Employment and Welfare Effects of Centralisation in Wage Setting

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Meiner Frau und meinen Kindern

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union density	number of unionised workers, as percentage of all (employed and unemployed) workers
union coverage	number of workers whose pay and employment conditions are covered by collective agreements, as percentage of all (employed) workers
SBTC	Skill Biased Technical Change
LAD	Least Absolute Deviations estimator
OLS	Ordinary Least Squares estimator
PV	P-value, denotes the probability that the value of theoretical distribution of a test statistic exceeds the computed value *under the null-hypothesis of the test.*
Okun's misery index	(unweighted) sum of unemployment rate and inflation rate
Trade openness indicator	sum of exports and imports, divided by GDP

Table 1: Abbreviations and Definitions

Country-Codes

AUI	Austria
AUL	Australia
CA	Canada
DEN	Denmark
FIN	Finland
FRA	France
GER	Germany
ITA	Italy
JAP	Japan
NL	Netherlands
NOR	Norway
NZ	New Zealand
SWE	Sweden
SWI	Switzerland
UK	United Kingdom
US	United States

Table 2: Country Codes

Chapter 1

Introduction

> *If peasants slaughter their fowls, then the fowls are sick – or the peasants.* German country saying

Currently we observe an active debate on the optimal degree of centralisation in wage bargaining. The driving forces for the growing interest seem to be international trends towards decentralisation and – in Germany – the re-unification of the west and east (former communist) countries. German wage bargaining institutions appeared stable even in the late eighties and early nineties when nation-wide wage setting in Sweden was abandoned and other countries (e.g. Australia and New Zealand) experienced similar trends.[1] Only the re-unification with the former communist East countries, and the implied severe economic problems in the East countries seem to have set the ball of decentralisation rolling in Germany. According to Kohaut & Schnabel (1999),[2] coverage of firms[3] has decreased in the period 1995–1998 from 53.4% to 47.7% in the West countries and from 27.6% to 25.8% in the East countries. The corresponding employee coverage rates have decreased from 72.2% to 67.8% and from 56.2% to 50.2%, respectively. This likely understates the true extent of decentralisation, since exits of firms from employers' associations (and of employees from unions) are accompanied by an increasing application of opening and hardship clauses, and more subtle strategies of wage agreement avoidance: As documented in Artus & Sterkel (1998), many firms adjust wages downward by assigning their employees to lower performance groups.[4] Additionally, the number of registered company wage agreements ('Firmentarifverträge') increased in the period 1992–2001 from

[1] For reports of the developments and their backgrounds in Sweden and Germany see Swensson & Pontusson (2000) and Thelen (2000)

[2] They report computations of Kohaut & Bellmann (1997)

[3] Firm Coverage denotes the share of firms applying collective wage agreements.

[4] 'Performance groups' is an *ad hoc* translation of the so-called term 'Leistungsgruppen'.

2422 to 4817 in the West and from 1178 to 1985 in the East countries.[5] Apparently, at least the trends in the West countries cannot be explained completely by the huge social and economic differences between East and West.

The question whether these erosions reflect efficient adjustments to changing market forces or whether they are accompanied with friction losses, or indicate even market failure, suggests itself. At least economists (which claim to be experts on this issue) seem to be divided into completely different camps. On the one hand, there exists a large strand of empirical literature containing (admittedly not so direct) evidence in favour of centralisation (we will discuss this in further detail). On the other hand, many economists derive arguments from abstract economic reasoning against centralisation. They argue that decentralisation must be superior in complex economic environments since central negotiators don't have the necessary information for the provision of efficient solutions, or that centrally negotiated wage schemes cannot reflect the diversity and heterogeneity of local situations and thus put too many restrictions on compensation policy. The 'evidence' of these arguments seems so compelling to them that less attempts are made to write them down in formal models or to investigate it empirically.

A representative example of this reasoning, accompanied by a clear and unfavourable assessment of centralised wage setting, provides the report (2003) of the German Council of Economic Experts (Sachverständigenrat).

> Regarding the wage determination process, the crucial problem is that the general collective wage agreement ['Flächentarifvertrag'] does not solve the adjustment problem between demand and supply adequately. Conditions are too different – between plants of the same industry, between regions, between different industries, between the employed and the unemployed. The system of collective bargaining does not accommodate to this appropriately in the negotiations with the application of results from one industry to others to a large extent. §461 on page 260. [Translation by Johannes Ludsteck][6]

It is an job and task classification scheme governing the remuneration in German collective wage agreements.

[5] See Bundesministerium (2001), p. 8.

[6] The original German wording is: "In Bezug auf den Lohnfindungsprozess besteht das entscheidende Problem darin, dass der Flächentarifvertrag das Abstimmungsproblem zwischen der Nachfrage nach Arbeitskräften und dem Angebot von Arbeitskräften nicht hinreichen löst. Die Bedingungen sind zu unterschiedlich – zwischen den Betrieben der gleichen Branche, zwischen den Regionen, zwischen den verschiedenen Branchen, zwischen

We pursue two modest goals in this book. Firstly, we review the theoretical and empirical economic literature on the issue and show that many questions are unsettled, at least with respect to the empirical relevance of the arguments. In the course of this review we also try to point to some issues which are widely neglected in the economic literature on centralisation. Furthermore, we will show that some seemingly 'self-evident' arguments don't stand up to a closer examination. Secondly, we design models capturing some aspects of the heterogeneity argument above, and show that they yield only ambiguous results regarding the employment and welfare effects of centralisation in wage bargaining. To sum up, this work is mainly a stocktaking of economist's knowledge on centralisation issues, with a rather pessimistic assessment.

To clear matters: we do not think that peasants are sick, as the country saying above presupposes. But we try to substantiate that peasants do not know whether their fowls are sick, and thus urge them to investigate things more carefully.

Beschäftigten und Arbeitslosen. Dem trägt das Kollektivvertragssystem in den Verhandlungen mit der weitgehenden Übertragung der Ergebnisse von einer Branche auf die andere nicht angemessen Rechnung."

Chapter 2

A Survey of the Literature

2.1 Motivation

At a glance, this chapter appears to be superfluous since several relevant surveys on the issue exist. A closer look, however, reveals that extensive theoretical surveys are now about ten years old, that the division of theoretical and empirical work is mirrored in most surveys (i.e. they specialise heavily on theoretical or empirical aspects), and that little attention is payed to the relation between centralisation and the structure/distribution of wages (which is surprising since this relation seems to be the most stable one). To close these gaps, we will complement the older surveys with current arguments, we will try to combine the presentation of theoretical models with the respective empirical evidence as far as possible, and we will discuss the relation between centralisation and wage dispersion in greater detail than it is done in the literature. Finally, we will try to point to some issues which are largely neglected in the literature, and to emphasise several unsettled problems.

It is clear, however, that the considerably large scope of the topic and the limited size of this work urge us to establish priorities and to ignore some relevant and interesting issues. Firstly, we do not provide a description of bargaining institutions and their evolution, because several contributions (e.g. Flanagan, 1999; Layard, Nickell, & Jackman, 1991; Berthold & Fehn, 1996; Blau & Kahn, 1996; Golden, Lange, & Wallerstein, 1993, and Golden & Wallerstein, 2000) contain sketchy summaries, and an extensive description would go beyond the scope of this work.[1] Secondly, we are quiet about the legal aspects of bargaining institutions (see Ruoff, 1999 for a discussion relating to the German legal framework). And thirdly, we ignore the interesting literature discussing the effects of the European unification and the European Monetary Union (EMU) on bargaining institutions. These issues are discussed in some detail in Calmfors (2001) and Lesch (1999).

The access to the centralisation debate is hampered for to reader not acquainted with the literature by the fact that most surveys put emphasis on certain aspects of centralisation, *but don't point to this specialisation.* Therefore we start here with a short 'classification' of the main existing surveys. Then we sketch the relevant field of research by explaining its theoretical foundations and central conceptional problems on the basis of definitions of

[1] Unfortunately, an up-to-date *comprehensive* international synopsis of bargaining institutions is missing, but needed. There exist some valuable book-length treatments, e.g. Crouch (1993), Flanagan, Soskice, & Ulman (1983), Addison et al. (1993), and Ebbinghaus & Visser (2000). However, countries are described in separate chapters, in different styles, and by different authors there, leaving the burden of comparisons and integration to the reader.

key terms. This will be followed by a thorough discussion of the results from the debate. However, though we try to integrate theoretical reasoning and empirical evidence as much as possible, we will have to put a large part of the empirical literature into a separate chapter. The reasons are (1) that the connection between theoretical arguments and empirical evidence is indirect or loose sometimes, and (2) that the discussion of methodological problems and the description of data and specification idiosyncrasies would fraught the exposition and cross the argumentation.

2.1.1 The Most Important Surveys

The most extensive theoretical contribution seems to be Hoel, Moene, & Wallerstein (1993). It provides a clear and formal exposition of the relevant theoretical arguments. Furthermore, in contains some new arguments and explains 'folk knowledge' which is scattered in marginal notes and footnotes in the literature. However, empirical aspects are left aside in their treatment. Calmfors (1993) shares this clear emphasis on theoretical reasoning but is less formal and therefore accessible for a wide readership. The only contribution in German seems to be Berthold & Fehn (1996). It complements a verbal theoretical discussion with selected descriptive empirical data. The authors cannot, however, hide a preconception in favour of decentralisation. Often they judge 'by appearances' alone (neglecting existing empirical evidence), and some of their verbal arguments aren't backed up by empirical evidence. On the whole, their contribution is rather a politically committed plea against central wage setting (or – more fundamentally – against collective wage bargaining in general) than a level-headed assessment.

A contribution, focussing more on empirical issues, is Booth et al. (2001). It includes also some current theoretical arguments and provides an extensive summary of empirical results on Calmfors & Driffill's hump-shape hypothesis. Unfortunately, the authors fail to discuss the differences and contradictions in the results of the listed empirical studies. The current book of Aidt & Tzannatos (2002) provides a lengthy discussion of general efficiency aspects of union activity and collective bargaining[2] and surveys the empirical literature on centralisation in several synoptical tables. However, their treatment of empirical results is rather mechanical. E.g. they simply *count* the number of regressions which deliver certain types of results. Since the base unit of their analysis is a single regression, studies which produce several regressions

[2]The hypotheses on efficiency-improving functions of unions, formulated by Freeman & Medoff (1984) more than 20 years ago, have attracted little attention since then. Though we think that many of their questions are unsettled, we cannot go into the details of this debate here.

by simply exchanging irrelevant control variables, obtain higher weights in their computations. Flanagan (1999) seems to be the only current survey (focussing on empirical aspects) providing a reflected discussion of conceptual and methodological problems.[3] Furthermore, some papers address several centralisation issues at the margin, as Farber (1986), Fitzenberger & Franz (1999), and Fitzenberger & Franz (1994).

The analytic surveys are complemented by several mainly descriptive papers on bargaining institutions and their evolution in OECD countries, e.g. Katz (1993), Thelen (1991, 2000), Swensson & Pontusson (2000), Golden & Wallerstein (2000), Freter (1998), Addison et al. (1993), Ebbinghaus & Visser (2000). We will provide no extensive comparative description of bargaining institutions, but place only some marginal (anecdotical) notes to support or illuminate the argumentation. The interested reader is referred to the cited literature.

Before we step into the details, we will – lead by definitions of central terms – sketch some important topics and theoretical foundations of the centralisation debate in a panorama. We will use this introductory section also in order to discuss some aspects of bargaining which do not fit seamlessly in the chapters below.

2.2 Central Definitions

2.2.1 Centralisation

In general, centralisation means that *workers or employers unite/merge in order to bargain collectively or to accomplish their goals on the labour market.*

Aggregation of individuals to groups or of groups to lager ones can occur along several dimensions and in several ways. We start by a short characterisation of the dimensions and modes of aggregation and then proceed with a characterisation of the directly (and indirectly) involved groups.

[3] His conclusions are accordingly much more pessimistic than the conclusions of his colleagues. His article ends with an extremely pessimistic judgement of the possibilities to measure centralisation of wage bargaining. On page 1172 he writes "Many indicators of institutional structure used in empirical research do not measure the concepts stressed by theory. Union density captures neither the scope nor the intensity of union influence and union coverage does not capture bargaining power. Indexes of corporatism obscure more than they reveal, and should be supplanted by explicit modelling of and tests for institutional interactions.

2.2.2 Dimensions and Modes of Centralisation

A closer look at the issue reveals that centralisation is a multidimensional phenomenon. Bargaining can take place at several levels. The most important ones are profession, firm, industry, sector, region and nation. The economic analysis of centralisation effects is complicated by the fact that these effects may depend heavily on the considered dimension (e.g. centralisation with respect to occupation may have other effects as centralisation along industry borders.) We will give examples for such differences int the sections below. In some countries (e.g. France and Italy), unions are separated along religious or ideological lines, implying that we could consider ideology and even religion as possible dimensions of centralisation.[4] It should be clear that the latter dimensions of centralisation do not lend themselves to simple economic explanations.

Especially empirical work on centralisation effects is complicated immensely by the fact that centralisation can be realised in many ways and that the dominant level of wage setting is not always reflected in a corresponding organisational structure of the bargaining parties. Merger of bargaining units (unions, employer organisations) is a self-suggesting way to centralise bargaining, but it may be supplanted by informal coordination. While wage setting takes place formally at the regional level in Germany, wages are set *effectively* at the industry level, since *some* agreements are often adopted by most other regional units.

The variety of forms and faces of centralisation is increased by the fact that the resulting or intended wage structure is not necessarily correlated with the level of bargaining. For example, the highly centralised bargaining system in Austria generates higher wage dispersion than more decentralised bargaining institutions in France and Italy. We will give a more detailed discussion of these issues in section 2.5.1.

2.2.3 The Relevant Groups

Unions and Employers

The relevance of unions and employer organisations in wage setting is self-evident. Almost all economic thinking concentrates, however, on the role of unions.[5] This bias translates directly to empirical research, i.e. only union

[4]Denominational unions ['Richtungsgewerkschaften'], e.g. the 'Katholischer Arbeitnehmer Bund (KAB)', exist in Germany too, but they have almost no impact on wage setting.

[5]Rare exceptions are Soskice (1990), Swensson & Pontusson (2000), Katz (1993), Thelen (2000), and Artus (2001). Thelen & Artus aren't economists, however!

concentration and density is considered in most studies.[6] The argument, that only unions determine the bargaining level and employers react passively by matching union organisation structures, is not valid empirically since, for example central wage bargaining was initiated and propagated by employers' associations in Sweden, and the exit of members from employers' associations seems to be the driving force for decentralisation in Germany.

We cannot go into the details further, since considerable investigations we could refer to, simply don't exist.[7]

2.2.4 'Third' Parties

Nonmembers Besides unions and employers' associations, other parties may influence bargaining outcomes (and the viability of centralised wage setting) though they don't participate actively in the negotiations. The most important of these groups seem to be *nonmemebers* of unions and employers' associations. The role of non-unionised workers is considered extensively in many theoretical models, e.g. Shister (1943), Farber (1983), Blair & Crawford (1984), Burda (1990) and empirical investigations[8]. We will consider such models in more detail in section 6.

As already noted above, employers abstaining from collective bargaining, are ignored largely (or only mentioned in marginal notes) in the theoretical literature. This is hard to comprehend, since the strategic situation on the employer side is different in many respects from its counterpart on the union side.

The Government Besides unions and employers, also the government and the public may have specific interests in collective bargaining outcomes and try to influence them. Governments influence wage bargaining indirectly (e.g. by setting legal restrictions through regulations of negotiation procedures and peace clauses or by providing a legal frame for the enforcement agreements) or participate directly in bargaining.[9] Several empirical studies (Farber & Western, 2002; Card, 1998; Freeman & Pelletier, 1990; Machin,

[6] An obvious reason for this ignorance is that employers' associations are much more silent about membership than unions.

[7] Economists cannot, however, claim to stand in the tradition of their often cited precursor and founder Adam Smith who showed an extreme attitude in this respect. In Smith (1776) he writes on page 70: "We rarely hear, it has been said, of the combination of masters; though frequently of those of workmen. But whoever imagines, upon this account, that masters rarely combine, is as ignorant of the world as of the object. Masters are always and every where in a sort of tacit, but constant and uniform combination, not to raise the wages of labour above their actual rate."

[8] See Farber (1986) for a survey.

1997) account for this explicitly. For example, Farber & Western (2002) and Machin (1997) find significant influence of Ronald Reagan's and Margaret Thatcher's anti-union campaigns. On the other hand, the commonplace that the ideological orientation (left/right) of the government affects bargaining outcomes directly, cannot be confirmed in the majority of empirical studies.

The Public Though the public is neglected widely in the literature, it may be relevant in practice, and – more importantly here – its impact on wage setting may depend on the degree of centralisation. The relevance of the public (opinion) can be derived from the observation that wage negotiations are reported and commented extensively in the mass media. – Or that a considerable number of economists 'participate' in bargaining by appealing (in a normative way) to the parties *in public*.[10]

If unions care about the public opinion, centralisation effects may exist. In decentralised wage setting, especially if contracting is staggered, local strikes neither affect local public live and consumption, nor have a noteworthy impact on aggregate variables. Then the public opinion should be a minor concern, since individual local negotiations will not cross the stimulus threshold of the mass media. A transition from centralised to more decentralised wage setting consequently would remove pressure from the bargaining parties (and economists would loose targets of their consultation activities).

2.3 Foundations and Conceptual Problems of Bargaining Models

Before we start with a discussion of centralisation effects, we sketch some of the foundations and conceptual problems of wage bargaining models. This seems to be imperative since the foundations are weak and the associated problems are severe. Furthermore, some centralisation effects depend heavily on basic assumptions.

[9]Wallerstein (1996) and Golden & Wallerstein (2000) distinguish in their empirical work 15 types of government involvement in wage setting. Examples are: provision of minimum wages, recommendation of guidelines or norms, compulsory indexation (cost of living adjustment), compulsory arbitration, or even formal tripartite agreements.

[10]These economists apparently know that the *information content* of their statements is approximately zero, since most of them say the same ('cut wages') since decades and they see that unions don't follow them (since decades). If one takes the neoclassical theory of unions seriously, there is no reason for advice to the (full informed and rational) bargaining parties from outside. The attempt to influence bargaining outcomes through media presence can consequently be taken as an implicit argument against the pure neoclassical view.

2.3.1 Objectives and Aggregation Problems

Unions

Bargaining outcomes depend naturally on the bargaining parties' objectives. Whereas the objectives of firms can in principle be approximated by simple profit functions,[11] union objectives are less clear. This is the case since unions are associations of *many* workers with *heterogenous* preferences. Things are complicated furthermore by the endogeneity problem of membership (at least in open shop unions[12]), i.e. membership depends on union objectives. Consequently, membership and objectives have to be determined simultaneously, giving rise to the interrelated theoretical problems of *existence* and *aggregation*.

If workers are rational and interested only in monetary payoffs, an union *existence* problem results because such workers have no incentive to become union members if the firm does not discriminate nonmembers. We will discuss this problem and possible consequences for centralisation extensively in chapter 6.

The *aggregation* problem is to derive a social preference relation from individual ones. If union objectives are established by democratic majority voting, it can be shown[13] that a unique consistent aggregated utility function exists only if voting is restricted to a single issue/decision variable (e.g. wages) and the (indirect) utility functions of all member are single-peaked (see Flanagan, 1993 or Blair & Crawford, 1984). Otherwise not even representative voting can guarantee the existence of a unique outcome (see McKelvey, 1976 or Flanagan, 1993).[14] Then, economic models, able to predict union behaviour, do not exist.

The ways out of that problem proposed in the literature are not convincing. Some authors argue that union leaders stabilize outcomes by manipulating voting sequences in order to push their own interests,[15] others claim that wages be the most relevant issue and that voting consequently is *effectively* one-dimensional. Flanagan (1993) argues that the status quo is maintained in pat situations.[16]

[11] We are aware that this simplicity vanishes in presence of adjustment costs and uncertainty.

[12] Closed shops/open shops are firms where union membership of workers is compulsory/not compulsory.

[13] The proof is simply a special case of Arrows (1951) impossibility theorem.

[14] A possibly important detail (neglected in the literature) which may generate inconsistencies, is that leaders are elected with simple majority (median), whereas strikes (ballots) require agreement rates of 60-80% in some countries.

[15] See Pemberton, 1988.

An alternative approach to micro foundation, which is often pursued in the literature, is simply to ignore the problem and to use fairly general utility functions putting as few restrictions as possibly on union behavior. Farber (1986) and Kaufman (2002) are full of examples of theoretical and empirical applications.[17]

We complain that no serious *empirical* attempts have been made to understand union member behaviour and decision making in unions, but we cannot propose a solution to these problems here. Instead, we close this section by pointing to a detail which is ignored in the literature, but may be relevant in the centralisation debate: Majorities for strikes may be harder to obtain in more centralised unions, since they span a much more heterogenous group of workers (implying a greater number of relevant preference dimensions) This may take away power from large unions.

Employers' Associations

This section is very short since we didn't find any model on preference aggregation in employers' associations. We will sketch Johansen's (1982) general analysis of the stability of coalitions in section 2.4.16. But his analysis is fairly abstract and not related specifically to employers' associations. The lack of interest in employers' associations is surprising since, as we mentioned already above, employers seem to be the driving forces for current decentralisation trends in Germany[18] and centralisaton/concentration on the employer side are quite different to the union side. For example, we observe no fractionalisation along ideological or religious lines and intra-organisational concentration may be higher than within unions because of large differences in firm size. The only attempt to collect data on employer concentration was made by Windmuller (1987). He finds that employers' associations are more concentrated than unions. For example, in the late eighties about 75% of firms Belgian firms were organised in the central employers's association, while union density was about 55%. In France, where union density rates are significantly below 20%, about 90% of firms are organised. Of course,

[16]Plott (1967) includes this explicitly in his definition of a voting equilibrium.

[17]Our short discussion explains why formal models of union behaviour are relatively young. The first systematic attempt goes back to Dunlop (1944) who proposed the wage bill as objective. Ross (1948) initiated an intense debate by considering unions as complex political organisations and denying the possibility to represent their objectives in a formal and *consistent* way.

[18]In our investigations we found only one descriptive analysis of membership in employers' associations (Artus, 2001). We could not identify clear testable hypotheses there, however. The only international comparative study of employers' associations, Gladstone & Windmuller (1986) contains only some basic information and ist not up-to-date.

membership rates may be misleading and have to be complemented with information on internal coordination. Nevertheless, we will mention several examples in the empirical literature below where this approach (concentrate on numbers and disregard coordination) was applied to the analysis of union concentration.

2.3.2 The Structure of Bargaining Models

The outcomes of bargaining models depend heavily on the rules of the game (and the sequence of actions). As regards the determination of wages and employment, basically two modes are possible:

1. Wages and employment are determined simultaneously by the bargaining parties (efficient bargaining).

2. Union and employer determine wages jointly[19] and employment is determined by the employer unilaterally (right-to-manage structure).

The standard reference on efficient bargaining is McDonald & Solow (1981), Manning (1987) investigates the relation between both structures. Since the outcomes of both structures differ significantly, it is of great importance to identify which of them applies in practice. The question is of special importance in the context of the centralisation debate since efficient bargaining appears to be feasible only with firm level bargaining (we will explain this below). The theoretical analysis shows that unions and employers prefer efficient bargaining if both structures are feasible (and agreements regarding the distribution of efficiency gains are enforceable). The reason is that efficient bargaining is based on joint optimisation of union's and firm's objectives whereas right-to-manage bargaining implies a (recursive) sequence of two one-dimensional optimization problems which leads to inferior results – compared to joint optimisation.[20]

Though economists do not agree on the relevant structure, a majority prefers right-to-manage bargaining by pointing to asymmetric information.

[19] In the monopoly union models wages are set unilaterally by the union.

[20] The argument can be shown also graphically: In a diagram with employment and wages on the horinzontal and vertical axis, the right-to-manage optimum must lie on the firm's labour demand curve because the firm sets employment (taking wages as given) in the second stage of the game. On the other hand, the efficient bargaining solution must be located on a tangent point of the firm's iso profit and the union's indifference curves and therefore cannot be identical with the right-to-manage solution, since the labour demand curve is the locus of alle maxima of the iso profit curves. If indifference curves are well formed, iso profit curves must have negative slopes at tangent points with the iso profit curves.

Already half a century ago, Leontieff (1946) mentioned that employment is *too high* from the firm's point of view *ex post*. Therefore management has an incentive to decrease employment below the level fixed in the bargaining procedure. An extensive discussion of the issue provide Hall & Lazear (1984) and Hall & Lilien (1979). They analyse contracting problems caused by private information of the firm on exogenous variables which influence employment.[21] Espinosa & Rhee (1989), Schultz (1997) and Sestini (1999) challenge this view by showing that these information problems can be avoided in repeated negotiations by application of subgame perfect trigger strategies.[22] However, the range of cooperative solutions (i.e. solutions where the firm doesn't cheat) shrinks if uncertainty about the relevant variables increases.[23] Unfortunately, also empirical approaches yield no conclusive evidence. The naïve strategy to check simply whether the bargaining contracts contain explicit specifications regarding employment is successful only in a few cases.[24] Nevertheless, some economists argue that this cannot be interpreted as evidence against efficient bargaining since employment may be fixed *implicitly,* e.g. by manning rules[25] or implied. We have moved a short sketch of the inconclusive empirical evidence on this issue to the appendix.

Centralisation Effects Depending on the Bargaining Structure

Evidently, efficient bargaining is feasible at most with firm level wage setting. An employers' association committing itself to a certain level of employment had to distribute it over all of the membership firms. Since employment is too large from a firm's point of view, this is impractical. Again a cooperative truth-telling solution is feasible, but highly unlikely. Since the centralisation effect depends on the feasibility of efficient bargaining at the firm level, it is probably not relevant in practice, however.

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[21] In addition to the pure observation problem the firm may have an incentive to manipulate variables which employment depends on.

[22] For a exposition of the theory see Fudenberg & Tirole (1991) or any textbook on game theory.

[23] The feasibility of the cooperative solution depends furthermore on the patience (time preferences) and the expected life time of the firm, see Fudenberg & Tirole (1991), section 5.6.

[24] A current example for explicit agreement on employment is the 5000 x 5000-agreement between the German IG Metall and the Volkswagen AG. In the contract the Volkswagen AG commits itself to hire 5000 unemployed workers at a wage of 5000 Deutsche Mark.

[25] Note that this argument does not explain why the parties use indirect, complex and error-prone formulations as manning rules instead of simply fixing the number of employed workers.

2.3.3 Bargaining Models

Neither the optimisation of joint gains in efficient bargaining nor the optimisation sequence in right-to-manage structures yield a sharing rule for the possible gains. This has to be fixed in a bilateral bargaining procedure. The work horses for bargaining theory are the Nash (1950, 1962) bargaining solution and Rubinstein's (1982) alternating offers game. Binmore, Rubinstein, & Wolinsky (1986) have shown the equivalence of both solutions if the time step between alternating offers approaches zero. In addition, their equivalence theorem delivers intuitive interpretations for the parameters of the abstract axiomatic Nash solution. We will not explain the details of the theory here since it is standard and contained even in introductory textbooks.

Since we will make use of the monopoly union model in later chapters, we comment briefly on its relation to the bilateral bargaining models here. The monopoly union model results as the limiting case from the Nash solution when the union has maximum bargaining power (is infinitely patient). Formally, this means that the union determines wages unilaterally, i.e. maximises its utility taking the firm's labour demand as given. Though the monopoly union model deals with an unrealistic borderline case, it is used often in order to avoid the formal complexity of the Nash solution.

We have to admit, however, that all conventional bargaining models and solution concepts have small predictive power for real world bargaining. With their experimental investigation of the ultimatum game, Güth, Schmittberger, & Schwarz (1982) have inspired a large number of studies which contain overwhelming experimental evidence against the relevance of the Nash solution.[26] Attempts to rehabilitate it (e.g. Binmore, Shaked, & Sutton, 1985) were not successful.[27] The results of experimental studies can be summarised in two sentences: (1) Fairness plays an important role – even in high stake experiments.[28] And (2), though egalitarian sharing rules serve as focal points, results are biased somewhat towards the game theoretic equilibrium, but large deviations from these 'focal' points are punished even if it is costly to the punisher.

Unfortunately the literature has not produced a ready-to-use alternative theory of bargaining.[29] Therefore we will proceed using the traditional

[26]Surveys on the large strand of literature give Güth (1995) and Roth (1995).

[27]For example, Ochs & Roth (1989) show that the accordance between Rubinstein game predictions for games with infinite (or finite but stochastic) time horizons and the experimental evidence can be explained by the fact that the noncooperative solution approaches fair sharing rules if players are patient.

[28]See Roth, Prasnikar, & Okuno-Fujiwara (1991) or Cameron (1999).

[29]Fehr & Schmidt (2000) review some attempts to incorporate fairness, altruism and social preferences into utility and game theory. These approaches appear somewhat arbitrary

models with reference to the disclaimer that they provide only a raw approximation.

2.3.4 Summary

Even a roughly sketched panorama of some basic issues of centralisation shows that the change of the level of bargaining involves changes of a complex environment (including the participating groups). By this, it may trigger second order effects (of unknown relevance and magnitude) which cannot be captured easily in simple formal models of bargaining. After a closer inspection, also important theoretical foundations (aggregation and bargaining theory) turn into Pandora's box.[30] Accordingly, this section turned from a conventional prologue into a collection of blind spots and disclaimers. Let us now – despite of many remaining problems – proceed with a presentation of the positive results from the literature.

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and less systematic, however.

[30]This seemingly heretical assessment is shared by renowned economists, e.g. Manning (1994): *"The only theoretical prediction [of union bargaining theory] that seems to be robust is that unions raise wages above the alternative wage, but we probably do not need a sophisticated theoretical framework to guess that this might be the case."*

2.4 Theoretical Arguments in Favour of and against Centralisation

The large number and heterogeneity of centralisation effects makes it difficult to cast them into a clear and consistent scheme. In consideration of this, we decided to organise the material (coarsely) according to expositional convenience. We start with models abstracting from firm/worker heterogeneity, extend the analysis to environments with heterogeneity, and complement the discussion with some reflections on the endogeneity of centralisation levels in a separate section.

The separate discussion of endogeneity demands a short justification. Economists expect that agents determine the bargaining level by weighting its advantages and disadvantages. As a consequence, the endogeneity problem cannot be solved independently of the analysis of employment and wage effects. Therefore this section will not (mainly) present new models, but discuss the ability of the models from the other sections to explain the prevailing bargaining level. Though the endogeneity problem could, in principle, be attached directly to the presentation of the respective models, it seems to concentrate this discussion to put some more weight on it (as it obtains in the literature).

The survey concludes with a short discussion of the effects of centralisation on strike incidence. We put it at the end of the survey because it does not fit seamlessly into the structure of the argumentation.

2.4.1 Price Externalities

The discussion of price externalities, re-initiated[31] by the important contribution of Calmfors & Driffill (1988), plays an important role in the centralisation debate since then. Since the argument is very simple, we will give here only a short verbal summary of the argument. By the way, Calmfors & Driffill did not provide an explicit formal presentation of the argument. Instead they showed the results on the basis of numerical simulations. An elegant *formal*

[31]It is interesting to note that the US government attempted to foster centralisation of bargaining institutions after the Korean war, *and that this attempt was justified by similar arguments*. The Construction Industry Collective Bargaining Commission (CICBC), was established 1969 with the intension, "to curb the excess of decentralised, locally autonomous bargaining by adopting procedures to strengthen the role of the nationale labor organisation and the national associations of contractors...", see Hartman & Franke (1980). The CICBC was, however, unsuccessful and short-lived. About ten years later, the government tried to impose direct controls in order to tackle significant increases of wages in the construction industry.

formulation contains Hoel (1991) which is summarised in Hoel et al., 1993.

The Argument

Consider an economy with identical firms. If wages of a firm are raised by its union, this (in general) induces an increase of its output price. In general (we will discuss special cases below), this generates an externality since the output price increase raises the aggregate price level and decreases real wages also in the rest of the economy. By this, it creates an incentive for an individual local union to realise a *real wage* increase by shifting part of the price effects to the rest of the economy. The evolving externality depends on the elasticity of output prices with respect to wages and on the elasticity of the aggregate price level with respect to an individual firm's output price.[32]

It is clear that the externality disappears in local wage setting under perfect competition since then an individual firm cannot raise its output price. Consequently, the union considers the aggregate price level as independent of its behaviour and has no price-shift incentive. This is not valid any more, however, under monopolistic competition. In this case, a firm can shift part of the wage increase to its consumers and thus induces its union to exploit the 'beggar my neighbours' mechanism (Hoel, 1991). The externality vanishes in completely central wage setting since then wages of *all* workers are arguments of the union utility function. Basically, Calmfors & Driffill's argument can be interpreted as an application of an important aspect if Olson's (1965) theory of groups: Small groups are forceful because they are not urged to care about the externalities they exert on the rest of the economy when pursuing their interests.

A closer inspection of the issue reveals that the relation between the levels of bargaining (centralisation) and wages may be nonlinear if intermediate levels are considered too. Specifically, Calmfors & Driffill claim that intermediate levels of bargaining are associated with higher wages (and lower employment) than completely centralised and decentralised ones. This is the celebrated hump-shape hypothesis. Again the argument is very simple. Products of firms within an industry (e.g. butter from firm A and butter from firm B) are closer substitutes than between industries (e.g. butter and furniture). Therefore competition between firms of the same industry is more intense than between industries.[33] Consequently, industry unions are able to exploit the output price externality if they rise all wages in a sector

[32]The external effect can be decomposed further. For example, it works also through input-output relations, since the output of some firms are inputs for others.

[33]This idea is not new. Marshall has pointed to this fact already a century ago.

simultaneously. On the contrary, local unions are defeated by the high price elasticity within industries.

The results from the analysis can be summarised in three points: (1) Decentralised and centralised wage setting generate equivalent outcomes under perfect competition. (2) Under monopolistic competition, complete centralisation is superior since price externalities prevail with local wage setting. And (3), intermediate levels of bargaining are generally inferior.

Empirical Relevance

Since the empirical relevance of the argument depends on the magnitudes of the involved elasticities, an empirical evaluation of the argument could, in principle, be performed by estimating these elasticities. Unfortunately estimates of these elasticities (especially at the firm level) are hard to obtain, at best with huge errors. Therefore almost all empirical studies concentrate on the *macroeconomic* relation between the level of wage setting and the macroeconomic indicators wages, inflation and unemployment. We have shifted the discussion of these applications to a special section (2.5), since the empirical evaluation of the argument is associated with several econometric and measurement problems (demanding an extensive discussion), and the empirical literature has grown considerably in the last decade (demanding much space).

Two intuitive theoretical criticisms of the hump-shape argument can be summarised here, however: Danthine & Hunt (1994) point to the fact that firms of an industry compete with firms of the *same* industry in foreign countries. Therefore the impact of the price externality should be correlated negatively with the degree of openness for international trade and the hump-shape should disappear in small open economies.

Rowthorn (1992) shows in an extension of Calmfors & Driffill's (1988) simulation model that the hump-shape levels off under moderate cooperation of industry unions. He formalises cooperation by assuming that individual unions maximise a weighted sum of their own member's utilities and the utilities of workers in other industries.[34] In his simulations the hump-shape flattens significantly even with moderate weights for workers from other industries.

[34]Rowthorn argues that cooperation be not necessarily driven by altruism, but may also result from intertemporal optimisation.

2.4.2 Unemployment Externalities

Two further externalities act through unemployment. Local unions generate an unemployment externality since unemployed members increase (expected) unemployment duration of others in the rest of the economy if they search for a job somewhere else (Mortensen, 1986; Calmfors, 1993). Therefore, the magnitude of the effect depends on mobility of workers and should internalised to a great deal already in regional wage setting.

The second one is a fiscal externality related to unemployment. It was stressed by Blanchard & Summers (1987) und Calmfors & Driffill (1988). An increase of unemployment implies higher unemployment insurance contributions of the employed. Since the rest of the economy contributes to the benefits of every dismissed worker, unions can shift a part of these costs to the rest of the economy by raising wages.

2.4.3 Interaction between Centralisation and Taxation

The Arguments

The idea that centralisation provides a framework for the internalisation of externalities was applied to the analysis of taxation problems by Gruber, Summers, & Vergara (1993) and Alesina & Perotti (1997).

Gruber, Summers and Vergara (1993) The authors hypothesise that wage taxes are less distortionary in highly centralised economies. The argument is again that central unions internalise the connection between tax burden and redistribution. Their formal model is essentially a two stage (Stackelberg-) game between the government, fixing tax rates as first mover, and the bargaining agents, responding with their wage policy.[35]

The basic argument can be read directly from the unions's utility function:

$$V = w\,(1-\tau)\,L + (N-L)\,b + g\,H(\tau\,w\,L)$$

where $g \in [0,1]$ represents the degree of centralisation, $H(\cdot)$ represents the production function of the government, and w, τ, N, L and b denote wages, the tax rate, the number of workers, employment and unemployment benefits, respectively.

[35]Bargaining in the second stage of the game is modelled as efficient bargaining. Efficient bargaining is used here only for sake of simplicity an does not change the qualitative predictions of the model, however.

In the handy special case $H(x) = x$, the government 'reimburses' all collected wage taxes to highly centralised unions ($g = 1$), whereas the government turns into a black hole devouring tax revenues if unions are decentralised ($g = 0$). It is self-evident that no deadweight loss arises (with $H(x) = x$) in a completely centralised labour market. The relation between tax rates and centralisation follows in a straightforward manner from the optimisation problem of the government. It fixes the tax rate such that the marginal gain of a unit revenue equals its deadweight loss. Since the deadweight decreases with centralisation, centralisation and tax rate are correlated positively.

This positive assessment of the interaction between government and central unions is criticised vehemently in the rent-seeking literature. Centralised bargaining is viewed as dangerous there, because

> "... this may give labour unions a strong *political* position, and because this position may be used to "blackmail" the government to political concessions of various types. Examples of such concessions are tax-financed "gifts" to unions, various types of privileges for the activities of unions (including the right to "secondary picketing"), or even tax-financed transfer of the ownership of industry to union-controlled organisations, as illustrated by the push by unions for collective, union-controlled "wage-earners funds" in Sweden. In my personal view, this political aspect is the overriding argument against strongly centralised wage bargaining, rather than the consequences for wage formation." (Lindbeck, 1990, p. 322).

This view rests on the central assumption that institutional arrangements are settled by opportunistic individuals in order to pursue private gains. Consequently, it neglects efficiency-increasing effects of institutions (such effects will be sketched in section 2.4.15.) Though this view clearly opens ways to some important insights regarding the problems of centralisation, a *consequent* application of its conclusions reveals its naivity (if taken at face value). It were simple to derive a ban of political parties in democratic societies from this view since parties give its leaders and members access to political power and allow them to influence redistribution and allocation of property rights *directly*.[36]

[36]It is interesting to note that Lindbeck mentions (and attacks) *only* unions. Concentration and power on the employer side may be no less dangerous because of considerable accumulation of capital.

Alesina & Perotti (1997) Alesina & Perotti (1997) find that the effect of distortionary taxation on unit labour cost depends nonlinearly (in a hump-shape relation) on the level of bargaining (centralisation). In essence, their model is a straightforward extension/application of the output price externality. Consider the effect of a wage tax increase. Under imperfect competition unions can shift part of the additional tax burden on to employers. Obviously, this opportunity increases with decreasing competition. Consequently unit labour costs increase with increasing levels of centralisation. The centralisation effect is not monotonic, however, since central unions can take into account the relation between wage taxes and the benefits to their members which are (by assumption) financed out of these taxes. The authors show this formally: taxes vanish from (after tax) unit labour costs if the expected benefit stream, financed out of tax revenues, is included into the union objective.

In contrast to Gruber et al. (1993), Alesina & Perotti (1997) obtain a hump-shape because they account for the competition effect accompanying centralisation (i.e. competition between unions decreases in the transition from decentralised to intermediate levels, giving them greater power to shift tax burden to employers).

Empirical Relevance

Both, Gruber et al. (1993) and Alesina & Perotti (1997) conduct empirical tests of their theories in cross-country regression models. A testable implication of the model in Gruber et al. is that the distortion of wage taxes on labour supply decreases with increasing levels of centralisation.[37] Building on this, Gruber et al. show in the empirical application that labour employment is less affected by changes in centralised countries.

Similarly, Alesina & Perotti find a hump-shape between unit wage costs and centralisation in the data. However, two further studies, Daveri & Tabellini (2000) and Bookmann & Peters (2003), which estimate similar models (they use unemployment as the dependent variable instead of unit labour

[37] Efficient bargaining leads (with $H(x) = x$) to the following first order condition

$$F'(L) = \frac{b}{1 - \tau\,(1 - g)}$$

with production function $F(L)$. Implicit differentiation yields

$$\frac{\partial L}{\partial g} = -\frac{b\,\tau}{F''(L)\,(1 - \tau\,(1 - g))^2} > 0$$

.

costs), nebulise Alesina & Perotti's results. We will postpone a detailed discussion of the applications to section 2.5.4 in order to make use of synergies with other empirical applications.

One qualifying remark on the strategy pursued in Gruber et al. seems in order here. Their evidence is somewhat indirect and rests on the availability of a sensible measure of labour supply. According to the central point of the paper, centralised unions get the government to spend tax wage revenues *exclusively* to the benefit of workers, whereas governments in decentralised economies mimic black holes wasting wage tax revenues or passing them on to capital. The central question, how tax revenues are used, could be answered more directly by analysing government expenditures.

2.4.4 Interactions between Unions and Central Banks

Inflation-averse Unions

Cukierman & Lippi (1999) and Guzzo & Velasco (1999) integrate the interaction between unions and central banks into the framework of Calmfors & Driffill (1988) and Hoel (1991). Central banks react to wage setting of unions with an adaption of money supply as in Kydland & Prescott (1977) and Barro & Gordon (1983). The common basic idea in both contributions is that liberal central banks respond to increases of unemployment with an increase of money supply (i.e pursue a *accommodating* monetary policy). This deters inflation-averse unions from aggressive wage claims because they can decrease inflation rates by wage moderation. Contrarily, conservative central banks do not create incentives to wage moderation, since they do respond to unemployment (i.e. pursue a non-accommodating policy).

Basically, the effect of centralisation on the unemployment rate is driven by the same mechanisms as in Calmfors & Driffill (1988): The elasticity of labour demand with respect to wages declines with increasing centralisation. This *competition effect* endows unions with greater 'market' power and induces more aggressive wage claims. On the other hand, centralisation shallows opportunities to shift the costs of wage claims to the rest of the economy (this is called the *strategic effect*). With low inflation-aversion of the unions or conservative policy of the central bank, the competition effect dominates for *all* levels of centralisation in Cukierman & Lippi's theoretical model, implying that wages and unemployment rates increase monotonically with centralisation. A hump-shape prevails only if inflation-aversion of the unions is strong enough or the central bank pursues a conservative policy. We note (and should remind this when comparing the predictions of their model with the model sketched in the following section) that the monotone

relation comes from an *ad hoc* assumption regarding the labour demand of firms. (Absolute values of) wage elasticities increase monotonically with decentralisation and approach infinity if the number of unions does.

Guzzo & Velasco (1999) derive labour demand from production functions with variable elasticities of substitution and obtain *contrary* results for the relation of centralisation and unemployment. For sufficiently low elasticities of substitution the relation is positive monotonous, for sufficiently large elasticities it is U-shaped (i.e. intermediate levels of centralisation maximise employment!). The main difference to Cukierman & Lippi (1999) is that the elasticity of labour demand does not approach infinity with an increasing number of unions, but converges towards the elasticity of substitution which is determined by the production function.

Real Effects of Monetary Policy

The models of Franzese & Hall (1998), Iversen & Soskice (1998), Iversen (1999), and Iversen & Soskice (2000) deliver almost opposite predictions. In these models unions have no preferences for inflation (i.e. inflation does not appear directly as an argument) but care only for the trade off between wages and employment. Nevertheless central bank behaviour creates real effects: With neutral money supply (i.e. money supply does not respond to wage setting), wage increases are neutralised by price increases. However, if the central bank responds to aggressive wage claims with a reduction of nominal money supply in order to fight a wage policy- driven increase of inflation, a decrease of the *real* money supply will result. This harms employment by lowering real demand and has therefore a moderating effect on rational unions. Of course, this incentive is present only if unions are sufficiently large (or coordinated) to be able to influence inflation by their wage policy. Therefore, the moderation effect of independent central banks attains a *maximum* with *intermediate* levels of centralisation. This effect vanishes with fully centralised bargaining since externalities are internalised already at this level. Note that the argument of the theory converts the hump-shape relation into a u-shape relation for countries with non-accommodating monetary policy. By this, it reverts the assessment of the prevailing level of bargaining. For example, German wage setters might have chosen just the right bargaining level in face of the highly independent and inflation-averse German central bank.

Empirical Relevance

Since the models of Cukierman & Lippi yield contrary predictions as all other, we expect that an empirical test should be able to differentiate between both theories. Surprisingly, Cukierman & Lippi (1999) as well as Iversen (1998) and Franzese & Hall (1998) have found support for their opposing theories. Again, we have to postpone a detailed discussion to the empirical part of the survey.

2.4.5 Interrelation of Bargaining Institutions and the Political/Legal Environment

The Argument

Kittel & Traxler (2000), Blaschke, Kittel, & Traxler (2001), Traxler (2003b, 2003a) emphasise that horizontal and vertical integration "represent different dimensions of the problem of internalizing externalities that cannot be reduced to one another". They even suggest that they obstruct each other because they depend on orthogonal loyalties. The shift of bargaining to a higher level increases the distance between officials/negotiators and the basis, and by that increases opportunities and incentives to neutralise centrally set rules by individual agreements at the firm level. Therefore Traxler and his co-authors consider an external legal/institutional framework as a crucial basis for the feasibility and effectiveness of centralisation. The framework consists of a laws enabling the enforceability of collective agreements, as for example collective bargaining autonomy, peace clauses and regulations concerning lock-outs. The authors label this issue with the term 'governability'[38] and try to capture it with a dichotomous index.

The idea that legal enforcement devices foster feasibility of cooperative collective solutions is not new in economics. Nevertheless, legal frameworks were disregarded widely in empirical applications, perhaps because of the implicit assumption that centralisation and the availability of such a framework were highly correlated. Though this contingency hypothesis is plausible, we are somewhat surprised that just sociologists[39] emphasise the role of *exogenous* institutional rules. Legal rules are possibly only the *visible* expression of social (background) norms. Laws do not appear from nowhere but are produced by democratic parliaments. Teulings & Hartog (1998) report (indirect) evidence in favour of this endogeneity hypothesis. To this aim they investigate the correlation between the centralisation indicators of Lehmbruch and

[38] See Kittel & Traxler (2000), p. 1175.

[39] All co-authors are sociologists.

Calmfors & Driffill, and the Hofstede-Indicators.[40] They regress the ranks of the both centralisation indicators on the four dimensions of the Hofstede-index and find significant coefficients for 'power distance' and 'masculinity', i.e. people in countries with more centralised bargaining institutions bear stronger aversion against inequality and weight social relations more than individual success. The regression tells us, of course, nothing about the direction of the causal relation. Besides this, attitude measurement is even more complex, fuzzy, and error prone than measurement of many economic variables (including marginal productivity?). The point of Traxler and his co-authors point appears to be nevertheless plausible and relevant for empirical work since legal rules show considerable stickiness. Consequently, the legal framework can be considered as quasi-exogenous or 'predetermined' in the sort and medium run.

Empirical Relevance

Traxler and his co-authors go on to substantiate their theory in an empirical study. Again, since the details of the estimations are somewhat involved, we will explain them in the empirical section below. However, we anticipate that reservations are in order against the pursued empirical implementation strategy, and that we consider their results as inconclusive or less reliable.

2.4.6 Synchronisation, Hysteresis, and Indexation

The Arguments

McCallum's (1983), Bruno & Sachs's (1985), and Tarantelli's (1986) observation that centralised economies came faster to terms with the oil price shocks in the seventies and eighties was probably the central trigger for the debate on centralisation. Taylor (1980) provides a possible explanation for the differing speed of adjustment to price shocks in a dynamic model of wage setting with staggered contracts. He shows that unions have (under imperfect indexation) low incentives to adjust wage claims quickly to changing prices in an environment of staggered contracts. Consequently, centralisation allows faster adjustment to price shocks by synchronising contract negotiations.

[40] The Hofstede index represents four dimensions of the role of social norms in societies. It captures the role of egoism (dubbed 'individualism versus collectivism') in a society, the attitude towards inequality (dubbed 'power distance'), the attitude towards uncertainty and deviant behaviour (dubbed 'uncertainty avoidance'), and the relevance of social relations (dubbed 'masculinity versus feminity). The semantics of his terminology is capable of being misunderstood – especially for economists. Terms like 'uncertainty' and 'individualism' bear another and particular meaning in economics.

In the same direction points the analysis of welfare implications of wage contract lengths in Ball (1987). He finds externalities of contract length which may be eliminated by centralisation. An extension of contract length of one firm has two opposed effects on other firms. (1) The individual firm can predict future wages and prices better if aggregate wage and price levels respond slowly to shocks. (2) On the other hand, exogenous shocks translate into higher *demand* volatility if prices are sticky. Therefore, sticky prices destabilise employment. A negative net effect results if the second effects dominates. In general, it depends on model parameters whether contract duration is too small or too high, but – except in rare special cases – contract duration is not optimal with local wage setting.

Empirical Relevance

An evaluation of Taylors argument appears extremely difficult. The attempt of Layard et al. (1991) to identify significant effects of centralisation on the adjustment of wages and prices to macroeconomic shocks was not successful.

However, the observation that contract duration is not optimised exactly but fixed by simple heuristics and changed only after severe exogenous shocks is against noteworthy effects of Ball's externalities. At a glance, contract duration times do not depend systematically on centralisation of wage setting. If they do, other mechanisms may even out contract duration differences. For example, longer contract lengths in the United States are often combined with COLA-clauses.[41] Other determinants of contract duration, not related directly to centralisation, may be more important. For example, Aoki (1984) explains longer average contract duration in the USA (compared with Germany and Japan) by the fact that incumbent unions are protected against challenges during the contract period. Though centralisation plays a role here, Ball's arguments of predictability and demand volatility apparently are of minor concern to the agents.

The literature does not provide a clear answer to the related question why wage contracts are formulated in nominal or real terms or why COLA-clauses are applied in some countries only. The only current empirical paper dealing with the issue directly seems to be Bratsberg & Ragan (2000). They document a drop in the application of COLA-clauses in the United States. In an econometric analysis, they identify decreasing inflation risks and shrinking bargaining power of unions as main causes. Further causes (in diminishing importance) are deregulation, increasing participation of female and a decrease of full-time jobs in manufacturing. However, their interpretation of

[41] COLA stands for 'Cost Of Living Adjustment.'

the estimation results is somewhat *ad hoc*. It is theoretically not clear, for example, why decreasing union power should lead to a drop of indexation clauses, since the attitude of unions towards COLA is mixed, at least in international comparisons. While unions in the Netherlands went on strike in favour of upkeeping COLA clauses, German unions reject them.[42]

Also economists don't agree on the assessment of indexation. Fischer & Summers (1989) warn about indexation with the argument that it entices governments to exploit the Phillips-curve relation (by alleviating its consequences). According to their view, unconsidered effects of inflation could then overcompensate the positive effects of indexation. Ball & Cecchetti (1991) challenge this view by constructing a model where increasing indexation (i.e. coverage of a larger share of wages by index clauses) creates a net increase of the inflation rate, but is nevertheless efficient.

