A variety of bargaining concepts have been developed in the last six decades. The aim of this study is to reflect and discuss various aspects of established bargaining theories. Thereby, we bridge between traditional normative bargaining concepts and newer descriptive bargaining approaches. In particular, we highlight the model of aspiration adaptation and balancing, a descriptive bargaining model with normative power as well. The axiomatic model of aspiration adaptation and balancing is based on principles of bounded rationality and incorporates systematically experimental findings into economic bargaining theory.

JEL: C78, D03, D63, D74

Key words: bargaining theory, bargaining process, bounded rationality, aspiration levels
1. Introduction

Bargaining problems are widely discussed in the literature of social sciences, particularly by economists, psychologists and political scientists. As there is no one theory of bargaining, the paper intends to overview and to summarize the most important economic conceptions of bargaining and to present the main theoretical developments of the last six decades.

Without any doubt, Nash's cooperative bargaining solution has affected the research on bargaining theory fundamentally. Since Nash's introduction of a bargaining solution in 1950, cooperative bargaining theory has been dominated basically by axiomatic approaches based on normative requirements. However, since cooperative bargaining concepts neglect the bargaining process and bargaining behaviour, procedural non-cooperative dynamic approaches have been emerged as well. There, the sequential nature of a negotiation game is in the focus of the analysis and solutions are derived by some kind of equilibrium of strategic interactions based on a payoff maximizing individual rationality.

Beyond these traditional game theoretical research streams, descriptive bargaining models are becoming a more and more important topic. One reason is that theoretical solutions derived in bargaining models generally do not lead to good predictions for outcomes in practical bargaining situations. The observed behaviour differs very much from the concept of full rational behaviour. Newer descriptive procedural approaches try to bridge this gap by considering boundedly rational behaviour, which is observable in experimental and real-life negotiations.

Thus after having discussed advantages and disadvantages of common cooperative and non-cooperative bargaining models, we introduce a descriptive bargaining model that has normative power as well. We apply the theory of aspiration adaptation and describe descriptive conditions of boundedly rational bargaining behaviour axiomatically. The main axioms model aspects of concession making in negotiations and are motivated by results of decades of bargaining experiments. The axioms capture the aspiration securing principle and the prudence of own concession making. We present an area solution concept and prove that the concession making process and accordingly the bargaining outcome are characterised by the aspiration balancing principle. From experiments it is known that such an area solution is a good predictor for achieved bargaining agreements.

The paper is structured as follows. After a short characterization of the bargaining problem (chapter 2), we review basic bargaining literature by distinguishing between game theoretical approaches (chapter 3) and descriptive bargaining theories (chapter 4). Afterwards, we discuss the concepts of full and bounded rationality (chapter 5). Finally, we present the theory of aspiration adaptation and balancing (chapter 6).

2. The bargaining problem

Bargaining is an important social phenomenon and occurs in innumerable institutional settings. An example of a typical bargaining problem is a price negotiation, where two actors, a seller and a buyer, haggle over the price. However, the good at stake is not always money, but could be time, space,
quantities of resources or any other property. According to Nash (1950) “the economic situations of monopoly versus monopsony, of state trading between two nations, and of negotiation between employer and labour union may be regarded as bargaining problems.” However, the number of negotiation parties can be more than two as it is often the case within international multilateral negotiations such as the WTO or UN climate negotiations, with more than hundred participating countries and actors. With regard to these examples, bargaining problems may be extremely diverse. The main principles of bargaining should be formulated very general so that they are applicable to many different situations such as diplomatic relations, industrial relations, commercial or private relationships.

A bargaining problem or conflict arises when parties perceive that there might be a mutual surplus to be gained by cooperation while having diverging interests how to realize the cooperation. During the negotiation parties try to overcome the clash of interests and find a consensus all parties can agree to. A possible agreement may also depend on the parties’ evaluation of the alternative of ending in a disagreement and on the go-it-alone alternatives (BATNA, Raiffa, 1982) of each party. Accordingly, bargaining can be interpreted as a strategic interaction between two or more (possibly many more) parties to solve a problem of a single or numerous issues.

Focusing on the bargaining process, the process of joint decision making has to be considered. There may be rules of interaction. However, during the negotiation the parties resolve disputes and attempt to find outcomes which serve their mutual interests. Though possessing significant differences, the involved parties share an interest in finding a common position that is profitable and acceptable for each negotiator. As negotiations typically are dynamic processes that occur over time, communication and exchange of arguments between the actors are possible, often strategic coalition forming, too. Furthermore, there is room for each party to present her position and claims in the conflict and to submit proposals. Typically all involved parties have the right to accept a proposal or to reject it. Thus, in the negotiation process, individual, as well as shared objectives of the opponents appear, but conflicts of interests also become apparent. To reach an agreement concessions have to be exchanged in a reciprocal satisfying way. Finally, a successful negotiation process finishes with a joint agreement, if all involved parties accept a proposal. Contrary, if the concession process does not end up in an agreement, the negotiation fails and parties drop back to the disagreement alternative. Under most negotiation rules it suffices that one party declares her break off of the negotiation process in order to induce a failure of the whole process.

There are various ways of analysing bargaining problems economically. We distinguish between game theoretical models and descriptive bargaining models based on experimental findings. Accordingly, in a first step, we highlight the most important game theoretical bargaining approaches. Afterwards we focus on procedural descriptive bargaining approaches based on experimental findings and evidence from case studies.
3. Game-theoretical bargaining models

As Young (1991) pointed out “the principle theoretical tool for analyzing negotiations is the theory of games”. In the past 60 years, an impressive amount of game theoretical research has been published. Both cooperative and non-cooperative game theoretical concepts have shed light on the bargaining problems.

