\hat{p} = 9 - e$. However, S is aggrieved by $(p - \hat{p}) = 9 - (9 - e)$ as she gets less than specified in the contract. Thus, B's payoff from offering $\hat{p} = 9 - e$ is $U_B^1(\hat{p} = 9 - e) = 9 - (9 - e) - \theta(e) = (1 - \theta)e$ in s1 and $U_B^2(\hat{p} = 9 - e) = 11 + (1 - \theta)e$ in s2.

If B offers $\hat{p} < 9$, S can walk away from trade and force B into renegotiation. B has an incentive to go to court (c) to have the contract enforced when the payoff is higher than under renegotiation. In s1, $U_B^1(p_c = 9, c) \geq U_B^1(\hat{p}^n)$ holds

if

$$(1 + \theta)4.5 \geq e \,. \tag{2.1}$$

In s2, $U_B^2(p_c = 9, c) \geq U_B^2(\hat{p}^n)$ holds if

$$(1 + \theta)5 + 1 \geq e \,. \tag{2.2}$$

In this section, I assume that litigation costs are not very high such that condition 2.2 and therefore also condition 2.1 holds. Thus, I am only considering cases in which B always has an incentive to litigate if S walks away.

Given constraint 2.2 holds, B offers $\hat{p}^s = 9 - e$ as $U_B^i(\hat{p}^s = 9 - e) > U_B^i(\hat{p} = 9)$ for $i = 1, 2$, and no party has an incentive to litigate. Note that I assume that there is no negative shading, meaning that B is not providing better performance because he has to pay less than he feels entitled to. Considering a simple contract with $p^s = 10$ gives similar results. B offers $\hat{p}^s = p^s - e = 10 - e$ and given constraint 2.2 holds, nobody has an incentive to litigate.

Consider a flexible contract with $p^f \in [9, 10]$. Likewise, B has three price offer options at date 1, irrespective of the state of nature. If B offers $\hat{p} = 9$, S can litigate. I assume that the court in this model decides that B did not breach the contract because he chose a price within the contract price range $[9, 10]$, see court assumption 4. Thus, the court enforces $p_c = \hat{p} = 9$. Anticipating this, no party has an incentive to go to the costly court. Also, B has no incentives to offer $\hat{p} > 9$.

However, if B offers $\hat{p} < 9$ and S litigates, I assume that the court decides that the contract was breached because the proposed price lies outside the contract price range. The court demands that trade takes place but has to decide on the trade price. I assume that the court randomly picks a price from the con-

tract price range $[9, 10]$, see court assumption 4. If the parties consider the best outcome under the contract as their reference point, see HM's reference point assumption 1, both will be aggrieved after court's decision. B is aggrieved by $(p_c - p_l)$, whereas S is aggrieved by $(p_h - p_c)$. S faces a trade-off in her litigation decision. On the one hand, she can benefit from litigation as the court would enforce a higher price $(E(p_c) = 9.5)$. On the other hand, she would face shading by B and has to pay litigation cost e. Therefore, S is indifferent between going to court or not if the payoff from accepting $\hat{p}$ is equal to the expected payoff from going to court, i.e. if $\hat{p}^f = 9.5 - e - \theta(9.5 - 9)$ in s1. Her opponent B is willing to offer $\hat{p}^f = 9.5 - e - 0.5\theta$ if the payoff is at least as high as the payoff from offering $\hat{p} = 9$. This is the case in s1 (the same holds in s2) if

$$9 - \hat{p}^f - \theta(10 - \hat{p}^f) \geq 9 - 9 - \theta(10 - 9)$$

$$e \geq (1 - \theta)0.5 \ .$$

To summarise, when a flexible contract has been signed, at date 1 B offers $\hat{p}^f_{eh} = 9.5 - e - 0.5\theta$ under relatively high litigation costs $e \geq (1-\theta)0.5$, whereas he offers $\hat{p}^f_{el} = 9$ under relatively low litigation costs $e < (1 - \theta)0.5$. Note that B's price offer with flexible contracts is higher than with simple contracts, $\hat{p}^f > \hat{p}^s$. Hence, if condition 2.2 holds, B has an incentive to litigate if S walks away.

Compare the different contract options. Assume that the aforementioned contracts are the only possible contracts. The parties have the choice between no contract; writing a simple contract with $p^s = 9$ and trade at $\hat{p}^s = 9 - e$; writing a simple contract with $p^s = 10$ and trade at $\hat{p}^s = 10 - e$; and writing a flexible contract with $p^f \in [9, 10]$ that leads to trade at $\hat{p}^f_{eh} = 9.5 - e - 0.5\theta$ if $e \geq (1 - \theta)0.5$ or trade at $\hat{p}^f_{el} = 9$ if $e < (1 - \theta)0.5$. In all cases, the contractors do not litigate but the option of going to court affects the trade price.

Note that with a flexible contract, the trade price is higher than with a simple contract with $p^s = 9$. The flexible contract gives B less incentives to undercut the contractual (lower bound) price because the price enforced by the court is in expectations $E(p_c) = 9.5$ and the potential punishment is more severe with flexible contracts.

Assume that the probability of both states occurring is equal, i.e. $\Pi_1 = \Pi_2$. The total surplus given by the different contracts is presented in Table 2.2. It is evident that the simple contract always yields a higher surplus than the flexible contract as it leaves less room for shading. The surplus loss by θe with simple contracts is less than with flexible contracts where S feels entitled to $p_h = 10$ but receives $\hat{p}^f \leq 9$. Nevertheless, wasteful shading cannot be completely eliminated with simple contracts and simple contracts are second-best contracts. If litigation costs are high, more specifically $e \geq (1 - \theta)0.5$, the surplus is very low with flexible contracts. This is because B can undercut the price heavily without incentivising S to go to court which increases shading. Consequently, B's payoff is the highest with a simple contract with $p^s = 9$ but he prefers a flexible contract over a simple contract with $p^s = 10$. In contrast, S is best off with a simple contract with $p^s = 10$ but prefers a flexible contract over a simple contract with $p^s = 9$.

Proposition 2.1. *In the presence of a court that enforces contracts as written and if litigation costs are not very high, $e \leq (1 + \theta)4.5$, simple contracts are second-best contracts. If the competitive environment at date 0 is such that B (S) chooses between no contract, writing a simple contract with $p^s = 9$, with $p^s = 10$ or a flexible contract with $p^f \in [9, 10]$, he (she) selects a simple contract with $p^s = 9$ ($p^s = 10$).*

Contract	No contract	Simple contract with $p^s = 9$	Flexible contract with $p^f \in [9, 10]$	
			if $e \geq (1-\theta)0.5$ $\hat{p}^f_{eh} = 9$	if $e < (1-\theta)0.5$ $\hat{p}^f_{el} = 9.5 - e - 0.5\theta$
Price offer	$\hat{p}^n = 0.5(v+c)$	$\hat{p}^s = p^s - e$		
$E(U_B)$	$\Pi_1(1-\theta)4.5+$ $\Pi_2(1-\theta)5$	$\Pi_1(1-\theta)e+$ $\Pi_2(11+(1-\theta)e)$	$\Pi_1((1-\theta)e - 0.5(1+\theta^2))+$ $\Pi_2(10.5 + (1-\theta)e - 0.5\theta^2)$	$\Pi_1(-\theta) + \Pi_2(11-\theta)$
$E(U_S)$	$\Pi_1(1-\theta)4.5+$ $\Pi_2(1-\theta)5$	$\Pi_1(9-e) + \Pi_2(-1-e)$	$\Pi_1(9.5 - e - 0.5\theta)+$ $\Pi_2(-0.5(1+\theta)-e)$	$\Pi_1(9) + \Pi_2(-1)$
$E(W)$	$\Pi_1(1-\theta)9+$ $\Pi_2(1-\theta)10$	$\Pi_1(9-\theta e) + \Pi_2(10-\theta e)$	$\Pi_1(9 - \theta(e+0.5(1+\theta)))+$ $\Pi_2(10 - \theta(e+0.5(1+\theta)))$	$\Pi_1(9-\theta) + \Pi_2(10-\theta)$

Table 2.2: Comparing expected payoffs and surplus under different contract types

2.5 Contract choice and shading in the presence of the court – all possible contracts

In the previous section, I focused on HM's contract examples to illustrate the role of courts in their analysis. In the following, I consider other possible contracts. Which contract is written depends on the competitive environment at date 0. First, I analyse which contract type is chosen if one party can unilaterally select it. Second, I examine the range of possible contract prices when parties bargain in the contract writing stage. Third, I discuss comparative statics and how the contract prices are affected by changes in the litigation cost and the shading parameter. Assume in the following that both states are equally likely to occur, i.e $\Pi_1 = \Pi_2$.

2.5.1 Contractual terms if one party unilaterally imposes them

In the previous section 2.4, I showed that B (S) prefers a simple contract with $p^s = 9$ ($p^s = 10$) to a flexible contract with $p^f \in [9, 10]$. Thus, B (S) also prefers a simple contract with $p^s < 9$ ($p^s > 10$) to a flexible contract. If at date 0, the competitive environment is such that one party can unilaterally choose the contract type, (s)he proposes a simple contract with the price most favourable to him/her that makes the opponent just indifferent to signing. The following derives those boundaries on possible simple contracts. A simple contract with p^s is undercut by B at date 1 and leads to trade at $\hat{p}^s = p^s - e$ which makes S indifferent to litigation.

Consider the case where B chooses the contract. If there are many sellers but only one buyer, B chooses a simple contract with a very low price such

that sellers are just indifferent to signing,

$$E[U_S(p^s)] = \Pi_1(p^s - e - 0) + \Pi_2(p^s - e - 10) = 0$$

$$p^s = 5 + e \ .$$

A simple contract with $p^s = 5 + e$ leads to trade at $\hat{p}^s = 5$. The difference between contract and trade price results in shading by θe. Thus, the higher are the litigation costs, the higher must be the contract price to compensate S for the anticipated undercutting of the contract price at date 1. Also, the higher are the litigation costs, the higher is the level of shading that B faces as a response to undercutting. B is willing to write a contract with $p^s = 5 + e$ if the expected payoff is higher than the expected payoff from relying on negotiation at date 1,

$$E[U_B(p^s = 5 + e)] \geq E[U_B(\hat{p}^n)]$$

$$\Pi_1(4 - \theta e) + \Pi_2(15 - \theta e) \geq \Pi_1(1 - \theta)4.5 + \Pi_2(1 - \theta)5$$

$$\frac{1 + \theta}{\theta}4.75 \geq e \ . \tag{2.3}$$

In s1, with a simple contract with $p^s = 5 + e$, S gets a higher payoff than with renegotiation and has no incentives to litigate when $\hat{p}^s = 5$. B has no incentive to offer anything lower than $\hat{p}^s = 5$ as S would litigate. B and S's payoffs are $U_B(p^s = 5 + e, nc) = 4 - \theta e$ and $U_S(p^s = 5 + e, nc) = 5$, respectively.

In s2, S makes negative profit $U_S(p^s = 5 + e) = -5$ but has no incentives to litigate. She can, however, try to force B into renegotiation by walking away. B has an incentives to litigate when

$$U_B(p_c = 5 + e, c) \geq U_B(\hat{p}^n)$$

$$20 - (5 + e) - e \geq (1 - \theta)5$$

$$5 + 2.5\theta \geq e \ . \tag{2.4}$$

Therefore, if $e \leq 5 + 2.5\theta < \frac{1+\theta}{\theta}4.75$, a simple contract with $p^s = 5 + e$ leads to trade at $\hat{p}^s = 5$ without litigation and renegotiation. If $5 + 2.5\theta < \frac{1+\theta}{\theta}4.75 \leq e$, B offers no contract and the parties rely on renegotiation at date 1.

If the litigation costs are such that condition 2.3 holds but 2.4 is not satisfied, i.e. $5 + 2.5\theta < e < \frac{1+\theta}{\theta}4.75$, the parties' behaviour depends on the realised state. In s1, trade at $\hat{p}^s = 5$ occurs without litigation (because condition 2.3 holds). In s2, S forces B into renegotiation by walking away and B has no incentive to litigate (because condition 2.4 does not hold). Given that the parties can anticipate renegotiation in s2, B can offer an even lower contract price (which only matters for s1). S is indifferent to signing a contract with a lower price $p^{s'}$ if

$$E[U_S(p^{s'})] = \Pi_1(p^{s'} - e) + \Pi_2(1 - \theta)5 = 0$$

$$p^{s'} = (1 - \theta)5 + e .$$

B is willing to offer a contract with $p^{s'} = (1 - \theta)5 + e$ if

$$E[U_B(p^{s'} = (1 - \theta)5 + e)] \geq E[U_B(\hat{p}^n)]$$

$$\Pi_1(9 - (1 - \theta)5 - \theta e) + \Pi_2(1 - \theta)5 \geq \Pi_1(1 - \theta)4.5 + \Pi_2(1 - \theta)5$$

$$\frac{9.5\theta - 0.5}{\theta} \geq e .$$

Thus if $5 + 2.5\theta < e \leq \frac{9.5\theta - 0.5}{\theta} < \frac{1+\theta}{\theta}4.75$, B offers $p^{s'} = (1 - \theta)5 + e$ and in s1 trade occurs at $\hat{p}^{s'} = (1 - \theta)5$ without litigation or renegotiation whereas in s2 the parties renegotiate. For litigation costs such that $5 + 2.5\theta \leq \frac{9.5\theta - 0.5}{\theta} < e < \frac{1+\theta}{\theta}4.75$, B offers no contract and the parties solely rely on renegotiation.

Note that no other contract does better than $p^s = 5 + e$ if condition 2.4 does not hold. In order to make S indifferent to renegotiation, B could offer a higher price $\hat{p}' > \hat{p}^s$. However, the price offer that would make S indifferent, $\hat{p}' = 15 - 5\theta$, makes B prefer the renegotiation outcome. On the other hand, B could

sign a contract with S that make him just indifferent to litigate if S threatens to walk away. However a contract with such a low price, $p^s = 15 - e + 5\theta$, would not be accepted by S at date 0.

Consider the case where S chooses the contract. If S faces many buyers, she will offer a simple contract with a price p^s that makes B just indifferent to signing such that

$$E[U_B(p^s)] = \Pi_1(9 - p^s + e - \theta e) + \Pi_2(20 - p^s + e - \theta e) = 0$$

$$p^s = 14.5 + (1 - \theta)e .$$

Similar to above, S offers to write a simple contract with $p^s = 14.5 + (1 - \theta)e$ as opposed to relying on negotiation at date 1 only if litigation costs are low and condition 2.3 holds.

In s1, such a contract always leads to trade at $\hat{p}^s = 14.5 - \theta e$ without renegotiation or litigation because S is better off than under renegotiation, $U_S(\hat{p}^s = 14.5 - \theta e) = 14.5 - \theta e \geq U_S(\hat{p}^n = 4.5) = (1 - \theta)4.5$ and has an incentive to litigate if B walks away as $U_S(p_c = 14.5 + (1 - \theta)e, c) \geq U_S(\hat{p}^n = 4.5)$ if $\frac{10}{\theta} + 4.5 > \frac{1+\theta}{\theta}4.75 \geq e$.

In s2, B has no incentive to walk away to force S into renegotiation as $U_B(\hat{p}^s = 14.5 - \theta e) = 5.5 + \theta e \geq U_B(\hat{p}^n = 15) = (1 - \theta)5$. S has either no incentive to walk away or B is willing to litigate, except for the special case $5 - \frac{0.5}{\theta} > e > \frac{5\theta + 0.5}{2 - \theta}$, where S prefers renegotiation and B has no incentive to litigate, $U_S(\hat{p}^s = 14.5 - \theta e) < U_S(\hat{p}^n = 15)$ and $U_B(p_c = 14.5 + (1 - \theta)e, c) < U_B(\hat{p}^n = 15)$. However, although B has no incentive to litigate, he is willing to offer a higher price in order to avoid renegotiation. The price offer $\hat{p}' = 15 - 5\theta$ at date 1 makes S indifferent to renegotiation $U_S(\hat{p}') = U_S(\hat{p}^n = 15) = (1 - \theta)5$. B has an incentive to offer this price $\hat{p}'$ if $U_B(\hat{p}') \geq U_B(\hat{p}^n = 15)$, which holds for $\frac{(2-\theta)5}{(1-\theta)} \geq e$ and is satisfied in this special case (as $\frac{(2-\theta)5}{(1-\theta)} > 5 - \frac{0.5}{\theta} > e > \frac{5\theta + 0.5}{2 - \theta}$). B

can anticipate he has to pay $\hat{p}' > \hat{p}^s$ in s2 in this special case. However as B has nevertheless (weakly) positive expected payoff for all e for which S wants to offer a contract, $E[U_B] = \Pi_1[U_B(\hat{p}^s)] + \Pi_2[U_B(\hat{p}^s)] \geq \Pi_1[U_B(\hat{p}^s)] + \Pi_2[U_B(\hat{p}')] \geq 0$ for $\frac{1+\theta}{\theta}4.75 \geq e$, he is willing to sign a simple contract with $p^s = 14.5 + (1 - \theta)e$.

Proposition 2.2. *In the presence of a court that enforces contracts as written, the parties write simple contracts if litigation costs are not very high, i.e. $e \leq 5 + 2.5\theta$ (if S decides on the contract $e \leq \frac{1+\theta}{\theta}4.75$). Only simple contracts with prices $p^s \in [5 + e, 14.5 + (1 - \theta)e]$ induce participation by both parties and lead to trade without renegotiation and litigation.*

Under high litigation costs ($\frac{1+\theta}{\theta}4.75 \leq e$), the parties agree to agree later and negotiate at date 1.

When B decides on the contract and for intermediate level of litigation costs ($5 + 2.5\theta < e < \frac{1+\theta}{\theta}4.75$), the parties write no contract (if $\frac{9.5\theta-0.5}{\theta} < e$) or do write a contract with $p^{s'} = (1 - \theta)5 + e$ (if $e \leq \frac{9.5\theta-0.5}{\theta}$) but renegotiate in s2.

2.5.2 Contractual terms if parties bargain over them

The competitive environment at date 1 can also be such that buyers and sellers bargain over the contract type and the pricing terms. Assume in the following that condition 2.4 holds. As shown before, B strictly prefers a simple contract with $p^s = 5 + e$ over a flexible contract with $p^f \in [9, 10]$, whereas S prefers the flexible contract. B might be willing to offer S a higher price p^s in the simple contract in order to achieve an agreement on this contract type and to avoid high shading levels from flexible contracts. In the following, consider the two different levels of litigation costs that with flexible contracts affect B's price offer at date 1 ($\hat{p}^f_{el}$ and $\hat{p}^f_{eh}$) and thus parties' payoffs, as presented in Table 2.2.

Consider relatively high litigation costs, $e \geq (1 - \theta)0.5$. S is indifferent between a simple contract with p_{min}^s and a flexible contract with $p^f \in [9, 10]$ if

$$E[U_S(\hat{p}_{eh}^f)] = E[U_S(\hat{p}^s = p_{min}^s - e)]$$

$$\Pi_1(9.5 - e - 0.5\theta) + \Pi_2(-0.5(1 + \theta) - e) = \Pi_1(p_{min}^s - e) + \Pi_2(p_{min}^s - e - 10)$$

$$p_{min}^s = 9.5 - 0.5\theta.$$

B's expected payoff from concluding a simple contract with $p_{min}^s = 9.5 - 0.5\theta$ is higher than the expected payoff from a flexible contract as

$$E[U_B(\hat{p}^s = p_{min}^s - e)] = \Pi_1((1 - \theta)e - 0.5(1 - \theta)) + \Pi_2(10.5 + 0.5\theta + (1 - \theta)e)$$

$$E[U_B(\hat{p}_{eh}^f)] = \Pi_1((1 - \theta)e - 0.5(1 + \theta^2)) + \Pi_2(10.5 - 0.5\theta^2 + (1 - \theta)e),$$

$$E[U_B(\hat{p}^s = p_{min}^s - e)] > E[U_B(\hat{p}_{eh}^f)].$$

However, there are simple contract prices that are so high that B prefers to sign a flexible contract at date 0 and having the chance to offer $\hat{p}^f \leq 9$ at date 1. B is indifferent between a simple contract with p_{max}^s and a flexible contract with $p^f \in [9, 10]$, if

$$E[U_B(\hat{p}^s = p_{max}^s - e)] = E[U_B(\hat{p}_{eh}^f)]$$

$$\Pi_1(9 - p_{max}^s + (1 - \theta)e) + \Pi_2(20 - p_{max}^s + (1 - \theta)e) =$$

$$\Pi_1((1 - \theta)e - 0.5(1 + \theta^2)) + \Pi_2(10.5 + (1 - \theta)e - 0.5\theta^2)$$

$$p_{max}^s = 9.5 + \frac{\theta^2}{2}.$$

S's expected payoff from concluding a simple contract with $p_{max}^s = 9.5 + \frac{\theta^2}{2}$ is

higher than the expected payoff from flexible contracts as

$$E[U_S(\hat{p}^s = p^s_{max} - e)]) = \Pi_1(9.5 + 0.5\theta^2 - e) + \Pi_2(-0.5(1 - \theta^2) - e)$$

$$E[U_S(\hat{p}^f_{eh})] = \Pi_1(9.5 - 0.5\theta - e) + \Pi_2(-0.5(1 + \theta) - e),$$

$$E[U_S(\hat{p}^s = p^s_{max} - e)]) > E[U_S(\hat{p}^f_{eh})] \,.$$

Therefore, under high litigation costs, B and S agree on a simple contract with a price of at least $p^s_{min} = 9.5 - 0.5\theta$ and at most $p^s_{max} = 9.5 + \frac{\theta^2}{2}$, which makes both (weakly) prefer a simple over a flexible contract. Which contract price the parties agree on depends on the competitive environment and contractors' bargaining powers at date 0.

Consider relatively low litigation costs, $e < (1 - \theta)0.5$. S is indifferent between a simple contract with p^s_{min} and a flexible contract with $p^f \in [9, 10]$ if

$$E[U_S(\hat{p}^f_{el})] = E[U_S(\hat{p}^s = p^s_{min} - e)]$$

$$\Pi_1(9) + \Pi_2(-1) = \Pi_1(p^s_{min} - e) + \Pi_2(p^s_{min} - e - 10)$$

$$p^s_{min} = 9 + e \,.$$

B's expected payoff from signing a simple contract with price $p^s_{min} = 9 + e$ is higher than the expected payoff from a flexible contract as

$$E[U_B(\hat{p}^s = p^s_{min} - e)] = \Pi_1(-\theta e) + \Pi_2(11 - \theta e)$$

$$E[U_B(\hat{p}^f_{el})] = \Pi_1(-\theta) + \Pi_2(11 - \theta),$$

$$E[U_B(\hat{p}^s = p^s_{min} - e)] > E[U_B(\hat{p}^f_{el})] \,.$$

B is indifferent between a simple contract with p^s_{max} and a flexible contract

with $p^f \in [9, 10]$ if

$$E[U_B(\hat{p}^f_{el})] = E[U_B(\hat{p}^s = p^s_{max} - e)]$$

$$\Pi_1(-\theta) + \Pi_2(11 - \theta) = \Pi_1(9 - p^s_{max} + (1-\theta)e) + \Pi_2(20 - p^s_{max} + (1-\theta)e)$$

$$p^s_{max} = 9 + \theta + (1-\theta)e .$$

S's expected payoff from signing a simple contract with $p^s_{max} = 9 + \theta + (1-\theta)e$ is higher than with flexible contracts as

$$E[U_S(\hat{p}^s = p^s_{max} - e)] = \Pi_1(9 + \theta(1-e)) + \Pi_2(-1 + \theta(1-e))$$

$$E[U_S(\hat{p}^f_{el})] = \Pi_1(9) + \Pi_2(-1),$$

$$E[U_S(\hat{p} = p^s_{max} - e)] > E[U_S(\hat{p}^f_{el})] .$$

Therefore, under relatively low litigation costs, B and S agree on a simple contract with a price of at least $p^s_{min} = 9 + e$ and at most $p^s_{max} = 9 + \theta + (1-\theta)e$, which makes both (weakly) prefer a simple over a flexible contract. Which contract price the parties agree on depends on the competitive environment and contractors' bargaining powers at date 0.

Note that, for example if $e \geq (1-\theta)0.5$, both parties prefer a simple contract with $9.5 - 0.5\theta \leq p^s \leq 9.5 + 0.5\theta^2$ to a flexible contract with $p^f \in [9.5 - 0.5\theta, 9.5 + 0.5\theta^2]$. The contractors prefer simple contracts to all other flexible contracts and my results are not restricted to flexible contracts with $p^f \in [9, 10]$.

Proposition 2.3. *In the presence of a court that enforces contracts as written under not very high litigation costs, such that condition 2.4 holds, B and S can find a simple contract that both (weakly) prefer to a flexible contract with $p^f \in [p_L, p_H]$. Under relatively high litigation costs, $e \geq (1-\theta)0.5$, such a simple contract comprises a price $9.5 - 0.5\theta \leq p^s \leq 9.5 + 0.5\theta^2$. Under relatively low litigation costs, $e < (1-\theta)0.5$, such a simple contract comprises a price $9 + e \leq p^s \leq 9 + \theta + (1-\theta)e$.*

2.5.3 Contractual terms – comparative statics

Figure 2.3 depicts how the shading parameter θ and the litigation costs e affect the range of simple contracts for which both contractors (weakly) prefer simple over flexible contracts, assuming that litigation costs are not very high and condition 2.4 holds.

Under relatively high litigation costs, $e \geq (1 - \theta)0.5$, represented in area I, the contract price is not affected by changes in e (for same θ). The trade price, however, decreases as e increases. With flexible contracts parties trade at $\hat{p}^f_{eh} = 9.5 - e - 0.5\theta$. Since this price depends on the litigation costs, the parties are aware that irrespective of the contract choice, litigation costs lower the trade price and the simple contract that makes parties at least indifferent does not depend on e. For same levels of e but different θ's, the minimum of the range of possible simple contract prices p^s_{min} decreases whereas the maximum p^s_{max} increases. Less favourable prices make both parties indifferent between simple and flexible contracts. This is because as θ increases shading with flexible contracts becomes increasingly hurtful. Hence, the contract price p^s that makes B indifferent between simple and flexible contract increases in θ. S, on the other hand, is aware that with flexible contracts, the trade price is decreasing with θ as $\hat{p}^f_{eh} = 9.5 - e - 0.5\theta$. This is because the higher is θ, the lower are the incentives for S to go to court to claim $E(p_c) = 9.5$ because B will be aggrieved by this. Thus, the trade price that makes S just indifferent to litigate with flexible contracts is lower the higher is θ.

