Fairness in Supply Chains

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Abstract:

This paper describes and analyses the results of two laboratory experiments that emphasise fairness in supply chains. Previous research has shown that fairness is required for long-term relationships involving trust, and these relationships form the core of successful supply chain coordination. As process integration develops and companies and business functions grow more dependent on one another, no company or function should feel mistreated at any level of the supply chain. Therefore, fair agreements and fair behaviour must be considered at both the strategic and operational levels. We use laboratory experiments to gain insights into inter-company as well as inter-functional negotiations, and distributive and procedural fairness are considered in analysing the results of the experiments.

JEL Classification: M29

Keywords: Fairness, Supply Chain Coordination, Laboratory Experiments

1 Introduction

Managing a supply chain depends on coordination among the companies and business functions involved (Mentzer et al. 2001). The main characteristic of this coordination is that it takes place between institutions with individual goals. Each institution (company or business function) seeks to profit from the collaboration. However, cooperation across functional borders as well as between companies can only be successful if the involved partners trust each other. Therefore, it is important to foster long-term relationships. In creating such partnerships, many factors must be considered; Wagner, Coley, and Lindemann (2011) identify fairness as a critical factor in trustworthy cooperation. Institutions are willing to commit to the success of the entire supply chain when they believe that they are treated fairly. The parameters of the relationship are typically determined in bilateral negotiations that concern the profit and the cost shares of investment, the prices of supplied goods, and/or the delivery schedule (including quantities and due dates). Although there is a significant amount of conceptual research about fairness in supply chains (e.g., Katok and Pavlov 2013; Ertogral and Wu 2000; Cui, Raju, and Zhang 2007) and experimental research on fairness in general (e.g., Bolton and Ockenfels 2000; Hoffman et al. 1994) as well as on decision making in supply chains (e.g., Becker-Peth and Thonemann 2016; Hyndman, Kraiselburd, and Watson 2013; Bolton and Katok 2008; Schweitzer and Cachon, 2000), there are only few experimental studies about fairness in supply chain negotiations.

Ho et al. (2014) and Nie and Du (2017) analyse the influence of peer-induced (referring to competitors) and distributional (referring to suppliers and customers) fairness concerns on the outcomes of supply chain coordination. They focus on a supply chain with two manufacturers and one retailer that is coordinated with wholesale price contracts. Choi and Messinger (2016) and Qin et al. (2016) examine how less availability of information regarding supply chain partners changes the coordination results. Their results show that fairness concerns become less important to the supply chain partners in situations with private information. All described experiments refer to the wholesale price as coordination. Hartwig et al. (2015) show that the wholesale price in combination with strategic inventory can lead to experimental results close to a theoretical equilibrium (if supply chain partners adhere to a certain negotiation procedure).

Whereas most other experimental studies address (wholesale) price or wage negotiations, we concentrate on the following two types of supply chain negotiations:

- Negotiations involving the share of profits from a collaborative supply chain project between a customer and a supplier (strategic management and coordination between companies); and

- negotiations of lot-sizes (operational management and coordination between business functions).

Both types are typical problems of supply chain coordination. Ballou, Gilbert, and Mukherjee (2000) describe the strategic task of supply chain cooperation as inter-organisational coordination. It may involve negotiations about profits generated from joint supply chain initiatives. An example for business function coordination is the negotiation about lot-sizes between assembly (small lot-sizes) and part manufacturing (large lot-sizes). This takes place on an operational level and can be referred to as inter-functional coordination (Ballou, Gilbert, and Mukherjee 2000). The aim of this paper is to examine the complex and abstract concept of fairness in negotiations in supply chains on the strategic as well as the operational level.

We focus on fairness in negotiations of the distribution of supply chain profits on the inter-organisational level and negotiations of order quantities on the inter-functional level. We examine the importance of fairness for supply chain management and illustrate the significance of fairness in supply chain negotiations.

The research question we answer with this paper is to what extent fair solutions (distributive and procedural fairness) are realised in bilateral negotiations under private payoff information on strategic and operational level in inter-organisational and inter-functional supply chains.

This paper is organised as follows. The second section presents an overview of the fundamentals of fairness. Because this term is difficult to define, we draw on research from the marketing and supply chain management perspectives, in addition to experimental approaches based on game theory. In the third and fourth section, we introduce findings from experimental studies on fairness in supply chain negotiations. Finally, the conclusion provides an overview of our main findings.

2 Theoretical background

2.1 Fairness

The concepts of fairness and justice (the two terms are used interchangeably in the literature) are found across disciplines (Bolton and Alba 2006; Dubinsky, Kotabe, and Lim 1993; Fehr and Schmidt 1999; Frazier et al. 1988; Griffith, Harvey, and Lusch 2006; Praxmarer-Carus, Sucky, and Durst 2013). Prominent fields of business research that have examined fairness are game theory, marketing and supply chain management. We will examine these areas in seeking an explanation of fairness. The difficulty in measuring fairness is that people have different norms of fairness, and they perceive processes and outcomes differently (Bolton, Brandts, and Ockenfels 2005). Table 1 shows this variety in the several definitions of fair-

ness it presents. Additionally, the perception of fairness depends on particular contexts and situations (Binmore, Shaked, and Sutton 1985; Ochs and Roth 1989). Because of this complexity, fairness models do not explain all behaviour and decisions. However, these models do help foster an understanding of the issues that are related to fairness (Bolton, Brandts, and Ockenfels 2005; Ochs and Roth 1989). Griffith, Harvey, and Lusch (2006) posited not only that fairness increases satisfaction and performance in business relationships but also that achieving fairness is the objective of companies. Explications of fairness have also been provided by experiments in the field of game theory. This theory builds on the assumption that people act rationally and seek to maximise profits. Experiments have shown, however, that this is not always the case (Bolton 1991; Eckel and Grossman 1996; Hoffman et al. 1994). One explanation for this finding is based on elements of fairness in social behaviour (Bolton 1991; Hoffman et al. 1994).

Author	Definition
Adams (1965)	"… fair correlations between inputs and outcomes […] for a reference person or group …"
Walster et al. (1978)	"… things were fair, only if the collaborators (who made markedly different contributions to the project) received markedly different net gains …"
Crawford (1979)	"… An allocation at which no agent envies another will be called a fair allocation …"
Deutsch (1985)	"… it is unfair for someone to get either more or less than his contribution deserves …"
Dubinsky, Kotabe, and Lim (1993)	"… fairness (a measure of perceived equity) …"
Fehr and Schmidt (1999)	"… We model fairness as self-centered inequity aversion. Inequity aversion means that people resist inequitable outcomes …"
Bolton and Alba (2006)	"… fairness is governed by the belief that vendors are entitled to a reference profit and customers are entitled to a reference price …"
Feess, Muehlheusser, and Walzl (2008)	"… contests […] should be fair in the sense that the one who performs best should be the winner …"

Table 1: Examples of Fairness-Definitions

Harrison and McCabe (1996) have argued that fairness alone cannot be responsible for the differences between the results into theoretical research in game theory and empirical research through experiments; however, it has also been acknowledged that fairness does play a role (Harrison and McCabe 1996; Ochs and Roth 1989). Common experiments to observe social interactions are the dictator game, the ultimatum game, and modifications of these games (Güth, Schmittberger, and Schwarze 1982). In such cases, players give large amounts of money to their partner without being required to do so and at their own cost (Forsythe et al. 1994; Güth, Schmittberger, and Schwarze 1982). In most cases, the agreement will be near the middle of the possible interval of transaction, even if it would be rational to give only a small portion of money to the bargaining partner. This altruistic behaviour is attributed to fairness considerations. However, it is doubtful that this behaviour is driven by selflessness. Research has shown that people want to be thought of as fair and act to be regarded as such (Bolton and Ockenfels 2000; Hoffman et al. 1994). They are less motivated by fairness considerations and act more in accordance with rational behaviour when they believe that they are unobserved and anonymous (Hoffman et al. 1994). The findings also conclude that fairness is selfish, in a manner of speaking (Bolton 1991; Ochs and Roth 1989). It has been shown that giving some of one's own potential profit will help increase the final payoff (Bolton and Ockenfels 2000; Kahn and Murnighan 1993; Ochs and Roth 1989; Weg and Zwick 1994). Therefore, it makes sense for companies to cooperate in supply chain management. By giving a fair amount of its gains derived from the cooperative relationship to its partner, a company enables the supply chain to make profits in the first place. The difficulty is to establish the amount of the "fair" payment. The simplest definition for fairness is formulated by Crawford (1979), who describes it as "[…] a situation in which nobody envies someone else […]". However, this explanation does not capture the complexity of the matter. Nevertheless, it is true that perceived fairness always depends on comparison with others (Ochs and Roth 1989). Figure 1 shows that fairness may be divided into two categories: procedural and distributive fairness (Kumar, Scheer, and Steenkamp 1995; Bolton, Brandts, and Ockenfels 2005).