In particular, the Nash bargaining solution (Nash, 1950) has strongly affected the cooperative bargaining literature in the last six decades. Cooperative bargaining problems can be seen as problems of fairly distributing a cooperative surplus between n persons. In this review we will concentrate on two-person-bargaining knowing that many of the presented models can be generalized. The basic cooperative bargaining model can be shortly summarized as follows. Two persons are confronted with a bargaining problem in an economic environment consisting of a set of feasible alternatives X (closed under lotteries on finite numbers of alternatives) and a disagreement alternative, the so-called status quo x₀. Each person is assumed to evaluate the alternatives in X by her cardinal von-Neumann-Morgenstern-utility function u₁ or u₂ respectively. Applying the pair of utility functions to (X,x₀) leads to (S,d), where S is the bargaining set representing all feasible alternatives in utility space and d is the image of the status quo in utility space. (S is assumed to be convex and compact and d is an element of S.) If they can agree on a special alternative s=(s₁,s₂) in S, s represents the payoffs of both persons in terms of their utility. If they do not find an agreement, such that the bargaining fails then the players end up with their payoff at the disagreement point d=(d₁,d₂).

The question is now, which alternative within the bargaining set S can be seen as a reasonable compromise between two rational acting players. It was Nash (1950) firstly defining a solution as a function that associates to each bargaining problem (S,d) a certain point in S, which can be interpreted as the bargaining solution of (S,d). Nash’s cooperative bargaining solution is based on a system of axioms requiring individual and collective rationality and some further normative properties. He proposed that a solution function on the set of all bargaining situations should be individually rational and satisfy the following four axioms: 1) Invariance under positive affine transformations, 2) Pareto-optimality, 3) Symmetry and 4) Independence of irrelevant alternatives (Roth, 1979a). Nash proved the existence of a unique solution function satisfying individual rationality and the four axioms and he argued that rational agents will choose what is known as the Nash Bargaining Solution by maximizing the product of utility gains from disagreement point d within the individually rational subset of S, which is generally referred to as the Nash-product. Nash’s bargaining model and his solution dominated cooperative bargaining theory a very long time and shaped the subsequent research. Since the mid-1970th cooperative bargaining theory has expanded in many directions and various other solutions have been proposed based on different normative requirements for the agreement point. As an important alternative to Nash the solution function by Kalai and Smorodinsky (1975) has to be mentioned. Their model is in line with ideas from the early 1950s by Raiffa who had worked on a concept, where the solution reacts to changes in irrelevant alternatives. Kalai and Smorodinsky substituted axiom 4 (Independence of irrelevant alternatives) with an appropriate monotonicity condition. The Kalai-Smorodinsky solution uses the so-called ideal point ̄x consisting of the pair of maximal utilities of each person in the individually rational subset of S and the respective utility gains.
for each person between status quo and ideal point. The solution is defined to be the point in the individually rational subset of the bargaining set S at which utility gains from disagreement point d are proportional to the ideal gains of the two agents and they are maximal. Thus, the solution maintains the ratios of maximal gains and is Pareto-optimal. Further cooperative solutions were introduced by Kalai (1977), Myerson (1977), Roth (1979b), Nielson (1983), Moulin (1985), Chun and Thomson (1990), Bossert (1992) and others which characterize proportional distributions of bargaining gains, or solutions requiring interpersonal comparisons of utility. The concept of an ideal point is defined depending on the given bargaining problem. Based on the fact that bargainers may have external claims which are not mutually compatible Chun and Thomson (1992) proposed a proportional solution that equalizes gains relative to the claimed gain, i.e. the solution of a situation is the point on the Pareto frontier of the feasible set and lies on the line segment connecting the disagreement point and the claims point. Assuming the existence of interpersonal comparisons of utilities, Bossert (1992) characterized the claim egalitarian solution to bargaining problems with claims. Whereas general egalitarian solutions for bargaining problems without claims equalize the gains of all agents over their respective components of the disagreement point, the claim-egalitarian solution equalizes the losses of all individuals from their claims. Bossert (1992) shows that the claim-egalitarian solution satisfies strong disagreement point monotonicity as well as a strong claims point monotonicity.

Cooperative bargaining models provide useful insights into the understanding of normative properties of solutions to bargaining problems. On the other hand, non-cooperative game theory concentrates on the analysis of strategic interactions. Non-cooperative bargaining games attempt to capture mathematically behaviour in strategic situations, where an individual's success in making choices depends on the choices of others. These strategic approaches are outcome related. Choices of each party in a negotiation are a part of her strategy depending on expected behaviour of others and of course on the payoff values of the available outcomes. The simplest model of a non-cooperative bargaining procedure is "the Ultimatum-Game" a game, introduced into the experimental literature by Güth, Schmittberger and Schwarze (1982). The Ultimatum-Game is a two-person one-shot bargaining game with perfect information. A given amount of money (a cake) has to be distributed between two players. Player I (proposer) makes a proposal for the distribution to player II (responder), who may then either accept or reject this proposal. If the responder accepts the proposal, it defines the payoffs for both players. If the responder rejects it, both players receive nothing. This simple model refers to an everyday bargaining procedure, for instance when a seller wants to sell a product in a store and a potential buyer decides to buy the product for a given price or not. The appropriate solution concept is that of subgame perfectness of Nash equilibrium (Selten, 1965). The subgame perfect Nash equilibrium for the Ultimatum-Game is the following pair of strategies: 1.) the proposer offers the smallest possible amount and 2.) the responder accepts any positive amount.