Under relatively low litigation costs, $e < (1 - \theta)0.5$, presented by area II, the contract price directly depends on the litigation costs e (for same θ). With a flexible contract, the contractors trade at $\hat{p}^f_{el} = 9$. S is indifferent between a flexible and a simple contract only if $p^s = 9 + e$, thus only if the simple contract accounts for the fact that the trade price $\hat{p}^s$ is decreasing in litigation costs. B is facing a trade-off between saving θ but experiencing shading by θe with simple
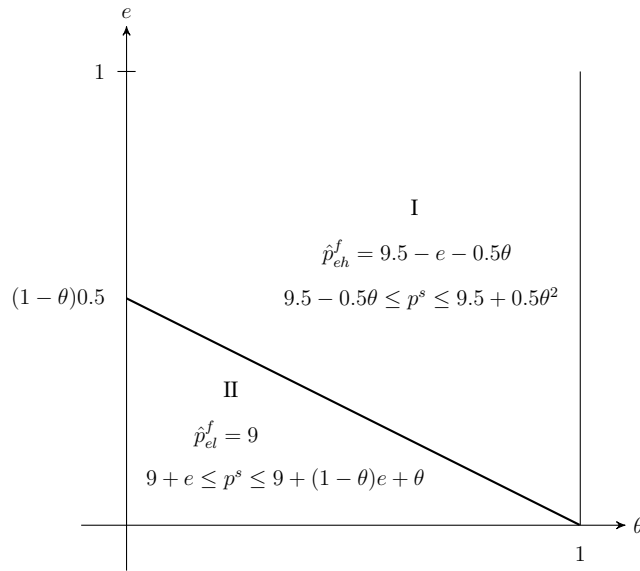
Figure 2.3: Range of simple contracts for which both contractors (weakly) prefer simple over flexible contracts depending on θ and e

contracts.

If going to court is costless, i.e. $e = 0$, B offers trade price $\hat{p}^f_{el} = 9$ with flexible contracts since otherwise S litigates to gain $E(p_c) = 9.5$. S is indifferent between the contract types when $p^s = 9$ ($\hat{p}^s = \hat{p}^f_{el} = 9$). B, however, prefers a simple contract over a flexible as long as $p^s \le 9 + \theta$, as he avoids shading by θ with simple contracts. Note that if $e = 0$, shading is completely eliminated when the parties write a simple contract as the contract price equals the trade price. Thus, the total surplus is maximised at $E(W) = \Pi_1 9 + \Pi_2 10$ with a simple contract when litigation is costless.

2.6 Discussion of the results

In this section, I discuss the results and compare how the assumptions in HM's and my analysis, specifically on voluntary trade, renegotiation and shading, affect the contract choice and conclusions about reference points for feelings of entitlement.

Consider a set-up in which shading is never occurring and where litigation

costs are really high, i.e. $\theta = 0$ and $e \to \infty$. In such a setting, a contract is not necessary to decrease shading. Also, courts would not be involved in either enforcing contracts or prohibiting renegotiation. Hence, the parties do not have incentives to write contracts at date 0 but rely on agreements to agree later and negotiation at date 1.

In contrast, consider $\theta > 0$ and $e \to \infty$. Thus, shading is possible. However, since litigation is unaffordable, trade is voluntary and renegotiation cannot be prohibited. Thus, instead of assuming voluntary trade by not allowing for a court as HM did, voluntary trade occurs in the presence of a court if litigation costs are set very high. Since shading is an issue, one could argue that the parties want to write a contract to anchor parties' feelings of entitlement. However, take the example from Table 2.1 and assume that the parties have agreed on a simple contract with $p^s = 9$. Say at date 1, s2 is realised. Since trade is voluntary and renegotiation is not prohibited, S has no incentives to trade at $p^s = 9$ given that her costs are $c(s2) = 10$ and she would rather walk away from trade. Consequently, B and S start to renegotiate and eventually agree on some price $\hat{p} \in [10, 20]$. The parties can anticipate this ex ante. Thus, it is questionable whether a simple contract actually does anchor parties' feelings of entitlement in the absence of a (affordable) court. Alternatively, parties could feel entitled to the best possible outcome of the renegotiation process at date 1, which in s2 would be $p = 20$ for S and $p = 10$ for B. This creates room for aggrievement and a simple contract does not eliminate shading. At date 0, the parties are indifferent between not contracting and writing a simple contract. Hence, HM's result that contracts are reference points for feelings of entitlement rely on the assumption of voluntary trade in combination with the assumption that courts automatically enforce simple contracts and renegotiation is prohibited.

In the analysis of Section 2.3, I assume that shading is an issue and that

trade is not necessarily voluntary because the contractors can litigate, i.e. $\theta > 0$ and e is small or zero. Renegotiation is also not ruled out. Under additional assumptions about the court, I argued that simple and flexible contracts can both always be enforced. Furthermore, I showed that both parties prefer writing simple and flexible contracts to no contracts. I also showed that simple contracts lead to shading by only θe whereas flexible contracts induce more shading. I concluded that the parties always agree on a simple contract as there always exists a simple contract that makes both parties (weakly) prefer simple over flexible contracts if there is a court (costly or not) that enforces contracts as written.

My analysis suggests that renegotiation does make a difference for the results. However, in addition to voluntary trade and shading, HM assume that renegotiation does not occur and thus do not examine the effect that renegotiation has on contractors' feelings of entitlement. But if trade is in fact voluntary, because litigation costs are very high, why should renegotiation not occur or how should renegotiation be prohibited? A necessary (or implicit) assumption in HM's set-up is that contracts are not only a benchmark for feelings of entitlement influencing non-contractable performance but also make parties stick to the contractable terms and not to renegotiate even in the absence of a court. This, however, would be a very much stronger behavioural assumption than found in the literature.

One could argue that given renegotiation is possible in my set-up, the contractors feel entitled to the best possible outcome from renegotiation. However as opposed to HM's set-up, in the presence of a court, the contract limits the possible trade prices that the court would enforce. Hence, my analysis substantiates where contractors' feelings of entitlement from contracts are coming from. The parties feel entitled to the best possible outcome that the court can impose based on the contract. Thus, contract enforcement is crucial for the

creation of reference points. My assumptions about (in-)voluntary trade and renegotiation are in line with the legal literature, see the discussion in Section 2.3.2. With flexible contracts, the trade price is deliberately left incomplete whereas there is a commitment to trade. So flexible contracts, as well as simple contracts, can be enforced. However, courts do not become active if no party decides to litigate and do not automatically enforce contracts.

A similar set-up to mine is utilised by Halonen-Akatwijuka and Hart (2013) although they only allow for renegotiation if $p^s > v$ or $p^s < c$. If trade is voluntary and renegotiation cannot be prohibited, restricting renegotiation to these cases is not realistic. Consider the example where parties write a simple contract with $p^s = 9$ at date 0 and s1 is realised with $v(s1) = 9$ and $c(s1) = 0$ at date 1. B is indifferent between trade at $p = 9$ and no trade. However, he may feel entitled to renegotiation and a lower price. So even in this case, a simple contract may not eliminate shading. A necessary (or implicit) assumption is that states are ex ante unverifiable but that a court can ex post observe v and c and thus void contracts when $p^s > v$ or $p^s < c$ but enforcing contracts otherwise. However, since the contractors are ex ante aware of all possible states, the court would not necessarily void the contract, see the discussion in Section 2.3.2. Furthermore, if ex post courts can observe v and c then the parties have no incentives to write other than state-contingent contracts.

My analysis relies on behavioural assumptions about how parties develop reference points and how they feel and behave when they receive less than what they feel entitled to. To check the robustness of my results, I analyse my hypotheses employing different behavioural assumptions in the appendix. The results do not qualitatively depend on the assumptions. Merely the range of possible contract prices changes.

Furthermore, this paper very much relies on HM's example where the cost in one state is higher than the value in another state. The argument, that

with renegotiation and voluntary trade contracts are not likely to be reference points, holds also for other examples where the smallest possible value of trade is at least as high as the largest possible cost.[12] I argue that in order for contracts to be reference points, a not too costly court or any other trusted third party needs to be present. The analysed choice of contracts and specifically the decision between flexible and simple contracts is relevant only in similar set-ups. However, my initial goal was to show that it matters whether courts are explicitly modeled or not. It is not always reasonable to assume that courts are either blindly and costlessly enforcing complete contracts or are not active at all in case of incomplete contracts. I examined one example with contractual incompleteness where the presence of a court affects parties' ex ante contract choice and their behaviour ex post. It would be very interesting to further analyse this interplay in different set-ups and with different forms of contractual incompleteness.

2.7   Conclusion

In this paper, I discuss the role that a contract enforcing court plays for contracts to serve as reference points based on HM's model. I assume that the contractors have the option to claim compliance with the contractual terms but also have the option to renegotiate. If litigation costs are not too high, the parties feel entitled to the best possible outcome that a court can enforce and not to the best possible outcome from ex post renegotiation, as it would be the case in HM's set-up without prohibiting renegotiation. As long as litigation costs are not too high, parties always write contracts. Simple contracts restrict the possible court decisions to a single price whereas flexible contracts give courts some discretion over the enforced price. Thus, flexible contracts leave more

---

[12]In all other examples where trade is efficient in each state, flexible contracts are not necessary in HM's basic model as the contractors can always find a first best simple contract.

room for aggrievement and lead to more shading on performance. I show that the parties always agree on a simple contract where the fixed price reflects the competitive environment at date 0. Simple contracts reduce the level of wasteful shading but, nevertheless, do not eliminate shading completely. The higher the litigation costs are, the more shading occurs. The downside of simple contracts in the presence of a court is that the parties are not able to incorporate flexibility into the contracts and are thus not able to adjust ex post to ex ante uncertain states of the world.

HM's theoretical predictions were tested and supported in several experiments, for example by Fehr et al. (2009), which utilised a similar set-up. It is desirable to run similar experiments but in the presence of a contract enforcing institution and to examine if and how the results differ and whether my predictions hold. In addition, it would be interesting to test which of my behavioural assumptions comes closest to how parties form reference points and to analyse whether reference points can change when a third party is involved.

This paper showed that the presence of a court affects parties' ex ante contract choice and ex post behaviour under contractual incompleteness. It is thus one step towards understanding the relationship between contract interpretation by a court, which depends inter alia on the type of contractual incompleteness, and contract formation. One could further pursue this analysis and examine in more detail how the ex ante use of specific or general terms as well as deliberate contractual gaps can be explained by ex post contract interpretation. Halonen-Akatwijuka and Hart (2013) work along these lines but do not incorporate an active court of law and solely rely on how these different types of contract terms affect ex post renegotiation. Furthermore, it would be valuable to investigate how a court decides if it observes that parties had an agreement but no explicit contract was concluded (verbal contract) and how this affects ex ante contract formation. I assume in this paper that the court does not make

any decisions in this case. In practice, however, verbal contracts are commonly used, especially for fairly simple trade relationships without high stakes.

Moreover, I assume throughout the paper that the parties are risk neutral. The analysis most likely changes if the contractors are risk-averse. On the one hand, I expect risk aversion to increase parties' preference for contractual flexibility in order to be able to adjust to ex ante uncertain states of nature. On the other hand, risk aversion will decrease parties' incentives to go to court, especially if contracts are incomplete and court's ruling is not perfectly predictable, and thus also influence pre-trial renegotiations. Pursuing to merge the ideas of contract interpretation from the legal literature and the aspects of incomplete contracts from contract theory is an interesting and valuable direction for future work.

Appendix

2.A Alternative reference point assumption 2: The price offer as the reference point

In this section, I use the same example than in the main part of the paper, see Table 2.1, but I assume that the reference point can change when the contractors litigate.

Assumptions. In the model of Section 2.4, I assume that the contract written at date 0 is the reference point for feelings of entitlement at date 1, irrespective of whether litigation occurs or not, see reference point assumption 1. Alternatively, I assume that if B offers $\hat{p}$ at date 1 and S litigates, the reference point for feelings of entitlement is the price offer at date 1, $\hat{p}$, and not the original contract. At date 1, the parties argue about the trade price and if one party is not happy, (s)he can litigate. The price enforced by the court, p_c, compared to the price offer, $\hat{p}$, can be the same, or higher for one and lower for the other party. Thus, it is possible that one party is pleased that the court settled the dispute in its favour and is not aggrieved even if the contract promised him/her a better trade outcome. Shading still occurs because the court resolves the dispute against the other party.

Reference point assumption 2. *The reference point for contractors' feelings of entitlement after litigation is B's price offer $\hat{p}$ before litigation at date 1.*

Furthermore, for simplification assume that at date 1, S has only two options. She can either 1) accept B's price offer $\hat{p}$; or 2) litigate. Hence, she does not have the option to walk away and force B into further renegotiation. The main results are not affected by this assumption, however more restrictions on the litigation cost e are necessary without this additional assumption.

Consider a simple contract with p^s. B always offers $\hat{p}^s = p^s - e$ and parties do not litigate similarly to the analysis in Section 2.4.

Consider a flexible contract with $p^f \in [9, 10]$. B has three options for price offers at date 1. In the following, I focus on s1 but the results similarly hold in s2. If B offers $\hat{p}^f = 9$, S can litigate. The court decides that B did not breach the contract and enforces $p_c = 9$. S's reference point for aggrievement is B's price offer at date 1 $\hat{p}^f = 9$ (instead of p_h as in the analysis in Section 2.4). If B offers $\hat{p}^f = 9$ and the parties go to court (c) which enforces $p_c = \hat{p}^f = 9$, S and B's payoffs are

$$U_S(\hat{p}^f = 9, p_c = 9, c) = 9 - e - \theta(9 - 9) = 9 - e$$
$$U_B(\hat{p}^f = 9, p_c = 9, c) = 9 - 9 - e - \theta(9 - 9) = -e \,.$$

If B offers $\hat{p}^f = 9$ but the parties do not go to court (nc), the reference point is the contract and the payoffs are

$$U_S(\hat{p}^f = 9, nc) = 9 - \theta(9 - 9) = 9$$
$$U_B(\hat{p}^f = 9, nc) = 9 - 9 - \theta(10 - 9) = -\theta \,.$$

In this case, S has no incentives to litigate as she cannot achieve a higher price but pays litigation costs. However, B has an incentive to go to court if $\theta > e$. Thus, if the litigation costs are low relative to the shading parameter, B can use

84

the court to eliminate shading. The court in this case 'convinces' S that $\hat{p}^f = 9$ is a reasonable price offer based on the signed contract.

B has no incentives to offer $\hat{p}^f > 9$ but might have an incentive to offer $\hat{p}^f < 9$. With $\hat{p}^f < 9$, S may want to litigate. The reference point for S's aggrievement after the court's decision is $\hat{p}^f$. S is indifferent to litigation if the payoff with $\hat{p}^f$ is equal to the expected payoff from litigation with enforced price $E(p_c) = 9.5$, i.e. if

$$U_S(\hat{p}^f, nc) = E[U_S(\hat{p}^f, p_c, c)]$$
$$\hat{p}^f = 9.5 - e - \theta(9.5 - \hat{p}^f)$$
$$\hat{p}^f = 9.5 - \frac{e}{1 - \theta} \ .$$

If B offers $\hat{p}^f = 9.5 - \frac{e}{1-\theta}$, neither contractor litigates and S's reference point for aggrievement is p_h. Whether B is willing to offer $\hat{p}^f = 9.5 - \frac{e}{1-\theta}$ depends on the litigation costs relative to the shading parameter. If $\theta < e$, B decides between offering $\hat{p}^f = 9$ and no litigation or $\hat{p}^f = 9.5 - \frac{e}{1-\theta}$. If $\theta > e$, B chooses between offering $\hat{p}^f = 9$ and litigation or $\hat{p}^f = 9.5 - \frac{e}{1-\theta}$.

For $\theta < e$, B offers $\hat{p}^f = 9.5 - \frac{e}{1-\theta}$ if

$$U_B(\hat{p}^f = 9.5 - \frac{e}{1 - \theta}, nc) \geq U_B(\hat{p}^f = 9, nc)$$
$$9 - \hat{p}^f - \theta(10 - \hat{p}^f) \geq 9 - 9 - \theta(10 - 9)$$
$$e \geq (1 - \theta)0.5 \ .$$

For $\theta > e$, B offers $\hat{p}^f = 9.5 - \frac{e}{1-\theta}$ if

$$U_B(\hat{p}^f = 9.5 - \frac{e}{1 - \theta}, nc) \geq U_B(\hat{p}^f = 9, c)$$
$$9 - \hat{p}^f - \theta(10 - \hat{p}^f) \geq 9 - 9 - \theta(9 - 9)$$
$$e \geq (1 + \theta)0.25 \ .$$

Consequently, there are four cases and B's price offer and litigation decisions depend on the shading parameter and the litigation costs. Table 2.3 provides an overview over the cases and B's choices, which are also illustrated in Figure 2.4.

	Conditions	Price offer $\hat{p}^f$	Litigation?
Case I:	$\theta > e$ and $e \geq (1+\theta)0.25$	$\hat{p}^f = 9.5 - \frac{e}{1-\theta}$	no
Case II:	$\theta > e$ and $e \leq (1+\theta)0.25$	$\hat{p}^f = 9$	yes ($p_c = 9$)
Case III:	$\theta < e$ and $e \geq (1-\theta)0.5$	$\hat{p}^f = 9.5 - \frac{e}{1-\theta}$	no
Case IV:	$\theta < e$ and $e \leq (1-\theta)0.5$	$\hat{p}^f = 9$	no

Table 2.3: B's price offer and litigation choice under flexible contracts (reference point assumption 2)

Flexible contract with $p^f \in [9, 10]$			
Cases	$E(U_B)$	$E(U_S)$	$E(W)$
I & III	$\Pi_1(e - 0.5(1+\theta))+$ $\Pi_2(10.5 + e - 0.5\theta)$	$\Pi_1(9.5 - \frac{e}{1-\theta})+$ $\Pi_2(-0.5 - \frac{e}{1-\theta})$	$\Pi_1(9 - \theta(0.5 + \frac{e}{1-\theta}))+$ $\Pi_2(10 - \theta(0.5 + \frac{e}{1-\theta}))$
II	$\Pi_1(-e) + \Pi_2(11 - e)$	$\Pi_1(9 - e) + \Pi_2(-1 - e)$	$\Pi_1(9 - 2e) + \Pi_2(10 - 2e)$
IV	$\Pi_1(-\theta) + \Pi_2(11 - \theta)$	$\Pi_1(9) + \Pi_2(-1)$	$\Pi_1(9 - \theta) + \Pi_2(10 - \theta)$

Simple contract with p^s			
Cases	$E(U_B)$	$E(U_S)$	$E(W)$
all	$\Pi_1(9 - p^s + (1-\theta)e)+$ $\Pi_2(20 - p^s + (1-\theta)e)$	$\Pi_1(p^s - e)+$ $\Pi_2(p^s - e - 10)$	$\Pi_1(9 - \theta e)+$ $\Pi_2(10 - \theta e)$

Table 2.4: Expected payoffs and total surplus with different contract types under different conditions (as identified in Table 2.3)

Compare the contract options. The parties have the choice between signing a simple contract with p^s but trading at $\hat{p}^s = p^s - e$ or signing a flexible contract with $p^f \in [9, 10]$ and trading at $\hat{p}^f$ with or without litigation according to Table 2.3. Table 2.4 provides an overview over B and S's payoffs and the total surplus with the different contract types under the different conditions identified in Table 2.3.

One party always strictly prefers to write a simple contract and may be willing to offer the opponent a more beneficial price to avoid a flexible contract. In the following, I analyse which contract prices with simple contracts make both parties (weakly) prefer simple over flexible contracts. Which contract the parties write depends on the competitive environment at date 0.

In case I and III, B is indifferent between a flexible contract and a simple price contract with $p^s_{max} = 9.5 - \theta(e - 0.5)$. S is indifferent if $p^s_{min} = 9.5 - \frac{\theta}{1-\theta}e$. Thus, a simple contract with $9.5 - \frac{\theta}{1-\theta}e \leq p^s \leq 9.5 - \theta(e - 0.5)$ makes both parties (weakly) prefer a simple over a flexible contract, in case I and III. Note that $p^s < 9$ if $e > \frac{0.5(1+\theta)}{\theta}$, $p^s > 9$ if $e < \frac{0.5(1-\theta)}{\theta}$ and the price can be below or above 9 if $\frac{0.5(1+\theta)}{\theta} > e > \frac{0.5(1-\theta)}{\theta}$. Furthermore, if p^s is very low in case I and III, namely $p^s < 5 + e$, S will not want to write a contract.

In case II, B is willing to offer S a simple contract with a price up to $p^s_{max} = 9 + e(2 - \theta)$ to avoid a flexible contract. The parties agree on a fixed price contract with $9 \leq p^s \leq 9 + e(2 - \theta)$. Similarly in case IV, the parties agree on a simple price contract with $9 + e \leq p^s \leq 9 + (1 - \theta)e + \theta$. In case II and IV, trade at any price in the derived range are in expectation better for both parties than no trade and the outside option of zero. Given the different conditions, the parties agree on different prices when writing a simple contract. Table 2.5 provides an overview of the possible contract prices in simple contracts under the different conditions, which are illustrated in Figure 2.4.

Proposition 2.4. *If parties' reference points for feelings of entitlements change to-*

wards the price offer $\hat{p}$ after litigation, there exists a simple contract with p^s which both contractors (weakly) prefer over a flexible contract with $p^f \in [9, 10]$.
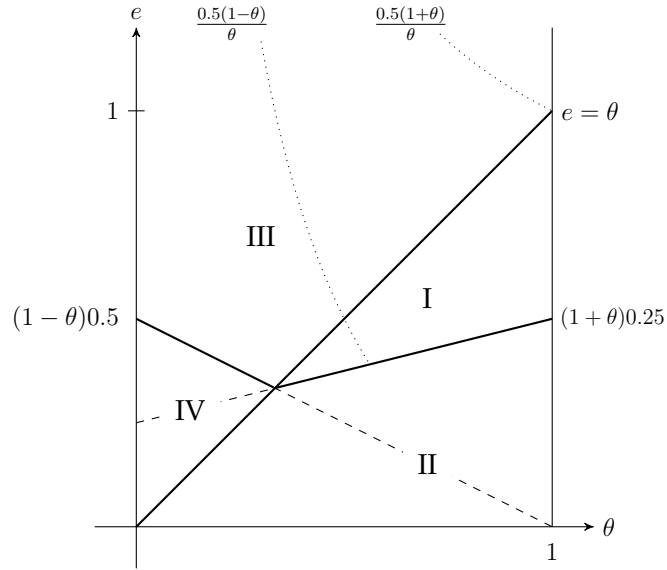
Figure 2.4: Different conditions depending on θ and e (reference point assumption 2)

Case	Simple contract with $p^s_{min} \leq p^s \leq p^s_{max}$
I & III	$9.5 - \frac{\theta}{1-\theta}e \leq p^s \leq 9.5 - \theta(e - 0.5)$
II	$9 \leq p^s \leq 9 + (2 - \theta)e$
IV	$9 + e \leq p^s \leq 9 + (1 - \theta)e + \theta$

Table 2.5: Simple contracts with p^s that make both parties (weakly) prefer simple over flexible contracts (reference point assumption 2)

Comparative Statics. Figure 2.4 depicts the different conditions the contractors can face. The range of simple contract prices that make both parties (weakly) prefer a simple over a flexible contract differ depending on whether the parties trade in an environment such as area I, II, III or IV in Figure 2.4.

Assume that the parties face low litigation cost e such that depending on θ they are in area IV or II. p^s_{min} and p^s_{max} are both lower in area II, i.e. when θ is relatively high. This is the case because in area II, B would litigate with

a flexible contract in order to eliminate shading. Hence, B can ask for a price lower by e with a simple contract. On the other hand, B faces a trade-off between eliminating shading completely but paying litigation costs with flexible contracts and facing shading by θe but saving litigation costs with simple contracts. Since in area II, the shading parameter is relatively high compared to the litigation costs, a simple contract with a lower price makes him indifferent.

Assume that the parties face relatively high litigation costs such that depending on θ, they are in area III or I. If θ is high, p^s_{min} can get (very) low, i.e. less than 9. If θ is small, p^s_{min} is above 9. In general, p^s_{min} and p^s_{max} are higher in in area III than in area I. The trade price with flexible contracts, $\hat{p}^f = 9.5 - \frac{e}{1-\theta}$, decreases as θ increases. This is because S faces shading by B of $\theta(9.5 - \hat{p}^f)$ if she litigates. Thus, S has less incentives to go to court and B can lower $\hat{p}^f$ further. The lower is the price offer with flexible contracts, the lower is also p^s_{min}, the contract price in simple contracts that makes S indifferent. Similarly, the contract price that makes B indifferent, p^s_{max}, is decreasing as θ increases, because flexible contracts allow him to trade at a relatively low price.

For a given low level of θ, as e increases, p^s_{min} and p^s_{max} both increase comparing area II, IV and III. But also the difference between the contract price and the price offer increases as e increases. In area II, S's payoff would be lower by e because B litigates, thus lower simple contract prices make her indifferent than in area IV. For even higher e, comparing area IV and III, B can offer lower prices with flexible contracts and thus p^s_{min} is lower. Focusing on a high level of θ, changes in e have ambiguous affects on p^s_{min} and p^s_{max}, comparing area II and I & III. For example, if e is very high, i.e. $e > \frac{0.5(1+\theta)}{\theta}$, the simple contract price p^s is lower than 9 and if e is low, i.e. $e < \frac{0.5(1-\theta)}{\theta}$, p^s is higher than 9 .

Conclusion. The alternative assumption, that buyer's price offer at date 1 is the reference point for feelings of entitlement after litigation, does not change the result that the parties can find a simple contract that both (weakly) prefer

over a flexible contract. Furthermore, I find that if this assumption holds, the buyer can strategically use litigation to reduce shading when litigation costs are small and shading is not a very minor issue (case II).

2.B Alternative reference point assumption 3: Court's decision eliminates aggrievement

In this section, I use the same example than in the main part of the paper, see Table 2.1, but I assume that the parties believe in the fairness of the court and are not aggrieved after court's decision.

Assumptions. If B offers $\hat{p}$ at date 1 and the parties trade at this price, assume that the contract signed at date 0 is the reference point for feelings of entitlement and shading occurs. It is imaginable that if one party litigates, the price p_c enforced by the court is seen as a fair trading price and no party shades on performance. The parties are happy that the court settles the dispute and are not aggrieved even if the contract promised a better trade outcome.

Reference point assumption 3. *Without litigation, the contractors feel entitled to the best possible outcome under the contract. However, contract enforcement by the court completely eliminates aggrievement and shading.*

Furthermore, for simplification assume that at date 1, S has only two options. She can either 1) accept B's price offer $\hat{p}$; or 2) litigate. Hence, she does not have the option to walk away and force B into further renegotiation. The main results are not affected by this assumption, however more restrictions on the litigation cost e are necessary without this additional assumption.

Consider a simple contract with p^s. B always offers $\hat{p}^s = p^s - e$ and no party has an incentive to litigate.