Procedural fairness concerns fairness as perceived by those who are directly affected by processes and procedures (Korsgaard, Schweiger, and Sapienza 1995; Konovsky 2000; Wu, Loch, and Van der Heyden 2008). The question is whether the process that is used to come to a solution is fair and whether this process is perceived to be fair. In supply chains in which independent companies work together, procedural fairness is perceived in negotiations. Several insights into procedural fairness and into the process of negotiation have been made by conducting experiments. Bolton, Brandts, and Ockenfels (2005) discovered that credibility is the key

for processes to be considered fair. Partners are able to react properly only when they know the processes that undergird decision making. However, a fair reaction does not always signal cooperation. Fairness means that people will give something back to help those who are kind to them (Kahneman, Knetsch, and Thaler 1986; Rabin 1993). However, fairness also means that people will forego profit to punish those who are not kind to them (Bolton, Brandts, and Ockenfels 2005; Güth, Schmittberger, and Schwarze 1982; Rabin 1993). In negotiations, this means that a company may break off the process if its potential partner does not show some willingness to compromise. This finding shows that behaviour and intention are important (Rabin 1993). The impact of procedural fairness on organisational behaviour, commitment, and strategic decision making has also been investigated (Korsgaard, Schweiger, and Sapienza 1995; Konovsky 2000). For example, it has been shown that team commitment increases when team leaders are perceived as behaving fairly, which helps with executing strategic decisions. Experiments have also shown that fair processes and procedures may be a substitute for fair outcomes (Bolton, Brandts, and Ockenfels 2005). Nonetheless, the results also indicate that a fair outcome is preferred.
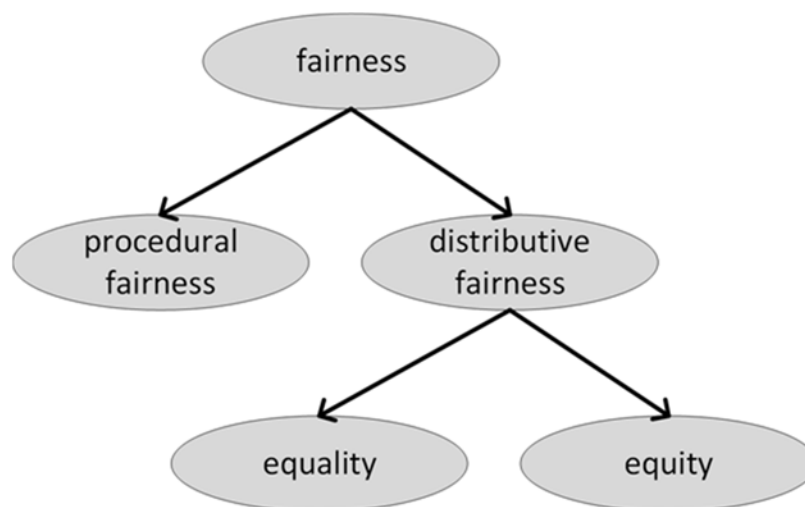
Figure 1: Differentiation of Fairness.

The perception of the fairness of outcomes received is known as distributive fairness (Konovsky 2000). In this case, distributive fairness seeks to determine whether the distribution of outcomes is fair. The fairness of an outcome may be determined according to equity or equality, which is also shown in figure 1 (Jap 2001). The principle of equity means is satisfied when the ratio of resources invested and outputs received by one party equals the ratio of resources invested and output received of the other party (Adams, 1965; Walster et al. 1978). This principle of fairness is often advocated by companies making greater investment (McGrath 1984). The other principle of distributive fairness, equality, means that each party should receive the same amount, such as a 50/50 split between two parties. Because equal

distribution is independent of the investment, it is preferred by the party making less investment. Some authors argue that this distribution leads to harmony and good relationships (Deutsch 1985; Kabanoff 1991). Both concepts of distributive fairness assume that input and output are known, which is not the case in supply chains because information about a company's costs and profits are sensitive. Nevertheless, equity and equality may help determine whether a solution is perceived to be fair.

2.2 Hypotheses

Experimental studies and the literature have shown that fairness affects organisational and individual decision making and behaviour. There have been several studies published concerning the importance of fairness and its influence on supply chain relationships (e.g., Dwyer, Schurr, and Oh 1987; Kumar, Scheer, and Steenkamp 1995; Griffith, Harvey, and Lusch 2006; Praxmarer-Carus, Sucky, and Durst 2013). However, certain fairness issues remain unobserved. Therefore, we will examine two different levels of supply chain negotiations to gain a deeper understanding of fairness within business relationships. On the strategic level, we will consider negotiations about profit sharing and its role in fair relationships (FitzRoy and Kraft 1987; Bensaid 1991). The example from the operational level concerns joint economic lot-sizing. There are models that provide mechanisms for determining the fair distribution of costs and profits (Shapley 1953; Schmeidler 1969; Zelewski and Peters 2010). The outcomes of these models depend on their assumptions. Using two laboratory experiments involving a supply chain negotiation game, we examine whether the process results in theoretically fair results and whether unfair actions that occur in the process are punished. The first experimental study refers to strategic supply chain management and the second to operational supply chain management.

The strategic management experiment has the following context. Two partners in a supply chain intend to realise a long-term supply chain project, one of whom (the profiteer) will gain disproportionately from the supply chain. The other partner (the investor) will bear additional costs. In the operational management experiment, the process of joint lot-sizing is investigated. In this situation, two companies negotiate over an order quantity. Because of convex cost functions, each bid has different effects on the payoffs. For both experiments, we assume that payoff information is private.

To examine fair solutions and behaviour, we first analyse the negotiation results. To do so, we build on the work of Hoffman et al. (1994) and Bolton and Ockenfels (2000) to observe fair behaviour when participants give more than the minimum of their profit to their negotiation partner. In the situations described herein, a result in

which one side gains a much higher payoff than the other is considered unfair. The first hypothesis is as follows:

- *H1: Experimental participants reach fair agreements from a game theory perspective.*

From the perspective of equality, a negotiation result in which all sides gain the same payoff is a fair solution. The fairness measure χ indicates the fairness of a solution. χ is the realised negotiation agreement multiplied by 100 and divided by the fair agreement (cf. equation 1).

$$\chi = (Realised\ Agreement)/(Fair\ Agreement) \cdot 100 \quad (1)$$

Because information about costs and profits is company-confidential information in supply chains, the participants in the experiments do not know the costs and profits position of their negotiation partner. Distributive fairness is determined according to the concept of equality. Because in one of the two analysed experiments only one side incurs a cost, it is not possible to find a feasible equity solution for this situation. Because of information distortion, the following two negotiation intervals must be distinguished:

- The negotiation interval between the real local optimum payoff values; and
- the negotiation interval between the initial bids.

Because each participant knows only his/her own payoff function, the negotiation interval between initial bids is the only public negotiation interval (Kagel, Kim, and Moser 1996). If the equality concept is applied to this interval, the second hypothesis is posited as follows:

- *H2: Experimental participants reach agreements near the centre of the negotiation interval between initial bids.*

The position of an agreement in the negotiation interval between initial bids is represented by PSSC. According to equation (2), the PSSC equals the difference between the realised agreement and the profiteer's bid that is divided by the quantity-based negotiation interval between the initial bids.

$$PSSC = (realised\ agreement - profiteer's\ initial\ bid)/(investor's\ initial\ bid - profiteer's\ initial\ bid) \quad (2)$$

If PSSC equals 0.5, the agreement is exactly in the centre of the negotiation interval between the initial bids. In summary, to examine H1 and H2, the three negotiation results shown in table 2 are important.

Realised Agreement	Result of the experimental negotiation.
Fair agreement	Agreement in which the payoff to both negotiators is equal and greater than zero. For this agreement, the measure χ is 100.
Centre agreement	Agreement in the centre of the negotiation interval between initial bids. For this agreement, *PSSC* takes the value of 0.5.

Table 2: Relevant agreements for the examination of H1 and H2.