Based on the bargaining problem of how to “divide a cake” also two-stage (or more stages) bargaining games can be modelled. In such a finite bargaining game, player II can make a counterproposal if she has rejected player I’s initial proposal. According to the shrinking cake phenomena, it is assumed, that the players prefer to get the money sooner rather than later. The impatience of each player is modelled by a discount factor per time period applied to her payoffs. “The Infinite Horizon Game" by
Rubinstein (1982) refers to the bargaining procedure where the game can be played infinite times. The bargaining process is modelled as a dynamic game in which the players take turns making proposals and counter-proposals as long as one party accepts a proposal made by the other party. In equilibrium the players reach an agreement in the first round. Consequently, the outcome is not a result at the end a bargaining process over time, but according to the rationality concept is determined by the first round proposal. The basic model of Rubinstein is only effective for two players and an expansion leads to conceptual difficulties (Berninghaus, Erhard, Güth, 2006). Furthermore, the result of Rubinstein depends on the assumption of divisibility of the bargaining pie.

However, a gap between game theoretical thoughts and observable behaviour in bargaining experiments occurs. Both, cooperative and non-cooperative bargaining concepts, have been tested in numerous bargaining experiments (see e.g. Kagel and Roth, 1995; Klemisch-Ahlert, 1996; Camerer, 2003; Güth et al., 1982). Overall, no concept provides reliable predictions for agreements in bargaining experiments. The main disadvantage is that game theoretical concepts lack many features that characterize real-life negotiations, including problems with information, learning, dynamics and behavioural norms. Cooperative as well as non-cooperative concepts assume that preferences and payoffs are common knowledge, which is in general not the case in real negotiations. In addition theory assumes that all actors act rationally by maximizing some goal function. However, experimental observations show that fully rational behaviour is limited due to human cognitive restrictions and because of norm guided behaviour. Empirical experimental evidence contradicts the principle of strict rationality and destroys the confidence in the optimization approach to the explanation of economic behaviour (Selten and Schuster, 1970; Güth et al. 1982; Kahnemann et al. 1986; Roth et al. 1991, Camerer et al. 1995; Fehr and Gächter 2000). In complex, but even in “simple” decision situations, people’s behaviour does not follow the theoretical principles of complete rationality; therefore, game theoretical results should not be applied directly and uncritically to behavioural processes in the real world.

4. Descriptive, procedural bargaining approaches

Besides strategic and normative bargaining models, the literature also provides procedural bargaining approaches. As already pointed out, bargaining can be seen as a process of adjusting divergent interests. Therefore, the centre of procedural bargaining studies is the search process for an agreement, an aspect which is completely disregarded by game theoretical models mentioned above. This gap is closed by plenty of studies, which focus on the bargaining process and meet the sequential character of a negotiation. Major contributions trace back to Zeuthen (1930), Schelling (1960), Iké (1964), Zartman (1978) and Raiffa (1982) and others. They consider bargaining situations between two bargainers as mutual adjustment processes of a continuous variable. Thus, negotiations are modelled as adaptation processes, in which bargaining parties successively change concessions. Most studies try to identify the main factors influencing the concession- and decision behaviour of the involved parties. For instance, Zeuthen (1930), Pen (1952), Bartos (1974/1978), Harsanyi (1979), Cross (1969/78), Hicks (1975), Pruitt (1981) developed dynamic bargaining algorithm by using concession rules, which describe the concession making behaviour of individuals or groups,
particularly the sequence and size of concessions. Such dynamic and reactive approaches try to model the convergence process to an acceptable agreement. However, very different approaches have been developed.

Already 1930 – long before Nash formulated his cooperative bargaining solution- Zeuthen analysed bargaining processes of wage negotiations between employees and employers and developed a model of an alternating concession process considering full rationality of bargaining steps. If bargainers make proposals in a bargaining situation that are not compatible\(^3\), a principle is needed to decide which player should or will make the next concession. Crucial for this criterion is the individual conflict risk or relative loss. Players compare each other’s readiness to risk disagreement. According to Zeuthen, the player whose relative loss is smaller has to make a concession.\(^4\) As the model was further extended and formalized by Harsanyi in 1956 it is now generally established as the Harsanyi-Zeuthen bargaining procedure. Harsanyi showed that players following Zeuthen's principle during a bilateral bargaining process will reach an agreement corresponding to the Nash solution. However, the sequence of concessions is not pivotal for the bargaining outcome.

Bartos (1974, 1978) describes bargaining as a reactive concession exchange between two parties. Contrary to the Zeuthen-Harsanyi-Model he developed a descriptive adaptation algorithm, which is determined by a fair concession making behaviour. In his 'Simple Model of Negotiation' (1978) he criticizes explicitly the assumption of full rationality and the maximization quest of game theory. In fact, he regards a negotiation as a dual process, which is affected by opposed motivations. On the one hand, bargaining parties behave competitive and aim to realize high individual gains. On the other hand, cooperative behaviour appears, as they aspire to a fair and mutual agreement. It is the main conclusion of Bartos, that fair and cooperative human behaviour dominates the rational economic view, as fairness is a social norm. Considering that negotiation as a give-and-take-process, all involved parties have to make compromises. Concessions have to be reciprocal and bargainers expect returns to their concessions. Non-reciprocity is evaluated as unfair behaviour, which can lead to stagnancy and failure of negotiations. However, large concessions may lead to excessive expectations of the opponent, which also may lead to a failure of negotiation. Consequently, proposals should be moderate and concessions should be balanced.