Consider a flexible contract with $p^f \in [9, 10]$. B has three options of price offers at date 1. In the following, I focus on s1 but the results similarly hold in s2. If B offers $\hat{p}^f = 9$, and the case is taken to the court, the court enforces

$p_c = 9$. S has no incentive to litigate as $U_S^f(\hat{p} = 9, nc) = 9$ if the court is not involved (nc) whereas $U_S^f(\hat{p}^f = p_c = 9, c) = 9 - e$ if the court is involved (c). However, shading can be completely eliminated by letting the court decide on the trade price. B has an incentive to litigate if

$$U_B^f(\hat{p} = p_c = 9, c) > U_B^f(\hat{p} = 9, nc)$$
$$9 - 9 - e > 9 - 9 - \theta(10 - 9)$$
$$\theta > e .$$

Thus, if litigation costs are low in relation to the shading parameter, B can use litigation to eliminate shading completely.

B has no incentive to offer $\hat{p}^f > 9$. If B offers $\hat{p}^f < 9$, he wants to avoid litigation as the court would decide that he breached the contract and impose $E(p_c) = 9.5$. In order to make S indifferent to litigation, B offers

$$U_S(\hat{p}^f, nc) = U_S(\hat{p}^f, E(p_c) = 9.5, c)$$
$$\hat{p}^f = 9.5 - e ,$$

as long as $e < 0.5$. If $e > 0.5$, offering $\hat{p}^f = 9$ is optimal for B. B's payoff from offering $\hat{p}^f = 9.5 - e$ and not going to court is

$$U_B(\hat{p} = 9.5 - e, nc) = 9 - (9.5 - e) - \theta(10 - (9.5 - e)) = (1 - \theta)e - (1 + \theta)0.5 .$$

If $\theta > e$ and with flexible contracts, B chooses between offering $\hat{p}^f = 9$ and litigation or offering $\hat{p}^f = 9.5 - e$ and no litigation. B offers $\hat{p}^f = 9.5 - e$ if

$$U_B(\hat{p}^f = 9.5 - e, nc) \geq U_B(\hat{p}^f = p_c = 9, c)$$
$$(1 - \theta)e - (1 + \theta)0.5 \geq -e$$
$$e \geq \frac{(1 + \theta)0.5}{2 - \theta} .$$

B is indifferent to the contract type with $p^s_{min} = 9 + (1 + \theta)0.5$, S is indifferent with $p^s_{max} = 9.5$. If $\theta > e$ but $e < \frac{(1+\theta)0.5}{2-\theta}$, B offers $\hat{p}^f = 9$ with flexible contract and litigates. In this case, B is indifferent to the contract type with $p^s_{min} = 9 + (2 - \theta)e$ and S is indifferent with $p^s_{max} = 9$.

If $\theta < e$ and with flexible contracts, B does not litigate and chooses between offering $\hat{p}^f = 9$ or $\hat{p}^f = 9.5 - e$. B selects $\hat{p}^f = 9.5 - e$ if

$$U_B(\hat{p}^f = 9.5 - e, nc) \geq U_B(\hat{p} = 9, nc)$$

$$(1 - \theta)e - (1 + \theta)0.5 \geq -\theta$$

$$e \geq 0.5 \,.$$

B is indifferent to the contract type if $p^s_{min} = 9 + (1 + \theta)0.5$ and S is indifferent if $p^s_{max} = 9.5$. If $\theta < e$ and $e < 0.5$, B offers $\hat{p}^f = 9$ with flexible contracts. In this case, B is indifferent to the contract type if $p^s_{min} = 9 + (1 - \theta)e + \theta$ and S is indifferent if $p^s_{max} = 9 + e$.

Consequently, there are four cases, as illustrated in Figure 2.5, and B's price offer and litigation decisions depend on the shading parameter and the litigation costs, see Table 2.6 for an overview. Depending on B's decisions under flexible contracts, the prices in simple contracts that make the parties at least indifferent between the contract types differ, as presented in Table 2.7.

Proposition 2.5. *If litigation can eliminate aggrievement completely, there exists a simple contract with p^s which both parties (weakly) prefer over a flexible contract with $p^f \in [9, 10]$.*

	Conditions	Choice of $\hat{p}^f$	Litigation?
Case I:	$\theta > e$ and $e > \frac{(1+\theta)0.5}{2-\theta}$	$\hat{p}^f = 9.5 - e$	no
Case II:	$\theta > e$ and $e < \frac{(1+\theta)0.5}{2-\theta}$	$\hat{p}^f = 9$	yes ($p_c = 9$)
Case III:	$\theta < e$ and $e > 0.5$	$\hat{p}^f = 9.5 - e$	no
Case IV:	$\theta < e$ and $e < 0.5$	$\hat{p}^f = 9$	no

Table 2.6: B's price offer and litigation choice under flexible contracts (reference point assumption 3)

Case	Simple contract with $p^s_{min} \leq p^s \leq p^s_{max}$
I & III	$9.5 \leq p^s \leq 9 + (1+\theta)0.5$
II	$9 \leq p^s \leq 9 + (2-\theta)e$
IV	$9 + e \leq p^s \leq 9 + (1-\theta)e + \theta$

Table 2.7: Simple contracts with p^s that make both parties (weakly) prefer simple over flexible contracts (reference point assumption 3)
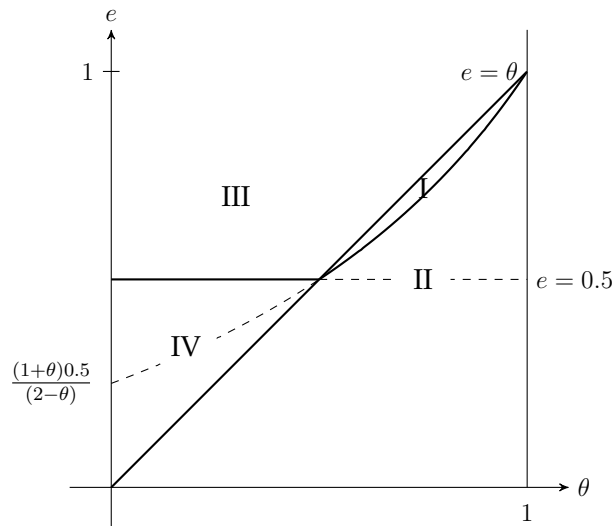
Figure 2.5: Different conditions depending on θ and e (reference point assumption 3)

Comparative Statics The range of possible simple contract prices that make both parties (weakly) prefer simple over flexible contracts depend on whether parties trade in an environment such as area I, II, III or IV in Figure 2.5, determined by litigation costs e and shading parameter θ. Both parties are better off signing a simple contract with any price in the derived ranges presented in Table 2.7 than without trade and outside option of zero.

Consider low levels of litigation costs ($e < 0.5$) and interaction in area II and IV depending on θ. In both areas, B offers $\hat{p}^f = 9$ with flexible contracts. In area II, B litigates with flexible contracts because e is low and he can eliminate (high) shading with litigation. Thus, S has to pay e with flexible contracts in area II but not in IV. A simple contract with a lower price makes her indifferent and p^s_{min} is lower in area II. In contrast, p^s_{max} is higher in II, because B is willing to offer better simple contract prices in order to avoid costly litigation that would be necessary with flexible contracts to eliminate shading.

Consider high levels of litigation costs ($e > 0.5$) and interaction in area III, I or II depending on θ. p^s_{min} in area III and I does not depend on θ, however p^s_{max} increases in θ. B is willing to sign simple contracts with higher prices to avoid high shading levels under flexible contracts, which cannot be eliminated by litigation due to high e. Comparing III (and I) and II, p^s_{min} is lower in II but p^s_{max} increases in θ. As shading becomes more severe and if e is high, both parties are willing to accept less favourable prices in order to sign simple instead of flexible contracts. In area II, S has a lower payoff from flexible contracts because B offers low prices ($\hat{p}^f = 9$) with flexible contracts but litigates to eliminate shading. In contrast, in area III (and I), B offers $\hat{p}^f = 9.5 - e$ under flexible contracts. The high e discourages B from litigation and S does not incur e.

Consider a given level of shading and compare area II, IV and III. For low litigation costs ($e < 0.5$) and interaction in area II and IV, p^s_{min} and the trade price $\hat{p}^s$ increase in e. B offers $\hat{p}^f = 9$ with flexible contracts in both areas. In

area II, S has to pay e and is thus indifferent to flexible contracts with lower simple contract prices. In area IV, B cannot eliminate shading under flexible contracts and is willing to offer higher prices in order to make S indifferent. Thus, p^s_{max} is higher in IV. For high litigation costs ($e > 0.5$, area III), p^s_{min} is even higher. However, the difference between the trade and the contract price increases in e. The higher is e, the more B can exploit S under simple contracts by undercutting the contract price, making S indifferent at higher simple contract prices. Similarly, p^s_{max} is higher in area III as B is willing to sign simple contracts with higher prices because he can exploit S at date 1.

Conclusion. The alternative assumption, that litigation completely eliminates aggrievement and shading, does not change the result that the parties can find a simple contract that both (weakly) prefer over a flexible contract. Furthermore, I find that if this assumption holds, the buyer can strategically use litigation to reduce shading (almost always) when the litigation cost is smaller than the shading parameter (case II).

2.C   Comparison of the results with different reference point assumptions

In the main part of this paper, see Section 2.3, I assume that the contract shapes the reference points for feelings of entitlement through potential contract enforcement (reference point assumption 1). In the appendix, I make different behavioural assumptions about contractors' reference point and assume that reference points can change with litigation. In Section 2.A, I assume that after court's decision B's price offer $\hat{p}$ is the reference point (reference point assumption 2). In Section 2.B, I assume that litigation eliminates shading completely (reference point assumption 3). In the following, I compare if and how my

results change based on the different assumptions.

The main finding is that with either behavioural assumption, the parties can always agree on a simple contract with price p^s that makes both parties (weakly) prefer simple over flexible contracts. However, the range of prices for which a simple contract is preferred differ based on the assumptions, see Table 2.8 for an overview.

Comparing Figures 2.3 (reference point assumption 1), 2.4 (reference point assumption 2) and 2.5 (reference point assumption 3), area II in Figure 2.5 is bigger than in 2.4. Under reference point assumption 3, I assume that litigation eliminates shading completely. In area II, B offers $\hat{p}^f = 9$ with flexible contracts and litigates. Thus, there are more combinations of e and θ for which litigation under flexible contracts is optimal under reference point assumption 3. Note that if court decisions are not assumed to affect reference points as in the original reference point assumption 1, it is never optimal for either party to litigate and there is no equivalent for this area in Figure 2.3.

Under reference point assumption 3 and with high litigation cost, such that the contractors interact in areas III or I, the possible simple contract prices are the highest compared to all other assumptions and conditions. For low litigation costs relative to θ, i.e. area II under reference point assumption 1, the price decision are the same than in area IV under reference point assumptions 2 and 3. If litigation costs are very low, B offers $\hat{p}^f = 9$ with flexible contracts (and does not litigate) because S has an incentive to go to court when $\hat{p}^f < 9$ in order to claim in expectations $E(p_c) = 9.5$. Under the original reference point assumption 1, court's decision does not diminish shading. Hence, B sticks to his strategy even for higher θ and low e. Whereas under reference point assumptions 2 and 3, if θ is high but e is low, it is optimal for B to offer $\hat{p}^f = 9$ and to litigate as this reduces shading. Therefore, area IV under reference point assumptions 2 and 3 is smaller than area II under the original assumption 1.

Under the original reference point assumption 1 and with high e ($e > (1 - \theta)0.5$), the simple contract price does not depend on the litigation costs but only on θ. Nevertheless, the price offer $\hat{p}^s$ decreases as e increases. Thus, S suffers from very high litigation costs whereas B benefits. This is also the case in areas III and I under reference point assumption 3, where litigation costs are also high. Under assumption 2, S is more negatively affected by increases in litigation costs when θ is big ($\hat{p}^s_{min}$ decreases more than $\hat{p}^s_{max}$), whereas B is more negatively affected when θ is low ($\hat{p}^s_{min}$ increases more).

Assumption (Cases)	Conditions	Flexible contract: price offer (Going to court?)	Simple contract: contract price at date 0	Simple contract: price offer at date 1
2 (I)	$\theta > e, e \geq (1+\theta)0.25$	$\hat{p}^f = 9.5 - \frac{e}{1-\theta}$ (no court)	$9.5 - \frac{\theta}{1-\theta}e \leq p^s \leq 9.5 + 0.5\theta - \theta e$	$9.5 - \frac{1}{1-\theta}e \leq \hat{p}^s \leq 9.5 + 0.5\theta - (1+\theta)e$
2 (III)	$\theta < e, e \geq (1-\theta)0.5$			
3 (I)	$\theta > e, e \geq \frac{(1+\theta)0.5}{2-\theta}$	$\hat{p}^f = 9.5 - e$ (no court)	$9.5 \leq p^s \leq 9 + (1+\theta)0.5$	$9.5 - e \leq \hat{p}^s \leq 9 + (1+\theta)0.5 - e$
3 (III)	$\theta < e, e \geq 0.5$			
2 (II)	$\theta > e, e < (1+\theta)0.25$	$\hat{p}^f = 9$ (court)	$9 \leq p^s \leq 9 + (2-\theta)e$	$9 - e \leq \hat{p}^s \leq 9 + (1-\theta)e$
3 (II)	$\theta < e, e < \frac{(1+\theta)0.5}{2-\theta}$			
2 (IV)	$\theta < e, e < (1-\theta)0.5$	$\hat{p}^f = 9$ (no court)	$9 + e \leq p^s \leq 9 + (1-\theta)e + \theta$	$9 \leq \hat{p}^s \leq 9 + \theta - \theta e$
3 (IV)	$\theta < e, e < 0.5$			
1 (II)	$e < (1-\theta)0.5$			
1 (I)	$e \geq (1-\theta)0.5$	$\hat{p}^f = 9.5 - e - 0.5\theta$ (no court)	$9.5 - 0.5\theta \leq p^s \leq 9.5 + 0.5\theta^2$	$9.5 - 0.5\theta - e \leq \hat{p}^s \leq 9.5 + 0.5\theta^2 - e$

Table 2.8: Comparison of price offers and contract price choices based on different behavioural assumptions under different conditions

Bibliography

Aghion, P., Dewatripont, M., and Rey, P. (1994). Renegotiation design with unverifiable information. *Econometrica*, 62(2):pp. 257–282.

Anderlini, L., Felli, L., and Postlewaite, A. (2007). Courts of law and unforeseen contingencies. *Journal of Law, Economics, and Organization*, 23(3):662–684.

Anderlini, L., Felli, L., and Postlewaite, A. (2011). Should courts always enforce what contracting parties write? *Review of Law and Economics*, 7(1):14–28.

Avraham, R. and Liu, Z. (2006). Incomplete contracts with asymmetric information: Exclusive versus optional remedies. *American Law and Economics Review*, 8(3):523–561.

Baker, G., Gibbons, R., and Murphy, K. J. (2002). Relational contracts and the theory of the firm. *The Quarterly Journal of Economics*, 117(1):pp. 39–84.

Battigalli, P. and Maggi, G. (2002). Rigidity, discretion, and the costs of writing contracts. *The American Economic Review*, 92(4):798–817.

Ben-Shahar, O. (2004). Agreeing to disagree: Filling gaps in deliberately incomplete contracts. *Wisconsin Law Review*, page 389.

Buzard, K. and Watson, J. (2012). Contract, renegotiation, and holdup: Results on the technology of trade and investment. *Theoretical Economics*, 7(2):283–322.

Che, Y.-K. and Hausch, D. B. (1999). Cooperative investments and the value of contracting. *The American Economic Review*, 89(1):pp. 125–147.

Chung, T.-Y. (1991). Incomplete contracts, specific investments, and risk sharing. *The Review of Economic Studies*, 58(5):1031–1042.

Edlin, A. S. and Reichelstein, S. (1996). Holdups, standard breach remedies, and optimal investment. *The American Economic Review*, 86(3):pp. 478 – 501.

Edlin, A. S. and Schwartz, A. (2003). Optimal penalties in contracts. *Chicago-Kent Law Review*, 78.

Fehr, E., Hart, O., and Zehnder, C. (2009). Contracts, reference points, and competition – behavioral effects of the fundamental transformation. *Journal of the European Economic Association*, 7(2-3):561–572.

Fehr, E., Hart, O., and Zehnder, C. (2014). How do informal agreements and revision shape contractual reference points? *Journal of the European Economic Association*.

Gilson, R. J., Sabel, C. F., and Scott, R. E. (2014). Text and context: Contract interpretation as contract design. *Cornell Law Review*, 100.

Grossman, S. J. and Hart, O. D. (1986). The costs and benefits of ownership: A theory of vertical and lateral integration. *Journal of Political Economy*, 94(4):pp. 691–719.

Halonen-Akatwijuka, M. and Hart, O. (2013). More is less: Why parties may deliberately write incomplete contracts. Technical report, National Bureau of Economic Research.

Hart, O. (2009). Hold-up, asset ownership, and reference points. *The Quarterly Journal of Economics*, 124(1):267–300.

Hart, O. and Holmström, B. (1987). The theory of contracts. In Bewley, T., editor, *Advances in Economics Theory*. New York: Cambridge University Press.

Hart, O. and Moore, J. (1988). Incomplete contracts and renegotiation. *Econometrica*, 56(4):pp. 755–785.

Hart, O. and Moore, J. (2008). Contracts as reference points. *The Quarterly Journal of Economics*, 123(1):1–48.

Heller, D. and Spiegler, R. (2008). Contradiction as a form of contractual incompleteness. *The Economic Journal*, 118(530):875–888.

Katz, A. W. (2004). The economics of form and substance in contract interpretation. *Columbia Law Review*, 104(2):pp. 496–538.

Kvaloy, O. and Olsen, T. (2009). Endogenous verifiability and relational contracting. *American Economic Review*, 99(5):2193–2208.

Levin, J. (2003). Relational incentive contracts. *The American Economic Review*, 93(3):835–857.

Liu, Z. and Avraham, R. (2012). Ex ante versus ex post expectation damages. *International Review of Law and Economics*, 32(4):339 – 355.

Nöldeke, G. and Schmidt, K. M. (1995). Option contracts and renegotiation: A solution to the hold-up problem. *The RAND Journal of Economics*, 26(2):pp. 163–179.

Posner, R. A. (2005). The law and economics of contract interpretation. *Texas Law Review*, 83:1581.

Rogerson, W. P. (1984). Efficient reliance and damage measures for breach of contract. *The RAND Journal of Economics*, 15(1):pp. 39–53.

Schwartz, A. and Watson, J. (2013). Conceptualizing contractual interpretation. *The Journal of Legal Studies*, 42(1):1–34.

Schweizer, U. (2012). Breach remedies, performance excuses, and investment incentives. *Journal of Law, Economics, and Organization*, 28(4):717–733.

Shavell, S. (1980). Damage measures for breach of contract. *The Bell Journal of Economics*, 11(2):pp. 466–490.

Shavell, S. (1984). The design of contracts and remedies for breach. *The Quarterly Journal of Economics*, 99(1):pp. 121–148.

Shavell, S. (2006). On the writing and the interpretation of contracts. *Journal of Law, Economics, and Organization*, 22(2):289–314.

Stremitzer, A. (2010). Standard breach remedies, quality thresholds, and cooperative investments. *Journal of Law, Economics, and Organization*.

Tirole, J. (2009). Cognition and Incomplete Contracts. *American Economic Review*, 99(1):265–94.

Walker, P. (2013). The reference point approach to the theory of the firm: an introduction. *Journal of Economic Surveys*, 27(4):670–695.

Watson, J. (2007). Contract, mechanism design, and technological detail. *Econometrica*, 75(1):55–81.

Williamson, O. E. (1985). *The Economic Institutions of Capitalism*. New York: Free Press.

Willington, M. (2013). Hold up under costly litigation and imperfect courts of law. *Journal of Law, Economics, and Organization*, 29(5):1023–1055.

Zhang, J. Z. and Zhu, T. (2000). Verifiability, incomplete contracts and dispute resolution. *European Journal of Law and Economics*, 9(3):281–290.

Chapter 3

Contract enforcement as a reference point for feelings of entitlement – experimental evidence

3.1   Introduction

Most contracts are incomplete, either because of the complexity to provide for all contingencies or because of non-verifiability of contractual terms. The standard economics literature assumes that if a court cannot verify that a contingency arose or whether an action was undertaken, it cannot enforce the contract and thus has no effect on parties' decisions. I follow the legal literature and claim that court enforcement is relevant even for incomplete contracts that include unverifiable terms. I find that writing incomplete contracts in the presence of a court is valuable. On one hand, writing incomplete contracts with the option of contract enforcement ensures that in equilibrium parties fulfill the contractual terms. More notably, I also have evidence that court's enforcement

procedure can shape contractors' behaviour in the relationship beyond simple compliance with the contract. I conduct a laboratory experiment to investigate how contractors' behaviour with regard to noncontractual terms (designed as costly punishment) is shaped by the option of the enforcement of unverifiable contractual terms. I find that contract enforcement affects contractors' feelings of entitlement from the contract. The court procedure can create a reference point for which outcomes are reasonable and thereby reduces retaliation if those outcomes are reached.

The laboratory experiment was conducted with two different enforcement procedures. One follows the theory set-up by Hart and Moore (2008) (henceforth HM), who have introduced the notion of contracts as reference points. In this treatment, the court procedure is such that, in case a flexible contract has been signed, the parties need to renegotiate to an allocation within the bounds of the contract after uncertainty about the unverifiable state is resolved. Thus, the court in this treatment does not enforce unverifiable contract terms. In the additional treatment, the court does enforce unverifiable terms and is always making a clear, foreseeable but uninformed decision. The two court procedures lead to different behavioural results. In the former treatment, the contractors are left to their own devices to reach an allocation. They have no outside validation for what is reasonable and thus both seem to expect better outcomes for themselves, creating room for noncontractual retaliation behaviour. In the latter treatment, the option to invoke a decision by the court aligns which outcomes the contractors perceive as reasonable and thus limits punishment. Hence, the reference point for feelings of entitlement differs with the enforcement procedure. The experimental results support HM's theory that contracts are reference points and can lead to aggrievement and punishment behaviour in contractual relationships. Furthermore, the results indicate that institutions matter as they can shape the behavioural responses to writ-

ing particular contracts and can inform the discussion on how to best design contract enforcement and in turn contracts.

In the baseline treatment, I follow the experimental approach by Fehr et al. (2011) (henceforth FHZ) which is based on the theory about the role of contracts as reference points by HM. I consider a buyer and seller trade relationship in which contracts about the trade of one unit of a standard good are signed. Buyer's value from trade is always the same but sellers' cost of production varies with the ex ante uncertain state of nature. States and costs are assumed to be unverifiable and thus the parties cannot design the pricing terms in the contract contingent on the state. In the baseline treatment, trade is designed to be voluntary. After ex post uncertainty is resolved, trade only occurs if the trade price is larger than the seller's cost. Although trade is always efficient, due to the restrictions imposed in the experiment, there exists no single price such that both parties gain from trade with a rigid contract. To ensure trade, the parties may agree on a range of prices. According to HM's theory a contract that fixes a price range (flexible contract) creates different feelings of entitlement and each contractor expects the best possible outcome within the contract. This leads to ex post aggrievement and punishment behaviour.[1] The implicit enforcement procedure in this set-up is such that the court voids a rigid contract if it is in the interest of the seller but prohibits renegotiation. For flexible contracts, the court provides a renegotiation protocol such that parties have to agree on a price within the bounds of the contract which covers the seller's costs.

In the experiment, buyers and sellers first write a contract and then trade after uncertainty is resolved. Contracts are determined in the following way. Each buyer chooses whether to offer a rigid or a flexible contract. A rigid

---

[1]Note that HM show that when lump-sum transfers are possible, first-best (fixed price) contracts are possible if only cost or value vary or if only one contractor can punish, which is both given in the experimental set-up. However, by ruling out lump-sum transfers, FHZ can utilise this simpler set-up without first-best results applying.

contract fixes a single price whereas parties agree on a price range with a flexible contract. After the sellers observe the buyer's contract choice, the sellers compete for the contract in an ascending clock auction which determines the pricing terms. The price at which a seller wins the auction becomes the price in the rigid contract or the lower bound of the price range in the flexible contract (the upper bound is exogenous). After contracts have been concluded, the contractors learn the state of the world, which is either high or low cost of production.

In the baseline treatment, trade is possible with both contract types in the good state (low cost). In the bad state (high cost), trade is only possible with the flexible contract. By design, costs are lower than the fixed price with rigid contracts in the bad state. Under flexible contracts, prices covering the costs of production are ensured in both states. If trade is possible and the parties have agreed on a rigid contract, they trade at the contract price. If trade is not possible, the parties receive the outside option. With a flexible contract, the buyer chooses a price from the range such that the price is greater than the seller's cost. After observing the trade price, the seller chooses the product quality. Producing low quality instead of normal quality is costly to the seller and diminishes buyer's value and is therefore a form of costly punishment.

The court treatment has a similar experimental set-up but allows for renegotiation and contract enforcement. The buyer can offer any price (even outside of the contract) after uncertainty about the state is resolved. Furthermore, the seller is permitted to actively choose contract enforcement. If the seller is unsatisfied with the buyer's price offer, she can reject it and ask for enforcement of the contract as written. The court procedure is such that the price in the fixed price contract is enforced, irrespective of the cost state. For flexible contracts, the buyer's price offer is enforced if it lies within the price range, otherwise the computer randomly draws a price from the price range. Contract

enforcement is costly and the enforcement procedure is known to all parties.

The experimental results show that contract enforcement matters both for sellers' punishment behaviour and buyers' contract choice. Different levels of punishment occur in both treatments with flexible contracts. One could argue that in both treatments a flexible contract constitutes an ex ante promise or an implicit understanding that higher prices will be offered ex post and that if this does not occur, sellers may punish buyers. However, this is not observed in the experiment. The amount of punishment is not significantly different between the contract types in the court treatment although there is a difference across contract types in the baseline treatment. Thus, it seems that the option of contract enforcement makes both contracts similar in the eyes of the parties and the court provides outside validation for which prices are reasonable. Furthermore, the level of punishment with rigid contracts in the good state is similar across treatments. Hence, parties do not seem to feel entitled to the best possible outcome of renegotiation and the different levels of restriction imposed on buyers' ex post price offers across treatments do not matter.

The results indicate that writing contracts, even if incomplete, in the presence of potential (uninformed) contract enforcement is not just about giving parties the right to make claims in court about verifiable terms. Contracts also shape parties' reference points and thus affect their behaviour regarding non-contractual terms. This seems to hold even if the court enforcement can be detrimental to sellers (as a price below the seller's cost may be enforced), if the enforcing court is uninformed, for different contract types and if renegotiation is possible. Also, buyers' contract choice differs with the enforcement procedures and possibly due to sellers' different behavioural responses. In the baseline treatment, significantly more buyers (74 percent) choose flexible contracts than in the court treatment (32 percent).