2.4.7 Monopsonistic and Oligopsonistic Labour Markets

The Argument

The outcomes of union-firm wage bargaining can be interpreted as profit sharing contracts (in the sense of Weitzman's writings). This gives firms the opportunity in local bargaining to influence bargained wages through their employment policy – if they possess some market power. They possess market power, for example, if their labour demand is significant, compared to the whole labour demand. Hoel et al. (1993) show this in a simple formal model. Consider a simple bargaining problem. Union utility $u = w - v$ depends only on wage w and alternative income v. Firm profits are $\pi = R(n) - w\,n$. Maximisation of the Nash-product $u^\alpha\,\pi^{1-\alpha}$ yields the following sharing of profits

$$w = \alpha\,\frac{R(n)}{n} + (1-\alpha)\,v \quad \text{and} \quad \pi = (1-\alpha)\,(R(n) - v\,n)$$

In a two stage game, the firm maximises its share of gross profits given this sharing rule by setting $R'(n) = v < w$. This generates higher employment with local bargaining. Of course, this requires that the labour demand function is not infinitely elastic from the firm's point of view. Furthermore, a problem similar to the efficient bargaining dilemma arises: The firm raises employment *only* in order to exert pressure on wages, and the level of wages fixed in the union-firm wage contract is too high *ex post*. Therefore, the firm

[42] In Germany, also dispensation of legitimacy of COLA clauses is controversial, see Hagermeier, Kempen, Zachert, & Zilius (1984).

has an incentive to fire part of the workers after bargaining. Since a completely rational union knows this, it will not believe in the firms promises and the contract is not viable.

In analogy to the efficient bargaining case (cf. section 2.3.2 and Hoel et al., 1993) credibility can be restored in repeated games.

Empirical Relevance

The existence of unemployment was considered as convincing evidence against monopsonistic or oligopsonistic market power of firms. Current contributions (e.g. Bhaskar, Manning, & To, 2002; Manning, 2002, 2003; Card & Krueger, 1995; a very early but apparently not received contribution is Schlicht, 1982) challenge this view. They show that unemployment is compatible with monopsony or inelastic firm labour supply if other imperfections (e.g. search costs) exist, and provide some empirical evidence in favour of the hypothesis. In a current contribution, Fakhfakh & Fitzroy (2003) provide strong empirical evidence in favour of inelastic labour supply using a employer-employee matched data set of 6000 French firms. With the exception of this paper, clear evidence is rather poor until now because of data availability problems. Since there is considerable progress in the generation and analysis of employer-employee matched data, we can hope to learn much on this issue in the near future.

A problem with the monopsony argument is that local monopsonists are loosers of centralisation. Therefore, it is hard to comprehend why they participate in centralised bargaining. A closer look at descriptive data (the 'Tariflohnstatistik', conducted by the 'Statistisches Bundesamt', the German national statistical office) reveals that the lower performance groups ('Leistungsgruppen', they serve as remuneration indicators) are almost empty in conurbation areas, but filled in rural ones. The implication that low performance workers are not needed in conurbation areas seems not very realistic. Instead, it can be interpreted as implicit wage differentiation between areas with high and low competition for workers.

2.4.8 Substitutability of Inputs – Centralisation according to Region and Occupation/Profession

The Argument

Bargaining power of a union depends heavily on how fast its members can be replaced by outsiders or members of other unions. Naturally, several unions act as competitors if their members are substitutes.

Oswald (1979) provides a framework for the analysis. It is straightforward to represent substitutability by means of the labour demand function:

$$L_i = L(w_1, \ldots, w_k)$$

Labour demand depends on the own wage w_i and the wages of all other $(k-1)$ unions/professional groups $(w_1, \ldots, w_{i-1}, w_{i+1}, \ldots, w_k)$. In general, $dL_i/dw_i < 0$. The signs of the $dL_i/dw_j, j \neq i$ depend on the elasticity of substitution between factor i and j. If inputs are substitutes $dL_i/dw_j > 0$, with complementary inputs, we have $dL_i/dw_j < 0$. Since the basic argument is straightforward, we do not repeat the formal discussion in Hoel et al. (1993) here, but sketch only the intuition.

If inputs are substitutes, unions act as competitors or – formulated in the game-theoretic approach of Horn & Wolinsky (1988) – one union's members can be used as scabs against the wage claims and strike threads of other unions. This simple reasoning predicts that unions (professional groups) merge in order to prevent competition if their members are gross substitutes. It is simple to show that centralisation increases wages in the case of substitutes and decreases them with complements (for a formal argument see Hoel et al., 1993). Therefore, the theory does not only allow an evaluation of wage and efficiency aspects but also explains whether centralisation occurs.

Empirical Relevance

If mobility of workers is low, the competition effect is important only for regional labour markets. Current examples from German labour markets suggest, however, that centralisation with respect to profession/occupation may be an issue of growing importance in the future. The departure of the 'Pilotenvereinigung Cockpit' from the Deutsche Angestellten Gewerkschaft (DAG) was associated with extremely high wage demands. Similarly, the German train driver union attracted attention through high wage claims and the refute to bargain together with the general union Transnet. Both professions are apparently highly specialised and difficult to replace. And both unions use this power in order to push up the wages of their members.[43]

Unfortunately, the predictive power of the theory vanishes if one tries to explain international differences in centralisation of wage setting. For example, it is hard to explain the high importance of professional unions in the United Kingdom and its low importance in Germany since the industrial structure of the both countries appears to be highly similar. A glimpse at

[43]Remarkably, the behaviour of these groups was not welcomed by employers as a valuable pioneering action towards greater decentralised wage setting.

the historical literature shows that the predecessors of English and German unions (e.g. journeyman clubs) were quite different already in the eighteenth century and that organisational structures show extreme inertia (an issue mostly ignored in the economic theory.) Granted this observation, the existence of powerful umbrella organisations may hinder privileged professional groups to break rank and so may help to avoid negative consequences of decentralisation.

On the other hand, the literature on skill biased technical change (SBTC) stresses negative effects of centralisation with respect to profession/qualification. For example, Acemoglu, Aghion, & Violante (2001) explain decreasing unionisation rates by SBTC, arguing that increasing skill premia erode solidarity between skill groups, inducing the more qualified workers to leave unions. Furthermore, the empirical literature on SBTC appears to be a possible source for information regarding substitutability of worker groups. However, we have to admit that we did not try to trace it in detail because the definition of skill groups is rather coarse in most applications (unskilled, skilled and college graduates in most cases), and therefore we do not expect that it reveals much evidence regarding cooperation between skill groups. We already know that unions predominantly represent the medium skilled, that density is highest among this group, and that college graduates are hardly organised in unions. The empirical evidence presented in Acemoglu et al. (2001) does not go beyond that.

Instead of regarding occupational groups, we could resort to the spatial dimension of competition and use fluctuation of workers as a proxy for competition between workers or unions. In this interpretation, unions have a stronger incentive to merge or build regional cooperation clusters if regional mobility of workers is high. A view at table 2.1[44] shows that this naïve theory is not confirmed by the data. According to the data, the USA should have the (regionally) most centralised labour market with a worker fluctuation rate of 96.2%[45], followed by Canada (92.6%), Finland (77.0%), the UK (74.8%), and Italy (68.1%). Fluctuation is rather low in Germany (63.0%) and even lower France (59.6%) and Japan (39.1%). A comparison with the centralisation indicator values in the last column reveals no clear relation between turnover and centralisation of bargaining. (Even if we found one, the bivariate analysis remains prone to spurious correlation bias.)

Also an inspection of the empirical literature on union mergers (see Michelson, 2000 for an introductory survey and Chaison, 1996 for a book-

[44]The table is an extract from table 19 in Layard & Nickell (1999).

[45]Turnover is measured as the sum of accession and separation rates. These rates, in turn, are yearly averages and measured as percent of total employment.

Country	Period	Accession	Separation	Turnover	CD
Belgium	1985	29.0	19.9	41.8	8
Denmark*	1984-1991	29.0	29.0	58.0	4
Finland	1984	40.0	37.0	77.0	5
France	1987	298.9	30.7	59.6	11
Germany	1984-1990	31.6	30.4	62.0	6
Italy	1985-1991	34.5	33.6	68.1	13
Netherlands*,a	1990	11.9	10.1	22.0	7
Spain	1993-1994	26.6	28.5	55.1	-
Sweden*	1977-1981	16.8	17.8	34.6	3
UK	1967-1985	37.2	37.6	74.8	12
Japan[a]	1988-1992	20.2	18.9	39.1	14
Canada	1988	48.2	44.4	92.6	17
USA	1985-1993	-	-	96.0	16
USA*	1977-1981	45.2	46.0	91.2	16

Sources: turnover, accession, and separation measures are taken from Layard & Nickell (1999), the centralisation indicator is from Calmfors & Driffill (1988)

Notes: $*$: Manufacturing only,

a: continuing firms only

Turnover rates are computed as sum of accession and separation rates.

All numbers are yearly averages.

CD: ranking of countries according to the Calmfors & Driffill-indicator of centralisation. Higher indicator values correspond to more decentralised bargaining. (Some positions in the range $\{1, \ldots, 17\}$ are empty, since fluctuation data is not available for some countries, e.g. Austria which occupies range 1 of the ranking)

Table 2.1: Worker accession, separation, and turnover rates in percent

length treatment) does not yield valuable results. Surprisingly, these articles focus on the organisational, administrative, membership acquisition, and cost aspects of mergers, *but disregard competition issues*. It is unclear whether we should interpret this as evidence against the relevance of competition, or as hint to a blind spot in this strand of research.

We found only one empirical study investigating centralisation with respect to profession/occupation: Machin, Stewart, & Reenen (1993). In an econometric analysis of firm data from England,[46] the authors find that the presence of several unions has no significant effect on wages if they bargain jointly. If bargaining is conducted *independently*, however, significant wage

[46]The use the Workplace Industrial Relations Survey (WIRS) 1984.

markups result.[47]

2.4.9 Insider-Outsider Effects

Insider-outsider theories (see e.g. Lindbeck & Snower, 1988a, 1988b) analyse issues related directly to substitutability of workers. While the models above *assume* imperfect substitutability, insider-outsider theories try to *explain* it by selfish behaviour of insiders, i.e. by (unionised) employed workers.

According to Lindbeck & Snower's approach, insiders hinder the management to hire new workers (outsiders) in an upswing by threatening to withdraw cooperation from entrants or to harass them. The implied reduction of outsider productivity deters management from hiring outsiders and gives higher bargaining power to insiders. Fehr (1990) shows that Lindbeck & Snower's solution of the model is not subgame perfect. The firm has an incentive to replace *all* insiders by outsiders if insiders threaten to reduce gross productivity. Therefore the insider threat is neither rational nor credible. Fehr shows furthermore that unvoluntary unemployment does not exist with a two-tier contract where insiders get higher wages and entrants get market-clearing wages. Although Fehr cleared the theoretical aspects, an empirical puzzle remains: Two-tiered contracts are observed rarely.[48] Fehr & Kirchsteiger (1994) explain this using a model based on fairness preferences of entrants. An alternative to postulating utility interdependence is simply to abandon strict rationality assumptions.[49] Thus, although Lindbeck & Snower's solution is not subgame-perfect, it may nevertheless be *relevant* in practice.

We do not want to go further into the details of this discussion, but investigate possible implications for the centralisation debate. Surprisingly, though insider-outsider aspects are mentioned frequently in the centralisation debate,[50] only the formal model of Fitzenberger & Franz (1999) focusses on the issue. Their model tries to capture central aspects of insider-outsider theories with two central assumptions. Firstly, productivity of outsiders is below that of insiders, formally gross labour input is $L_e = L_I + \pi L_O$, where L_I denotes the number of insiders, L_O the number of outsiders,

[47] Naylor (1995) explains their findings on the basis of Horn & Wolinsky (1988).

[48] There exist, however indirect and subtle forms of differentiation between incumbents and entrants. For example, academics start their careers often with placements. Both the duration as well as the frequency of placements seem to show a pronounced countercyclical pattern. Current political debates center on the introduction of explicit two-tier remuneration schemes into collective wage agreements.

[49] See chapter 6 and the experimental evidence cited there.

[50] For an related issue see section 2.4.16.

and $\pi \in (0,1)$ the relative productivity of outsiders. Secondly, relative weights of outsiders in the union utility function are less than unity, formally $V(L_I, L_O, w) = (L_I + g\,L_O)\,(w-b)^{\beta}$, where $g \in (0,1)$ denotes the weight of outsiders. Stochastic fluctuations, which generate employment changes in firms, are represented by exponentially distributed demand or productivity shocks. Unfortunately, the introduction of stochastic shocks renders the model intractable symbolically and urges the authors to accept possibly severe inconsistencies. The exponential distribution of shocks generates a complicated stationary Markov process of firm employment, and the productivity discount parameter π introduces state-dependence of employment (since outsiders become insiders after one period of employment). State dependence requires a stochastic dynamic solution concept for the employment decisions of firms. *However, the authors resort to a purely static optimisation of period profits.* (By the way: It is not clear whether they were aware of this inconsistency. They do not justify the application of the inferior solution concept or comment on the state dependence problem). In a numerical analysis of the system's steady state they find ambiguous effects of centralisation on employment but they do not even try to give an intuitive explanation of the effects. Besides that, the results may possibly be artifacts, caused by the application of an inadequate solution concept.

The ongoing theoretical *and* practical debates on two-tier wage schemes for entrants and long-term unemployed workers in Germany indicate a potentially high relevance of the insider-outsider problem. However, since the model generates ambiguous effects, is highly stylised (for example, the specification of the model restricts firm employment to 0,1, or 2 workers), and yields no clear prediction regarding the size of the effects, it appears to early to assess its implications and relevance in more detail.

2.4.10 Fairness, Envy, and Wage Compression

The Argument

Decentralisation of wage setting generates other externalities if union (or their members') utility functions are interdependent in the sense that wage (or income or consumption) of union A enters utility function of another union B *directly* (and vice versa).[51] In a less formal and abstract formulation: workers are altruistic or envious. This idea is implicitly used (but not applied to the centralisation debate) in several models explaining the wage structure within firms, e.g. Akerlof & Yellen (1990), Frank (1984), and Levine (1991).

[51] Of course, *mutual* (or symmetric) interdependence are the most relevant cases but not necessary to generate the externality.

Hoel et al. (1993) show that the envy externality can be eliminated by coordination.[52] It is clear that envious and identical unions play a zero sum game if they do not cooperate, since a relative wage above unity of one union implies a relative wage below unity for the other union. Nevertheless, it is straightforward to show that both unions choose higher wages and lower employment in the non-cooperative solution. Though the argument is relevant also in an environment with homogenous unions and firms, it seems to be much more important in a world with heterogenous firms and workers. Differences in remuneration become prominent when firms are different but workers are not (or the differences between workers are at least not ostentatious). The slogan 'equal pay for equal work,' stressed again and again by unions serves as indirect evidence for this.

Empirical Relevance

The assumption that *relative* consumption matters was discussed in detail already by Duesenberry (1967).[53] Nevertheless, economists ignore it often customarily. The main reason seems to be that explicit account of utility interdependence makes formal models much more complicated.[54] But a long search is required in order to find an empirical rationale for this custom. Experimental investigations (Fehr & Schmidt (2000) provides a survey, Holländer (2001) contains a theoretical analysis of the implications) point to utility interdependencies in many cases of daily life. Since externalities are present both in the case of positive (altruism) and negative (envy) interdependencies and internalisation does not depend of the type, coordination (centralisation) of unions increases welfare unambiguously. They vanish only in the borderline case of utility independence.

A comparison of polls reported in Agell & Lundborg, 1999 (for Sweden) and Bewley, 1998 (for the USA) suggest that relative wage comparisons are more important to Swedish workers.[55] This could be taken as an explanation

[52]Gylfason & Lindbeck (1984) analyse a similar model but treat centralisation effects only in passing remarks.

[53]It is used implicitly in Keynes' (1936) rationale for the absence of wage adjustment to falling demand. "Since there is imperfect mobility of labour, and wages do not tend to a exact equality of net advantage in different occupations, any individual or group of individuals, who consent to a reduction of money-wages, will suffer from a *relative* reduction in real wages, wich is a sufficient justification for them to resist it." ((1936), Chapter 2, III, p. 14).

[54]Rumelin, Schmidt, & Munk (1996) show that interpersonal dependency of preferences may even result in indeterminacy of preferences.

[55]Relative wage comparisons are relevant in the USA too, however. Brown (1978) finds in an investigation of air force industry workers that worker's primary concern was about

of the higher degree of centralisation in Sweden. – And as a rationale for the lack of coordination in the USA. However, a closer view at the polls cited above shows that an accurate and reliable empirical evaluation of the issue should be extremely difficult, if not impossible, because of extreme measurement problems. Furthermore, though the stable relation[56] between centralisation and wage dispersion is suggestive for that, it is unclear to what extent these externalities are really internalised in practice.

2.4.11 Efficiency Wage Effects

The Argument

Efficiency wage theories consider the impact of fluctuation costs (Schlicht, 1978; Salop, 1979), moral hazard (Shapiro & Stiglitz, 1984), adverse selection (Weiss, 1980), and fairness considerations (Solow, 1979; Akerlof, 1982). In most variants of this strand of literature, firms raise the wage above a level compatible with market clearing[57] and such 'create' externalities to other firms, since higher wages in one firms make fluctuation or motivation problems in other firms worse. Hoel (1989) shows in a bargaining model with efficiency wage ingredients that these externalities are internalised by centralisation.

Empirical Relevance

The relevance of this centralisation effect depends on the existence of efficiency wage problems in labour contracts. As in many other regards, the economic profession is split here too. Some empirical studies contain rather indirect evidence on efficiency wages. Industry wage differentials (Krueger & Summers, 1988; Wagner, 1990; Katz & Summers, 1989; Barth & Zweimüller, 1994; Bellmann & Möller, 1993, 1996; Gerlach & Stephan, 2003), or firm size effects (Oi & Idson, 1986; Wagner, 1991, 1997) remaining after controlling for several important personal traits (qualification, tenure, experience, sex etc.) are interpreted as indirect evidence in favour of efficiency wage theories. There exists also some more direct evidence, e.g. Rebitzer (1995), Wadhwani

relative wages between groups and that they were rather prepared to accept small common drops of wages than relative wage losses.

[56] We will report some empirical results on this issue in section below.

[57] The explanation of unemployment by efficiency wage theories is questionable, however. Moral hazard problems can in principle by eliminated by bonding. Furthermore unemployment is replaced by wage differentials if a second labour market without information problems is present. For a short survey see Schlicht (1990).

& Wall (1991), Konings & Walsh (1994). These econometric studies suffer, however from severe observation and identification problems.

2.4.12 Wage Drift: Pattern and Multi-Level Bargaining

Significant deviations between standard and effective wages (wage drift) are symptomatic for highly centralised labour markets. Flanagan (1990) reports that wage drift was responsible (in the eighties) for about 30–60 % of gross real wage growth in the Nordic countries.[58] Wage drift results either if firms (unilaterally) raise wages above standard wages, e.g. in order to avoid efficiency wage problems, or if local parties negotiate a mark-up over standard wages from central negotiations. Re-negotiations at the firm or regional level are customary in the Nordic countries. The existence of wage drift poses several questions on most stylised models of centralisation and wage bargaining. The most important of these questions is whether and to what extent effective wages are affected *at all* by central negotiations. If standard wages had no impact, the question whether central negotiations take place all is open. A straightforward implication for welfare considerations were that central negotiations simply are waste of time. And an important consequence for empirical studies were that the top level of wage negotiations is not a reliable indicator for the degree of centralisation.

If markups of effective wages over standard wages differ between firms, we have to explain why this occurs and to investigate whether the wage-compressing function of centralisation is effective at all. We will analyse these problems briefly within the framework of efficiency wage models and multi-level bargaining models.

Efficiency Wage Models

Schlicht (1992) analyses the relation between standard and effective wages in a pure efficiency wage model. In his setting, effective wages depend on standard wages and (imaginary) fair wages (i.e. wages perceived as fair by workers). Fair wages in turn depend on standard *and* average wages (paid in the respective branch/industry). Mark-ups of effective wages over standard wages are caused (as in all efficiency wage models) the dependence of productivity on wages. Schlicht obtains the surprising result *that high wage drift results just then if standard wages have only small impact on fair wages!*

[58] Phelps-Brown (1962) and Holmlund (1986) appear to be the first contributions pointing directly to the relevance of wage drift and its implications.

He concludes from this that the economic models may respond sensibly to non-economic factors (which are often neglected in economic models). Of course, the model shows an impact of standard of effective wages, but the relation is somewhat unorthodox. We should notice, that the model takes standard wages as given, but not explain their determination. An integration of standard wage setting procedures into the model is possible and realised in the framework of the multi-level bargaining models which are discussed briefly in the following section.

Multi-Level Bargaining Models

We choose a more formal analysis here, since the interpretation of multilevel bargaining models hinges on details which can be demonstrated easily by inspection of central formulas. Our presentation follows Holden (1998) on the heels.

Basically, these models (e.g. Holden, 1989, 1990, 1998) are two-stage Stackelberg games. In the first stage, central authorities (of unions and employers' associations) set a standard wage which serves as threat point (or fall-back option) for the second stage lower level (local) bargaining. In the second round of negotiations, work force (local union) and firm determine the effective wage $w_l = \underline{w} + D$ by maximisation of the Nash-product.

$$\{\pi(w_l) - \pi_0(\underline{w})\}\ \{u(w_l) - u_0(\underline{w})\}$$

with respect to the drift parameter D. $\underline{w}$ denotes the standard wage, $u(w) \equiv U(w, N(w))$ the utility function of the work force, which (after substitution of the labour demand relation) can be written as a function of w alone, and $\pi(w_l)$ denotes the profit function. The threat points $u_0(\cdot)$ und $\pi_0(\cdot)$ are to be interpreted as utility of the workforce and profit of the firm during conflict.[59]

The dependence of u_0 and π_0 on $\underline{w}$ is driven highly by institutional settings. In the Nordic countries strikes are banned if a standard wages is fixed (until the next central negotiation round takes place). This means that the union threat reduces to work-to-rule practices which lowers profits (the effect on u_0 is ambiguous a priori).[60] The first order condition of the Nash-problem is

$$0 = \frac{\pi'(w_l)}{\pi(w_l) - \pi_0(\underline{w})} + \frac{u'(w_l)}{u(w_l) - u_0(\underline{w})} =: \phi$$

[59] For a rationale of this interpretation see Binmore et al. (1986) or Booth (1995), p. 150–153.

[60] The formulation is not realistic here, since wages and productivity are reduced (by *mutual agreement*) by 25 to 30% in many plants. See Holden (1990), p. 334.

By implicit differentiation we obtain the derivative

$$\frac{d\,w}{d\,\underline{w}} = -\frac{\partial\phi/\partial\underline{w}}{\partial\phi/\partial w}$$

$\partial\phi/\partial w \equiv \partial\phi/\partial D$ must be negative (by maximisation). Consequently the sign of $d\,w/d\,\underline{w}$ is equal to the sign of

$$\frac{\partial\phi}{\partial\underline{w}} = \frac{\pi'\pi_0'}{(\pi-\pi_0)^2} + \frac{u'u_0'}{(u-u_0)^2} \geq 0$$

implying that local wages w_l depend on standard wages $\underline{w}$. The magnitude of the drift depends on how costly work-to-rule is for the firm and the work force. Clearly, if it affects only the firm, the resulting drift parameter must be strongly positive. In the end – also this can be seen directly from the formulas – all results are driven by the functions $u_0(\cdot)$ and $\pi_0(\cdot)$. They simply *hide* the efficiency wage core of the model. Therefore, a closer view at the issues reveals explicit bargaining models rather as decorative embellishment around the efficiency wage core. All the more it is surprising that the efficiency wage component is not even spelled out directly in this strand of literature.

Empirical Relevance

The relevance of standard wages for the determination of effective wages can be conducted as straightforward significance test of the standard wage in wage regression of effective wages on standard wages and control variables. Holden (1998) estimates a wage equation[61] with aggregated time series data for four Nordic countries (Denmark, Finland, Norway, and Sweden). Specifically, he explains the change of effective wages by unemployment rates, changes of prices, productivity, the relevant tax rates, and a error correction term. The coefficient of the standard wage must be zero (or insignificant) if the effect of central wage setting is neutralized completely by local bargaining, and unity if local bargaining does not matter at all. Both, OLS as well as instrumental variable methods[62] produce highly significant standard wage coefficients (all t-statistics are between 2.92 and 10.85) close to unity. Earlier investigations (e.g. Holden, 1989, 1990) deliver very similar results.[63]

[61] It is specified as error-correction model.

[62] Instrumental variable methods are applied in order to correct bias caused by endogeneity of central wages.

[63] Holden applied switching regression models to the data in order to account for possible bias due to nominal wage rigidity. We do not look into the details of these procedures here, since the mainly confirm the evidence of the simpler specifications reported above.

Wage Drift and Wage Dispersion

Since wage drift mark-ups differ between firms, regions and industries, they create possibilities for wage flexibility and (moderate) wage differentials. Though the negative correlation between centralisation and wage dispersion seems to be the most stable stylised fact from the empirical literature (see section 2.5.5), regional, firm size, and industry wage differentials are significant also in Germany[64] and seemingly cannot be explained by heterogeneity of workers or compensating differentials alone.

Characteristics	mean	std. dev
By formal qualification		
Less than completed occupational training	1.0	7.3
compl. occupational training, no Abitur	1.6	7.3
Abitur, no occupational training	3.1	8.3
compl. occupational training and Abitur	4.1	8.6
Technical College*	3.0	6.6
College*	2.9	7.8
By employment continuity		
continuously employed	1.5	6.8
with employment interrupts	1.7	8.9
By occupational status		
blue collar (Arbeiter)	1.1	7.3
white collar (Angestellte)	2.3	7.4
By nationality		
Germans	1.6	7.3
foreigners	1.1	8.0

Source: Pfeiffer (2003)

∗: results for these qualification groups may be biased significantly since a large share of wages is censored from above in the social security data.

Table 2.2: Wage drift and its standard deviation by several characteristics, measured as relative deviation between effective and standard wages in percent.

The most current descriptive evidence for Germany, Pfeiffer (2003) confirms the significance of wage drift. The author computes wage drift rates by several worker characteristics (qualification, employment continuity, occupational status, and nationality) for the time period 1975-1995, based on

[64]For example Wagner (1997) reports maximum firm size wage effects of more than 20%, cf. also Oi & Idson (1986), Wagner (1991, 1997).

a social security data subsample (IABS), which was merged with the German statistics of standard wages (Tariflohnstatistik des Statistischen Bundesamtes). As in many other cases, a closer look at the issue reveals several data problems and limitations. The most severe one is that some thousand (4892 in 1995) collective wage agreements exist for Germany, and that a good deal of the regional and sectoral heterogeneity is not captured in the official statistics. For example, 16 of 63 industries (mainly from the services sector) could not be assigned in the sample since the official standard wage statistics does not record them. The fact that the share of workers employed in these sectors increased from 16% to 28%, indicates noteworthy bias.

Under these reservations, Pfeiffer's results show (see table 2.2) significant wage drift, especially for the qualified, white collar workers, and job movers. An interesting detail of the analysis, which will be relevant in the sections below, is that *wage drift is negative for about 40% of the sample.* This may – perhaps even to a great deal – be due to the mentioned data problems. Nevertheless, the share is large enough to indicate significant downward flexibility in several industries and regions.

By this, also central negotiations seem to provide considerable flexibility for wage adjustment.[65] Nevertheless, the resulting wage structure may be inefficient. We will discuss some aspects of the issue in more detail in section 2.5.5.

2.4.13 Matching and Informational Efficiency

An argument that attracted less attention in the literature relates to the informational efficiency of local and centralised wage setting. Empirical studies suggest that workers in centralised labour markets are better informed on wages and working conditions. Bewley (1998) reports that workers in the USA possess less systematic knowledge on wages payed by other firms while Agell & Lundborg (1999) stress the importance of wage comparisons for Swedish workers.

If one is willing to believe in these results (despite the questionable comparability of the polls and the usual precision and semantics problems of questionnaires), a seemingly inconsistency appears: If wages are more compressed (because of eqalitarian union policies), Swedish workers had less incentives to gather information on wages than American workers where wage differentials are greater on average.

Two explanations suggest themselves: The first, in the vein of section 2.4.10, is that Swedish workers are more envious than US-American ones

[65] Wage drift is procyclical, for example.

and that higher centralisation is simply a response to this. An alternative explanation could be based on the observation that wage agreements regulate, in addition to compensation matters, many other aspects of labour relations, for example working conditions, working time, overtime restrictions, breaks, holiday duration, dismissal notice periods etc. Since a worker's net utility depends on compensation as well as all other utility implications of the labour relation, 'wage' comparisons are much more easy in an environment where all other components are standardised or similar.

Standardisation creates two effects with opposed welfare implications. On the one hand, it restricts possibilities to exploit firm and worker heterogeneity by creation of favourable matches. On the other hand, it increases competition on the labour market by improving comparability of jobs and lowering information costs. The price jungle prevailing in the German telecommunication market may serve as an illustration. Extremely complicated and heterogenous telephone charge schemes are apparently not created to match particular preferences of customers, but rather to differentiate products and to raise information (price comparison) costs. High information costs in turn decrease search activities and alleviate competitive pressure from firms.[66]

A one-to-one transfer of this example to labour markets seems problematic. Firms apparently do not differentiate working conditions in order to gain competitive advantages, because standardisation implies productivity gains. Nevertheless, externalities may be present, and it is unlikely that uncoordinated actions of employers internalise them.

Empirical Relevance

An empirical evaluation of the significance of search costs seems to be extremely difficult. Manning (2002) and Manning (2003) contain some evidence on the relevance of search costs, but it is almost impossible to distinguish the advantages and disadvantages of these costs.

2.4.14 Effects of Centralisation on Investment

Capital is treated as constant or disregarded in most studies on centralisation of wage setting (in order to simplify the models). However, capital allocation may be of high importance in the long run (and dominate other short run effects). There are some rare studies in the literature. But they do not deliver unambiguous results.

[66] For a comprehensible presentation of the topic see Tirole (1995), chapter 7.

Static Models

Grout (1984) and Hoel (1990) show that capital allocation is distorted in local bargaining. The reason is that a high capital stock weakens the bargaining position of the firm by rising losses (opportunity costs of capital) during conflict. In centralised wage setting this effect does not arise since the investment decision of a single firm has no impact on wage setting of the central bargaining authorities (see also Hoel et al., 1993). The effect does, however, not imply higher investment in centralised bargaining since employment may be higher with local wage setting, and higher employment raises the productivity of capital. The only unambiguous effect of the model is that centralisation decreases investment per capita.

Dynamic Models

Moene & Wallerstein (1992) and Moene & Wallerstein (1997) investigate effects of centralisation in wage setting on investment in a vintage model. In such models, productivity of capital (plant) depends only on the time of its installation (vintage). Productivity of an installed plant remains then constant until it is aborted. Nevertheless, plants may be closed down due to the availability of newer more productive capital. The number of newly installed and closed plants in one point of time depends on wages and is therefore endogenous: A plant is built if the required setup costs are less or equal to the expected (discounted) present value of profits. And in remains in operation as long as it delivers positive profits.

With decentralised bargaining, workers of plants with the *same vintage* obtain equal wages. Nevertheless a non-degenerate wage distribution results since plants with different vintage pay different wages. In contrast, a centralised union sets equal wages for all workers, independent of plant age. Though the details of the model are somewhat involved, it is intuitively clear that centralised wage setting yields a larger average productivity and lower average age of plants than the decentralised. The reason is that equal wages favour new installation of capital and put older plants out of business. The relative efficiency of centralised and decentralised wage setting depends on the share $\alpha \in [0, 1]$ of the value added received by workers.[67] (In order to concentrate on the central effects, α is assumed to be independent of the bargaining level.) The range of α can be divided in three (disjunkt) subintervals which characterise the relative efficiency of centralised and decentralised wage setting. If α is small enough, central wage setting is efficient. In the next interval above, centralised wage setting leads to lower employment, higher

[67] α in turn depends on bargaining power.

investment and higher output than decentralised wage setting. If α is close enough to unity, decentralised wage setting is efficient, i.e. yields higher employment, investment and output. Without reference to the parameters of the model, no more specific prediction can be made.

Empirical Relevance

Moene & Wallerstein's model fits neatly to stylised facts: capital equipment is higher and the capital stock is younger in economies with centralised labour markets. Also the empirical investigation of Hibbs & Locking (2000) suggest that the reduction of wage dispersion in the period 1963–1993 lead to higher productivity growth[68] However, the ambiguity of the results of Moene & Wallerstein's model do not allow a definitive assessment regarding relative efficiency. If one agrees to the common-sense opinion (which ist not backed up by clear evidence) that unions are strong in countries with highly centralised bargaining institutions and weak in the others, he has to conclude that the economic world is upside down with respect to bargaining institutions, and that the inferior institutional settings prevail. This admittedly naïve conclusion points to a highly relevant aspect of the debate on centralisation: to the endogeneity problems, i.e. the question whether an to what extent centralisation of wage bargaining depends on the economic environment. We will come back to this issue below.

2.4.15 Centralisation and the Allocative Function of Wages in an Environment with Heterogenous Firms and/or Workers

Heterogeneity of Firms, Regions and Industries

A central argument against centralisation of wage setting rests on the fact that collective wage agreements put certain restrictions on wage differentiation between industries, firms and workers. According to this argument, centralisation generates inefficiencies by 'lumping together' heterogenous firms (or sectors or regions) and workers. Let us consider two quotations from the literature which seem to be representative for several varieties of the argument. The first one, from the yearly report of the German Council of Economic Experts (Sachverständigenrat zur Begutachtung der Gesamtwirtschaftlichen Entwicklung), stresses problems involved by *heterogeneity between firms, regions, and industries (sectors).*

[68] A more detailed summary of the study will be given in section 2.5.5.

> "In bargaining rounds – at least in the last ones – the traditional convoy procedure ['Geleitzugverfahren'] can be observed: agreements are concluded in the strong pilot-regions of a branch, this bargaining outcome is then transferred – more or less – to other regions, and even then, if the economic conditions are significantly worse there, and unemployment is much higher. Furthermore, the agreement in one sector serves as an orientation for agreements in other sectors. Both, aggregate and regional unemployment are not accounted for sufficiently in the wage agreements." Sachverständigenrat (2003), §461, page 259 [translation by Johannes Ludsteck][69]

We will try to discuss the argument implicit in this quotation using two stylised theoretical models in sections 4.2 and 4.3. If these models capture relevant aspects of centralisation, we find no confirmation to this position, but ambiguous effects of centralisation on employment. Unfortunately, the quotation above does not state the relation between centralised and locally determined wages directly. The experts seem to suppose that the bargaining parties in the strong regions do not account for other regions, i.e. *centralised bargaining parties in the strong regions behave as if they conducted purely local negotiations.* If we assume – as it is done in the theoretical models in sections 4.2 and 4.3 – that bargaining is coordinated between regions, centralisation produces lower wages for the strong regions as local negotiations did. With coordinated wage setting, gross employment effects may be positive. Furthermore, it is difficult to find an obvious purely economic reason why *rational* local unions and employers from a weak region (or industry or firm) should adopt agreements from strong regions *if this agreement did not – at least partially – account for its worse conditions.*

Basically, there are four possible reasons. Firstly, expected costs of regional bargaining were too high to justify renegotiations or wage adjustment. Secondly, union members are motivated by envy (see section 2.4.10 above) or loss aversion,[70] i.e. a relative wage significantly below unity would imply

[69]The original German text reads: "In den Tarifrunden – so in den letzten – kann das traditionelle Geleitzugverfahren beobachtet werden: In der oft wirtschaftlich starken Pilotregion einer Branche wird abgeschlossen, dieses Verhandlungsergebnis wird auf andere Tarifbezirke mehr oder weniger übertragen, und dies selbst dann, wenn dort die wirtschaftliche Basis deutlich schwächer und die Arbeitslosigkeit erheblich höher ist. Zudem stellt der Abschluss in einem Sektor eine Orientierung für die Abschlüsse in anderen Sektoren dar. Der Arbeitslosigkeit, sei es der gesamtwirtschaftlichen oder sei es der regionalen, wird in den Tarifabschlüssen zu wenig Rechnung getragen."

[70]See Kahneman, Knetsch, & Thaler (1991). The loss aversion argument requires that workers from the inferior regions consider the wage in the high region as reference point.

a significant loss of utility due to utility interdependence. (Note that we had to account for transaction costs and utility implications of envy in an welfare comparison of bargaining structures if these two reasons were relevant.) Thirdly, unions do not account for the fate of unemployed workers. In this case, we have to explain why local unions put greater weight on utilities of the unemployed in decentralised bargaining. (The argument put forward by Hoel et al., 1993 claims just the opposite, see 2.4.16 below.) Fourthly, unions (and employers) might simply show herd behaviour, have too a high 'preference' for rules of thumb, or suffer from biased perception, i.e. forget low labour demand in their region when they hear about high wages in other regions. By the way: Even if unions are not rational, employers can improve their fates, i.e. can get rid of general collective wage agreements by simply leaving the employers' association and bargaining individually or founding another association (see Hagermeier et al. (1984), p. 84 and pp. 400-411). Even if we take irrational behaviour of unions for granted, it is unclear whether and why these anomalies should disappear in the transition to more decentralised bargaining. If perception bias does matter, decentralisation could improve things, since then wages might become more dispersed and loose their 'focal point' nature. Unfortunately, we found no explicit discussion of this interesting issue in the literature. If the 'irrationality' and 'biased perception' arguments were relevant, economists should try to discuss them in more detail (or consult psychologist) and search for conclusive evidence. Currently, these arguments seem to be used as gap-fillers – *in face of missing empirical evidence.*

By the way, the statement quoted above is not backed up by data or references to empirical studies. Even the attempt to retrieve the fuzzy remark "that the agreement in one sector serves as an orientation for agreements in other sectors" in descriptive data is not successful. Lesch (2001) compares the growth rates of standard wages ('Tariflöhne') between industries for the period 1991-1999. We find the private banking, insurance, and wholesale branches at the bottom with 28.1, 28.8 and 33.4 percentage increases. The 'top ranks' are occupied by the chemical industry, the textile industry, and metal- and electrical industry with 44.0, 48.9, and 61.0 percentage increases. (Yes, the losers had to be content with less than half of the winners' increases.) Though it is really difficult to consider these differences as negligible, *it remains – in face of lacking structural evidence – a matter of subjectivity to interpret them as too high or too low.*

This seems a little bit heroic.

Downward Wage Rigidities An issue often stressed in the context of this debate concerns the question whether and to what extent centralised or decentralised collective wage agreements are more flexible in the sense that they allow for (downward) wage adjustment to cyclical fluctuations. There exists now a considerable strand of empirical research on wage rigidity. Most contributions focus, however, exclusively on the existence and extent of nominal rigidities, but only some studies try to identify possible causes of rigidities. Unfortunately, also the latter are related only loosely to the centralisation debate. At the theoretical level matters are complicated significantly by the fact that several reasons may be responsible for wage rigidity: collective wage agreements (long term contracts), implicit contracts, efficiency wage considerations, or insider-outsider aspects (see Campbell & Kamlani, 1997 for a survey). Even worse, these factors are not mutually exclusive but may complement and enforce one another. For example, efficiency wage problems may facilitate the foundation of a local union. Finally, even if it were possible to attribute wage rigidities precisely to the existence of collective wage agreements, this would be of less help since the rigidity is created *intentionally* by the bargaining parties – at least if they are rational and bargain voluntarily as in Germany – and therefore may be an efficient arrangement.

Empirical studies follow two main approaches. The first one is simply to ask managers for the reasons why they resist to wage cuts in (more or less) representative surveys. The second one is to inspect large micro datasets and to compare the factual distribution of wages with a counterfactual one which would result if wages were flexible.

Let us start with the first approach. Such surveys were conducted (among others) by Akerlof & Yellen (1996) and Bewley (1998) for the USA, Agell & Lundborg (1999) for Sweden, and Franz et al. (2000) for Germany.[71] A comparison of the results for Germany and the USA in Franz et al. (2000) suggests that rigidities due to collective wage agreements are somewhat more important for German managers than for their US colleagues. However, though the questionnaires contain identical items, the differences in the answers are likely to be caused by differences of the sampling procedure and a lack of representativeness in the US study. (The German survey is based on 801 answered questionnaires, the US on 185. Response rates for the surveys are 15.5% and 18.5%, respectively.)

Micro data studies (the second approach), e.g. Altonji & Devereux (1999) for the USA, Beissinger & Knoppik (2001), and Pfeiffer (2003) for Germany find significant nominal wage rigidities in Germany as well as in the decentralised USA. However, Beissinger & Knoppik (2003) find no systematic

[71] For a listing of further studies see Beissinger & Knoppik (2003) and Pfeiffer (2003).

differences between Anglo-Saxon and continental European countries in a comparison of seven studies. Furthermore, even the results of studies relating to the same country or dataset differ significantly and depend highly on the used estimation approach. For example, Beissinger & Knoppik find in an analysis based on a subsample of German social security data that 90% of white collar and 70% of blue collar workers are protected against nominal wage cuts. Pfeiffer, who does not differentiate between blue and white collar, finds (with the same dataset) that at most 60% of all workers are protected against nominal wage cuts. Surprisingly, Pfeiffer finds that higher sectoral wages have a *negative* effect on firm coverage, i.e. firms in industries which pay above-average wages have a lower probability to apply general collective wage agreements (see Pfeiffer, 2003, p. 203). Besides that, several methodological problems indicate that precision and stability of the results are insufficient for cross-country comparisons.

Franz & Pfeiffer (2001) appears to be the only study which tries to attribute reasons for nominal wage rigidity to the competing theories (collective bargaining, implicit contracts, efficiency wage considerations, and insider-outsider aspects) in an econometric analysis. They run several ordered probit regressions which explain the managers' agreement to statements on the reasons for rigidity by firm characteristics. For example, the agreement[72] to the statement 'Collective Wage agreements inhibit wage cuts' is regressed on a dummy for membership in an employers' association, on a dummy for the presence of a company collective agreement, a dummy on voluntary application of a general collective wage agreement, and several control variables.[73] Surprisingly, the coefficient of the company collective agreement dummy is significantly positive and even larger than the membership dummy, i.e. agreement of managers of firms with company collective agreement is even more likely than that of managers of firms being members of an employers' association. However, the difference between the two coefficients is highly insignificant. Besides that, the explanatory power of the probit regression is extremely poor: The pseudo-R^2 is 5.1%, placing the result under strong reservations. Franz & Pfeiffer conclude that collective wage agreements are more important reasons for wage ridigity (than the other theories mentioned above), since probit regressions relating to statements on other theories have even less explanatory power. We think, however, that also this conclusion is heroic in consideration of the vagueness of the concepts. From comparisons

[72] Agreement can be expressed in four degrees: 'Not important' ('trifft nicht zu'), 'of minor importance' ('trifft eher nicht zu'), 'moderately important' ('trifft eher zu'), and 'very important' ('trifft voll zu').

[73] Control variables are industry dummies, a dummy on the presence of a work council, firm size dummies and a dummy indicating employee recruitment problems.

of separate answers for low, medium, and high qualified workers, they find that collective wage agreements are a more important obstacle to wage cuts for the low and medium qualified. This is, of course not surprising (and conveys little information) since the high qualified are hardly represented by unions.

To summarise, also a closer look at the empirical evidence on wage rigidities delivers no clear answers.

Wage Differentials, Fluctuation and Structural Change

An argument, sometimes used implicitly in the literature, appeals to the function of wages as signals for structural change. According to this hypothesis, wage differentials provide incentives for workers to move from the less productive firms/industries to more productive ones. A related question concerns fluctuation of workers between firms in centralised and local bargaining.

Basically, the argument presupposes imperfect competition in the labour market, since wage differentials are eliminated instantaneously under perfect competition. Union wage policy, dictating equal wages in all firms/industries is *in this sense*[74] equivalent to perfect competition. Though wage differentiation and wage compression (as implied by centralisation of wage bargaining) may yield similar results, they do this by different mechanisms. Local wage setting 'pulls' workers from the less productive firms to more productive ones by higher wages, central wage setting 'pushes' them to the high productive ones, since the less productive firms are induced to fire workers while the more productive ones obtain opportunities to hire workers.

A significant difference between local and central wage setting exists only under imperfect competition in the labour market, for example due to fluctuation- or mobility costs or due to asymmetric information (regarding wages and working conditions). Then it is unclear *a priori* whether wage differentiation or wage compression is more suitable to eliminate productivity differentials.

A simple *ad hoc* comparison of the incentives gives no clear result. Central standard wages induce 'bad' firms to dismiss workers. The incentive to move to a 'good' firm amounts to the (utility) difference between the central wage[75] w_c and the unemployment benefit b,[76] formally $u(w_c, m) - u(b, 0)$.

[74] Of course, the wage level in a unionised labour market is different from the competitive solution. This is an *important* difference between true competition and union wage setting.

[75] Of course, our comparison had to be based on expected lifetime incomes instead of 'wages'. We use the sloppy terminology because of its simplicity.

[76] More precisely, b should to be defined such that it covers the utility or disutility of

Respectively, the incentive to move in a local wage setting environment amounts to the difference between wages in 'good' (w_h) and 'bad' (w_l) firms $u(w_h, m) - u(w_l, 0)$. The relative size of the both differences is *a priori* unclear and depends heavily on the mark-up of wages over unemployment benefits. If it is large or workers dislike unemployment *per se*, the *push*-effect of centralisation is more effective than the *pull*-effect of wage differentials.

The simple comparison of mobility incentives is misleading (or too simple) in an important respect. Mainly, it does not account for the fact that wage setting affects labour demand of firms, i.e. that labour demand of the highly productive firms is lower with local than it were with centralised wage setting. Bertola & Rogerson (1997) construct a model with mobility costs where productivities of firms are subject to stochastic changes, and show that fluctuation increases unambiguously with centralisation (because of the wage adjustment argument). This result seems to be unambiguously in favour of decentralisation since fluctuation is costly. Fluctuation costs have, however, to be weighted against positive productivity effects of wage equalisation (leading to an adjustment of marginal productivities). Therefore, the net welfare effect is unclear *a priori*. Unfortunately, we are not aware of models answering this question in a dynamic setting.

Note that Bertola & Rogerson's fluctuation result leaves us with an empirical puzzle. At least, the numbers in table 2.1 on page 33 do not confirm it.[77] Bertola & Rogerson find no systematic differences in job turnover attributable to labor market regulation and explain this by the fact that the higher job turnover caused by wage compression in the more centralised countries is neutralised by employment protection and other job-security provisions in the more centralised countries.[78]

Similarly, Burgess (1999) conducts regressions explaining mean job tenure by country dummies[79] and control variables (sex, sector dummies, education, and age-groups). With base category UK (i.e. the UK-dummy is omitted from the set of regressors) he finds that mean job tenure relative to UK is considerable higher in Japan (3.7 years) and Italy (3.0), but only somewhat higher in Spain (1.7), Germany (1.3), Sweden (1.1), Poland (0.8), and the

leisure.

[77]Furthermore, we realise that we exploit the same data now in a different context – by (implicitly) assuming the opposite causal direction. In search of empirical evidence on union mergers, we considered worker mobility as exogenously given and the level of wage bargaining as the endogenous (dependent) variable. In the present context, the direction of causality has to be reversed to make the data informative.

[78]Their descriptive data include only Italy, Germany France, the United Kingdom, Canada, and the United States.

[79]The data set covers Germany, the Netherlands, France, Italy, Japan, Poland, Spain, Sweden, UK, and USA.

Netherlands (0.7), and slightly lower in the USA (-0.2). The rank correlation between wage dispersion (dispersion is, for example, large in Japan) and tenure does not show a clear pattern.

By the way, even the commonplace that wages in Germany respond generally less to demand shocks than wages in the USA is not confirmed unambiguously in the empirical literature. Mertens (1998) compares German and US workers with respect to mobility in a micro data study (using the IABS for Germany and for the USA), and finds that – according to expectations – wages are regionally more flexible in the US than in Germany, but that – surprisingly – German wages respond more to *industrial* shocks. Her results are, however, under the disclaimer that comparability of German and US data is poor because of quite different data collection procedures.[80] Furthermore, the meaning of the shock variable is quite unclear – it is generated as the residual from a regression of (log) employment on a constant and a linear and squared trend.

What to conclude from the raw descriptive evidence? Either wage compression caused by centralisation is not strong enough to induce higher levels of fluctuation, or mobility costs are so much larger in some countries that centralised wage setting cannot offset them, or industry structure is much more stable in some centralised countries. The descriptive empirical evidence leaves us with a large number of degrees of freedom, and structural evidence (i.e. econometric models delivering *partial* effects of centralisation on job and worker fluctuation) does – to the best of our knowledge[81] – not exist.

Finally, we remind that wage differentials prevailing in decentralised bargaining represent relative scarcities of labour correctly *only* if they are erected by the highly productive firms *exclusively* in order to attract workers. Though the empirical literature on firm wage differentials (cf. also section 2.4.11) is far from being conclusive, it gives rather rise to a rent-sharing interpretation of wage differentials.[82] In this insider-outsider or efficiency wage interpretation, wage differentials coexist with rationing of high wage jobs. Despite of rationing, wage differentials may keep allocative functions (they increase the

[80]The IABS is a 1% sample of the German social security data, the CPS (Current Population Survey) is based on voluntary participation of the respondents.

[81]We traced a survey on job and worker flows (Davies & Haltiwanger, 1999) but found no hints no centralisation effects.

[82]Blanchflower, Oswald, & Garret (1990) draw a decisive conclusion from their empirical investigations: "...these results, when taken together, appear to favor the idea that British wage determination may be seen as a kind of rent-sharing in which workers appropriate a portion of profits..." The empirical works of Holmlund & Zetterberg (1991) and Nickell & Wadhwani (1990) produce similar conclusions.

size and mean quality of the queue of applicants). Their size may, however be far away from an optimum value, since they are created by insider power.

Information Asymmetries

Berthold & Fehn (1996) mention several arguments concerning the allocative function of wage differentials in a concise summary.