A further interpretation of bargaining processes is provided by Cross (1978). According to incomplete information on goals and strategies of the opponent bargaining processes are mainly determined by the expectations of opponents' behaviour. The continuous adaptation of the expectations is result of a permanent learning process. Based on the fact, that bargaining problems are not manageable one-dimensionally, Cross requires a “traded concession making” across different issue dimensions. Concessions should be given within issues which are less relevant for one, in order to achieve concessions for important issues. According to Cross' “searching and trading – philosophy” in negotiations the bargaining corridor should be extended and reciprocal acceptable concessions and adaptation ways should be searched. Thus, Cross understands bargaining as a search- and learning

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\(^3\) Proposals in utility space are incompatible, if Player 1 proposes the point \(x=(x_1,x_2)\) and player 2 proposes \(y=(y_1,y_2)\) with \(x_1>y_1\) and \(y_2>x_2\).

\(^4\) Relative conflict losses: \(r_1=\frac{(x_1-y_1)}{x_1}\) and \(r_2=\frac{(y_2-x_2)}{y_2}\). If \(r_1<r_2\), person 1 concedes.
process, which develops an adaptive dynamic and finally leads to a convergence of interests. Hereby, learning is seen as a factor, which increases cooperative behaviour.

Beyond that, negotiations are also influenced by psychological issues. For instance Spector (1978) and Pruitt (1981) show that psychological aspects, such as personality, persuasiveness, perception and perspective taking ability, are determining factors of bargaining. According to Spector (1978, p. 66): “Each negotiation case is conceived to be a distinct and unique mixture of personality, perception and persuasion. Different negotiators will bring their different styles to the bargaining table”.

A comprehensive descriptive theory of distributive bargaining is developed by Raiffa (1982). According to Raiffa, a reciprocal concession making is necessary to overcome the conflict between two agents – the “high aspirer” and the “low aspirer” (for instance price negotiation between a seller and a buyer). This process is called “dance of concessions” (figure 1). Essential aspects influencing the concession dance are as follows: BATNA, reservation values, planned goals, initial positions or rather opening proposals, the first concession as well as concession value, sequence of concessions and concession resistance. The reservation prices are determining factors to locate the agreement area. Thus, the so called zone of possible agreement (ZOPA) is the range of possible solutions for the final contract.

A typical concession process is a sequence of alternating proposals \((a_1; b_1; a_2; b_2 \text{ and so on})\), where the opening proposal of the seller \((a_1)\) exceed his reservation price and conversely, the opening proposal of the buyer \((b_1)\) is lower than his reservation value (figure 1). However, the initial proposals should not be exaggerated and not too far away from the reservation prices of the opponent. The concessions by the seller are usually monotonically decreasing and those by the buyer are monotonically increasing. Thus, concessions are made only in a single direction. There should not be inefficient backward movements during a negotiation. Concessions that were once made by one proposer in favour of his opponent should not be withdrawn at later stages of the negotiation, as one of the principles of good faith bargaining is that once concession is made, it is not reversed.

The main question is, however, how to share the bargaining surplus. Obviously, the focal point would be the middle between the reservation prices. Empirical results of hundreds of bargaining experiments by Raiffa and Hammond at Harvard University show that the best prediction of the final contract \((x^*)\) is the midpoint between the opening offers \((a_1 \text{ and } b_1)\), provided that the midpoint falls within the zone of possible agreements (Raiffa et al., 2002, p. 114).

However, as in bargaining situations there is no symmetric information between bargainers about their reservation prices it is important to anticipate the opponents’ conflict limit, as bluffing and distorted signalling may be strategic tactics to manipulate the bargaining partner in order to achieve advantages.
All mentioned procedural, descriptive bargaining theories focus on the bargaining process. Contrary to normative game theory, procedural bargaining studies aim to represent real-life human behaviour to achieve insights into the concession making behaviour. Although, there are many different approaches, there is no general descriptive theory which considers all the factors influencing bargaining behaviour. “The numbers of variables playing a role in the negotiation process is presumed to be rather large. Their role is as yet not fully or convincingly understood and additional difficulty being to establish the independent variable that would permit one to determine why a negotiator selects one path over another (and what kind of parameter is involved)” (Dupont, Faure, 2002, p. 49).

Nevertheless, it is possible to draw some general conclusions from the procedural bargaining studies (figure 2). Concluding, concession making is not a result of full rationality. Moral norms and even cultural aspects (Henrich, 2000; Gaechter et al. 2010) have to be considered, too, when explaining
bargaining behaviour. Different categories of fairness are norms that have an effect on bargaining. This includes reciprocal as well as monotonic concession making and certain equality or proportionality norms for agreements on distributions of resources.

5. Bounded rationality and aspiration levels

Economic theory is mainly based on the fully rational behaviour of individuals. The homo oeconomicus is endowed with great capabilities of solving problems and has no restrictions concerning his perceptual, cognitive, and intellectual capacities.