It is recognised in the law and economics literature that courts play a vital role in governing the relationship between parties and that contract enforcement expands the contracting options. The availability of contract enforcement by courts does not only prevent inappropriate contracts, but manages contractual incompleteness as well as widen the range of credible promises and threats (Hermalin and Katz, 1993). As opposed to the assumptions in HM's theory, in reality courts are not inactive or simply void contracts in case of incompleteness, but might enforce at least the verifiable terms and/or interpret the contract.[2] As Ben-Shahar (2004) argues, courts usually compel parties to trade if they agreed on this, even if some other terms like the price are incompletely specified. I follow this approach in the court treatment, in which an uninformed court enforces the trade promise and makes a decision on the pricing terms as conforming to the contract as possible.

If courts follow a certain interpretative process, rational parties will form expectations about contract enforcement. These expectations will affect the contract design with regard to the provision of incentives and the allocation of risk (Hermalin and Katz (1993), Katz (2004)). Furthermore, they might influence the decisions to write more precise (contingent) or more vague (non-contingent) contracts (Posner, 2003). Hence, the law and economics literature analyses whether courts should simply enforce contracts as written or interpret them (Posner, 2003). However, this literature does not discuss the effect that contract enforcement has for the formation of reference points for reasonable outcomes. My experimental analysis indicates, utilising a very simple enforcement procedure, that enforcement matters for parties' behaviour and consequently the contract design. It does not try to answer 'what courts should do'

---

[2]There is plenty of legal discussion if and how courts should interpret incomplete contracts. For example, Schwartz and Scott (2003) argue that contract interpretation aims at finding the 'correct answer', which is what parties intended to enact. Posner (2005) looks at the trade-off between different doctrines of contract interpretation (mutual mistake, contra proferentum, four corners rule and extrinsic nonevidence).

in case of contractual incompleteness. Instead it shows, using two examples of enforcement procedures, that the anticipated enforcement influences which outcomes the contractors perceive as reasonable and thereby affects their punishment behaviour. These issues ought to be considered when analysing efficient enforcement rules. It is an interesting array for future research to investigate how various types of contract enforcement procedures affect contractors' behaviour differently.

Some literature discusses the behavioural effects of contract enforcement, mainly with a focus on breach and litigation decisions (Hermalin et al., 2007).[3] Wilkinson-Ryan and Hoffman (2015) argue that "the law itself (or at least what parties believe the law to be)" affect contractors' decisions and their commitment to personal obligations. My experimental results support this. An array of literature examines how individuals perceive the law.[4] Finkel (1995) discusses the difference between the law that legislators follow ('law on the books') and what people regard as just and fair ('commonsense justice') and its consequences for contract enforcement.[5] In my experiment, parties know exactly how contracts are enforced, so uncertainty or different intuitions about contract enforcement are not investigated. Also Wilkinson-Ryan (2015) argues, individuals usually expect courts to enforce contracts as written. In law, however, contracts are not always enforced as written but damages might be awarded. The enforcement procedure used in my court treatment is thus close to what people usually expect from courts. Furthermore, no actual good is

---

[3]For economic experiments that deal with litigation and dispute resolution, see for example Kuhn (2009) for a literature review on arbitration in the laboratory. Loewenstein et al. (1993) and Miettinen et al. (2012) analyse when parties reach a settlement and when cases proceed to trial. Birkeland (2011) investigate whether the possibility of litigation influences bargaining efficiency.

[4]For literature on people's intuition about the law, see for example Mandel (2014) for an experimental study about how people perceive intellectual property rights and Friedman (2008) for an experiment on perceived ownership rights.

[5]For some other examples of legal literature in this area, see Ellman and Braver (2012) for a discussion of the role of intuitions in family law; Kelman (2013) for a discussion about whether or not law should follow rules that are morally acceptable; and Robinson and Darley (2007) for a discussion of the implications of people's intuition of justice for the criminal law and policy.

traded in the experiment. 'Specific performance' as opposed to paying damages is therefore in the seller's interest. My experimental results indicate that contractors' view on the law matters. Investigating these effect for different court procedures and heterogenous intuitions about what the law is, is an interesting area for further research.

The experimental questionnaires by Wilkinson-Ryan and Hoffman (2015) provide evidence, inter alia, that misunderstandings about legal rules affect parties' interactions. People seem to think that legal obligations follow from formalisation of a contract and not actual assent, as opposed to the way this is regarded in contract law. Parties tend to be more committed to a contract if it has been formed even without formal sanctions in place. Furthermore, Wilkinson-Ryan and Hoffman (2015) find that subjects differentiate between legal and moral obligations. They argue that legal obligation comes from formal manifestation, for example by signature, whereas moral obligation comes from legal formalism and other moral norms, as promise and disappointment. Wilkinson-Ryan (2015) conjecture that the ritual of formalisation has an internalized meaning and that signing a document is a sacred act making parties more bound to the contract. Given that my experimental procedure does not allow for actual contract signing and provides a rather artificial way of contract formation, I am not able to fully investigate these issues. However in the experimental set-up, the contract design as a way of legal formalism does not play as much of a role as the contract enforcement. The contracts that the subjects sign are the same in both of my treatments, nevertheless the difference in contract enforcement is what shapes their behaviour.

Several experimental papers in the economics literature deal with the role of contracts as reference points for feelings of entitlement. FHZ conduct several robustness checks and allow for different treatments based on their baseline experiment. FHZ analyse the effect that ex ante competition, imposed by

the auction among sellers, has for the reference point effect of contracts. In Fehr et al. (2009), the computer selects a basis price, which will become either the fixed price or the lower bound of the price range, before the buyer chooses the contract type; in Fehr et al. (2011) the buyer chooses first the contract type before the computer exogenously sets the price. FHZ observe more punishment with fixed price contracts in both these treatments. This suggests that contracts are less strong reference points when competition is removed. For this reason, I keep the auction among sellers in the experimental set-up. In Fehr et al. (2011), FHZ also test the effect of reducing the price range in the flexible contract. This leads to less punishment with flexible contracts and thus indicates that sellers indeed feel entitled to the best possible outcome within the contract as claimed by HM. In Fehr et al. (2015), FHZ allow for informal agreements (the buyer can send non-binding, standardised messages). These informal messages do not fully align reference points but mitigate the trade-off between contractual flexibility and rigidity. Also Brandts et al. (2015) find that communication (through a chat window) resolves the ambiguity created by flexible contracts.

Fehr et al. (2015) test whether sellers expect better prices from renegotiation than set in the contract by allowing for unilateral ex post revision of the contract price. The buyer can choose a price between cost and valuation after the state is revealed with both contract types. Because punishment levels are the same with rigid contracts in the baseline and revision treatment, FHZ conclude that renegotiation does not affect sellers' reference points and the contract continues to shape sellers' feelings of entitlement. I also allow for revision in my experiment to make court enforcement meaningful. However, I impose less restrictions and the buyers can offer any price (even below cost and below the competitive auction outcome) which makes opportunistic revision always possible in my court treatment. Also, in FHZ's revision treatment, the buyer

has very strong incentives to (mutual beneficially) revise the rigid contract in the bad state, because otherwise he only receives the outside option. Nevertheless, my experimental results support FHZ's finding that sellers do not appear to feel entitled to the best possible outcome of renegotiation. In contrast to my court treatment, FHZ still find a difference, yet reduced compared to their baseline treatment, in punishment behaviour across contract types when allowing for revision. Bartling and Schmidt (2015) also analyse the effect of renegotiation and compare a contract and a no-contract treatment in a different contractual setting.[6] They similarly conclude that contracts create reference points because they observe that ex post sellers ask less often for markups and buyers reject markups more often than without contracts. For an experimental analysis of the role of renegotiation in a contractual setting with hold-up problems see Hoppe and Schmitz (2011) and Iyer and Schoar (2015).

Erlei and Reinhold (2016) replicate FHZ's baseline treatment and in addition allow for exogenously determined contract types. Punishment decreases with exogenous contract choice in their experiment. They argue that sellers punish buyers for choosing a rigid contract in the endogenous contract type treatment ('reciprocity effect'). In the exogenous contract type treatment on the other hand, concluding a flexible contract is not a 'signal' for cooperative behaviour and thus induces less punishment. Nevertheless, there is a difference in punishment levels across both contract types in both treatments which is evidence for reference point effects.

This paper is structured as follows. I explain the experimental procedure for both treatments in section 3.2 and the behavioural predictions in section 3.3. Section 3.4 presents an overview of the aggregate results and compares the results from my baseline treatment with FHZ and with my court treat-

---

[6]In the experiment by Bartling and Schmidt (2015), B and S have to agree on a contract without knowing the optimal delivery time. After learning the optimal time, B can ask to change the delivery time and S can ask for a markup on the contracted price. In the no-contract treatment, the same threat points as in the contract treatment are imposed exogenously.

ment. Section 3.5 focuses on sellers' choices. Sellers' punishment behaviour is examined in order to draw conclusions about sellers' reference points. Section 3.6 analyses buyers' choices with regard to price offers and contract type. The last section 3.7 summarises the findings. Some additional analysis is presented in the appendix.

3.2   Experimental design

The following explains the experimental design of the baseline and the court treatment and describes the procedures in the laboratory.

3.2.1   Baseline treatment

The experimental design follows the baseline treatment of the experiments conducted by FHZ. There are 16 subjects in each experimental session. All subjects receive a show-up fee of £3. At the very beginning of the experiment, subjects are randomly divided into the role of buyer or seller, which they keep for the whole session. In each of the 15 rounds, subjects interact in groups of four, two buyers and two sellers, which are randomly formed at the beginning of every round.

Buyers and sellers can trade a product in each round. Sellers can sell up two units whereas buyers can buy only one unit. Hence, sellers face competition for buyers. Payoffs for the sellers and buyers depend on the trade price and the cost of production c or the value of the product v, respectively. There are two state of nature σ, good ($\sigma = g$) and bad ($\sigma = b$) . The probability of the good state occurring is $P(\sigma = g) = 0.8$. v does not depend on the state of nature but c does. Furthermore, when trade occurs, the seller can choose between a normal (q_N) and low quality level (q_L). Providing low quality is costly to the seller and decreases v. Whenever a seller or a buyer are not involved in a trade, which

can happen for various reasons, they realise an outside option of $x_B = x_S = 10$.

Table 3.1 gives an overview of the experimental parameters. The structure of each round of the experiment is as follows.

State (σ)	**Good** [$P(g) = 0.8$]		**Bad** [$P(b) = 0.2$]	
Quality (q)	normal (q^N)	low (q^L)	normal (q^N)	low (q^L)
Value (v)	140	100	140	100
Cost (c)	20	25	80	85

Notes: Buyers' valuation and sellers' cost of production are displayed for the two possible states of nature and the two quality levels between which sellers can choose.

Table 3.1: Experimental parameters

Step 1: Formation of interaction groups. At the beginning of every round, two buyers and two sellers are randomly assigned to groups of four.

Step 2: Buyer's choice of the contract type. Each buyer has to choose which contract type he wants to use, flexible or rigid contract. A rigid contract fixes a price p^r whereas a flexible contract specifies a price range $[p_L, p_H]$.

Step 3: Determination of trade terms by the sellers in the contract auction. After both buyers in the interaction group have decided on the contract type, the contracts are auctioned off to the sellers in a randomly determined sequence. In case of a rigid contract, the auction determines the contract price p^r. In case of a flexible contract, the auction determines the lower bound p_L of the contract price range. The upper bound of the price range is exogenously fixed at $p_H = 140$, which is the highest possible value that the buyer can receive ($v(q_N)$). The auction starts at 35 Points and increases by one Point every half second.[7] The auction does not go above 75 Points to ensure that trade with a

---

[7]The auction starts at 35 Points to ensure that the seller does not make losses relative to his outside option in the good state even when providing low quality to ensure that the seller will not refrain from punishment due to loss aversion.

rigid contract cannot occur in the bad state.[8] Both sellers can stop the auction at any point and the first one to accept the displayed price gets the contract. The loser of the auction receives the outside option $x_S = 10$.

Step 4: Determination of the state of nature. For each contract independently, the computer randomly determines the state of nature which is observed by both buyer and seller. Both parties are also informed whether mutually beneficial trade can take place. With a rigid contract and in the bad state, seller's costs are higher than the contract price p^r and mutually beneficial trade is not possible. In that case, buyer and seller both realize outside option $x_S = x_B = 10$. In all other cases, trade happens because with a rigid contract the price covers the cost in the good state (by design), and with flexible contracts, the buyer must adjust the trade price to ensure that the price covers the cost.

Step 5: Buyer's trade price offer. After the subjects have learned the state, the buyer makes an offer for the actual trade price $\hat{p}$. There is no choice with a rigid contract and the trade price offer must equal the contract price $\hat{p} = p^r$. With a flexible contract, the buyer can pick any price in the contract price range in the good state, $\hat{p} \in [p_L, p_H]$. In the bad state, the buyer has to choose a price such that the seller cannot make losses relative to the outside option even when providing low quality. The buyer has to pick $\hat{p} \in [c(q^l, b) + x_S, v(q^N)] = [95, 140]$.

Step 6: Seller's quality choice. After observing buyer's trade price offer, the seller chooses the quality level. Irrespective of the state, when choosing low quality (q^L) instead of normal quality (q^N), seller's cost increases by 5 Points

---

[8]This restriction on the upper bound ensures that there is a trade-off between rigidity and flexibility as in HM's theory. In the theory, the trade-off stems from the fact that the costs in one state are higher than the value in the other state. Consequently, there does not exist a fixed price contract that leads to mutually beneficial trade in each state. Since FHZ changed the payoff structure in order to simplify the game for the subjects, the trade-off is imposed by restricting the possible prices in a fixed price contract.

and buyer's value decreases by 40 Points. Selecting low quality is thus a punishment of the buyer.

Step 7: Profit calculations. After all decisions have been made, individual profits for the current round are calculated and displayed to the subjects.

Step 8: Market information for the buyers. All buyers receive market information to enhance learning among them since the game is fairly complicated with ex ante uncertainty about states, auctions and many choices. The buyers get aggregated information about 1) all buyers' contract choice in the current round and 2) buyers' average profits with both contract types over all rounds.

Then, a new round begins and the subjects are randomly assigned to a new interaction group.

3.2.2 Court treatment

The design of the court treatment is close to the baseline treatment. The main difference is that trade is not voluntary as in the baseline treatment. Voluntary trade can be interpreted as an enforcement procedure in which the court automatically enforces the contract unless one party wants to void it. In contrast, in the court treatment the court enforces the contract as written if there is a complaint. Consequently, trade can occur in either state with either type of contract (and thus the seller can make negative payoffs in the bad state).

Contract enforcement in the experiment works in the following way. The seller can decide to reject the buyer's price offer and let the court settle the contract by enforcing p_c.[9] Contract enforcement is costly to both parties and both pay litigation cost $e = 5$. With a rigid contract, the court imposes trade at the contract price, $p_c = p^r$. With a flexible contract, the court enforces the price

---

[9]Note that the term 'court' is not used in the experiment but instead subjects are told that the 'computer settles the contract'.

that has been offered by the buyer as long as it is within the contract price range (even if it is lower than seller's cost). If the trade price offer is outside of the contract price range, the contract is regarded as breached and the court imposes trade at a price randomly chosen from the price range. The payoff structure and contract restrictions are the same than in the baseline treatment. The structure of each round in the experiment is as follows.

Step 1: Formation of interaction groups.   (Same as in baseline treatment)

Step 2: Buyer's choice of the contract type.   (Same as in baseline treatment)

Step 3: Determination of trade terms by the sellers in the contract auction. The auction proceeds similar than in the baseline treatment. However, the auction starts at 50 Points (and similarly does not go above 75 Points).[10]

Step 4: Determination of the state of nature.   For each contract independently, the computer randomly determines the state of nature which is observed by both buyer and seller.

Step 5: Buyer's trade price offer.   After the subjects have learned the state, the buyer makes an offer for the actual trade price. In this treatment, he always has a choice irrespective of the contract type. With both contract types, the buyer can choose any price $\hat{p} \in [25, 140]$.[11]

Step 6: Seller's choice to accept of reject buyer's price offer.   After observing buyer's trade price offer, the seller chooses whether to accept, or reject and

---

[10]With these restrictions, I want to ensure that the seller does not make less payoffs in expectation when winning the auction as compared to her outside option. Following FHZ, I use the cost associated with low quality ($c(q^L, \sigma)$) to calculate the bounds, such that the seller is not refraining from punishment due to loss aversion. Thus, the auction start price should be 47 Points. However, I use 50 Points because all other parameters are in units of 5. The upper bound is the same than in the baseline treatment to keep the same trade restriction for the rigid contract.

[11]The lower restriction on $\hat{p}$ ensures that at least in the good state without litigation, the seller will not refrain from punishment due to loss aversion.

litigate. If she accepts, the parties trade at $\hat{p}$. If she rejects, both parties' payoffs decrease by 5 Points due to the litigation costs. With a rigid contract, trade at the contract price is enforced, $p_c = p^r$. With a flexible contract, trade at $p_c = \hat{p}$ is enforced as long as $p_L \leq \hat{p} \leq p_H$. Otherwise, the court enforces a price p_c randomly drawn from the price range.

Step 7: Seller's quality choice. After observing the trade price which has been determined either by accepting $\hat{p}$ or by contract enforcement, the seller chooses the quality level. Irrespective of the state, when choosing low quality (q^L) instead of normal quality (q^N), the seller's cost increases by 5 Points and buyer's value decreases by 40 Points. Selecting low quality is thus a punishment of the buyer.

Step 8: Profit calculations. (Same as in baseline treatment)

Step 9: Market information for the buyers. (Same as in baseline treatment)

Then, a new round begins and subjects are randomly assigned to a new interaction group.

3.2.3 Procedure and payments

The experiment was conducted in the BLUE laboratory at the University of Edinburgh using z-Tree by Fischbacher (2007). There were 4 sessions for each of the two treatments, i.e. 8 sessions in total. In 7 sessions, 16 subjects (8 buyers and 8 sellers) participated per session. In one of the court treatment sessions, only 12 subjects (6 buyers and 6 sellers) participated due to no-shows. The sessions of the baseline treatment lasted approximately one hour, and of the court treatment 1.5 hours. On average, subjects earned GBP 17 plus a show-up

fee of GBP 3.[12]

All of the 124 subjects were students of a variety of degrees, including economics. Each subject only participated in one session. The subjects were randomly divided into sellers and buyers at the beginning of the experiment and kept their role for the entire experiment. All interactions were anonymous. The subjects interacted with the same opponents more than once, but repeated game effects are unlikely because the subjects did not know with whom they were interacting at any point.

Before the start of the experiment, a short (ca 10 minutes) presentation summarised the set-up and subjects' actions. Then, the subjects read detailed instructions. The instructions provided to sellers and buyers in the court treatment can be found in Appendix 3.D.[13] Afterwards, the subjects were asked to answer several questions regarding feasible actions and payoff consequences. The session only proceeded after all subjects answered all questions correctly. The instruction and question part of the experiment lasted approximately 30 minutes.

3.3 Behavioural predictions

This sections discusses hypotheses for the experimental results and examines in more detail some experimental design features.

3.3.1 Predictions for purely selfish subjects

In the following, predictions for purely selfish subjects are derived. Similar to FHZ, I do not expect that these predictions describe subjects' behaviour accurately, however, they offer a benchmark for other predictions.

---

[12]Average earnings were GBP 16 and GBP 19 in the baseline and court treatment, respectively.

[13]The first part of the instructions, 'short summary of the procedure', was read out loud to the subjects in the presentation.

Baseline treatment. Because of the competition among sellers in the auction stage, the fixed price in rigid contracts and the lower bound of the price range in flexible contracts end up at the competitive level of 35 Points, $p^r = p_L = 35$. Assuming common knowledge of rationality and payoff-maximising strategies, purely selfish sellers never punish buyers for their price offers because punishment is costly. Since buyers can anticipate this, they always offer the lowest possible price with each contract type. That is 35 Points in the good state, $\hat{p}(g) = p^r = p_L = 35$, and 95 Points in the bad state with flexible contracts, $\hat{p}(b) = c(q^l, b) + x_S = 95$. Buyers' expected payoff with rigid contracts is thus $E(U_B^r) = P(g) * (v(q^N) - \hat{p}(g)) + P(b) * x_S = 0.8 * (140 - 35) + 0.2 * 10$. Buyers' expected payoff with flexible contracts is higher, $E(U_B^f) = P(g) * (v(q^N) - \hat{p}(g)) + P(b) * (v(q^N) - \hat{p}(b)) = 0.8 * (140 - 35) + 0.2 * (140 - 95)$. Therefore, buyers always select flexible contracts.

Court treatment. Because of the competition among sellers, the fixed price and the lower bound of the price range end up at the competitive level of 50 Points, $p^r = p_L = 50$. Purely selfish sellers never punish buyers for their price offers because punishment is costly. Self-interested buyers have thus no incentives to offer prices above the contract price. Sellers only litigate if the gain is higher than the litigation cost of 5 Points. With rigid contracts, sellers are indifferent to litigation if the contract price is undercut by 5 Points. Anticipating this, under rigid contracts buyers offer the fixed price minus 5, $\hat{p}^r = p^r - e = 50 - 5 = 45$. Under flexible contracts, any price offer below the lower bound of the price range leads to litigation. Sellers pay 5 Points litigation cost but the court enforces in expectations a price of 95 Points. Hence under flexible contracts, buyers offer the lower bound, $\hat{p}^f = p_L = 50$. Buyers' anticipated payoff with rigid contracts, $E(U_B^r) = v(q^N) - \hat{p}^r = 140 - 45$, is higher than with flexible contracts, $E(U_B^f) = v(q^N) - \hat{p}^f = 140 - 50$. Therefore, buyers select rigid contracts.

Hypotheses for purely self-interested contractors:

i) Auction outcome: The contract prices are at the competitive level; $p^r = p_L = 35$ in the baseline and $p^r = p_L = 50$ in the court treatment.

ii) Punishment: Sellers never punish buyers irrespective of buyers' price offers, contract type, state of nature or treatment.

iii) Price offer in the baseline treatment: Buyers offer the fixed price under rigid and the lower bound under flexible contracts, $\hat{p}^r = p^r$ and $\hat{p}^f = p_L$.

iv) Litigation and price offer in the court treatment: Under rigid contracts, sellers litigate if the fixed price is undercut by more than the litigation cost. Under flexible contracts, sellers litigate if buyers offer less than the lower bound of the price range. Therefore, buyers offer $\hat{p}^r = p^r - e$ under rigid contracts and $\hat{p}^f = p_L$ under flexible contracts.

v) Contract choice: Buyers select flexible contracts in the baseline treatment and rigid contracts in the court treatment.

3.3.2 Predictions for subjects with feelings of entitlement

HM's theory predicts that the contractors feel ex post entitled to the best possible outcome permitted by the contract that was written under competitive conditions ex ante. The best possible outcome permitted by the contract is the fixed price in rigid contracts and the upper bound of the price range in flexible contracts. If the contractors do not receive what they feel entitled to, they are aggrieved and punish the opponent by selecting low quality (HM refer to this as 'shading on performance'). Based on this theory, the following predictions about subjects' behaviour in the experiment can be derived.

Baseline treatment. Reference dependent behaviour is not expected to affect the auction outcome and the competition among sellers leads to $p^r = p_L = 35$.

In the baseline treatment and with rigid contracts, buyers have by design no choice over the price offer after state uncertainty is resolved. Rigid contracts do not allow for more than one price and thus align reference points. The sellers receive what they expect, are not aggrieved and do not select low quality as a punishment. In contrast, buyers do have a meaningful choice over which price to offer under flexible contracts and the contractors implicitly agree on ex post renegotiation when signing flexible contracts. HM's theory predicts that sellers feel entitled to the best possible outcome under the contract, i.e. the upper bound of the price range. Thus, sellers are aggrieved if they get a price offer below 140 Points in flexible contracts. Sellers may not feel entitled to the *entire surplus*, but it is possible that sellers feel entitled to a certain share of the surplus, as assumed by Halonen-Akatwijuka and Hart (2013). In that case, sellers may refrain from punishment if offered some price above the lower bound. If that is true, buyers may be willing to offer prices above the lower bound to avoid punishment. Hence, buyers' payoffs with flexible contracts may be lower than with rigid contracts.

Court treatment. Reference dependent behaviour is not expected to affect the auction outcome and the competition among sellers leads to $p^r = p_L = 50$. The court treatment has two crucial design features. First, it gives the buyer a meaningful choice over the price offer with both contract types in both states of nature. This makes it possible for the seller to receive a price offer of 140 Points (and get the whole surplus) under all circumstances, but it also allows buyers to offer prices as low as 25 Points. Second, sellers have the option of litigation, which limits very low price offers but still allows for (voluntary) high price offers. Sellers litigate if the gain is higher than the litigation cost of 5 Points. Anticipating this, buyers offer $\hat{p}^r = p_L - e = 50 - 5 = 45$ under rigid contracts and $\hat{p}^f = p_L = 50$ under flexible contracts.

The design features of the court treatment may affect sellers' reference

points in different ways. One hypothesis is that sellers, similarly to the baseline treatment, feel entitled to the best possible outcome permitted by the contract, as hypothesised by HM. Sellers do not punish when offered the fixed price but do punish when offered the lower bound in flexible contracts. An alternative hypothesis is that sellers feel entitled to the best possible outcome from renegotiation. In that case, buyers may offer prices above the lowest possible price permitted by the contract with both contract types to avoid punishment. Also, sellers may feel entitled to what the court would enforce based on the contract. In that case, buyers offer the lowest possible price permitted by the contract. Since the court would enforce this offer in litigation, sellers do not punish such offers. If the first hypothesis is true, rigid contracts yield higher profits for buyers as they allow for trade in each state without punishment. For the latter two hypotheses, there is no difference in expected profits between the contract types. Trade will always take place and the sellers would under both contract types expect equally high prices (second hypothesis) or equally low prices (third hypothesis where $p_c = \hat{p}^f = p_L = 50$).

Hypotheses for punishing subjects with feelings of entitlement:

i) Auction outcome: The contract prices are at the competitive level;
$p^r = p_L = 35$ in the baseline and $p^r = p_L = 50$ in the court treatment.

ii) Reference point hypotheses for the baseline treatment: Sellers feel entitled to the best (or more favourable) outcomes permitted by the contract. Under rigid contracts, sellers never punish buyers and buyers offer the fixed price, $\hat{p}^r = p^r$. Under flexible contracts, sellers' punishment choice is price dependent and buyers may offer prices above the lower bound of the price range, $\hat{p}^f \geq p_L$.

iii) Litigation in the court treatment: Under rigid contracts, sellers litigate if the fixed price is undercut by more than the litigation cost and buyers offer at least the fixed price minus 5 Points, $\hat{p}^r \geq p^r - e$. Under flexible contracts, sellers litigate if buyers offer less than the lower bound of the price range and buyers offer at least that, $\hat{p}^f \geq p_L$.

iv) Reference point hypotheses for the court treatment:

   (a) Sellers feel entitled to the best possible outcome permitted by the contract. Under rigid contracts, sellers do not punish. Under flexible contracts, sellers do punish when offered the lower bound of the price range and buyers offer higher prices to avoid this.