After analysing the distributive fairness by examining the negotiation results, procedural fairness should then be considered. In each negotiation in the experiments, a profitable solution for both companies is possible, and rational behaviour will always lead to an agreement in both experiments. As mentioned above, this type of rationality does not exist because of fair behaviour. In this case, fairness does not mean cooperation; it means a breakdown in negotiation. Perceived fairness is the reason for this outcome. According to Bolton, Brandts, and Ockenfels (2005), Güth, Schmittberger, and Schwarze (1982) and Rabin (1993) participants will forego profits to punish negotiation partners whose actions are perceived as unfair. Therefore, there will likely be breakdowns in negotiations, and we propose the following as a third hypothesis:

- *H3: The existence of a fair and profitable solution does not avoid negotiation breakdowns.*

If this assumption is right, the cause of the breakdowns should be analysed – perhaps because of the distribution of profits. If a company will incur losses as a result of an agreement, it will prefer breaking off negotiations. A negotiation will also be cancelled if the behaviour of the negotiation partner is uncompromising. Because procedural fairness has something to do with tit-for-tat exchanges (Kahneman, Knetsch, and Thaler 1986; Rabin 1993), a breakdown will occur if one side observes no concessions made by the other party. We thus posit the fourth and fifth hypotheses:

- *H4: Negotiation breakdowns occur when one of the negotiators suffers losses.*
- *H5: Negotiation breakdowns occur when a negative concession or no concession was made by the negotiating partner.*

3   Experimental Study 1: Profit sharing in supply chains

3.1   Design of experimental study 1

The purpose of this infinite set of bilateral negotiation experiments (see, for laboratory experiments and their use, Friedman and Sunder 1994; LaLonde 1986; Plott 1982; Siegel and Fouraker 1960) with a symmetric distribution of power was to yield insights into profit allocation in supply chains and to obtain information about bargaining behaviour and perceptions of fairness. As indicated in the previous sections, we will focus our analysis on distributive and procedural fairness issues. Following a pretest, the experiment was conducted with 60 German students at the University of Bamberg and followed a popular experimental procedure (Montgomery 2009; Friedman and Cassar 2004).

Before the experiment began, all participants were given an oral and a written introduction. They were introduced to the following supply chain situation: Two companies intend to realise a supply chain project. The results of the project will be additional profit. However, this profit will be unbalanced between the actors. One side will incur additional costs because of investment that is necessary for the project (the investor), whereas the other side will realise a disproportionate revenue (the profiteer). The revenue always exceeds the costs of the investor and leads to profit on the supply chain. Because of the unbalanced distribution of profits and the symmetric power distribution between the companies, they must negotiate about the revenue sharing. If there is no agreement, the project will fail, and neither side will realise additional income.

The task of the participants in the experiment was to negotiate the amount of side payment the investor will obtain from the profiteer such that the investor has sufficient interest to engage in the supply chain project. As representatives of their companies, the participants only know their own cost/revenue calculations, which mean that there is incomplete information. The participants do not know the profits of the other side. However, the participants know that it is always possible to find a side payment that will ensure that both parties gain additional income.

To minimise social effects such as sympathy or friendship and to make the participants anonymous, students were only able to interact by computer. Every participant had to login on a php-based platform (designed for the experiment) and was randomly paired with a negotiation partner. Each student negotiated in six different situations. In each of these situations, the negotiation partner is different, and the cost and revenue structure was different to eliminate experience effects (Bryman and Bell 2003; Davis and Holt 1993). The process of negotiation consists of offers and counteroffers with respect to the amount of the side payment. No other form of

communication was possible between the negotiation partners. The profiteer began the negotiation with an offer. Following this offer, every negotiation partner could accept the last offer and agree on it, give a counteroffer or cancel the negotiation so that no agreement would be reached. In total, the results in the next section refer to 96 negotiations and 1,965 bids.

In the introduction to the experiment, the participants were informed that they would receive a payment for their participation. The amount of their payment depended on their success in the negotiation process; the payment was a certain proportion of the profit that the company would realise if negotiations ended in an agreement. If there is no agreement, the participants receive no payment related to that negotiation. The functions of the payment were not connected to one another. However, at all times, the participants could use a calculator to simulate their own payoff from a certain side payment. This monetary incentive was used to match the interest of the participants in the experiment to the interest of the decision makers in the described supply chain (Smith 1976; Friedman and Sunder 1994; Davis and Holt 1993). The maximum payoff was 25 €, and the minimum was 5 €.

3.2   Results of experimental study 1
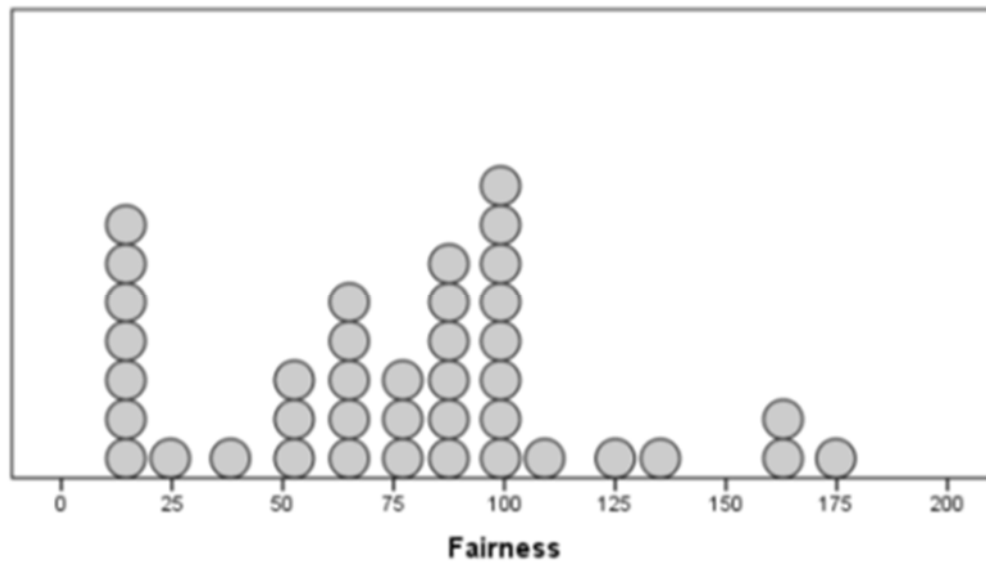
Fair agreements (H1):

Figure 2: Frequencies of Fairness for the realized agreements.

The overview of the fairness measure χ (paragraph 2) for the realised agreements in figure 2 shows maximum fairness at the fair solution (100). Two further findings are obvious: a local maximum near zero, which indicates an unfair solution for the investor, and the upper quartile (99.42), which remains lower than 100. According

to these results, the median is 83.30. The mean of 97.60 is influenced by one extremely high value of 952, which is not shown in figure 2.

To quantify the correlation between the fair and the realised agreements, both values for each negotiation and each cost function are normalised with respect to revenue (without consideration of the costs). The resulting revenue share indicates the percentage of revenue that the profiteer gains after paying the transfer payment. The correlation between the realised and the fair revenue share of the profiteer is illustrated in figure 3. The values of the fair revenue share are always less than 0.5. The fair agreement consists of equal cost and revenue shares for each site. The supply chain's profit is the profiteer's revenue minus the investor's cost. The agreement is fair when the global profit is divided into two equal parts. Because of the cost, the fair revenue shares of both parties are less than 0.5. Figure 3 indicates a medium-sized correlation between the fair agreement and the realised agreement. This result is supported by a Spearman's ρ of 0.62, which is significant at the 0.001 level. If the realised agreements are compared with the fair agreements by applying the Wilcoxon signed-rank test, the test result reveals a significant difference between both samples at the 0.005 significance level. The high correlation supports hypothesis 1, but the frequencies and the test results enable us to reject hypothesis 1.
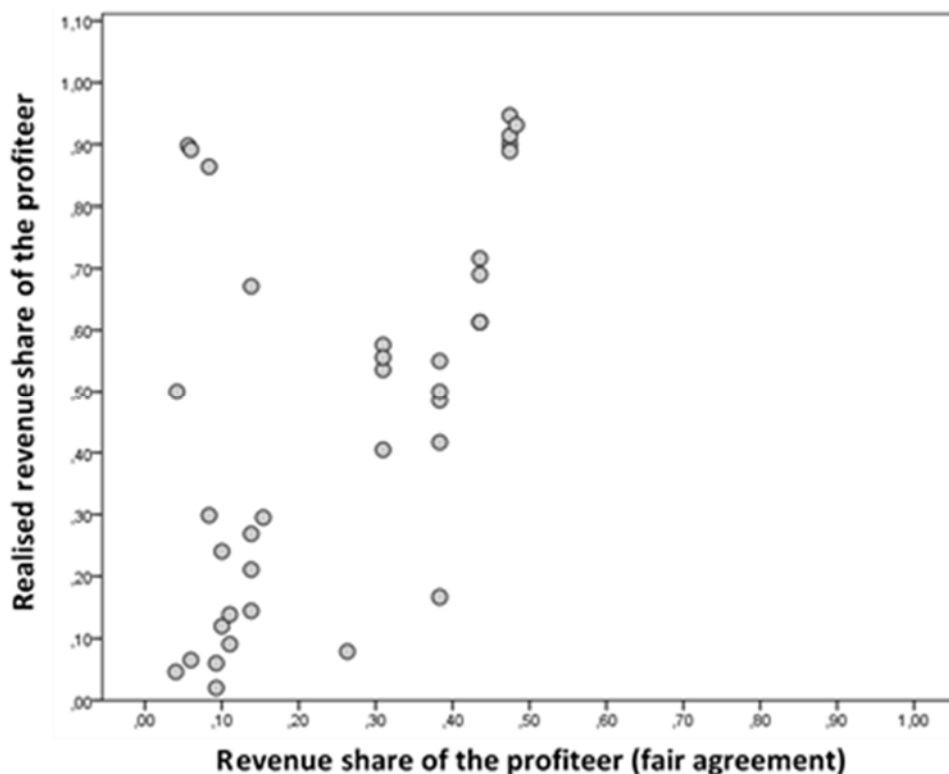