However, practical decision-making differs very much from the behaviour of utility maximization which models of rational decision-making predict. Already in the early 1950s in many experimental studies it has been shown that people’s decision behaviour does not follow the principles of complete rationality (Sauermann and Selten, 1962). Empirical evidence contradicts ideal optimization behaviour of individuals, which is postulated by neoclassical theory (int. al. Selten and Berg, 1970; Pruitt, 1970; Selten 1990). In reality, the decision maker is subject to the bounds of rationality. Due to their limited amount of information and limited cognitive capabilities people cannot make optimal decisions. In general a person neither knows the solutions of the mathematical problems underlying her decision task nor performs computations immediately. Restricted human computational and memory capacities as well as incomplete information and uncertain expectations limit the rationality principle (Simon, 1955) and restrict the scope of applicability of theories which assume strict rationality.

Against this background, the question arises how observed human behaviour can be explained and modelled within a theory. A more realistic approach is the concept of bounded rationality, which was already developed by Simon in 1955 and which explains observed human decision-making by aspiration levels that have roots in psychology (Lewin et al., 1944), together with the “aspiration satisficing principle”. An aspiration level is a value of a goal variable, which must be reached or surpassed by a decision alternative. If the aspiration level is met, the decision maker is satisfied. Accordingly, a decision-maker does not search for the best solution; he is satisfied with a “good enough”-solution in this way reducing search and computational effort. Thus, the theory of aspiration levels describes decision-making as a goal striving behaviour. Goal striving is a rationality principle underlying non-optimizing adaptive behaviour of real people; however, it is not irrational.

6. Negotiation Analysis by Aspiration Levels

Stimulated by the work of Simon on bounded rationality as well as the aspiration adaptation theory of Sauermann and Selten (1962) aspiration based bargaining research expanded in the 1970s. Experimental research on aspiration levels is of importance for the development of aspiration based bargaining theory.

6.1 Experimental Findings

In the 1960s and 70s bargaining experiments have been conducted to analyse bargaining behaviour by observing aspiration levels. The focus has been on aspiration forming as well as on the influence of
aspiration levels on the behaviour of bargaining parties during the bargaining process (see e.g. Siegel and Fouraker, 1960 and 1964; Kelley et al. 1967; Morgan and Sawyer 1967; Liebert et al. 1968; Holmes et al 1971; Tietz 1972a,b,c, and 1975; Weber 1976; Crott 1971, Crott et al. 1974). These experiments provide useful insights into bargaining processes and behaviour. However, there are different specific focuses. These are for instance the identification of aspiration forming, the relevance of aspiration levels for the bargaining process, aspects of availability of information, the relevance of the first proposal, the conflict limit as well as the concession making behaviour, particularly the concession sequence and concession size.

For instance, the experiments of Siegel and Fouraker (1960 and 1964) addressed the question of the effect of aspiration levels on the payoff distribution in bargaining by bilateral monopolists. They, as well as Morgan and Sawyer (1967) showed that “the larger share of the joint payoff will go to the bargainer with the higher level of aspiration” (Siegel and Fouraker, 1964, p. 136). Accordingly, agents with high aspiration levels on average achieve higher payoffs than agents with low aspiration levels. These findings support the assertion that aspiration levels are important determinants of payoff distributions and thus of the price in a bilateral monopoly (p. 143).

The forming of aspirations and the role of information are in the focus of experiments by Liebert et al. (1968). They show that due to asymmetric information bargaining behaviour differs between parties. In case of asymmetric information bargainers do not know the gain potential of the opponent. Thus, a realistic estimate of a fair and appropriate gain division is hindered. In such a case analysing the opponents behaviour, especially his first proposal, is essential for the own aspiration forming. Experimental results of Liebert et al. (1968) show that uninformed bargainers use opponents’ bids to set their own goals and aspirations, while contrary, informed bargainers use them to assess the reasonableness of the opponents’ goals, which can lead to a more successful and efficient bargaining process and an information dependent outcome.

There are further factors influencing the aspiration forming. According to Lamm (1975) and Weber (1976) the need of an agreement, personal factors, success and failure in previous negotiation situations as well as the expectations on the opponent’s behaviour are determining factors of aspiration forming behaviour.

Besides the relevance of information level and first proposal the conflict limit is also an important issue determining the bargaining outcome. According to Kelley et al. (1967) the conflict limit is the aspiration level which must be reached so that a negotiation will not break up.

This selection of very early bargaining experiments highlights the beginning of aspiration based bargaining research and provides useful insights into the meaning of aspiration levels in negotiations. However, the main objective of these experiments was to study specific individual aspects of negotiations and not to formulate a comprehensive bargaining theory.

A generalisation of such results was firstly presented by Tietz (1972) and Tietz and Weber (1972). Based on experimental findings, Tietz and Weber (1972) extended the theory of aspiration adaptation by Sauermann and Selten (1962), to bilateral and multilateral problems by considering the interaction of aspiration-oriented individuals, i.e., the mutual aspiration adaptation in bargaining situations (see
also Selten 1998). The complex macroeconomic bargaining experiments KRESKO as well as the results of many other bargaining experiments were the basis for the formulation of a descriptive bargaining theory. The dynamic aspiration balancing theory explains the bargaining outcome by a multi-stage decision process (Weber and Tietz 1975). The theory includes a model for the aspiration adaptation by bargaining agents, the concession sequence and the bargaining outcome. The aspiration balancing theory provides a good prediction of bargaining results, what is experimentally proven in many studies (Weber und Tietz, 1975; Tietz, 1975; Tietz and Weber, 1978; Tietz and Bartos, 1982; Crott et al. 1974; Scholz, 1979 and 1980; Tietz, 1997). This model was further developed by Ahlert (2007) to a model of a one-dimensional bargaining process based on behavioural axioms.