   (b) Sellers feel entitled to the best possible outcome from renegotiation. Sellers punish with both contract types when offered the lowest possible price permitted by the contract. Buyers may offer higher prices to avoid this.

   (c) Sellers feel entitled to what the court would enforce based on the contract. Sellers do not punish under both contract types when offered the lowest possible price permitted by the contract. Thus, that is what buyers offer.

 v) Contract choice in the baseline treatment: If sellers' punishment behaviour has a strong effect, buyers' profits may be higher with rigid contracts.

vi) Contract choice in the court treatment: Under hypothesis a), buyers select rigid contracts. Under hypotheses b) and c), buyers are indifferent between the contract types.

3.4 Aggregate findings

The following summarises aggregate findings of the baseline and the court treatment. The experimental results of the baseline treatment are compared to

FHZ's results in order to examine differences and similarities in the replication of the experiment. Furthermore, the results from the baseline treatment are compared to the court treatment in order to analyse subjects' behavioural responses to the treatment.

3.4.1 Aggregate findings baseline treatment (compared to FHZ)

Overall, FHZ's main findings were replicated in this experiment. See Table 3.2 for an overview of my experimental results compared to FHZ.

Auction outcome with rigid and flexible contracts. The auction outcome determines the contract price (i.e. the fixed price in rigid contracts and the lower bound of the price range in flexible contracts). The average auction outcome over all rounds is 41.1 Points with both contract types, see Table 3.2. The averages are higher than the competitive level of 35 Points because the auction outcomes are higher in the first rounds. However for both contract types, the contract price converges to the competitive level of 35 Points over time, as illustrated in Figure 3.1. FHZ have similar results.

Trade prices with rigid and flexible contracts. Under flexible contracts, buyers may have an incentive to offer prices above the lower bound because low prices may lead to punishment. The lower bound of the price range is on average 41.1 Points, the average price level is 45.2 Points in the good state, see Table 3.2. This difference does not disappear over time, see Figure 3.1. In 33.1 percent of flexible contracts, buyers pay a price which is strictly above the lower bound of the contract. In the bad state, buyers have to choose a price of at least 95 Points with flexible contracts. On average, buyers offer 3.1 Points more than this minimum requirement. FHZ find a bigger difference of 10.9 Points in the

Experiment	My replication (baseline)				FHZ (baseline)			
Contract type	Rigid contract		Flexible contract		Rigid contract		Flexible contract	
State of nature	Good	Bad	Good	Bad	Good	Bad	Good	Bad
Relative frequency of punishment	0.09	–	0.23	0.22	0.06	–	0.25	0.30
Average auction outcome	41.1		41.1		40.7		40.2	
Average trade price	41.3	–	45.2	97.1	40.7	–	51.1	98.4
Average profit buyer (per state)	95.2	10	85.7	34	96.8	10	78.9	29.7
Average profit seller (per state)	20.8	10	24	15.9	20.4	10	29.8	16.9
Average profit buyer (over both states)	72.3		76		77.9		68.9	
Average profit seller (over both states)	17.9		22.5		18.1		27.2	
Relative frequency of contract	0.26		0.74		0.50		0.50	

Notes: The table displays the outcomes with rigid and flexible contracts in my baseline treatment based on data from all 4 sessions. The table also summarises the outcomes of the baseline treatment in Fehr et al. (2011). *Relative frequency of punishment* measures how often sellers have chosen low quality. Trade does not take place under rigid contracts in the bad state. *Average auction outcome* is the average of the lower bound of the price range in flexible contracts or the average fixed price in rigid contracts. *Average trade price* is the average price at which the contractors trade if trade takes place. *Average profit buyer (seller) (per state)* measures the average payoff for buyers (sellers) by contract type for each state. Under rigid contracts and in the bad state, both parties receive the outside option. *Average profit buyer (seller) (over both states)* is the overall average payoff for buyers (sellers) by contract type. *Relative frequency of contract* is the share of each contract type from the total number of contracts.

Table 3.2: Summary of outcomes with rigid and flexible contracts in my baseline treatment and in FHZ's experiment
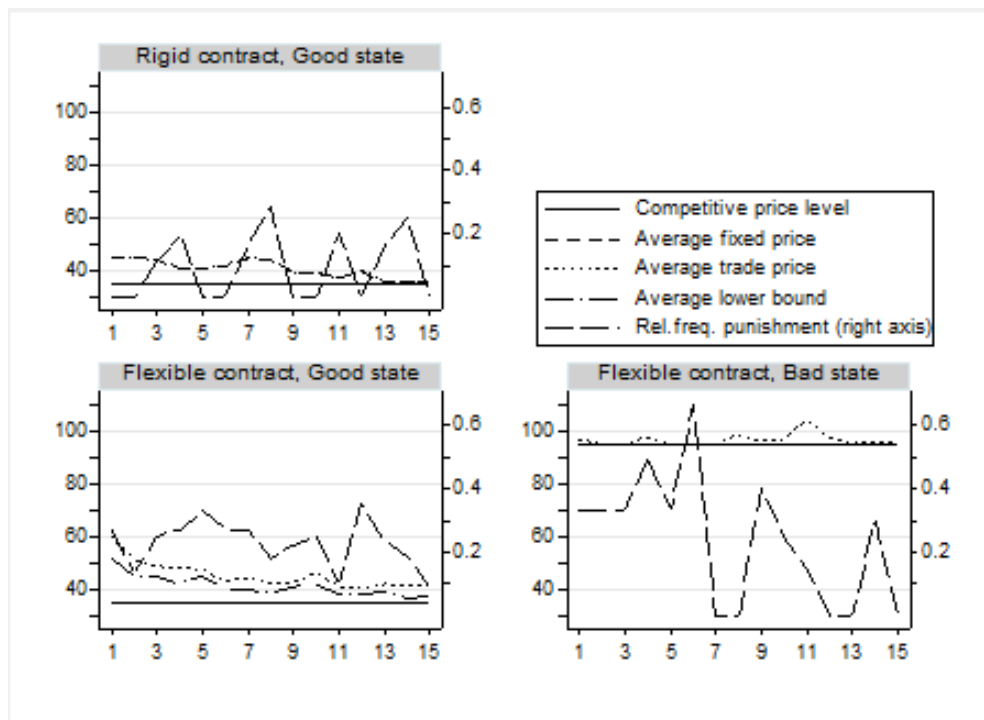
Figure 3.1: Development of punishment and prices over time – baseline treatment

good state and 3.4 Points in the bad state. Note that with rigid contracts there can be no difference between contract price and trade price. The difference in the average auction outcome and average trade price in Table 3.2 is due to the fact that the former is calculated for all concluded rigid contracts whereas the latter for trades that take place under rigid contracts. Furthermore, there is a significant difference in the average trade price of rigid and flexible contracts in the good state.[14]

Punishment under rigid and flexible contracts. With rigid contracts, low levels of punishment are observed. Low quality is chosen only in 9 percent of rigid contract relationships. FHZ observe punishment in 6 percent of cases. With flexible contracts, sellers punish in 23 percent of good states and in 22 percent of bad states, see Table 3.2. The frequency of punishment with both contract types is volatile but there is no upward or downward trend, see Fig-

---

[14]The p-value for the Wilcoxon (Mann-Whitney) rank-sum test of the difference in average trade prices between both contract types in the good state is 0.0043.

ure 3.1.[15] The 13 percentage point difference in punishment levels between the contract types in the good state is statistically significant. FHZ find similarly a significant difference, however they observe less punishment with rigid and more with flexible contracts. There is no statistically significant difference in punishment under flexible contracts between the good and the bad state.[16]

Payoffs and contract choice. In the good state, buyers offer lower prices and face less punishment under rigid than under flexible contracts. Thus, buyers' payoff is on average 9.5 Points higher with rigid than with flexible contracts. The opposite holds for sellers. Although, they (costly) punish more with flexible contracts, the price increases beyond the lower bound offset this. Sellers earn on average 3.2 Points more with flexible contracts. FHZ find similar results, although they observe even higher differences in the average payoffs for buyers and sellers, see Table 3.2. In the bad state, trade does not occur with rigid contracts and both buyer and seller receive the outside option of 10 Points.

In total, buyers get higher payoffs with flexible contracts (76 Points) than with rigid contracts (72 Points), although prices are higher under flexible contracts and there is more punishment, see Table 3.2. This is due to the fact that trade always occurs under flexible contracts. Similarly, sellers make higher profits with flexible contracts. In FHZ, buyers make on average lower payoffs under flexible contracts whereas sellers make more. This is the case because buyers offer higher prices in FHZ, probably because they face more punishment.

---

[15]OLS regressions with one observation per round and session, where the dependent variable is the fraction of punishment under the respective contract type and the explanatory variable is the round, are used to check for time trends. With rigid contracts, the p-value for the coefficient on round is 0.56. With flexible contracts, the p-value for the coefficient on round is 0.24. Hence, there are no significant time trends in punishment levels with both contract types.

[16]The rank-sum test gives a p-value of 0.0037 for the difference in average punishment between contract types in the good state and a p-value of 0.9480 for the difference in average punishment between states with flexible contracts.

FHZ find that on average half of the buyers choose flexible contracts. This is an interesting result because rigid contracts yield higher average payoffs for buyers. In my experiment, on average 74 percent of buyers choose flexible contracts. The share increases over time. In the first three rounds, on average 69 percent of buyers choose flexible contract, in the last three rounds 78 percent.

3.4.2 Aggregate findings court treatment (compared to baseline treatment)

Auction outcomes with rigid and flexible contracts. In the court treatment, the auction starts at 50 Points. The average auction outcome is with 52 Points close to the competitive level under both contract types. Even more so than in the baseline treatment, where the price is on average 6 Points above the competitive level, see Table 3.3. The auction outcome gets closer to the competitive level over time, as illustrated in Figure 3.2.
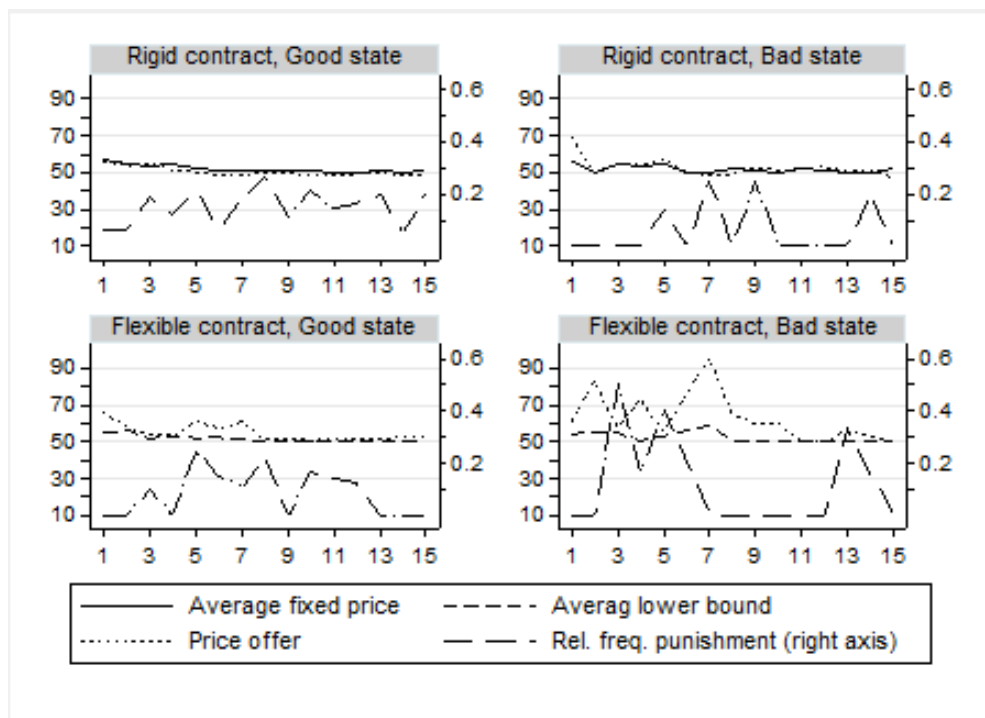
Figure 3.2: Development of punishment and prices over time – court treatment

Experiment	Baseline treatment				Court treatment			
Contract type	Rigid contract		Flexible contract		Rigid contract		Flexible contract	
State of nature	Good	Bad	Good	Bad	Good	Bad	Good	Bad
Relative frequency of punishment	0.09	–	0.23	0.22	0.15	0.08	0.09	0.17
Average auction outcome	41.1		41.1		52		52	
Average price offer	–	–	45.2	97.1	50.4	53.6	55.4	63
Average final trade price	41.3	–	45.2	97.1	51.8	55.2	56.1	62.8
Relative frequency of rejecting price offer	–	–	–	–	0.20	0.25	0.17	0.14
Average profit buyer (per state)	95.2	10	85.7	34	81.1	80.4	79.5	69.6
Average profit seller (per state)	20.8	10	24	15.9	30.1	-26.5	34.8	-18.8
Average profit buyer (over both states)	72.3		76		81		78	
Average profit seller (over both states)	17.9		22.5		20.7		23.9	
Relative frequency of contract	0.26		0.74		0.68		0.32	

Notes: The table displays by contract type the outcomes of the baseline (see Table 3.2) and court treatment based on data from all 8 sessions. In the court treatment, trade always takes place. *Relative frequency of punishment* measures how often sellers have chosen low quality. *Average auction outcome* is the average of the lower bound of the price range or the average fixed price. *Average price offer* is the average price that buyers offer to sellers. *Average final trade price* is the average trade price. In the baseline, price offer and final trade price are the same. In the court treatment, the final trade price can be affected by litigation. *Relative frequency of rejecting price offer* measures how often sellers have chosen to litigate. *Average profit buyer (seller) (per state)* measures the average payoff for buyers (sellers) by contract type for each state. *Average profit buyer (seller) (over both states)* is the overall average payoff for buyers (sellers) by contract type. *Relative frequency of contract* is the share of each contract type from the total number of contracts.

Table 3.3: Summary of outcomes with rigid and flexible contracts in my baseline and court treatment

Prices and contract enforcement with rigid and flexible contracts. In the baseline treatment, buyers have no influence on the trade price under rigid contracts and the final trade price is equal to the contract price (i.e. the auction outcome). With flexible contracts, the buyer makes a trade price offer within the contract price range. In the court treatment, buyers can offer any price between 25 and 140 Points, irrespective of the contract type or the state of nature. Sellers can reject buyers' price offers. In the good state, buyers offer on average 50.4 Points under rigid and 55 Points under flexible contracts, although the average auction outcome is 52 Points for both contract types. These price offers are rejected on average in 20 percent (rigid contract) or 17 percent (flexible contract) of the cases, see Table 3.3. Under flexible contracts, the average price offers are higher than the lower bound in the first periods. This difference disappears over time, as illustrated in Figure 3.2. The average price offers under rigid contracts stay close to (and slightly below) the average contract price over all rounds. Buyers undercut the contract price in 22 percent of rigid contracts. However, the lower bound of the price range is undercut rarely, in 0.14 percent of flexible contracts. Sellers punish price undercutting with rejection in 54 percent of the cases. In the bad state, buyers offer on average higher prices than the auction outcome but still below the seller's cost; the average offered price is 53.6 under rigid and 63 Points under flexible contracts. These offers are on average rejected in 25 and 14 percent of the cases, respectively. If a seller rejects an offer, the contract is enforced by the court which leads to slightly higher average final trading prices, see Table 3.3.

Punishment under rigid and flexible contracts. In the court treatment, buyers offer higher prices (than the auction outcome) in the bad than in the good state. However, neither the 7 percentage point difference in punishment across states with rigid contracts nor the 8 percentage point difference across states with flexible contract is statistically significant. Compared across contract

types, punishment is 6 percentage points lower with flexible than with rigid contracts in the good state, see Table 3.3. This difference is significant at the 10 percent significance level. The punishment behaviour is volatile but no significant trends over time are observable with both contract types, as illustrated in Figure 3.2.[17]

Comparing across treatments, in the good state and with rigid contracts punishment is higher in the court treatment (15 percent) than in the baseline treatment (9 percent). This is presumably due to the fact that some buyers undercut the contract price in the court treatment. However, this difference is not statistically significant. With flexible contracts and in the good state, punishment is significantly higher in the baseline treatment. Sellers are by design getting on average higher prices in the court treatment. However, with flexible contracts and in the good state, the markups over the lower bound of the price range are not statistically different across treatments and can thus not solely explain the difference in punishment levels across treatments. The average punishment across treatments in the bad state with flexible contracts is not significantly different.[18]

As mentioned before, price undercutting seems to explain some of the punishment under rigid contracts. Undercutting occurs in 32 percent of all rigid

---

[17]OLS regressions with one observation per round and session, where the dependent variable is the fraction of punishment under the respective contract type and the explanatory variable is round, check for time trends. With rigid contracts, the p-value for the coefficient on round is 0.29. With flexible contracts, the p-value for the coefficient on round is 0.468. Hence, there are no significant time trends in the punishment levels under both contract types. Also when differentiating between cost states, no significant time trends in punishment levels can be identified with each contract type.

[18]The rank-sum tests give a p-value of 0.1342 for the difference in average punishment across treatments with rigid contract in the good state; a p-value of 0.1683 for comparing the punishment in the good and bad state with rigid contracts in the court treatment; a p-value of 0.0987 for the difference in the average punishment between contract types in the good state in the court treatment; a p-value of 0.1912 for the difference in average punishment between cost states in the court treatment with flexible contracts; a p-value of 0.0014 for the difference in the average punishment across treatments in the good state and under flexible contracts; a p-value of 0.3929 for the difference across treatments in the average markups over the lower bound with flexible contracts in the good state; a p-value of 0.5706 for the difference in the average punishment across treatments in the bad state under flexible contracts.

contracts. With self-interested agents, price undercutting by 5 Points (litigation cost) should be observed. In 21 percent of all rigid contracts, buyers undercut by less than 5 Points. 41 percent of sellers react to this by accepting the price offer and providing normal quality. However, an almost equal amount of affected sellers react by one type of punishment, costing them 5 Points each. 24 percent of those punish with low quality and 23 percent choose litigation. The former causes the buyer a loss of 40 Points, the latter of 5 Points. The remaining 12 percent opt for double punishment, costing the seller 10 Points and the buyer 45 Points. When buyers undercut prices by more than 5 Points, which happens in 11 percent of all rigid contracts, sellers reactions are more aligned. 82 percent of affected sellers opt for contract enforcement, but provide normal quality. 12 percent choose double punishment. When the contract price of rigid contracts is not undercut, punishment occurs only in 5 percent of the cases.

In the court treatment, buyers can also offer markups with both contract types. The markups with flexible contracts are not statistically different across treatment. However, there is a difference within the court treatment across contract types. Only in 9 percent of rigid contracts, buyers offer a markup over the fixed price, whereas in 37 percent of flexible contracts, buyers offer a price higher than the lower bound of the price range. This difference is statistically significant.[19]

Payoffs and contract choice. Buyers receive on average 3 Points higher payoffs with rigid contracts than with flexible contracts because although punishment is higher this is offset by lower prices, see Table 3.3. Sellers make on average 3.2 Points less with rigid than with flexible contracts because of low prices and high (costly) punishment under rigid contracts. Compared to the

---

[19]The p-value from the rank-sum test for the difference in occurrence of markups across contract types in the court treatment is 0.000.

baseline treatment buyers receive higher payoffs under both contract types in the court treatment. This is because trade always occurs in the court treatment and, although buyers have to pay by design higher prices, they face less punishment in the court treatment, which offsets this. Also, sellers earn higher average payoffs in the court treatment as they benefit from the higher prices and the extra cost for litigation is not prominent.

Buyers choose with 68 percent on average more often rigid than flexible contracts in the court treatment. The share of buyers choosing flexible contracts is statistically decreasing over time.[20] In the first three rounds, on average 39 percent of buyers choose flexible contracts whereas 22 percent in the last three rounds. In the baseline treatment, on average 26 percent of buyers choose rigid contracts. The difference in the contract choice is significant.[21]

3.5   Sellers' choices

In this section, I analyse whether sellers self-select into one or the other type of contract in order to rule out that sellers' behaviour solely stems from specific types of sellers always choosing one or the other contract type. Furthermore, I investigate when sellers punish buyers by choosing low quality. Understanding when punishment does not occur (does occur) gives insights into when parties receive (do not receive) what they feel entitled to, and therefore allows for inference about reference points.

3.5.1   Sellers' contract choice

Sellers can influence which contracts they sign by being more or less aggressive in the auction stage. However, sellers do not appear to self-select into a specific

---

[20]Regressing a dummy for flexible contracts against rounds yields a significant negative coefficient.

[21]The p-value for the rank-sum test of the difference in contract choice across treatment is 0.000.

type of contract in both treatments, see Figure 3.3. In general, sellers write more flexible contracts in the baseline treatment and more rigid contracts in the court treatment based on buyers' different preferences for those contract types in the two treatments.
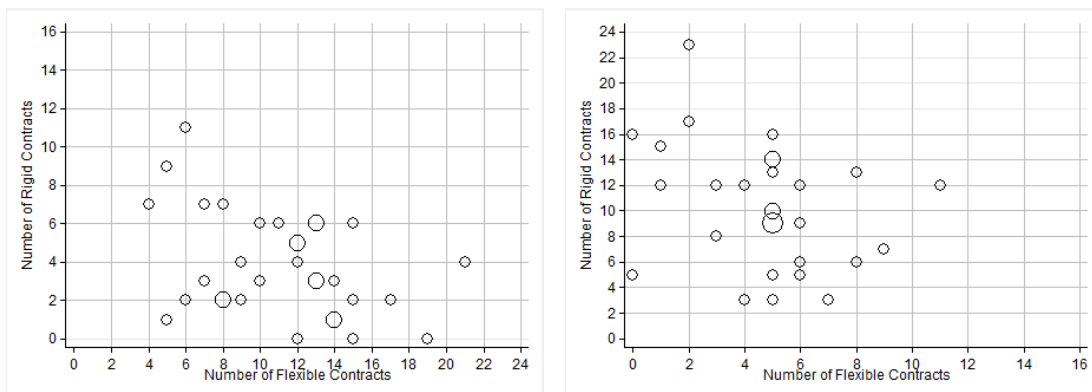
Baseline treatment   Court treatment

Figure 3.3: Number of rigid and flexible contracts per individual seller by treatment

3.5.2 Sellers' punishment choice

Table 3.4 provides estimations of what drives sellers' punishment behaviour in the two different states of nature. In columns (1) – (4), *punishment* in the good (low cost) state is the dependent variable whereas columns (5) – (6) consider *punishment* in the bad (high cost) state. Both OLS and Probit estimations are used.

As mentioned before, punishment occurs with around 9 percent of rigid contracts in the baseline treatment, see Table 3.3. This cannot be explained by the reference point theory. The buyer has no choice over the trade price in this case. Thus, sellers should not expect more than the contract price and have no reason to punish due to hurt feelings of entitlement. It is possible that sellers punish buyers for the contract choice, as argued by Erlei and Reinhold (2016). Since rigid contracts do not allow for price adjustments in the seller's favour, sellers might punish buyers for tying their hands by selecting rigid

Dependent variable	Punishment good state				Punishment bad state	
	(1) OLS	(2) Probit (ME)	(3) OLS	(4) Probit (ME)	(5) OLS	(6) Probit (ME)
Treat	0.0629 (0.0449)	0.0768 (0.050)	0.0209 (0.0530)	0.0198 (0.059)	-0.0515 (0.0817)	-0.044 (0.0766)
Flex	0.139*** (0.0443)	0.1446*** (0.0487)	0.164*** (0.0460)	0.1601*** (0.048)		
Flex x Treat	-0.202*** (0.0606)	-0.222*** (0.0668)	-0.135** (0.0644)	-0.127* (0.0699)		
Auction price			-0.00307 (0.00232)	-0.003 (0.002)		
Markup x Flex			-0.0715* (0.0416)	-0.0634 (0.0385)		
Markup x Treat			0.0145 (0.0650)	-0.132 (0.075)		
Undercut			0.323*** (0.0636)	0.2676*** (0.055)		
Reject offer			-0.00715 (0.0805)	-0.004 (0.0909)		
Reject undercut			-0.182 (0.111)	-0.1228 (0.112)		
Rigid x Treat					-0.0940 (0.0855)	-0.112 (0.0889)
Constant	0.0889** (0.0387)		0.216** (0.103)		0.224*** (0.0449)	
Observations	750	750	750	750	147	147
Adjusted R-squared	0.0191		0.0524		0.0172	

Notes: Standard errors in parentheses; *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$. *Auction price* is either the lower bound of the price range or the fixed price. All other variables are indicator variables. *Treat* is unity for the court treatment. *Flex* is unity for a flexible contract. *Markup* is unity if the buyer offers a price above the auction price. Only relevant for the court treatment are: *Undercut*, unity for a price offer below auction price; *Reject offer*, unity if a seller litigates; *Reject undercut*, unity if a seller litigates after observing price undercutting; *Rigid*, unity for a rigid contract. Also included are interactions denoted by *variable x variable*. Columns (1)-(4) are for the good and (5)-(6) for the bad state. Columns (1), (3) and (5) report coefficients of OLS estimations. Columns (2), (4) and (6) report marginal effects based on Probit estimations.

Table 3.4: Sellers' punishment choice by state

contracts. However, punishment under rigid contracts might also simply be driven by some subjects' random choices. Nevertheless, the frequency of punishment with rigid contracts is not significantly different between treatments as the treatment dummy variable (*court treat*) in columns (1) and (2) of Table 3.4 is not significant. In the court treatment, buyers have the option to offer prices above the fixed price, whereas this is not possible in the baseline treatment. The result that the punishment level with rigid contracts is not different across treatment thus indicates that renegotiation does not affect sellers' reference points for feelings of entitlement. Sellers do not seem to feel entitled to more favourable outcomes from renegotiation but the contract shapes sellers' feelings of entitlement to some extent.