> ..."The structure of production is moving away from a largely standardised, fordistic mass production to more flexible, differentiated "high-tech" products. This post-fordistic mode of production is distinguished by a flexible specialisation in production technology... *In such an environment, qualified tasks and consequently firm-specific human capital gain in importance, such that the question arises, how to motivate and to train workers by suitably devised contracts. Therefore it becomes more and more important to use flexible skill and industry wage structures and a high wage dispersion as an incentive device... If one wants to avoid severe agency-problems, workers have to be remunerated more output-oriented.*" [translation and emphasis by Johannes Lusteck][83]

Apparently, the authors use the term 'incentives' in at least two seemingly different contexts. The first one concerns incentives for the acquisition of human capital, the second one relates to general agency problems, caused by private information of workers. We will start with a discussion of general agency problems here since an important aspect of the human capital acquisition problem (the further training problem) turns out to be a special case (or instance) of information asymmetries, and the framework developed for agency problems can be applied then directly.

[83]The original German text reads: "... Die Produktionsstruktur entwickelt sich [vielmehr] überall weg von einem weitgehend standardisierten, fordistischen Massenprodukten hin zu flexibler einsetzbaren, differenzierten "High-Tech"-Produkten. Diese postfordistische Produktionsweise zeichnet sich durch eine flexible Spezialisierung in der Produktionstechnik aus... In einem solchen Umfeld gewinnen qualifizierte Tätigkeiten und damit vor allem das unternehmensspezifische Humankapital an Bedeutung, so dass sich verstärkt die Frage stellt, wie man Arbeitnehmer auch durch entsprechend gestaltete Lohnkontrakte motivieren und weiterbilden kann. Daher wird es immer wichtiger, flexible qualifikatorische und sektorale Lohnstrukturen und eine hohe Lohndispersion als Anreizinstrumente einzusetzen... Will man gravierende Agency-Probleme vermeiden, müssen Arbeitnehmer verstärkt erfolgsorientiert entlohnt werden.

General Agency Problems

Berthold & Fehn (1996) and Lindbeck & Snower (2001) identify efficiency problems caused by information asymmetries as the main reason against centralised wage setting. They start with the observation that team work, knowledge- and technology- intense and flexible production of small lots become increasingly important. According to their view, such production processes require especially that workers disclose private information and knowledge, and adapt to changing demand and production requirements on their own authority. In such an environment, private information of employees regarding their effort, knowledge, productivity, and preferences may exert more detrimental effects than in traditional tayloristic production. According to the central hypothesis, incentive-compatible contracts replace an expensive system of monitoring. Lindbeck & Snower go on to show that centralised collective wage agreements are not able to represent the extreme variety of incentive-compatible remuneration schemes. We try to show in chapter 5.1 that their model contains a crucial inconsistency, that their view of flexible production processes is biased in several respects, and that incentive-compatible wage schemes may be very simple or not useful at all.

An empirical study seemingly in line with the argument is Lazear (2000). He investigates the effects the transition of hourly wages to a piece-rate pay scheme in a large US firm (Safelite Auto Glass Corporation) in 1994/1995 and finds that (1) this raised productivity significantly (by 44%!), and that (2) productivity gains are shared between firm and workers. Unfortunately Lazear's example does not fit the description of human capital- intense flexible production processes. Installation of auto glass appears to be rather a perfect example of 'good old' tayloristic production (where piece rates are standard). It does not require much training, measurement of output is easy, and quality problems can be detected and attributed to single workers without difficulty (or at low cost).

We will sketch now an approach from institutional economics which interprets *wage compression and standardisation* of job definitions as solutions to agency problems.

Contract-theoretic and Institutional Approaches to Incentives within Firms The neoclassical view of unions is based exclusively on their function to create and exert market power (to raise wages above the competitive level). This ist contrasted by the view from institutional economics which interprets collective wage agreements (or collective agreements in general) as solution to contract problems in labour relations. Unions possibly provide (or, at least, are compatible with) a structure for the implementation

of collective agreements. The question whether this contrasting view implies an different assessment or interpretation of centralisation suggests itself. We base our discussion (rather a sketch) on the important contribution of Harris, Wachter, & Williamson (1975).

The authors compare the contract modes spot markets, sequential spot markets, authority relations and collective action (often manifested as internal labour markets) with respect to the viability and efficiency for labour relations in firms. The starting point of their investigation are contracting problems resulting from job idiosyncracies (dubbed 'small numbers problems') in conjunction with bounded rationality and opportunism. Job idiosyncracies are characterised by firm specific knowledge (or firm-specific qualifications and capabilities in Becker's 1965 terminology) and economies of scale arising from cooperation in teams.[84] Firm-specific knowledge is not relevant only with respect to production but also with respect to the transmission of knowledge to new workers (since on-the-job training depends highly on incumbent worker's willingness to disclosure information.)

Idiosyncracies generate crucial contract problems by reducing the exchangeability of workers. Because of this, they suspend spot markets and give individual employees a privileged bargaining position which can be exploited and implies detrimental consequences for all other contracting partners.[85] A solution of the problem by contingent claims contracts fails because of risk, high transaction costs, and bounded rationality: contingent claims specify actions and payouts for all conditions which are potentially relevant for the labour relation, and consequently necessitate a complete enumeration of them. Even if this were possible, the approach fails because of bounded rationality of the parties (who have to represent and evaluate the abundancy of information). The authors show that also the authority relation (analysed by Simon, 1957) suffers from the same problems als spot markets and contingent claims contracts. This is so because the authority relation presumes that the instructions given to the worker do not differ significantly with respect to their utility implications.[86]

According to the authors, only collective action and social contracts re-

[84]The authors differentiate further between equipment idiosyncracies (incomplete standardised equipment), process idiosyncracies, informal team accommodations, and communication idiosyncracies.

[85]This is, of course also the basis for insider-outsider theories.

[86]In Simon's own words (1957, S. 185): "W [the worker] will be willing to enter into an employment contract with B [the boss] only if it does not matter to him 'very much' which [action] x (within the agreed upon area of acceptance B will choose, or if W is compensated in some way for the possibility that B will choose x that is not desired by W (i.e. that B will ask W to perform an unpleasant task).

main a solutions to the small numbers problem. Collective action reduces bargaining power of individual workers by rationalising the internal wage structure in terms of *objective* job characteristics. (Internal labour markets, as described by Doeringer & Piore, 1971, are a typical manifestation of this.) If compensation is tied to jobs/positions, reasons for bargaining over individual wages vanish. Unfortunately, the authors do not discuss (or mention) the problem that bargaining incentives are not abandoned completely by collective action. They seem to be shifted only to other issues, for example to the definition of tasks or the appointment to positions. Nevertheless, job specific remuneration transforms the conflicts since the number of positions is exogenously given and bargaining then relates mainly to discrete structures (instead of continuous compensation). We suspect that a game-theoretic answer to the question how and to what extent collective action is a solution to job idiosyncracy problems will be impossible or awkward. A helpful answer has to be based on empirics, i.e. on an analysis of the behaviour of workers in different organisational settings. Social organisations apparently limit opportunistic behaviour of individuals and small groups, but they may also provide additional opportunities to such behaviour (rent seeking).

An important question remains: the collective-action solution to agency problems can be implemented within firms, centralised agreements are apparently not required. (Apparently, Harris et al. had the firm-level solution in mind.) We offer two answers. The first one is defensive: Centralisation may not improve collective agreements at the firm level, but is rather neutral in this respect. If wage differentials are not suited to solve most agency problems, they cannot be used as a cause against centralisation (especially, since unions do not set maximum wages).

The second answer is less *neutral*. We argued above that the attachment of compensation to jobs may only shift the bargaining problem from *wage setting* to the *definition of tasks or job profiles*. This reservation vanishes if job descriptions (they are dubbed 'Leistungsgruppen' in German collective wage agreements) are fixed at the industry level, since all negotiations are conducted by *representatives* there and it becomes impossible for individuals to influence job descriptions according to their personal advantage. Of course, even if responsibility for the definition of jobs is shifted away from the firm level, it remains to interpret abstract and general definitions from centralised agreements and to determine who obtains the favourable positions. Therefore, it is ultimately an empirical matter to determine whether job-specific remuneration solves agency problems.

Further Misunderstandings with Incentive Compatible Remuneration Schemes Here we point to two problems with the application of incentive-compatible wage schemes to labour relations and the centralisation debate. The first one concerns the relevance of incentives in labour relations, the second one concerns the naïve assumption that incentive-compatible contracts provide exact optimal solutions.

Profit sharing and output-dependent compensation are interpreted as incentive schemes in the mainstream information economics literature. Experimental evidence, e.g. Fehr, Kirchsteiger, & Riedl (1993), Fehr, Gächter, & Kirchsteiger (1997)[87] refute the incentive interpretation in favour of Akerlof's (1982, 1990) gift-exchange- hypothesis. The experimental design of their study allows employers to offer wages above the market-clearing level. These wages are *not* incentive-compatible (i.e. depend neither on effort nor on output), because wage levels are determined before employees choose effort levels. Employers offer indeed non-incentive-compatible wages and the employees respond to this by choosing effort above the enforceable minimum level.[88] Fehr & Gachter (2000) show that conventional incentive schemes may hamper voluntary cooperation so much that they are dominated even by contracts without incentives.[89] Nevertheless, they are preferred by employers (principals), since they allow them to capture a larger share of the smaller cake (profit).[90]

What are the implications of these results for the assessment of centralisation? We think that the role of unions and centralisation depends heavily on the interpretation of incentive schemes. Centralised wage setting may compromise the application of incentive schemes if profit sharing is a necessary means to control strategic behaviour of opportunistic employees. This is not the case if profit sharing is a condensate of reciprocity between management and employees and markups dominate over penalties in wage setting. Then worker solidarity (i.e. solidarity between workers of different firms) may compete with or substitute intra-firm fairness considerations and cause no detrimental effects on motivation. If crowding out of voluntary cooperation by incentive schemes (as found in Fehr & Gächter, 2001) matters empiri-

[87]Introductory surveys to the topic provide Fehr & Falk (2001) and Fehr & Schmidt (2000).

[88]In a variant of the experiment employers can punish 'shirking' employees at the end of the game. Employers show moral aggression by imposing costly punishment (which would not be used by rational players).

[89]For survey on *abundant* related evidence see Frey & Jegen (2001).

[90]Schlicht (2001) stresses that the effect of incentive schemes depends highly on the interpretation by the employees. They have positive effects if they are perceived on the basis of a gift-exchange frame. This turns to the opposite, if they are viewed as means to extract information are as substitute to monitoring.

cally, centralisation may increase efficiency by reducing the applicability of such contracts.

A second *crucial* misunderstanding of incentive schemes is that they provide *exact optimal* solutions for individual incentive problems. Everyone acquainted with these models knows that they are based partially on heroic assumptions regarding rationality and ability to process information of the agents. Formal models are good devices to show *that* dependence of wages on output creates incentives. However, it would be naïve to compute concrete exact compensation schemes for real problems with these models. In practice, near-optimal and approximate incentive schemes are found by trial-and-error search on markets. Practical problems with lacking information and bounded rationality are avoided by extensive usage of rules-of-thumb and standardisation – but *standardised and simplified incentive schemes can represented also in centralised collective wage agreements.*

What to conclude from our discussion? Our presentation here is not aimed to deny the relevance of incentive problems in labour relations. Some arguments in favour of decentralisation appear sensible. We do not claim that the theories sketched above provide a clear argument in favour of centralisation, but we think that the catch phrases put forward by Berthold & Fehn (and others) has no save grounds too.

Acquisition of General Human Capital and Skill Premia

A quite intuitive argument against wage compression is based on the fact that acquisition of general human capital (e.g. college education) is costly. Consequently, skill premia are required to provide individuals with incentives to bear these costs. Application of this logic to wage compression by unions delivers the result that egalitarian union wage policy hampers the creation of efficient skill premia in two ways: Directly, by evening out wage differences between qualification groups represented by them, and indirectly, by raising their member's wages relative to more qualified groups which are usually not organised in unions. The argument fits neatly into the explanation of high unemployment of the unskilled in (continental) Europe, put forward in the literature on skill biased technical change (SBTC).[91] According to this theory, technical progress shows (at least in the last two decades) 'bias' in favour of high skilled workers by raising their marginal productivity more than that of the low skilled. Labour markets without restrictions on wages (as for example the USA and the UK) respond to this with increasing skill

[91] It was put forward first by Krugman (1994), see Acemoglu, 2000; Topel, 1997; Gottschalk, 1997, and Autor & Katz, 1999 for surveys of the theoretical and empirical literature.

premia (i.e. decreasing relative wages of the low-skilled), whereas labour markets with rigid relative wages generate an unequal distribution of employment risks, i.e. greater relative unemployment of the unskilled. Though this explanation for high unemployment of the low skilled in Europe is sound, a closer look at the issues reveals that an application to the centralisation debate deserves several qualifications.

Direct application of the SBTC argument implicitly assumes that centralisation in wage bargaining is responsible for the compression of skill premia in the continental European and Nordic countries. Though the literature on the impact of unions on the dispersion of wages (see e.g. Freeman, 1980; Freeman & Medoff, 1984 or Lewis, 1986) shows that unions in decentralised bargaining environments exert considerable within-plant wage compression too, the cross-country evidence reported in section 2.5.5 establishes a stable positive correlation between wage compression and centralisation. However, Atkinson (2000) put forward a difficulty with the SBTC argument. Wages have not risen significantly at the top of the skill and earnings distribution in continental Europe though unions don't play a role in wage determination of this group[92] and legal *maximum* wages do not exist. There exists, however, one situation where centralisation necessarily leads to a compression of skill premia: If fairness considerations between colleagues and union wage compression policy is eluded by segregating skill groups into different plants or firms. It were interesting to inspect differences in such outsourcing practices between centralised and decentralised countries. Unfortunately, we are not aware of evidence on this.

A closer look at the literature on SBTC shows that there exists no agreement on the reasons for different development of skill wage premia in continental Europe and the Anglo-Saxon countries. Acemoglu (2001) list three competing explanations: (1) that intensified international trade played a larger role for the Anglo-Saxon countries,[93] (2) that technical change has been less skill biased in Europe, and (3) "that the growth in the proportion of the labor force with higher or middle-level qualification did slow down in the United States and the United Kingdom in the 1980's but did not so in Germany." (see Bell & Nickell, 1996[94] and Card & Lemieux, 2001). Though the

[92]This is the case simply because the high skilled and high income earners are hardly represented by unions.

[93]The trade explanation, advocated by Wood (1995) among others, argues that intensified international trade increases skill premia by lowering wages of the unqualified in advanced industrial countries trough increased competition from huge supply of unqualified labour from underdeveloped countries.

[94]Their conclusion is based on data in OECD, 1993 and Abraham & Houseman, 1994, 1995)

different development of the relative skill supply in the Anglo-Saxon and the continental European countries may be caused by other exogenous factors,[95] these stylised facts make it at least difficult to conclude that centralisation is a clear obstacle to sufficient supply of skills.

Alternative Explanations Based on Union Density and Coverage An alternative explanation for greater within-firm skill premia in the decentralised countries is based on differences with respect to union density and coverage rates. Indirect evidence on this issue contains Gerlach & Stephan (2003). The authors analyse effects of firm-coverage (Tarifbindung) on the qualification-specific wage structure.[96] They find that wage dispersion and skill premia are lower in firms covered by collective wage agreements than in uncovered ones. Their data do not compare decentralised and centralised labour markets, however, but highly unionised and less unionised ones. Consequently their results should be interpreted rather as general effects of unionisation. Furthermore the analysis may suffer from considerable endogeneity bias. Since coverage (derived from membership im employers' association) is not compulsory in Germany, firms apply industry wage agreements only if they gain by doing so.[97]

What to conclude from this argument? We observe a strong positive correlation between centralisation of wage setting and union density. This induces many economists to lump both phenomenons together and to attribute all skill premia effects to centralisation. Despite the popularity of this 'approach', we did not find empirical studies disentangling these effects.

Other Forms of Worker Heterogeneity Bertola, Blau, & Kahn (2002) analyse the effects of labour market institutions on the employment of typical

[95] There exist obvious differences in migration policies.

[96] The analysis is based on a linked data set of the 'Hannoveraner Firmenpanel' and the 'Gehalts- und Lohnstrukturerhebung' (GLS) of the German Federal Statistical Office. The data relate to the federal state Niedersachsen.

[97] For a short discussion of the legal conditions see Ruoff (1999). Strictly speaking the endogeneity argument is not correct, since wage agreements can be declared generally binding by the Federal Minister of Labour in Germany. Such declarations have become rare in the near past, however (Bundesministerium, 2001, 2002). Furthermore they are endogenous too, since the declaration requires an unanimous petition of unions *and* employers' associations. According to a approximately representative survey, conducted by the ZEW Mannheim in 2000 (see Pfeiffer, 2003, p. 67), only 8 percent of German firms were restricted by generally binding agreements. Since the declaration of generally binding wage agreements presumes unanimous requests of unions and employers' associations, the number of firms urged to obey wage agreements *against their will* may be overstated significantly by this share.

outsider- groups (female, younger and older workers; characterised by elastic labour supply) using a cross-section data set of 17 OECD countries. They show that unions crowd out these groups of the labour market. In regressions explaining the relative employment opportunities of middle-aged men (25–55) to employment opportunities of female, and younger and older workers, union density has a significant positive impact. However, the effect of a measure of union coordination[98] is insignificant in all regressions.

Compensating Differentials Another argument against centralisation may be derived from compensating differentials. If jobs differ with respect to working conditions (accident risks, health damages, overtime work, noise pollution), compensating differentials are efficient solutions to heterogeneity (even with homogenous workers).[99] Though centralised wage agreements contain differentiations for special working conditions, local wage agreements may fit more to idiosyncracies. Again, it is an empirical matter of whether special working conditions play a significant role for compensation. After an assessment of a large number of empirical studies relating to US data, Smith (1979) concludes that "Tests of the theory of compensating differentials, to date, are inconclusive with respect to every job characteristic except the risk of death." That this indeterminacy is not only due to data problems is suggested in the study of Brown (1980), who uses informative longitudinal data. Sometimes, inconvenient working conditions have even the 'false' sign in wage equations, i.e. they even lead to a *reduction* of wages, as in Lorenz & Wagner (1991). False signs (though insignificant ones) arise also in attempts to find 'risk premiums' for temporary workers. Hagen (2001) finds that 'wrong' signs stand even up to the attempt to account for unobserved differences between temporary and non-temporary workers by application of sophisticated matching and prospensity score methods.

Further Training and Firm-Specific Human Capital

Human capital acquisition occurs in two considerably different ways (we will explain this below) which demand special treatment in the economic analysis. *General training* (its implications for centralisation were discussed above) generates skills which raise productivity in *many* employment relations, e.g. schooling. Since it is provided either by the state or acquired in training

[98] They use an indicator from Belot & Ours (2000). For problems with such measures see 2.5.1.

[99] The issue is already discussed in Smith (1776). Rosen (1986) provides a survey on the theory of compensating differentials.

markets, it generates *ex ante* heterogeneity between employees. If the qualification level can be observed, no further information or agency problems arise in the labour relation. On the contrary, information problem prevail with *firm-specific* training, and that this has several important economic implications. We will discuss them in the following paragraph

Arguments against Centralisation When Berthold & Fehn (1996) stress the role of wage differentials as incentives, they apparently appeal to the role of firm-specific skills: *"...In such an environment, qualified tasks and consequently firm-specific human capital gain in importance, such that the question arises, how to motivate and to train workers by suitably devised contracts."* To appraise their conclusion that the implied economic problems can be solved better in a decentralised bargaining environment, we have to take a swing.

Pigou (1912) pointed almost hundred years ago to the fact that firms loose part of their investment in the human capital of their employees if these quit after training has taken place. Then the poaching firm will create an externality by capturing a share of the human capital revenues and cause too a low level of training. This implies that high competition for workers and high mobility of workers may generate severe efficiency problems in the labour market.

Becker (1962, 1965) tried to dissolve the externality in a seminal contribution by the important distinction between firm specific and general training. He argued that general training raises (by definition) productivity of an employee in each employment relation and thus provides him with the right incentives to bear the required costs.[100]

Firm-specific training does not create poaching incentives (since specific training does not raise the employee's productivity in other firms *by definition*), but the firm has to incur losses also if the employee quits for some other reason. Employees equipped with specific human capital can therefore claim a share of the productivity effect of the training with the strategic threat of quit and generate an externality too. Becker suggests that it can be (and is) internalised if costs and revenues of specific training are shared between firm and employee. He argues that this investment sharing is realised in practice if apprentices/trainees accept lower wages during the training and obtain a wage above their marginal productivity in other firms thereafter.[101]

[100]The argument is based on the (partially problematic) assumptions that competitive markets for general training exist, that employees have complete information or at least rational expectations on the revenues of training, and that there is no credit rationing. Existence of credit rationing is, however, likely since employees have private information on expected revenues and their trainability, cf. Waldman (1990).

Hashimoto (1981) formalises Becker's argument and shows that an (implicit) training contract is efficient *only* with complete symmetric information. It is not viable if the firm holds private information on productivity gains from training and the employee holds private information on his outside option. In this case firm and employee construct a second-best contract by computing an optimal sharing ratio (for costs and revenues) in order to approximate separation decisions (for dismissal and quit) to the first best solution.

The second-best contract may be far from the optimal solution *in practice* because the determination of the optimum sharing rule requires that firm and employee understand the problem. In many other applications of incentive contracts, agents need not to understand the problem in order to find a good solution. They can find the optimum solution in a trial-and-error search. Trial-and-error search is here not applicable, however, since firm-specific training is idiosyncratic *by definition*.[102]

Stevens (1994, 1996) shows that Becker's separation of skills into general and specific ones is not possible in many cases. She analyses the case of *transferable* training, i.e training yielding productivity effects in other firms with positive probability and shows that *transferable* training generates externalities too. A current alternative explanation of skill idiosyncracies widening the externality problem is advanced by Lazear (2003). The obvious idea is that a worker's human capital endowment becomes specific (even if all skill components are perfectly general) if firms require these skills in different proportions.[103]

Consequently, Becker's attempt to explain externalities away appears to have failed and we have to ask whether decentralisation is a suitable solution to inefficiencies caused by specifity of human capital (as suggested by Berthold & Fehn). Hashimoto's training contract requires wages below collectively agreed standard wages during the training period and above af-

[101]The reader may ask why firm and employer don't solve the problem by simply writing a contract specifying that the worker has to stay with the firm a certain time. Becker argued this were not possible since it amounted to a reintroduction of slavery. A more realistic rationale seems to be that private information (e.g. on productivity effects of training) make it impossible to write an efficient contract. Such a contract had to specify a fine to be payed by the worker to the firm in the case of a quit. Too a high or too a low value of the fine renders the contract inefficient.

[102]Manning (2003) points to the fact that Hashimotos model assumes imperfect competition (an increase of the after-training wage reduces the probability of quits) and thus does not solve the problem for the case of perfect competition which was assumed in Becker's original treatment.

[103]For example, though LaTeX typesetting and basic secretary skills are highly general, secretaries equipped with both tasks are rare.

terwards. If collective wage agreements do not allow for such exceptions, centralisation decreases efficiency. However, if wage drift is present (and large enough), average wages exceed standard wages. Then investment sharing can be realised by reducing wages to the standard rate. Additionally, a closer inspection of collective wage agreements reveals that they leave indeed some space for adaptions to special needs.

Finally, Hashimoto's separation of training and 'harvesting' period (introduced for sake of simplicity) and the implied step-shaped wage profile play a minor role in reality, since training is typically a continuous process. The implied continuously increasing wage profiles can be (and apparently are) approximated well in collective agreements. Wage compression seems to improve the situation in such cases because a mean decreasing spread of the worker's alternative income reduces the information problem in Hashimoto's model.

If we go back to the institutional approach set out by Harris et al. (1975), we find an additional case against wage differentiation. A passage from Thurow (1976) can be read as a direct application of their arguments to our current topic. Note that Thurow's description of training problems and their solution is just contrary to Berthold & Fehn's.

> "If... we live in an economy where laborers acquire many of their cognitive skills through informal training from other workers or from their immediate supervisors, we need a differently structured labor market than we would if the only purpose of the labor market were to allocate skills and establish equilibrium wages. A labor-training market must be so structured as to maximise the willingness of existing laborers to transmit their knowledge to new workers and to minimize every worker's resistance to acquiring new skills and accepting new technology. Eliminating direct wage competition and limiting employment competition to entry jobs is a necessary ingredient in the training process. *If workers feel that they are training potential wage or employment competitors every time they show another worker how to do their job, they have every incentive to stop giving such informal training.* In that case each man would seek to build his own little monopoly by hoarding skills and information to make himself indispensable. Wage and employment security also means that every man has a vested interest in resisting any technical changes that might reduce his wages or employment opportunities. *To encourage training, employers must repress wage competition and build employment security.* [Emphasis by Johannes Ludsteck]

What about the empirical evidence? A glance at the descriptive empirical evidence is not very informative, but provides little support against centralisation. With respect to *further* training, countries with centralised labour markets seem to do better in cross country comparisons (see e.g. Franz & Soskice, 1995; Soskice, 1994; OECD, 1994). Standards of occupational and further training are quite high in the centralised countries.[104] The differences in training standards, however, may be caused by other factors than centralisation of wage setting. In a comparison of Germany and the USA, Acemoglu & Pischke (1998) attribute the eye-catching differences to lower mobility in Germany. Harhoff & Kane (1997) suspect that German employers' associations were able to implement normative obligations for firm-based training. Though the descriptive evidence cannot explain the source of differences in further training between the more and less centralised labour markets, it does not produce any clear indication that the centralised labour markets are less capable to provide training incentives than the decentralised ones.

If we trace the literature for some more structural empirical approaches, we find indirect and weak evidence in favour of centralised solutions. Agell & Lommerud (1997) show in a theoretical model that minimum wages may exert positive effects on the acquisition of human capital in labour markets with imperfect information, and Acemoglu & Pischke (2002) suggest in a microeconometric study that the model is relevant in reality.[105] In line with this, Booth et al. (2001) find that the introduction of a national minimum wage caused an (admittedly insignificant) *increase* of work related training (for workers affected by the minimum wage).

Unfortunately, all this evidence is inconclusive, leaving many empirical aspects of the issue in the dark. The 'proposition' that centralisation generates severe externalities or obstructs their internalisation, however, appears to be questionable and unfounded. Its popularity seems to come from the fact that 'incentives', 'decentralisation' and 'flexibility' have become magic spells whose meaning has not to be explained any more.

[104]For example, Beicht, Feher, & Bardeleben (1995) report that firms spend some thousand Deutsche Mark per apprentice.

[105]We should note here that also negative effects of minimum wages were found in earlier studies, which (according to the Acemoglu & Pischke's remarks) possibly can be attributed to data and specification problems. For example Hashimoto (1982) finds a negative effect of minimum wages on wage growth of the affected workers and concludes from this that minimum wages reduce training. The conclusion is, of course, neither direct nor compelling. Acemoglu & Pischke (2002) contains a detailed discussion of the involved issues.

2.4.16 Viability of Cooperation and Endogeneity of the Bargaining Level

> Despite the extensive use of the lighthouse example in the literature, no economist, to my knowledge, has ever made a comprehensive study of lighthouse finance or administration. The lighthouse is simply plucked out of the air to serve as an illustration... This seems to me to be the wrong approach. I think we should try to develop generalizations which would us give guidance as to how various activities should be best organized and financed. But such generalizations are not likely to be helpful unless they are derived from studies of how such activities are actually carried out within different institutional frameworks. Such studies would enable us to discover which factors are important and which are not in determining the outcome, and they would lead to generalizations which have a solid base. They are also likely to serve another purpose by showing us the richness of the social alternatives among which we can choose."

This paragraph closes a contribution of Ronald Coase (1974), investigating (on the basis of historical sources) the financing and maintenance of lighthouses in the seventeenth century in England. Background of his investigation is the prominent role of lighthouses as an example in economic theory and rationale for government intervention. *Contrary to expectations and the predictions from economic reasoning, he finds that many lighthouses were financed and maintained by private cooperatives of shipowners.*

Following Coase's advice, it seems reasonable to put an explanation of the dominant level of wage setting on the beginning of the centralisation debate, or to combine the analysis of the determination of bargaining levels and their efficiency properties. If, for example, the analysis reveals that the bargaining level is determined mainly by technology (as in the models of centralisation with respect to occupation), or that the level of bargaining emerges as efficient response to transaction costs and market imperfections, there is no ground for recommendations on how to change bargaining structures. International differences between bargaining levels can then be attributed simply to different environments.

The dominating economic approach seems to put the cart before the horse by isolating and analysing certain aspects of centralisation without regard to the economic environment.[106] Many researchers stop after an assessment of

[106]Of course, isolation and ceteris paribus clauses are often a necessary prerequisite which open the view to the interesting effects and make models tractable. Thus our critique is

the employment or efficiency properties of bargaining levels and conclude with rather abstract advice. A search (in the economic literature) for the reasons why unions and employers' associations show certain organisational structures, yields at most some hints and marginal notes. For example, in the literature research for this work we found only two (book-length) contributions (from political scientists, Gladstone & Windmuller, 1986; Sisson, 1987) focussing on the objectives, role, and organisational structure of employers' organisations.[107] Empirical contributions to industrial relations for Germany come mainly from sociologists (Streeck, 1984; Müller-Jentsch & Ittermann, 2000) and political scientists (Thelen, 1991). Newer empirical studies on actual prevalence of and compliance to collective wage agreements were conducted by sociologists (Artus, 2001) und jurists (Oppolzer & Zachert, 2000).[108] That these contributions are mentioned at best in marginal notes but not received, may come from significant differences of methods and paradigms between economics and other social sciences. Though economists may not be responsible for these communication problems, a considerable hole in our knowledge of these topics remains.

After the obligatory and necessary hint that the minor theoretical contributions of this work (in sections 4.2-6) conform to this tradition by considering highly stylised problems and abstracting from institutional and organisational aspects of bargaining, we will sketch now some results regarding endogeneity of bargaining institutions.

Formation of Coalitions

Centralisation of wage bargaining generates winners and loosers, especially if firms and workers are heterogenous. For example, workers of highly productive firms loose from centralisation since it hinders them to exploit their insider power to some extent. (Typically the centrally negotiated wages will be smaller than local ones for this group.) Similar consequences result for workers with different qualification. The stylised fact that unions compress also qualification wage differentials ist stressed repeatedly in the large literature on skill biased technical change (SBTC). This argument takes cooperation between skill groups for granted but does not explain it.[109]

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not levelled at the isolation principle in general.

[107] we have to notice that Soskice (1990) stressed and explained the role of employers' associations in his critique of Calmfors & Driffill's hump-shape hypothesis. We will come back to this in section .

[108] Though we do not want to belittle Coase's contribution we have to mention that he does not explain *how* shipowners managed to overcome the prisoners dilemma arising in the open good allocation problem.

Centralised wage setting presupposes coordination among unions and employers: An industrial union representing several skill and qualification groups has (at least in non-trivial cases) to set wages *for each group*. This may generate significant conflicts between the groups. The same problem arises in employers' associations with heterogenous firms. Unfortunately, the analysis of multilateral bargaining appears to be much more involved than the simple voting mechanisms (sketched in section 2.3.1) and *bilateral* bargaining (see section 2.3.3). This is so because the small number of members and heterogeneity give them market power and such generates strategic interactions. The question 'why and how achieve individuals cooperative solutions despite of significant clashes of interests?' suggests itself.

An (rather abstract) answer provides the theory of coalitions. Johansen (1982) contains a discussion of the issue which is applied to centralisation by Hoel et al. (1993). Consider a coalition game for the set $N = \{1, \ldots, n\}$ of players. A coalition is represented as set of indexes of its members. Maximum utility that can be obtained by a coalition S (no matter how other coalitions behave[110]) is represented by the characteristic function $v(S)$. Complete centralisation (i.e. a grand coalition) of a union (or employers' association) is possible only if the game has a core. The core $C(v)$ is defined as a sequence of payouts $\{x_1, \ldots, x_n\}$, with $\sum_{i \in N} x_i = v(N)$ and $\sum_{i \in S} \geq v(S)$ for all coalitions $S \subset N$. In words: the core is a grand coalition dominating all other possible coalitions. It is easy to construct games (or payout sequences) with an empty core, though the characteristic function v is superadditive, i.e. $v(S)+v(T) \leq v(S \cup T)$ for all S, T with $S \cap T = \emptyset$. In words: a grand coalition may not even exist if it is efficient for all pairs of coalitions to merge. The grand coalition breaks if at least one coalition S exists which can increase its utility by separation from the grand coalition. A more narrow concept of the core, defined by Johansen (1982) is based on the idea that each coalition (or single player) demands what it could obtain outside the grand coalition *plus a share of the surplus it creates by joining the grand coalition.*[111] Formally the Johansen-core is defined by

$$\sum_{i \in N} x_i = v(N) \text{ and } \sum_{i \in S} x_i \geq v(S) + \big\{ v(N) - v(S) - v(N \backslash S) \big\} \lambda_S \text{ for all } S \subset N,$$

[109] Even theories focussing on the effects of cooperation between skill groups in unions (e.g. Barth & Zweimüller, 1995; Gregg & Manning, 1997, and Akerlof & Yellen, 1990) are quiet about the viability of cooperation.

[110] In a formally more accurate definition $v(S)$ is *maximin* utility, i.e. the maximum utility obtained by coalition S if other coalitions choose a combination of actions exerting maximum harm to S.

[111] The outside value is the maximum utility the coalition (player) could obtain by separating from the core.

where λ_S is the share claimed by coalition S. If the shares λ_S and $\lambda_{N\setminus S}$ are determined via the Nash bargaining solution, we obtain (by efficiency of the solution) $\lambda_S + \lambda_{N\setminus S} = 1$. *Therefore the Johansen core is empty in almost all cases.*[112]

All in all, the formal analysis shows that grand coalitions are highly unlikely. Though the model is highly abstract, it helps us to structure thinking about centralisation. All models predicting positive centralisation effects provide reasons for cooperation. If we observe decentralisation, this does not necessarily imply that positive centralisation effects are absent or that they are outweighted by negative effects. It is possible that short run gains of deviation from a cooperative strategy are too high for certain groups, and that side payments from other groups are not possible. Nevertheless, there is no reason for political intervention as long as we do not know the exact reason for the observed decentralisation trend.

Cooperation in Repeated Games

While the theory of coalitions tries to examine the conditions for the viability of cooperation at a very general level, disregarding concrete strategies of the agents, the game theoretic analysis of repeated games puts focus on the strategies. This gain in concreteness is made possible by simplifying many other details. Particularly, sub-coalitions are assumed away by the rules of the game (or payout vector definition). Players then have to choose only between two strategies ('cooperate' and 'defect').

Holden & Raaum (1991) analyse cooperation of independent decentralised unions in a repeated game by application of subgame perfect trigger strategies.[113] The not surprising results (which are analogous to the results from the industrial organisation literature, e.g. Rotemberg & Saloner, 1986), can

[112]The results of the game theoretic literature on multilateral bargaining (extensions of the Rubinstein game to more than two parties) are not unique and seem to respond sensibly to small changes of the rules. We mention only two examples here: In the unanimity game (described by Sutton (1986)) each division of the cake can be an equilibrium. The rules are (in the case of three players): player 1 proposes a division of the cake. 2 and 3 then simultaneously choose to agreement or to disagree. The game ends (with the division according to 1's proposal) if both agree. Otherwise 2 obtains the right to make a proposal in the next round and so on.
Krishna & Serrano (1996) analyse a game with slightly different rules: Again 1 makes a proposal and the other two players decide simultaneously on agreement. The game end as Shaked's game if both agree. However, if only 2 agrees, he obtains his share according to 1's proposal and the game goes on as the 2-player Rubinstein game in the next round. If the discount rate is close enough to unity, all players receive equal shares of the cake.

[113]Pohjola (1990) contains a similar analysis within a survey article.

be summarised in two sentences. Cooperation prevails if the gains of deviation from cooperative behaviour are small enough and the players are patient enough (i.e. the discount rates for future consumption/profits are large enough). Private information generates additional hurdles to cooperative behaviour.[114] A possible consequence of the existence of concludent cooperative solutions is that the organisational structure of unions and employers' associations does not matter (or plays a minor role) for bargaining outcomes: "An interesting conclusion drawn from this extension of the basic one-shot game: bargaining structure may not matter at all, but the 'mode of play' is important. If the unions possess complete and perfect information and if they are not too myopic, then they should be able to reach consensus on wage policies and obtain efficient outcomes without any binding contracts." (Pohjola, 1990).

We conclude this section with a disclaimer. Game theoretic models of coordination explain the existence of cooperation and coalitions exclusively by rules of the game and preferences of the individuals and don't allow for any repercussions. On the contrary, experimental psychological investigations suggest forcefully that groups exert a strong impact on the behaviour of their members, even if they place no formal constraints on their behaviour. The experimental research on this issue (dubbed *minimal group studies*) started about 20 years ago with the intention to find the minimal conditions required to make people feel to belong to a group. The research, however, gathered quickly momentum by its own since the results were surprising even to the investigators (for an introduction to the issue with application to organization theory see Haslam, 1995).

In the seminal study of Taifel, Flament, Billig, & Bundy (1971), schoolboys were assigned according to an apparently arbitrary criterion to two groups. The both criterions were the schoolboy's estimates of the number of points on a screen or the preference for the abstract painters Klee and Kandinsky. Surprisingly, even this minimal form of agreement shaped perception and action of the group members. For example, if the boys had to distribute (small) amount of member to anonymous member of the own and the other group, in-group members were favoured. Doise et al. (1972) report that – in spite of the lack of additional interaction within groups, in-group members were perceived as more flexible, kind and fair. The bias prevailed even if investigators indicated the arbitrariness of group assignment to the test subjects.

[114] A typical example for private information in this context is that only local workforces know their deviation gains since only the have good information on the situation of the firm and their working conditions.

It is not clear, whether these findings would prevail in 'high stake' experiments where test subjects can gain large amounts of money. If they are relevant, however, they point to a blind spot and significant limitations of several economic models on centralisation effects.

Demand for Insurance

Agell & Lommerud (1992), Burda (1995), and Agell (2002) discuss the worker's demand for insurance as rationale for egalitarian wage policy and centralisation. Wage compression (e.g. elimination of firm and industry wage differentials) can be interpreted as insurance against wage income risks. This argument, of course, relates only to *ex ante* identical workers, implying that it applies only if worker have equal abilities and human capital endowments when entering the labour market. Consequently, it cannot be used to explain compression of wage differentials related to qualification.

At an abstract level, a problem with the insurance argument arises: Egalitarian union wage policies can be substituted by governmental redistribution and other public and private income insurance. Therefore egalitarian public policies may crowd out unions from the 'insurance market'. (Apparently Bismarck aimed his compulsory insurance policies as an bulwark against the upcoming labour movement.) The crowding-out hypothesis lends itself to a empirical test. Bivariate correlations between centralisation of wage setting or union density and the size of public redistribution point strongly to a positive relationship, i.e. social policy is more egalitarian in countries with strong unions. Thus the evidence is against the hypothesis. The argument of Gruber et al. (1993), sketched in section 2.4.3 above, may serve as an alternative explanation of this fact.

Agell (2002) provides alternative indirect evidence on the issue with cross-section country data (from OECD countries). He uses the openness to international trade (measured as the sum of export and imports, divided by GDP) to proxy how much population is exposed to income risks (caused by macroeconomic shocks). The openness index is used (together with control variables[115]) to explain several dimensions of labour market institutions and social insurance systems. He finds a positive impact of the openness indicator on the unemployment replacement ratio, on union density and the (Calmfors-Driffill-) index of centralisation. If the population size is added to the set of regressors, however, the openness indicator becomes insignificant for union density. Despite of appropriate reservations against cross section/cross country regressions,[116] the study delivers some evidence in favour of the hypothesis

[115]Control variables are GDP per capita, an index for linguistic fractionalisation, and population size. All variables enter the regression equation as logs.

that union wage policy is driven by insurance motives.

Utility Interdependence, Envy and Fairness

The models sketched in section 2.4.10 deliver effects of centralisation on the level and dispersion of wages together with a prediction of the degree of centralisation. Note that, while wage compression may be an unintended 'accompanying symptom' of collective wage agreements in the institutional approach (Harris et al., 1975), these approaches declare it as an *intended* result, caused by preferences for fairness, envy or altruism. Of course, there are no grounds for institutional reform if utility interdependence is a dominant factor for the determination of the bargaining level. Nevertheless, we have to remind that all evidence on the relevance of interdependencies is highly indirect.

Endogeneity of the Membership Definition

Hoel et al. (1993) argue that centralised unions apply a broader concept of membership. If dismissed workers leave the union, this leads to a decline of membership of local unions and a change of the union objective (as stressed in insider outsider models, e.g. Blanchard & Summers, 1987; Lindbeck & Snower, 1988b). The ties of workers to centralised unions may, however, be closer since the boundary of a firm is not the boundary of the union there. If this is the case, unemployed members' utility functions obtain higher weights in centralised bargaining. Unfortunately, direct evidence regarding this point does not exist. Farber (1986) and Dertouzos & Pencavel, 1981 are probably only studies trying to estimate the weights of employment in union utility functions. Since both studies use data from the United Staates, it is impossible to make a comparison between different levels of centralisation.

Efficiency Wages, Technology and Reorganisation

Ramaswamy & Rowthorn (1993) explain the prevailing level of centralisation in wage setting by heterogeneity of production technologies in an economy. The basic idea is simple. Since the 'law of one price' does not apply in efficiency wage models, wage differentials exist – even with homogenous workers – if the effort functions (damage potential, monitoring technologies etc.) differ between firms or industries.[117] In their model, the level of bargaining depends simply on the heterogeneity of the effort functions. If they differ

[116]The main problem of such studies are the unclear direction of causality and the low number of observation imposing severe restrictions on choice of control variables.

significantly from one another, employers will prefer decentralised solutions. The authors attribute the reasons for increasing heterogeneity to the increasing relevance of the services sector in gross employment: The services sector seems to show the most heterogenous structures of production and employment.

At a glance it is not clear why efficiency wage models with unilateral wage setting can provide any contribution to explain the behaviour of unions at all since union behaviour is not considered there. Models integrating union-firm bargaining into an efficiency wage framework, (see Pichler, 1993; Layard et al., 1991; Hoel, 1989; Garino & Martin, 2000) show, however, that this does not change the qualitative behaviour of the efficiency wage relation.

In a less formal, but more accessible manner Soskice (1990) argues that technical change leads currently to an increasing share of employment in the services sector, a decrease of firm sizes, a more heterogenous pool of firms, and a more flexible production structure. Furthermore, it increases bargaining power of the highly qualified employees to the disadvantage of the less qualified and, by this, undermines solidarity. Soskice does not conclude a dissolution of coordination networks, but rather a shift of power in favour of employers. "The mistake of the decentralisation hypothesis is the belief that economy-wide coordination no longer exists... What has in fact happened is more interesting. In economies in which co-ordination was well established in the 1960s and 1970s it still exists (and for reasons connected with changing industrial relations structures has even developed in the case of France and Italy). But unions now play a less important role and employer organizations and networks a more important one. In part, indeed, this accounts for the lack of fanfare: for employer organizations are more reticent than unions." (Soskice, 1990, S. 53). Soskice stresses a point often underexposed in the literature. Decreasing union density, coverage, and bargaining power can be interpreted as decentralisation (Katz, 1993). We find Soskice's explanation of decentralisation and deunionisation by structural change in favour of the services sector highly plausible. However, we have to emphasise that Soskice is careful to interpret these shifts not as long run tendencies or as efficient developments. Soskice's reasoning might be extended by the hypothesis that employers are gaining temporarily because they are more capable to exploit heterogeneity of workers and less structured new developments of market and working conditions (for example, small firm sizes and the dynamics of establishment formation assigns unions to new tasks). Unfortunately, we

[117]Further causes for the heterogeneity of effort functions are differences in the importance of firm-specific human capital, differences in the capital equipment, differences if fluctuation costs etc.

have found no empirical evidence on this issue.

2.4.17 Strikes

Theoretical Models

Relatively low strike activity in highly centralised labour markets is considered as a stylised fact by many economists (Hoel et al., 1993, p. 103. Berthold & Fehn, 1996, p. 82). (This is somewhat surprising, since that empirical evidence is poor. We will present an explorative empirical investigation in section 3.) Unfortunately, economic explanations of strike activity turn out to be rather involved. Therefore we have to take a swing.

For a long time it seemed to be impossible to explain the occurrence of strikes with economic models based on rational agents. Hicks recognised already in (1962) that strikes cannot occur in bargaining models based on perfect symmetric information, since rational agents can agree *ex ante* on the outcome resulting after a strike and thus avoid costly a harmful/costly strike. The Nash bargaining solution excludes strikes *by definition* and the solution strategy to the Rubinstein game (proposed by Shaked & Sutton, 1984) shows explicitly that rational agents come to an agreement instantaneously.

Consequently, current game theoretic models of strikes are based on private information of firms/unions.[118] Strikes serve as screening devices in order to extract private information (regarding profits, strike fund, willingness to strike of the work force) of the opponent. Unfortunately the predictive power of these models is restricted since minor variations of the rules can lead to significant changes of the outcomes (as in many other game theoretic models). In screening models proposals are possible only within fixed time intervals, while the length of a bargaining round is a variable of choice in signaling and attrition games. (see e.g. Kennan & Wilson, 1989, 1990, 1993). Stylised facts on real world strike activity are explained only partially by the models.[119]

The models provide, however, a plausible explanation of effects of centralisation in wage setting in strike activity. Central wage setters base their negotiations on aggregate (average) parameters (profits, productivity etc.) published by neutral outside parties (e.g. statistical offices). This impartial

[118] An exception is Fernandez & Glazer (1991). They show that strikes may result even with complete symmetric information if three actions are possible in every bargaining round: (1) agree, (2) strike (wait), and (3) prolongation of an existing agreement.

[119] For example, the otherwise plausible attrition models predict that profits are 'burned down' almost completely. This contrasts the low strike incidence and the relative low duration of strikes in reality. Furthermore the models predict a negative relation between strike duration and wages. Empirical research gives no conclusive confirmation of this.

information, available symmetrically to both parties, should reduce the information asymmetry problem significantly. A problem with the argument is that negotiators are concerned mainly (a) with predicted values of these variables and (b) parameters of profit and utility functions which are not reported by statistical offices. Nevertheless, relevant information in centralised bargaining appears to be more symmetric.

Alternative Explanations: Self-Serving Bias and Transaction Cost Arguments

Self-Serving Bias A way out of the problem to explain strikes with rational agents is simply to modify (or abandon) the rationality assumption. Everyone who participated personally in tough negotiations is likely to share the reservations against completely rational behaviour. Babcock & Loewenstein (1997) explain strikes by self serving bias and claim support of reliable experimental evidence. They hypothesise that direct involvement in negotiations biases perceptions (of fairness) in favour of the own position. As a consequence, the sum of claimed shares in the whole cake (the sum in dispute) is greater than one.

In an experiment conducted by Babcock, Issacharoff, Camerer, & Lowenstein (1993), 80 law students were assigned randomly to the role of plaintiff or defender in a virtual tort case (with whole sum in dispute equal to $100000). Though all participants obtained identical case materials, the sum of claimed shares was greater than 100%. More surprisingly, when participants were asked to write down a guess of what a (virtual) independent judge, the bias prevailed though they were told to receive a bonus of $1 if their prediction was within $5000 of the actual judge's award. Babcock, Lowenstein, & Wang (1996) show that this bias does not disappear if the test persons were pointed *explicitly* to the problem of self-serving bias. Self serving bias seems to remain significant even in high stake experiments, i.e in experiments with considerable monetary awards (Hoffman, McCabe, & Smith, 1996).

The self-serving bias argument is supported by several results from experiments on cognitive dissonance. According to Festinger's (1957) theory, individuals try to reduce internal inconsistencies between action and perception (or between opinions regarding different objects) by ignoring information challenging their behaviour/actions or irreversible decisions. In Aronson & Mills' (1959) impressive experiment, girl students were randomly assigned to two groups. While members of one group had to pass an unpleasant test as prerequisite for attendance of a seminar, members of the control group were admitted without restrictions. Before the seminar started (it was 'simulated' by the investigators but never took place), the test persons were confronted

with a tape recording of an intentionally boaring and trivial seminar session. Only the control group members unmasked the low quality of the seminar. Several later studies show that subjects unconsciously (but systematically) search for information reducing dissonance and suppress information increasing it.

A possible conclusion from these theories with respect to the relation between centralisation and strike activity is that specialisation and professionality of the negotiators my reduce self serving bias. Furthermore, motions should play a lower role for the negotiators since they are less directly affected by the outcomes (their wages are not fixed by the negotiations).[120]

The Transaction Cost Argument It is surprising that a very simple and quite intuitive argument, applying not only to strikes but to efficiency of centralisation in general, does not appear in the literature.[121] If *similar* wage setting problems appear in several firms, it is efficient to solve the problem once instead of repeating the bargaining problem in every firm. Economists are used to stress gains of designing custom solutions to special needs. The argument, however, applies only if the gains of 'made-to-measure' solutions pay for their costs. In face of the observation that wage setting is an extremely complex task in reality and market forces are rather weak because of small numbers problems and the high importance of human capital, it appears to be worthwhile for many firms to adopt wages set in other firms instead of bearing the costs of plant level bargaining. This argument is implicit in statements of managers pursuing the strategy to obey collective wage agreements exactly or to pay above standard wages in order to 'keep unions out of the plant'. An testable implication of the argument is that centralisation implies concentration of strike activity in large firms, or (more general) that strike activity is more evenly distributed over firms in decentralised labour markets. To the best of our knowledge this issue has never been addressed in empirical research.[122]

Social Peace

Strikes are an eye-catching aspect of bargaining conflicts. There exist, however, several other implications of conflicts, for example on productivity. These are sometimes subsumed under the label 'social peace'.

[120] However, Eisenberg's (1994) poll, addressed to professional lawyers and judges, shows that also professional negotiators are not immune against self serving bias.

[121] Ekkehart Schlicht stressed this argument repeatedly.

[122] Our attempt to conduct an empirical study on this matter was frustrated by the fact that firm level strike and union density data are not available in Germany.

Practical persons refer sometimes to this broader notion of 'peace' when they point to conflict-reducing effects of centralisation in wage setting. The simple argument is that cooperation (and productivity) at the plant level is affected negatively if management and workers have to solve distributional conflicts *personally*. Rare marginal notes in the economic literature appear not very valuable. Instead the reveal a lack of competence to make simple semantic differentiations.[123] Also a search in the psychological literature ended without success. Therefore we have to close this section with the confession that we know almost nothing about the issue.

Empirical Relevance

The lack of direct evidence on the relation between centralisation and strike incidence is surprising in face of the large number of empirical contributions to the centralisation debate in general. The only exceptions from this seem to be Cameron (1984) and Schnabel (1993). Cameron finds positive (bivariate) correlations between strike activity (measured as lost days due to strikes per year and thousand workers) and the macroeconomic indicators inflation, unemployment and growth rates of earning. Schnabel (1993) obtains significant negative rank correlations between strike activity and the centralisation indicators of Calmfors & Driffill (1988) and Bruno & Sachs (1985) for a cross section data set of OECD countries.