6.2 Aspiration Adaptation and Balancing in Negotiation

6.2.1 Basic Aspiration Levels

Contrary to traditional cooperative bargaining theory, the model of aspiration balancing is not based on utility functions. Rather, the set of alternatives, i.e. the bargaining set, is partitioned by the aspiration levels of each involved party and the bargaining process is structured by the positions of the several aspiration levels. According to the experimental findings by Tietz (1972), Tietz and Werner (1982) as well as Tietz and Bartos (1982) basically five aspiration levels determine the bargaining process. The basic structure of aspiration levels of a negotiating person may be summed up as follows (figure 3):

Figure 3: Hierarchy of aspiration levels

<table>
<thead>
<tr>
<th>Preference</th>
<th>Enforceability</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) planned goal (P);</td>
<td></td>
</tr>
<tr>
<td>(2) agreement seen as attainable (AT);</td>
<td></td>
</tr>
<tr>
<td>(3) lowest acceptable agreement (AC);</td>
<td></td>
</tr>
<tr>
<td>(4) conflict threat; i.e., the planned threat to break off negotiation (T);</td>
<td></td>
</tr>
<tr>
<td>(5) conflict limit; i.e., the planned break off of negotiation (L).</td>
<td></td>
</tr>
</tbody>
</table>

Source: Tietz (1972); Ahlert (2007)

“Experiments indicate that the preceding five levels should be expected to play a role in practically all real world bargaining processes and the mental process of a typical bargainer,” (Ahlert, 2007, p. 122). These aspiration levels have a “natural” ranking according to the preferences of the actors, individuals prefer to reach an agreement in a higher aspiration levels.\(^5\) However, a higher preference is connected with a lower enforceability of an aspiration level (Tietz, 1972; Weber 1976). In one-dimensional bargaining situations an ordinal aspiration ranking can be presented for each bargainer.

The intervals between two adjacent aspiration levels of a person form aspiration ranges \(r_a\) or \(r_b\) which are partitions of the bargaining set \(X\). The aspiration ranges of person a are denoted by \(A_1\) to \(A_6\) and those of person b by \(B_1\) to \(B_6\).

\(^5\) \(P > AT > AC > T > L\); Thus, \(P\) is the highest level and \(L\) is the lowest one.
In one-dimensional negotiations the aspirations of the two persons are ordered inversely. Figure 5 shows the opposed aspiration ranking of the bargainers a and b (figure 5). A high aspiration range of one person is faced with a low aspiration range of the opponent.  

**6.2.2 Bargaining Process**

In this chapter we present the dynamic model of aspiration balancing of a two-person one-dimensional bargaining process. We choose the form of alternating proposals, such that in each round \( t = 1, 2, 3, \ldots \) of the negotiation each person makes a proposal. The proposal of person a in round \( t \geq 1 \) is denoted by \( p_t(a) \) and that of person b by \( p_t(b) \), respectively. All proposals are elements of the bargaining set \( X \).

The sequence of proposals continues until the process stops with an agreement or disagreement. Following aspects of decision making in the bargaining process are modelled:

- bargaining start;
- conditions for agreement;
- conditions for disagreement;
- principles of aspiration adaptation, which are

\[ A_1, \ldots, A_n \text{ are the aspiration ranges of person a, and } B_1, B_n \text{ are aspiration ranges of person b. For any alternative } x \in X \text{ we consider the index of the aspiration range of person a and the range of person b in which } x \text{ can be found, } r_a(x) \text{ and } r_b(x): r_a(x) = i \leftrightarrow x \in A_i; \text{ and } r_b(x) = k \leftrightarrow x \in B_k. \text{ (cf. Ahlert, 2007).} \]
• concessions in own aspirations and concessions in aspiration ranges of opponent;
• aspiration securing principle, and
• prudence of own concession making.

**Bargaining start**

The choice of the first proposal \((p_1(j))\) of a bargaining person \(j\) is a very essential step in a bargaining process. (Siegel and Fouraker, 1960; Liebert et al., 1968; Bartos, 1974; Raiffa et al., 2002). On the one hand, the first proposal provides relevant information about the own bargaining objectives to the opponent. On the other hand, according to the initial demands it can be seen, whether there is a potential for bargaining or not. The opening proposals have to be chosen according to two aspects. Firstly, the first proposal has to satisfy the own maximal aspirations. Secondly, it has to secure minimally the conflict limit (lowest aspiration level) of the opponent in order to not to endanger the negotiation by a too high demand. An opening proposal which is below the opponents’ conflict limit might directly lead to a deadlock of the negotiation as the opponent cannot identify a common bargaining and agreement area. However, the opening proposal should not be too low either as this could suggest to the opponent a low but wrong bargaining objective.

Accordingly, the bargaining start can be characterized as follows:

Each bargaining person chooses the first proposal from her best aspiration range, i.e. \(r_a(p_1(a))=1\) and \(r_b(p_1(b))=1\). This proposal has to secure the lowest aspiration range of the opponent \((r_a(p_1(b))\leq 6\) or \(r_b(p_1(a))\leq 6\)) (see figure 6).

**Figure 6: Example of a bargaining start**


**Agreement**

The aim of bargaining is to achieve a mutually satisfying agreement. An agreement is reached if the proposal of one bargaining person is accepted by the opponent. Ahlert (2007) has assumed that a person agrees to a proposal, if the opponent’s proposal lies in the same aspiration range as the last own proposal of the responding person (figure 7) or is even better.
Disagreement

As a rule of the game Ahlert (2007) has modelled that a person announces her final disagreement if this person makes a proposal in her own lowest aspiration range, i.e. outside her conflict level. If and only if this happens, the process ends with a disagreement.