Focusing on the baseline treatment, the contract choice appears to affect sellers' punishment behaviour. The dummy variable for writing a flexible contract (*Flex*) is significant, in columns (1) and (2) of Table 3.4. Hence, signing a flexible contract makes punishment more likely in the baseline treatment. Table 3.5 provides OLS and Probit estimations to check whether the punishment behaviour depends on the trade price. The variable *Price minus 35* is defined as the difference between the actual trade price and the competitive price of 35 Points. Also included is the interaction of this variable with a dummy for flexible contract (*Flex x Price minus 35*). In the bad (high cost) state, the similarly defined variable *Price minus 95* is utilised, accounting for the fact that buyers have to offer at least 95 Points in this state. Also included is the dummy *Flex* to account for the contract type, which is not relevant in the bad state as trade only takes place with flexible contracts in this case. The estimation results show that only the contract choice is significant. The price is neither significantly affecting punishment with rigid nor with flexible contracts in both states.[22] The fixed price and the lower bound of the price range are not significantly differ-

_____

[22]Similar qualitative results are found if punishment level is regressed against the auction outcome, a dummy for whether a markup was offered and the dummy for flexible contracts.

Dependent variable	Punishment good state		Punishment bad state	
	(1) OLS	(2) Probit (ME)	(3) OLS	(4) Probit (ME)
Price minus 35	-0.00492 (0.00688)	-0.0084 (0.0087)		
Flex	0.134** (0.0674)	0.1388* (0.0727)		
Flex x Price minus 35	0.00237 (0.00718)	0.0058 (0.00897)		
Price minus 95			-0.00780 (0.00812)	-0.0189 (0.0194)
Constant	0.120** (0.0597)		0.240*** (0.0540)	
Observations	380	380	67	67
Adjusted R-squared	0.0196		-0.00117	

Notes: Standard errors in parentheses; $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. *Price minus 35* is defined as the final trade price minus the competitive price of 35 Points. *Price minus 95* is defined as the final trade price minus 95 Points and is only relevant in the bad state with flexible contracts. *Flex* is unity for a flexible contract. *Flex x Price minus 35* is the interaction between flexible contract and price increment. Columns (1)-(2) are for the good and (3)-(4) for the bad state. Columns (1) and (3) report coefficients of OLS estimations. Columns (2) and (4) report marginal effects based on Probit estimations.

Table 3.5: Price dependency of punishment across contract types – baseline treatment

ent.[23] Nevertheless, sellers seem to expect more favourable outcomes than the lower bound of the price range under flexible contracts and punish if they do not receive this. Rigid contracts restrict what sellers feel entitled to and thus induce less punishment.

Focusing on the court treatment, the punishment increasing effect of a flexible contract (*Flex*), observed in the baseline treatment, is counteracted by a significant decreasing effect in the court treatment, see the interaction term *Flex x Treat* in columns (1) and (2) of Table 3.4. Thus, in the court treatment the difference in punishment across contract types disappears. The fixed price

---

[23]The p-value of the rank-sum test of the difference in auction outcome across contract types is 0.3002 in the baseline treatment.

and the lower bound of the price range are also not significantly different in the court treatment.[24] However, because the court treatment allows for renegotiation, buyers can always offer the same trade prices irrespective of the contract type or the state. One could expect that sellers feel entitled to the same prices under both contract types, or more specifically the best possible outcome from renegotiation. Nevertheless, sellers in the court treatment appear to punish rarely under both contract types, instead of similarly often. Therefore, the experimental results lead to the conclusion that sellers feel entitled to receive the fixed price or the lower bound of the price range, respectively, instead of more favourable outcomes from renegotiation. Note that the fixed price or the lower bound of the price range is what the court would enforce if there is litigation and this appears to shape the feelings of entitlement.

The estimations in columns (3) and (4) of Table 3.4 allow for more variables to explain punishment in the good state. Rejecting a price offer from the buyer (*Reject offer*) in the court treatment does not appear to affect seller's punishment behaviour. Offering prices above the lower bound of the price range or above the fixed price in the court treatment (*Markup x Treat*) does also not significantly affect punishment. In the baseline treatment, offering prices above the lower bound of the price range (*Markup x Flex*) appears to decrease punishment, although this effect is only significant at the 10 percent significance level in the OLS estimation. Given that the *Auction price* does not significantly affect punishment, the treatment effects do not appear to be driven by the different price levels across treatments imposed by the experimental design. The only additional variable that gives convincing significant effects is the dummy *Undercut*. *Undercut* is unity for a price offer below the fixed price or the lower bound of the price range, and zero otherwise, and is only relevant in the court treatment. Since undercutting makes punishment more likely, undercut prices

---

[24]The p-value of the rank-sum test of the difference in auction outcome across contract types is 0.8520 in the court treatment.

appear to be considered as very unreasonable by sellers.

For the less likely bad (high cost) state, only a limited number of observations are available. No significant difference in punishment levels under flexible contracts across treatments can be observed, see variable *Court treat* in columns (5) and (6) of Table 3.4. Furthermore, punishment levels across contract types in the court treatment are not significantly different, see variable *Rigid x Treat*.

3.5.3 Discussion – court procedure and reference points

To summarise, in the baseline treatment, sellers punish more with flexible contracts than with rigid contracts although they receive similar prices (equal to the auction outcomes which are similar for both contract types). Hence, sellers appear more aggrieved under flexible than under rigid contracts when facing comparable prices. This leads to the conclusion that they have different feelings of entitlement depending on the contract type. The experimental results cannot verify whether sellers feel entitled to the *best possible outcome* permitted by the contract, as assumed by HM, but at least indicate that sellers feel entitled to *more favourable outcomes* if possible.

In the court treatment, no differences in the frequency of punishment across contract types is observed. Given that buyers' price offers are similar under both contract types, this leads to the conclusion that sellers' feelings of entitlement are not different with both contract types. The perception of the contract seems to vary across treatments although the contracts are designed in the same way. Also, sellers appear to be equally pleased with buyers' price offers under flexible and rigid contracts as low levels of punishment are observed. Hence, sellers do not appear to feel entitled to more favourable outcomes permitted by the contract, in contrast to the baseline treatment.

Furthermore, although renegotiation is allowed with both contract types in

the court treatment, punishment levels are not only the same with both contract types but also at an equally low level. Since punishment levels are low although buyers offer prices similar to the auction outcome, sellers also do not appear to feel entitled to more favourable outcomes from renegotiation.

The experimental results show that punishment is low when sellers receive either the fixed price or the lower bound of the price range in the court treatment, which is not true in the baseline treatment. The presence of the court appears to affect sellers' reference points and the sellers feel entitled to what the court would enforce in case of litigation. If the buyer offers the lower bound of the price range, the court would enforce this price. Similarly, the court would enforce the fixed price. Therefore, the court enforcement seems to create a reference point for feelings of entitlement and creates an outside validation for which prices are reasonable. This also holds for trades in which the parties do not litigate and the sheer presence of the court affects the feelings of entitlement. Note that the court would potentially enforce all possible price offers within the price range. Buyers could, for example, offer the upper bound of the price range p_H which would be approved by the court. Nevertheless, sellers accept the lower bound p_L as a reasonable price, probably also due to the fact that the lower bound is set by the sellers in the auction.

Furthermore, sellers' behaviour can be distinguished from simply responding to the anticipated optimal behaviour by the buyers. If this were driving sellers, they would similarly respond to buyers' anticipated behaviour in the baseline treatment. Sellers can anticipate that with flexible contracts, it is in the buyers' interests to offer the lower bound. Nevertheless, sellers appear to expect higher price offers from buyers and otherwise punish in the baseline treatment. In addition, concerns that the treatment effect is driven by the difference in price levels, as the auction starts at a higher price in the court treatment, are mitigated as the auction outcome is found to not significantly

affect punishment levels.

Subjects' behaviour may also be driven by fairness considerations. With in-equity aversion (see for example Fehr and Schmidt (1999)), subjects are willing to forgo material payoffs to avoid inequitable outcomes. With flexible con-tracts, buyers decide on the share of the surplus for sellers. In order to limit the payoff inequality, sellers may punish buyers when a low share is offered. In turn, buyers may offer higher shares to avoid punishment. This game is com-parable to an ultimatum game (see for example Camerer and Thaler (1995)). If inequity aversion were driving sellers' behaviour, punishment should not only occur under flexible but also under rigid contracts, where sellers only get a low share of the surplus and punishment could reduce payoff inequal-ity. Moreover, same punishment levels should be observed across treatments when inequity aversion is what mainly drives sellers' choices. However, all of this is not observed in the experiment. Furthermore, also reciprocity models (see for example Gary Charness (2002), Falk and Fischbacher (2006)) cannot describe sellers' behaviour. The underlying idea is that subjects care about how unfavourable outcomes occur and whether they are beyond the oppo-nent's control. Following this, agents punish when favourable outcomes are intentionally not achieved. Reciprocity models would thus predict high pun-ishment levels in the court treatment where renegotiation is possible. Price offers that lead to a fairer share of the surplus are available but are not se-lected by the buyers in the court treatment. Nevertheless, punishment is not observed and reciprocity does not appear to play an important role for sellers' behaviour.

3.6 Buyers' choices

Buyers can potentially affect punishment levels with the price offers and strategically adjust prices to avoid punishment. Hence in order to understand sellers' punishment behaviour, an analysis of buyers' price offers is relevant. Furthermore, the influence of the enforcement procedure on the contract design, chosen by the buyer, is examined.

3.6.1 Buyers' price offers

Baseline treatment. With rigid contracts, buyers have no choice over the price. With flexible contracts, buyers have to choose a price from the price range. Figure 3.4 illustrates how many buyers decide to offer always or sometimes markups under flexible contracts. A markup is defined as a price offer above the lower bound of the price range ($\hat{p} > p_L$). Many buyers never offer markups (43 percent), a third of buyers offer markups at least 8 times.

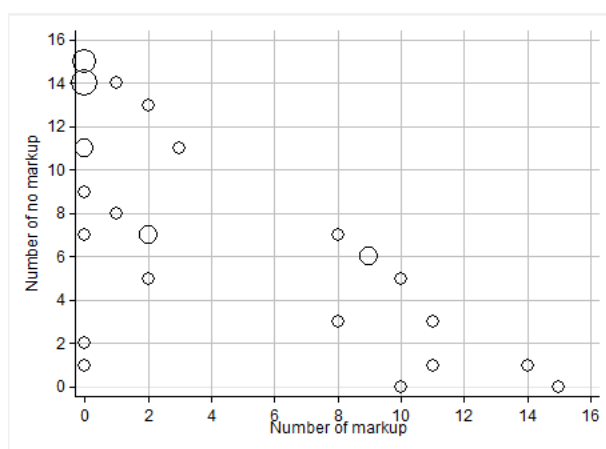

Figure 3.4: Number of markups per individual buyer under flexible contracts – baseline treatment

In order to explain buyers' choice to offer a markup, a *Markup* dummy is regressed against a one-round-lagged markup dummy (*LagMarkup*), one-round-lagged punishment dummy (*LagPunish*) and an interaction of the two (*LagPunish x LagMarkup*). The regression results are presented in column (1) of

Dependent variable	Markup baseline treat		Markup court treat	
	(1)	(2)	(3)	(4)
	OLS	OLS (Buyer FE)	OLS	OLS (Buyer FE)
LagMarkup	0.7107***	0.2035***	0.433***	0.2236***
	(0.0456)	(0.057)	(0.0402)	(0.0459)
LagPunish	0.0862	0.0240	-0.0617	-0.0297
	(0.0526)	(0.0491)	(0.0467)	(0.0459)
LagPunishxLagMarkup	-0.0626	0.0584	0.0950	0.0284
	(0.105)	(0.0956)	(0.147)	(0.142)
Flex			0.176***	0.281***
			(0.0324)	(0.0429)
Constant	0.0893***	$3.08e-14$	0.0283	-0.0158
	(0.0265)	(0.0797)	(0.0197)	(0.0758)
Observations	327	327	420	420
Adjusted R-squared	0.468	0.626	0.312	0.400

Notes: Standard errors in parentheses; $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. All variables are indicator variables. *LagMarkup* is unity if the buyer has offered a markup over the fixed price or the lower bound of the price range in the previous round. *LagPunish* is unity if the buyer has faced punishment by the seller in the previous round. *LagPunish x LagMarkup* is the interaction between those two variables. *Flex* is unity for a flexible contract. Columns (1)-(2) are for the baseline and (3)-(4) for the court treatment. All columns report coefficients of OLS estimations. Columns (2) and (4) are based on OLS estimations including buyer fixed effects.

Table 3.6: Buyers' markup choices – baseline and court treatment

Table 3.6. Column (2) presents the results of a similar regression but accounting for buyer fixed effects to control for unobserved differences among buyers.[25] The only significant effect on the choice to offer a markup that can be identified is whether the buyer has offered a markup in the previous round. If a markup has been offered previously, buyers are more likely to offer it again. This also holds in the buyer fixed effect estimation. The experience of punishment in the previous round appears to have no effect on buyers' markup offers.

---

[25]Note that I am not providing Probit estimations when using individual fixed effects due to the incidental parameter problem, see Lancaster (2000).

Court treatment. In the court treatment and with both contract types, buyers always have a choice over the price offer. They can always offer markups but also undercut. Undercutting is defined as offering a price below the fixed price in rigid contracts ($\hat{p} < p^r$) or below the lower bound of the price range in flexible contracts ($\hat{p} < p_L$).

Markups with rigid contracts are never offered by 57 percent of buyers under rigid contracts and 39 percent under flexible contracts, as illustrated in Figure 3.5. The estimation results regarding buyers' markup choices in the court treatment are presented in columns (3) and (4) of Table 3.6. Markup is, similarly to the baseline treatment, estimated using a one-round-lagged markup dummy, a one-round-lagged punishment dummy and an interaction of the two. Additionally, the dummy for writing a flexible contract (*Flex*) is included, see column (3), because markups are possible with both contract types in this treatment. The regression in column (4) also considers buyer fixed effects. As in the baseline treatment, buyers are significantly more likely to offer markups if they have offered them in the previous round. Also, buyers appear to be significantly more likely to offer markups with flexible than with rigid contracts in the court treatment.

Rigid contract   Flexible contract
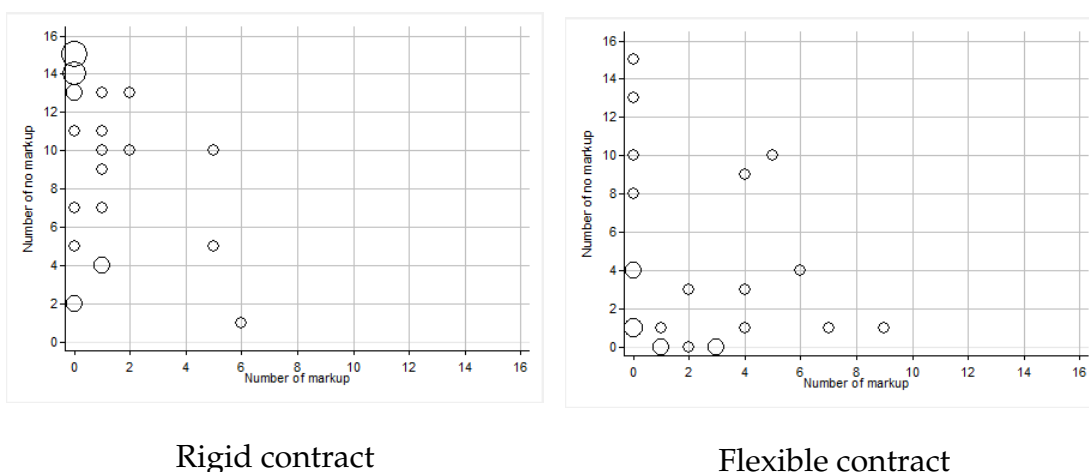
Figure 3.5: Number of markups per individual buyer by contract type – court treatment

Buyers' choice to undercut is investigated with estimations presented in Table 3.7. *Undercut* is estimated using a one-round-lagged undercut dummy (*LagUndercut*), a one-round-lagged punishment dummy (*LagPunish*), an interaction of the two (*LagPunish x LagUndercut*) and a dummy for concluding a flexible contract (*Flex*), see column (1) of Table 3.7. The estimation presented in column (2) also allows for buyer fixed effects and finds that some buyers are in general more likely to undercut than others. If buyers have undercut in the previous round, they are significantly more likely to undercut again. However, if buyers experienced punishment after having undercut in the previous round, they are significantly less likely to undercut again. Accounting for buyer fixed effects, if buyers have experienced punishment without undercutting in the previous round this has an increasing effect on undercutting. With flexible contracts, undercutting is significantly less likely. In fact, undercutting only occurs in 0.14 percent of flexible contracts. Figure 3.6 illustrates that many buyers (64 percent) try undercutting at least once under rigid contracts.
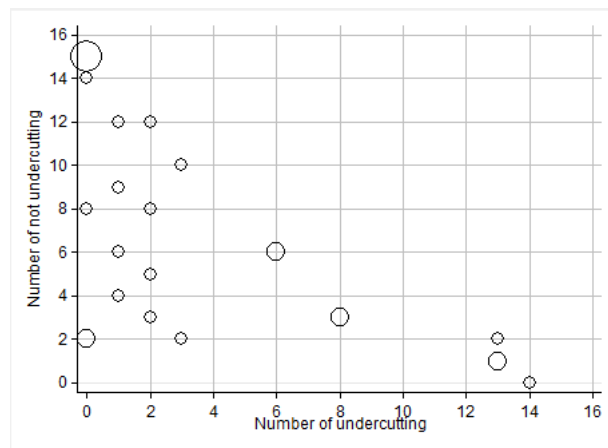
Figure 3.6: Number of undercutting per individual buyer under rigid contracts – court treatment

Dependent variable	Undercut court treatment	
	OLS	OLS (Buyer FE)
	(1)	(2)
LagUndercut	0.577***	0.0806*
	(0.0448)	(0.0477)
LagPunish	0.0822	0.105**
	(0.0650)	(0.0527)
LagPunish x LagUndercut	-0.186*	-0.196**
	(0.0999)	(0.0813)
Flexible contract	-0.233***	-0.328***
	(0.0351)	(0.0389)
Constant	0.177***	0.140**
	(0.0225)	(0.0696)
Observations	420	420
Adjusted R-squared	0.396	0.628

Notes: Standard errors in parentheses; $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. All variables are indicator variables. *LagUndercut* is unity if the buyer has undercut the fixed price or the lower bound of the price range in the previous round. *LagPunish* is unity if the buyer has faced punishment by the seller in the previous round. *LagPunish x LagUndercut* is the interaction between those two variables. *Flex* is unity for a flexible contract. Undercutting can only occur in the court treatment. Column (1) reports coefficients of an OLS estimation, column (2) is based on an OLS estimation including buyer fixed effects.

Table 3.7: Buyers' undercutting choice – court treatment

3.6.2 Buyers' contract choice

Baseline Treatment. The majority (74 percent) of contracts in the baseline treatment are flexible contracts. The advantage of flexible contracts in this treatment is that trade can take place in both states; the disadvantage is that buyers may face punishment. As long as only a certain fraction of sellers punish with flexible contracts, the buyers should prefer flexible contracts.[26] Most

---

[26]Given that 9 percent of sellers punish under rigid contracts in the baseline treatment, buyers should prefer flexible contracts if less than 24.7 percent of sellers punish under flexible contracts, which is observed in the experiment. Buyers prefer flexible contracts if $x \leq 0.175 + 0.8z$, where z is the share of sellers punishing under rigid contracts and x the share of sellers punishing under flexible contracts. This is because $0.8[(1-z)(140-35)+z(100-35)]+0.2(10) \leq (1-x)[0.8(140-35)+0.2(140-95)]+x[0.8(100-35)+0.2(100-95)]$, where the left-hand side is the expected payoff from a rigid contract and the right-hand side from a flexible contract.

|Baseline treatment|Court treatment|
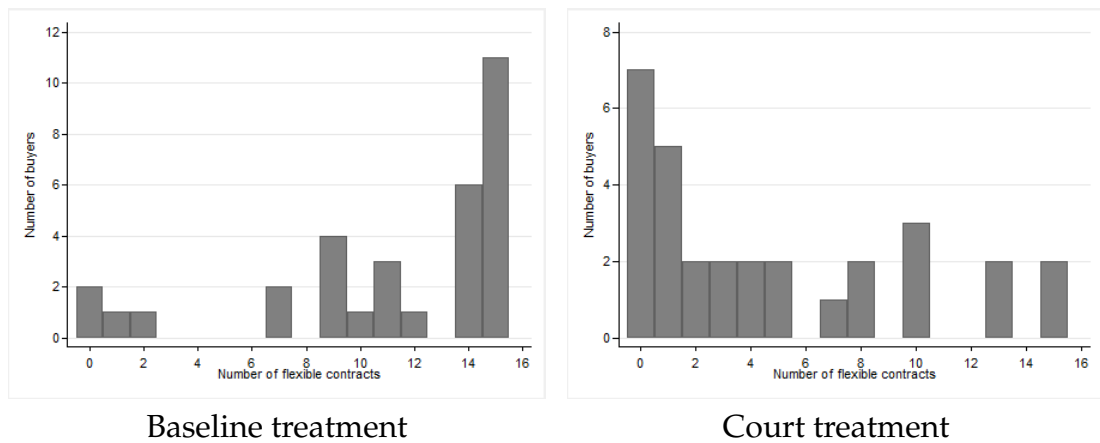
Figure 3.7: Number of flexible contracts per individual buyer by treatment

buyers indeed prefer flexible contracts in the baseline treatment because the punishment levels are not too high. There are many buyers who always choose flexible contracts, but many also try both, see Figure 3.7.

Columns (1) – (2) in Table 3.8 present the estimation results regarding buyers' contract choice in the baseline treatment with the dummy for flexible contract (*Flex*) as the dependent variable. At the end of each round, buyers are provided with information about the average profit of all rigid and flexible contracts that have been signed until that round. This information does not appear to significantly influence buyer's contract choice. In columns (1) and (2), the one-round-lagged difference in average profits from both contract types (*LagDiffAverageProfit*) is not significant. Neither does previous round's profit (*LagProfit*) have a significant effect on the contract choice. However, having experienced punishment under rigid contracts in the previous round (*LagPunish*) makes buyers more likely to offer flexible contracts. Also, having selected a flexible contract in the previous round (*LagFlex*) makes buyers more likely to offer it again. However, if buyers have experienced punishment with a flexible contract in the previous round (*LagPunish x LagFlex*), they are less likely to offer a flexible contract. The regression accounting for buyer fixed effect in column (2) of Table 3.8 gives similar qualitative results.

Court Treatment. The majority (68 percent) of contracts in the baseline treatment are rigid contracts. There are many buyers who always choose rigid contracts but also many who try both contract types, see Figure 3.7. The estimation results regarding buyers' contract choice in the court treatment can be found in columns (3) and (4) of Table 3.8. In contrast to the baseline treatment, the one-round-lagged difference in average profits between fixed price and flexible contracts (*LagDiffAverageProfit*) is significant. Thus, if buyers observe that all buyers have earned more with fixed price contracts in all previous rounds, they are more likely to offer fixed price contracts. Also in contrast to the baseline treatment, the experience of punishment does not significantly affect the contract choice. However, similarly to the baseline treatment, having selected a flexible contract in the previous round makes buyers more likely to offer it again. Accounting for buyer fixed effect gives similar qualitative results, see column (4) in Table 3.8.

In the court treatment, buyers face the same (little) restrictions on the price offer under both contract types. However, there is a difference between the contract types (in addition to possible effects on reference points and punishment) because they provide different incentives for sellers to litigate. Under flexible contracts, buyers have no incentives to undercut because sellers have strong incentives to litigate as the litigation cost is lower than the expected price gain. Under rigid contracts and with self-interested subjects, a price undercut by 5 Points (litigation cost) should be observed, making sellers indifferent to litigation and buyers prefer rigid contracts. In the experiment, undercutting by up to 5 Points can cause punishment. Only 21 percent of rigid contract prices are undercut by up to 5 Points. Thus, it seems that sellers' response to punish diminishes buyers' incentives to undercut, making rigid contracts less attractive to buyers. As analysed before, the lower bound and the fixed price (i.e. the auction outcomes) are not significantly different and flexible contracts

do not trigger more punishment in the court treatment. However, 68 percent of buyers choose rigid and 32 percent select flexible contracts in the court treatment. Some buyers experience that undercutting is not worthwhile, whereas others realise they can get away with undercutting (sometimes even by more than 5 Points) and thus prefer rigid contracts. Also, buyers appear to be more driven by profit comparisons across contract types than by punishment experiences.

Dependent variable	Flex baseline treatment		Flex court treatment	
	(1) OLS	(2) OLS (buyer FE)	(3) OLS	(4) OLS (buyer FE)
LagProfit	-0.000427 (0.000807)	0.000189 (0.000739)	0.000701 (0.00191)	-0.000937 (0.00197)
LagPunish	0.440*** (0.130)	0.397*** (0.119)	0.0418 (0.0970)	0.00557 (0.0975)
LagFlex	0.610*** (0.0461)	0.131** (0.0558)	0.561*** (0.0430)	0.178*** (0.0509)
LagPun x LagFlex	-0.503*** (0.134)	-0.480*** (0.122)	0.0903 (0.121)	0.0699 (0.111)
LagDiffAvgProfit	-0.000481 (0.00165)	-0.000953 (0.00146)	-0.0126*** (0.00369)	-0.00938* (0.00478)
Constant	0.334*** (0.0881)	0.783*** (0.119)	0.126 (0.167)	0.237 (0.205)
Observations	416	416	420	420
Adjusted R-squared	0.314	0.493	0.358	0.497

Notes: Standard errors in parentheses; $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. *LagProfit* measures a buyer's profit in the previous round. *LagDiffAvgProfit* is the difference in average profits from both contract types for all previous rounds. All other variables are indicator variables. *LagPunish* is unity if the buyer has faced punishment by the seller in the previous round. *LagFlex* is unity if the buyer has selected a flexible contract in the previous round. *LagPun x LagFlex* is the interaction between those two variables. Columns (1)-(2) consider the baseline, columns (3)-(4) the court treatment. All columns report coefficients of OLS estimations. Column (2) and (4) include buyer fixed effects.

Table 3.8: Buyers' choice of a flexible contract by treatment

3.7 Conclusion

This paper provides experimental evidence that the option of contract enforcement, even if it is not invoked, affects agents' behaviour in a contractual relationship. Different enforcement procedures appear to cause different behavioural effects because they create different reference points for feelings of entitlement. The experimental results suggest that contracts, even if incomplete, are not only giving contractors the right to make claims in court about verifiable terms but also shape parties' behaviour regarding noncontractual terms. This is true even for an uninformed court that can impose detrimental prices for the seller.

In the baseline treatment, the implicit enforcement procedure is such that the court does not impose a price on the contractors but ensures that buyers' price offers are not outside of the contract. With flexible contracts, the parties implicitly agree to renegotiate ex post. The court simply provides a bargaining protocol and the trade price is at the discretion of the buyers. The bargaining protocol defines the boundaries (i.e. the contract price range) and gives the buyer the power to make a take-it-or-leave-it offer. Thus, although buyers' price offers are more restricted in the baseline treatment, sellers may regard this situation as one in which higher prices are reasonable and expect more than the lower bound. This leaves room for disappointment and high levels of punishment are observed under flexible contracts. When the seller is unhappy with the offer, she undertakes costly punishment. With rigid contracts, sellers know what to expect and punishment occurs rarely. The results provide evidence that (more favourable outcomes within) contracts are reference points when this implicit enforcement procedure is employed. This supports HM's reference point theory.