Two further contributions provide rather indirect evidence. Lesch (2002) computes bivariate correlations between strike incidence and an index of institutional regulations on bargaining (peace clauses, compulsory arbitration, statutory work councils, legal admissibility of lockouts and general strikes) but fails to detect significant effects, and Ochel & Selwitschka (2003) point to a decreasing trend in strike activity for OECD countries.

In order to close this gap, we will report results from some explorative regressions explaining strike activity in section 3. The presentation was shifted to that section since it requires some concepts and definitions explained in

[123] Freter (1998) sketches a caricature of the argument in order to defeat it. "Die Sonderordnung des Arbeitsmarktes wird ausserdem damit begründet, dass erst eine überbetriebliche Regulierung den sozialen Frieden im Sinne der Abwesenheit von Arbeitskämpfen als positiven Standortfaktor gewährleiste. Die These unterstellt großen Teilen der Bevölkerung eine latente Bereitschaft zur Unfriedlichkeit, die durch Kartellierung des Arbeitsmarktes gezügelt werden müsse und könne. Bei funktionierendem Wettbewerb gibt es keinen Anreiz für irgendeine Art der unfriedlichen Austragung von Interessensgegensätzen... Da dem größten Teil des deutschen Volkes darüber hinaus die behauptete Tendenz zur Gewaltbereitschaft wohl nicht immanent ist, kann die These, eine umfassende Arbeitsmarktregulierung sei nötig um den sozialen Frieden zu sichern, als widerlegt gelten.

the following sections. The simple central result can, however be anticipated here. Also our empirical investigation shows that strike activity is significantly lower in countries with more centralised bargaining. However, the results are not very robust with respect to the choice of the functional form of the regression relation.

2.4.18 Conclusion

It is extremely difficult to provide a short summary of the theoretical debate on centralisation in wage bargaining because of a large number of extremely heterogenous models with antithetic results. The literature provides strong cases in favour of centralisation (e.g. models dealing with the internalisation of externalities), and strong cases against centralisation (e.g the monopsony or SBTC arguments), and several models with ambiguous effects, (e.g. models explaining effects of centralisation on investment).

Unfortunately, the considerably large strand of empirical literature (to be surveyed in the next section) cannot disentangle the arguments or rank them with respect to their relevance or – at least – select the most relevant arguments, but gives only a summary- indication on positive or negative employment effects of centralisation.

The most visible lack of our theoretical knowledge on centralisation seems to regard the dependence of bargaining structures on their economic and social background. Game-theoretic models of cooperation and the formation of coalitions give a rough clue of the conditions required for the feasibility of centralised bargaining, but they neither are able to explain the extreme differences between the Anglo-Saxon and the Nordic countries, nor the high persistence of institutions.

If one tries to 'optimise' institutions with respect to economic efficiency, he should, however, have a clear conception of their functions and structure. Thus research on the functioning of bargaining institutions and the parties involved of bargaining should be put on the top of the research agenda.

2.5 Empirical Evidence on Centralisation Effects

2.5.1 Operationalisation Issues

> *Wie ist denn der Begriff des Spiels abgeschlossen? Was ist noch ein Spiel und was ist keines mehr? Kannst du die Grenzen angeben? Nein. Du kannst welche ziehen: denn es sind noch keine gezogen. (Aber das hat dich noch nie gestört, wenn du das Wort "Spiel" angewendet hast.)* Wittgenstein (1990), § 68

Empirical tests of centralisation theories and estimation of centralisation effects pose a considerable number of problems, mainly because it does not allow to abstract from particularities of the economic environment. Mixing all special case consideration and econometric problems with the theoretical argumentation would overload the presentation. Therefore we decided to shift some empirical aspects of the debate to a separate section.

The considerations in the theoretical part above show that centralisation may influence the level as well as the structure (distribution) of wages.[124] The effects are transmitted through wages to employment (unemployment) and inflation. Most empirical studies estimate and test the *indirect* relation between centralisation and unemployment for two reasons. Firstly, it is much easier to obtain internationally comparable data for unemployment than for wages[125]. Secondly, wage levels and the distribution of wages depend on other economic conditions, as for example investment and technology (productivity growth). These other effects have to be eliminated in order to obtain pure (partial) effects of centralisation on wages. This is difficult especially if centralisation effects are computed by comparison of different countries. But cross-country comparisons are the main source of empirical evidence since centralisation levels are extremely sticky (i.e. change slowly over time – if they change at all).[126] These problems drop to a good deal if instead the relation between centralisation and employment/unemployment rates are analysed, since markets should clear (at least in the medium and long run) independently of technology and other factors.[127] Expressed in a

[124]The analysis of synchronisation in section 2.4.6 suggests also influences on the dynamics (speed of adjustment to shocks). We will streak this issue in some marginal notes.

[125]The main points are that wage data are available only for manufacturing in many countries and that international differences of labour income taxation my hamper comparability significantly.

[126]Rare exceptions, i.e studies exploiting time-variation of bargaining levels (Hibbs & Locking, 2000 and Bell & Freeman, 1988 are reported in section 2.5.5.

more technical way, specification problems are sailed around by estimating reduced forms.

Nevertheless, heavy hurdles remain on the way to an identification of centralisation effects, because it requires an operational definition and measurement of centralisation. As sketched already in section 2.2.2, centralisation is a multidimensional phenomenon. We will explain this in more detail in the following section.

2.5.2 Dimensions and Modes of Centralisation

In the simplest case centralisation can be measured as the level of bargaining. Possible levels are occupation, plant, firm, region, branch, industry, sector, and the nation.[128] Of course, this scheme suffices only if all bargaining is conducted exclusively at one level and there are only one union and one employer/employers' association at this level. (Note that 'centralisation' is used both as generic term summarising all dimensions of centralisation, and in a special meaning denoting the bargaining level.) Otherwise, if bargaining is conducted at more levels simultaneously, a considerable number of combinations results. A typical combination in Germany is to partition collective wage agreements into umbrella agreements (Manteltarifverträge) and special agreements. Umbrella agreements, usually negotiated at the industry level, settle *general* issues of the labour relation as dismissal notice periods, working time, length of payed leave etc., while special agreements fix wage rates at the regional or firm level. Besides that, bargaining levels may differ between industries.[129]

In negotiations not taking place at the lowest level, workers and employers may be represented in principle by more than one union/employers' association. In the United Kingdom firms bargain often with several occupational unions. Even in Germany some professions were represented by competing unions, for example the Deutsche Angestellten-Gewerkschaft (DAG) and the Gewerkschaft Öffentliche Dienste, Transport und Verkehr (ÖTV).[130] The number of unions/employers' associations is captured by the term 'concentration', 'coordination' captures the degree to wich competing unions coordinate

[127]The market clearing argument is challenged by some economist. We do not want to step into that discussion here.

[128]In some countries, e.g. Italy and France, unions are split furthermore at ideological or religious dimensions. To the best of our knowledge there exist no attempts to explain this in the economic literature.

[129]E.g. Sisson (1987) reports that national level bargaining was established in France in the 1950s *only* in chemicals and clothing.

[130]The situation changed when both unions merged (together with other unions) to VER.DI.

their bargaining strategies. The measurement of coordination appears much more challenging than the measurement of centralisation and concentration. This is so because coordination can be realised either by writing binding contracts, or tacitly, and tacit collusion detracts itself from observation. Even visible forms of coordination appear in manifold forms. Vertical (creation of umbrella organisations) as well as horizontal forms (associations) are possible. Even similar forms do not necessarily imply a similar distribution of power. While umbrella organisations in the highly centralised countries possess sweeping powers, i.e. are able to sign binding contracts on behalf of their member organisations and have control over strike funds, their functions in decentralised countries (e.g. the USA) are reduced to services for and exchange of information between the member organisations. The term 'centralisation' bears a third meaning special meaning. If it is related exclusively to unions or employers' associations, it indicates the power of umbrella organisations .

Finally, the union and employer side show different degrees of *concentration*. Unions membership is (in principle) atomistic. employers' associations are dominated by large firms since financial contributions depend on the wage bill.[131] A fact often neglected in empirical research is that unions and employers' associations may show different levels of centralisation or coordination. for example, Calmfors & Driffill (1988) neglect coordination/centralisation at the employer side to a large extent in the definition of their centralisation index by arguing that high coordination/centralisation on the union side provokes matching degrees on the employer side. Soskice, 1993 and Layard et al. (1991) show that this logic does not apply for Japan and Switzerland. In these countries (especially in Japan), loosely coordinated unions face a tightly coordinated cartel of employers.

Even this lengthy list does not exhaust all relevant aspects of centralisation. Already at the beginning of the centralisation debate in the eighties especially contributions from political science (Schmitter, 1981; Lehmbruch, 1984; Crouch, 1993) pointed to the importance of social partnerships between unions and employers' associations. Also governments participate in various ways directly (e.g. by compulsory arbitration/settlement or indexation) or indirectly (by providing a legal framework)[132] in bargaining. Burda (1997) tries to formalise the point that inconspicuous details of the interaction between government and the bargaining parties may have considerable influence on the outcomes. He sketches a simple game where the strategies of

[131]This does not imply always that voting rights are weighted by contributions. Nevertheless the exit threat of large firms is more powerful.

[132]The legal framework comprises (inter alia) legal regulations of work councils, peace clauses, and legalisation of lock-outs and political strikes.

unions and government are interrelated via unemployment benefits financed out wage taxes. More specifically, the union determines wages given unemployment replacement ratio and tax rates, and the government determines the replacement ratio and (implicitly) the tax rate. It is clear that the outcomes depend on the structure of interaction between the parties, i.e. on whether they play a Cournot game or a Stackelberg game or optimise their goals jointly. Burda concludes that the level of bargaining alone delivers no sufficient information. Newer contributions (Skott, 1997; Cukierman & Lippi, 1999; Iversen, 1999) put also central banks into the set of relevant agents.

A further aspect, making the measurement of centralisation more difficult, regards the relation between organisational structures and goals: They can be largely independent, i.e. centralised organisations may settle flexible wage agreements in highly centralised negotiations. A often cited example are the bargaining institutions in Austria which generate a significantly more dispersed wage structure than several countries with intermediate levels of bargaining. In the last decade also German wage setters reduced (in a coordinated manner!) the tightness/frequency of regulations in collective wage agreements. Bundesministerium (2001, 2001) and Freter (1998) report a significant increase of opening and hardship clauses as well as lowered wages for entrants (Einsteiger-Tarife) in German collective wage agreements. Oppolzer & Zachert (2000) observe a more subtle form of passive but 'intentional' decentralisation: Their poll under work councils members and managers reveals intentional undershooting of wage standards in firms which known to local union representatives, but not punished. This form of decentralisation is not captured by indicators of centralisation covering only the structure of bargaining and bargaining organisations.

2.5.3 Indicators of Centralisation and Coordination

In face of the large number of facets of bargaining, it appears sensible to record all potentially relevant aspects, to include all these indicators (simultaneously) in one regression model, and to select the actually relevant of them in a 'horse race' by applying individual significance tests. Unfortunately, this strategy is not practicable because of small observation numbers in cross-country studies and high correlation of these indicators (leading to severe collinearity problems). The first studies (McCallum, 1983; Bruno & Sachs, 1985; Tarantelli, 1986) are based on 15-20 observations, significantly larger numbers of observations in current studies (e.g. over 200 in Elmeskov, Martin, & Scarpetta, 1998) may be misleading since the centralisation indicators show small variability in the time dimension. Furthermore, common

trends in centralisation (towards decentralisation) cannot be identified by the (in most cases) ordinal indicators.[133] The dominant solution of the dimensionality problem in the literature was to create one-dimensional aggregate indicators by combining several basic indicators.This introduces some arbitrariness and subjectivity since selection of the relevant basic indicators and weighting is carried out by the researchers. (Surprisingly, none of the researchers tried to reduce the number of dimensions by application of factor-analytic methods. Though also factor-analysis is not free of methodological problems, it removes subjective evaluations from the construction process.)

We give a rough (but nevertheless tiring) survey of some indicators with the less ambitious goal to convey an impression of their variability and to point to the problems implied by them. table **??** gives an impression of the rankings of bargaining institutions in OECD countries according to some important centralisation indicators.

More detailed comparisons provide Calmfors & Driffill (1988), OECD (1997), Kenworthy (2001) and Aidt & Tzannatos (2002). Kenworthy concentrates on newer indicators,[134] whereas Aidt & Tzannatos (2002) ignore some newer ones. Unfortunately, a really thorough *detailed* comparison does not exist.[135] A typical problem with a comparative assessment of the indicators is that (especially if they contain subjective components) the authors do not indicate exactly why certain countries obtain certain ranks.

The first indicators were created by Blyth (1979), Schmitter (1981), Crouch (1983), Cameron (1984), Bruno & Sachs (1985), and Tarantelli (1986). They are based mainly on qualitative information. Blyth (1979) concentrates on the dominant level of bargaining and the degree of integration of unions and employers' associations via umbrella organisations. Schmitter (1981) and Cameron (1984) build their indicators upon Heady (1970). Heady's index aggregates four dimensions: (1) the role of government in bargaining, (2) decision-making of umbrella organisations over strike action, (3) the relation between staff in umbrella and member organisations, and (4) the share of funds controlled by umbrella organisations.

Cameron extends this by information on the involvement of umbrella or-

[133] We will come back to the issue later. It is clear that ordinally scaled indicators cannot capture common trends if they do not lead to a change of the ranking.

[134] Some older ones are not even mentioned, though the article is devoted mainly to a comparison and evaluation of the indicators. Unfortunately, the comparison is somewhat mechanical and less reflective. Kenworthy favours the indicators Iversen (1999) and Blaschke et al. (2001), failing to recognise that they concentrate on certain aspects of centralisation.

[135] All studies sketch the indicators and report the implied country rankings, but do not report the exact definition of the indicators.

	OECD (1994,1997)			CD	TAR	JLN	
	CENT	COOR	COMB			UCO	ECO
Austria	2	3	3	1	1	3	3
Belgium	2	2	2	8	7	2	2
Germany	2	3	3	6	2	2	3
Denmark	3 $\searrow$ 2	3	3	4	4	3	3
France	2	2	2	11	9	2	2
Finland	3 $\searrow$ 2	2	3 $\searrow$ 2	5	6	3	3
Italy	1, 3 (92)	2, 3 (92)	1, 3 (92)	13	12	2	1
Netherlands	2	2,3 (82)	2, 3 (82)	7	6	2	2
Sweden	3 $\searrow$ 2	3 $\searrow$ 1, 2 (91)	3 $\searrow$ 2	3	4	3	3
UK	2 $\searrow$ 1	1	2 $\searrow$ 1	12	11	1	1
Switzerland	2	2	2	15	3	1	3
Norway	3	3	3	2	4	3	3
Australia	2, 1 (88)	2, 1 (88)	2, 1 (88)	10	6	2	1
Canada	1	1	1	17	7	1	1
Japan	1	3	1	14	3	2	2
New Zealand	2,1 (91)	1	2,1 (91)	9	8	2	1
USA	1	1	1	16	7	1	1

Sources: OECD (1997), Elmeskov et al. (1998), Calmfors & Driffill (1988), Layard et al. (1991).
Note: Since we present the OECD indicator values as reference for our strike incidence estimations, we report here the *recoded* values from Elmeskov et al. (1998) instead of the *original* indicator values from OECD (1994,1997). The reason is that the OECD tables show intermediate values (e.g. 2+) in some cases which 'cancel out' after recoding into three dummy variables.

Legend:
The notation $x \searrow y$ indicates a gradual change of the indicator value from x to y. The notation $x, y(z)$ indicates a 'jump' change of the indicator value from x to y in year $19z$.

Shorthands

CD	Calmfors & Driffill ranking (1988)
TAR	Tarantelli's (1986) corporatism indicator
JLN	Jackman et al. (1991)
CENT	centralisation indicator
COOR	coordination indicator
COMB	combined indicator (CENT $\cup$ COOR)
UCO	union coordination
ECO	employer coordination

Table 2.3: Synopsis of some centralisation indicators

ganisations in wage bargaining, veto power of umbrella organisations, and union density. All information contained in these indicators is restricted almost exclusively to the worker side. Crouch (1985) accounts also for coordination of employers.[136]

The indicator most often used in empirical studies seems to be Calmfors & Driffill (1988). It is defined as sum of two basic indicators: The first one represents the (dominant) level of bargaining and takes on values 1,2, and 3 for the firm, industry, and national level.[137] The second one captures the number of dominating unions in each level and the extent of coordination between them (Calmfors & Driffill, 1988, p. 53). Layard et al. (1991) modify the index by accounting for Soskice's objection that informal coordination on the employer side is hardly taken into account.

In the nineties the list was extended by some indicators representing centralisation in a very detailed manner. For example, Golden & Wallerstein (1996, 2000) distinguish 15 categories of government involvement in bargaining. Iversen (1999) constructs a metric index by combining union concentration measures (similar to the Herfindahl index) for three bargaining levels (firm, industry, nation).[138] Though this strategy generates a highly objective measure, it is confined exclusively to union concentration, which also may be biased significantly. For example, the (mainly descriptive) literature[139] on union mergers documents 143 trade union mergers over the period 1900–1978 in the United States (Chaison, 1986). This tendency has increased: alone 57 mergers are observed in the much shorter period 1980–1994 (Chaison, 1996). Nevertheless, in many cases this seems to reflect rather union struggles against declining membership and administrative cost increases rather than the longing for stronger bargaining coordination and bargaining power.[140]

Besides that, attempts have been made (e.g. OECD, 1994, 1997) to isolate individual dimensions (barganing level, coordination, and potential of conflict). Several studies (e.g. OECD, 1997) use also union density and coverage as separate indicators. The rationale for this is based on the distinction between the *structure* of institutions/organisations and their *significance* for labour market outcomes: A highly centralised bargaining system does not

[136]Other used characteristics in his indicator are: centralisation of unions, autonomy of plants in negotiations, and existence/importance of work councils.

[137]They do not comment the neglect of other levels (occupation, region). Calmfors & Driffill denote this index as 'coordination level within central organizations'. Main *sources* for the classification are Flanagan et al. (1983) und Faxen (1986).

[138]A detailed description of the index can be read fromIversen (1999) on page 83

[139]For a short survey see Michelson (2000).

[140]Only micro-econometric studies were able to disentangle these effects. The macro-econometric studies just convert the direction of causality, i.e. explain union mergers by changes of wage rates, and are therefore less useful.

matter much if the wage agreements cover only a small share of gross employment in a country. E.g. Katz (1993) interprets the drop of union density as decentralisation. A nice feature of union density and coverage are that they are more suitable to capture continuous changes of centralisation, whereas other institutions change only in discrete steps. However, also these measures are flawed.[141] Firstly, the impact of a collective wage agreement of one industry/branch on others does not necessarily depend on its size. A small industry with highly productive firms may – under high competitive pressure on the labour market – exert considerable influence on wages in other industries. Secondly, the meaning of these indicators depends on the institutional framework. In some countries (statutory) unemployment insurance is administered by the government directly, in others it is managed by unions or by union-dominated administrations with support of the government. The first type is dubbed Non-Ghent, the second Ghent system.[142] Clearly union density is biased by workers entering unions *only* in order to obtain unemployment insurance. Furthermore union density may depend directly on labour market conditions in Ghent systems since unemployment insurance requires membership in some countries. Because of this workers enter unions if they expect a downswing. Furthermore, the insurance provision put unions in a good basis for the recruitment of members. It is clear that this biases the information contained in union density and coverage. Surprisingly, empirical studies do not try to account for this by interacting union density measures with a Ghent-dummy.

Though aggregated indicators emphasise different aspects of centralisation, they show considerably high correlation among themselves. Teulings & Hartog (1998), Table 1.1, and OECD (1997), Table 3.3 find correlation coefficients between about 0.7 and 0.9 for the most commonly used indicators.[143]

Most indicators have effectively at most ordinal scale level.[144] Because

[141]Flanagan (1999), p. 1172, is extremely pessimistic: "Union density captures neither the scope nor the intensity of union influence and union coverage does not capture bargaining power. Indexes of corporatism obscure more information than they reveal, and should be supplanted by explicit modelling of and tests for institutional interactions."

[142]Non-Ghent- systems prevail in the United Kingdom, Austria and Germany (Rothstein, 1992), Ghent systems in Sweden, Denmark, Finland, and Iceland. In Belgium (where it was 'invented'), Norway, and the Netherlands Ghent systems wer put under government administration. In Belgium, however, unions kept some voice and duties. In Italy Spain, Portugal and Greece, comprehensive compulsory unemployment insurance systems do not exist. (Ferrera, 1996); see also Booth et al. (2001).

[143]Kenworthy (2001) obtains in a comparison of 14 indicators correlations between 0.22 und 0.94. (The minimum value 0.22 is an outlier; most other values are greater than 0.5. Unfortunately Kenworthy does not indicate the type of the applied measure of correlation (Spearman / Bravais-Pearson).

of this, they can be used in regression models only after recoding them into dummy variables.[145] Besides the implied loss of information, recoding requires a partition of the countries into groups and therefore introduces some arbitrariness[146] We will show in the following sections that significantly different estimation results can be produced with the indicators despite the comparatively high correlation among them.[147]

We close this short discussion with the result that a definitive assessment of the validity and reliability of the indicators is not possible in face of the high dimensionality and complexity of centralisation. The treatment and use of the indicators in the literature provokes some critique, however. Some applications raise the suspicion that an indicator was tailored (unconsciously) to obtain certain results, since the evidence found with the original indicator vanishes if it is substituted by another one, which claims to capture similar aspects of centralisation.[148]

There exist some attempts to compare the impact of several indicators by including them alternately into regression equations. Unfortunately this procedure has not become a standard. Several contributions (Calmfors & Driffill, 1988; OECD, 1997; Booth et al., 2001; Kenworthy, 2001; Layard et al., 1991) provide synoptical tables of indicators, but papers (e.g. Layard et al., 1991; Golden et al., 1993) containing indicators together with *all* information necessary to replicate the computation of index values are extremely rare.

2.5.4 Empirical Studies on the Effects of Centralisation on Unemployment and Inflation

[144]This means that the give a unambiguous ranking of countries with respect to centralisation but do not allow to interpret distances between positions of the ranking.

[145]The linear regression model requires metric or binary regressors.

[146]We will report some studies below which disregard the scale issue, i.e. they include the indicators directly into regression models. This may render the interpretation of the results worthless.

[147]Amusing but worthless result produces Kenworthy (2001). He compares several indicators in a regression model explaining unemployment rates by an indicator of centralisation, an indictor for central bank independence, and some control variables (the model specification follows Franzese & Hall (1998)). He finds (and comments at some length) that the effects of centralisation on unemployment depend highly on the choice of the indicator. However, he includes some older ordinal indicators without recoding them, and consequently should not be surprised to obtain senseless results. Nevertheless, an alarming result of his investigation is that *even the signs of centralisation coefficients differ* in the regressions.

[148]Soskice's (1990) critique of Calmfors & Driffill (1988) serves as a good example. We will come back to it below.

First Empirical Approaches

The first empirical attempts to compute macroeconomic effects of centralisation were confined almost exclusively to graphical analysis and computations of bivariate correlations.

Crouch (1985) computes the correlation of indicators for macroeconomic performance (inflation, Okun's misery index,[149] and the change of inflation in the sixties and seventies) with union density. Tarantelli (1986) regresses Okun's misery index on a self-created indicator for corporatism[150] and finds a negative relation, pointing to positive effects of centralisation.[151] The scatterplot in his paper suggests a linear relation between Okun's misery index and his indicator of corporatism.[152] Bruno & Sachs (1985) and Crouch (1985) obtain similar results with Crouch's indicator of centralisation.

The only application using strike activity as a regressor variable is McCallum (1983). He finds that strike incidence (measured as log of days lost per thousand workers, averaged over the period 1950–1969) has a highly positive significant impact on inflation rates (averages for the period 1973–1979). Contrarily the indicator of centralisation (corporatism) of Crouch (1983) has a negatively significant impact.[153]

All these early contributions suffer at least from one of two basic problems. The are either confined to bivariate correlations (which do not deliver the relevant *partial* effects) or they treat ordinal indicators of centralisation like metric variables.

The direct strategy of studying relations between centralisation and wages is pursued by Agell & Lommerud (1987). They estimate wage equations for the period 1965–1983 with time series data for Germany, Japan, Sweden, the United Kingdom, and the USA and find a positive effect of an indicator for worker militancy on real wages. Unfortunately, the definition of the militancy indicator (growth of *world-wide* union density) is not very specific and appears to represent essentially a trend variable. Very general is also their definition of a corporatism indicator, which has negative effects on wages

[149]The Okun index is defined as (unweighted) sum of unemployment and inflation rate.

[150]The index is used also in Layard et al. (1991).

[151]The used data set contains averages of inflation and unemployment rates for the periods 68-73,74-79, und 80-83. Included countries are Australia, Belgium, Denmark, the Netherlands, Germany, Finland, France, Canada, New Zealand, United Kingdom, Sweden, and the USA.

[152]It is remarkable that Calmfors & Driffill (1988) did not include his index in their synoptic table containing five other indicators.

[153]Further control variables are lagged inflation rates (1971–1972), mean per capita growth rate of GDP (1972–1978), average growth rate of money supply (1972–1978), and its standard deviation.

in some countries. Additionally, replication studies of the paper show that the outcomes respond sensitively to changes of the corporatism indicator.

Bean, Layard, & Nickell (1986) use a similar approach, splitting the analysis in two steps. In the first step they estimate wage equations. Then they compute correlations between the coefficients (of the unemployment variable) from these equations and Crouch's indicator of corporatism, and find that real wages respond faster to unemployment rate changes in countries with a high degree of corporatism.

The Hump-Shape Hypothesis

The most influential contribution to the debate on centralisation seems to be Calmfors & Driffill (1988). The authors test their hump-shape hypothesis (sketched in section 2.4.1) by correlating several indicators of economic performance (employment rate, unemployment rate, and Okun's misery index) with their own and Cameron's (1984) indicator of centralisation.

According to the hump-shape hypothesis unemployment is higher with intermediate levels of bargaining than with completely decentralised or centralised bargaining. (In a visualisation of the relation in a diagram with the bargaining level on the x-axis and unemployment on the y-axis, the graph is hump-shaped.) Consequently, we should observe a small and insignificant rank correlation between the unemployment rate and an indicator of centralisation which increases monotonically with the bargaining level. This should change if the indicator is reflected at the center, i.e. if rank numbers increase in the transition from decentralised to intermediate levels and decrease in the transition from intermediate levels to full centralisation. The empirical rank correlations, computed with OECD data (averages for the period (1974–1985) confirm this hypothesis.

Calmfors & Driffill account for the scaling problem by computing *rank* correlations. This, however, forces them to restrict the analysis to bivariate relationships, and thus solves one problem at the cost of the ability to obtain partial effects by inclusion of control variables. It is clear (and often shown in applications of regression analysis) that nonlinearity may appear spuriously if relevant variables are omitted from a regression relation. Thus the hump-shape may be simply an artifact, created by an reduction of the dimension.

Calmfors & Driffill's work initiated a controversial debate and a large number of empirical investigations. We will present and discuss important arguments and results from this debate, but cannot claim to be exhaustive.[154]

[154]Other surveys dealing with the issue are Flanagan (1999), Aidt & Tzannatos (2002) and Booth et al. (2001). Our presentation differs from the latter two works by greater emphasis on the involved methodological problems.

Evidence and Critique Concerning the Hump-Shape Hypothesis

The first critique regarding the construction of the index was formulated already in the discussion following the first presentation of the paper. Giavazzi (1988) argues that Italy and Switzerland were classified incorrectly as decentralised.[155] Additionally he demands to account for consent between unions and employers as in Tarantelli's (1986) indicator. As mentioned above, Tarantelli's Index shows a linear relation with unemployment.

Soskice (1990) provides a systematic investigation of Calmfors & Driffill's Index and shows in a suggestive scatter plot that the hump-shape vanishes it the two 'outliers' Japan and Switzerland are removed from the sample. Calmfors & Driffill classify these countries as highly decentralised. According to Soskice bargaining is well coordinated there because of a highly coordinated network of employers' associations and networks. In Switzerland coordination takes place in an employer-dominated arbitration system[156], in Japan through informal wage cartels consisting of a small number of large firms (Shirai, 1984; Tachibanaki & Noda, 1996). As mentioned above, Calmfors & Driffill neglect centralisation/coordination on the employer side arguing that high centralisation on the union side provokes similar levels on the employer side.

Soskice also does not agree with the classification of other countries (Germany, France, the Netherlands, and Italy) in the centralisation ranking. Wage agreements are settled formally at the regional level in Germany and the Netherlands. In practice, however, regional units simply adapt industry level agreements without significant changes. Similar arguments apply for Italy and France. Additionally, the Italian labour market shows a peculiarity which may produce considerable bias. Soskice suggests that the Italian labour market is effectively separated. Wages are set effectively in the North while unemployment resides in the South. He constructs an alternative rank indicator which combines several dimensions of centralisation in an eclectic manner: Formal coordination is decisive in Austria, Norway and Sweden. Employer coordination is decisive in Japan and Switzerland, and informal coordination across regional and industry borders matter in Germany and the Netherlands. Though he applies no unified 'neutral' definition, his categorisation is justified and explained in detail. This fact makes his index more accessible than many other indicators (including Calmfors & Driffill's).

Soskice's critique is confirmed indirectly by Golden (1993). Using data from Calmfors & Driffill (1988), she compares several indicators with respect

[155] We will explain the reasons below

[156] An interesting anecdote regarding the issue is that unions bound themselves by contract to abstain from strikes and that these contracts are renewed in the last years.

to their explanatory power (measured as coefficient of determination R^2) in a bivariate unemployment regression.[157] In a first step she compares the explanatory power of *elementary* indicators, measuring only union concentration and coordination,[158] with the composite Calmfors-Driffill- Index and finds that they do better. Further comparisons reveal that Soskice's index dominates the elementary ones.

Jackman et. al. (1991) The results in Layard et al. (1991) can be interpreted as further indirect critique of Calmfors & Driffill. In a structural empirical model (estimated with cross section data of 20 OECD countries) the authors find that measures of coordination are more significant than the indicator of Calmfors & Driffill. In the first step (of a two step procedure) they obtain the impact of unemployment on real wages in a wage regression. This coefficient is then (together with the unemployment replacement ratio and the duration of unemployment benefits) sequentially regressed on several indicators of centralisation: To the monotone and reflected indicator of Calmfors & Driffill, to Tarantelli's (1986) indicator, to an indicator of employer coordination, to an indicator of union coordination, and to the average durations of strikes. While the monotone indicator of Calmfors & Driffill creates a significant effect, the reflected does not. Furthermore the coordination measures produce more precise estimates that the Calmfors & Driffill indicator. Of course the reliability of their results is questionable, since they treat all ordinal indicators as metric variables in the regressions.

Fitzenberger & Franz (1994) The papers of Fitzenberger & Franz (1994) and Fitzenberger (1995) relate to effects of centralisation in a more general fashion.[159] The value of their contribution seems to be derived more from its methodological innovation rather than from the contestable and unclear results. The authors try to obtain empirical evidence on the effects of bargaining institutions without usage of the problematic indicators of centralisation. To this aim they use the direct approach (mentioned in section 2.5.1) to estimate wage equations with time series data[160] on industry level data (13 industries) for 7 countries[161] of the European Union. The change of

[157]The coefficient of determination represents the share of variance of the dependent variable explained by the regressors.

[158]Die used measures are components of the indicators of Cameron (1984) und Schmitter (1981). They represent the number and power of union umbrella organisations.

[159]Fitzenberger (1995) is, with respect to methodological issues, identical with Fitzenberger & Franz (1994), but is based on a larger and more reliable data set. We will discuss only the earlier work, since it is confirmed by the later in almost every respect.

[160]Period lengths range between 10 and 27 (depending on country).

wages is regressed to its lag, the change of unemployment rates, productivity, prices, an error correction term (representing the long run relationship), and several control dummies[162]

Within this framework two strategies are suggested to obtain evidence on the effects of bargaining institutions (centralisation) on wage setting.

1. If the specification allows coefficients to differ between countries, it can be tested whether the coefficients differ between countries. For example, the impact of the lagged unemployment rate on wage changes is negatively significant and similar across countries or not. Furthermore – according to the authors – they show no clear relation with centralisation levels. A similar result applies for the speed of adjustment to macroeconomic shocks.

2. In an alternative specification coefficients are allowed to differ across industries. This allows to check the significance of deviations of individual industry-effects from an average effect. The authors find that wage setting is considerably uniform across industries in all countries and interpret this as evidence *against* significant institutional differences.

Besides several methodological problems[163] the indirect form of evidence seems problematic. Especially the power[164] (the authors keep the null hypothesis!) of the joint tests of industry coefficient differences may be small because of the high number of coefficients to be estimated.

Scarpetta (1996) A (methodologically flawed) rehabilitation of Calmfors & Driffill's position comes from Scarpetta (1996). He explains unemployment rates by indicators of centralisation, the output gap,[165] average unemployment replacement ratios, an indicator for employment security regulations,

[161] Germany, France, Italy, the Netherlands, Belgium, Denmark and United Kingdom.

[162] For example, a Thatcher-dummy for the United Kingdom or dummies for center-left governments.

[163] The discussants Burda and Möller point to unresolved identification problems, object that aggregated unemployment seem not be a valid regressor, and that (at least in theoretical models) wages do not depend on unemployment if unemployment benefits are proportional to wages (Manning, 1995). This may generate a severe identification problem in the empirical application.

[164] The power denotes the probability, to reject a false hypothesis. The determination of the power of a test is extremely involved in multivariate analyses, cf. Davidson & MacKinnon (1993), chapter 12.

[165] defined as the relative deviation of actual output from potential output (i.e. the output attainable with full employment of all production factors.)

union density and expenditures for active labour market policy (as percentage of GDP). Indicators of centralisation are included in three alternative specifications. The first one contains the both OECD indicators for union and employer coordination. Both, employer as well as union coordination reduce unemployment. However, only the employer effect is significant (significance level below 1%). The second specification contains the sum of both indicators. Not surprisingly, the 'joint' effect is again highly significant (significance level below 1%). In the third specification – it contains Calmfors & Driffill's indicator both linear and squared, Scarpetta finds weak evidence in favour of the hump-shape Hypothesis. The linear term is significant positive (significance level below 1%), the squared term weakly significant (significance level between 5 and 10%) negative. If unemployment is replaced by long term unemployment, the squared term becomes insignificant. The investigation, however, suffers from inadequate treatment of the ordinal indicators in regression analysis.

OECD (1997) This study holds an outsider position since it finds no significant effects of centralisation on unemployment. It tries to present itself as a replication of earlier contributions (mainly Calmfors & Driffill, 1988), but does not fully meet this requirement. The researchers provide a synoptical table of the most important indicators[166], proceed then, however, by using *exclusively* their own OECD (1994) indicators: (1) an indicator for centralisation, (2) and indicator for bargaining coordination, (3) a combined index of centralisation and coordination, (4) union density, and (5) union coverage. They point to high rank correlations between their own and other centralisation indicators,[167] but do not try to trace the reasons for the crucial differences between the results of their predecessors and their own.

The study starts with computations of rank correlations between centralisation indicators and measures of macroeconomic performance (unemployment rate, employment rate, inflation rate, growth of real wages, and wage dispersion) separately for the time periods 1978–1982, 1988-1992 and 1992-1996. Neither the monotone nor the reflected indicators show considerable correlations.

Unclear are also the results from the regression studies, where the performance measures are explained (in multivariate regressions) by the above indicators. The researchers treat the scale-level problem of the indicators by

[166]See p. 73. It contains Soskice (1990), Calmfors & Driffill (1988), Bruno & Sachs (1985), Blyth (1979), Schmitter (1981), Cameron (1984), Tarantelli (1986), Lehmbruch (1984), Crepaz & Lijphart (1991), and Layard et al. (1991).

[167]the rank correlation measures between the indicators are about 0.8.

sorting the countries into three groups (low, intermediate and high centralisation) and defining dummy variables for intermediate and high centralisation. Although they include no further control variables except time period dummies, an implicit elimination of cyclical fluctuations is realised by using five-year averages (1978–1982, 1988-1992 and 1992-1996) of all variables.[168] With this recoding of the centralisation indicators, the Calmfors-Driffill hypothesis predicts a significant positive coefficient for the intermediate group dummy. Furthermore, the high group dummy should have a insignificant or negative impact. If its effect is significant positive, it must at least be significantly lower than the intermediate group coefficient.

The only significant results from the regressions are, however, a significantly lower unemployment rate (significance level is 10%) of highly centralised countries and a significantly lower (level is 5%) inflation rate. None of the five regressions is in favour of the hump-shape hypothesis. The only really stable and highly significant findings (level less equal 1%) are negative effects of centralisation on wage dispersion. Finally we should mention that the results are checked for robustness by jackknife outlier search methods and that they do not respond sensitively to small changes of the estimation sample.[169] The only noteworthy effect of the elimination of observations with high leverage is an increase of the negative effect of centralisation on unemployment becomes significant at the 5% level.

In a last very preliminary analysis *changes* of unemployment and employment rates are regressed on changes of union density, coverage, and a dummy for decentralisation (i.e. a *change* towards decentralisation). Countries where bargaining institutions became more decentralised in the last decade did worse than the rest, i.e. they had to accept a higher decrease of employment rates than the base group (with constant degree of centralisation). However, the effect is only marginally significant (at the 10% level).

Further Studies Other investigations, basing on partially very similar specifications, indicate on the whole positive effects of centralisation on employment, but give no conclusive evidence regarding the hump-shape hypothesis.

Centralisation effects depend highly on the used centralisation indicator in Bleany (1996).[170] Significant negative (monotone) effects (of cen-

[168]Of course, the centralisation indicators are constant within periods, but may change between. Changes are, however, rare.

[169]They apply studentised residuals test und leverage tests, see Annex 3.B of the study. Introductions to the methods are contained in Belsley, Kuh, & Welsch (1980) and Atkinson & Riani (2000).

[170]His regressions are based on 17 observations (17 OECD countries) for the period

tralisation on the unemployment rate) result from the indicators of Bruno & Sachs (1985) and an index combining Bruno-Sachs and Calmfors-Driffill. This is not the case for a specification with linear and squared terms of the Calmfors-Driffill indicator.[171] Unfortunately, Bleany does not report whether the monotone specifications of the both other indicators are found by statistical tests or were simply imposed *a priori*. He also does not comment on the treatment of the ordinal indicators as metric variables.

Nickell (1997) and Layard & Nickell (1999)[172] regress the (log) unemployment rate on an indicator for union density[173] the coverage rate, the sum of two indicators on union and employer coordination, and several control variables[174] The used data relate to the periods (1983–1988 and 1989–1994) and 20 OECD countries. Since cyclical fluctuation bias is eliminated by generation of 6 year averages, 40 observations remain for the estimations. The authors find highly significant positive effects of density and coverage and a highly significant negative effects of the coordination index. Unfortunately, they do not find it worthwhile to tell the reader whether the monotonic effects of centralisation indicators were tested or imposed.

Baker, Glyn, Howell, & Schmitt (2002) note that the effects of the indicators are surprisingly high. For example, the unemployment rate increases by 2.3 percentage points if the coverage index increases from low (values below 25%) to high (values above 75%). The corresponding (highly significant) effect in the OECD study is about 0.045 percentage points![175] Apparently the log-linear specification was imposed. (Though it is a simple task to test for its validity in the framework of a Box-Cox transformation.)

Elmeskov et al. (1998) and Haffner, Nickell, Nicoletti, Scarpetta, & Zoega (2001) adopt the data and the sensible dummy variable recoding[176] from

1983–1989 (all variables are averaged).

[171]Both coefficients have expected signs but are insignificant.

[172]Data and specifications in both papers are almost identical. Layard & Nickell (1999) contains the owner occupation rate as additional regressor.

[173]the range of possible density rates $[0, 1]$ is partitioned into 4 subintervals. Countries with density in $[0, 0.25]$ obtain indicator value 1, countries in $[0.25, 0.5]$ indicator value 2 and so on.

[174]The coordination indicators are described in Layard et al. (1991), p. 419. Control variables are the tax wedge, an indicator for employment protection regulations, the unemployment replacement rate, an indicator for active labour market policy, and the change of the inflation rate.

[175]Coverage enters the (linear) regression directly in the OECD study. Thus we have multiplied the coefficient from 0.075 with the difference of coverage rates $0.8 - 0.2$ to obtain a comparable effect. If the means (0.875 and 0.125) of the high and low coverage intervals are used, the effect increases slightly to 0.056. Interval means are, however, no sensible approximations, since coverage rates are not distributed evenly within the subintervals. cf. OECD (1997), table 3.3.

OECD (1997) and extend the considered time period to 1983–1995 (1982–1995 in Haffner et al., 2001). The studies differ mainly with respect to the dependent variable. (Elmeskov et al. (1998) explain unemployment rates, Haffner et al. (2001) employment rates), but the regressors are almost identical.[177]

Haffner et al. (2001) find a significant hump-shaped effect of the combined (centralisation & coordination) OECD indicator. Countries with intermediate levels of centralisation have, ceteris paribus, a significantly lower (on the 1% significance level) employment rate than decentralised ones, highly centralised countries have a weakly significantly higher (at the 10% level) one. The evidence in Elmeskov et al. (1998) is less clear. A hump-shape appears for the combined OECD indicator and (less significant) for the OECD centralisation indicator. unemployment is 0.66% higher in intermediate and 0.79% lower in highly centralised countries (each coefficient significant at the 10% level) with the centralisation indicator. The respective coefficients for the combined indicator are 0.61 (10% level) and -1.39 (1% level). But the coordination indicator generates a monotone and significantly negative effect on unemployment. Both papers contradict the results from the earlier OCED study. This is surprising since the authors apparently know the OECD study[178]

An eye-catching cause for the differences might be the higher observation numbers in the later studies. OECD (1997) is based on 57, Elmeskov et al. (1998) and Haffner et al. (2001) on 238 and 223 observations, respectively. The explanation that the insignificance of the OECD results comes from lower observation numbers is nevertheless conclusive. All studies cover the same period (1983–1994) and the same sample of countries (19 or 20). The later studies gained observation numbers simply by abandoning period averaging (i.e. using yearly data). Of course, the increase in observation numbers is in a bad relation to the increase of information, since the centralisation indicators show minor variation in the time dimension[179] (i.e. are almost constant over time). Furthermore, averaging appears as a sensible

[176] Centralisation indicators are taken directly from OECD (1997).

[177] The following regressors appear in both publications: unemployment replacement rate, an employment security indicator, output gap, and the tax wedge. Elmeskov et al. (1998) additionally contains an indicator for active labour market policy, Haffner et al. (2001) additionally contains the share of public sector employment in gross employment (private and public).

[178] Two of the authors (Elmeskov and Scarpetta) are (or were) employed at the concerned OECD department! Unfortunately we have no access to the data and can therefore only suspect about the reasons for the different findings.

[179] According to the tables in Elmeskov et al. (1998), only 6 changes of centralisation indicator values occurred in the 12 year period with 19 countries

method to remove cyclical fluctuation. Nevertheless it may leave some bias if averaging ranges do not match business cycle turning points, and it may shallow information. The alternative to averaging (used in the latter studies) is to capture business cycle effects by including a proxy for cyclical fluctuation (the output gap) into the regression equation and/or application of the Prais-Winsten transformation. All methods may leave serial correlation in the residuals. Though a test for serial correlation of the residuals were possible (and straightforward), both latter studies fail to check for this.[180] A further econometric problem not dealt with concerns contemporaneous correlation between countries. This form of correlation appears if certain macroeconomic shocks (or relevant variables which are not included in the estimated equation) hit some countries symmetrically. Beck & Katz (1995) show in a simulation study that standard errors may by underestimated by more than 200% in small samples if one fails to correct for contemporaneous correlation when computing the covariance matrix of the regression coefficients.[181]

A further possible reason for the differences is the use of additional control variables in the latter studies. This extension is, of course, in favour of the latter studies. Again, we can make no clear statement regarding this point without inspection of the data.

Evidence on Extensions of the Hump-Shape Hypothesis: Interaction Effects

We sketched some models extending the Calmfors-Driffill framework by analysing interactions between unions and the government (via taxation and the legal/institutional environment), and between unions and central banks in sections 2.4.3, 2.4.5, and 2.4.4 above. Some of these extensions have crucial implications for the empirical estimation and testing of the hump-shape hypothesis. This is the case because they imply that the sign and/or the shape of the relation between decentralisation and unemployment (or real wages etc.) depends on further economic variables, e.g. monetary policy and the institutional framework. Consequently, regression equations are not specified correctly if they do not account for these interactions. *At best*, the centralisation coefficients from non-interacted specifications represent a

[180] Once serial correlation is detected, it can be eliminated by inclusion of a lagged endogenous variable or (more easy and robust) by application of the Prais-Winsten transformation.

[181] Elmeskov et al. (1998) apparently do not compute correlation-corrected standard errors (though the procedures are straightforward and meanwhile have found their way into econometrics textbooks e.g Greene, 2000, section 13.9).

'mean' effect for different regimes.

Econometric Measurement of Interactions All applications in the following sections use interaction terms in regressions, making it worthwhile to introduce the concept briefly for readers not acquainted with it.

Interaction terms are simply products of two[182] regressors. Consider the regression equation

$$u = b_0 + b_1\, z_1 + b_2\, z_2 + b_3\, z_1\, z_2 + x\, \beta + \epsilon$$

where x denotes a vector of other regressors and ϵ denotes a residual. The interaction term $z_1\, z_2$ allows for interaction effects, i.e. the effects of z_1 and z_2 on the dependent variable u depend on the coefficient of the interaction term b_3 *and* the value of the other regressor, e.g $\partial y/\partial z_1 = b_1 + b_3\, z_2$. Now let z_1 represent a (metric) indicator of centralisation in bargaining, and z_2 a (metric) indicator of central bank independence. Then, if the signs of b_1 and b_3 differ) the effect of centralisation on unemployment may change its sign, depending on the level of central bank independence. A hump-shape effect of centralisation on unemployment for a *given* monetary regime can, of course, be identified only if an interaction term containing the square of z_1 is added (i.e. $\cdots + b_4\, z_1^2\, z_2 + \dots$).

If only a categorial or ordinal centralisation indicator is available, it has to be recoded into dummy variables. Then at least three dummies (corresponding to low, intermediate and high degrees of centralisation) are required to identify a hump-shape. Consider the equation

$$u = (b_{lo}\, d_{lo} + b_m\, d_m + b_{hi}\, d_{hi})\, \tau + x\, \beta + \epsilon,$$

where d_{lo}, d_m, d_{hi} denote dummies for countries with a low, intermediate, and high level of centralisation,[183] and τ denotes the tax rate. In this case, the effect of taxation on employment is hump-shaped with respect to centralisation if $b_{lo} < b_m$ *and* $b_m > b_{hi}$.

Gruber, Summers, & Vergara (1993) Their model, sketched in section 2.4.3, predicts that the distortionary effect of wage taxes on labour supply decreases with increasing levels of centralisation. This prediction is directly testable. The authors conduct a test by regressing the log of relative labour

[182] In general, more than two regressors may be involved. Since all applications considered below use only interactions between two regressors, we confine ourselves to this case here.

[183] More precisely, d_{lo} takes on value 1 if centralisation level is low, and on value 0 otherwise. d_m and d_{hi} are defined analogously.

supply (measured as hours worked divided by potential hours of work) on the wage tax rate (measured as labour income tax revenues divided by GDP), the centralisation indicator of Calmfors & Driffill (1988), an interaction term of the tax rate and the indicator, and a control variable.[184] An estimation of the model with OECD country data for the period 1980–1984 and 1965–1984 delivers moderately significant interaction terms (at the 5% significance level) for the second period, but not for the first and for the pooled (both periods) data.[185] In order to eliminate bias due to the ordinal scale of the centralisation indicator, they define one centralisation dummy, taking on value 1 for Austria, Norway, Sweden and Denmark, and 0 for the other countries in the sample (Canada, United States, Switzerland, and Japan), and find a significant coefficient for the interaction between this dummy and the tax rate. On the whole, their findings are far away from being robust or stable.

Alesina & Perotti (1997) Alesina & Perotti's model implies a hump-shaped relationship of taxation on wages with respect to centralisation, i.e. effects of taxation on wages are most pronounced in countries with intermediate bargaining levels. The authors test their theoretical model with a panel of 14 OECD countries for the period 1965–1990. They regress unit labour costs on interaction terms between the share of tax revenue in GDP and three dummies indicating the level of wage setting.[186] Total factor productivity, the ratio of government consumption and the ratio of nonwage government consumption serve as control variables. (Country specific individual effects are eliminated since all variables enter the model log-differenced.) In accordance with their theoretical predictions, only the intermediate bargaining level interaction term is significant and of considerable size. (coefficients relating to the centralised, intermediate, and decentralised countries are about 0.2, 0.7, and 0.5[187]). Furthermore, it is statistically (1% level) different from the coefficient relating to decentralised countries and marginally different (10% level) from the centralised countries.

[184]Union density, the share of public employment and the output gap enter the regression in different specifications.

[185]To eliminate bias, only data relating to manufacturing were used, since unions play a dominant role in manufacturing.

[186]They use the index of Calmfors & Driffill (1988). The dummy indicating a high degree of centralisation takes on value unity for Norway, Sweden, Denmark and Finland. Germany, Belgium and the Netherlands build the intermediate bargaining level group, and the low level countries are Canada, Japan, Italy, France, Australia and the USA.

[187]Especially the coefficients for the decentralised countries differ considerably between specifications. The minimum value is -0.19, the maximum value is 0.11.

Daveri & Tabellini (2000) Daveri & Tabellini (hereafter D & T) find similar evidence in regressions of the *unemployment rate* on interaction terms of labour tax rates and centralisation dummies, and control variables.[188] They arrange countries with respect to centralisation in three groups, Anglo-Saxon (Canada, Japan, USA, and UK), continental-European (Australia [!], Belgium, France, Germany, Italy, the Netherlands, Spain) and nordic countries (Finland Norway, Sweden),[189] and find again that effects of tax rates on unemployment are highly significant only for the continental European countries. The size of the effects is relatively large, between 0.3 and 0.5 (depending on the specification). Since tax rates are measured in percent, this means that an increase of the tax rate by one percentage point leads to an increase of unemployment by 0.3 - 0.5 percentage points.

The stability of their estimation coefficients with respect to estimation methods is intriguing. They estimate specifications with levels and differenced variables, apply moving average correction, allow for country-specific constants, and add lagged policy variables. However, the standard errors reported in their tables may be biased significantly. Firstly, they use FGLS estimation procedures which may be biased severely in small samples (as was shown by Beck & Katz (1995) in a simulation study). Secondly, they apparently do not apply a correction procedure (accounting for contemporaneous correlation) for the standard errors.