Concession making rules and principles of aspiration adaptation

After the opening proposals the sequential concession making process starts. Concessions require moving away from original objectives in favour of opponents’ aspirations. Which rules does the concession making follow? According to boundedly rational behaviour, we define rules and conditions under which a person makes a concession or defends her aspiration level. Figure 8 summarizes the principles of the adaptation process.

Figure 8: Rules of aspiration adaptation in bilateral bargaining situations

Aspiration adaptation: concessions in own aspirations and weak monotonicity of concessions in aspiration ranges of opponent

According to traditional aspiration adaptation theory, a boundedly rational person is going to reduce her aspiration level if she cannot achieve it. The process of adjustment is characterized by a (double) weak monotonicity of concessions. Aspiration adjustments are assumed to be always monotonic. Firstly, the proposals of a person are monotonically decreasing with respect to her own aspiration ranking, which means that the numbers $r$ of her own levels are weakly decreasing. This requirement models the direction each person adopts her aspiration in case it is necessary. In addition the maximal step size is one, i.e. if necessary the person adapts her aspiration level to the next lower one. Secondly, interpreting her proposals as offers to the opponent, they are weakly improving the opponent’s aspiration levels, which is described by decreasing numbers $r$. In the model the concession behaviour of a person does not lead to a worsening of the opponent’s position, but to an improvement measured by higher aspiration levels. It is assumed that concessions that were made by one proposer in favour of his opponent are not withdrawn at later stages of negotiation. 

Aspiration securing principle

Beside the adaptation rules without interaction above now the principles of aspiration adaptation with interaction of the negotiating parties will be presented. The key question is: Who makes the next concession? This is assumed to be dependent on the actual aspiration levels of own and opponent’s proposal, i.e. on four levels, two for each person. “Both parties have to compare the size of concessions they have already made in their last proposals in terms of their own aspiration levels. Each person also considers her opponent’s aspiration level that is reached by her last proposal and her own aspiration level defined by the opponent’s last proposal” (Ahlert, 2007). In bargaining experiments it is observed, that under certain circumstances subjects secure their aspiration level. Ahlert (2007) models this behaviour in an axiom formulizing the following rule. A person defends (secures) her aspiration range if her aspiration level offered by the opponent is worse than the aspiration level she offered to the opponent. This is a situation where a person has already given up at least as much as the opponent but is not treated equally well by the opponent (Ahlert, 2007). Thus, a bargaining party will wait until the opponent will make a better offer. The aspiration securing principle makes sure that mutual offers are balanced considered from the perspective of what one gets. A comparison of secured aspiration levels is a reasonable decision rule that prevents bargainers from being exploited.

However, in order to have a convergence some rule for making perceivable concession has to be formulated.

\[\text{Axiom: Aspiration Adaptation: For both persons } j \in \{a,b\} \text{ and for all } t = 1,2,\ldots,t_0-1: r_j(p_{t+1}(j)) = r_j(p_t(j)) \text{ or } r_j(p_{t+1}(j)) = r_j(p_t(j)) + 1 \text{ holds.} \]

\[\text{Axiom: Weak Monotonicity of Concessions in Aspiration Ranges of Opponent: For all } t = 1,2,\ldots, t_0-1: r_b(p_{t+1}(a)) \leq r_b(p_t(a)) \text{ and } r_a(p_{t+1}(b)) \leq r_a(p_t(b)) \text{ (cf. Ahlert 2007).} \]

\[\text{Axiom: Aspiration Securing Principle: If } r_a(p_t(a)) \leq r_b(p_t(b)) \text{ and if } r_a(p_t(b)) > i \text{ and } r_a(p_t(b)) > r_b(p_t(a)) = :k \text{ and if there exists } x \in A \text{ such that } p_{t+1}(a) = x \text{ is admissible, then person a chooses an admissible } p_{t+1}(a) \in A \text{ (cf. Ahlert 2007).} \]


**Prudence of own concession making**

Besides the balancing of secured aspiration levels the balancing of proposals is important. In case both bargaining parties have secured the same aspiration level in offers but one person has given up less aspiration levels than the other measured in her own proposals, than this person should be prudent and give up an aspiration level in the next step. “A person should not try to force the opponent to make an even larger concession by insisting on her own aspiration level for the next period as well, as this might lead to a prolonged negotiation process or even to a failure” (Ahlert, 2007).  

Figure 9: Example for Aspiration Securing Principle

![Prudence of own concession making](image)

Source: Ahlert, 2007; Lajtos 2010.

Figure 9 illustrates a situation where one person secures her level. Figure 10 gives an example for a situation where prudence of concession making applies. Figure 11 illustrates some examples of aspiration adaptation according to aspiration securing principle and prudence of own concession making. The three examples show which person should make the first, the next and the last concession.

Figure 10: Example of prudence of concessions

![Prudence of own concession making](image)

Source: Ahlert, 2007; Lajtos 2010.