Figure 3: Realised revenue share of the profiteer subject to his fair revenue share.

Centre agreements (H2):

Each negotiation begins with an initial bid of the profiteer, which is answered in nearly all negotiations with a counteroffer. These (initial) bids determine the perceived quantity-based negotiation interval. A centre agreement that equals the centre value of the negotiation interval implies fairness because the relevant payoff information of the negotiation partner is private. As discussed above, the position of an agreement in the negotiation interval is represented by PSSC. According to equation (2), PSSC equals the difference between the negotiation result and the profiteer's bid, which is then divided by the quantity-based negotiation interval between the initial bids. If PSSC equals 0.5, the agreement is exactly in the centre of the negotiation interval between the initial bids. If the value of PSSC is 0, the initial bid of the profiteer is accepted by the investor. If PSSC is equal to 1, the investor's initial bid is accepted by the profiteer.

The frequencies in figure 4 are dominated by a maximum at zero. Therefore, a share of 29 % of the agreements are realised because the investor accepts the initial bid of the profiteer or a value close to it. A total of 39 % of the successful negotiations end with PSSC values from 0.3 to 0.6. The correlation analysis for the profiteer's realised revenue share and the revenue share, which he gains if the centre agreement is realised, reveals a value of 0.91 for Spearman's ρ. The Wilcoxon signed-rank test does not indicate any significant difference. The high correlation (which is shown in figure 5) and the results of the Wilcoxon signed-rank test support hypothesis 2.
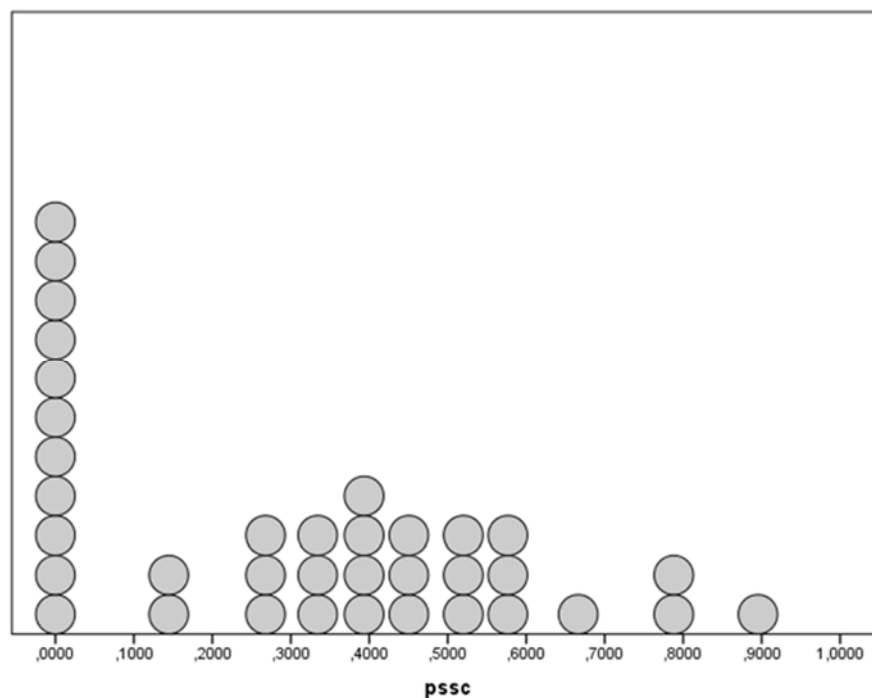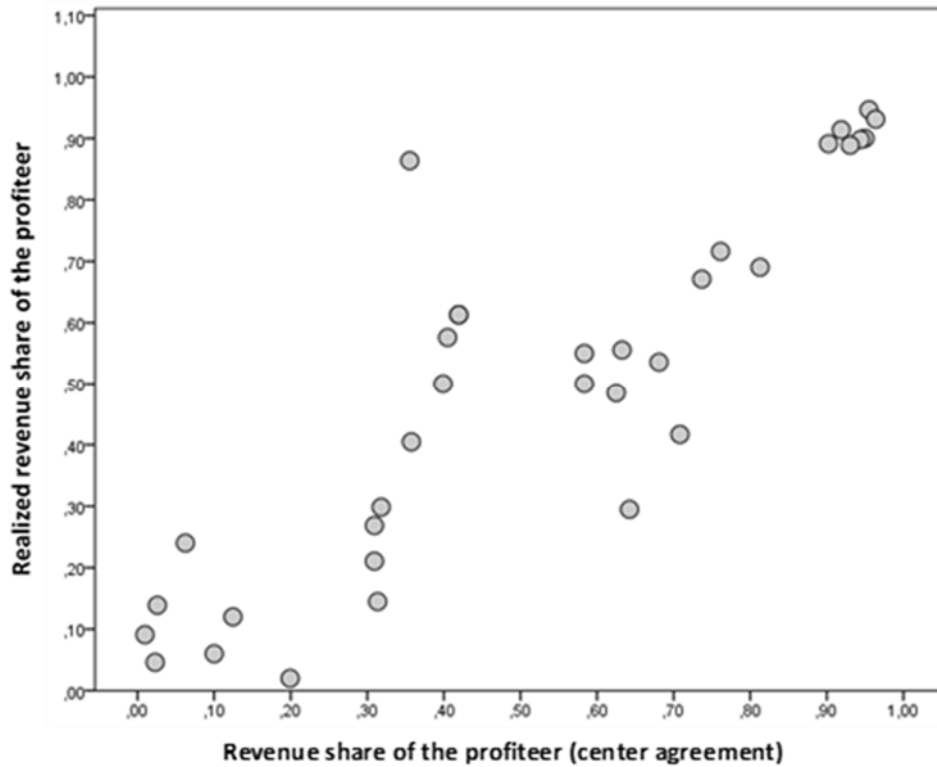

Figure 4: Frequencies of PSSC.

Figure 5: Realised revenue share of the profiteer subject to his centre revenue share.
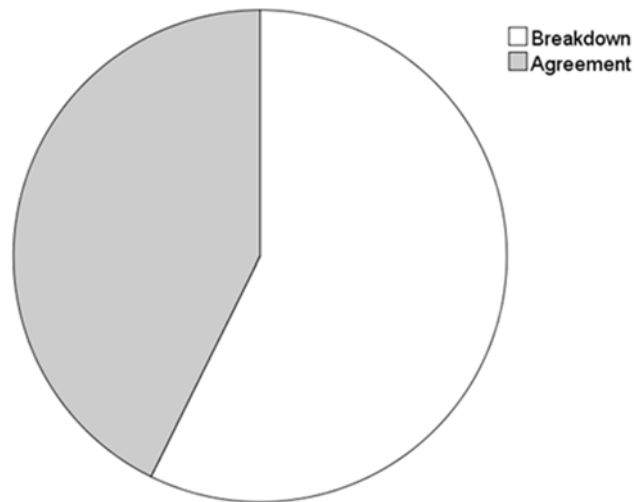
Negotiation breakdowns (H3, H4, H5):

Figure 6: Realised revenue share of the profiteer subject to his centre revenue share.