In the ensuing discussion Bentilola (2000) stresses that the coefficients in D & T's estimations exceed the effects found by Blanchard & Wolfers (1999)[190] by a factor of about 15. It is hard to explain this by the fact that Blanchard & Wolfers (hereafter B & W) do not interact the tax rate with a centralisation index and thus restrict the coefficients to be equal across all countries. This should produce an effect ranging somewhere *between* the maximum and minimum effects obtained by D & T. He agrees to the explanation put forward by D & T, that B & W do not exploit time series variation since their estimation is based on time-averages over the whole period. He objects, however, that the time series correlations may not identify the true causal effect of tax rates and centralisation on unemployment (the

[188]The used control variables are unemployment benefits, an employment protection index, and an index for the duration of benefits. Data relate to the period 1965–1995 and are averaged over (five-year) subperiods

[189]This classification scheme for centralisation differs somewhat from other studies. The authors pretend to have used information on union density, coverage and measures of centralisation and coordination from OECD (1997). Unfortunately they do not report the criteria for the classification.

[190]We do not report the details from this study here since it focuses on the *interaction* between labour market institutions and macroeconomic shocks.

causal effect may go just the opposite direction) but rather capture effects from other missing institutional control variables. Furthermore, he argues that the correlation between taxes and unemployment may be a short or medium run phenomenon, and that it may be impossible to detect this even with 30-year observation periods. Finally, Bentilola complains that D & T do not account for the heterogeneity with respect to the progessivity of wage taxes between countries.

Huizinga (2000) adds that the interpretation of the tax-centralisation coefficients as *partial* effects were valid only if capital income tax and other taxes were integrated into the specification.

It is difficult to evaluate the relevance of Bentilola's and Huizinga's objections without access to the data. The point that causality may go from unemployment to tax rates seems to be refuted by the D & T's data, since the effects are hardly affected by inclusion of the lagged endogenous variable and instrumental variable estimation. Elmeskov et al. (1998) found reverse causality for the relation between unemployment and wage taxes (i.e. unemployment causes tax wedges) for Austria, Ireland, and Norway in explicit Granger causality tests. This contradicts D & T's results not directly, however, since Ireland is not in their sample and Norway belongs to the nordic group where interaction effects are insignificant. Finally, the high robustness of D & T's results is questioned by the findings in Elmeskov et al. (1998). They found a highly significant but much smaller interaction term coefficient of 0.15 for the intermediate countries and a marginally significant interaction term of 0.12 for the highly centralised countries in a similar regression (exploiting time variation too in a data set of yearly data for the period 1983–1995). Unfortunately, direct comparison of the results is hampered by the problem that the tax rate variables used in the regressions may differ from one another.[191] A possible explanation for the significantly smaller coefficients is that they added non-interacted centralisation dummies to the set of regressors. Inclusion of the (almost) time invariant centralisation dummies is not possible with the differenced equations in D & T, but it would certainly put light on the issue to include them in the level equations.

A last – and possibly severe – criticism of the paper is that D & T did not perform the relevant tests. They emphasise that the interaction terms

[191] Elmeskov et al. (1998) use the tax wedge, defined (on page 244) as total value of employer's and employee's social security contributions and personal income tax paid divided by gross earnings plus employer's social security contributions. D & T use the effective tax rate, defined (on page 101) as the ratio between total taxes on labour income (= an imputation of taxes on wages and salaries from the individual income tax + social security contributions + payroll taxes) and the labour tax base (= wages and salaries + employer's contributions to social security).

are highly significant mainly in the continental European countries. However, the critical question to be answered here is whether the interaction terms coefficients *differ significantly between the country groups*! The coefficients corresponding to the Anglo-Saxon countries are only marginally significant (in some specifications) and insignificant for the Nordic countries, but the coefficients are positive and of considerable size for both groups. Unfortunately, we cannot compute the relevant tests (because covariances between the coefficients are not reported by D & T). Nevertheless, the standard errors from the table give rise to the suspicion that the differences of the relevante coefficients do not differ significantly. As an example consider the coefficients for a specification with 'medium' coefficient sizes and 'medium' precision, the OLS regression on differenced variables. The coefficients of the continental European and the Nordic countries are 0.54 and 0.12, the respective standard errors 0.12 and 0.194. If both coefficients were independent, the (standard approximation) 95% confidence interval for the difference of both coefficients would include 0, since $0.54 - 0.12 \pm 1.96\sqrt{0.12^2 + 0.194^2} \doteq [-0.027, 0.867]$. A similar comparison with the larger coefficient for the Anglo-Saxon countries produces an even larger confidence interval: $0.54 - 0.27 \pm 1.96\sqrt{0.12^2 + 0.22^2} \doteq [-0.223, 0.763]$.

To conclude, it may be a useful information that coefficients are highly significant *only* for the continental European countries, but this does not imply that response of unemployment to taxation differs between the country groups.

Cukierman & Lippi (1999) As discussed in section 2.4.4, models of the interaction between centralisation and the monetary regime claim that the employment (and inflation) effects of centralisation depend highly on the prevailing central bank policy.

The first class of models (Cukierman & Lippi, 1999, among others), basing on inflation-aversion of unions, predict a hump-shape only if inflation-aversion of unions is strong enough and the central bank pursues an accommodating monetary policy. The second class (Iversen, 1998, 1999, among others), considering real effects of monetary policy, predict even a u-shaped relationship between centralisation and unemployment if central bank policy is non-accommodating, which *contradicts* the unconditional hump-shape hypothesis.

Let us start with Cukierman & Lippi's model. They test their model by interacting three centralisation dummies with a (time-variable) indicator of central bank independence,[192] in the unemployment regressions from OECD

[192]The indicator is adopted from Cukierman, Neyapti, & Webb (1992) and takes on

(1997).[193] Formally, the estimated specification has the form

$$u = \sum_{j=1}^{3} (\beta_j + \gamma_j I) D_j + x \beta + \epsilon$$

with centralisation dummies D_j, (D_1 : decentralised, D_2 :, intermediate, D_3 : centralised), central bank independence indicator I, control variable vector x, and residual ϵ. The point estimates of the interaction terms $(\gamma_1, \gamma_2, \gamma_3)$ in the model with the largest number of control variables[194] are $(15, -4.8, -2.5)$ with t-statistics $(2.7, -1.2, -0.2)$.

		predicted unemployment rates[a]		
		centralisation level		
I	F-test	decentr.	intermed.	centralised
0.1	$***$	4.0	10.7	8.3
0.2	$**$	5.5	10.2	8.0
0.3	$*$	6.9	9.7	7.8
0.4	-	8.4	9.2	7.5
0.5	-	9.9	8.7	7.2
0.6	-	11.4	8.3	7.0

Source: Cukierman & Lippi (1999), table 6.

a : Predictions are evaluated setting the levels of control variables to zero.

Asterisks indicate confidence levels of F-tests for the $H_0 : \beta_1 + \gamma_1 I = \beta_2 + \gamma_2 I = \beta_3 + \gamma_3 I$. 1, 2, and 3 asterisks indicate rejection of the hypothesis at the 10,5, and 1% level, minus signs indicate rejection levels greater that 10%.

Table 2.4: Predicted values of unemployment for different centralisation levels and central bank independence.

The authors compute predictions of the unemployment rate, using the estimated coefficients in order to show that a hump-shape prevails for low levels of central bank independence and a monotonous relation for high levels. Table 2.4 shows these predicted values. They try to underpin this by performing a joint F-test with null hypothesis

$$H_0 : \beta_1 + \gamma_1 I = \beta_2 + \gamma_2 I = \beta_3 + \gamma_3 I,$$

values in the range $[0, 0.7]$.

[193] They also use the data from that study.

[194] Control variables are a time period dummy, a dummy for Spain, the replacement ratio, and labour taxation.

and interpret the rejection of the hypothesis for low central bank independence levels (see table 2.4) as evidence in favour of a hump-shape.

To the best of my knowledge, *this is the false test*. Additionally, the authors give a false interpretation of the (false) test. For the hump-shape hypothesis to be true, *two* tests are required: $\beta_1 + \gamma_1 I < \beta_2 + \gamma_2 I$ and $\beta_2 + \gamma_2 I > \beta_3 + \gamma_3 I$. The joint test on all three magnitudes is rejected if the difference between *any two* of them is large enough, the ranking of the three magnitudes does not matter. For example, the first data row of table 2.4 shows that unemployment achieves a maximum for intermediate centralisation levels, but the predicted unemployment difference between intermediate and high levels of centralisation $10.7 - 8.3 = 2.5$ is not large, if compared with the magnitudes of the effects. Unfortunately, it is impossible to replicate the test because the covariances of the involved coefficients are not reported in the paper.

Similarly, they interpret the fact that the F-tests for high central bank independence levels cannot be rejected as evidence in favour of a monotonic relationship. Again this is (at least) misleading. The correct interpretation of the test result is that unemployment rates do not differ significantly from one another if central bank independence is high, i.e. information in the data does not suffice to make any clear predictions at all. In consideration of the severe problems with respect to the statistical tests, the interpretations of the authors have to put under *serious* reservations.

Finally, the estimation results have to be taken with caution, since the countries are distributed unevenly over the range of the central bank independence indicator. Inspection of the indicator (table 1 in their paper) reveals that only two countries (Germany [0.66] and Switzerland [0.68]) have indicator values greater than 0.6, whereas 10 countries (Australia, Belgium, Finland, France, Italy, Norway, Spain, Sweden, and the UK) are in the range $[0.14, 0.4]$, and 6 countries (Austria, Canada, Denmark, Netherlands, Portugal, and the USA) are in the range [0.4,0.6]. This does not necessarily imply that the coefficients are less precise for high levels of central bank independence, but they are more prone to outliers, because they depend heavily on a small number of observations.

Iversen (1998,1999) Let us now compare this with the contrary evidence in Inversen's contributions. His model predicts a hump-shaped or monotone relation between centralisation and unemployment for accommodating monetary policy, but an u-shaped for a non accommodating one. He conducts a careful econometric study of the model and finds compelling evidence in favour of its predictions. However, a closer inspection of his results (which

is possible since he put his data under public domain) shows that the overwhelming high precision of the estimated interaction term coefficients does not necessarily imply corresponding precision of the interesting effects.

He estimates an equation of the form

$$u_{i,t} = b_0 + b_1\, C_{i,t} + b_2 C_{i,t}^2 + b_3\, C_{i,t}\, I_{i,t} + b_4\, C_{i,t}^2\, I_{i,t} + b_5\, I_{i,t} + b_6\, u_{i,t-1} + \beta\, x_{i,t} + \epsilon_{i,t}$$

where $u_{i,t}$ denotes the unemployment rate of country i in period t,[195] $C_{i,t}$ denotes Iversen's metric indicator of centralisation,[196] $I_{i,t}$ denotes an indicator of central bank independence, and $x_{i,t}$ a vector of control variables.[197] Both indicators can (in a good approximation) be interpreted as metric variables. The interaction terms $C_{i,t}\, I_{i,t}$ and $C_{i,t}^2\, I_{i,t}$ are intended to capture interdependencies between centralisation of bargaining and the monetary regime.

Iversen interprets the highly significant coefficients as *strong* evidence in favour of the postulated interdependence. A closer look at the data shows, however, that the highly significant coefficients translate only into moderate significant effects. This is the case, since the impact of centralisation on unemployment is a *nonlinear* function of several estimated coefficients and the data (including the central bank policy). Therefore the statistical assessment has to focus on the nonlinear relation, not on the coefficients. We will explain this in more detail below. In our replication of the study we will compute significance levels for this relation and show that it is estimated only with moderate precision, despite of the high significance of the coefficients.

[195] The data set covers five periods: 1973-1977, 1978-1981, 1982-1985, 1986-1989, 1990-1993. Iversen computes period averages for all variables.

[196] The indicator combines a measures of union concentration (measured as Herfindahl-index) for three bargaining levels (firm, industry, nation). Its construction is described in Iversen (1999) on page 83.

[197] For short information on the control variables see the table with estimation results below.

Dependent variable: unemployment rate (u)						
	(1)		(2)		(3)	
Constant	2.65		-0.99		-0.74	
	(2.14)		(2.38)		(2.23)	
C	-5.92		12.47		9.95	
	(5.87)		(13.21)		(6.81)	
C^2	2.21		-43.73	**	-40.17	***
	(7.98)		(19.15)		(11.52)	
$C\,I$	-		-57.19	***	-51.30	***
	-		(26.94)		(11.87)	
$C^2\,I$	-		142.66	***	134.24	***
	-		(46.46)		(31.73)	
I	-1.51		0.94		-	
	(0.88)		(3.97)		-	
u_{-1}	0.7	***	0.6	***	0.6	***
	(0.08)		(0.08)		(0.08)	
$\bar{u}_{OECD}$	0.06		0.15		0.15	
	(0.2)		(0.19)		(0.18)	
$EXMAR$	-0.19		-0.20	*	-0.20	*
	(0.12)		(0.11)		(0.10)	
$TRADE$	0.01		0.01		0.01	
	(0.01)		(0.01)		(0.01)	
LR	0.31		1.28	*	1.31	*
	(0.57)		(0.66)		(0.64)	
$DENSITY$	0.02		0.02		0.02	
	(0.02)		(0.01)		(0.01)	
$FIXITY$	-		-35.14		-35.06	
	-		(27.06)		(27.20)	
N	75		75		75	
adj. R^2	0.75		0.8		0.8	

Notes: Consistent standard errors (accounting for heteroscedasticity, contemporaneous correlation between panels, and serial correlation) are given below the coefficients in brackets. **Variable definitions:**

C: Iversen's indicator of centralisation, I: indicator of central bank independence, u_{-1}: unemployment rate (lagged one period), $\bar{u}_{OECD}$: average (over all countries) of unemployment $EXMAR$: growth rate of exports, LR: partisan (left/right) indicator of government orientation, $DENSITY$: union density , $FIXITY$: indicator of fixity of exchange rates

Table 2.5: Prais-Winsten regression of unemployment rates on institutional variables. Source: Iversen (1999), table 3.3, p. 66.

Let us start with a look at Iversen's estimation results. Column (1) in table 2.5 contains results from a typical hump-shape regression without account of the monetary regime. Columns (2) and (3) contain results for his favoured specification.[198] A striking 'feature' of the pure hump-shape regression in column (1) is the insignificance of linear and squared coefficients of the centralisation indicator C. Though the linear term of C remains insignificant in columns (2) and (3), all other interaction terms are highly significant.

By the way, the robustness of the coefficient estimates is surprising. Iversen checks robustness by usage of a jackknife procedure, i.e. by removing in each replication of the estimation exactly one country from the sample,[199] or by removing exactly one period from the sample. The coefficient values (and standard errors) are quite similar over all replications. We applied some other outlier detection methods and found no hints to noteworthy problems.[200]

Unfortunately, Iversen has not computed all relevant statistical measures for an assessment of his theory. The crucial significance test relates to the nonlinear relation of unemployment, centralisation, and central bank independence. Iversen graphs point estimates of the relation in a diagram with the centralisation indicator C on the x-axis and unemployment on the y-axis for two different values (about 0.2 and 0.6) of central bank independence[201] We have reproduced is in the upper left part of figure 2.1. The relation between centralisation and unemployment is u-shaped for non-accommodating (independent) monetary policy and monotonous negative for accommodating monetary policy. The difference appears large, it amounts to about 4 percentage points for intermediate centralisation ($C \approx 0.2$) and more that 10 percentage points for high centralisation ($C \approx 0.55$).

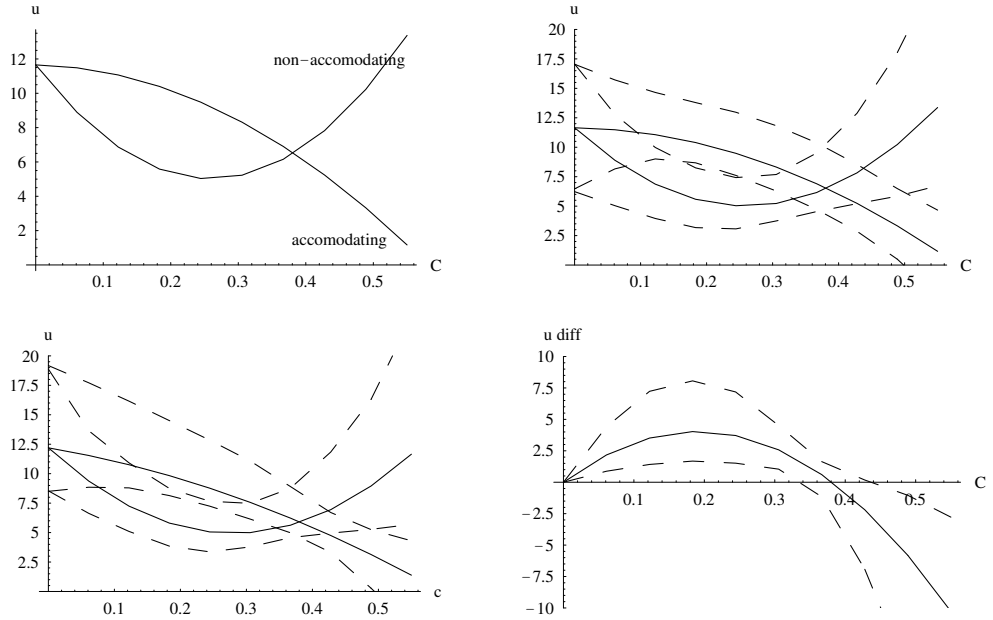
The next two graphs in the figure complement Iversen's representation with 95% confidence intervals. The confidence bands are fairly wide and overlapping, suggesting rather vague evidence on the difference between central bank regimes. However, the figure in the down right block, containing a graph and confidence band of the *difference* between the both regimes,

[198] Iversen gives three arguments for the elimination of I from the specification. Firstly, the sign of this term is not unique from his theoretical model (a weak argument!), second, its coefficient is insignificant, and third a collinearity problem exists. He substantiates this by showing that a regression of I on $C, C^2, C\,I$, and $C^2 I$ yields a R^2 of 0.96. This is not convincing, however, since a regression of C on C^2, $C\,I$, and $C^2\,I$ yields the same R^2.

[199] This means that each replications contains $(N-1)\,T$ observations when T denotes the number of periods and N the number of countries.

[200] We used DFBETAS and DFITS (see Belsley et al., 1980 or Jeong & Maddala, 1993).

[201] The central bank independence 'values' amount to the mean value of the independence index for the sample $\pm$ one standard deviation.

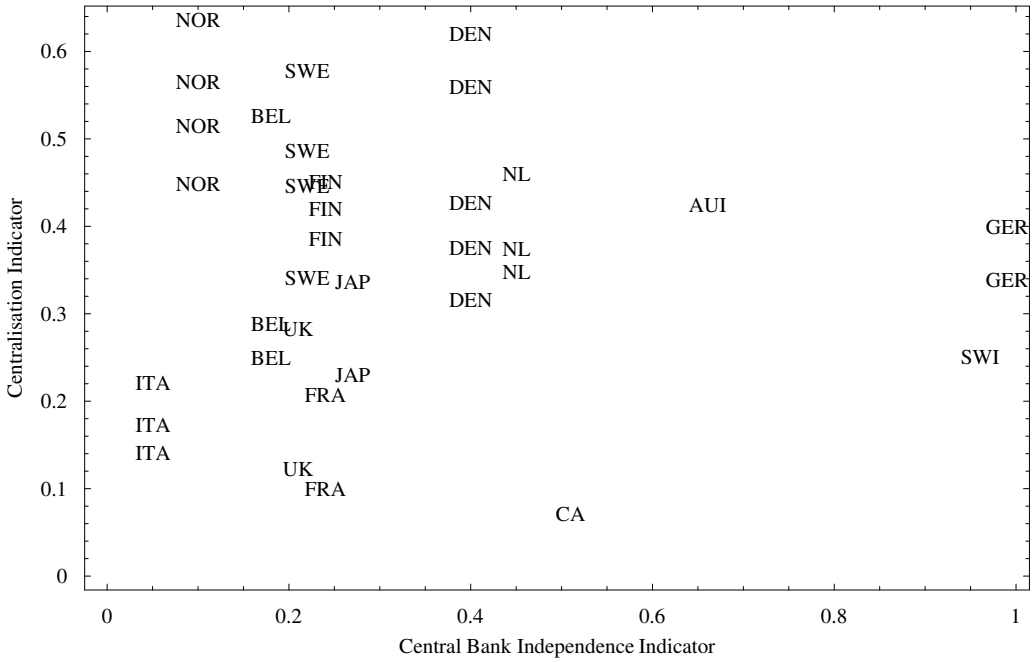


Notes: The u-shaped graphs relate to non-accommodating ($I \approx 0.6$), the other to accommodating ($I \approx 0.2$) monetary policy.
Top left panel: point estimates,
Top right panel: 95% bootstrap confidence intervals (10000 replications),
Down left panel: 95% monte carlo confidence interval (10000 replications),
Down right panel: 95% bootstrap confidence interval for the *difference* between the graphs for accommodating and non-accommodating central bank policy (10000 replications).
Note that the confidence bands are nonparametric ones and therefore may not be symmetric.

Figure 2.1: Impact of centralisation on unemployment for accommodating and non-accommodating monetary policy. Point estimates with confidence bounds.

shows that the regimes differ significantly in two intervals. If one does not care about the difference between regimes, but only about the u-shape in the case of non-accommodating central banks, evidence is again not compelling. The 95% confidence band is fairly wide. Therefore the minimum value of the upper confidence limit is above the maximum of the lower limit. We should add that the significance bands become even wider if two time dummies are included into the set of regressors (p-value for a F-test for joint significance of the dummies is below 1%). Our confidence bands presented in the graphs are based on Iversen's specification of the regression equation to preserve comparability.

Finally, a glance at the distribution of central bank independence and



Note: A list of the country code abbreviations can be found in the table on page VI.

Figure 2.2: Two-dimensional plot of the indicators of central bank independence and centralisation used in Inversen's regressions.

centralisation levels in the estimation sample raises the suspicion that the u-shaped graph in Iversen's plot is an *out-of-sample prediction* in the intervals $[0, 0.25]$ and $[0.4, 0.64]$. As can be read from 2.2, there is no country with highly independent central banks (indicator value above 0.6) *and* a bargaining centralisation level below 0.2 or above 0.4, *implying that only the medium branch, i.e. the range* $[0.25, 0.4]$*, is based on information from the data!* Now cover the intervals $[0, 0.25]$ and $[0.4, 0.64]$ with a sheet such that only the window $[0.25, 0.4]$ of the figure remains visible and try to detect clear evidence in favour of an u-shape.

Despite these qualifications, Iversen's estimation and testing procedure appears somewhat more reliable and reflected than Cukierman & Lippi's. Again, we remind that Iversen's result contradict Cukierman & Lippi's. He finds no clue for a hump-shape with accommodating, but an u-shape for non-accommodating monetary policy. Furthermore, Iversen's results refute the conventional (unconditional) hump-shape hypothesis. In Calmfors & Driffill's world, German unions and employers have chosen the *worst possible* bargaining regime. In Iversen's world, they have taken just the right one (with a mean centralisation indicator value of about 0.33).

It remains to explain why we have computed three different (but similar) confidence intervals. The reason: it is not trivial to compute them, and some methods may be biased. To avoid errors or significant bias in the computation, we have applied three different methods (only two are graphed to show the similarity between them). We are happy to report that the procedures yielded fairly similar results and shift the rather technical details to an appendix.

Franzese & Hall (1998) Franzese & Hall (1998) do not present a formal macroeconomic model of centralisation, but work with a verbal description of the issues involved. Accordingly, their theory specifies only qualitative interdependencies, i.e. it claims that centralisation has a stronger effect on employment with independent central banks. They test the interaction hypothesis with a regression of the unemployment rate on Soskice's (1990) centralisation indicator,[202] an indicator of central bank independence,[203] an interaction term of the both indicators, and some control variables.[204] The data set relates to OECD countries and covers the period 1955-1990. They find a positive effect of central bank independence, a negative of the coordination indicator, and a negative interaction term,[205] and interpret the highly significant interaction coefficient as confirmation of their argument.

As in several other papers discussed above, bias may be introduced by usage of ordinal regressors. The bias is probably less severe as in some other papers because they confine themselves to linear terms of the ordinal regressors. The linear specification, however, does not allow to exploit their evidence as a direct check of the hump-shape hypothesis.

Kittel & Traxler (2000) Kittel & Traxler's 'governability'-hypothesis (presented in section 2.4.5) claims that the viability and effectiveness of centralisation requires an institutional background (e.g. wage bargaining legislation). They test it in the regression framework by adding interacting

[202]The indicator is extended to countries not contained in Soskice's original discussion by usage of information in Layard et al. (1991). This may be a problem since Soskice's ordinal definition *implicit* (i.e. has to reconstructed from the classification of countries). The index takes on values 0, 0.25, 0.5, 0.75 und 1.0 an. Note that the scaling is different from Soskice who defined only a ranking scheme Soskice (1990).

[203]They compute the average of five indicators from other authors.

[204]Control variables are the log of real GDP per capita, an indicator of openness to international trade, the terms of trade, the share of seats in government occupied by left-oriented parties, and trade union density.

[205]Because of the presence of the interaction term, coefficients (including their significance) cannot be interpreted independently. The effects of these variables depend on the interaction term and the covariance matrix of all three variables included in the interaction.

terms between a centralisation index (constructed by themselves) and their governability index to the set of regressors. The empirical implementation, however, appears problematic in several respects. In a first step the authors try to show that their interacted indicators have better predictive power than the Calmfors-Driffill-Indicator – with a somewhat problematic regression. Firstly, they use *growth rates* of *nominal* unit labour costs.[206] The regression can hardly represent a long run relation, since the regressors are levels (unless one accepts that unit labour costs of countries with different levels of centralisation drift apart in the long run). Furthermore, reliable measurement and interpretation of labour costs is difficult, especially in international comparisons. Also the use of *nominal* unit labour costs appears at least awkward, since real ones (or harmonised inflation rates as control variables) are readily available from the OECD. That they include the growth rate of money supply as a control variable in their regressions does not improve things considerably: It is well known that money supply displays its impact on prices with a considerable lag. Comparability of the specifications is reduced further by the fact that *only* the specification with Calmfors & Driffill's indicator contains an endogenous lagged regressor,[207] whereas alle specifications with the Kittel-Traxler- indicators are static.

Traxler & Kittel find no significant effects for linear and squared terms of Calmfors & Driffill's indicator,[208] but highly significant effects (at the 1% significance level) for their own indicator. Centralisation is significant especially for countries with high governability. Highly significant effects come out also in a regression with the rate of inflation as dependent variable. *However, the predictive power of their indicators vanishes if the try to explain unemployment growth.*

We abstain here from an assessment in face of several unclarified points with respect to conceptual and methodological issues.

2.5.5 Empirical Evidence on the Relation between Centralisation and Wage Dispersion

The most robust evidence produced from the empirical literature on centralisation of bargaining appears to be the relation between centralisation and wage dispersion. It is documented in numerous descriptive summaries, e.g. OECD, 1997; Flanagan, 1999. Gottschalk & Smeeding (1997), Autor &

[206] Unit labour costs are defined as total labour costs divided by GDP

[207] It is well known (see e.g. Beck & Katz, 1995 that this may create considerable bias in estimations with even medium length samples (in the time dimension).

[208] As mentioned repeatedly, modelling with polynomial expressions of ordinal indicators may generate senseless results.

Katz (1999), Steiner & Wagner (1998) (among others) report – if at all – only minor increases of wage dispersion in countries with centralised bargaining institutions, but significant increases for the less centralised. Descriptive evidence on the effects of *changes* in bargaining structures points to the same direction. For example, Maloney & Savage (1996) attribute increasing wage dispersion in Sweden (1984) and New Zealand (1991) to movement towards more decentralised bargaining.

It is more surprising that only few papers address the issue directly while numerous studies (many of them being based on the same data) repeat tests of the hump-shape hypothesis again and again.

Rowthorn (1990,1992)

One of the first studies on the relation between centralisation and wage dispersion ist Rowthorn (1990). His study is based on international comparable industry level data. He computes coefficients of variation for pre-tax[209] wages manufacturing industries[210] as measure of dispersion. The Calmfors & Driffill indicator is used as measure for centralisation.

Explorative correlation studies show a high correlation between the indicator and wage dispersion. But the picture is confused somewhat by 'outliers': Austria, Italy and Switzerland. Austria and Switzerland show a relatively high industry wage distribution. Wage dispersion in Austria (which is the most centralised country according to the indicator) is even comparable to the USA. Data from Italy should interpreted with care, however, because of low data reliability.

Rowthorn finds also a significant positive relation in a regression of the difference between the employment rate and the measure of dispersion on the indicator. On the other hand, a regression of the employment rate on the indicator and the measure of dispersion is insignificant. Analogous analyses, where industry wage dispersion is replaced by gender wage dispersion, generate similar results. Rowthorn's results are confirmed in later studies, e.g. Holmlund & Zetterberg, 1991). A problem with the macro data approach is, however, that industry and gender wage dispersion represent only part of gross dispersion, i.e. they shadow intra-industry dispersion.

[209]This may generate some bias because of significant differences in tax rates between countries. Rowthorn justifies his choice by data limited availability.

[210]Similar comparable data for the service sector are not available.

Barth & Zweimüller (1994)

Barth & Zweimüller (1994) investigate a similar question with micro data of Austria, Canada, Germany, Norway, Sweden, and the USA. They estimate a static wage equation with the usual regressors schooling, experience, dummy variables for sex and race.[211] These specifications are extended by industry dummies[212]

The first result from the estimations is that the *structure* of industry wage differentials is similar across countries (in the sense that industries with over-average and below-average wages are about the same in all countries). There exists considerable heterogeneity, however, with respect to the size of deviations from the mean. While, for example, the best and worst- wage industries are 39% below (hotels) and 37% above (mining) average in the USA, the respective maximum deviations in Sweden are only 14% (private households) and 16% (insurance).

The authors try to obtain a more concise picture of the situation by computing correlations of the industry wage differentials between all countries. Inspection of the matrix reveals high similarities: 13 of the 25 entries in the correlation matrix are larger than 70% and only 3 less that 50%. There looms no pattern regarding centralisation of wage setting in the matrix. A clear pattern evolves, however, with respect to dispersion: The standard deviations of the industry dummies are considerably larger in Canada and the USA (both greater than 0.16) than in Austria, Norway, Germany, and Sweden (all below 0.07).

Wallerstein (1996)

Wallerstein (1996) finds also clear evidence for the equalising effects of centralisation on wages in a regression model of lagged adjustment based on data from 16 OECD countries for the period 1980–1992. He uses the log of the relative difference between the 90% and 10% quantile of the wage distribution as dependent variable. It is regressed on a centralisation indicator representing the bargaining level,[213] a measure of union concentration (Herfindahl-Index), union density, union coverage, an openness indicator, the share of public sector employment in gross employment, the share of public

[211] The race variable shows that the specifications of the equations have to differ somewhat in order to adapt to 'local needs'. The authors explain that these differences of the specifications, however, do not cause significant problems for their interpretations.

[212] Problems of comparability are present also in this respect since the classification of industries differ somewhat.

[213] It takes on values 1 to 4 for firm level, industry level, national level without sanctions, and national level with sanctions.

spending in GDP and a partisan indicator (distribution of seats in parliament among left and right parties). Wallerstein finds highly significant negative effects of the bargaining level (t-statistic 6.03), union concentration (t-statistic 3.75), and coverage (t-statistic 2.43) variables.

Blau & Kahn (1996)

The results of the above studies are not very specific, because they consider only the entire distribution. Blau & Kahn (1996) provide more detailed insights by decomposing the wage dispersion into dispersion due to measured characteristics (schooling, experience, tenure, and marital status), dispersion due to valuation effects (i.e. 'prices' of measured characteristics), and a residual category which cannot be explained by characteristics and their valuation.[214] This decomposition is applied to international differences of (log) wage dispersion, i.e. to the differences of (log) wage dispersion between the USA and the other countries in the sample (Germany UK, Austria, Switzerland, Sweden, Norway, Australia, and Hungary).

According to their results, only 6% (on average) of the standard deviations are due to differences in measured characteristics, while prices of the characteristics account for 15–20% (on average) and 74–79% (on average) are due to residuals.

In a further investigation they gain more detailed information on the lower and upper part of the wage distribution by applying this decomposition to the (log) wage percentile differences 50-10 and 90-50. (E.g. the 50-10 difference means the difference between the 50% percentile and the 10% percentile of the wage distribution.)

Firstly, international differences between the USA and the other countries are considerably small for the upper part (90-50 difference) of the wage distribution, but large for the lower part. This is in line with the reasoning that unions and centralised wage setting compress mainly the lower part of the wage distribution. The most eye catching aspect of the separate decompositions for lower and upper part of the wage distribution is that measured characteristics *widen* the gap between the US and other countries for low wage workers but narrow the gap for high wage workers. For low wage earners, measured characteristics account for about 40% of the difference between the other countries and the USA, meaning that greater heterogeneity of US workers with low income is responsible for a good share of the international differences. A possible interpretation for this observation is that collective

[214] One has to be careful with the interpretation of the residual term. It is not clear whether is due to unobservable productivity differences or due to 'errors' and 'arbitrariness' in wage determination.

wage agreements and wage standards in some of the other countries make the low income worker group more homogenous with respect to qualification.

In a last step of the analysis, they try to gather direct evidence on the impact of centralisation on wage dispersion by regressing several dispersion measures on a centralisation indicator[215] and control variables.[216] All findings are in line with expectations. (1) The standard deviation of the gross wage dispersion decreases significantly with increasing centralisation. (2) Centralisation exerts a large impact on the lower part of the wage distribution (represented by the 50-10 percentile difference), but only (3) a small and insignificant impact on the upper part (represented by the 90-50 percentile difference). A similar pattern appears if the measured characteristics are eliminated from the dependent variables in the regressions (1)–(3).

All disclaimers of the interesting paper relate to data quality problems. Data from several countries reached the authors in aggregated form, urging them to use cell-midpoints instead of the raw data. Another (more crucial) problem may be caused by the fact that the data of several countries contain monthly or annual earnings and that they are not complemented with exact/reliable information on working hours. Since and working hours may differ significantly across the wage distribution and across countries, the (hourly) wage measures computed from this information may be biased severely.

Further Studies and Competing Theories

Indirect hints to dispersion-increasing effects of de-unionisation delivers the study of Machin (1997). He investigates the impact of the drastic reforms of bargaining institutions in the Thatcher era in the United Kingdom using micro data (the General Household Survey 1983 and the British Household Panel Survey 1991). The reforms generated institutional changes which can – because the top-down nature of the legal changes – be considered exogenous. The legal reforms included restrictions on picketing (1980), repeal of statutory recognition procedures (1980), increased liability of unions for damages (1982), increased requirements for the introduction of a closed shop (1982)[217], repeal of pre-entry union shops (1990), and prescription of secret ballots before industrial action/strikes (1984)[218] According to his empirical

[215]They use the average of the rankings Blyth (1979), Schmitter (1981), Cameron (1984), Bruno & Sachs (1985), and Calmfors & Driffill (1988).

[216]Control variables are the relative female labour supply and relative net labour supply of medium and low skilled workers.

[217]The minimum support to legalise the closed shop was raised to 80%.

[218]For a complete list see Machin's paper.

result both the reduction of minimum wages as well as decreasing union density and power (caused by the legal restrictions) lead to an increase of wage inequality. Of course, his investigation is at most tangent to the centralisation debate, since it focusses mainly on effects of the legal frame on union *power*.

Similar studies concentrating on wage dispersion effects of union power are Card (1992), DiNardo, Fortin, & Lemieux (1996), Bound & Johnson (1992), and Card, Lemieux, & Riddell (2003). According to Card's results, decreasing union power explains about 25% of the increase in wage dispersion (of men) for the period, DiNardo et al. (1996) come to 14–20%. These results are confirmed in a study with comparable data on the United Kingdom, Canada and the USA.

We cannot conclude this discussion without some qualifying hints on competing explanations of international differences in wage dispersion. Studies focussing on centralisation effects share a summary view of wage dispersion, i.e. reach at best the industry or gender level of analysis. The large strand of literature on skill biased technical change (SBTC) has stepped deeper into the details by analysing wage dispersion further into skill premia and residual dispersion (i.e. within-sector and within-firm dispersion which cannot be explained by observable industry, technology, firm and personal characteristics). We can only sketch the most important contributions of this literature here because of its large scale.

Central explanations for different developments of skill wage premia in continental Europe and the Anglo-Saxon countries (USA and United Kingdom) put forward in this literature (cf. Acemoglu, 2001, surveys of the literature give Acemoglu, 2000; Topel, 1997; Gottschalk, 1997, and Autor & Katz, 1999) are (1) that relative skill supply increased faster in Europe (Card & Lemieux, 2001), (2) that technical change has been less skill biased in Europe, and (3) that intensified international trade played a larger role for the Anglo-Saxon countries[219] Besides that, researchers working in this field are apparently aware of the role of wage-setting institutions. Nevertheless, they are hardly taken into account in empirical studies because of the lack of internationally comparable data. This is the reason why the intersection between empirical contributions on SBTC and centralisation of bargaining is almost empty though the most important answers to both strands of literature can be expected to come from this intersection.

[219]The trade explanation, advocated by Wood (1995) among others, argues that intensified international trade increases skill premia by lowering wages of the unqualified in advanced industrial countries trough increased competition from huge supply of unqualified labour from underdeveloped countries.

Effects of Wage Dispersion on Productivity

All studies reported as far consider only the impact of centralisation in wage setting on the dispersion of wages. To the best of our knowledge, only two study considers the more interesting effects of wage dispersion on employment and productivity. Surprisingly, they do not deliver averse effects of dispersion.

Bell & Freeman (1987,1988) The authors start their investigation with a short theoretical discussion of the effects of wage dispersion on employment. It is clear that employment effects of wage flexibility (increasing wage dispersion)[220] are unambiguously positive in frictionless markets with full symmetric information and perfect competition. This must not be the case, however, in imperfect markets. Then the effects of wage flexibility on employment are unclear *a priori*, since adjustment may go in either direction: downwards and upwards. Downward flexibility increases employment, upward flexibility may represent the ability of employees to appropriate rents, and therefore may decrease employment.

The authors try to obtain the net effect of wage flexibility by regressing the (log of) the employment ratio on the (log of) GDP, a quadratic trend, and the inter-industry dispersion of wages. They find a negative *but insignificant* coefficient. Of course, their results are subject to an important disclaimer. The direction of causation is assumed to go from dispersion (flexibility) to employment. But they did not attempt to test for causality. Therefore, the reverse direction is possible as well. All in all, a correct and cautious interpretation of their results is rather that we cannot observe a clear relation between wage dispersion (flexibility) and employment in a sparse *ad hoc* regression model.

Hibbs & Locking (2000) The authors try to determine the signs of *partial* effects of wage dispersion on productivity in a regression framework using Swedish data for the period 1964–1993.[221]

They extend a Cobb-Douglas production function by an 'efficiency term' Ef which depends on within and between wage dispersion:

$$Ef = Ef(CV_W^2, CV_B^2)$$

[220] The authors use the therm 'flexibility' instead of 'wage dispersion'. By doing so, they assume implicitly that a compression of the wage structure is caused by rigidities. This must be not necessarily the case. At least their data do not allow to differentiate between dispersion and flexibility.

[221] Swedish data are well suited for such studies since the bargaining parties changed wage policy (and even the level of centralisation) several times. These policy-changes generate high variation of the regressor variables.

Within and between dispersion CV_W^2 CV_B^2 are measured as (squared) coefficients of variation ($CV_i^2 = \sigma_i^2/\bar{w}_i^2$). From this production function, a productivity relation is derived. Exogenous technical progress is represented by linear time trends (linear spline functions) whose coefficients may vary within time periods. The resulting specification has the form

$$\ln(Q_t/L_t) = b_{0\tau} + b_{1\tau}\, t + b_2\, \ln Q_t + b_3\, \ln w_t + b_4\, \ln r_t + b_5 \ln Ef_t + b_6\, L_{t-1}$$

with output Q, employment L, wage w, and interest rate r. Subscript τ displays possible changes of the trend coefficients in the periods $1964 - 1969, 1970 - 1982, 1983 - 1993$. Ef is included both in a log-log as well as in a log-linear form.

$$\begin{aligned} \ln Ef &= \beta_0 + \beta_1\, \ln CV_W^2 + \beta_2\, \ln CV_B^2 \\ \ln Ef &= \beta_0 + \beta_1\, CV_W^2 + \beta_2\, CV_B^2 \end{aligned}$$

Hibbs & Locking find significant *positive* effects of within-plant and within-industry dispersion on productivity but *negative* effects of between plant and between industry dispersion.[222] They interpret their results in favour of the Rehn-Meidner theory, and against Akerlof & Yellen (1990) and Levine (1991).

A weakness of Hibbs & Locking (2000) and Bell & Freeman (1988) (caused by a lack of suitable data) is that they do not differentiate between homogenous and heterogenous labour. Of course, their results are unter the same reservation as most econometric models: It is unclear whether the have found causal effects or only less informative partial correlations. For example, higher productivity of labour in times of stronger wage compression could be explained by the capital allocation effect discussed in section 2.4.14. It is clear, however, that their results cannot be taken as evidence against centralisation in wage setting.

2.5.6 Summary

The discussion of the empirical contributions in the sections above urged us to put several conceptual and methodological problems in marginal notes. Because of their high importance, we start our concluding assessment of empirical studies with a compilation of these problems.

[222] Effects of dispersion between plants and industries were obtained from separate regressions.

Summary of Methodological Problems

1. The high dimensionality of centralisation makes its operationalisation and measurement extremely difficult. Several possibly important aspects of centralisation (e.g. tacit cooperation) cannot be observed at all. In principle, many basic indicators are required for a sensible representation of centralisation. Low observation numbers, especially in cross-section studies, however, put tight limits on the number of indicators as explanatory variables.

2. The definition and construction of many centralisation indicators is (and must be) based on subjective evaluations, at least with respect to weighting of their components or with respect to the selection of relevant aspects. Blanchard & Wolfers (2000) are very decisive about this point: "One must worry however that these results are in part the result of economic Darwinism. The measures ... have all been constructed ex post facto, by researchers who were not unaware of unemployment developments... Also, given the complexity in measuring institutions, measures which do well in explaining unemployment have survived better than those that did not." [p. 18]

3. Most available centralisation indicators are *ordinal* measures. This requires recoding into dummy variables and leads to loss of information. Regressions with polynomial terms of ordinal regressors are almost worthless.

4. 'Horse races' between centralisation indicators from different sources (authors) are not possible because of high correlations between them. On the one hand, these correlations are large enough to make 'horse races' impossible, on the other hand they are large enough to produce significantly different results in regression studies.

5. There is no simple way to test whether bargaining structures are only manifestations of underlying social background norms or economic conditions. In any case, empirical studies deliver no reliable causal relations, but only correlations.

6. Besides this, the general legal, social, and institutional environment may have a considerable impact on the outcome of bargaining and the measurement of control variables. For example, the interpretation of union density depends heavily on the type of the unemployment insurance system (Ghent/Non-Ghent). Therefore additional information on the general environment should be added to the set of regressors.

A simple solution to the problem of country-specific heterogeneity (fixed effects estimation with panel data) which would reduce the number of control variables considerably, and in addition account for unobservable heterogeneity, is not applicable due to low variation of the indicators in the time dimension[223]

7. If the gains and costs of centralisation depend on the economic, social and institutional environment, the effects of centralisation on macroeconomic indicators should change if parameters of the environment do. If these parameters do not enter the empirical specification (a frequent case), the coefficients of hump-shape regressions become time-varying, and regression results, obtained by pooling over time periods, yield only mean effects but cannot reflect and identify these institutional changes. The solution to reduce estimation period lengths reduces the number of observations and brings back the precision and degrees of freedom-problem.

8. Though changes occurring in discrete jumps are eye-catching and simple to observe, they may nevertheless carry biased information. Consider, for example a situation where large differences in productivity between firms trigger the break of a bargaining coalition. These differences will generate increasing wage differences prior to the break if firms and workers try to elude the common agreement by biased interpretation or clandestine deviation. A dummy variable indicating the break will then convey 'displaced' information.

9. Several components or aspects of institutions change continuously and slowly (e.g. the compliance with collective wage agreements by individual firms), others 'jump', (e.g. the dominant level). Small and almost continuous changes are not captured by indicators representing rank orderings if the changes follow a common trend in all countries.

On the whole, the experience with centralisation indicators suggests that more coordination would be favourable to this strand of research. It has produced a large number of indicators serving 'special needs' of applications, but this confronts the reader with the additional burden of tracing the reasons for differing and sometimes contradictory results. Attempts to compare existing indicators or to use existing work in a systematic manner to create better indicators are often hampered by the poor documentation of the existing indicators.[224]

[223]Elmeskov et al. (1998) report only 7-9 changes of the centralisation level for a sample for 19 OECD countries 1980–1995.

General Assessment

Besides the unsolved methodical problems, we take the numerous contradictions in the literature as main criterion for a general assessment of the empirical evidence. The spectrum of results on centralisation results ranges from insignificant to strong monotone and strong hump-shaped effects. It is somewhat disappointing that the newer literature is often silent about these contradictions. Apparently, there is no strong pressure to justify specification choices which deviate from predecessors. Several authors do not even comment on or try to explain the differences of their own results from previous ones (though it were possible to trace the differences by inspection of the data: several studies use the *same* data set!). An example for a somewhat laissez-faire and mechanical attitude is the survey Booth et al. (2001). The authors summarise 13 results regarding the hump-shape hypothesis (in table 5.2 on page 94)[225] which find/specify hump-shaped as well as monotone relations between centralisation and unemployment. A mentioning of the OECD-study (which does not fit into the picture) is shifted into a footnote: "A study not included in the table is OECD (1997), which *had problems coming up with any significant relationship.* It found only some weak evidence in favour of a monotonic relationship (and some weak evidence in favour of the hypothesis that more foreign trade will lead to lower unemployment in countries with intermediate coordination." (Booth et al., 2001, S. 93). One searches vainly for a hint on whether the monotonous relations in some of the studies were imposed *a priori* or determined by statistical tests. Iversen's work (which contradicts the unconditional hump-shape hypothesis) is not mentioned too here, but some pages below.

By the arguments put forward above, our assessment of the evidence regarding the hump-shape hypothesis is rather pessimistic. Though there is no study establishing significant negative employment effects of high centralisation levels, all other results (especially regarding the hump-shape hypothesis) are possible. Besides that, the somewhat careless use and abuse of methods undermines the credibility of the results considerably.

Some theories dealing with interaction effects appear interesting and promising. Nevertheless, the empirical results are full of contradictions (e.g. Cukierman & Lippi, 1999 versus Iversen, 1999). Therefore it is unclear at the current stage of analysis, whether the available data lend themselves to a reliable identification of such effects. All these studies gain significant re-

[224]Of course, there are several positive exceptions, e.g. Soskice (1990) or Iversen (1999) among others.

[225]The results come from Layard et al. (1991), Scarpetta (1996), Zetterberg (1995), Bleany (1996), Layard & Nickell (1999), Elmeskov et al. (1998), Haffner et al. (2001).

sults by an empirical application of the isolation principle: They consider a certain interaction (e.g. central bank independence) and disregard all other (e.g. taxation *and* the legal framework). The isolation principle is a sensible tool for economic reasoning, but not valid in empirical research.

As regards the relation of centralisation and wage dispersion, we observe more uniform and robust results in the literature. Though we cannot expect that investigations of the relation are able to reveal the direction of causation, some more effort appears worthwhile to gather more detailed information on the dispersion effects of centralisation, especially because it is a central input to the current (purely abstract and theoretical) discussion on the implications of bargaining institutions for the design of incentives.

Attentive readers may have noticed that the theoretical section contains many references to *indirect* empirical evidence from related or even seemingly different fields of research. The body of indirect empirical evidence seems to be much larger than the papers categorised under the 'centralisation label'. We have to admit that we did not check these 'related' studies with the same precision as the studies from the empirical section above. But we have to emphasise that we were not directed to many of them by the 'official' centralisation literature, but came up against them casually, simply because they are hardly received. With hindsight, we regret that we followed the less promising track in the empirical part of this survey by trying to give a thorough summary of the existing empirical 'official' centralisation studies instead of trying to reach the less investigated regions of the topic.

Chapter 3

An Explorative Investigation of the Relation between Centralisation and Strike Activity

3.1 Introduction

As announced in section 2.4.17, we present here results from an own investigation of the relation between centralisation and wage bargaining using data on 17 OECD countries for the period 1973-2000.

We anticipate that our estimations suffer from many problems reported in the sections above. Time restrictions imposed additional restrictions on the data. For example, we ignore information on some possibly relevant aspects of the legal framework of bargaining: statutory work councils, compulsory strike ballots, allowance of lock-outs and political strikes, peace clauses, and compulsory arbitration. Unfortunately, these data are readily available only for European countries. Though they can – in principle – be gained by access of national sources, the required effort deterred us from doing this. We checked the relevance of these dummy control variables by including them into estimations for the subsample of European countries and found (surprisingly) neither individually significant effects nor joint (F-test for all these dummies) significance. These checks do not allow us to give the clear-all, however, since the sample for these estimations is restricted in the country dimension, and additionally relates only to a relatively homogenous subsample of the data.

We explain lost working days per 1000 workers and year due to strike

actions by indicators for the level of centralisation of bargaining and several control variables (explained below). Our choice of centralisation indicators is OECD (1997). The indicators $CENT$ und $COORD$ represent the level and coordination of the bargaining parties. A third indicator, $COMB$ is obtained by combining both other indicators. Table **??** on page **??** lists the values of the indicators for the countries in our estimation sample. All problems and disclaimers from section 2.5.1 apply to these indicators too. An advantage of the OECD indicators over several others is, however, that it captures significant changes of centralisation in the last twenty years (i.e. it is time-variant). Other indicators, e.g. Calmfors-Driffill, which are not updated since their creation, would urge us to put hands-on and expose us the criticism of subjectivity. However, we report that preliminary regressions with the Calmfors-Driffill indicator produced qualitatively similar results.

All specifications contain the following control variables: standardised unemployment rates (UN), the average of unemployment rates over all countries in the sample, ($\bar{UN}_{OECD}$), the inflation rate I, the output gap (GAP), and time-trend dummies. Unfortunately, output gap series provided by the OECD and the IMF are not available for all countries and the whole period of our sample. To fill this gap, we computed an output gap as the relative difference between actual real output (GDP) and its smooth trend (generated by the Hodrick-Prescott Filter, with smoothing parameter value 50 for all countries.) Unemployment rates, and especially average unemployment rates and the output gap serve as proxies to account for business cycle effects. Though theory does not provide guidance on further relevant regressors, union density, coverage, and openness indicators suggest themselves als controls. Unfortunately these variables are not available for all countries and the whole time period of our sample. We run some explorative regressions with these control variables included in a smaller sample of countries and found that only the union density variable was significant. The fact that elimination of the union density did not lead to noteworthy change of the centralisation coefficients, we have some clue that omission of these variables does not cause severe bias.