In the court treatment, the enforcement procedure is different. The court does not automatically enforce contracts and the contractors are aware that all

prices are possible.[27] However, if the seller actively decides to let the court settle the contract, the court makes a foreseeable decision dictated by the contract. There is a tighter bound on sellers' expectations which disciplines sellers' feelings of entitlement. Sellers appear to feel entitled to the price that the court would enforce based on the contract and punish less if they receive this price. Thus, the court provides an outside validation for which prices are reasonable. This holds although there is more than one (reasonable) price that the court would enforce and sellers appear not to be aggrieved when offered the worst of those. Hence, sellers do not seem to feel entitled to more favourable outcomes within the contract. Neither do sellers appear to feel entitled to better possible outcomes from renegotiation. Therefore, the contract enforcement is the reference point for feelings of entitlement in the court treatment.

In the literature, contracts are often simply regarded as a disagreement point in ex post renegotiations on which parties can fall back on if renegotiation fails (Bartling and Schmidt, 2015). Also some (option) contracts are considered only valuable if renegotiation is prohibited (Hoppe and Schmitz, 2011). My results show that contracts in the presence of a contract enforcing court can shape what the contracting parties regard as appropriate in contract renegotiations. Therefore, contracts are neither irrelevant when renegotiation is possible nor solely threat points. This is an insight complementary to the existing literature on the behavioural effects of contracts in renegotiation, such as Iyer and Schoar (2015) who find that social norms limit exploitative behaviour in renegotiations; Herweg and Schmidt (2014) who argue that loss aversion leads to inefficient renegotiation because the contractors compare renegotiated outcomes to the contract; and the basic reference point theory by Hart and Moore (2008) that assumes a self-serving bias in renegotiations in the absence of out-

---

[27]Strictly speaking there is some form of automatic enforcement because buyers can only offer prices between 25 and 140 Points. However, these are extreme boundaries and can be ignored.

side validation of appropriate terms by a court.

The experimental results furthermore show that the role of courts goes beyond simple enforcement of contracts. Expectations on contract enforcement affect how contractors regard their own and their opponent's obligations from (incomplete) contracts. This affects the contract design and the outcome of the contractual relationship. These results can inform the discussion about optimal enforcement procedures that limit aggrievement among contractors and reduce detrimental punishment behaviour. It is desirable to analyse in further research the effect of different, more realistic enforcement procedures on contractors' feelings of entitlement and also to examine the effect of certain versus uncertain contract enforcement rules.

Appendix

This appendix provides additional information, which is not necessary for the analysis of the research question but which nevertheless offers some additional checks and interesting insights. In part 3.A, the regression models used by FHZ are replicated to ensure comparability to my experimental results. Also, I show that the qualitative results do not depend on the utilised regression models and specifications. In part 3.B, I use additional information about the subjects and examine how subjects' behaviour in the experiment is affected. Part 3.C investigates session effects in the experiment. The instructions which were provided to buyers and sellers in the court treatment of the experiment can be found in Part 3.D.

3.A   Replication of FHZ's regression

When analysing the price dependency of sellers' punishment behaviour, I estimate slightly different models than FHZ in order to focus on the difference in my treatments. In this section, I provide estimations of the same models as utilised by FHZ to facilitate comparison and to check whether the results depend on the estimated models. Table 3.9 replicates FHZ's regression (Table 3, FHZ 2011) and uses standard errors adjusted for clustering at the session level.[28]

---

[28]Clustering at the session level is problematic in this case because adjusting standard errors for clustering is only valid when the number of clusters is large (Cameron and Miller, 2015). Since there are only 4 sessions per treatment, I do not use clustering at the session level in the

The results from the OLS and Probit regression are presented in Table 3.9. *Quality* is an indicator variable equal to one if the seller chooses normal quality and is thus reversely defined as the variable *Punish* in the main part of the paper. *Price increment* is defined as the difference between the trade price and the competitive auction price of 35 Points in the good state and as the difference between the trade price and the minimum possible price of 95 Points in the bad state. Also included is a dummy for flexible contracts (*Flex*) and an interaction term for price increment and flexible contract (*Flex x Price increment*). Trading at a higher price than the competitive price does not significantly effect the quality choice with both rigid or flexible contracts. However, normal quality appears significantly less likely (i.e. punishment is more likely) with flexible than with rigid contracts. When focusing only on the bad state and thus only on flexible contracts, no significant effects of price increments on quality can be identified. Thus, the quality choice in the good state can only be explained by the contract choice. FHZ get similar results, although they find an even stronger effect of the contract type on the quality choice. Also, FHZ find a slight effect of price increments with flexible contracts. The Probit estimation results in columns (2) and (4) give similar qualitative results. Overall, these results are in line with the results from the analysis in Table 3.4 in the main part of this paper.

In Table 3.10, FHZ's analysis is applied to the court treatment. *Quality* is the dependent variable. *Price minus 50* is similarly defined to *Price increment* in the baseline treatment, however accounting for the fact that the auction starts at 50 Points in the court treatment. Note that this variable follows the same definition in both states because in the court treatment the restrictions on buyer's price offers are not state dependent. Also included are the flexible contract dummy (*Flex*) dummy and an interaction term of flexible contract and price

---

regressions in the main part of this paper. However for completeness, I provide the regression results with clustering in appendix 3.C.

Dependent variable	Normal qual good state		Normal qual bad state	
	(1)	(2)	(3)	(4)
	OLS	Probit (ME)	OLS	Probit (ME)
Price increment	0.00492	0.008	0.00780	0.0189
	(0.00569)	(0.011)	(0.00521)	(0.0255)
Flex	-0.134*	-0.139***		
	(0.0422)	(0.051)		
Flex x PriceIncrement	-0.00237	-0.0058		
	(0.00600)	(0.0119)		
Constant	0.880***		0.760***	
	(0.0678)		(0.0531)	
Observations	380	380	67	67
Adjusted R-squared	0.0196		-0.00117	

Notes: Standard errors in parentheses; $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors are adjusted for clustering at the session level. Only data from the 4 baseline treatment sessions are considered. *Price increment* is defined as the difference between the trade price and 35 in the good state (columns (1)-(2)) and as the difference between trade price and 95 in the bad state (columns (3)-(4)). *Flex* is an indicator variable and unity for a flexible contract. Also included is the interaction between those two variables, *Flex x PriceIncrement*. Columns (1) and (3) report coefficients of OLS estimations. Columns (2) and (4) report marginal effects based on Probit estimations.

Table 3.9: Replicating FHZ's regression – price dependence of quality across contract types clustered by session – baseline treatment

increment (*Flex x Price minus 50*). Clustering at the session level is utilised. In the good state, neither *Price minus 50* nor its interaction with flexible contracts is significant. Also, agreeing on a flexible contract has no significant effect on the provision of normal quality. For the bad state, no clear significant results can be identified with both OLS and Probit estimations. These results are in line with the results from the analysis in Table 3.4 in the main part of the paper.

Dependent variable	Normal qual good state		Normal qual bad state	
	(1)	(2)	(3)	(4)
	OLS	Probit (ME)	OLS	Probit (ME)
Price minus 50	-0.0000181	-0.000013	0.00394*	0.0081
	(0.00401)	(0.0029)	(0.00131)	(0.0057)
Flex	0.0615	0.0659	-0.137	-0.136**
	(0.0351)	(0.04066)	(0.0829)	(0.068)
Flex x Price minus 50	0.000335	0.0004	0.000507	0.00122
	(0.00553)	(0.004997)	(0.00192)	(0.006)
Constant	0.848***		0.907***	
	(0.0415)		(0.0369)	
Observations	370	370	80	80
Adjusted R-squared	-0.000715		0.0217	

Notes: Standard errors in parentheses; $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors are adjusted for clustering at the session level. Only data from the 4 court treatment sessions are considered. *Price minus 50* is defined as the difference between the trade price and 50. *Flex* is an indicator variable and unity for a flexible contract. Also included is the interaction between those two variables, *Flex x Price minus 50*. Columns (1)-(2) consider the good state and columns (3)-(4) the bad state. Columns (1) and (3) report coefficients of OLS estimations. Columns (2) and (4) report marginal effects based on Probit estimations. All estimations are only for the court treatment.

Table 3.10: Replicating FHZ's regression – price dependence of quality across contract types clustered by session – court treatment

3.B Subject heterogeneity

At the end of the experiment, the subjects filled out a short questionnaire asking, inter alia, for gender and degree. This section provides some information about subject's heterogeneity and whether or not this influenced subjects' decisions.

Baseline treatment. More females than males participated in the experiment. In the baseline treatment, 58 percent of subjects were female, see Table 3.11. In the baseline treatment, female buyers are more likely to offer flexible contracts than male buyers. However, buyers do not significantly differ by gender in their markup offers under flexible contracts. With regard to sellers' choices, there are also no significant gender effects. Women do not appear to self-select more into either contract type. Also, women's punishment behaviour is not significantly different to men's. However, subjects who study economics as part of their degree are less likely to punish than non-economics students. The p-values of the signed rank-sum tests are presented in Table 3.12.

Court treatment. In the court treatment, 73 percent of subjects are female, see Table 3.11. Buyers' gender does not appear to affect the contract choice. However, female buyers appear to be less likely to offer a markup but are more likely to undercut. Thus, women behave more rational (or ruthless) then men in the court treatment. Female sellers are also more likely to punish than males. However, no gender difference in rejecting the buyer's price offer can be identified. Furthermore, the degree has not significant effect on the sellers' punishment choice. The p-values of the signed rank-sum tests are presented in Table 3.12.

	Baseline treatment	**Court treatment**
Buyer	63% Female	63% Female
Seller	53% Female	83% Female
Total	58% Female	73% Female

Table 3.11: Share of female subjects by role and treatment

	P-value of rank-sum tests
Baseline treatment	
Difference in buyers' contract choice by gender	0.0055***
Difference in buyers' markup offers by gender	0.7019
Difference in sellers' contract selection by gender	0.5074
Difference in sellers' punishment choice by gender	0.887
Difference in sellers' punishment choice by econ degree	0.0003***
Court treatment	
Difference in buyers' contract choice by gender	0.2996
Difference in buyers' markup offers by gender	0.0046***
Difference in buyer's undercutting choice by gender	0.0098***
Difference in sellers' punishment choice by gender	0.043**
Difference in sellers' litigation decision by gender	0.3186
Difference in sellers' punishment choice by econ degree	0.2987

Notes: This table reports p-values for various Wilcoxon (Mann-Whitney) rank-sum tests.

Table 3.12: P-values for rank-sum tests regarding subject heterogeneity

3.C Session effects

Observations of subjects who participated in the same session may be correlated, which would affect hypothesis testing. This can be caused by the dynamic interaction of the subjects, as the subjects observe the other subjects' behaviour and responses. Furthermore, there may be unobserved static differences across sessions (Fréchette, 2012). In order to check whether my results depend on session effects, the main regressions from the paper in Table 3.4 are replicated by adjusting standard errors for clustering at the session level, see Table 3.13, and by including session fixed effects, see Table 3.14. The former approach has limitations in the case of a small number of clusters, as it is the case here, but is a robust approach to testing. The latter addresses potential static session-effects.

My main results regarding sellers' punishment behaviour in the good state, see Table 3.4, also holds when using clustering at the session level, see Table 3.13. The *Flex* and *Flex x Treat* variables are similarly found to significantly affect punishment. Offering a markup with flexible contract (*Markup x Flex*) in the baseline treatment is found to not significantly affect punishment with this approach. *Undercut* is similarly significant. In addition, the variable *Reject undercut* is significant with both OLS and Probit estimations using this approach. This means that sellers are less likely to punish after they have experienced undercutting by the buyer and litigated. Thus, there is some evidence that sellers are less likely to punish by choosing low quality after they already punished the buyer by litigation. This only supports the interpretation that the price enforced by the court is a reference point for feelings of entitlement. If sellers receive this price (either with or without court's help), they are not aggrieved and do not punish by choosing low quality. For the bad state, the variable *Rigid x Treat* appears significant in the Probit estimation when using clustering at the session level. This indicates that punishment is less likely under rigid

than flexible contracts in the bad state, meaning that sellers may feel entitled to higher prices under flexible contracts. Hence, there is some tendency for different reference points depending on the contract type in the bad state. However, the evidence is not very strong as *Rigid x Treat* is neither significant in the OLS estimation nor in the estimations presented in Table 3.4 and 3.14.

Looking at the results from replicating the main regression from Table 3.4 with session fixed effects, the main variables *Flex* and *Flex x Treat* are significant, see column (1) in Table 3.14. However when allowing for more variables, see column (2), *Flex x Treat* is only significant at a 14 percent significance level. This might be driven by the limited number of observations compared to the amount of explanatory variables when accounting for session fixed effects. Since all other tests and regressions found significant effects, this does not cause fundamental concerns. *Markup x Flex* appears to significantly decrease punishment whereas *Undercut* significantly increases punishment. No significant results can be identified for the bad state, see column (3) in Table 3.14.

Dependent variable	Punishment good state				Punishment bad state	
	(1) OLS	(2) Probit (ME)	(3) OLS	(4) Probit (ME)	(5) OLS	(6) Probit (ME)
Treat	0.0629 (0.0637)	0.0767 (0.0823)	0.0209 (0.0650)	0.0198 (0.0927)	-0.0515 (0.0929)	-0.0441 (0.0804)
Flex	0.139*** (0.0153)	0.1446*** (0.0308)	0.164*** (0.0248)	0.1601*** (0.0249)		
Flex x Treat	-0.202*** (0.0279)	-0.2219*** (0.0395)	-0.135*** (0.0219)	-0.1271*** (0.0301)		
Auction price			-0.00307 (0.00274)	-0.0032 (0.0029)		
Markup x Flex			-0.0715 (0.0608)	-0.0634 (0.0523)		
Markup x Treat			0.0145 (0.0543)	-0.0132 (0.0681)		
Undercut			0.323*** (0.0838)	0.2676*** (0.0736)		
Reject offer			-0.00715 (0.0111)	-0.0041 (0.0211)		
Reject Undercut			-0.182** (0.0618)	-0.1228* (0.0565)		
Rigid x Treat					-0.0940 (0.0671)	-0.112* (0.0628)
Constant	0.0889 (0.0507)		0.216 (0.128)		0.224*** (0.0377)	
Observations	750	750	750	750	147	147
Adjusted R-squared	0.0191		0.0524		0.0172	

Notes: Standard errors in parentheses; $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. Standard errors adjusted for clustering at the session level. *Auction price* is either the lower bound of the price range or the fixed price. All other variables are indicator variables. *Treat* is unity for the court treatment. *Flex* is unity for a flexible contract. Only relevant for the court treatment are: *Undercut*, unity for a price offer below auction price; *Reject offer*, unity if a seller litigates; *Reject undercut*, unity if a seller litigates after observing price undercutting; *Rigid*, unity for a rigid contract. Also included are interactions denoted by *variable x variable*. Columns (1)–(4) are for the good and (5)–(6) for the bad state. Columns (1), (3) and (5) report coefficients of OLS estimations. Columns (2), (4) and (6) report marginal effects based on Probit estimations.

Table 3.13: Sellers' punishment choice by state clustered by session

163

Dependent variable	Punishment good state		Punishment bad state
	(1)	(2)	(3)
	OLS	OLS	OLS
Flex	0.0821*	0.123***	
	(0.0454)	(0.0470)	
Flex x Treat	-0.164***	-0.0952	
	(0.0618)	(0.0652)	
Auction price		-0.00282	
		(0.00246)	
Markup x Flex		-0.117***	
		(0.0425)	
Markup x Treat		0.0502	
		(0.0645)	
Undercut		0.324***	
		(0.0629)	
Reject offer		-0.0252	
		(0.0794)	
Reject Undercut		-0.162	
		(0.109)	
Rigid x Treat			-0.0813
			(0.0865)
Session 2	0.243***	0.277***	0.217
	(0.0534)	(0.0541)	(0.135)
Session 3	0.233***	0.257***	0.190
	(0.0530)	(0.0534)	(0.139)
Session 4	0.198***	0.190***	0.150
	(0.0542)	(0.0534)	(0.128)
Session 5	0.157***	0.151**	-0.0104
	(0.0606)	(0.0656)	(0.166)
Session 6	0.104*	0.0645	0.0151
	(0.0596)	(0.0692)	(0.137)
Session 7	0.242***	0.195***	0.104
	(0.0602)	(0.0658)	(0.137)
Session 8	0.261***	0.209***	0.202
	(0.0599)	(0.0665)	(0.140)
Constant	-0.0362	0.0679	0.0769
	(0.0450)	(0.110)	(0.102)
Observations	750	750	147
Adjusted R-squared	0.0601	0.0979	0.0230

Notes: Standard errors in parentheses; $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. *Session 2 - Session 8* are the session fixed effects (Session 1-4 baseline and Session 5-8 court treatment). *Auction price* is the lower bound of the price range or the fixed price. All other variables are indicator variables. *Flex* is unity for a flexible contract. *Markup* is unity if the buyer offers a price above the auction price. Only relevant for the court treatment are: *Undercut*, unity for a price offer below the auction price; *Reject offer*, unity if a seller litigates; *Reject undercut*, unity if a seller litigates after observing price undercutting; *Rigid*, unity for a rigid contract. Also included are interactions denoted by *variable x variable*. All columns report coefficients for OLS estimations. Columns (1)-(2) are for the good and column (3) for the bad state.

Table 3.14: Sellers' punishment choice by state with session fixed effects

3.D Experimental instructions – court treatment

INSTRUCTIONS FOR SELLERS

For participating in this experiment, you will receive a show-up fee of £3. You can earn more by accumulating points during the experiment. The experiment has 15 rounds. How many points you earn in one round depends on your decisions and those of other participants. At the end of the experiment, all points will be added and converted to pounds at the following conversion rate:

25 Points = £0.50.

At the end of the experiment, you will receive your earnings in pounds plus the show-up fee. Please note that communication is strictly prohibited during the experiment. You are only allowed to use the computer for completing the experiment. Any form of communication and misuse of the computer will lead to exclusion from the experiment and from any payment. However, you are at all times allowed to ask questions by raising your hand.

Short summary of the procedure

The 16 participants in this room have been randomly divided into two groups: sellers and buyers. There are 8 sellers and 8 buyers. **You are a seller for the entire duration of the experiment.**

The experiment is divided into 15 rounds. In every round, you will interact in a new group of four with 2 sellers and 2 buyers and you can earn points. How many points you earn depends on the decisions that you and the other participants in your group make. All the decisions are made on the computer. Once one round is finished, all participants are randomly assigned to new groups of four. The following describes what happens in every round.

In your group of four, each buyer wants to purchase one product from the sellers. The two sellers can sell up to two products each. Thus, the sellers are competing for selling their products. The buyer pays a price in exchange for receiving a product. The product has value to the buyer. The seller incurs costs for producing products. In order to trade a product, a buyer and a seller agree on a contract. We refer to this as 'concluding a contract'. The contract specifies the pricing terms of the purchase.

The following describes the different steps in one round of the experiment. Note that you always interact in your group of four and all your decisions in the current round only have consequences for the current round.

1. The **buyer selects the type of contract** that (s)he wants to conclude with one of the sellers in your group of four. The buyer can choose between a contract that fixes a single price or a contract that specifies a price range.

2. After the buyers have selected the type of contract, the **two sellers compete for the first contract in an auction**. The first buyer concludes the contract with the seller that offers him/her the best pricing terms. The other seller cannot sell his/her product to this buyer. In a similar way, the **sellers compete in another auction** for the contract with the second buyer in your group. If a seller does not conclude either of the two contracts, the round ends for the seller at this stage.

3. The **computer randomly determines whether the cost of production for the seller is high or low**. Producing a product of normal quality costs 20 points if costs are low and 80 points if costs are high.

4. After the buyer has been informed about the cost level of his/her seller, the **buyer proposes the final price** of the trade. The buyer may choose any price between 25 and 140 points, independent of the contract.

5. The **seller decides to accept or reject the buyer's final price offer**. If the seller accepts the price offer, the seller and buyer trade at that price.

6. If the seller rejects the buyer's price offer, the **computer settles the contract** and decides at which price seller and buyer trade. Contract settlement is costly to both seller and buyer. The outcome of the settlement depends on the type of contract that has been concluded.

   ◇ If a contract with a fixed price has been concluded, the computer enforces trade at the price specified in the contract.

   ◇ If a contract with a price range has been concluded, the contract settlement depends on the price offer: If the buyer's price offer lies within the price range of the contract, the contract is not breached and the computer enforces trade at the offered price. If the buyer's price offer lies outside of the price range, the contract is breached. In order to ensure trade at the terms specified in the contract, the computer enforces trade at a price randomly picked from the price range of the contract.

7. After the final price has been determined, either with or without contract settlement by the computer, the **seller decides on the quality of the product** that the buyer purchases. The seller has two quality levels to choose from: normal and low quality. Normal quality gives the buyer a value of 140 points and low quality a value of 100 points. For the seller, delivering a product of low quality is 5 points MORE costly than a product of normal quality.

8. The round ends and **all participants are informed about their earnings** in this round. The buyer's earnings are the difference between the value of the product to the buyer and the price (s)he must pay to the seller. The seller's earnings from a sale are the difference between the price (s)he receives from the buyer and her cost of production. If the seller cannot sell a product, (s)he receives a fixed income of 10 points. Buyer's and seller's earnings may be reduced by 5 points due to contract settlement.

Following this, the next round begins in which you and the other participants go through the same procedure. Note that you will interact in a new group of four every round. All participants are anonymous and you will not know with whom you are interacting at any point during the experiment.

Please read now the detailed explanation of the procedure in your instructions pages 4-10! You have approximately 20 minutes for reading. Once you have finished reading, you can start with the test questions on your computer screen. Try to solve all questions. If you enter a wrong answer and click "OK", a message appears with help to solve the question. You are allowed to use the calculator on your desk.

Detailed explanation of the experimental procedure

The following shows step by step which types of decisions you and the other participants will make in each round. The experiment has 15 rounds. At the beginning of each round, you will be randomly assigned to a new group of four participants, in which 2 are buyers and 2 are sellers. Note that you will only interact with the participants in the group of four that you have been assigned to in a round. But, **every round your group will consist of different participants**. The whole experiment is anonymous and you will not know with whom you are interacting at any point during the experiment. Your decisions in a round will only have consequences for that round. Remember, you are a **seller** for the entire duration of the experiment.

1 Selection of the type of contract by the buyer

After the random assignment to groups of four, both buyers in your group first select the type of contract that they want to conclude. They have two options to choose from:

1) Contract with a fixed price: If a buyer chooses a contract with a fixed price, (s)he agrees with a seller on a single price for the purchase of the product. You and the other seller in your group compete for selling your products to a buyer. A buyer will trade with the seller that offers the lowest price. If, at a later stage, you decide to let the computer settle the contract, the computer will enforce trade at the price specified in the contract.

2) Contract with a price range: If a buyer chooses a contract with a price range, a price floor (minimum possible price) and a price ceiling (maximum possible price) are specified in the contract. You and the other seller in your group compete for selling your products to the buyer. The buyer will trade with the seller that offers the lowest price floor. The price ceiling is always set at 140 points. If you decide at a later stage to let the computer settle the contract, the computer will enforce trade at a price that lies within the price range of the contract.

2 Determination of the contract price by the sellers

You and the other seller each want to sell two identical products to the buyers in your group of four. Each buyer can only buy one product. Thus, you and the other seller compete for selling your products. In order to decide who is selling a product to a buyer, you engage in an auction with the other seller. There are two auctions, one for each buyer. The computer randomly determines for which buyer in your group you compete first. The seller that offers the lowest fixed price (if the buyer has selected a contract with a fixed price) or the lowest price floor (if the buyer has selected a contract with a price range) wins the auction. The winner of the auction concludes a contract with the buyer. A contract specifies the pricing terms of the trade. After the first auction, you proceed with the second auction. After both auctions have finished, you have either concluded two, one or no contracts.

2.1 Auction when the buyer has chosen a contract with a fixed price

If a buyer has chosen a contract with a fixed price, the auction proceeds in the following way. First, you are informed about the contract type. Then, a notification, that indicates how many seconds remain until the beginning of the auction, appears.

Time until the beginning of the auction: **3**

As soon as the time expires, you are notified that the auction begins.

The auction starts now!

The auction always **starts with a fixed price of 50 points** and this price is displayed on the screen. From the beginning of the auction, the price increases by one point every half second. If you or the other seller wants to trade at a shown fixed price, you can decide to conclude a contract at this price by clicking the "Agree" button.

Fixed Price: XX

Agree

The first seller to click "Agree" wins the contract and the auction ends. Both sellers are notified about which seller won the auction. The seller who lost the auction cannot sell this product in this round and receives a fixed earning of 10 points.

If neither you or the other seller clicks the "Agree" button, the price increases to a maximum of 75 points. Once a price of 75 points is reached, the price remains at this level until one seller agrees. Hence, **the price can never exceed 75 points in a contract with a fixed price**.

2.2 Auction when the buyer has chosen a contract with a price range

If the buyer has chosen a contract with a price range, the auction proceeds in a similar way.

Sale of Product 1

The buyer has selected a contract with a: **Price Range**

The difference from the auction of a fixed price contract, as explained above, is that you agree to a price range and not a single price. The price range consists of a price floor (minimum possible price) and a price ceiling (maximum possible price). **The price floor is determined in the auction, but the price ceiling is always set at 140 points** and thus is not affected by the auction. The auction always begins with the lowest possible price floor of 50 points which is displayed on the screen. The price floor increases by one point every half second. The price ceiling is always set at 140 points. If you or the other seller wants to conclude a contract with the displayed price range, you can do so by clicking the "Agree" button.

Price range: XX to 140

Agree

The first seller to click "Agree" wins the contract and the auction ends. Both sellers are notified about which seller won the auction. The seller who lost the auction cannot sell this product in this round and receives a fixed earning of 10 points. If neither of the sellers clicks the "Agree" button, the price floor increases to a maximum of 75 points. Once a price floor of 75 points is reached, it remains at this level until one seller agrees.

3 Determination of the cost level by the computer

When you sell a product, you must bear the cost of production. After the contracts have been concluded, the computer randomly determines whether the cost of production is high or low. The cost level is determined for each product (i.e. each contract) separately. There is an 80% probability (8/10 chance) that costs are low and thus that the production of the product of normal quality costs only 20 points. There is a 20% probability (2/10 chance) that costs are high and that the production of the product of normal quality costs 80 points. This means that low costs of production are 4 times more likely than high costs.