Although there are fair solutions for every negotiation, according to hypothesis 3, certain negotiations terminate with a negotiation breakdown. The frequencies in figure 6 reveal that 57.3 % of the negotiations end with a breakdown. This finding strongly supports hypothesis 3. As discussed in section 2, breakdowns are used to punish the negotiation partner for unfair behaviour. Indicators of unfair behaviour

are a negative concession (a bid that leads to a lower payoff for the negotiation partner than one's own previous bid) or a bid that induces losses for the negotiation partner. Hypothesis 4 refers to the effect of the bid before the breakdown. It is proposed that a negotiation breakdown is the result of a bid that leads to no payoff for one of the negotiation partners. Figure 7 illustrates that 94.4% of the breakdowns occurs after a bid that leads to no payoff for the breakdown initiator. Therefore, hypothesis 4 is strongly supported. Another extension of unfair behaviour is a negative concession in which one side makes a worse bid for the negotiation partner compared to the previous bid. Figure 8 shows that 54.0 % of the bids before breakdown represent a negative concession or a concession of zero. However, this finding implies that a sizeable share – 46.0 % – of breakdowns follow positive concessions. This finding enables us to reject hypothesis 5.
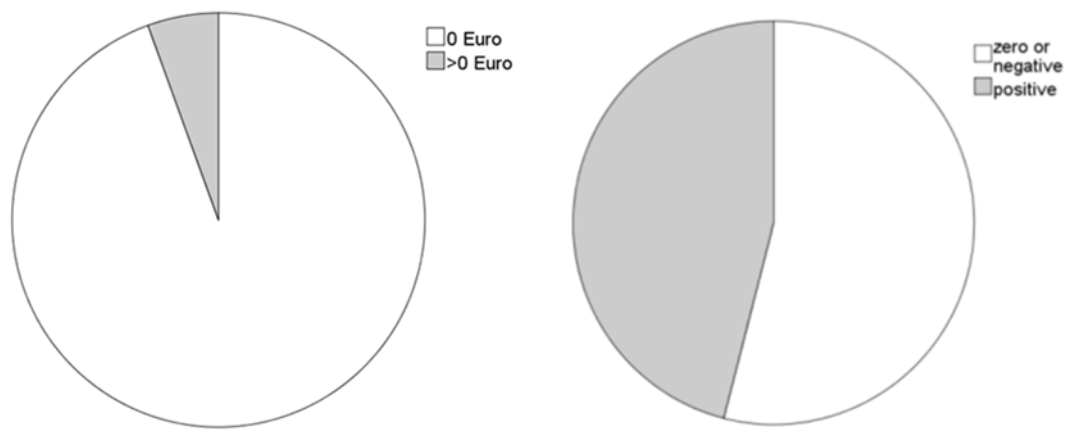

Figure 7 and 8: Percentage of payoff values (Figure 7, left) and percentage of null or negative concessions (Figure 8, right) for the last bid before breakdown.

3.3   Discussion of results of experimental study 1

The results regarding fair agreements from a game theory perspective (hypothesis 1) imply that fair solutions are not reached in supply chain negotiations with private information. These results support the game theory work of Chatterjee and Samuelson (1988) and Cramton (1992), who introduced game theoretical models with a high number of equilibria into bilateral negotiations with private information. A unique equilibrium that indicates a preferred solution for the situation could not be identified. The experimental results in this paper show that negotiation results vary and do not concentrate on one value, even if certain trends are obvious. This finding is the result of two factors. First, as described above, private payoff information impedes the collaborative determination of a fair agreement. Fair solutions that are declared by the subjects differ significantly from the fair solution from a game theory perspective even with complete information.

The main reason for the observed difference between a game theory fair solution (complete information) and the realised agreements is the assumed information privacy in the experimental situation. Even if the participants intend to reach a fair agreement under game theory, they must know the payoff function of the negotiation partner. However, this information is private. Therefore, the participants concentrate on the negotiation interval between the initial bids instead of on the payoff function (Kagel, Kim, and Moser 1996). The PSSC results indicate that the participants prefer agreements close to a 50/50 split of the negotiation interval between the initial bids. A similar result for a different context was presented by Roth and Malouf (1979), Roth, Malouf, and Murnighan (1981), and Roth and Murnighan (1982), who conducted experimental studies in another context, in which participants negotiate over a one dollar share. In one treatment, the participants negotiate over a number of chips. Each chip represents a certain amount of money. The participants only know the value of their own chips and do not know the value of each chip held by their partner. The negotiations mainly result in agreements with a 50/50 chip split. It may be observed in our experiment that negotiators intend a fair solution for public negotiations, although the private payoff for each side is the relevant result. This finding enables us to suppose that participants would be willing to accept a game theory fair agreement for public information but are unable to find such an agreement. The role of fairness in negotiations has been examined in Ochs and Roth (1989) and Harrison and McCabe (1996); the results from these studies are also consistent with the findings of Hoffman et al. (1994) and Bolton and Ockenfels (2000) that people desire to be perceived as fair. However, under private information fairness concerns of the actors are less obvious, if just the payoff is considered. That fits the results of Choi and Messinger (2016) and Qin et al. (2016). They observe weaker fairness concerns under private information in laboratory experiments with retailer-manufacturer supply chains.

The second reason for deviation from a fair solution under game theory is not dependent on the information distribution. Divergent perceptions of fairness between the participants lead to negotiation results that deviate from the fair solution (Binmore, Shaked, and Sutton 1985; Ochs and Roth 1989; Bolton, Brandts, and Ockenfels 2005; see also paragraph 2). To determine their personal preferences regarding fairness, the participants must choose a fair solution for the following problem in an after-experimental questionnaire: An investor must incur a cost of 20,000 to implement a supply chain project. The profiteer of the project is able to gain additional revenue of 100,000 caused by this project. Participants may choose between nine possible agreements (0; 10,000; 20,000; 30,000; 40,000; 50,000; 60,000; 80,000; and 100,000) for transfer payments from the profiteer to the investor. The participants then mark the agreement that they perceive to be fair. The resulting dis-

tribution of the fairness indicator χ is contained in figure 9, which reveals that 87.5 % of experimental participants choose agreements that deviate from fair solutions under game theory. Furthermore, the Mann-Whitney U-test indicates a significant difference (p=0.00) between the questionnaire results and the agreement that is fair under game theory. These results confirm the difference between game theory fair solutions and the perceived fair solutions for supply chain projects, such as the experimental one.
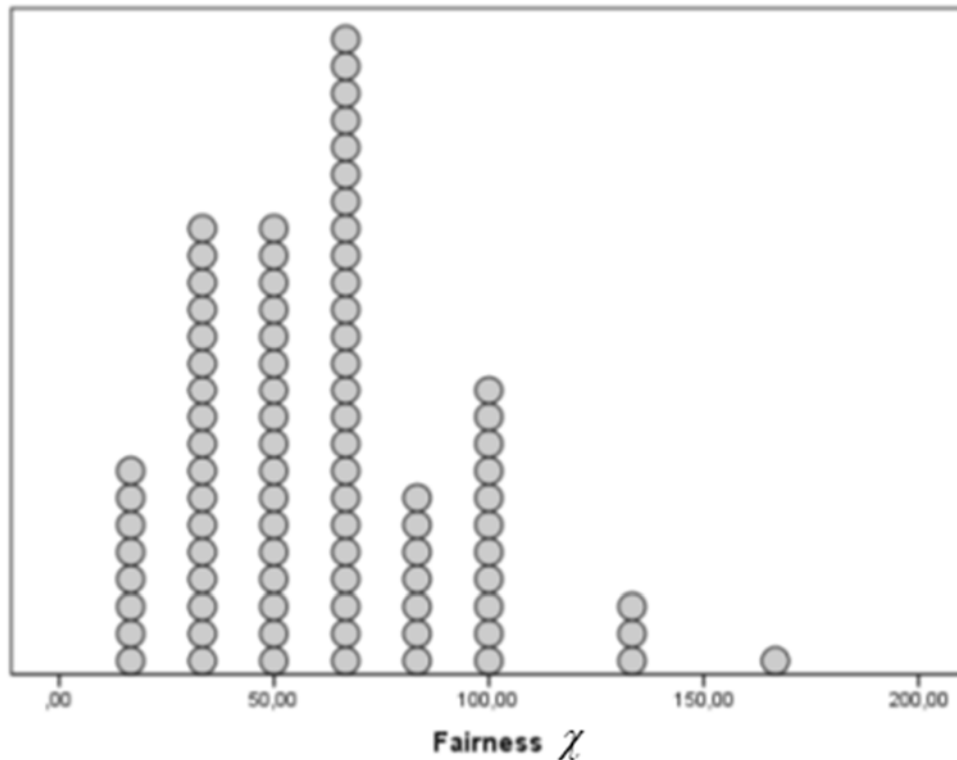

Figure 9: Frequencies of fairness for the questionnaire.