A glance at a plot of the strike data reveals their main characteristics and the implied problems. Figure 3.1 shows the high volatility of our dependent variable and considerable differences between countries. A disclaimer regarding the comparability if strike data is in order here. Lesch (2002) and Schnabel (1995) point to the fact strike data are censored from below at the firm level in the USA, i.e. only strikes with more than 1000 days lost are reported. According to Lesch and Schnabel this may lead to an underestimation of the true strike activity by 30%.

Both high volatility in the time dimension and huge international dif-

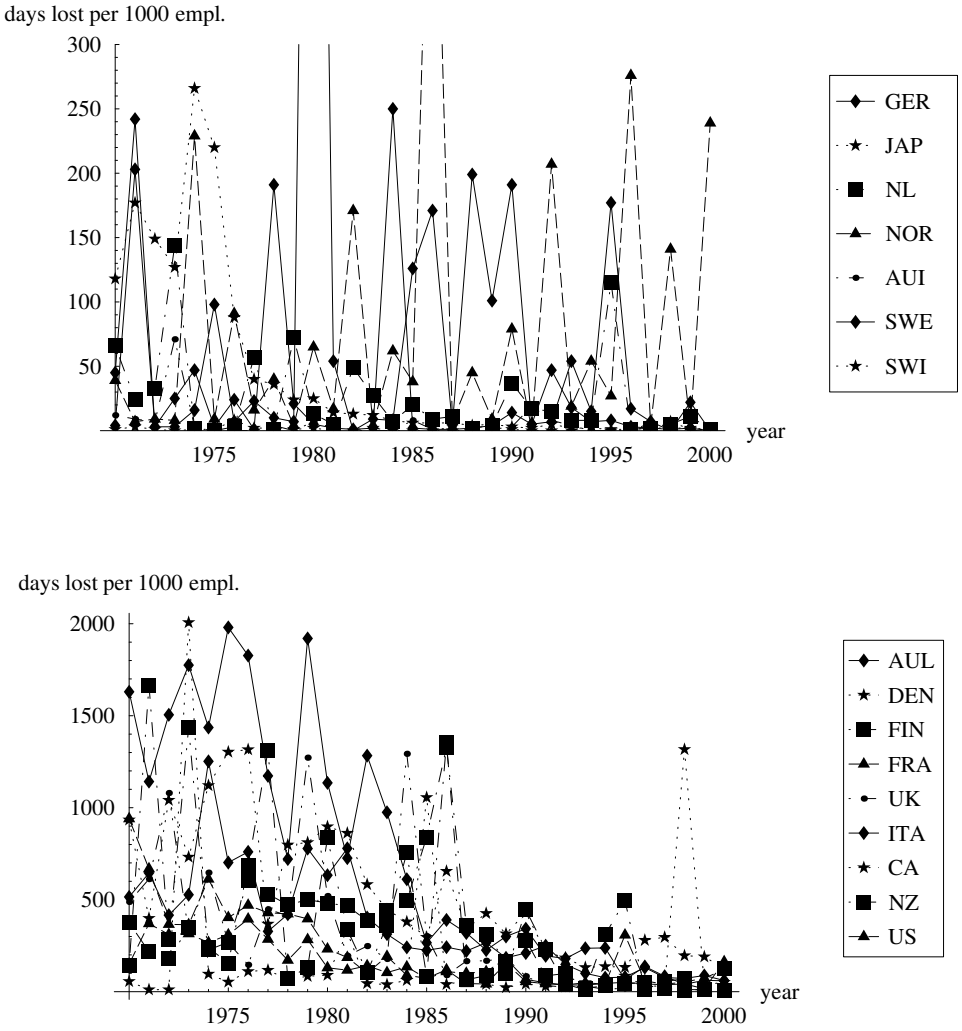


Figure 3.1: Lost days due to strikes per 1000 employees, 16 OECD-countries

ferences pose several possible challenges to regression methods. The most important one seem to be that individual outlier observations may exert a high impact in the regression coefficients. We will explain these problems and solutions to them below.

Before we step into the details, let us take a look at some descriptive measures in table 3.1. They suggest lower strike activity in the more centralised countries: Both means as well as medians, and 25% and 75% percentiles are less for the more centralised countries. The lower panel of the table points

centr.-level	mean	median	25%-percentile	75%-percentile
		indicator of centralisation (OECD)		
low	353.4	176	40	429
intermed.	173.9	40.5	2	268
high	222.3	81.5	19	207
		indicator of coordination (OECD)		
low	332.8	245	89.5	447
intermed.	345.7	138	7	421
high	79.6	17.5	4	62
		combined indicator (OECD)		
low	369.0	189	41	437.5
intermed.	255.4	145	9	390.5
high	125.8	27	5	93.5
period		strike activity by periods		
1971–1975	393.4	227.0	16.0	417.0
1976–1980	343.0	146.0	23.0	482.0
1981–1985	229.3	101.0	8.0	322.0
1985–1990	155.3	71.0	6.0	210.0
1991–1995	68.4	34.0	8.0	85.0
1996–2000	63.8	17.5	2.0	61.5

sources: IW Köln, OECD (1997), own computations.
The combined indicator denotes the centralisation level according to the OECD centralisation indicator (combining information on the level of wage bargaining and the degree of coordination in wage bargaining

Table 3.1: descriptive measures of strike activity (lost working days per 1000 employees and year)

to a clear negative time trend in all countries. Since these effects may be generated by spurious correlations (i.e. are not partial effects), we have to apply regression techniques in order to disentangle matters. Let us start with a description of central data and estimation problems.

3.2 Data and Estimation Problems

The explanation of strike action by regression techniques has to solve mainly two problems. The first problem is present in all cross country studies. It is caused by individual heterogeneity of the observational units (countries),

which cannot be eliminated because of lack of control variables,[1] and by contemporaneous correlations (i.e. correlations between panels). Contemporaneous correlations appear if countries are hit/affected by macroeconomic shocks (or unobservable regressors) symmetrically.[2] It is straightforward to show that the standard OLS covariance matrix formula generates biased results then. If panel data are available (as in our case), a correct estimation of the covariance matrix if straightforward, however (see Greene, 2000, section 13.9). Though the estimated covariance matrix *of the residuals* could in principle be used to compute an efficient GLS estimate, we do not follow this approach here because of the warnings in Beck & Katz (1995). The authors show in a simulation study that GLS estimates respond sensibly to minor over- or underestimation of the residual covariance matrix. This may cause severe problems, especially if the time dimension of the sample is small. Besides this, we account for serial correlation by usage of the Prais–Winsten correction.

The second estimation problem relates to the high volatility of strike data in the time dimension. The eye-catching outliers from figure 3.1 may dominate the determination of coefficients and thus generate biased and less robust results. Two reasons for high volatility suggest themselves. Either is caused by unobserved variables, or it is caused by highly nonlinear dependence of strike duration on the regressors.

As regards the first reason, we guess that several unobserved variables are good candidates for explaining outliers, e.g. reforms of the legal framework affecting the strike power of unions, or other social reforms which provoked general strikes. Unfortunately, we are not aware of exhaustive and detailed data on such changes. Besides that, we expect that such a detailed list would generate a very large number of control (dummy) variables.[3] Here we pursue two alternative strategies to the inclusion of control variables,

[1] An alternative way to deal with the heterogeneity problem, fixed effects estimation, is not possible in our application, since the main important regressors (centralisation indicators) show to less time variation.

[2] Note that contemporaneous correlations may be present also in microeconometric studies. They are either ignorable in these applications, or cannot be accounted for because of small observation numbers of the data sets *in the time dimension*.

[3] For example, Machin (1997) reports eight labour market acts delivered by the Thatcher government in the period 1980-1993. Though this government seems to be more productive regarding labour market reforms than others, we have to note that these acts relate directly to bargaining, and that the list could be complemented by other social policy acts and regulations which could have provoked strikes on general strikes (national minimum wage policies, unemployment benefit changes, mandatory retirement regulation, social security contribution acts, labour taxation etc). If we obtained 20 such dummies for each country, a total of 340 additional variables would result.

statistical outlier detection procedures and robust estimation.

The second possible cause for 'outliers' (nonlinearity) is tackled by application of the Box-Cox transformation (it is explained below).

3.2.1 Outlier Detection Procedures and Robust Estimation

Influential observations emanate in regression equations either by creating large changes of the regression coefficients or (more less specific) by blowing up residual variance and decreasing predictive power. The literature contains several diagnostics algorithms and influence measures for the detection of outliers (see e.g. Belsley et al., 1980 or Atkinson & Riani, 2000). They relate either to the (relative) change of individual coefficients after elimination of a certain observation (as for example DFBETAS), or to the change of the residual variance or predictive power (as for example studentised residuals or DFITS). The DFBETAS statistic appears to be best suited for our application since our focus is centered on two coefficients (centralisation dummies), and the DFBETAS statistic provides the most specific information.[4]

DFBETAS(β_k, i) represents the relative change of coefficient β_k when observation i is dropped from the sample. 'relative' means here: in units of the coefficients standard deviation. (for example DFBETAS$(\beta_k, i) = 2$ means that β_k changes by two standard deviations if observation i is dropped from the sample.) Belsley et al. (1980) propose $|DFBETA(\beta_k, i)| > 2/\sqrt{\sharp(obs.)}$ as criterion for highly influential observations. Unfortunately, this bound is (asymptotically) valid only with homoscedastic residuals. Since tests reject homoscedasticity in our specifications, this bound is rather to narrow and can serve only as a raw rule of thumb in our application.

As an alternative to the elimination of outliers, we use a robust estimation procedure, the Least Absolute Deviations (LAD) estimator. LAD estimators minimize the sum of absolute deviations of the dependent variable from the regression line and therefore attach lower weights to observations far away from the regression line.[5] The higher robustness of the estimator is traded off by lower precision in many cases. A further disadvantage of the estima-

[4]We applied also the DFITS statistics to our estimations. As expected, the centralisation dummy coefficients showed even more stability with respect to this outlier detection method. Therefore only the results of the DFBETAS detection procedure are reported in the tables.

[5]In an alternative illuminating interpretation the estimator can be considered as a regression model of the conditional *median* of the dependent variable. By analogy of the unconditional and conditional median estimator it is clear that LAD coefficients are insensitive to truncation or censoring at the tails of the distribution.

tor is that procedures for the consistent estimation of the covariance matrix in face of (contemporaneously or serially) correlated residuals are not developed. Nevertheless, consistent estimates can be computed by application of moving-blocks bootstrap methods or residual based methods. We conducted a standard bootstrap procedure here because of time restrictions. This may allow for a better estimation of standard errors than the asymptotic ones but still deliver biased results.[6]

3.2.2 Functional Form Considerations

The repertoire of semiparametric methods is small in our application because of relatively low observation numbers. Therefore, we use the Box-Cox transformation which creates considerable flexibility but imposes less computational burden and mild identification requirements. The model has the form

$$\frac{y^{\lambda}-1}{\lambda} = X\beta + u.$$

It allows – depending on the scaling parameter λ – a continuous transition from the linear ($\lambda = 1$) to the logarithmic transformation ($\lambda \to 0$) of the dependent variable. The implementation used here obtains coefficients by maximum likelihood estimation and is based on the (unrealistic) assumption of homoscedastic and uncorrelated residuals. In order to obtain more reliable inference, we decided to estimate λ by the maximum likelihood procedure, to transform the dependent variable with this value, and to plug it into the linear regression model and into the median regression. Also the standard errors from this heuristic two-step estimation are biased, because it treats λ as a deterministic variable. However, this bias seems to be less severe than the other, since λ is estimated with high precision and is insensitive with respect to outliers. We accept a further bias by using the parameter λ, which is based on a conditional *mean* estimation procedure, to transform the dependent variable for a median regression. Though an algorithm for Box-Cox median regression is worked out in Powell (1991), we decided to abstain from implementing it here because we expect a minor bias from this minor inconsistency.

Finally, we have to note a minor censoring problem in the data. The reported strike duration is exactly zero in 28 of 436 observations.[7] In principle, the censoring problem could be solved by application of suited estimation

[6]The bootstrap standard errors are considerably greater than the asymptotic ones in our application.

[7]Contracting without strikes is distributed very unevenly above the countries: 14 zero observations come from Switzerland, two from Sweden, and one from the Netherlands.

procedures (ML-Tobit, Symmetrically Censored Least Squares (SCLS), Censored Least Absolute Deviations (CLAD), Heckman-Selection). We abstain from using such procedures, since two of them (ML-Tobit and Heckman-Selection) require strong assumptions regarding the structure of error terms and respond quite sensitively to violations. Beside this, the censoring problem (only about 6% of observations are censored) appears to be negligible. Thus we simply drop the censored observations from the sample.

3.3 Estimation results

Our estimations are based on observations for the period 1973–2000 for the OECD countries Austria (AUI), Australia (AUL), Belgium (BEL), Germany (GER), Finland (FIN), France (FRA), United Kingdom (UK), Italy (ITA), Japan (JAP), Canada (CAN), New Zealand (NZ), the Netherlands (NL), Norway (NOR), Sweden (SWE), Switzerland (SWI), and the USA (US). Let us start with the results of the combined (centralisation and coordination) indicator.

3.3.1 Results for the combined OECD indicator

Table 3.3 summarises all results for estimations with the combined indicator. The upper, middle, and bottom panel relates to the linear, the Box-Cox, and the log-linear specification, respectively. The left, middle, and right block relates to (Prais-Winsten transformed) OLS estimates based on the full sample, to (Prais-Winsten transformed) OLS estimates based on the outlier-corrected sample, and the LAD (Median-Regression) results. The criterion used for the elimination of possible outliers is $DFBETAS = 0.1$, i.e. all observations causing a change of the medium or high centralisation dummy of more that 10% of its standard deviation, are removed. We experimented also with a less tight criterion $DFBETAS = 0.25$. The results are not reported here, since they caused no noteworthy changes of significance levels.

As indicated by the low p-values of the centralisation dummy coefficients, all specifications contain almost clear evidence in favour of strike-moderating centralisation effects. The dummy COM_{hi}, capturing highly centralised (and coordinated) countries is significant in all specifications at the 5% level. From the linear specifications we read that the effects are also of considerable size: between 80 and 130 days per thousand workers (depending on the specification). A eye-catching feature is their considerable difference between columns. The difference between OLS regressions for the full and the outlier-corrected sample tells us that the elimination of the 36 observations with the

highest impact on the both centralisation dummy coefficients is considerable, and thus put a small question mark on the robustness of the effect. On the other hand,the OLS and the Median (LAD) regression coefficients cannot be compared directly, since they measure different things: OLS coefficients represent the impact of regressors on the conditional *mean*, LAD coefficients represent the impact on the conditional *median* of the dependent variable. They may differ considerably if the conditional distribution of the dependent variable is skewed. Thus, an (in absolute value) higher coefficient of the mean regression indicates that bargaining institutions exert stronger effects on the upper quantiles, i.e. on countries with higher strike duration. Of course, this interpretation presumes that the difference between both estimators is not driven by outliers. Since we conducted the LAD regression mainly as an indirect outlier and robustness check, we should be cautious with this interpretation.

If one takes the results from the Box-Cox estimation seriously, only the Box-Cox results should be considered as valid: χ^2- Tests for $H_0 : \lambda = 1$ and $H_0 : \lambda = 0$ are rejected at the 1% level, meaning that only the Box-Cox specification is correct. We report the linear and logarithmic specifications anyhow because they are the ones employed usually in most macro estimations, and doing without these 'natural' choices would raise suspicions. Additionally, the specification changes can be taken as an additional (though very heuristic) robustness check, since a really stable relation should not vanish due to moderate changes of the functional form of the regression.

Besides the centralisation effects, some control variable effects deserve attention. Unemployment (and all other control variables) are measured in percent. Consequently, the coefficients of the linear specification give the change in lost strike days due to a one percent increase of these variables. Since the coefficient of the squared terms are quite small, the linear term coefficients are good approximation to the marginal effects. Somewhat surprising is the positive impact of unemployment which vanishes (because of the negative squared term) only for considerably high levels of unemployment (above ca. 9%). The significant positive effects of inflation and the output gap appear to be more in line with expectations. This is also the case with the considerably high (but individually insignificant) time dummy effect (not reported in the tables). They grow (in absolute value) from about -50 in 1975 to about -150 at the end of the estimation period.

3.3.2 Results for the indicators $CENT$ and COO

While the estimates for the coordination indicators are similar with the combined index, the relation of significance levels is 'crossed' for the pure central-

isation indicator, i.e. only intermediate bargaining levels bear a (marginally) significant impact. In face of the numerous problems with measurement of the centralisation indicators we do not try to create an intuitive explanation for this, but are satisfied with the observation that the signs and sizes of the effects remain stable after a change of the indicator.

3.4 Conclusion

Though our investigation leaves some uncertainties and question marks (like many other empirical studies), we have shown that centralisation and coordination of wage setting appear to have moderating effects on strike activity. The findings are in line with several theories of strike activity and bargaining, ranging from screening models to the simple transaction cost model.

Variable	Meaning
CEN_{med}	Dummy, = 1 for intermediate level of centralisation
CEN_{hi}	Dummy, = 1 for high level of centralisation
COO_{med}	Dummy, = 1 for intermediate level of coordination
COO_{hi}	Dummy, = 1 for high level of coordination
COM_{med}	Dummy, = 1 if combined indicator takes on value 2
COM_{hi}	Dummy, = 1 if combined indicator takes on value 3
u	Unemployment rate (source: OECD)
u^2	Unemployment rate squared (source: OECD)
$\bar{u}$	average of unemployment rate (over all countries in the sample)
i	Inflation rate (source: IMF)
i^2	Inflation rate squared
GAP	Output gap, computed as deviation of actual GDP from smoothed GDP. Smoothing is performed with the Hodrick-Prescott filter. value of the smoothing parameter is 50 for all countries.
Prais-Winsten	OLS estimation of the Prais-Winsten transformed regression equation
Obs.	Number of observations in the sample
PV	P-value
R^2	Coefficient of Determination (R^2); Pseudo-R^2 in LAD estimation
ρ	estimated coefficient of the $AR(1)$-Process representing serial correlation of the residuals (used to build the Prais-Winsten regression

All dummy variables with subscript *med* (*hi*) take on value unity if the respective OECD indicators take on value2 (3), and zero otherwise. Ranges of all used OECD indicators are $\{1, 2, 3\}$. Consequently decentralised/uncoordinated countries form the (omitted) base category.
All estimations contain additionally a constant and 12 time dummies. The dummies are for each two years unity (and 0 otherwise); formally:

$$D_{x-1/x} = \begin{cases} 1 & \text{if } t = x \text{ or } t = x - 1 \\ 0 & \text{otherwise} \end{cases}$$

All coefficients of the time dummies (not reported in the tables) are negative (omitted base period is 1974–1974) and show a negative trend, but only some are individually significant. F-Tests for common significance on all dummies always rejected the null hypothesis $H_0 : D_{75/76} = D_{77/78} = \cdots = D_{97/98} = 0$ in the OLS and Prais-Winsten regressions. The two-year coding was chosen because perfect collinearity occurred otherwise in some regressions.

Table 3.2: Legend for tables 3.3 bis 3.5

Dependent variable: days lost per thousand employees (y)									
Estimator	Prais-Winsten			Prais-Winsten			Median-Regression		
				$DFBETAS < 0.1$					
Coeff.	coeff.	t	PV	coeff.	t	PV	coeff.	z	PV
COM_{med}	-55.62	-1.16	0.24	-37.09	-1.50	0.13	-30.22	-1.65	0.05
COM_{hi}	-129.74	-2.49	0.01	-100.31	-3.43	0.00	-80.20	-4.60	0.00
u	66.54	3.15	0.00	51.47	4.63	0.00	33.11	3.71	0.00
u^2	-3.33	-1.92	0.06	-2.36	-2.68	0.01	-1.45	-2.51	0.01
$\bar{u}$	-33.42	-0.82	0.41	-4.60	-0.20	0.84	-0.15	0.06	0.48
i	31.88	2.82	0.01	7.42	1.13	0.26	5.02	0.78	0.22
i^2	-0.43	-0.90	0.37	0.96	3.23	0.00	1.39	2.01	0.02
GAP	8.55	1.04	0.30	11.59	2.28	0.02	5.02	1.47	0.07
obs.	438			402			438		
R^2	0.24			0.42			0.25		
ρ	0.36			0.37					
Dependent variable: $(y^\lambda - 1)/\lambda$, $\lambda = 0.12$									
Coeff.	coeff.	t	PV	coeff.	t	PV	coeff.	z	PV
COM_{med}	0.05	0.18	0.85	-0.04	-0.17	0.86	-0.29	-1.10	0.14
COM_{hi}	-0.85	-2.37	0.02	-1.44	-4.51	0.00	-1.84	-4.33	0.00
u	0.87	5.86	0.00	0.85	6.31	0.00	0.96	4.70	0.00
u^2	-0.03	-2.79	0.01	-0.03	-3.12	0.00	-0.04	-2.23	0.01
$\bar{u}$	-0.03	-0.09	0.92	-0.09	-0.34	0.74	0.14	0.58	0.28
i	0.48	4.81	0.00	0.49	5.52	0.00	0.58	4.27	0.00
i^2	-0.01	-2.62	0.01	-0.01	-3.15	0.00	-0.01	-2.04	0.02
GAP	0.20	2.90	0.00	0.23	3.42	0.00	0.21	3.11	0.00
obs.	438			404			438		
R^2	0.41			0.53		0.40			
ρ	0.30			0.36					
Dependent variable: $\ln(y)$									
Coeff.	coeff.	t	PV	coeff.	t	PV	coeff.	z	PV
COM_{med}	0.07	0.38	0.70	0.06	0.35	0.72	-0.09	-0.55	0.29
COM_{hi}	-0.46	-1.90	0.06	-0.81	-3.61	0.00	-1.06	-3.43	0.00
u	0.59	5.87	0.00	0.58	5.87	0.00	0.59	4.49	0.00
u^2	-0.02	-2.81	0.01	-0.02	-2.90	0.00	-0.02	-2.00	0.02
$\bar{u}$	0.03	0.13	0.89	-0.12	-0.75	0.45	0.28	0.54	0.30
i	0.33	4.71	0.00	0.34	5.60	0.00	0.40	4.41	0.00
i^2	-0.01	-2.77	0.01	-0.01	-3.73	0.00	-0.01	-2.55	0.01
GAP	0.14	2.99	0.00	0.15	3.46	0.00	0.17	3.09	0.00
obs.	438			406			438		
R^2	0.40			0.47		0.39			
ρ	0.32			0.40					

For definitions of variables and further explanations see table 3.2

Table 3.3: Regression results for the linear, Box-Cox and the log-linear specification; indicator of centralisation: combined indicator of centralisation and coordination (OECD, 1997).

Dependent variable: days lost per thousand employees (y)									
Estimator	Prais-Winsten			Prais-Winsten			Median-Regression		
				$DFBETAS < 0.1$					
Coeff.	coeff.	t	PV	coeff.	t	PV	coeff.	z	PV
CEN_{med}	-86.68	-1.92	0.06	-57.90	-2.11	0.04	-63.06	-4.10	0.00
CEN_{hi}	-103.01	-1.36	0.17	-97.23	-2.40	0.02	-98.14	-2.67	0.00
u	0.65	2.99	0.00	0.54	5.33	0.00	0.30	3.31	0.00
u^2	0.00	-1.76	0.08	0.00	-3.21	0.00	0.00	-1.90	0.03
$\bar{u}$	-0.36	-0.88	0.38	-0.35	-1.71	0.09	0.00	0.38	0.35
i	32.10	2.79	0.01	4.69	0.66	0.51	8.72	1.05	0.15
i^2	-0.43	-0.88	0.38	1.10	3.54	0.00	1.31	1.97	0.02
GAP	9.11	1.08	0.28	10.62	2.08	0.04	4.83	1.36	0.09
obs.	438			398			438		
R^2	0.23			0.42			0.24		
ρ	0.37			0.42					
Dependent variable: $(y^\lambda - 1)/\lambda$, $\lambda = 0.12$									
Coeff.	coeff.	t	PV	coeff.	t	PV	coeff.	z	PV
CEN_{med}	-0.43	-1.31	0.19	-0.62	-2.10	0.04	-0.90	-3.16	0.00
CEN_{hi}	-0.32	-0.66	0.51	-0.73	-1.59	0.11	-0.53	-1.30	0.10
u	0.01	5.71	0.00	0.01	6.85	0.00	0.01	4.24	0.00
u^2	0.00	-2.49	0.00	0.00	-3.42	0.00	0.00	-1.86	0.03
$\bar{u}$	0.00	-0.18	0.85	0.00	-0.26	0.79	0.00	0.60	0.27
i	0.47	4.74	0.00	0.51	5.31	0.00	0.56	4.00	0.00
i^2	-0.01	-2.39	0.02	-0.01	-3.13	0.00	-0.01	-1.66	0.05
GAP	0.21	2.95	0.00	0.17	2.64	0.01	0.17	2.73	0.00
obs.	438			401			438		
R^2	0.40			0.51			0.39		
ρ	0.30			0.37					
Dependent variable: $\ln(y)$									
Coeff.	coeff.	t	PV	coeff.	t	PV	coeff.	z	PV
CEN_{med}	-0.24	-1.09	0.28	-0.33	-1.63	0.10	-0.47	-2.78	0.00
CEN_{hi}	-0.08	-0.26	0.80	-0.37	-1.20	0.23	-0.19	-0.88	0.19
u	0.01	5.78	0.00	0.01	6.71	0.00	0.01	4.24	0.00
u^2	0.00	-2.55	0.02	0.00	-3.25	0.00	0.00	-1.77	0.04
$\bar{u}$	0.00	0.03	0.97	0.00	-0.31	0.76	0.00	0.44	0.33
i	0.32	4.66	0.00	0.36	5.60	0.00	0.40	4.26	0.00
i^2	-0.01	-2.53	0.01	-0.01	-3.55	0.00	-0.01	-2.07	0.02
GAP	0.15	3.06	0.00	0.13	2.93	0.00	0.13	3.04	0.00
obs.	438			406			438		
R^2	0.39			0.47			0.38		
ρ	0.31			0.38					

For definitions of variables and further explanations see table 3.2

Table 3.4: Regression results for the linear, Box-Cox and the log-linear specification; indicator of centralisation: indicator of centralisation (OECD, 1997).

Dependent variable: days lost per 1000 employees(y)									
Estimator	Prais-Winsten			Prais-Winsten $DFBETAS < 0.1$			Median-Regression		
Coeff.	coeff.	t	PV	coeff.	t	PV	coeff.	z	PV
COO_{med}	32.71	0.76	0.45	-23.71	-0.96	0.34	-37.28	-0.96	0.17
COO_{hi}	-106.90	-2.33	0.02	-107.78	-3.70	0.00	-90.92	-3.86	0.00
u	0.65	3.06	0.00	0.50	4.54	0.00	0.30	3.30	0.00
u^2	0.00	-2.02	0.04	0.00	-2.77	0.01	0.00	-2.25	0.01
$\bar{u}$	-0.35	-0.88	0.38	-0.24	-1.13	0.26	-0.12	-0.38	0.35
i	26.36	2.42	0.02	1.18	0.19	0.85	3.46	0.29	0.39
i^2	-0.23	-0.50	0.62	1.10	3.95	0.00	1.23	2.04	0.02
GAP	8.59	1.06	0.29	10.01	2.10	0.04	5.05	1.43	0.08
Beob.	438			400			438		
R^2	0.24			0.42			0.25		
ρ	0.35			0.36					
Dependent variable: $(y^\lambda - 1)/\lambda$, $\lambda = 0.12$									
Coeff.	coeff.	t	PV	coeff.	t	PV	coeff.	z	PV
COO_{med}	-0.22	-0.68	0.50	-0.33	-1.31	0.19	-0.64	-1.58	0.06
COO_{hi}	-1.14	-3.22	0.00	-1.78	-5.59	0.00	-1.84	-4.30	0.00
u	0.01	5.36	0.00	0.01	6.05	0.00	0.01	3.64	0.00
u^2	0.00	-2.57	0.01	0.00	-3.54	0.00	0.00	-1.66	0.05
$\bar{u}$	0.00	-0.12	0.90	0.00	0.19	0.85	0.00	0.20	0.42
i	0.44	4.51	0.00	0.50	5.94	0.00	0.46	3.85	0.00
i^2	-0.01	-2.31	0.02	-0.01	-3.43	0.00	-0.01	-1.63	0.05
GAP	0.20	2.96	0.00	0.22	3.64	0.00	0.23	2.75	0.00
Beob.	438			391			438		
R^2	0.41			0.60			0.40		
ρ	0.31			0.34					
Dependent variable: $\ln(y)$									
Coeff.	coeff.	t	PV	coeff.	t	PV	coeff.	z	PV
COO_{med}	-0.17	-0.80	0.42	-0.23	-1.39	0.17	-0.37	-1.54	0.06
COO_{hi}	-0.65	-2.74	0.01	-1.12	-5.26	0.00	-1.16	-4.16	0.00
u	0.01	5.42	0.00	0.01	5.49	0.00	0.00	3.37	0.00
u^2	0.00	-2.58	0.01	0.00	-3.12	0.00	0.00	-1.49	0.07
$\bar{u}$	0.00	0.11	0.91	0.00	0.03	0.98	0.00	0.37	0.35
i	0.30	4.52	0.00	0.32	5.61	0.00	0.33	4.22	0.00
i^2	-0.01	-2.56	0.01	-0.01	-3.51	0.00	-0.01	-2.19	0.01
GAP	0.14	3.04	0.00	0.14	3.55	0.00	0.13	2.60	0.00
Beob.	438			395			438		
	0.40			0.53			0.39	0.39	
ρ	0.32			0.39					

For definitions of variables and further explanations see table 3.2

Table 3.5: Regression results for the linear, Box-Cox and the log-linear specification; indicator of centralisation: indicator of coordination (OECD, 1997).

Chapter 4

Two Centralisation Models with Heterogenous Firms

4.1 Introduction

As mentioned in the introduction of the book, pleas against centralised bargaining are often backed up by the argumentation that wages have to reflect heterogeneity of firms, regions and industries in order to obtain efficient markte outcomes, and that decentralised bargaining matches these flexibility requirements.

In this chapter we construct two models capturing certain aspects of firm heterogeneity and show that they do not yield unambiguous results against centralisation of wage bargaining. The first model is a straightforward application of Robinson's (1933) work on monopolistic discrimination. Though the results can be derived in a quite general form, it is difficult to provide an intuitive interpretation of the conditions required for positive (or negative effects of centralisation. Among other problems, the model suffers from the fact that the aggregation problem is solved by assuming it away (this will become clear below).

The second model tries to address this problem by deriving the centralised union objective using the median voter approach. Though things appear more involved at the outset, it is easier to derive intuitive conditions for positive (or negative) employment effects of centralisation in this modelling framework.

4.2 A Robinsonian Model of Union Wage Discrimination*

4.2.1 Introduction

We try to show here that employment and welfare effects are ambiguous for a certain class of models. And we show that (in these models) an unambiguous relation of employment and welfare may not exist. Consequently, positive employment effects of decentralisation in wage bargaining may be simply waste of human resources. The result, originally relating to price discrimination of monopolists, is not new. It was discovered by Robinson (1933) long time ago and generalized by Edwards (1950) and Shih, Mai, & Liu (1988). However, to the best of my knowledge, its implications for wage setting institutions were not realised until now.

We do not claim the Robinson-argument to be of high relevance or to dominate other aspects of centralisation. As we explain below, there are good reasons to suspect that it is at least extremely difficult to test the argument empirically or to assess its relevance. Thus the message of the model to economists is rather: 'be careful if you argue in favour of less centralisation and be aware of the holes and uncertainties in your knowledge about the issue.'

The idea is simple enough to be explained in five sentences: Consider a union operating in an economy with (at least) two firms or sectors. Firms are exposed to stochastic demand shocks[1] which in turn imply different elasticities of the firms' labour demands (this is the core aspect of the model). Most models on centralisation of wage negotiations ignore such heterogeneity. This has two important reasons. The first is that economists prefer models without stochastic shocks and firm heterogeneity, because they make models complex and intractable in many circumstances.[2] The second is that the frequency of employment adjustments is higher than the frequency of wage negotiations in practice. In theoretical models, this is accounted for by assuming that uncertainty over labour demand prevails when wage negotiations take place and

*An earlier version of this model was presented at the annual conference of the 'Verein für Socialpolitik' 2002. I am indebted to the session participants, to Ekkehart Schlicht, Michael Burda, Bernhard Rauch, Joachim Möller and Lutz Arnold for helpful comments.

[1]We do not formalize the type of demand shocks explicitly, but assume (for simplicity) that they are serially uncorrelated. As will become clear below, the specific form of demand shocks is not important.

[2]Fitzenberger & Franz (1999, 2000) are exceptions here. However they assume that bargaining takes place *before* the shocks are revealed. Thus firms are homogenous *ex ante* in their model.

that employment adjustment is realized if demand uncertainty is resolved (at least partially). But this is an idealization, since there remains much heterogeneity between firms or sectors even in the medium run. A large strand of empirical literature is suggestive for this view (see Oi & Idson, 1986; Wagner, 1997 for surveys on firm size effects and Lewis, 1986 for union effects). Though it may be a good idea to exclude heterogeneity if some other aspects of wage negotiations are focussed, an explicit analysis may yield additional insights.

Consider the union as a monopolist who has the option to set the same wage in both (all) firms or to discriminate between firms. This is simply third degree price discrimination (see Varian, 1989). As is well known from the literature, price discrimination increases profits (if there are no additional costs associated with a discriminatory policy) and thus is pursued by monopolistic firms whenever possible. In our context this implied that unions prefer firm level bargaining. At this stage of our investigation we do not consider this problem by pointing to possibly high fixed costs associated with decentralised negotiations[3]. These costs maybe come in the form of bargaining costs or psychic cost which, in turn, depend on institutions and customs. Especially if firms are exposed to random demand fluctuations, their fate may change again and again and therefore require corresponding wage changes. Such distortions disappear at a more central level. Instead we ask for the implications regarding employment. The results are readily available from the literature mentioned above.

The plan of this section is as follows: in section 4.2.2 we review the results from Shih et al. (1988) and give some interpretations. Then we outline a welfare analysis backed up with some illustrative numerical examples. The conclusion discusses some implications and tries to assess the empirical relevance of the issue.

4.2.2 Employment Effects

As emphasized in the introduction, the model is not new, the exposition follows Shih et al. (1988) on the heels. The only contribution of this section is to note that Robinson's analysis may have significant implications for bargaining outcomes.

In order to keep things tractable, we consider a monopoly union which is able to set wages unilaterally for K firms.[4] We start with the union utility

[3]However, we will discuss some implications of these costs in the welfare analysis.

[4]We did not check explicitly whether the result is invariant to a change of the bargaining structure (substitution of the unilateral wage setting procedure by a Nash bargaining solution). But we suspect that this would only complicate the computations and bear no

function

$$U(n_1, ..., n_K) = \sum_i u_i(n_i) \tag{4.1}$$

where $u_i(n_i) = \tilde{u}_i(w_i(n_i), n_i)$ is utility from employment n_i in firm i and $w_i(n_i)$ is the (inverse) labour demand function of firm i. We assume $U(...)$ to be a sum or linear combination of the u_i in order to rule out masked aggregation effects.[5] Furthermore, the model is formulated in real terms in order to study isolated effects of discrimination. To obtain a clear and consistent notation, we define $v_i(w_i) := \tilde{u}_i(w_i, n_i(w_i))$. Note that extending the utility definition by adding an alternative wage (for example unemployment compensation), i.e. substituting w_i by $w_i - b$ does not change the results. Therefore, we work with the simpler version for expositional convenience.

Note that the (inverse) labour demand functions are subscripted with index i to represent labour demand heterogeneity and that labour demand functions are independent here, i.e. labour demand of firm i does depend only on its own wage. The latter assumption excludes wage competition between firms and is therefore not fully realistic. Though it were in principle possible to admit competition, this would complicate the analysis considerably, and is likely to yield little additional insight. In the case of perfect competition, wage differentials could not prevail. In this case our analysis would be groundless.[6] However, if wage competition takes on moderate forms, wage differentiation will be restricted and reduce the employment effects. Because of this, our analysis models the extreme case and overstates the true effects.

We put no further restrictions on the functional form[7] of the $w_i(.)$ but we assume that they are such that the utility maximisation problems of the union possess unique solutions.

Now let us consider the union utility maximisation problems. If the union discriminates (or if local unions set wages at the firm level independently of each other), the set of first order conditions

$$u_i'(n_i) = 0, \quad \text{for } i = 1, ..., K \tag{4.2}$$

must hold.

If a central union instead fixes the same wage for all firms, the following condition must hold:

$$\frac{d}{dw} \sum_i v_i(w) \equiv \sum_i v_i'(w) = 0 \tag{4.3}$$

additional findings.

[5] Of course, the additive separable form also simplifies the derivations below dramatically, enabling us to obtain conclusive results at all.

[6] Cf. section 2.4.8 for further remarks and references.

[7] I.e. the $w_i(.)$ may have different functional forms.

Since $n_i(w_i)$ is the inverse of $w_i(n_i)$, we get (with $w_i := w$ for $i = 1, .., K$)[8]

$$\sum_i v_i'(w) = \sum_i \frac{u_i'(n_i)}{w_i'(n_i)} = 0 \tag{4.4}$$

Let n_i^* be the number of employees in firm i under wage discrimination and n_i^0 be the employment for non-discriminatory wages. The mean value theorem tells us that there exist $\bar{n}_i$ between n_i^0 and n_i^* such that

$$u_i'(n_i^0) = u_i'(n_i^*) + (n_i^0 - n_i^*)u_i''(\bar{n}_i) \tag{4.5}$$

holds.

Now let S be a set containing all firm indices for which $w_i^* > w_i^0$ and $n_i^* < n_i^0$. Correspondingly, W contains the indices of firms with $w_i^* < w_i^0$ and $n_i^* > n_i^0$. The sets S and W simply comprise firms where the union is in a strong and weak bargaining position, respectively. Then

$$\begin{array}{ll} n_i^* < \bar{n}_i < n_i^0 & \forall i \in S \\ n_i^0 < \bar{n}_i < n_i^* & \forall i \in W. \end{array} \tag{4.6}$$

Using $u_i'(n_i^*) \equiv 0$ we can modify equation (4.5) and get

$$\frac{u_i'(n_i^0)}{w_i'(n_i^0)} = (n_i^0 - n_i^*)\frac{u_i''(\bar{n}_i)}{w_i'(n_i^0)}. \tag{4.7}$$

After summation over i and substitution into equation (4.4), we arrive at

$$\sum_i (n_i^0 - n_i^*)\frac{u_i''(\bar{n}_i)}{w_i'(n_i^0)} = 0. \tag{4.8}$$

Now define

$$E_i^0 := \frac{w_i'(n_i^0)}{u_i''(n_i^0)} \quad \text{and} \quad V_i := \frac{u_i''(n_i^0)}{u_i''(\bar{n}_i)} \tag{4.9}$$

Then (4.8) can be written as

$$\sum_{i \in S} (n_i^0 - n_i^*)\frac{1}{E_i^0 V_i} = \sum_{i \in W} (n_i^* - n_i^0)\frac{1}{E_i^0 V_i} \tag{4.10}$$

This is the central formula of the model. In oder to interpret it, first observe that

$$E_i^0 \gtreqless 1/2 \quad \Leftrightarrow \quad w_i''(n_i) \gtreqless 0 \quad \forall i \tag{4.11}$$

[8]The equality $v_i'(w_i) = u_i'(n_i)/w_i'(n_i)$ becomes clear if we expand the derivatives $u_i'(n_i) = \tilde{u}_i^{(1)} w_i'(n_i) + \tilde{u}_i^{(2)}$ and $v_i'(w_i) = \tilde{u}_i^{(1)} + \tilde{u}_i^{(2)} n_i'(w_i)$ where $\tilde{u}_i^{(h)}$ denotes the partial derivative of $\tilde{u}_i$ with respect to its h-th argument.

As regards V_i, it is clear that $V_i > 0 \ \ \forall \ i$ (this would hold even if u_i were globally convex). Furthermore we have

$$\begin{array}{l} V_i \gtreqless 1 \Leftrightarrow u_i'''(n_i) \gtreqless 0 \quad \forall i \in S \\ V_i \lesseqgtr 1 \Leftrightarrow u_i'''(n_i) \lesseqgtr 0 \quad \forall i \in W \end{array} \tag{4.12}$$

If u_i has the simple form $w_i(n_i)n_i$, its second and third derivative are

$$u_i''(n_i) = n_i w_i''(n_i) + 2w_i'(n_i) \tag{4.13}$$

$$u'''(n_i) = n_i w_i'''(n_i) + 3w_i''(n_i). \tag{4.14}$$

From (4.10), (4.11) and (4.12) we see immediately that the degree of centralisation has no impact on total employment if all labour demand functions are linear, since then E_i^0 and V_i are constant and equal for both groups. Since all other results are analogous to Proposition 2 in Shih et al. (1988) we simply repeat it here (with minor modifications):

Proposition 1 *If all values of $E_i^0 V_i$ in K firms are equal, then total employment is the same under discrimination (local wage setting) as it is under simple central wage setting. Moreover, if the value of $E_i^0 V_i$ in each of the firms in W is greater than that of $E_i^0 V_i$ in all of the firms in S, then total employment will be greater under discrimination, and vice versa.*

A remark of Edwards (1950) is simply a special case of this: If $K = 2$, if both marginal utilities are concave, and if the slope ratio in the firm with more elastic demand is smaller than that in the less elastic one at central wage setting, then total output under discrimination is less than under central wage setting. Here 'slope ratio' means the slope of the labour demand curve of firm i divided by the slope of the utility corresponding to firm i.

Shih et al. (1988) formulate corollaries dealing with special cases and explaining the relations between their general derivation and the results in Robinson (1933), Edwards (1950) and Formby, Layson, & Smith (1983). We do not repeat them here, because they are of minor importance in our context.

As should be clear now, the result above tells us that higher employment is possible with both centralised or decentralised wage setting. *The outcome depends on the curvature of labour demand functions and of the union utility function.* This result is interesting, but of course welfare is more important. Unfortunately, I didn't manage to derive a general welfare analysis until now. Therefore I proceed by considering some important cases and by listing numerical examples showing that also welfare effects may be ambiguous in some cases.

4.2.3 Welfare Analysis

Before we step into the details of the numeric examples let us pause for a moment to consider some fundamental issues concerning the union utility and welfare.

As mentioned above, the definition of the union utility function is very special and ignores some important aspects. It is sensible to use this special form in order to eliminate aggregation problems and employment changes (artifacts) generated by the functional form of the utility function. But when considering welfare, we have to remember that wage discrimination maximises union utility for additive separable utility functions. I.e. in our setting the union will set equal wages only if exogenous (for example institutional or legal) restrictions urge it to do so. If centralised bargaining takes place in absence of exogenous restrictions, then we can conclude from a revealed preference argument that either discrimination is associated with costs overcompensating its gains[9] or workers have a strong preference for egalitarian wages. In these cases, equal wages maximise welfare in our setting, since gross production is maximised in this economy by equalization of marginal productivities between firms.[10] Thus we arrive at the clear result that equal wages are efficient in an economy where unions *deliberately* set equal wages. Of course, this result depends heavily on the assumption that our model is the correct one in reality.

In other cases, we obtain no unique results. Consider the welfare measure

$$W = \sum_i v_i(w_i) + \pi_i^*(w_i)$$

where the asterisk indicates that π_i is maximised with respect to n_i and write the difference in welfare between central and local wage setting $(W^0 - W^*)$

[9]This argument hinges on the assumption that the information on costs available to the union is reliable.

[10]This is simply the law of one price.

using the mean value theorem[11]

$$\begin{aligned} W^0 - W^* &= \sum_i (w - w_i^*) \left.\frac{\partial W}{\partial w_i}\right|_{w_i=\bar{w}_i} \\ &= \sum_i (w - w_i^*)\{v_i'(\bar{w}_i) - n_i(\bar{w}_i)\} \\ &= \sum_i (n_i^0 - n_i^*)\{u_i'(\bar{n}_i) - w_i'(\hat{n}_i)\bar{n}_i\} \end{aligned}$$

where the last line follows from a further application of the mean value theorem: $(w - w_i^*) = (n_i^0 - n_i^*)w_i'(\hat{n}_i)$. Again, one could split the sum into subsets with strong and weak firms. However, I didn't manage to obtain any further clear results because of the complexity of these expressions.[12]

Therefore, we illustrate the ambiguity of centralisation with respect to employment and welfare using a simple utility function of the form

$$U(n_1, n_2) = \sum_i u_i(n_i) = \sum_i = w_i(n_i)n_i$$

and CES production functions

$$f_i(n_i) = \theta_i \left\{(a_i n_i)_i^\rho + 1\right\}^{1/\rho_i} \quad i = 1, 2$$

Unfortunately, even with these simple functional forms, the problem of the central union cannot be solved symbolically, forcing us to use a numerical solution procedure. We compute relative employment and welfare changes by varying some parameters of the production functions and by evaluating the union maximisation problem numerically for the respective parameter values.

The two columns of the figure represent each one example. In row 1 of each column, you find two (inverse) labour demand functions representing the extreme cases of the considered scenarios. Row 2 contains a graph showing the relative employment difference $(n_{cent} - n_{loc})/n_{loc}$ between centralised and decentralised wage setting. And row 3 contains the corresponding relative welfare differences based on the simple unweighted utilitarian welfare definition

$$W = u(n_1) + u(n_2) + f_1(n_1) - w_1 n_1 + f_2(n_2) - w_2 n_2$$

[11] The strategy to obtain lower and upper bounds to the welfare change by Taylor approximations around W^0 and W^* is not applicable here since we cannot assume W to be convex nor concave around W^0 or W^* without further assumptions. Furthermore, the differences $n_i^0 - n_i^*$ are not marginal ones.

[12] As the following numerical examples show/suggest, the sign of this expression is not unique. But the examples are only casual evidence and do not allow more general statements.

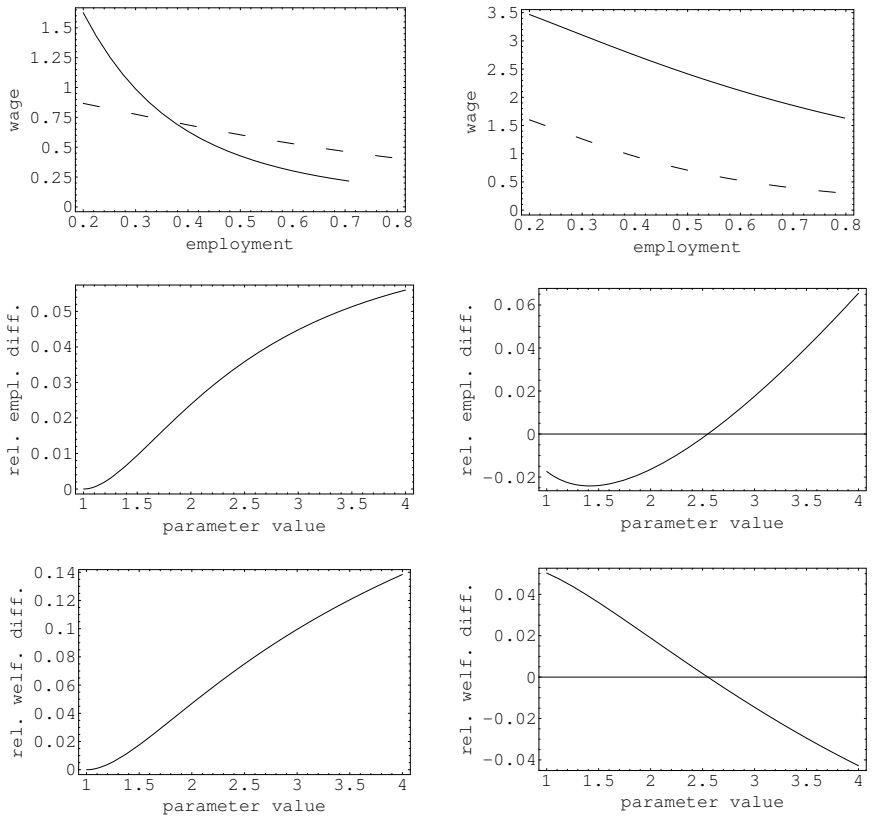


Figure 4.1: inverse labour demand functions (row 1), relative employment (row 2) and welfare (row 3) differences

Parameter values in production functions The range notations $[\alpha, \omega]$ indicate that the corresponding parameter is varied within α and ω to obtain the graphs.

column	a_1	a_2	ρ_1	ρ_2	θ_1	θ_2
1	$[1, 4]$	1	-1.5	-1.5	1	1
2	2	1	-2	-1.5	[1,4]	1

Even these two examples demonstrate that almost everything can happen. Centralisation may be accompanied by positive employment and welfare effects (left hand side). But other cases are possible as well. The right hand side graphs show scenarios where negative employment effects are associated with positive welfare effects and vice versa.

4.2.4 Conclusion with some Qualifications

The main aim of the model is to show that employment and welfare effects of decentralisation in wage bargaining are ambiguous if labour demand heterogeneity plays a significant role. This contrasts the view held by many economists that more flexibility or additional degrees of freedom in utility optimization 'automagically' increase employment and welfare. Furthermore, the setting suggests that employment effects may be a wrong indicator for welfare considerations.

The plan to gather empirical evidence suitable to feed the model with empirical content appears impracticable, since *firm* heterogeneity is a central issue here and therefore an econometrican would have to estimate labour demand functions at the firm or sector level allowing for heterogeneity and flexibility in functional forms.

At the theoretical level, our model shares an important shortcoming of all economic models: It considers some – possibly relevant – aspects of the centralisation debate and ignores many others. Thus we should not close the discussion without some remarks regarding the problems assumed away in our model.

A possibly crucial blind spot of the model concerns worker mobility. Efficiency of centralised wage setting is often justified by the argument that wage equalisation 'simulates' competition, and by this fosters reallocation of workers to the most productive firms/jobs. Our model does not address this issue directly, since the assumption of independent firm labour demand functions implicitly excludes noteworthy mobility of workers: basically every firm resides on an island with its own pool of workers. The law of one price works nevertheless in face of unemployment, since unemployment is lower in the islands with more productive firms.

A further issue, stressed often by proponents of more decentralised bargaining, but disregarded in our model, concerns shutdown costs of firms. If firms are hit by averse shocks, centralised collective wage agreements may hinder them to adjust wages (temporarily) to avoid a shutdown. Firm or plant closures may generate noteworthy loss of tangible and intangible (accumulated knowledge, experience etc.) assets and thus imply significant welfare losses. A closer inspection of the empirical evidence reveals, however, that this argument suffers from a clear foundation. At least in Germany, many collective wage agreements contain provisions for such cases (cf. Bundesministerium, 2001, 2002; Freter, 1998) e.g. hardship clauses,[13] allowing firms and their workers to deviate from standard wages if they are hit by adverse

[13]For a short compilation of hardship clauses and other and special case regulations in German collective wage agreements c.f. Bundesministerium (2002), pages 29ff.

shocks. Qualitative empirical evidence even shows that these clauses are not very strict, since many firms apparently do not exploit applicable exceptions, see for example Oppolzer & Zachert (2000).