Your cost of producing a product of normal quality	Probability
80 (high)	20 %
20 (low)	80 %

You and the buyer are informed whether the cost of production is low or high. Also, you are reminded of the type and the pricing terms of your contract with the buyer.

For example, you might get the following information screen. Note that the buyer gets similar information.

> *Sale of Product 1*
> You have concluded a contract with a: **Fixed Price**
> Fixed Price: **XX**
> Your cost of production for this product: **Low**

Or another possible information screen at this stage is:

> *Sale of Product 2*
> You have concluded a contract with a: **Price Range**
> Price Floor: **XX**
> Price Ceiling: **140**
> Your cost of production for this product: **Low**

4 Final price offer by the buyer

After the computer has randomly determined the seller's cost of productions, each buyer is informed about the fixed price or the price range that resulted from the auction of his/her contract. Furthermore, **each buyer learns whether his/her seller has low or high cost of production**.

Then, your buyer must declare the final price that (s)he wants to offer to you. Independent of the pricing terms and the type of contract that you have concluded with the buyer, **(s)he may choose any price between 25 and 140 points.**

5 Your choice to accept or reject the price offer

After observing the buyer's proposed final price, you have two options to choose from:

1) Accept the buyer's final price offer: You can accept to trade at the final price that the buyer has suggested. In this case, you trade with the buyer at the proposed final price and the experiment proceeds with the next stage (your product quality choice).

2) Reject the buyer's final price offer: You can alternatively reject the buyer's price offer. In this case, the computer settles the contract, i.e. the computer makes a decision about the price

at which you trade with the buyer. Contract settlement costs both you and the buyer 5 points each, which will be deducted from your earnings for this round. The outcome of the contract settlement by the computer depends on the type of contract that you have concluded with the buyer:

◇ **Contract with a fixed price**: The computer enforces that you and the buyer trade at the price specified in the contract, irrespective of the final price offer.

◇ **Contract with a price range**: If the buyer has proposed a final price that lies *within the contract price range*, (s)he complied with the contract. In this case, the computer enforces trade at the final price that the buyer has suggested.

On the other hand, if the buyer has offered a price *outside of the contract price range* (i.e. the buyer has offered a price below the price floor of the contract), the buyer breached the contract. The contract settlement always ensures that trade takes place as it was agreed upon in the contract. Therefore, in this case, the computer randomly picks a price from within the price range and enforces trade at that price. Note that all prices within the price range are equally likely to be selected by the computer. Also, prices are rounded to whole numbers (e.g. 51, 52, 53,...).

6 Selection of the product quality by you (the seller)

After the final price has been determined, either because you have accepted the buyer's final price offer or because the computer has enforced a final price, you decide on the quality of your product. You can choose between two possible quality levels for each sold product: normal quality and low quality.

The choice of the quality level determines the value of the product to the buyer. Products of normal quality have a higher value (140 points) than products of low quality (100 points). Details are presented in the following table:

Product quality	Value to the buyer
normal	140
low	100

The choice of the quality level influences your cost of production. If you choose low quality instead of normal quality, your cost increases slightly. If the cost level has been randomly determined to be low, a product of normal quality costs you 20 points whereas a product of low quality costs 25 points. Given a high cost level, a product of normal quality costs 80 points and of low quality 85 points. This is summarised in the following table:

Product quality	Your cost of production	
	low cost	high cost
normal	20	80
low	25	85

Thus, if you choose low quality instead of normal quality, your cost of production increases by 5 points, whereas the value of the product to the buyer decreases by 40 points.

7 Calculation of the earnings in each round

7.1 Your earnings in each round

You sell a product to a buyer, if you win the competition and conclude a contract with the buyer. In case of a sale, your earnings are the difference between the price you receive from the buyer and your cost of production. Thus, your earnings from the sale of a product are higher, the higher the price is and the lower the cost of production is. The price depends on the final price that the buyer offers or the contract settlement. The cost of production depends on the randomly determined cost level and your quality choice. If you let the computer settle the contract, your earnings decrease by 5 points.

If you do not win a contract in the auction, you cannot sell this product in this round and you receive a fixed payment of 10 points.

Your earnings from a product are **either** the earnings you get from the sale of the product, with or without contract settlement, or from not selling a product.

	Sale without contract settlement:	Your earnings = price − cost of production
or	Sale with contract settlement:	Your earnings = price − cost of production − 5
or	No sale:	Your earnings = 10

Since you can sell up to two products in each round, your earnings in each round always consist of the sum of the earnings from product 1 and product 2. Each of these earnings are calculated either as earnings from the sale of a product or from no sale.

Your earnings in one round = earnings from product 1 + earnings from product 2

7.2 The buyer's earnings in each round

The buyer will always buy a product from a seller. The buyer's earnings from the purchase are the difference between the value of the product to him/her and the price (s)he must pay to the seller. The buyer's earnings are higher, the lower the price (s)he must pay is, and the higher the value of the product is. The value of the product is affected by the product quality that is chosen by the seller. If the seller lets the computer settle the contract, the buyer's earnings decrease by 5 points.

	Without contract settlement:	Buyer's earnings = value of product − price
or	With contract settlement:	Buyer's earnings = value of product − price − 5

After the sellers and the buyers have been informed about their respective earnings in this round, the next round begins. At the beginning of the next round, you and the other participants will be randomly assigned to a **new** group of four consisting of 2 sellers and 2 buyers. Thus, every round you will interact with different participants. The procedure will be exactly the same.

Accumulated earnings

At the end of the experiment, you will get paid all earnings that you have accumulated over the 15 rounds. You and the other sellers start with a credit of 150 points, the buyers start with a

credit of 50 points. In each round, you can gain or lose points. In the very unlikely case where your total earnings up to a certain round become negative, we set your total earnings to zero. From the following round, you can accumulate points again.

In order to make sure that all participants are completely aware of the experimental procedure, we ask you to solve test questions, which will not affect your earnings. Once you have finished reading, you can start with the questions on your computer screen. Try to solve all questions. If you enter a wrong answer and click "OK", a message appears with help to solve the question. You are allowed to use the calculator on your desk.

Summary:

Product quality	Value to the buyer	Seller's cost of production	
		low cost	high cost
normal quality	140	20	80
low quality	100	25	85

INSTRUCTIONS FOR BUYERS

For participating in this experiment, you will receive a show-up fee of £3. You can earn more by accumulating points during the experiment. The experiment has 15 rounds. How many points you earn in one round depends on your decisions and those of other participants. At the end of the experiment, all points will be added and converted to pounds at the following conversion rate:

25 Points = £0.50.

At the end of the experiment, you will receive your earnings in pounds plus the show-up fee. Please note that communication is strictly prohibited during the experiment. You are only allowed to use the computer for completing the experiment. Any form of communication and misuse of the computer will lead to exclusion from the experiment and from any payment. However, you are at all times allowed to ask questions by raising your hand.

Short summary of the procedure

The 16 participants in this room have been randomly divided into two groups: sellers and buyers. There are 8 sellers and 8 buyers. **You are a buyer for the entire duration of the experiment.**

The experiment is divided into 15 rounds. In every round, you will interact in a new group of four with 2 sellers and 2 buyers and you can earn points. How many points you earn depends on the decisions that you and the other participants in your group make. All the decisions are made on the computer. Once one round is finished, all participants are randomly assigned to new groups of four. The following describes what happens in every round.

In your group of four, each buyer wants to purchase one product from the sellers. The two sellers can sell up to two products each. Thus, the sellers are competing for selling their products. The buyer pays a price in exchange for receiving a product. The product has value to the buyer. The seller incurs costs for producing products. In order to trade a product, a buyer and a seller agree on a contract. We refer to this as 'concluding a contract'. The contract specifies the pricing terms of the purchase.

The following describes the different steps in one round of the experiment. Note that you always interact in your group of four and all your decisions in the current round only have consequences for the current round.

1. **The buyer selects the type of contract** that (s)he wants to conclude with one of the sellers in your group of four. The buyer can choose between a contract that fixes a single price or a contract that specifies a price range.

2. After the buyers have selected the type of contract, the **two sellers compete for the first contract in an auction**. The first buyer concludes the contract with the seller that offers him/her the best pricing terms. The other seller cannot sell his/her product to this buyer. In a similar way, the **sellers compete in another auction** for the contract with the second buyer in your group. If a seller does not conclude either of the two contracts, the round ends for the seller at this stage.

3. The **computer randomly determines whether the cost of production for the seller is high or low**. Producing a product of normal quality costs 20 points if costs are low and 80 points if costs are high.

4. After the buyer has been informed about the cost level of his/her seller, the **buyer proposes the final price** of the trade. The buyer may choose any price between 25 and 140 points, independent of the contract.

5. The **seller decides to accept or reject the buyer's final price offer**. If the seller accepts the price offer, the seller and buyer trade at that price.

6. If the seller rejects the buyer's price offer, the **computer settles the contract** and decides at which price seller and buyer trade. Contract settlement is costly to both seller and buyer. The outcome of the settlement depends on the type of contract that has been concluded.

   ◇ If a contract with a fixed price has been concluded, the computer enforces trade at the price specified in the contract.

   ◇ If a contract with a price range has been concluded, the contract settlement depends on the price offer: If the buyer's price offer lies within the price range of the contract, the contract is not breached and the computer enforces trade at the offered price. If the buyer's price offer lies outside of the price range, the contract is breached. In order to ensure trade at the terms specified in the contract, the computer enforces trade at a price randomly picked from the price range of the contract.

7. After the final price has been determined, either with or without contract settlement by the computer, the **seller decides on the quality of the product** that the buyer purchases. The seller has two quality levels to choose from: normal and low quality. Normal quality gives the buyer a value of 140 points and low quality a value of 100 points. For the seller, delivering a product of low quality is 5 points MORE costly than a product of normal quality.

8. The round ends and **all participants are informed about their earnings** in this round. The buyer's earnings are the difference between the value of the product to the buyer and the price (s)he must pay to the seller. The seller's earnings from a sale are the difference between the price (s)he receives from the buyer and her cost of production. If the seller cannot sell a product, (s)he receives a fixed income of 10 points. Buyer's and seller's earnings may be reduced by 5 points due to contract settlement.

Following this, the next round begins in which you and the other participants go through the same procedure. Note that you will interact in a new group of four every round. All participants are anonymous and you will not know with whom you are interacting at any point during the experiment.

Please read now the detailed explanation of the procedure in your instructions pages 4-10! You have approximately 20 minutes for reading. Once you have finished reading, you can start with the test questions on your computer screen. Try to solve all questions. If you enter a wrong answer and click "OK", a message appears with help to solve the question. You are allowed to use the calculator on your desk.

Detailed explanation of the experimental procedure

The following shows step by step which types of decisions you and the other participants will make in each round. The experiment has 15 rounds. At the beginning of each round, you will be randomly assigned to a new group of four participants, in which 2 are buyers and 2 are sellers. Note that you will only interact with the participants in the group of four that you have been assigned to in a round. But, **every round your group will consist of different participants**. The whole experiment is anonymous and you will not know with whom you are interacting at any point during the experiment. Your decisions in a round will only have consequences for that round. Remember, you are a **buyer** for the entire duration of the experiment. Both sellers in your group will try to sell their products to you. You will not interact with the other buyer in your group.

1 Selection of the type of contract by you (the buyer)

After the random assignment to groups of four, you first select the type of contract that you want to conclude. You have two options:

1) Contract with a fixed price: If you choose a contract with a fixed price, you agree with a seller on a single price for the purchase of the product. The two sellers in your group compete for selling their products to you. You will trade with the seller that offers the lowest price. If, at a later stage, the seller decides to let the computer settle the contract, the computer will enforce trade at the price specified in the contract.

2) Contract with a price range: If you choose a contract with a price range, a price floor (minimum possible price) and a price ceiling (maximum possible price) are specified in the contract. The two sellers in your group compete for selling their products to you. You will trade with the seller that offers the lowest price floor. The price ceiling is always set at 140 points. If, at a later stage, the seller decides to let the computer settle the contract, the computer will enforce trade at a price that lies within the price range of the contract.

2 Determination of the contract price by the sellers

Each of the two sellers want to sell two identical products to you and the other buyer in your group of four. You and the other buyer can only buy one product each. Thus, the sellers compete for selling their products. In order to decide who is selling you a product, the sellers engage in an auction. The seller that offers the lowest fixed price (if you have selected a contract with a fixed price) or the lowest price floor (if you have selected a contract with a price range) wins the auction. The winner of the auction concludes a contract with you. A contract specifies the pricing terms of the trade. The sellers also proceed in a similar auction with the other buyer. The computer randomly determines whether the sellers compete first for you or the other buyer in your group.

2.1 Auction when the buyer has chosen a contract with a fixed price

If you have chosen a contract with a fixed price, the auction proceeds in the following way. First, the two sellers are informed about the contract type. Then, a notification, that indicates how many seconds remain until the beginning of the auction, appears.

175

As soon as the time expires, the sellers are notified that the auction begins.

The auction always **starts with a fixed price of 50 points** and this price is displayed on the screen. From the beginning of the auction, the price increases by one point every half second. If a seller wants to trade at a shown fixed price, (s)he can decide to conclude a contract at this price by clicking the "Agree" button.

As soon as the first seller clicks "Agree", (s)he wins the contract and the auction ends. Both sellers are notified about which seller won the auction. The seller who lost the auction cannot sell this product in this round and receives a fixed earning of 10 points.

If neither of the sellers clicks the "Agree" button, the price increases to a maximum of 75 points. Once a price of 75 points is reached, the price remains at this level until one seller agrees. Hence, **the price can never exceed 75 points in a contract with a fixed price**.

2.2 Auction when the buyer has chosen a contract with a price range

If the buyer has chosen a contract with a price range, the auction proceeds in a similar way.

The difference from the auction of a fixed price contract, as explained above, is that the seller agrees to a price range and not a single price. The price range consists of a price floor (minimum possible price) and a price ceiling (maximum possible price). **The price floor is determined in the auction, but the price ceiling is always set at 140 points** and thus is not affected by the auction. The auction always begins with the lowest possible price floor of 50 points which is displayed on the screen. The price floor increases by one point every half second. The price ceiling is always set at 140 points. If a seller wants to conclude a contract with the displayed price range, (s)he can do so by clicking the "Agree" button.

As soon as the first seller clicks "Agree", (s)he wins the contract and the auction ends. Both sellers are notified about which seller won the auction. The seller who lost the auction cannot sell this product in this round and receives a fixed earning of 10 points. If neither of the sellers clicks the "Agree" button, the price floor increases to a maximum of 75 points. Once a price floor of 75 points is reached, it remains at this level until one seller agrees.

3   Determination of the cost level by the computer

When a seller sells a product, (s)he must bear the cost of production. After the contracts have been concluded, the computer randomly determines whether the cost of production is high or low. The cost level is determined for each product (i.e. each contract) separately. There is an 80% probability (8/10 chance) that costs are low and thus that the production of the product of normal quality costs only 20 points. There is a 20% probability (2/10 chance) that costs are high and that the production of the product of normal quality costs 80 points. This means that low costs of production are 4 times more likely than high costs. As soon as the computer has randomly determined the cost level, you and the seller are informed whether the cost of production is low or high. Note that the seller knows that you are informed about his/her cost level.

Seller's cost of producing a product of normal quality	Probability
80 (high)	20 %
20 (low)	80 %

4   Final price offer by you (the buyer)

After the computer has randomly determined the seller's cost of production, you are informed about the fixed price or the price range that resulted from the competition between the sellers in the auction. Furthermore, you learn the cost level for the seller.

For example, you might get the following information:

> You have chosen a contract with a: **Fixed Price**
> The following fixed price was determined in the auction.
> Fixed Price: **XX**
> The cost of production for the seller is: **Low**

Or another possible information screen at this stage is:

> You have chosen a contract with a: **Price Range**
> The following price range was determined in the auction.
> Price Floor: **XX**
> Price Ceiling: **140**
> The cost of production for the seller is: **High**

After you have examined this information, you must declare the final price that you want to offer to the seller. Independent of the pricing terms and the type of contract that you have concluded with the seller, **you may choose any price between 25 and 140 points.**

5   The seller's choice to accept or reject your price offer

After observing your final price offer, the seller has two options to choose from:

1) Accept your final price offer: The seller can accept to trade at the final price that you have suggested. In this case, you trade with the seller at the proposed final price and the experiment proceeds with the next stage (seller's product quality choice).

2) Reject your final price offer: The seller can alternatively reject your final price offer. In this case, the computer settles the contract, i.e. the computer makes a decision about the price at

which you trade with the seller. Contract settlement costs both you and the seller 5 points each, which will be deducted from your earnings for this round. The outcome of the contract settlement by the computer depends on the type of contract that you have concluded with the seller:

◇ **Contract with a fixed price**: The computer enforces that you and the seller trade at the price specified in the contract, irrespective of your final price offer.

◇ **Contract with a price range**: If you have proposed a final price that lies *within the contract price range*, you complied with the contract. In this case, the computer enforces trade at the final price that you have suggested.

On the other hand, if you have offered a price *outside of the contract price range* (i.e. you have offered a price below the price floor of the contract), you breached the contract. The contract settlement always ensures that trade takes place as it was agreed upon in the contract. Therefore, in this case, the computer randomly picks a price from within the price range and enforces trade at that price. Note that all prices within the price range are equally likely to be selected by the computer. Also, prices are rounded to whole numbers (e.g. 51, 52, 53,...).

6 Selection of the product quality by the seller

After the final price has been determined, either because the seller has accepted your final price offer or because the computer has enforced a final price, the seller decides on the quality of his/her product. (S)he can choose between two possible quality levels for each sold product: normal quality and low quality.

The choice of the quality level determines the value of the product to you. Products of normal quality have a higher value (140 points) than products of low quality (100 points). Details are presented in the following table:

Product quality	Value to you (the buyer)
normal	140
low	100

The choice of the quality level influences the cost of production for the seller. If a seller chooses low quality instead of normal quality, his/her cost increases slightly. If the cost level has been randomly determined to be low, a product of normal quality costs the seller 20 points whereas a product of low quality costs 25 points. Given a high cost level, a product of normal quality costs 80 points and of low quality 85 points. This is summarised in the following table:

Product quality	The seller's cost of production	
	low cost	high cost
normal	20	80
low	25	85

Thus, if the seller chooses low quality instead of normal quality, his/her cost of production increases by 5 points, whereas the value of the product to the buyer decreases by 40 points.

7 Calculation of the earnings in each round

7.1 Your earnings in each round

You will always buy a product from the seller. Your earnings from the purchase are the difference between the value of the product to you and the price you must pay to the seller. Your earnings are higher, the lower the price you must pay is, and the higher the value of the product is. The value of the product is affected by the product quality that is chosen by the seller. The price depends on your final price offer and whether or not the contract has been settled by the computer. If the contract has been settled, your earnings decrease by 5 points.

Without contract settlement:	Your earnings = value of product − price
or With contract settlement:	Your earnings = value of product − price − 5

7.2 The seller's earnings in each round

The seller only sells a product to a buyer, if (s)he wins the competition and concludes a contract with a buyer. In case of a sale, the seller's earnings are the difference between the price (s)he receives from the buyer and his/her cost of production. Thus, the seller's earnings from the sale of a product are higher, the higher the price is and the lower the cost of production is. The cost of production depends on the randomly determined cost level and the seller's quality choice. If the seller lets the computer settle the contract, his/her earnings decrease by 5 points. If a seller does not win a contract in the auction, the seller cannot sell this product in this round and (s)he receives a fixed payment of 10 points.

The seller's earnings from a product are **either** the earnings (s)he gets from the sale of the product, with or without contract settlement, or from not selling a product.

	Sale without contract settlement:	Seller's earnings = price − cost of production
or	Sale with contract settlement:	Seller's earnings = price − cost of production − 5
or	No sale:	Seller's earnings = 10

Since the seller can sell up to two products in each round, his/her earnings in each round always consist of the sum of the earnings from product 1 and product 2. Each of these earnings are calculated either as earnings from the sale of a product or from no sale.

Seller's earnings in one round = earnings from product 1 + earnings from product 2

8 Summary information

At the end of each round, you receive information on the average earnings that all buyers have received in all previous rounds of the experiment. This information will be provided for both contract types separately. You will also be informed how many buyers choose either a contract with a fixed price or a contract with a price range in the current round. The summary information looks like this:

	Fixed Price	Price Range
Average earnings of buyers in all previous rounds	XX	XX
Number of contracts in the current round	XX	XX

After you have had a chance to examine this summary information, the next round begins. At the beginning of the next round, you and the other participants will be randomly assigned to a **new** group of four consisting of 2 sellers and 2 buyers. Thus, every round you will interact with different participants. The procedure will be exactly the same.

Accumulated earnings

At the end of the experiment, you will get paid all earnings that you have accumulated over the 15 rounds. You and the other buyer start with a credit of 50 points, the sellers start with a credit of 150 points. In each round, you can gain or lose points. In the very unlikely case, where your total earnings up to a certain round become negative, we set your total earnings to zero. From the following round, you can accumulate points again.

In order to make sure that all participants are completely aware of the experimental procedure, we ask you to solve test questions. Once you are done reading, you can start with the questions on your computer screen. Try to solve all questions. If you enter a wrong answer and click "OK", a message appears with help to solve the question. You are allowed to use the calculator on your desk.

Summary:

Product quality	Value to the buyer	Seller's cost of production	
		low cost	high cost
normal quality	140	20	80
low quality	100	25	85

Bibliography

Bartling, B. and Schmidt, K. M. (2015). Reference points, social norms, and fairness in contract renegotiations. *Journal of the European Economic Association*, 13(1):98–129.

Ben-Shahar, O. (2004). Agreeing to disagree: Filling gaps in deliberately incomplete contracts. *Wisconsin Law Review*, page 389.

Birkeland, S. (2011). Negotiation under possible third party settlement. *NHH Dept. of Economics Discussion Paper*, (6).

Brandts, J., Ellman, M., and Charness, G. (2015). Let's talk: How communication affects contract design. *Journal of the European Economic Association*.

Camerer, C. and Thaler, R. H. (1995). Anomalies: Ultimatums, dictators and manners. *The Journal of Economic Perspectives*, 9(2):209–219.

Cameron, A. C. and Miller, D. L. (2015). A practitioner's guide to cluster-robust inference. *Journal of Human Resources*, 50(2):317–372.

Ellman, I. M. and Braver, S. L. (2012). Lay intuitions about family obligations: The case of alimony. *Theoretical Inquiries in Law*, 13(1):209–240.

Erlei, M. and Reinhold, C. (2016). Contracts as reference points – the role of reciprocity effects and signaling effects. *Journal of Economic Behavior & Organization*, 127:133 – 145.

Falk, A. and Fischbacher, U. (2006). A theory of reciprocity. *Games and economic behavior*, 54(2):293–315.

Fehr, E., Hart, O., and Zehnder, C. (2009). Contracts, reference points, and competition – behavioral effects of the fundamental transformation. *Journal of the European Economic Association*, 7(2-3):561–572.

Fehr, E., Hart, O., and Zehnder, C. (2011). Contracts as reference points – experimental evidence. *The American Economic Review*, 101(2):493–525.

Fehr, E., Hart, O., and Zehnder, C. (2015). How do informal agreements and revision shape contractual reference points? *Journal of the European Economic Association*, 13(1):1–28.

Fehr, E. and Schmidt, K. M. (1999). A theory of fairness, competition, and cooperation. *Quarterly journal of Economics*, pages 817–868.

Finkel, N. J. (1995). *Commonsense Justice: Jurors' Notions of the Law*. Harvard University Press.

Fischbacher, U. (2007). z-tree: Zurich toolbox for ready-made economic experiments. *Experimental Economics*, 10(2):171–178.

Fréchette, G. R. (2012). Session-effects in the laboratory. *Experimental Economics*, 15(3):485–498.

Friedman, O. (2008). First possession: An assumption guiding inferences about who owns what. *Psychonomic Bulletin & Review*, 15(2):290–295.

Gary Charness, M. R. (2002). Understanding social preferences with simple tests. *The Quarterly Journal of Economics*, 117(3):817–869.

Halonen-Akatwijuka, M. and Hart, O. (2013). More is less: Why parties may deliberately write incomplete contracts. Technical report, National Bureau of Economic Research.

Hart, O. and Moore, J. (2008). Contracts as reference points. *The Quarterly Journal of Economics*, 123(1):1–48.

Hermalin, B. E., Katz, A. W., and Craswell, R. (2007). Chapter 1 contract law. In Polinsky, A. M. and Shavell, S., editors, *Handbook of Law and Economics*. Elsevier.

Hermalin, B. E. and Katz, M. L. (1993). Judicial modification of contracts between sophisticated parties: A more complete view of incomplete contracts and their breach. *Journal of Law, Economics, and Organization*, 9(2):230–255.

Herweg, F. and Schmidt, K. M. (2014). Loss aversion and inefficient renegotiation. *The Review of Economic Studies*.

Hoppe, E. I. and Schmitz, P. W. (2011). Can contracts solve the hold-up problem? experimental evidence. *Games and Economic Behavior*, 73(1):186 – 199.

Iyer, R. and Schoar, A. (2015). Ex post (in) efficient negotiation and breakdown of trade. *The American Economic Review*, 105(5):291–294.

Katz, A. W. (2004). The economics of form and substance in contract interpretation. *Columbia Law Review*, 104(2):pp. 496–538.

Kelman, M. (2013). Intuitions. *Stanford Law Review*, 65:1291.

Kuhn, M. A. (2009). To settle or not to settle: a review of the literature on arbitration in the laboratory.

Lancaster, T. (2000). The incidental parameter problem since 1948. *Journal of econometrics*, 95(2):391–413.

Loewenstein, G., Issacharoff, S., Camerer, C., and Babcock, L. (1993). Self-serving assessments of fairness and pretrial bargaining. *The Journal of Legal Studies*, 22(1):135–159.

Mandel, G. N. (2014). The public perception of intellectual property. *Florida Law Review*, 66:261.

Miettinen, T., Ropponen, O., and Sääskilahti, P. (2012). Gambling for the upper hand – settlement negotiations in the lab. *Jena Economic Research Papers*, 2011:022.

Posner, E. A. (2003). Economic analysis of contract law after three decades: Success or failure? *The Yale Law Journal*, 112(4):829–880.

Posner, R. A. (2005). The law and economics of contract interpretation. *Texas Law Review*, 83:1581.

Robinson, P. H. and Darley, J. M. (2007). Intuitions of justice: Implications for criminal law and justice policy. *Southern California Law Review*, 81:1.

Schwartz, A. and Scott, R. E. (2003). Contract theory and the limits of contract law. *The Yale Law Journal*, 113(3):541–619.

Wilkinson-Ryan, T. (2015). Intuitive formalism in contract. *University of Pennsylvania Law Review*, 163:2109.

Wilkinson-Ryan, T. and Hoffman, D. A. (2015). The common sense of contract formation. *Standford Law Review*, 67(6):1269–1301.