The discussion of the experimental results refers to distributive fairness and reveals that the results of negotiations with private information correlate with the fair solution. However, the fair solutions are not reached, and the correlation of centre agreements with realised negotiation results is substantially greater.

By contrast to distributive fairness, procedural fairness refers to the negotiation process. The analysis of the negotiation process is necessary for the examination of breakdowns. The results concerning negotiation breakdowns are consistent with theoretical expectations. As we hypothesised in paragraph 2, the experimental results indicate that negotiation breakdowns will occur even if there is a fair solution. Participants utilise breakdowns as punishment for unfair negotiation behaviour (Güth, Schmittberger, and Schwarze 1982; Rabin 1993; Bolton, Brandts, and Ockenfels 2005). This argumentation is supported by the results relating to the payments shortly before a breakdown. A total of 94.4 % of breakdowns occur after a

bid that would result in a zero payment for one of the negotiators. The clarity of these results increases if we consider that out of all bids in general, only 73.3 % lead to a null payoff for one of the negotiators. The results concerning concession behaviour are more ambiguous: Only 54.0 % of breakdowns follow directly after a negative or null concession. This percentage remains notably higher than the overall percentage of such concessions. Only 31.1 % of all bids represent a negative or null concession. If these two specifications of unfair behaviour are analysed together, it becomes obvious that every breakdown occurs following the unfair behaviour of the negotiation partner. Therefore, the results are consistent with theoretical expectations because breakdowns are utilised as punishment for unfair behaviour as a type of tit-for-tat (Kahneman, Knetsch, and Thaler 1986; Rabin 1993).

To conclude, the results of experimental study 1 show that fair behaviour and fair results influence the agreements realised. Furthermore, we must consider that the fairness perception of experimental participants differs from fair agreements under game theory for the described situation of a supply chain project with one profiteer and one investor. In addition, the results of this experimental study indicate that private payoff information leads to a fair solution for a public negotiation interval, e.g., a 50/50 split of the negotiation interval between the initial bids.

4   Experimental study 2: Lot-sizing between business functions

4.1   Design of experimental study 2

To generalise the results of experimental study 1, we examine the results of a second laboratory experiment regarding another typical supply chain negotiation situation: the collaborative determination of production and supply quantities (Dobhan 2012).

By contrast to experimental study 1, the negotiation object is not a side payment but joint lot-sizes, which induces different payoffs for each negotiation partner. The experiment was conducted with a platform similar to that used in experimental study 1. We applied the Joint Economic Lot-size Model of Banerjee (1986) to determine the payoff function of each participant. The payoff function is private for every participant and in every negotiation round. The kurtosis of the payoff function equals the kurtosis of the cost functions. The maximum payoff that a participant could gain for its local economic lot-size was equal for both negotiators. This condition sup-ports the assumption of a symmetric power distribution. If there were a negotiation breakdown or a negotiation result that would originally induce a negative payoff, participants did not receive any payoff. The exclusion of learning effects and a high validity was reached by the randomisation of the cost functions and

the participant selection. The negotiation situation refers to the assumptions found in Sucky (2004) and Corbett and de Groote (2000).

The experimental activities followed the procedure of experimental study 1. The participants earned up to 15 € for the experiment. A total of 112 students at the Universities of Bamberg and Regensburg participated in this experimental study. After two test negotiations, each student finished three negotiation rounds with the described situations. The negotiation partner, the payoff function and the local economic lot-sizes varied in each negotiation round. One prematurely terminated negotiation round that was reasoned by a busy participant was eliminated. A sample of 167 negotiation rounds remained. These 167 negotiations are used below to examine the hypotheses presented in paragraph 2.3.

4.2   Results of experimental study 2

Fair agreements (H1):

In the described lot-sizing experiment, a fair agreement represents an agreement in which both parties obtain the same payoff. In this case, the joint payoff reaches the maximum. The realised agreement of each negotiation round is divided by the fair agreement for the determination of the fairness measure χ. The mean of χ is 107.73 for this experiment, and the median is 102.46. For comparability, the realised and the fair agreements are divided by the difference of the local economic lot-sizes for each negotiation round. A correlation analysis reveals a Spearman's ρ of 0.27 for the relationship between the realised and fair agreements at the 0.001 significance level. The Wilcoxon signed-rank test does not indicate a significant difference between the two samples (realised and fair agreements).

Centre agreements (H2):

Considering our profit-sharing experiment from the previous section, the negotiation results are more influenced by the centre of the relevant negotiation interval than by fair agreements determined by game theory. An agreement at the centre of the negotiation interval is represented by a PSSC value of 0.5. According to equation (2), PSSC is the difference between the negotiation result and the local economic lot-size of one side divided by the difference of both local economic lot-sizes. For experimental study 2, the result is a mean of 0.31 with a standard deviation of 0.97 and a median of 0.46. Spearman's ρ for the relation between the normalised centre agreement and the normalised realised agreement comes to 0.43 with a p-value of 0.000. The Wilcoxon signed-rank test indicates a difference between the two samples and has a significance level of 0.021.

Negotiation breakdowns (H3, H4, H5):

The results concerning the negotiation breakdowns reveal that breakdowns occur, even when an agreement with payoffs for both participants is possible. A total of 10.2 % of negotiations terminated with a breakdown, which is a notably lower share than in the profit-sharing experiment. A total of 52.9 % of the bids before a breakdown do not induce a payoff for one of the negotiation partners, and 58.8 % of these bids represent a null or negative concession. Both shares are remarkably higher than the relevant shares for all bids: only 23.0 % of all bids lead to a null payoff for one side, and only 30.6 % of all bids are null or negative concessions.

4.3   Discussion of results on both studies

The results of the lot-sizing experiment support hypothesis 1. The correlation of the fair agreement on the realised agreement is significant at a low level. The Wilcoxon signed-rank test does not show any significant difference between fair and realised agreements. In comparison with experimental study 1, the correlation is low, which results from the different payoff functions. The concave payoff functions in experimental study 2 make it more difficult to anticipate a fair solution compared to the linear function in experimental study 1.

Another obvious difference between both experiments concerns the distribution of the χ-frequencies. Because of the differentiation between profiteers and investors in study 1, both parties are treated differently. The results show that costs are valued differently from profits. This design leads to a right-sided distribution of χ-frequencies, in which the main share of agreements are between 0 and 100. In experimental study 2, both parties incur costs that are correlated with the payoff. Therefore, a nearly symmetric distribution may be observed for experimental study 2.

Furthermore, the results of both experiments show a strong correlation for the centre of the negotiation interval between the initial bids and the realised agreements. The Spearman's ρ values are even higher for the centre value than for χ. As we discussed above, the centre of the negotiation interval is a feasible agreement that is considered fair by both sides in negotiations with private information. Obviously, this value is more meaningful for the position of the agreement than for fairness (Kagel, Kim, and Moser 1996).