Nevertheless, proponents of decentralised bargaining assess the conditions for the application of hardship clauses as too restrictive (cf. Freter, 1998). Unfortunately, we are not aware of any founded empirical (case) studies establishing that restrictiveness of hardship clauses be responsible for plant closures. In some sense this debate seems to be motivated by the attempt to make curls on a bald head, since membership in firms is voluntary in Germany and generally binding collective wage agreements ('Allgemeinverbindlichkeitserklärungen') do not play a significant role anymore. Bundesministerium (2001) reports that only 53 of 14518 collective wage agreements fixing wages are declared generally binding in 2001 in Germany.[14]

Our model ignores also – possibly important – costs of local bargaining, namely for additional bargaining costs. As emphasized often by bargaining practitioners, real time costs (time required for bargaining and writing the contract) and psychic cost (social peace) of local bargaining may be considerable. Most empirical evidence collected by social psychologists and sociologists is in favour of this position and shows that also managers agree with union representatives on this issue.[15]

To summarize, the mode adds a further question mark regarding the centralisation debate and extends the strand of models where the chance to obtain clear empirical evidence is out of reach.

[14]The term 'generally binding' is somewhat misleading, since many of these 'generally binding' contracts relate to narrows defined occupational groups in certain regions. Again we remind that the declaration of generally binding contracts requires unanimous requests of unions *and* employers.

[15]Cf. the detailed case studies by Kotthoff (1981), Kotthoff & Reindl (1990). In his interviews managers often emphasize the importance of 'social peace' in the work force. And they repeat the pacifying force of wage and job standard rules coming from outside again and again. E.g. managers are happy to be able to prevent the access of unions to working councils and admit that this is alleviated by centrally set wages.

4.3 A Median Voter Model of Centralisation*

4.3.1 Introduction

A weakness of the model presented in the last section is, that it rests upon a somewhat *ad hoc* specification of the union utility function $U = \sum_i u_i(w_i, n_i)$. Here we replace this *ad hoc* specification by another one: The median voter mechanism. Though the median voter approach is not less problematic in our view, since the existence of a voting equilibrium depends on single peakedness of worker utility functions and thus is applicable only as long as wages are the *only* concern of workers (cf. the discussion in section 2.3.1), it provides a consistent micro foundation of the aggregation problem in bargaining and therefore is approbated by many economists.

We anticipate that the employment effects are not unique. We are able to state some general properties of utility and production functions which are responsible for the direction of the employment effects, but this is only possible at the cost of realism, i.e. we have to confine the analysis to a very simple setting with two firms (or industries) only. An important shortcoming of the 'general' statements it that they are hardly testable empirically. Therefore the model leaves many questions unanswered.

In the following section we present a general formulation of the model. Then we try to obtain some general statements regarding employment effects of centralisation. Since the general statements are rather weak and give us no clue about the magnitude and relative importance of the effects, we illustrate them in a small simulation, and conclude the section with a short discussion of the central model assumptions.

4.3.2 The Model

The framework of our voting model follows Blair & Crawford (1984). Blair & Crawford investigate the conditions for the existence and uniqueness of a voting equilibrium in union member decisions. To clarify things in the employment and welfare analysis later on, our notation is a little bit more fussy than theirs.

Labour demand of firm i is

$$n_i = \max\{0, \phi_i(w_i) + \theta_i + \xi_i\}$$

*An earlier version of this model was presented at the annual EALE conference in Sevilla. I am indebted to the session participants, Ekkehart Schlicht, Bernhard Rauch, Joachim Möller, and Lutz Arnold for helpful comments.

with $\phi_i'(w_i) < 0$.[16] θ_i denotes a random disturbance term which is revealed after bargaining has taken place whereas ξ_i is known before contracting. Note that the additive form $\phi_i(w_i) + \theta_i$ implies a shock having no effect on labour demand and technology parameters. Therefore, additiveness of shocks is plausible in the short run since, for this period, the Leontieff technology is a good approximation to reality. This argument is much weaker for ξ, since ξ represents (at least) medium run heterogeneity between firms which has more structure in reality, and should be represented by differences in production function parameters.

The max operator eliminates the possibility that demand could become negative for sufficient small values of θ_i and ξ_i. The interpretation is straightforward: If $\phi_i(w) < -\theta_i - \xi_i$, the firm closes down. Depending on the distribution of ξ_i, there is a positive probability that this happens. At this stage of our analysis, we take ξ_i as given (deterministic).

To employ the median voter theorem for our analysis, we have to check whether the expected utility functions of all workers are single-peaked. To this aim consider the utility maximisation problem of a worker with seniority s and von-Neuman-Morgenstern expected utility function

$$E[U(w|s)] = u(w)P[n > s] + u(b)P[n < s]$$

with wage w and alternative income level b which is assumed to be exogenous in our simple setting. $u(w)$ is assumed to be twice continuously differentiable with $u'(w) > 0$ and $u''(w) < 0$, i.e. workers are risk-averse.[17] Usage of the seniority index s implies that we assume the existence of a unique ordering of all workers (including unemployed ones) prescribing in which order employees are dismissed if labour demand decreases.[18]

After substitution of n we can write the probability that the worker becomes unemployed $P(n < s)$ as $F(s - n_i(w) - \xi_i)$ where $F(.)$ is the cumulative

[16] The max operator is introduced here to handle the possibility that $\theta_i < -\phi_i(w_i) - \xi_i$. This saves us to restrict the range of θ_i. Blair & Crawford are a little bit sloppy here. They omit the max operator and point to the fact that "the assumption of an additive Error can lead to negative labor demand, a situation that is clearly impossible. This specification was chosen largely for expositional convenience." With the max operator the obvious interpretation is that the firm is shut down (i.e. employment of the firm is zero) with strictly positive probability.

[17] Note that we deviate here from Blair & Crawford (1984) by removing the index relating to $u(\cdot)$. We do this for convenience (since even then the model contains more heterogeneity in the model than we can handle).

[18] We use the term 'seniority' in a metaphorical manner, since seniority is not the only criterion commanding dismissal. For unemployed workers it is not applicable at all. However, other properties of workers may substitute seniority, for example productivity differences not reflected by remuneration. For a discussion of the problems associated with a seniority index see Blair & Crawford (1984), Grossman (1983), Burda (1990).

distribution function of θ_i (without loss of generality we can set the expectation of θ_i to zero[19]). Then a more explicit expression of the expected utility is

$$E[U(w|s)] = u(w)\{1 - F(s - \phi(w) - \xi_i)\} + u(b)F(s - \phi(w) - \xi_i)$$

with first and second order conditions

$$\frac{\partial}{\partial w}E[U(w|s)] = u'(w)\{1 - F(\bar{\theta}_i)\} + \phi'(w)f(\bar{\theta})\{u(w) - u(b)\} = 0 \quad (4.15)$$

$$\frac{\partial^2}{\partial w^2}E[U(w|s)] = 2f(\bar{\theta}_i)u'(w)\phi'(w) + (1 - F(\bar{\theta}_i))u''(w) + (u(w) - u(b))\{f(\bar{\theta}_i)\phi''(w) - f'(\bar{\theta}_i)\phi'(w)^2 < 0\} \quad (4.16)$$

where $\bar{\theta}_i := s - \phi(w) - \xi_i$. Blair & Crawford (1984) show (by setting (4.15) to zero and straightforward manipulation) that $E[U(w|s)]$ has a unique maximum if the inverse mill's ratio

$$\frac{f(\bar{\theta})}{1 - F(\bar{\theta})} \quad (4.17)$$

is increasing and the expression

$$\frac{-u'(w)}{\phi_i'(w)(u(w) - u(b))} \quad (4.18)$$

is decreasing in w. We do not try to present an exhausting analysis of the conditions necessary to guarantee single-peakedness of expected utility here but assume here simply that they are met.[20]

By setting the derivative in (4.15) to zero, we obtain the preferred wage, call it $\omega(\xi, s)$ of a worker with seniority s as an implicit function of the parameters b, ξ_i and the parameters of the distribution function $F(\theta)$. Let us pause here for a moment to derive some results on the derivatives and shape of ω. The derivatives $\partial\omega/\partial s$ and $\partial\omega/\partial\xi$ are of central interest in our context. $\partial\omega/\partial s$ is obtained by implicit differentiation

$$\frac{\partial\omega}{\partial s} = -\frac{\partial^2 E[U]/\partial w\partial s}{\partial^2 E[U]/\partial w^2}$$

Since $\partial^2 E[U]/\partial w^2$ must be negative (by utility maximisation), the sign of $\omega'(s)$ is equal to the sign of the numerator

$$\frac{\partial^2}{\partial w\partial s}E[U(w|s)] = \phi'(w)\{u(w) - u(b)\}f'(\bar{\theta}) - u'(w)f(\bar{\theta})$$

[19] This is so because n_i is shifted by ξ.

[20] Again we refer to the relevant literature Blair & Crawford (1984), Grossman (1983), and Burda (1990).

To show that this is negative we substitute $\phi'(w)$ from (4.15) to obtain

$$\frac{\partial^2}{\partial w \partial s} E[U(w|s)] = -u'(w) \left\{ \frac{f'(\bar{\theta})}{f(\bar{\theta})}(1 - F(\bar{\theta})) + f(\bar{\theta}) \right\}$$

As noted above, single-peakedness requires the inverse mills ratio (4.17) to be an increasing function of w. Substitution of this condition, i.e.

$$\begin{aligned} \frac{d}{dw}\left[\frac{f(\bar{\theta})}{1 - F(\bar{\theta})}\right] = -\phi'(w)\frac{f(\bar{\theta})^2 - \{1 - F(\bar{\theta})\}f'(\bar{\theta})}{\{1 - F(\bar{\theta})\}^2} > 0 \\ \Leftrightarrow \quad f(\bar{\theta})^2 - \{1 - F(\bar{\theta})\}f'(\bar{\theta}) > 0 \end{aligned}$$

into the expression in curly braces of (4.3.2) gives the (in no respect surprising) result. Since ξ appears like s inside $f(\cdot)$ and $f'(\cdot)$ but with opposite sign, $d\omega/d\xi > 0$ by the same argument. Below we will find that the second derivatives of ω play an important role in the evaluation of centralisation or decentralisation. Unfortunately, we could not derive a unique sign for these derivatives. The attempt to characterise more general intuitive conditions for a unique sign were unsuccessful too. After insertion of all available restrictions (the first order condition (4.15), the single-peakedness conditions (4.17), and (4.18)) into $d\omega^2/ds^2$, we obtained a complicated expression depending on f, ϕ, and u. The sign remained ambiguous even after application of further simplifying assumptions (risk neutral workers and linear labour demand functions).[21] Nevertheless, $d^2\omega/ds^2 > 0$ for all choices of f and u in our numerical applications below. Furthermore, we know that

$$\frac{\partial^2 \omega}{\partial s^2} = -\frac{\partial^2 \omega}{\partial \xi \partial s} \quad \text{and} \quad \frac{\partial^2 \omega}{\partial s^2} = \frac{\partial^2 \omega}{\partial \xi^2} \tag{4.19}$$

because ξ and s enter all subexpressions of $E[U]$ with opposite sign.

We want to use this framework now in order to assess employment and of centralisation in wage bargaining. For simplicity we consider an economy where firms do not compete for workers, i.e. labour demand functions are independent of each other. Though this is an extreme case applying only when firms are far away from each other and worker mobility is small (or labour is differentiated in some other way, for example qualification) this assumption gathers an essential feature of labour markets, since heterogeneity considerations are groundless in labour markets with perfect competition.[22] Nevertheless, we possibly introduce a significant inconsistency into the model.

[21] The derivations are available from the author on request.

[22] The fast growing current literature on thin labour markets backs up this view. See Bhaskar & To (1999a, 1999b), Bhaskar et al. (2002), Manning (2002), Lewis (1986).

Cost which reduced mobility of workers may influence the labour demand of firms too and, by this, change the model predictions. We will come back to this issue below.

In our simple economy central wage setting occurs if all workers in the economy vote for one single wage, whereas local wage setting takes place when only workers in the employment pool (region/branch) of each firm vote for a wage applying to this firm. As will become clear below, the comparison of central and local bargaining outcomes is quite involved for models with more than two firms and general forms of firm heterogeneity. Therefore we confine our analysis to the simplest case with two firms only and additive stochastic heterogeneity. Though this is a serious limitation, it allows us to gather some first insights into the structure of the problems.

4.3.3 Analytical results

If wages are set locally, we obtain the median wage w_i in firm $i \in \{1, 2\}$ simply by setting s_i to $q_i/2$ where q_i is the mass of the employment pool related to firm i:

$$w_i = \omega_i(\xi_i, q_i/2)$$

If the workers in both pools vote for a common wage claim, the median worker index $\tilde{s}$ is implicitly defined by the equation

$$\omega_1(\xi_1, \tilde{s}) - \omega_2\left(\xi_2, (q_1 + q_2)/2 - \tilde{s}\right) = 0. \tag{4.20}$$

We assume that the pool sizes q_1 and q_2 and the ranges of the heterogeneity parameters ξ_i are such that $\tilde{s} \in [0, q_1]$ to eliminate 'degenerate' special cases here. Figure 4.3.3 illustrates the relation between local and central median wages.

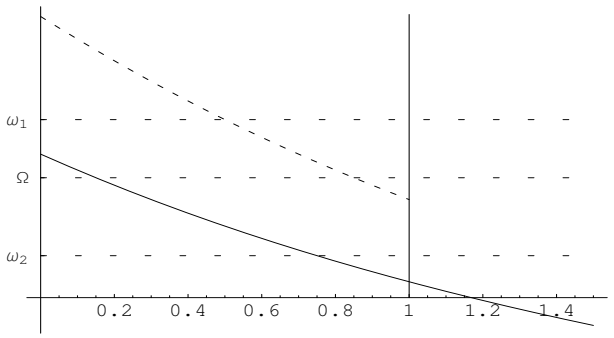


Figure 4.2: ω_i and Ω

Note that our definition of ω implies that *all* workers in the catchment area of a firm, employed *and* unemployed union members vote for the wage. Though this assumption may be not realistic in some cases, it can be shown, that it does not lead to qualitative changes of the main results.[23] The meaning of $s_2 = (q_1 + q_2)/2 - s_1$ becomes clear if we write it in the form $s_1 + s_2 = (q_1 + q_2)/2$ which is simply a generalisation of $s_1 + s_2 = 1$, i.e. the definition of the median for $q_1 \neq 1$ and $q_2 \neq 1$.

The common wage, call it Ω, depends (through $\tilde{s}$) on all ξ_i and q_i. We write down the definition here, since it will play a central role in the following sections.

$$\Omega(\xi_1, \xi_2, q_1, q_2) := \omega_1\big(\xi_1, \tilde{s}(\xi_1, \xi_2, q_1, q_2)\big).$$

As will be explained below, a general analysis of employment effects of centralisation (going without restrictions on the functions ω_i and the q_i) is quite involved. But we obtain intuitive first results already from a special case where the ξ_i are the only source of heterogeneity, i.e. production function parameters are equal and employment pools have equal size ($q_1 := q_2 := 1$[24]). Our strategy is simple: We start from a situation where outcomes in central and local bargaining are identical in our setting and generate a 'perturbation' by changing one parameter (here: the stochastic shock ξ_1). Then we can use calculus to analyse differences between employment in local and central wage setting. Let

$$\eta_l = \phi\big(\omega(\xi_1, 1/2)\big) + \xi_1 + \theta_1 + \phi\big(\omega(\xi_2, 1/2)\big) + \xi_2 + \theta_2$$

denote gross employment in a local and

$$\eta_c = \phi\big(\Omega(\xi_1, \xi_2)\big) + \xi_1 + \theta_1 + \phi\big(\Omega(\xi_1, \xi_2)\big) + \xi_2 + \theta_2$$

in a central wage setting environment. Note that ϕ and ω are not indexed any more, and that we have set $q_1 := q_2 := 1$, implying that the ξ_i are the only remaining source of heterogeneity.

[23] Lindblom (1949) initiated the so-called 'Ceshire Cat' discussion with the hypothesis, that unions have a natural tendency to shrink if unemployed workers leave the union or have no voting rights. This occurs since the least senior workers with preferences for lower wages become unemployed first and the remaining ones will generate additional unemployment in the next bargain by raising wages. This process continues until the union looses bargaining power because of small membership. Blair & Crawford (1984) (c.f. also Farber, 1986) clear this point by arguing that this problem vanishes if union members account for it in an intertemporal utility maximisation procedure. Burda (1990) shows the validity of the argument (at least in many realistic situations) in an intertemporal formal model.

[24] Since s is a (continuous) index, we can set the q_i to unity without loss of generality

To compute the expected employment levels observe that (in general)

$$\begin{aligned} E[\eta|\xi] &= \int_{-\infty}^{\infty} \max\{0, z(\xi)+\theta\}\, dF(\theta) = \int_{-z(\xi)}^{\infty} (z(\xi)+\theta)\, dF(\theta) \\ &= z(\xi)\{1-F(-z(\xi))\} + \int_{-z(\xi)}^{\infty} \theta\, dF(\theta) \\ &= \{1-F(-z(\xi))\}\,\{z(\xi)+E[\theta|\theta > -z(\xi)]\} \end{aligned}$$

with shorthand $z(\xi) := \phi(\omega(\xi)) + \xi$. The expression in the last line has an obvious interpretation. The first term in curly braces represents simply the probability that employment is positive and the second one is the expected employment, given employment is positive.

Applying this to local and central gross employment levels yields the expected values

$$\begin{aligned} E[\eta_l|\xi_1,\xi_2] &= \sum_{i\in\{1,2\}} \left\{ z(\xi_i)\{1-F(-z(\xi_i))\} + \int_{-z(\xi_i)}^{\infty} \theta\, dF(\theta) \right\} \\ E[\eta_c|\xi_1,\xi_2] &= \sum_{i\in\{1,2\}} \left\{ z_i(\xi_1,\xi_2)\{1-F(-z_i(\xi_1,\xi_2))\} + \int_{-z_i(\xi_1,\xi_2)}^{\infty} \theta\, dF(\theta) \right\} \end{aligned}$$

where $z_i(\xi_1,\xi_2) := \phi(\Omega(\xi_1,\xi_2)) + \xi_i$. We evaluate the expected employment difference $E[\eta_c|\xi_1,\xi_2] - E[\eta_l|\xi_1,\xi_2]$ by means of a Taylor series approximation starting from a situation where $\xi_1^0 = \xi_2^0 =: \xi_0$. If (as assumed here) the ξ_i are the only source of heterogeneity, $E[\eta_c] = E[\eta_l]$ in this situation. Since the situation is symmetric ($q_1 = q_2$), it suffices to consider an increase in ξ_1 when holding ξ_2 constant. With local wage setting, only expected employment in firm 1 changes. Then

$$\left.\frac{\partial E[\eta_l]}{\partial \xi_1}\right|_{\xi_i=\xi_0} = \left\{ 1 + \phi'(w_0) \left.\frac{\partial \omega(\xi)}{\partial \xi}\right|_{\xi_i=\xi_0} \right\} \{1 - F(-\phi(w_0) - \xi_0)\} \qquad (4.21)$$

where $w_0 = \omega(\xi_0, 1/2)$. Henceforth we will drop the second argument of ω for notational convenience if this does not lead to confusion. For central wage setting, wages in both firms increase, but the increase is smaller. We obtain

$$\left.\frac{\partial E[\eta_c]}{\partial \xi_1}\right|_{\xi_i=\xi_0} = \left\{ 1 + 2\phi'(w_0) \left.\frac{d\Omega(\xi_1,\xi_2)}{d\xi_1}\right|_{\xi_i=\xi_0} \right\} \{1 - F(-\phi(w_0) - \xi_0)\} \quad (4.22)$$

The expressions in large curly braces give the increase in employment, given employment is positive. They split into the direct effect 1 and the indirect effects $\phi' d\omega/d\xi_1$. The factor $1 - F(\cdot)$ accounts for the fact that a marginal increase of ξ_1 has effects only if employment is positive, i.e. if $\theta > -\phi(w_0) - \xi_0$.

Comparison of the both expressions reveals that central wages generate higher (equal/lower) employment than local ones if

$$\left.\frac{\partial \omega(\xi)}{\partial \xi}\right|_{\xi=\xi_0} \lessgtr 2 \left.\frac{d\Omega(\xi_1, \xi_2)}{d\xi_1}\right|_{\xi_i=\xi_0} \tag{4.23}$$

The interpretation of this condition is straightforward. With local wage setting, only the wage of firm 1 is affected by rise of ξ_1, whereas with central wage setting, both firms face the same (but lower) wage increase. We will show below that (4.23) is met tautologically with equality. At a glance one would conclude from this that no centralisation effects exist. A closer look, however, reveals that this result were valid only if $\phi(\cdot)$ and $\omega(\cdot)$ were linear functions (since we applied a first order Taylor series expansion until now) and if changes of ξ_1 are marginal ones. Thus the effects must be of second order. In reality, the difference $\xi_1 - \xi_2$ may be large, destroying the validity of first order approximations.[25]

Before we proceed with the straightforward but tedious computations, let us pause for a moment to get some intuition for the issues involved. First consider the median wage. If ω is linear in s, the definition of the median wage (4.20) tells us that (after an increase of ξ_1) the change of $\omega(\tilde{\xi_1}, \xi_2)$ is exactly one half of the change in $\omega(\xi_1)$. If ϕ is linear too, it is clear that centralisation has no employment effects. However, if ϕ is convex, centralisation must have negative employment effects, since then a wage increase of dw in one firm leads to a smaller employment reduction than the sum of employment reductions from wage increases $dw/2$ in two firms. However, since $\omega(\cdot)$ and $\tilde{s}(\cdot)$ are nonlinear functions too, the median wage increase possibly is smaller than 1/2 of the local wage increase in firm 1. This may overcompensate the labour demand function effect. However, things are a little bit more complicated since changes of ξ_1 affects also the truncation (represented by the factor $1 - F(\cdot)$).

To show formally that first order effects vanish, we compute $d\Omega(\xi_1, \xi_2)/d\xi_1$. After substitution of $\Omega(\xi_1, \xi_2) \equiv \omega(\xi_1, \tilde{s}(\xi_1, \xi_2))$ we have

$$\frac{d\Omega(\xi_1, \xi_2)}{d\xi_1} = \frac{\partial \omega}{\partial \xi} + \frac{\partial \omega}{\partial \tilde{s}} \frac{d\tilde{s}}{d\xi_1} \tag{4.24}$$

[25]The Existence of second order effects only does not mean that they must be small or ignorable. They are small only at the margin and grow with order proportional to $(\xi_1 - \xi_2)^2$.

$d\tilde{s}/d\xi_1$ is obtained by implicit differentiation of (4.20)

$$\frac{d\tilde{s}}{d\xi_1} = -\frac{\partial\omega(\xi_1, s)/\partial\xi_1}{\partial\omega(\xi_1, s)/\partial s + \partial\omega(\xi_2, 1-s)/\partial s} > 0 \tag{4.25}$$

For $s = 1 - s$ and $\xi_1 = \xi_2 =: \xi^0$ this simplifies to

$$\frac{d\tilde{s}}{d\xi_1} = -\frac{\partial\omega(\xi, s)/\partial\xi}{2\,\partial\omega(\xi, s)/\partial s} \tag{4.26}$$

After substitution of (4.24) and (4.26) into (4.23), we see that it is an equality.

Now let us investigate the second order derivatives. We have

$$\left.\frac{\partial^2 E[\eta_l]}{\partial\xi_1^2}\right|_{\xi_i=\xi_0} = (1+\omega_\xi\,\phi')^2\,f + (1-F)\,\left\{\phi'\,\omega_{\xi\xi} + \omega_\xi^2\,\phi''\right\} \tag{4.27}$$

$$\begin{aligned}\left.\frac{\partial^2 E[\eta_c]}{\partial\xi^2}\right|_{\xi_i=\xi_0} &= \left\{1 + 2\,\phi'\,\Omega_{(\xi_1)}(1+\phi'\,\Omega_{(\xi_1)})\right\}\,f \\ &\quad + 2\,(1-\,F)\,\left\{\phi''\,\Omega_{(\xi_1)}^2 + \phi'\,\Omega_{(\xi_1\xi_1)}\right\}\end{aligned} \tag{4.28}$$

where we have dropped all arguments of the functions for notational convenience. Note that whereas ω_h, ω_{hh} denote the first and second *partial* derivatives of ω with respect to h, $\Omega_{(h)}, \Omega_{(hh)}$ denote the first and second *total* derivatives of Ω with respect to h.

Let us again pause a moment to interpret the second order derivatives before we proceed with our investigations. The terms multiplied by $(1-F)$ represent the change of the derivative of employment, given positive employment (in the sense that $\phi(w) + \xi + \theta > 0$). The other terms account for the change of the truncation limit $P(\text{employment} > 0)$ due to a shift of ξ_1.[26]

After substitution of $\Omega_{(\xi_1)} = \omega_\xi/2$ the difference of the second derivatives has the form

$$\begin{aligned}\frac{\partial^2 E[\eta_c]}{\partial\xi_1^2} - \frac{\partial^2 E[\eta_l]}{\partial\xi_1^2} =& (1-F)\,\phi'\,\left\{2\,\Omega_{(\xi_1\xi_1)} - \omega_{\xi\xi} - \frac{\omega_\xi^2\,\phi''}{2\phi'}\right\} \\ &- f\,\omega_\xi\,\phi'\,(1+\omega_\xi\,\phi'/2)\end{aligned} \tag{4.29}$$

Implying that centralisation leads to higher employment if

$$(1-F)\,\left\{2\,\Omega_{(\xi_1\xi_1)} - \omega_{\xi\xi} - \frac{\omega_\xi^2\,\phi''}{2\,\phi'}\right\} < f\,\omega_\xi\,(1+\omega_\xi\,\phi'/2) \tag{4.30}$$

[26] A change of ξ causes $P(n_1 > 0)$ to increase by $(1+\omega_\xi\phi')\,f$ for local wage setting. Consequently, the term $(1+\omega_\xi\phi')^2\,f$ represents the expected change of the derivative due to the effect on truncation. With central wages, different reactions of employment in firm 1 and 2 complicate the situation a little bit. The change in $P(n > 0)$ is $f\,(1+\phi'\Omega_{(\xi_1)})$ for firm 1 and $f\,\phi'\Omega_{(\xi_1)}$ for firm 2.

This expression shows that the effects of ξ on 'uncensored' employment possibly are contrary to the effects on truncation (represented by the right hand side term). Still it is not very handy. It will turn out that no clear and unambiguous result can be derived. But we can exploit the formulas, (a) to learn something about the model properties favouring local or central wages, and (b) to provide more accessible results for special cases.

As a first (important) special case, suppose that truncation (of the distribution of employment) does not occur, i.e. that employment is positive in both firms.[27] Then the condition above reduces to $2\,\Omega_{(\xi_1\xi_1)} - \omega_{\xi\xi} - \omega_\xi^2\phi''/(2\phi')$. If we insert

$$\Omega_{(\xi_1\xi_1)} \equiv \frac{d^2\Omega(\xi_1,\xi_2)}{d\xi_1^2} \equiv \frac{\partial^2\omega}{\partial\xi_1^2} + \left\{2\frac{\partial^2\omega}{\partial\xi\partial s} + \frac{\partial 2\omega}{\partial s^2}\right\}\frac{\partial\tilde{s}}{\partial\xi} + \frac{\partial\omega}{\partial s}\frac{\partial^2\tilde{s}}{\partial\xi_1^2}$$

and $\omega_s = -\omega_x$ (from equation 4.19) and assume labour demand to be linear ($\phi'' \equiv 0$), then this expression reduces to

$$(\omega_{ss} - 3\,\omega_{\xi s})\omega_s < 0.$$

Substitution from (4.19) shows that this is met for convex wage setting functions, i.e. $\omega_{ss} > 0$. However, the calculations above have shown that ω_{ss} is a rather complex expression and that a simple relation between ω and the properties of (u,ϕ,F) does not exist. The expression in curly braces in (4.30) also shows that convexity of the labour demand function is unambiguously in favour of local wages.

Now let us inspect the more general case where truncation occurs. Then the truncation term works in favour of central wage setting if

$$f\,\omega_\xi\phi'\,(1 + \omega_\xi\phi'/2) < 0$$

or $\omega_\xi\phi' < -2$. In the case of linear labour demand it is met if

$$\epsilon_1 > \frac{2\,((1-F)\,u'' - 2\,u'\,\phi'\,\epsilon_2)((1-F)\,u'' - u'\,\phi'\,\epsilon_2)}{(1-F)\,(u'\,\phi')^2}.$$

In this expression $\epsilon_1 > 0$ and $\epsilon_2 > 0$ capture the single peakedness conditions (i.e. positivity and negativity of the derivatives of (4.17) and (4.18))

$$\begin{aligned}\epsilon_1 &\equiv f^2/(1-F) - f' \\ \epsilon_2 &\equiv f - \frac{1-F}{\phi'}\left\{\frac{\phi''}{\phi'} - \frac{u''}{u'}\right\}\end{aligned}$$

[27] Of course, this implies restrictions on F, u and ϕ. We do not try to state them formally.

The condition above reduces to $\epsilon_1 > 4\,\epsilon_2^2/(1-F)$ if workers are expected earnings maximisers (i.e. $u' = 1$ and $u'' = 0$). After backsubstitution from (4.31) this reads

$$f' < -3f^2/(1-F),$$

meaning that $\bar{\theta} = s - \phi - \xi$ must be located where f is decreasing.

Probably it would be possible to squeeze some further results out of the model. But we have good reasons to doubt that they would be worth the effort, since we deal with the simplest version of the model and even here the dependence of employment effects on properties of u, ϕ, and F is intransparent. Therefore we summarise the most important results here and proceed by illustrating the effects in two parametric numerical examples.

As we noted already, if the wage claim function ω is convex in s, $2\,\Omega_{(\xi_1,\xi_1)} < w_{\xi\xi}$. This makes the left hand side of (4.30) small and is consequently in favour of central wage setting. The direct consequence of convexity of ω is that the reaction of the central wage to a demand shock ξ in one firm is *less* than half of the reaction of a local wage in one firm (hit by the shock).

The more moderate increase of central wages must overcompensate *at least* the adverse effect (represented by $\omega_\xi^2\phi''/(2\phi')$) stemming from convexity of labour demand function. Convexity simply means that (other things equal) a wage increase of two units in one firm reduces employment less than one-unit increases in two (identical) firms.

Finally, truncation of the distribution of labour demand (represented by the right hand side of (4.30) generates a third effect on relative employment. It's sign is ambiguous, however, and we see – again from inspection of (4.30) – that it is negligible if unemployment risks of the median worker are low, since then employment probability $1 - F$ is high and f small.

This seems to be all we can say about the model at a general level. Since it seems hardly possible to consider less restrictive scenarios (e.g. heterogeneity with respect to q or production function parameters) and the analytical results tell us no clue about the magnitude or relative importance of the effects, we amend our small investigation by a short numerical illustration.

4.3.4 Some Numerical Illustrations

Here we evaluate centralisation effects using a parameterised model. This allows us to relax some of the restrictions applied above. We confine our analysis to the special case of two firms but relax the assumption $q_1 = q_2$ and consider more general form of heterogeneity of labour demand.

We use the constant relative risk aversion utility function

$$u(w) = w^\beta,$$

and a CES production function with fixed capital stock (normalised to unity)

$$h(n) = \lambda\left\{(\alpha n)^{\rho} + 1\right\}^{1/\rho}$$

and labour demand function

$$\phi(w) = \frac{1}{\alpha\left\{\left(\frac{w}{\alpha\lambda}\right)^{\rho/(1-\rho)} - 1\right\}^{1/\rho}}$$

λ can be intepreted as total factor productivity or demand shift indicator. θ is assumed to be distributed according to a Weibull distribution with CDF $F(\theta; a, b) = 1 - \exp(-(\theta/b)^a)$. The Weibull distribution is used because of its flexible functional form (with two parameters only) and its simple and closed form CDF representation. Furthermore, the Mill's ratio has the simple form $x^{a-1}a/b^a$ and is increasing (as required for single-peakedness) for $a > 1$. Its support is $[0, \infty)$, but we can produce negative shocks to the labour demand by rescaling ξ. The model is solved by numerical optimisation and root search procedures.[28] The following figures compile results of four simulations.

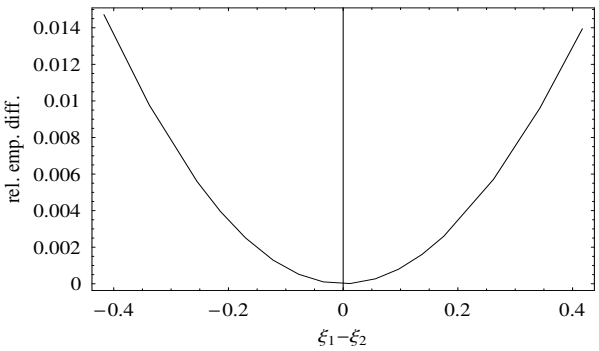


Figure 4.3: relative employment effect of a change in ξ

All graphs are obtained by varying one parameter, while holding all other constant. The standard parameter values are

probability distribution	$a = 1.5$	$b = 1.0$	
utility function	$\beta = 0.3$	$w_0 = 1$	
production function	$\alpha = 1$	$\rho = -2$	$\lambda = 3$
other	$q = 1$	$\xi_0 = -1.5$	

[28] In some cases the Newton root search algorithm failed to find the correct solution to (4.20). Therefore we reformulated the root search problem as a (degenerate) minimisation problem and used a robust global minimisation algorithm to solve it. We followed this strategy mainly for convenience reasons, since our symbolic mathematics Package (Mathematica) provides convenient and robust global minimisation routines.

and relative employment difference $((E[n_c] - E[n_l])/E[\eta_l])$ is defined such that a positive value implies higher employment with central wage setting. In the first simulation we vary ξ holding all other parameters constant. To interpret the magnitude of the effect correctly, note that the maximum difference of ξ is equal to central employment for $\xi_1 - \xi_2 = 0$. Since this is a rather large difference, the graph shows that significant employment effects (maximum is about 1.5 percent here) occur only if firm size differences are large. However, the scenario appears not unrealistic, since the relative difference of wages at the extreme points is about 6.5 percent. This is rather moderate compared to maximum firm size wage effects of more than 20 percent reported in the empirical literature (c.f. Oi & Idson, 1986 for a survey or Wagner, 1991 for Germany).

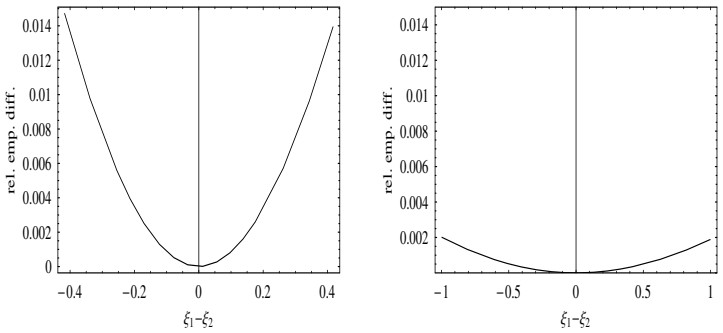


Figure 4.4: Comparison of nonlinear and (almost) linear case (obtained by setting $b := 3$)

Figure 4.4 shows that centralisation effects vanish if ω approaches a linear function. The right hand side graph was obtained by setting the distribution function parameter $b := 3$ such that $\omega(\cdot)$ becomes (almost) linear.

Figure 4.5 relates to the case of risk neutral workers. It shows that the centralisation effect diminishes, but a maximum effect of about 1 percent remains.

Figure 4.6 shows that the effects increase *ceteris paribus* to about 2.5 percent if the catchment areas (and thus unemployment rates in the areas) of firms differ. In the simulation q_2 was set to 1.5, i.e. catchment area is 50 percent larger in firm 1. The effects are not symmetric with respect to the difference $\xi_1 - \xi_2$, and it matters whether firm 2 or firm 1 is affected by the change if ξ. As can be seen in the figure, the effect becomes even negative for certain values of ξ but the magnitude is small. Figure 4.7 contains an example for negative centralisation effects. They occur if the labour productivity parameter α varies between firms. These effects are of considerable size for a

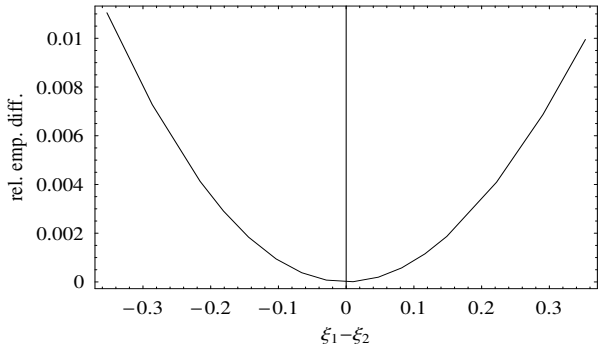


Figure 4.5: Relative employment effects in the case of risk neutral workers ($\beta = 1$)

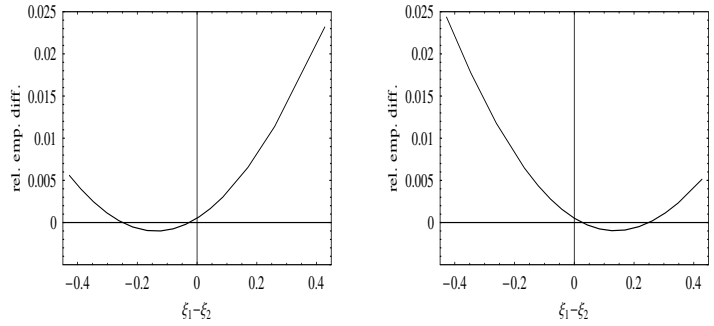


Figure 4.6: Differences in catchment area sizes ($q_2 = 1.5$). ξ_1 varies in the left hand side and ξ_2 varies in the right hand side.

negative difference $\alpha_1 - \alpha_2 = -0.15$.[29] The last figure illustrates the positive but small effects of a change in the total factor productivity parameter λ. To sum up, we find positive as well as negative employment effects. Considering the simple structure of the model, it appears less promising to 'estimate' the model empirically.

A Qualification

The probably most severe shortcoming of our model is the restriction to the case of two firms only. Since the generalisation of the model with respect to the number of firms promises to be complicated and tedious, we are content with some speculations here. If a large number of firms in our economy is homogenous (with respect to labour demand characteristics) and only a few firms deviate, the relative importance of the deviating firms in wage setting

[29] We have to note that the computations become unstable for larger differences of α.

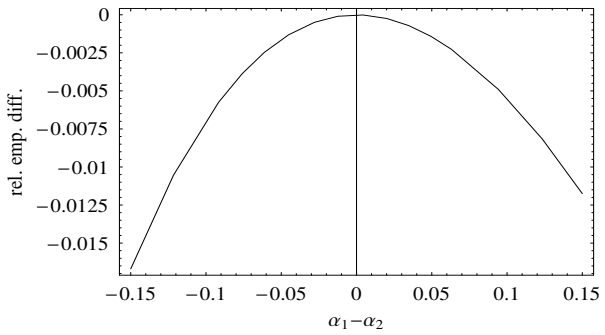


Figure 4.7: Employment effects associated with a change of α.

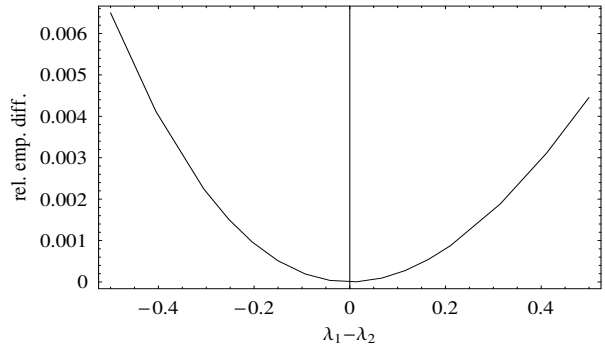


Figure 4.8: Employment effects associated with a change in λ.

and employment becomes small and we expect that centralisation effects are negligible. Even in an economy with heterogenous firms, the effects shrink if we have a continuum of firm sizes. Consequently our results tend to overestimate the real effects.

4.3.5 An even Simpler Version of the Model with a Closed Form Solution

If one is willing to throw away even little realism, it is possible to construct a version of the model with a closed form solution. Contrary to the simulation model its results can be verified directly (i.e. without use of an intransparent computer program). Again we employ a constant relative risk aversion (CRRA) utility function

$$u(W) = W^{\beta}$$

and a Cobb-Douglas type production function $g(N) = \gamma N^{\alpha}$ with labour demand function

$$\phi(W) = \left(\frac{W}{\alpha\gamma}\right)^{1/(\alpha-1)} \quad \text{or} \quad \ln[\phi(w)] = \psi - \eta w$$

where $\psi = \ln(\alpha\gamma)/(\alpha-1)$ and $\eta = 1/(1-\alpha)$. In order to obtain model with a closed form solution we have to make some further restrictions and normalisations. We set $b := 0$ (to eliminate the alternative income term) and choose a multiplicative exponential specification for the terms ξ and θ. Then $E[U]$ has the form

$$\begin{aligned} E[U(W|S)] =& W^{\beta} P[S \leq \phi(w) e^{\xi} e^{\theta}] \\ =& W^{\beta}\{1 - P[s > \ln(\phi(W)) + \xi + \theta]\} \end{aligned}$$

where lower case letters denote logs of the corresponding (latin) capital letters. After further manipulation we arrive at

$$\ln E[U(w|s)] = \beta w + \ln\left[1 - F(s + \eta w - \psi - \xi)\right]$$

where $F(\cdot)$ is the CDF of θ. If θ has a uniform distribution in the range $[0;1]$, $f(\theta) = 1$ and $F(\theta) = \theta$ and the (log) worker utility function has the simple form

$$\ln(E[U|s,w,\xi]) = \beta w + \ln\left[s - \xi - \frac{w}{1-\alpha} + \frac{\ln(\alpha\gamma)}{1-\alpha}\right]$$

Solving the worker's utility maximisation problem gives

$$\omega(s,\xi) = (s-\xi)(1-\alpha) - 1/\beta + \ln(\alpha\gamma)$$

And also $\Omega(\xi_1, \xi_2)$ has now a closed form representation.

4.3.6 Effects of Changes in ξ

If firms and workers are identical with respect to all parameter values except ξ, $\tilde{s}$ has the form

$$\tilde{s} = (q_1 + q_2)/4 + (\xi_1 - \xi_2)/2$$

and the median wage is

$$\Omega = \ln(\alpha\gamma) - 1/\beta + (1-\alpha)\big\{(q_1+q_2)/2 - (\xi_1+\xi_2)\big\}/2$$

After setting $q_1 = q_2$ and some further straightforward manipulations we can write the expected employment difference between central and local wage setting as

$$E[\eta_c] - E[\eta_l] = (e-1)\, e^{\frac{2-\beta(\alpha-1)}{2\beta(\alpha-1)}} \left\{ e^{\frac{-\xi_1}{2} - \frac{\xi_2}{2}} \left(e^{\xi_1} + e^{\xi_2}\right) - 2 \right\}$$

This expression is positive if the expression in curly braces is. It is easy to show that it is zero if and only if $\xi_1 = \xi_2$ and strictly positive otherwise. Note that only the magnitude but not the sign does depend on α and β. α and β have *ceteris paribus* a negative and positive effect on its magnitude.[30] However, figure 4.9 shows, that the effects are ignorably small. The figure is obtained by holding $\xi_2 = 0.5$ constant and varying ξ_1 in the interval $[0.4; 0.6]$ (note that the relative change of ξ_1 is large, since the central employment level is about 0.1 in our example). In the general case with differing worker pool sizes ($q_1 \neq q_2$), it can be shown that the effect of centralisation on employment is ambiguous.

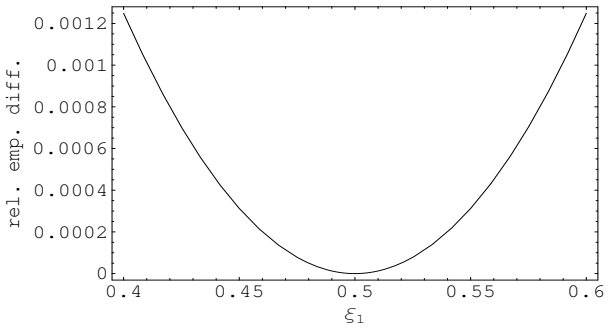


Figure 4.9: Relative employment effects of a change in ξ

4.3.7 Effects of Changes in γ

Now consider the impact of variability in γ on employment. With $\xi_i := 0$ the general solution is

$$\tilde{s} = -\frac{-\ln(\alpha_1\,\gamma_1) + \ln(\alpha_2\,\gamma_2) + \frac{1}{2}\,(q_1 + q_2) - \frac{1}{2}\,(q_1 + q_2)\,\alpha_2 + \frac{1}{\beta_1} - \frac{1}{\beta_2}}{\alpha_1 + \alpha_2 - 2}$$

with further parameter equality restrictions (including $q_1 = q_2 = 1$) we obtain

$$\tilde{s} = \frac{\alpha - 1 + \ln(\gamma_1) - \ln(\gamma_2)}{2\,(\alpha - 1)}$$

After further manipulations we obtain an algebraic expression for the employment difference

$$\sqrt{e}\,(e-1)\,e^{\frac{1}{\beta\,(\alpha-1)}}\,(\gamma_1\gamma_2)^{\frac{1}{2\,(1-\alpha)}}\left\{\gamma_1^{\frac{1}{2\,(\alpha-1)}} - \gamma_2^{\frac{1}{2\,(\alpha-1)}}\right\}^2.$$

[30] The derivatives of the exponent with respect to α and β are $\frac{-1}{(a-1)^2\,b}$ and $\frac{1}{b^2\,(1-a)}$.

Again it is immediately clear that employment differences are positive for all $\gamma_2 \neq \gamma_1$ and zero otherwise. However, the implied effects are considerably large as figure 4.10 shows. It is generated by varying γ_2 in the interval $[0.7, 1.0]$ holding $\gamma_1 = 1.0$ constant.

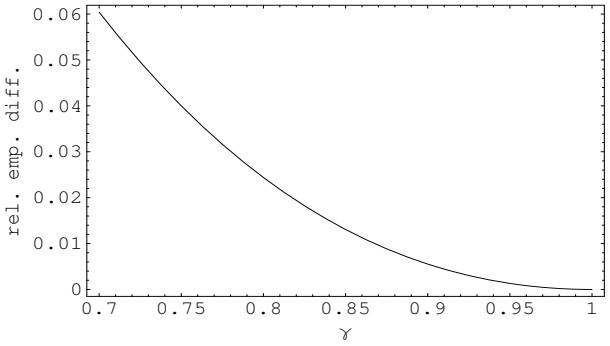


Figure 4.10: Relative employment effects of a change in γ

4.3.8 Conclusion

In our stylised median voter model we found ambiguous employment effects of centralisation in wage setting. Considering the information requirements of the model it seems to be at least difficult (and probably impossible) to predict the effects on the base of available empirical data and parameters. However, simple reasoning suggests that the effects found here shrink if the number of firm increases and probably becomes negligible. On the other hand, since the most graphs in the simulation plots are parabolas, the effects of differences in some parameters could grow quadratic and thus create significant effects.

The most legitimate criticism of our model is its shortcoming of realism. Thus we should conclude with a thorough discussion of its assumptions. Before we do this, we once more note that the aim of the model is not to derive guidelines for politicians, unions and firms, but to show that institutional changes in wage setting may generate possibly considerable employment effects which are less understood by economists.

Firstly, our model shares a crucial shortcoming with most other investigations of centralisation. It takes the degree of centralisation as given and does not explain why unions choose the one or the other form. Many papers find that central wage setting internalises externalities and thus must be efficient (at least if the considered externalities were the only issue in bargaining), but they don't explain why wage setting remains decentralised in many countries even if unions and employers were free to build bargaining coalitions. Most

authors will respond to this critique with the custom argument that economic models isolate some certain aspects of reality and ignore all other in order to simplify things and that some of the ignored aspects (for example firm heterogeneity or institutional costs) may be responsible for the observed stability. This view assumes tacitly that the these aspects are neutral with respect to employment – a rather heroic assumption.

We note that the degree of centralisation could in principle be endogenised in our framework, with a clear and too a simple answer: In the special case of two firms it is clear that wages would be set locally if θ were the only stochastic parameter, since the work force of a firm will always prefer its own local median to an aggregated one (by definition). If other parameters are stochastic – at least in the medium and long run (for example ξ labour demand parameters) – central wages are possible with risk averse workers, since the central wage is less volatile than local ones. However, this result is not likely, since firm heterogeneity appears to be a phenomenon with high persistence.

Thus uncertainty alone cannot explain the existence and stability of central wage setting regimes and we have to look for other arguments. The best candidates to fill this gap are bargaining costs, institutional barriers, internalisation effects of centralisation, or deviations from the standard utility independence assumptions. Fixed bargaining costs have the 'advantage' that they can be introduced into the model without any other adaptions. However, we fear that other institutional issues and deviations from standard utility theory are more important. But it is more difficult to tackle them in a formal model and – even more important – they require (at least qualitative) empirical evidence.

Secondly, the median voter solution to the aggregation problem requires a merger of the unions. If the unions decided not to merge, but only to cooperate, voting responsibility would remain in the respective individual unions. The common wage had then to be found in a bargaining procedure. Let $E[U_1(w_1^*)]$ and $E[U_2(w_2^*)]$ denote the respective utilities attainable by the median workers in union 1 and 2 if wages are set locally, and $E[U_i(W)]$ denote the respective indirect utilities of the median workers if a common wage W is set, then both unions find the common wage by maximising

$$\left\{E[U_1(W)] - E[U_1(w_1^*)] - Z_1\right\}^{\beta} \left\{E[U_2(W)] - E[U_2(w_2^*)] - Z_2\right\}^{1-\beta}$$

with respect to W. The Z_i represent the fixed increase of bargaining costs for union i if bargaining has to be conducted at the firm level.[31] Unfortunately, no time was left to inspect this variant in further detail.

[31]Note that $Z_i > 0$ is required to make cooperation sensible.

Thirdly, an even more fundamental challenge to our model is based on the suspicion that the aspects modelled here (wages and employment risk) don't play a prominent role in worker's decisions at all, but are dominated by fairness considerations. We cannot check the validity of this argument since empirical evidence is rare. Experimental (cf. the references in section 2.4.10) evidence suggests that fairness, framing effects, and adherence to norms play an important role in everyday live interactions. But this evidence is not specific enough for a direct application to our problem.

Fourthly, the model ignores fluctuation costs. If fluctuation costs, e.g. costs of movements into and out of unemployment are noteworthy, central wage setting may generate significant higher losses due to fluctuation than local wage setting. Then productivity gains of centralisation (wage equalisation implies equalisation of marginal productivities in firm and, by this, yields higher gross productivity) have to weighted up against fluctuation costs. Unfortunately, fluctuation costs render centralisation models highly complex in presence of stochastic shocks. Because of this, no simple model with clear and general predictions exists. To the best of our knowledge, Bertola & Caballero (1994) is the only advance into this direction. They construct a model with heterogenous firms which are prone to stochastic shocks and conduct costly searches for workers. The model predicts inefficiencies of decentralised bargaining. But these predictions depend highly on a large number of special assumptions.