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9Axiom: Prudence of own Concession Making (for Person a): If there is no agreement in t implied by the Axiom Agreement, and if \( r_a(p(a)) < r_b(p(b)) \), than at time \( t+1 \) two cases can happen: 1.) If \( r_a(p(b)) = r_a(p(a)) + 1 \), then person a agrees to \( p(b) \). 2.) If \( r_b(p(b)) > r_b(p(a)) + 1 \), then for person a’s proposal at time \( t+1 \) \( r_a(p(a)) = r_a(p(a)) + 1 \) holds (analogously for person b) (see Ahlert 2007).
Figure 11: Examples of aspiration adaptation under the axioms

<table>
<thead>
<tr>
<th>Example 1:</th>
<th>Example 2:</th>
<th>Example 3:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person a</td>
<td>Person a</td>
<td>Person a</td>
</tr>
<tr>
<td>A1 A2 A3 A4 A5 A6</td>
<td>A1 A2 A3 A4 A5 A6</td>
<td>A1 A2 A3 A4 A5 A6</td>
</tr>
<tr>
<td>p(a)</td>
<td>p(a)</td>
<td>p(a)</td>
</tr>
<tr>
<td>r_a(p(a))</td>
<td>r_a(p(a))</td>
<td>r_a(p(a))</td>
</tr>
<tr>
<td>B6 B5 B4 B3 B2 B1</td>
<td>B6 B5 B4 B3 B2 B1</td>
<td>B6 B5 B4 B3 B2 B1</td>
</tr>
</tbody>
</table>

Person a makes first concession.

Person b makes next concession.

Person a makes next concession and agrees to p_b(a).

Source: Ahlert, 2007; Lajtos 2010.

**Bargaining result: aspiration balancing**

The weighting of interests during the bargaining process is based on assumptions of bounded rationality as well as fairness principles. The bargaining is described by a mutual, reciprocal and step-wise aspiration adjustment process, where individuals care about own and their opponent’s aspiration levels and behaviour. Crucial for decisions in step t are the four aspiration ranges defined by the last
proposals in round t-1, \( r_a(p_{t-1}(a)); r_a(p_{t-1}(b)); r_b(p_{t-1}(a)); r_b(p_{t-1}(b)) \). These ranges are used for the evaluation of the individual bargaining positions and are the basis for further decisions according to concessions.

The interaction of the described adaptation mechanisms leads to an aspiration balancing which can be interpreted as the primary principle of the concession process (Tietz and Weber, 1978; Tietz and Bartos, 1982). “A comparison of the aspiration grids of the bargaining partners yields, e.g. by means of the static aspiration balancing principle, an agreement value or range at which both partners reach, as far as possible, equally high aspiration levels” (Tietz, 1997). Such an agreement is considered as a fair one by all bargaining actors.

On the basis of the axiomatically founded dynamic aspiration balancing theory for bargaining problems of the considered type an agreement area can be modelled. Ahlert (2007) defines the agreement area of the process as a set \( S \) of solution candidates which is the intersection of the smallest aspiration ranges \( s \) of both persons such that there are common alternatives in these ranges or in preferred ones.\(^{10}\) She proves that under assumptions of finitely many alternatives and finitely many repetitions of proposals each bargaining process that follows the proposed behavioural axioms ends up with an agreement in the defined agreement area and that each point in the agreement area could be the agreement of some process following the rules of the axioms. Thus the presented theory leads to a characterization result for feasible agreements which is based on axioms derived from descriptive theories. In figure 12 the agreement area for a two-party one-dimensional bargaining situation according to the principle of aspiration balancing is illustrated.

**Figure 12:** Agreement area

![Agreement area](source)

Source: Ahlert, 2007; Lajtos 2010.

### 7. Conclusion

In contrast to traditional game theory the concept of aspiration balancing is derived from behavioural assumptions on bounded rationality that have been observed in many experiments conducted over decades (e.g. Tietz, 1975; Weber and Tietz, 1975; Tietz and Bartos, 1982; Ahlert 1996). The concept

\[ s := \min \{ k | (U_{i=1+k} A_i) \cap (U_{j=1+k} B_j) \neq \emptyset \} \]

\( s \) is the smallest index of aspiration ranges of both persons. The number of aspiration ranges \( n \) is an element of \( k | (U_{i=1+k} A_i) \cap (U_{j=1+k} B_j) \neq \emptyset \), therefore this set is nonempty. Since it is also finite, the minimum \( s \) exists. Then we can define \( S := [A_s \cap (U_{i=1-s} B_i)] \cup [B_s \cap (U_{j=1-s} A_j)] \).
also incorporates the dynamics of a bargaining process. Aspiration balancing theory leads to an area solution that turns out to be a good prediction for agreements in bargaining experiments. The theory is presented as a formal model of descriptive elements, but has normative power as well. If both negotiators in a bilateral negotiation follow the axioms as rules or standards guiding their choices they will reach a fair and efficient solution in a process that is as long as necessary and as short as possible (Ahlert, 2007).

There is a long lasting challenge to model bargaining behaviour. As an amount of economic experiments have shown, the assumption of a full rational homo oeconomicus type is not appropriate to model bargaining behaviour. An alternative is the bounded rational behaviour of aspiration adaptation. This concept does not use a representation by utility functions; it uses directly observable variables like aspiration levels. Aspiration levels are and can be used as decision criteria in bargaining situations, as they reduce the complexity of the decision task and allow solving the bargaining problem by simple decision rules of bounded rationality. There is no assumption needed like maximization of some goal function. Instead there are assumptions for concession making that induce aspiration balancing and convergence to an agreement within the agreement area. So far, aspiration based bargaining research has mainly been focused on experimental findings. Empirical case studies regarding bargaining processes and the dynamics of real negotiation problems are rare, however, may be promising. With her study of the WTO Agricultural Negotiations of the Doha Round Lajtos (2010) made a first contribution to towards closing this gap. Our future aspiration is to contribute to aspiration based bargaining theory beyond experimental studies also by case studies of real negotiation problems.
References