When we compare the results about negotiation breakdowns, we can observe that breakdowns occur in both experiments. However, the share of breakdowns is higher in experimental study 1 than in experimental study 2 because of the different levels of uncertainty and different ranges of the decisions. In the profit-sharing experiment, the profiteer knows before the initial bid that a higher transfer payment would

be preferred by the investor. The investor is even conscious of the best solution for the profiteer before the negotiation starts. The profiteer's best solution is a transfer payment of zero. By contrast to this situation, participants do not know the optimum agreement of the other side in experimental study 2. They must even worry that an initial bid that deviates from one's own local economic lot-size is a positive concession. Therefore, the difference in the negotiation interval between initial bids and the negotiation interval between the real values is smaller than in experimental study 1, which increases the probability of finding an agreement with high payoffs for both sides. The differences in the initial bids become clear in figure 10, which depicts the frequencies of the deviation of initial bids from the real values. For comparability, the deviation is divided by the real values, i.e., the profiteer's revenue and investor's cost in experimental study 1, and the local economic lot-sizes in experimental study 2. If the deviation is high, a negotiator intends to conceal his own data. If the deviation is low, the interests are revealed.
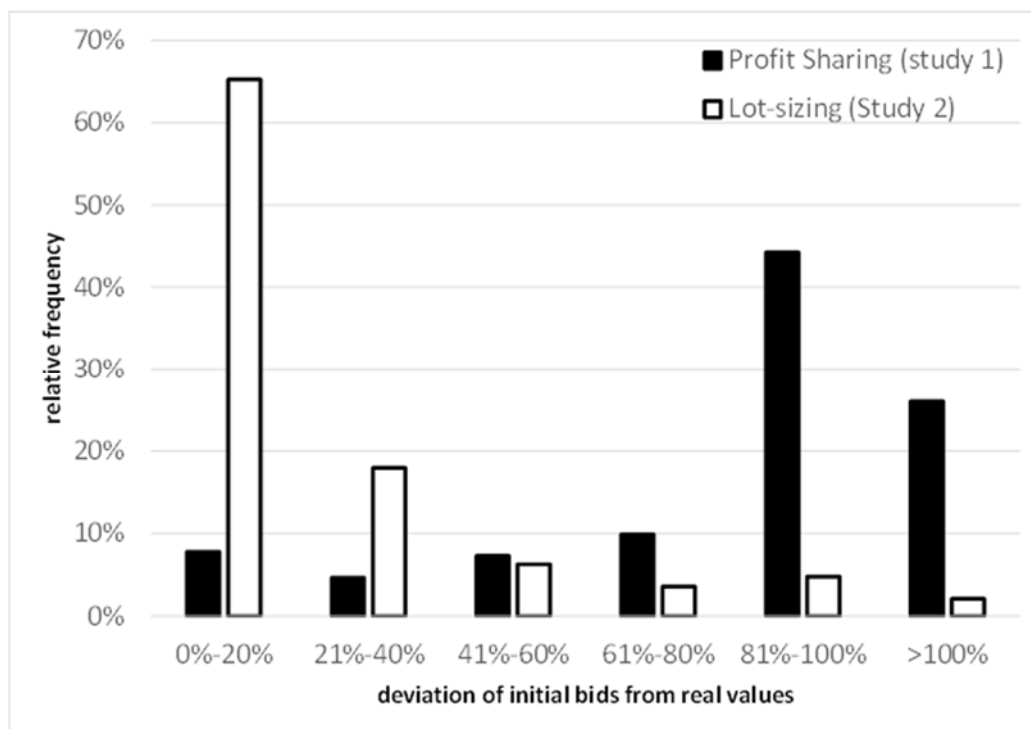

Figure 10: Relative Frequencies of the normalised initial bid's deviation for both studies.

The difference between both experimental studies (shown in figure 10) is supported by the significant results of a Mann-Whitney U-test with a large effect size of 0.694. The mean normalised deviation of initial bids is 1.08 in experimental study 1 and 0.34 in experimental study 2. Considering the importance of the initial bids for the negotiation results, the different share of breakdowns in both experimental studies is explained primarily by the different initial bids (Min, LaTour, and Jones 1995; Chertkoff and Conley 1967).

5   Conclusion

For both experiments, we observe in conclusion that the realised agreements are correlated with fair agreements, although both samples are not necessarily similar. This result might be caused by private payoff information, which is one reason for the concentration at the centre of the negotiation interval between initial bids. The results show that there are further breakdowns in both settings that are primarily used as punishment for unfair behaviour, including bids that induce a null payment for one party or bids that represent negative concessions. That shows that in inter-organisational as well as in inter-functional coordination fairness is important to create trustworthy relationships and manage supply chains successful. Further research should address the following points:

- the influence of negotiation settings on reaching a fair agreement;
- differences in negotiation settings on inter-organisational and inter-functional levels; and
- intentions of decision-makers in companies and business functions regarding fair agreements.

6   Literature

Adams, J. S. 1965. "Inequity in Social Exchange." In *Advances in Experimental Social Psychology*, edited by Leonard Berkowitz, 267–300. New York: Academic Press.

Ballou, R. H., S. M. Gilbert, and A. Mukherjee. 2000. "New Managerial Challenges from Supply Chain Opportunities." *Industrial Marketing Management* 29 (1): 7–18.

Banerjee, A. 1986. "A Joint Economic-Lot-Size Model for Purchaser and Vendor." *Decision Science* 17 (3): 292–311.

Becker-Peth, M., and U. W. Thonemann. 2016. "Reference points in revenue sharing contracts—How to design optimal supply chain contracts." *European Journal of Operational Research* 249 (3): 1033–1049.

Bensaid, B., and R. J. Gary-Bobo. 1991. "Negotiation of profit-sharing contracts in industry." *European Economic Review* 35 (5): 1069–1085.

Binmore, K., A. Shaked, and J. Sutton. 1985. "Testing Noncooperative Bargaining Theory: A Preliminary Study." *The American Economic Review* 75 (5): 1178–1180.

Bolton, G. E. 1991. "A Comparative Model of Bargaining: Theory and Evidence." *The American Economic Review* 81 (5): 196–1136.

Bolton, G. E., J. Brandts, and A. Ockenfels. 2005. "Fair Procedures: evidence from Games Involving Lotteries." *The Economic Journal* 155 (506): 1054–1076.

Bolton, G. E., and E. Katok. 2008. "Learning by Doing in the Newsvendor Problem: A Laboratory Investigation of the Role of Experience and Feedback." *Manufacturing and Service Operations Management* 10 (3): 519–538.

Bolton, G. E., and A. Ockenfels. 2000. "A Theory of Equity, Reciprocity, and Competition." *The American Economic Review* 90 (1): 166–193.

Bolton, L. E., and J. W. Alba. 2006. "Price fairness: good and service differences and the role of vendor costs." *Journal of Consumer Research* 33 (2): 258–265.

Bryman, A., and E. Bell. 2003. *Business research methods.* Oxford: Oxford University Press.

Chatterjee, K., and L. Samuelson. 1988. "Bargaining under two-sided incomplete information: the unrestricted offers case." *Operations Research* 36 (4): 606–619.

Chertkoff, J. M., and M. Conley. 1967. "Opening Offer and Frequency of Concession as Bargaining Strategies." *Journal of Personality and Social Psychology* 7 (2): 181–185.

Choi, S., and P. R. Messinger. 2016. "The role of fairness in competitive supply chain relationships: An experimental study." *European Journal of Operational Research* 251 (3): 798–813.

Corbett, C. J., and X. de Groote. 2000. "A Supplier's Optimal Quantity Discount Policy Under Asymmetric Information." *Management Science* 46 (3): 444–450.

Cramton, P. C. 1992. "Strategic Delay in Bargaining with Two-Sided Uncertainty." *The Review of Economic Studies* 59 (1): 205–225.

Crawford, V. P. 1979. "A Procedure for Generating Pareto-Efficient Egalitarian-Equivalent Allocations." *Econometrica* 47 (1), 49–60.

Cui, T. H., J. S. Raju, and Z. J. Zhang. 2007. "Fairness and channel coordination." *Management Science* 3 (8): 1303–1314.

Davis, D. D., and C. A. Holt. 1993. *Experimental Economics.* Princeton, NY: Princeton University Press.

Deutsch, M. 1985. Distributive Justice: A Social Psychological Perspective. New Haven: Yale University.

Dobhan, A. 2012. *Internal Supply Chain Management.* Bamberg: University of Bamberg Press.

Dubinsky, A. J., M. Kotabe, and C. U. Lim. 1993. "Effects of organizational fairness on japanese sales personnel." *Journal of International Marketing* 1 (4): 5–24.

Dwyer, F. R., P. H. Schurr, and S. Oh. 1987. "Developing buyer-supplier relationships." *Journal of Marketing* 51 (2): 11–27.

Eckel, C. C., and P. J. Grossman. 1996. "Altruism in Anonymous Dictator Games." *Games and Economic Behaviour* 16: 181–191.

Ertogral, K., and S. D. Wu. 2000. "Auction-theoretic coordination of production palnning in the supply chain." *IIE Transactions* 32 (10): 931–940.

Feess, E., G. Muehlheusser, and M. Walzl. 2008. "Unfair contestes." *Journal of Economics* 93 (3): 267–291.

Fehr, E., and K. M. Schmidt. 1999. "A Theory of Fairness, Competition, and Cooperation." *The Quarterly Journal of Economics* 114 (3): 817–868.

FitzRoy, F. R., and K. Kraft. 1987. "Cooperation, Productivity, and Profit Sharing." *The Quarterly Journal of Economics* 102 (1): 23–35.

Forsythe, R., J. L. Horowitz, N. E. Savin, and M. Sefton. 1994. "Fairness in Simple Bargaining Experiments." *Games and Economic Behaviour* 6: 347–369.

Frazier, G. L., R. E. Spekman, and C. R. O'Neal. 1988. "Just-in-time exchange relationships in industrial markets." *Journal of Marketing* 52: 52–67.

Friedman, D., and A. Cassar. 2004. "Finish what you started: project management." In *Economics Lab* edited by Daniel Friedman, Alessandra Cassar, and Reinhard Selten, 75–81. London: Taylor and Francis.

Friedman, D., and S. Sunder. 1994. *Experimental Methods: A Primer for Economics*. Cambridge: Cambridge University Press.

Griffith, D. A., M. G. Harvey, and R. F. Lusch. 2006. "Social Exchange in supply chain relationships: The resulting benefits of procedural and distributive justice." *Journal of Operations Management* 24 (2): 85–98.

Güth, W., R. Schmittberger, and B. Schwarze. 1982. "An experimental analysis of ultimatum bargaining." *Journal of Economic Behaviour and Organization 3* (4): 367–388.

Harrison, G. W., and K. A. McCabe. 1996. "Expectations and Fairness in a Simple Bargaining Experiment." *International Journal of Game Theory* 25: 303–327.

Hartwig, R., K. Inderfurth, A. Sadrieh, and G. Voigt. 2015. "Strategic inventory and supply chain behaviour." *Production and Operations Management* 24 (8): 1329–1345.

Ho, T. H., X. Su, and Y. Wu. 2014. "Distributional and Peer-Induced Fairness in Supply Chain Contract Design." *Production and Operations Management* 23 (2): 161–175.

Hoffman, E., K. McCabe, K. Shachat, and V. Smith. 1994. "Preferences, Property Rights, and Anonymity in Bargaining Games." *Games and Economic Behaviour* 7: 346–380.

Hyndman, K., S. Kraiselburd, and N. Watson. 2013. "Aligning Capacity Decisions in Supply Chains When Demand Forecasts Are Private Information: Theory and Experiment." *Manufacturing and Service Operations Management* 15 (1): 102–117.

Jap, S. D. 2001. "Pie Sharing in Complex Collaboration Contexts." *Journal of Marketing Research* 38 (1): 86–99.

Kabanoff, B. 1991. "Equity, Equality, Power, and Conflict." *The Academy of Management Review* 16 (2): 416–441.

Kagel, J. H., C. Kim, and D. Moser. 1996. "Fairness in Ultimatum Games with Asymmetric Information and Asymmetric Payoffs." *Games and Economic Behaviour* 13: 100–110.

Kahn, L. M., and J. K. Murnighan. 1993. "A General Experiment on Bargaining in Demand Games with Outside Options." *The American Economic Review* 83 (5): 1260–1280.

Kahneman D., J. L. Knetsch, and R. H. Thaler. 1986. "Fairness and the Assumptions of Economics." *The Journal of Business* 59 (4): 285–300.

Katok, E., and V. Pavlov. 2013. "Fairness in supply chain contracts: A laboratory study." *Journal of Operations Management* 31: 129–137.

Konovsky, M. A. 2000. "Understanding procedural justice and its impact on business organizations." *Journal of Management* 26 (3): 489–511.

Korsgaard, M., D. M. Schweiger, and H. J. Sapienza,. 1995. "Building Commitment, Attachment, and Trust in Strategic Decision-Making Teams: The Role of Procedural Justice." *The Academy of Management Journal* 38 (1): 60–84.

Kumar, N., L. K. Scheer, and J.-B. E. M. Steenkamp. 1995. "The effects of supplier fairness on vulnerable resellers." *Journal of Marketing Research* 32 (1): 54–65.

LaLonde, R. J. 1986. "Evaluating the Econometric Evaluations of Training Programs with Experimental Data." *The American Economic Review* 76 (4): 604–620.

McGrath, J. E. 1984. *Groups: Interaction and Performance*. Englewood Cliffs, NJ: Prentice Hall.

Mentzer, J. T., W. DeWitt, J. S. Keebler, S. Min, N. W. Nix, C. D. Smith, and Z. G. Zacharia. 2001. "Defining Supply Chain Management." *Journal of Business Logistics* 22 (2): 1–25.

Min, H., M. S. LaTour, and M. A. Jones. 1995. "Negotiation Outcomes: The Impact of the Initial Offer, Time, Gender, and Team Size." *Journal of Supply Chain Management* 31 (4): 19–24.

Montgomery, D. C. 2009. *Design and analysis of experiments*. Hoboken, NJ: John Wiley and Sons Ltd.

Nie, T., and S. Du. 2017. "Dual-fairness supply chain with quantity discount contracts." *European Journal of Operational Research* 258 (2): 491–500.

Ochs, J., and A. E. Roth. 1989. "An Experimental Study of Sequential Bargaining." *The American Economic Review* 78 (3): 355–384.

Plott, C. R. 1982. "Industrial Organization Theory and Experimental Economics." *Journal of Economic Literature* 20 (4): 1485–1527.

Praxmarer-Carus, S., E. Sucky, and S. M. Durst. 2013. "The relationship between the perceived shares of costs and earnings in supplier development programs and supplier satisfaction." *Industrial Marketing Management* 42 (2): 202–210.

Qin, F., F. Mai, M. J. Fry, and A. S. Raturi. 2016. "Supply-chain performance anomalies: Fairness concerns under private cost information." *European Journal of Operational Research* 252 (1): 170–182.

Rabin, M. 1993. "Incorporating Fairness into Game Theory and Economics." *The American Economic Review* 83 (5): 1281–1302.

Roth, A. E., and M. W. K. Malouf. 1979. "Game-Theoretic Models and the Role of Information in Bargaining." *Psychological Review* 86 (6): 574–594.

Roth, A. E., M. W. K. Malouf, and K. J. Murnighan 1981. "Sociological Versus Strategic Factors in Bargaining." *Journal of Economic Behaviour and Organization* 2 (2): 153–177.

Roth, A. E., and K. J. Murnighan. 1982. "The Role of Information in Bargaining: An Experimental Study." *Econometrica* 50 (5): 1123–1142.

Schmeidler, D. 1969. "The Nucleolus of a Characteristic Function Game." *SIAM Journal of Applied Mathematics* 17 (6): 1163–1170.

Schweitzer, M. E., and G. P. Cachon. 2000. "Decision Bias in the Newsvendor Problem with a Known Demand Distribution: Experimental Evidence." *Management Science* 46 (3): 303–420.

Shapley, L. S. 1953. "A Value for n-Person Games." In *Contributions to the Theory of Games,* edited by Harold W. Kuhn and Albert W. Tucker, 1–28. Princeton, NY: Princeton University Press.

Siegel, S., and L. E. Fouraker. 1960. Bargaining and Group Decision Making: Experiments in Bilateral Monopoly. New York: Niedernberg.

Smith, V. L. 1976. "Experimental Economics." *The American Economic Review* 66 (2): 274–279.

Sucky, E. 2004. "Coordinated order and production policies in supply chains." *OR Spectrum* 26 (4): 493–520.

Wagner, S. M., L. S. Coley, and E. Lindemann. 2011. "Effects of Suppliers' Reputation on the Future of Buyer-Supplier Relationships: The Mediating Roles of Qutcome Fairness and Trust." *Journal of Supply Chain Management* 47 (2): 29–48.

Walster, E. H., E. Hatfield, G. W. Walster, and E. Berscheid. 1978. *Equity: Theory and Research.* Boston: Allyn and Bacon.

Weg, E., and R. Zwick. 1994. "Toward the settlement of the fairness issues in ultimatum games." *Journal of Economic Behaviour and Organization* 24: 19–34.

Wu, Y., C. H. Loch, and L. Van der Heyden. 2008. "A Model of Fair Process and Its Limits." *Manufacturing and Service Operations Management* 10 (4), 637–653.

Zelewski, S., and M. L. Peters. 2010. "Fair Distribution of Efficiency Gains in Supply Networks from a Cooperative Game Theory Point of View." *International Journal of Information Systems and Supply Chain Management* 3 (2), 1–24.