Finally, the median voter mechanism relies on single-peakedness of utility functions. As is well known from the literature on social welfare and voting equilibria (and explained in section 2.3.1), a unique voting equilibrium may not exist at all if workers vote on different variables (e.g. wages and working time) simultaneously. However, even if this 'curse of dimensionality problem' were negligible, we had to assume full rationality of the workers and to exclude any other institutional imperfections (e.g. manipulation of workers by union leaders) in order to put the median voter results on save grounds. Especially the rationality assumptions are heroic; worker must understand the voting mechanism and be capable of processing all relevant information.

Chapter 5

Reorganisation and Incentives*

5.1 A Critique of an 'Incentive' Argument against Centralisation

5.1.1 Introduction

Lindbeck & Snower (2001) investigate the effects of multitasking and teamwork on the efficiency of centralisation in collective setting. The authors emphasize that workers likely have private information concerning their task mix when multitasking plays a significant role in the production process. They try to show in a formal model that only a complicated wage scheme provides incentives for workers to choose an optimal task mix and suggest that centralized wage setting cannot tackle this complexity.

Unfortunately, the authors miss to specify and analyse their basic assumption regarding private information of the workers explicitly. A closer inspection of the issue reveals that – contrary to the claims of the authors – the wage scheme resulting from their model is not implementable for the given information structure and therefore *does not solve the information problem.* Among this logical inconsistency the model suffers from a more general conceptual problem. It is at odds with reality by presupposing utility taking behaviour of the firm. The conclusion that more specific remuneration of factors (tasks) increases efficiency is a trivial consequence of this assumption. But it seems to be empirically irrelevant.

We start with a short summary of Lindbeck & Snower's model, followed by an analysis of its logical problems. The rest of the section is devoted to some remarks on the role of teamwork and multi-tasking within firms

*I thank Ekkehart Schlicht, Joachim Möller, Stefan Seth, Lutz Arnold and Kurt Raster for helpful conversations about the issue.

and a short sketch of a case study contrasting Lindbeck & Snower's view of reorganised firms

5.1.2 A short summary of the model

Lindbeck & Snower consider the profit maximisation problem of a firm whose production function $q(\lambda_1, \lambda_2)$ requires two labour inputs (tasks) λ_1 and λ_2. These tasks are performed by two types of workers. Workers of each type are able to perform *both* tasks. According to the Lindbeck & Snower terminology, a holistic firm is characterized (and distinguished from tayloristic firms) by the fact that *both* worker types perform *both* tasks in optimum but type 1 workers have a *comparative advantage* in performing type 1 tasks in the sense $e_1/e_2 > E_1/E_2$, where the e_i denote efficiency units for type 1 workers when performing task i and the E_i denote the corresponding measures for type 2 workers. In general, lowercase letters are used for type 1 workers and uppercase letters for type 2 workers. The e_i and E_i are functions of the task mix parameters, i.e. $e_i = e_i(\tau), E_i = E_i(T)$ where τ and T denote the share of the gross working time a worker devotes to task i.[2] Together with the definition of the e_i and E_i, and the production function, a full representation of the model consists of the specification of labour services

$$\lambda_1 = e_1\,\tau\,n + E_1\,(1-T)\,N, \tag{5.1}$$
$$\lambda_2 = e_2\,(1-\tau)\,n + E_2\,T\,N, \tag{5.2}$$

worker utility functions

$$u = w_1\,\tau + w_2\,(t-\tau) + v(\tau), \tag{5.3}$$
$$U = W_1\,(1-T) + W_2\,T + V(T), \tag{5.4}$$

and participation constraints

$$w_1\,\tau + w_2\,(1-\tau) \geq v(\tau) \tag{5.5}$$
$$W_1\,(1-T) + W_2\,T \geq V(T) \tag{5.6}$$

where $v(\tau)$ and $V(T)$ represent preferences of specialisation/diversification.[3] In the formulas the $w_i, (W_i)$ denote wages for the respective tasks and $n, (N)$

[2] In the paper the functional dependence of the e_i and E_i is decomposed further in the form $e_i = e_i(s_i, c_i)$ where $s_1 = s_1(\tau)$ and $s_2 = s_2(t-\tau)$ denote the effects of *specialisation* and complementarity on workers' productivity respectively. Again the specification of the E_i is fully analogous (with uppercase symbols) $E_1 = E_1(S_1(1-T), C_1(T))$. We ignore this here, since it is irrelevant for the main point.

[3] Of course, $v(\tau)$ and $V(T)$ must be negative.

the number of workers of type 1, (2). After substitution of the e_i and the E_i, output can be written as

$$q = q(\tau, T, n, N),$$

and the cost function has the form

$$\kappa = \{w_1\,\tau + w_2\,(1-\tau)\}\,n + \{W_1\,(1-T) + W_2\,T\}\,N$$

By straightforward maximisation of the profit function subject to participation constraints, Lindbeck & Snower derive a wage structure (from the maximising values τ^*, T^*, n^*, N^*) where $w_1 \neq W_1$ and $w_2 \neq W_2$ in general if full specialisation does not occur, more formally, if an inner solution results, we have $0 < \tau^* < 1$ and $0 < T^* < 1$. This implies, for example, that type 1 and type 2 workers obtain different wages for performing task 1. In the case of full specialisation only two instead of four wages are needed (since each worker type performs only one task). Lindbeck & Snower associate the inner and outer solution with the labels 'holistic' and 'tayloristic' production, and conclude that the flexible form of wage setting required for holistic production is incompatible with central collective bargaining, since centralized wage setting puts natural restrictions on the number of wages. To emphasise the problem, they note that the number of tasks is much larger in most firms and the number of required wages rises quickly with the number of tasks and worker types.

As noted above, the assumption that the task mix (i.e. the parameters τ and T in their terminology) cannot be observed by the employer (principal), is central for the model. If it were observable, the principal would simply specify the optimum task mix to every worker type and pay every type it's outside option.

5.1.3 The Consistency Problem

For a clear discussion of the issues let us start with a quotation of what Lindbeck & Snower say regarding the information structure. On page 1860 they write:

> "An important aspect of multi-tasking, documented in the recent empirical literature, is that employees often have discretion over the proportions in which different tasks are performed. In practice, employers generally determine the range of tasks that each of their employees perform, while the employees often have some latitude in deciding the task mix... Beyond that, task mixing is usually difficult to monitor, and thus managers often have little alternative but to leave some of the decision making to the

> employees. Managers can, however, influence their employees decisions through wage incentives. These wage incentives may be distorted through centralized wage bargaining."

A sensible interpretation of the central quotation above appears to be that the task mix parameters τ and T are not observable for the principal. This implies, however, that Lindbeck & Snower's wage scheme cannot be implemented. If τ is not observable, earnings of type 1 workers $w_1\,\tau + w_2\,(1-\tau)$ cannot be computed, simply because they depend on τ. In other words, if the firm cannot observe the task mix, type 1 workers do not determine τ by maximising utility from equation (5.3) $u = w_1\,\tau + w_2\,(t-\tau) + v(\tau)$, to obtain Linbeck & Snower's reactions functions $(w_1 - w_2) + v'(\tau) = 0$ but simply set $v'(\tau) = 0$. Contrary to their claims, the authors set up and solve a fully deterministic model of symmetric information. In the deterministic case, however, the principal simply prescribes an optimum task mix for every type and determines wages (call them ω and Ω) such that they meet the participation constraints, e.g. $\omega := v(\tau^*), \Omega := V(T^*)$. *A central collective wage agreement can handle the task mix problem simply by specifying a wage for the typical task mix instead of for tasks separately.* The number of wages to be determined is unaffected by this change. By the way: Jobs where each worker specialises on exactly one task were exceptions also in the past, and occupational groups in collective wage agreements relate to a *typical task* mix. Of course, these standard wages are only approximations to an perfectly efficient choice. But there is no reason to expect that a principal is able to determine exact optimising wages for a firm with 10 worker types and 50 tasks (just compute the number of resulting Lindbeck-Snower wages!), even if he could observe the realised task mix.

There is only one (trivial) way to construct heterogeneity in wages with this model: If production functions of firms are heterogenous in the sense that optimum task mix parameters differ between firms, worker types obtain different wages in firms. Then, however, the model reduces simply to a nice illustration of the old and well known compensating differentials argument. Even in this case it is hard to comprehend a high significance of the argument for the centralisation debate. As an empirical implication of compensating differentials, we would observe some wage drift. Lindbeck & Snower's argument would hit only if general collective wage agreements did not admit upwards deviations of wages.

We will show now that an explicit treatment of the given information structure will lead to utterly different results. Though further information

asymmetries likely exist in several other respects[4] and *may even be more important*, let us start with the task mix observability problem.

Is there a way to trick employees into choosing the optimal task mix when it is not observable? The standard advice from information economics is to make wages contingent upon output. A closer look at the problem reveals that the principal in Lindbeck & Snower's model faces a *highly* complex moral hazard problem, since output does not depend on the task mix of a *single* agent but of the *whole work force*. Before we report the relevant results from the information economics literature, we point to the fact that the information structure in Lindbeck & Snower does not meet the standard assumptions exactly. In most information economics models, it is assumed that the agent's effort or working time is not observable. Apparently , Lindbeck & Snower's model rests on the assumption that the gross working time is observable, but its *division* is not. This difference has no effect on qualitative results, however.

If the principal cannot observe the individual task mix of each worker but only gross output, the results from Holmström (1982) apply. For convenience reasons we discuss only the simplest case where gross output q is observable without error. Holmström considers incentive problems associated with a setting where the output produced by a team of agents can be observed by all players but the individual contributions of the agents are private information. He shows that the team production moral hazard problem can be solved efficiently via a simple group punishment incentive scheme: If production equates the output attainable with the social optimum values of τ and T, the principal distributes gross revenues such that the wage of each worker is (at least marginally) above his disutility of effort $v(\tau^*)$ or $V(T^*)$. If it falls short this level, every worker gets nothing.[5]

Several observations are in order here. Firstly, *Holmström's scheme does not require different wages for different tasks* as in Lindbeck & Snower's model. The earnings of each worker (strictly speaking: each worker type) depend on his disutility of effort (or outside option value) and the number of wages equals the number of worker types. It suffices to set a severe group punishment and every worker (type) will choose his optimal task mix, since otherwise productivity would fall short of the objective and trigger group

[4]The clause *"...managers often have little alternative but to leave some of the decision making to the employees"* in the above citation probably means that employees have private information on productivity effects of specialisation and task complementarities. Unfortunately, Lindbeck & Snower don't concretise this further. We will dwell on this below.

[5]Holmström notes that this scheme is not the only viable and other solutions are possible, for example bonding.

punishment.[6] Secondly, the scenario discussed in Holmström's paper is too simple for our application. In more realistic settings the principal doesn't have complete knowledge of other parameters. It is likely that the functions determining the optimum task mix $e_i, E_i, s_i, S_i, c_i, C_i$ and the preferences of the workers v and V are stochastic objects for the principal. For example, workers may have private information on complementarities between tasks or on the relevance of certain tasks for gross productivity. In the terminology of information economics, we don't face an isolated hidden action, but a combination of hidden action and hidden information. We will discuss the hidden information issue below. However, the main result that compensation does not require wage differentiation, remains valid.

Could Lindbeck & Snower's main argument be recovered by assuming that the output of each individual worker can be observed, but not his task mix? By the way: this scenario seems to have less in common with the one in Lindbeck & Snower's article, since the impossibility to observe task-specific (and group-specific) output seems to be a defining property of teamwork. Nevertheless, we discuss it in brief. If individual output is observable, we have to differentiate further between the case where only gross output of a worker, and the case when even the outputs for individual tasks are publicly known. Let us first discuss the simpler former case. It is a standard result from incentive theory that pay will depend on output then. But again, we don't need different wages for tasks. With output-dependent wages the worker has an incentive to choose the optimal task mix in order to attain high output.

Holmström & Milgrom (1991) deal with a special case of the situation where task-specific individual outputs are observable. They consider a situation where one agent performs different tasks and each task can be observed separately by the principal, but with error. Payment depends on individual output n their linear incentive scheme[7] and different piece rates are possible. But Holmström & Milgrom show that fixed wages are optimal if efforts are substitutes in the effort-cost function of the agent and some tasks are not observable at all or only with large error. The intuition is clear and simple: If an agent is awarded for tasks with observable output, he will put his effort where it is awarded and will disregard other tasks.

A more realistic description of production in holistic firms seems to be a situation where agents produce several goods in joint production and only gross outputs are observable. Holmström & Milgrom (1990) analyse a model

[6] Of course the punishment scheme can be replaced by a bonus scheme. This is mainly a matter of semantics.

[7] Of course, the linear incentive scheme is somewhat arbitrary. It can be shown, that it is optimal if errors are distributed normally.

with two agents and the following information structure. The principal observes

$$x_i = f_i(a_i, b_i) + \epsilon_i$$

where x_i denotes output i, the ϵ_i denote observation errors and $a_i(b_i)$ the unobservable inputs of agent 1(2) for output i. The f_i determine, together with the ϵ_i, whether and to which degree of precision outputs are attributable to inputs provided by an individual agent.

In general, optimal incentive schemes make all wages contingent on all outputs. However, the low-powered incentive case is present here too: Dependence of wages on output may be small or zero if teamwork is important, i.e. if some tasks raise performance of the colleague. This is intuitively clear, since agents will withdraw cooperation and concentrate on producing the goods which are attributable to their efforts if such behaviour is honoured.

These results explain Williamson's observation that incentives offered to employees *within* firms are generally "low-powered", contrary to the incentives to independent contractors, and thus vitiate the picture drawn by Lindbeck & Snower. Their picture puts reality upside down: We observe piece rates in old-fashioned tayloristic but not in holistic firms. In holistic firms even the tie of earnings and working hours is loose.

5.1.4 Other (Likely more Important) Information Problems

In reality, the hidden action problem (monitoring of task mix and effort) may be less important than hidden information problems. For example, the impact of complementarity and specialisation on worker's productivity is probably best known to the worker. Furthermore, the worker has private information on his preferences, i.e. worker's preferences for diversification represented by the disutility of work functions $v(\tau)$ and $V(T)$ are unknown (stochastic) to the principal. We give a short summary of the topic in order to show the complexity of the issues involved.

A principal trying to find out the true preferences of his workers faces a mechanism design problem. We obtain a formal representation of the situation by introduction of shift parameters which are stochastic from the principal's point of view. I.e. we extend v and V to $v(\tau, \gamma)$ and $V(T, \Gamma)$. The optimal incentive scheme (c.f. Fudenberg & Tirole (1991), chapter 7) makes wages contingent on the task mix parameter τ. For scalar problems (τ and T are one-dimensional) this problem has a simple solution (gross earnings of the worker depend on the realized task mix). However, in settings with more than two tasks, the principal faces a multidimensional screening

problem and τ, T, γ and Γ become vectors. Then a generalisation of the well known single crossing property introduced by Spence and Mirrlees is required in order to generate an incentive scheme implementable via transfers. And it is very difficult then to get sufficient conditions for the implementability of the transfer scheme if $v(\tau, \gamma)$ and $V(T, \Gamma)$ are *not linear* with respect to γ and Γ (see Rochet, 1987, proposition 3 or Rochet & Stole, 2001, formula (3")). Plausible forms of v and V do not meet these linearity conditions in the multidimensional case, implying that the incentive scheme is not implementable. Even if the scheme were implementable, it required observation of τ and T (or a proxy) for each single worker. If τ and T are not observable, output suggests itself as proxy. But this brings back the complicated and almost surely unresolvable observational problems mentioned above.

5.1.5 An Alternative View of Teamwork and Multi-Tasking

Among its formal problems, the model is based on a one-sided and too a narrow view of teamwork and multitasking.

It is a commonplace of the relevant literature that job rotation, teamwork and multitasking are not exclusively, but *also* natural *solutions* to the information problems of firms. Firstly, in many firms job rotation is a prerequisite for promotion. For future managers and leaders this is not only an opportunity to become acquainted with the task but also to get some experience on mean work load, task-specific disutility of effort, contentment of the workers, task-specific specialisation gains, synergies with other tasks and the role of the task for the gross productivity of the firm. Apparently, the information gathering function of job rotation is more important than learning specific tasks (which most managers will no longer perform after promotion).

Secondly, and even more important, teamwork *is* or implies a system of mutual monitoring. If every worker knows his colleagues' tasks from own experience, he has a clear comprehension of mean work load, specialisation effects and synergies, disutility of effort and its contribution to gross output and will unmask false claims and reveal harmful behaviour of his colleagues – at least if they imply disadvantages for him. Employees not complying fully with the concept of homo oeconomicus will do even more – in many cases to the benefit of the firm.

5.1.6 Evidence from a Case Study

Lindbeck & Snower's paper starts with a detailed "overview of the evidence" showing that teamwork, quality circles, multi-tasking, job rotation and other

aspects of the reorganisation trend can be observed in many branches and countries and that this trend is accompanied with a reduction of the degree of centralisation in wage setting. *But they don't provide a single example for wage schemes similar to the one resulting from their model!*[8] We suspect that, if such wage schemes existed at all, they were rather exceptions than standard and could more likely be observed within traditional tayloristic firms. The simple reason is that complicated production processes and teamwork production make it extremely difficult to evaluate the marginal contribution of an individual task. By application of a simple cost argument we conclude that the allocation of tasks is found via rules of thumb and that the sharing rules used in practice are rough approximations to an optimal one. This is particularly clear if production processes change frequently, and if this necessitates adjustment of the task mix.

We did not discover a current case study reporting the introduction of and experience with a payment scheme as described by Lindbeck & Snower. However, we found an interesting study from Kotthoff & Reindl (1990)[9] which describes a *traditional firm* matching the picture of highly flexible reorganised production. Nevertheless, a traditional payment scheme appears to solve the firm's motivation problems to the advantage of all involved agents.

The firm, employing 65 workers, produces and installs top-class fitted kitchens. The workforce is mixed of skilled and unskilled workers, and firm-specific knowledge appears to play an important role (see the descriptions below). Flexibility requirements are extreme because of small production runs (and frequent unique-copy production). We start with some excerpts characterising the flexibility requirements, the importance of teamwork, and the flatness of hierarchy.

On page 89 the authors write: "... If we used the terms 'sales manager' and 'foreman', then the hierarchical aspect of the term was misleading. Every job assignment in the firm had to be put into quotation marks, ... The sales manager is an ordinary blue collar worker, employed for 30 years in the firm, and has performed almost every task as main task over the years... There exist no titles (action or job designators) in the firm. Everyone has his name and all colleagues know the bundle of tasks associated with him." On page 91 they add: "Every worker is attributed to a job (task) as main job, but rotations to other tasks occur so frequently and natural that it is inappropriate to view this as fixed division of labour." [All translations by

[8] I admit that it quickened my phantasy to imagine such a payment scheme with large numbers of tasks and worker types and the reaction of a firm's workforce to it, or the reaction of the accountant's department responsible for the wage bill.

[9] A qualitative approach is adopted in the study, i.e. information is gathered in several interviews (each lasting more than one hour) with workers and management.

Johannes Ludsteck]

Furthermore, responsibility appears to be distributed evenly among the workers, and detailed instructions and monitoring are reduced to a minimum level. When the boss is asked how he runs and instructs the wickerwork tangle of production, his answer is very short:[10] "Everything regulates itself. They [the workers] are experts!" The statements from worker interviews agree to this view of self responsibility, for example Worker-1: "The work quota is working well. It does not matter whether I require 20 or 25 hours with cutting. This is not determined, the main thing is that I do not make errors." Worker-1: "I was in all the years, when I was [employed] here, virtually in every corner. This is so in the small plant. Everyone has here to help in other jobs if nothing is to do in his job. It is a wheel, it has to go on. This goes here directly from man to man... Everyone looks around here. Halt! we have to do something different. This has to stay behind, that has to be brought forward. And we make this do-it-yourself. The boss does not have to tell us: There is a change of order. This is certainly not possible in large plants. It works in our plant, and it works pretty well." [Interviewer: "How can it work well if the boss does not arrange it?"] "Oh, it works! It must be in the interest of workers. There must not be pigheaded persons. We have to talk to one another. Here are many workers which were trained here, which work here for 25, 30 years, they know the workshop." [The colloquial speaking of the workers required a free translation sometimes.]

Now let us consider the payment and incentive scheme. On page 93 we read: "In the firm all work is payed by hourly wage rates. There is no attempt to introduce time management... The boss who is not a member of the employers' association obeys all rules of the collective wage agreement. Christmas bonus, leave pay, overtime premiums, and the length of payed leave are handled according to the collective wage agreement. All standard wage increases are obeyed, though the boss emphasises sometimes that he were not obliged to do so, since effective wages are 20% above standard wages."

What about wage differentiation? "The boss does not want to introduce wage discrimination – as far as possible. He prefers an egalitarian philosophy, since he fears needless frictions ['Reibereien'], i.e. a real test ['Zerreissprobe'] of the 'community of equals'. He considers equity as pilar of the self-regulating capabilities of the producer's cooperative".

Taken all information from the study together, there is nothing new or special with the payment scheme. It fits neatly into traditional efficiency

[10] Other interviews from workers reveal that this is an exaggeration, however. The boss is, of course, present in the workplace, and participates in team work.

wage or gift exchange theories, and agrees to trivial transaction cost arguments. As a by-product, the reports suggest that Lindbeck & Snower's reasoning is based on misconceptions of multi-tasking and flexibility. In the quotations below, 'flexibility' just means that workers *change* their actual task mix *almost permanently* in response to changing demands, and that they do this on their own authority. Translated into Lindbeck & Snower's model, this implied that wages and task mix parameters change permanently, and that every worker had to keep account of his actual task mix. Coase (1937) showed a long time ago that firms exist because markets cannot provide solutions to such flexibility requirements. Apparently his seminal contribution has sunk to oblivion.

Chapter 6

Centralisation Effects in 'Custom Models' of Union Membership*

6.1 Introduction

The existence of unions in face of missing monetary incentives for entry has puzzled economists a long time. Since membership is costly and also non-members participate in the advantages of union activity through higher wages and improved working conditions, rational workers have no incentive to join. The social custom model of Akerlof (1980) smoothed the way to a solution of this puzzle. Booth (1985), Naylor (1989, 1990), Naylor & Raaum (1993), Booth & Chatterji (1993), and Booth & Chatterji (1995) applied Akerlof's basic idea fruitfully to the union membership problem by introducing reputation utility as a counterbalance to the monetary incentives of free riding. Put simply, workers derive utility or reputation from union membership by obeying a social norm.[2] Corneo (1993, 1995) applies the social custom framework to the centralisation debate and finds positive effects of centralisation on union membership and bargaining power. We survey his interesting contribution, point to some problems, and contrast his arguments with another one, implying opposite effects.

To start with, let us summarise Corneo's central idea in a few sentences.

*I thank Ekkehart Schlicht and his assistants for a helpful conversation about the issue.

[2]The scope of Akerlof's contribution was somewhat wider. He showed that an custom generating 'inefficient' outcome can nevertheless persist in the long run, but that it may be prone to erosion if monetary rewards for deviation from norms are too large. Romer (1984) extends Akerlof's argument by showing that inefficient customs may persist also in a continuous model, i.e. a model where *marginal* deviations from norms are possible.

Corneo investigates management opposition to union activity in a reputation[3] model. According to his theory, it may be profitable for the firm to 'shrink' the union by offering a positive reward to nonmembers if the decrease of the bargained wage due to union weakness outweighs the bonus costs. Centralisation of bargaining depreciates the gains of paying a bonus to nonmembers by reducing the effect of local management opposition on centrally bargained wages. This is the case because local union density has then only a small impact on gross density. If the bonus system is not enforceable by a central employers' association, firms save the costs of opposition and union power increases.

We claim that Corneo's model ignores one possibly important aspect of reputation. He uses the reputation argument only in order to fill a consistency gap of union membership models. But he fails to analyze the sources and behavioral consequences of reputation effects. Reputation is an exogenously given 'consumption good' in his model and workers are neoclassical utility functions with a less integrated preference for reputation. Consequently, they don't *respond* to management opposition and the centralisation effects become one-sided.

We contrast Corneo's mechanism with another one, leading to opposite effects. The reverse effect comes up if we account for significant strategic aspects of reputation and allow the workers to respond to management's discrimination activities. However, we have to note that model is not aimed to provide a satisfactory theory of reputation effects for wage bargaining and its implications for centralisation. We are content here by pointing to an instance of the fundamental problems of the available models and the possibly significant bias on model results.

6.2 Corneo's Model

Corneo (1993, 1995) uses a social custom approach in order to discuss the effects of centralisation in wage bargaining on membership and wages. He considers workers with the following utility function:

$$U_i = \{w + (1 - d_i)\,\delta\}\,L + w_0\,(1 - L) + d_i\,(r_i - c) \tag{6.1}$$

where w denotes the bargained wage, L is employment, d_i is a dummy, taking on value 1 for union members and 0 otherwise, c is the membership fee and r_i denotes utility from reputation. We have normalised the mass of workers (denoted by N in Corneo's model) to unity without loss of generality.

[3]Note that the term 'reputation' does not have the special meaning (together with its implications) it represents in information-theoretic models.

Heterogeneity of workers is represented by the distribution of r_i. For sake of simplicity, Corneo assumes r_i to follow a uniform distribution with support $[0, \Theta]$.

For convenience and readability we 'expand' the compact representation (using a variable) of the utility function above into separate formulas for members and free riders

$$\begin{aligned} U_i^u &= w\,L - w_0\,(1-L) + r_i - c \\ U_i^f &= (w+\delta)\,L - w_0\,(1-L) \end{aligned}$$

and give a verbal summary: union members obtain wage w if employed and w_0 as outside option. They receive reputation r_i and have to pay the fee c irrespective of employment status. Free riders obtain the union wage w plus a free rider bonus δ if employed and w_0 otherwise. They save c, but have to do without reputation utility.

The model is a simple three stage game, solved by backward induction. In the first stage, the firm determines a bonus δ as reward for non-members. Then workers decide on membership and finally the bargain is struck.

The profit function of the firm is

$$\pi = R(L) - w\,M - (w+\delta)\,(L-M) \tag{6.2}$$

where M denotes union membership. In order to simplify things considerably, Corneo assumes efficient bargaining which implies full employment ($L = 1$).[4] The wage is determined in a generalised Nash bargaining solution, i.e. by maximisation of

$$(U - U_0)^{\alpha}(\pi - \pi_0)^{1-\alpha} \tag{6.3}$$

where U and π denote utility of the median member and profit of the firm in case of an agreement, and U_0 and π_0 denote the respective thread points. The components of this expression are

$$\begin{aligned} U &= w + r_U - c \\ U_0 &= w_0 + r_U - c \\ \pi &= R(1) - w\,M - (w+\delta)\,(1-M) \\ \pi_0 &= R(1-M) - (w_0+\delta)\,(1-M) \end{aligned}$$

[4]The plausibility of efficient bargaining deteriorates considerably with the transition to centralised wage setting, since the level of employment determined in efficient bargaining is too high ex post from the firm's point of view. And the employers' association is faced with the difficulty to distribute the high level of employment over firms. Here the assumption is made, however, only in order to isolate the relevant effects, to retain the applicability of the ceteris paribus clause, and to keep the model as simple as possible.

To the best of my understanding, π_0 is specified incorrectly. Corneo *assumes* that the firm pays the bonus δ (as markup on the outside wage) to free riders also during a strike. This is not optimal for the firm, since w_0 is – by definition – the wage workers are willing to work for if they are not unionised. If the rules of the game allowed free riders to reverse their membership decision, π_0 had to be determined (recursively) in a bargaining process. Consequently, we see that the firm will not pay a bonus to strike breakers for two reasons (a direct and an indirect one) if we take the rules of the game seriously. The bonus lowers profits during a strike and weakens the bargaining position against the union by lowering the firm's thread point.

Another minor flaw of the specification concerns the constraint $\delta \geq 0$ in the firm's profit maximisation problem. $\delta \geq 0$ is not a natural exogenous constraint.[5] It is simple to show that $-c < \delta < 0$ is an optimising choice for certain values of the exogenous parameters. In the conclusion we will discuss several other reasons for this constraint. We will correct these points here, but note that Corneo's minor lapse does not change the qualitative results of his model.

The solution of the model (by backward induction) is straightforward. Maximisation of the Nash product gives the wage[6]

$$w = w_0 (1 - \alpha M) + \alpha \{R(1) - R(1 - M) + \delta (1 - M)\} \tag{6.4}$$

Straightforward comparison of the member and nonmember utility positions shows that reputation must be higher than the sum of the lost bonus and the membership fee to make membership attractive. From this Corneo derives

$$M = \begin{cases} 1 - (\delta + c)/\Theta & \text{if } \delta < \Theta - c \\ 0 & \text{otherwise} \end{cases} \tag{6.5}$$

if r is distributed uniformly in $[0, \Theta]$. Again, we have some reservations against this computation. We think that is valid only when a union is already present. If no union exists, the worker has not to compare $w + r - c$ with w, but $w + r - c$ with w_0, the relevant wage for the union-free firm. Consequently a worker enters the union if $r > w_0 - w + c$. At a glance, this detail seems

[5] In most countries wage differentiation between members and nonmembers is not banned. 'Allgemeinverbindlichkeitserklärungen' in Germany are an exception here. However, they are not general in scope, but relate only to certain industries or regions, and the are applied seldomness now.

[6] The corresponding solution in Corneo's paper (for bonus payments during a strike) is

$$w = w_0 (1 - M) + \alpha\{R(1) - R(1 - M)\}$$

to be not important for the central results of the model. Therefore we will discuss the issue in the conclusion.

After Insertion of M and w into the profit function we can perform the maximisation procedure of the firm in the first stage of the game. To show the existence of an outcome with $\delta^* > 0$, we have to consider three cases. In the 'trivial' case $c \geq \Theta$, i.e. even maximum reputation does not compensate the membership fee and no worker joins the union. Thus $\delta^* = 0$. If contrary $c < \Theta$, we have to check whether $\delta < \Theta - c$ for the optimum choice of δ, since $M = 0$ if $\delta \geq \Theta - c$. If δ^* meets this condition, an interior solution exists if.[7]

$$\left.\frac{\partial \pi}{\partial \delta}\right|_{\delta=0} > 0 \quad \Leftrightarrow \quad R'(c/\Theta) > w_0 + \frac{1-\alpha}{\alpha}\, c \tag{6.6}$$

The second order conditions are fulfilled. After an extensive comparative statics investigation of the model properties (which is of minor interest for us here), Corneo applies this model to the centralisation debate and finds that it predicts gross membership and wages to be larger in a centralised bargaining environment, since an individual firm's union density has a smaller effect on wages than for local bargaining. Consequently, the gain to the firm associated with the bonus payment shrinks with the number of firms in the economy. If a central employers' association cannot enforce the payment of a bonus, each single firm will save this cost, management opposition shrinks and union membership and wages rise. *It should be emphasised that Corneo's argument rests heavily on the fact that bonus payment violates equal treatment laws.* Otherwise bonus payment could be fixed in collective labor agreements and free riders could enforce payment by law. This implies that bonus payments have to be masked in most cases, e.g. the have to take place in biased promotion or firing procedures.

6.3 A Stylised Model with Sanctions

We will provide a short discussion of the question whether the centralisation effect is relevant at all in a section below. Here we contrast Corneo's management opposition mechanism with a simple 'member acquisition' mechanism. We claim that Corneo's reputation function *hides* an important aspect of the membership decision and the rules of his game are too restrictive for a

[7] Again we report the corresponding solution in Corneo's paper (for bonus payments during a strike)

$$R'(c/\Theta) > w_0 + c/\alpha.$$

A comparison of both conditions and the corresponding first order condition shows that δ^* is larger in the unrestricted case.

simulation of reality. Corneo's workers like high wages and reputation and consume reputation just as they consume bread and fish. Their social preferences or fairness conceptions relate only to union membership.[8] But they are indifferent with regard to discrimination and don't envy free riders. And – more important – they don't respond to discrimination.

So we come to the point: The model does not explain why unions try to *attract* members. We try to show now that a simple model, explaining why workers are not indifferent with respect to membership of their colleagues, can generate contrary predictions of centralisation effects. Since there exist several doubts whether our model captures all relevant aspects of reality, we will devote a section to a short discussion below. Consequently, we have to be cautious interpreting the results. Because of many remaining question marks, we will not believe too much in its predictions. Rather we are happy to show that models with an unclear foundation of its behavioral assumptions should be taken with care.

We expand the repertoire of actions of workers by giving them control on kindness[9] against members and nonmembers. This is utterly obvious, since reputation is related intimately to kindness. It were even possible to define the reputation of a person by the number of (significant) others being kindly against her, admiring her or holding her in great respect. Of course, as reputation is a complex psychological and social entity, kindness may not capture all its relevant facets, but surely a certain fact. There exist several types of sanctions against free riders: Members could reduce kindness against them, exert social pressure on them or refute to cooperate with them. In some escalated situations even harassment is conciveable. Though picket lines are not violent actions generally[10], they nevertheless generate significant social pressure – especially if the free riders believe in the social norm, but don't join the union because of monetary rewards.

Of course, there exist also more 'positive' types of action. E.g members could organise social events from which nonmembers are excluded or provide legal advice exclusively for members and other services or simply be more friendly to comrades. (We will use only the term 'kindness' in the rest of the paper for sake of convenience. But we have to keep in mind that it is only a proxy for other mechanisms.) The allocation of such services is aimed to at-

[8]Unfortunately, most economic papers using the reputation effect don't contain a thorough discussion of where these effects come from.

[9]The economic standard vocabulary is more tough. Most economists tend to replace 'kindness' by the more distinct term 'harassment' (with inverse meaning). We try to enrich the literature here with a somewhat unusual terminology.

[10]For a description and analysis of picketing action see Batstone, Boraston, & Frenkel (1978).

tract members and not given exogenously. In our *very* simple formulation we assume that union members have control on kindness k against nonmembers, but that reduction of kindness comes at a psychological cost $K(k)$. Formally

$$U_i = \{w + (1 - d_i)(\delta - k)\}L + w_0\,(1 - L) + d_i\,(r_i - c - K(k)) \qquad (6.7)$$

Note that we have defined k negatively for notational convenience, i.e. we define $k = 0$ as the natural level of kindness of members against members and $k > 0$ as a *lower* level of kindness. $K(k)$ represents a psychological cost depending on k. We assume $K(.)$ to be a continuous C^2 function with $K(0) = 0$, $K(k) > 0$ for $k > 0$, $K'(k) > 0$ for $k > 0$, and that there exist no fixed costs of reducing kindness.[11] Note that we do not make further assumptions regarding the second derivative of $K(.)$ here. Below we will show that our argument works for concave *and* convex $K(.)$. This is important since $K''(k) > 0$ appears to be the most appropriate assumption.

Some comments and warnings are in order here. Firstly, in a more realistic formulation $K(.)$ should depend on membership M too, since the density of the union matters. A minority of free riders probably may be highly vulnerable by disregard of union colleagues. This may change or even be reverted in a firm where free riders become a majority. We will deal with this issue in an extension of the model but ignore it here for convenience and for the sake of comparability with Corneo's model. (By the way, this reasoning applies to reputation too, i.e. a more realistic formulation of the reputation function were, for example $r_i + \rho_i\,M$.[12])

As a last problem, it seems artificial and arbitrary to consider r and k as different objects. Of course, we do this only for sake of convenience, since this makes it simpler to identify exogenous given reputation sensitivity r from the endogenous action parameter k.

Though most readers will consider it trivial then, and refute to go on reading,[13] we anticipate the underlying mechanism. Purposeful disregard of free riders increases membership which in turn (through improvement of the bargaining position) raises wages. This effect vanishes in a centralised bargaining environment since local membership looses its impact on wages. We end with negative effects of centralisation on membership and wages. It suffices to show that equilibria with $k^* > 0$ exist and that centralisation reduces k^*.

[11] Also the 'no fixed cost' - assumption is made for sake of convenience in order to avoid additional case differentiations. Nevertheless it seems to be plausible.

[12] Booth & Chatterji (1993) specify reputation by the term $r_i\,M$.

[13] It is probably efficient to skip the rest of this section and to proceed with the conclusion if the basic idea is clear.

In our model we assume that the firm is restricted to set $\delta = 0$, i.e. cannot use a bonus scheme to fight the union. We do this for the sake of convenience, since the more general case renders the model much more complicated. Consequently, our model cannot characterise the conditions for inner and corner solutions, when *both* parties can make use of their strategic instruments (k and δ).

The timing of our model is completely analogous to Corneo's: In the first stage, the (future) union members decide on kindness, then workers decide on membership (given kindness), and in the last stage the union bargains with the firm over (employment and) wages. Again some remarks are in order here.

Firstly, the threads associated with harassment and kindness are not subgame perfect. If negotiations are finished, rational unionised workers have no incentive to harass free-riders, rendering the thread implausible. Below we will report experimental evidence suggesting that behaviour of people apply and enforce non subgame perfect threads in everyday live.

Secondly, this game seems to require or contain schizophrenic workers. Potential union members of a not yet existing union set the level of kindness against potential free riders. And an implication of the model is that the marginal union member which plans to disregard free riders could become a disregarded free rider due a small parameter change. Again the model is not realistic in this respect, since the entry into a union will change the way how workers perceive labour relations and other relevant issues.[14] It will furthermore change the cannels of information available to him. Eventually the worker can predict these influences and take them as constraints for his membership decision. Similar (symmetric) forces are at work for free riders. If they believe in the custom, cognitive dissonance mechanisms will urge them to reinterpret their conception of labour relation and seek for another free-rider friendly ideology.[15]

Our model probably underestimates the true ex post heterogeneity of the workforce due to its static nature. But – again for sake of simplicity – we ignore these effects. Anyway, we claim that the sequence of the game captures an central aspect of reality: It represents the fact that the behaviour of union

[14] A large strand of psychological experimental evidence shows that group membership affects the perception of group members and outsiders significantly even if these groups are artificial ones and membership is determined by highly arbitrary or trivial criteria (e.g. similar estimation of the number of dots on a screen). The classical paper is Taifel et al. (1971), Haslam (1995) provides a survey (chapter 2) with several interesting applications to organisational psychology.

[15] Similar problems arise in Akerlof & Dickens (1982), where the economic consequences of cognitive dissonance are analysed.

members is given for the individual worker at the time when he decides on membership.

With this at hand we can proceed by solving the wage bargain.[16] Substitution of the utility function and the profit function into the Nash product and solution of the first order condition gives

$$w^* = w_0\,(1-\alpha\,M) + (1-\alpha)\,K(k) + \alpha\,\{R(1) - R(1-M)\}. \tag{6.8}$$

The formula shows that membership has a positive impact on wages.[17] Of course, this comes from the fact that higher membership reduces the firm's threat point.

The membership decision is based now on a comparison of $U^U = w + r - K(k) - c$ and $U^F = w - k$ giving the reputation for the marginal member

$$\tilde{r} = c + K(k) - k$$

with the simple interpretation that the reputation effect must compensate the sum of union fees and disutility $(-k)$ of kindness reduction less costs of being disregarded by colleagues. Evaluation of the membership decision yields

$$M = \begin{cases} 1 - (c + K(k) - k)/\Theta & \text{if } c + K(k) - k < \Theta \\ 0 & \text{otherwise} \end{cases} \tag{6.9}$$

The derivative of M with respect to k, $\partial M/\partial k = -(K'(k) - 1)/\Theta$ is positive for $K'(k) < 1$, meaning that the cost of being unfriendly for the union member is less than the harm of being treated unfriendly to nonmembers.

At the first stage of the game a democratic union maximises the utility of the median member. In the case of the uniform distribution the median reputation r^m is simply

$$r^m = (\tilde{r} + \Theta)/2 = (\Theta + c + K(k) - k)/2$$

after insertion into the utility function we obtain the first order condition

$$\begin{aligned} \frac{\partial U^m}{\partial k} &= \frac{dw^*}{dk} + \frac{\partial r^m}{\partial k} - K'(k) \\ &= -\frac{1}{2}\,(K'(k)+1) + (1-\alpha)\,K'(k) + \alpha\,\frac{(K'(k)-1)\,\{R'(1-M(k)) - w_0\}}{\Theta} \end{aligned} \tag{6.10}$$

[16] We replicate Corneo's efficient bargaining assumption here for sake of comparability.

[17] To state it formally, the derivative $\partial w^*/\partial M = \alpha\,(R'(1-M) - w_0)$ is positive for $R'(1-M) > w_0$ which is the case for the plausible assumption $w_0 \leq R'(1)$.

We will now investigate the conditions for the existence of a solution with $k^* > 0$. For the special case of equal bargaining power ($\alpha = 1/2$) we obtain (after straightforward manipulation)

$$\frac{\partial U^m}{\partial k} = \frac{1}{2\,\Theta}\left\{(1 - K'(k))\left\{R'(1 - M(k)) - w_0\right\} - \Theta\right\} \tag{6.11}$$

This derivative is strictly positive if

$$K'(k) - 1 < -\frac{\Theta}{w_0 - R'(1 - M(k))}$$

To investigate this inequality further, consider first the derivative at the right boundary of k, i.e. for the value of k solving $M(k) = 1$. If $M(k) \to 1$ then $R'(1 - M) \to \infty$ and $\Theta/(R'(1 - M) - w_0) \to 0$.[18] This implies that U^m has a positive derivative near the right boundary of k if $K'(k) < 1$. In words, increasing k is profitable if the marginal cost of disregarding free riders is lower than the (constant) marginal loss of disregard for free riders.

Now consider the opposite boundary solution $k = 0$. Substituting this into the membership and revenue function gives

$$K'(0) - 1 < \frac{\Theta}{w_0 - R'(1 - c/\Theta)}$$

At this general level of analysis nothing more can be said, except that the condition may be met for some functions $K(.)$ and $R(.)$, and values of c and Θ. I.e. it is possible that U^m is strictly increasing over the whole range of k, implying that $k^* = 1$. Of course, centralisation exerts a negative impact on wages and membership in such cases.

A closer inspection of the second order derivative shows that indirect utility U is convex for many realistic parameter values, implying the existence of corner solutions. In this case we have to compare the utilities associated with the two corner solutions.

To simplify the relevant expressions we again consider only the special case $\alpha = 1/2$. Then

$$\frac{\partial^2 U^m}{\partial k^2} = \frac{\left\{\Theta(w_0 - R'(1 - M(k))\,K''(k) - (K'(k) - 1)^2\,R''(1 - M(k))\right\}}{2\,\Theta^2} \tag{6.12}$$

Straightforward manipulation shows that U^m is convex in k if

$$K''(k) < \frac{(K'(k) - 1)^2\,R''(1 - M(k))}{\Theta\,(w_0 - R'(1 - M(k)))} \tag{6.13}$$

[18] The last implication requires that labor is a necessary input for the firm, a standard and sensible assumption.

Since the right hand side of this expression is positive, a sufficient but not necessary condition for U^m to be convex is $K(k)$ to be concave. But U^m is convex too if $K''(k)$ is 'not too large', and it is simple to construct numerical examples which meet the condition. Finally we obtain an inner solution if $K''(k)$ exceeds this limit and the first derivative $\partial U^m/\partial k > 0$ for $k = 0$.

To summarise, we have shown that functions $K(.)$ and $R(.)$, and parameter values c, Θ exist such that the k set by the union is strictly positive implying that centralisation in wage bargaining reduces k^*. The trivial rationale is that k raises U by increasing membership, which in turn strengthens the bargaining position of the union (more precisely: weakens the firms bargaining position by lowering its threat point) and raises the wage. Of course, raising k also lowers utility directly through cost $K(.)$. But this loss is outweighted by wage gains. Centralised bargaining reduces the effect of local membership on the bargained wage and therefore reduces k^*, $M(k)$ and w.

The model presented so far is only a half of the story, since it is based on the restriction $\delta = 0$. If we relax this assumption, union and firm determine k and δ simultaneously at the first stage of the game, we expect that positive as well as negative net effects of centralisation are possible.

6.4 Discussion

As noted above, central assumptions of our model are questionable and restrictive in several respects. Therefore we devote a special section for a more detailed discussion of the most crucial problems. Furthermore, we try to guess whether and how central results of the model change if they are relaxed or replaced by more realistic ones. In addition, we investigate here some qualifications of Corneo's model which are not related directly to our main argument.

Strategic Application of Reputation Effects

At the outset we have to justify the claim that social relations in general and kindness ('soft' incentives) play a significant role at all. This seems to be the simplest task here, since k is relevant if r is. In his somewhat one-sided description Olson (1965) tries to establish an intimate association of union organisation with compulsory membership and violence.[19] One has not to appeal to violence, however, since also mild social pressure and regard may exert considerable effects.

[19] Olson does not even mention violence applied by employers towards union members.

Our argument requires, however, that the level of kindness can be determined by union members and that they are willing to exploit it strategically. Though the existence of reputation effects does not necessarily imply strategic exploitation of such effects, exploitation seems to be in accordance with social norms. Unions are not an end in itself but a coalition of workers formed to bargain for fair wages and working conditions.[20] Therefore, it is not inconsistent to exploit strategic means in order to attain these ends, at least if they appear to be fair, and the means do not contradict the ends.

Furthermore we have indirect evidence for the application of social pressure on both sides. Why should workers build picket lines instead of taking advantage of striking days by enjoying leisure or indulging their hobbies? Of course, several indications suggest that social pressure is exerted by managers and free riders too. The right to keep union membership secret seems to be older than many other privacy regulations. And 'unionist' is an invective in some plants where unions don't exist or are weak. Finally, it should be clear that social norms are generated and kept alive by different degrees of sanctions and that social norms are the result of social and individual preferences.

Two problems remain. Firstly, the kindness thread is not incentive compatible, since union members reduce their utility by reducing kindness to free-riders when bargaining is over. Secondly, union strength is a collective good increasing the wage and utility of all union members. Since each union member has to bear the cost of collective action *individually*, the tragedy of the commons may destroy the argument. Among the casual evidence now several experimental studies show that people act reciprocatively (and retalitatory), i.e. they apply (and enforce) threads which are not subgame perfect *ex post*. Experimental evidence in favour of this contains Fehr et al. (1993, 1997). Furthermore, people they try to enforce public goods provision mechanisms by punishing free riders, even if punishment is costly to them, see e.g. Fehr & Gachter (2000), Fischbacher, Gachter, & Fehr (2001), Ostrom, Walker, & Gardner (1992), Keser & Winden (2000).[21] These effects, initially observed by Ostrom et al. (1992) in repeated face-to-face interaction, prevail even in one-shot stranger treatment experiments. Reputation effects can be derived in a straightforward application of the punishment mechanism. Workers consider the yields of worker organisation as a public good and therefore try to enforce it by costly punishment. Note that the punishment strategies don't increase conflicts if they are successful, since potential free

[20] We do not want to initiate a discussion on what should be considered as fair here. Instead we take fairness conceptions of workers as an empirical fact.

[21] For a general survey including related work see Fehr & Schmidt (2000).

riders can avoid punishment by joining the union. For the union membership game this means that no conflict within the workforce arises if all workers join the union. Our investigation above shows that this is the case for convex utility functions with $u|_{M(k^*)=1} > u|_{M(k^*)=0}$.

Realism of Kindness Effects Representation

As noted above, the specification of the utility loss due to disregard of colleagues is too simple. In a more realistic formulation this loss should depend on the relation of members and nonmembers in the firm. Consequently $-k$ should be replaced by $D(k, M)$. By a similar argument M should enter $K(.)$. For sake of simplicity $D(k, M)$ could be approximated by $-M\,k$.[22] If we expand the reputation component accordingly, union and free rider utilities become

$$\begin{aligned} U_i^U &= w + r_i\,M - K(k) - c \\ U_i^F &= w - k\,M \end{aligned}$$

the reputation of the marginal member then has the form

$$\tilde{r} = \frac{K(k) + c}{M} - k. \tag{6.14}$$

with implied membership function

$$M = \frac{k + \Theta - \sqrt{(k+\Theta)^2 - r\Theta(c + K(K))}}{2\,\Theta} \tag{6.15}$$

Substitution of these expressions into the utility function leads now to more complex expressions and the analysis becomes much more tedious. We give here only a short summary of the consequences of these extensions. Consider a reference situation where workers cannot apply kindness as a strategic variable, i.e. where $k = 0$. If equilibrium membership is small (say, less than 50%), then union members will face high costs if they try to put social pressure on free riders and free riders were hardly vulnerable. Thus, exerting social pressure may not be profitable and $k^* = 0$ will result. If contrarily union density is high ex ante, the relation of social pressure cost and vulnerability is reversed and $k^* > 0$.

The attentive reader may have noted that this formulation is still unrealistic in an important respect: It is not symmetric, since only union members

[22]The approximation is exakt if kindness is additive for the recipient.

actively exert social pressure and free riders are passive. In a symmetric formulation free riders could choose a kindness parameter too. Then the utility functions have the form

$$\begin{aligned} U_i^U &= w + v_i \left\{k^{UU}\, M - k^{FU}\,(1-M)\right\} - K^{UU}(k^{UU}) - K^{UF}(k^{UF}) - c \\ U_i^F &= w + v_i \left\{k^{FF}\, M - k^{UF}\,(1-M)\right\} - K^{FF}(k^{FF}) - K^{FU}(k^{FU}) \end{aligned}$$

The v_i have to be interpreted as receptivity for kindness and disregard[23], k^{ij} are the levels of kindness/disregard of members of group i towards members of group j, and K^{ij} are the associated cost functions. In the case of pairwise identical functions[24] $K^{ij}(x)$, free riders save c and therefore have a competitive advantage in the 'union density battle'. The returning puzzle of union existence can be solved in several ways. Firstly, the cost of exerting social pressure towards free riders and the cost of kindness towards members may be lower, either because union members are the more sociable types, or because they are organised. c can then be considered as a fixed cost for lowering $K^{U\cdot}(.)$. Secondly, this formulation is *too* symmetric if all workers believe in the 'usefulness' of unions. Then also free riders share this belief, but to a lesser degree, urging them to take a rather defensive position. Formally this implied that r_i has to be introduced again into U^U.

Though it may not be worthwhile to analyse these extensions in full detail, our short exploration qualifies the basic simple model in the section above. It serves as a sensible approximation to reality *only if* union membership were considerably high even in absence of strategic application of social pressure (i.e. if $k = 0$ due to exogenous constraints). Then the possibilities to exert social pressure are restricted severely for free riders making them passive.

By the way, the model could be extended (and completed) by making r_i dependent on M_i, i.e. defining a replicator function where utility from reputation depends on how many workers obey the social norm. In a dynamic context ($r_i^t = r_i^t(M_i^{t-1})$), we could then derive conditions for the erosion or persistence of the social norm in the long run.[25] We did not pursue this here, since it does not add much to the understanding of the argument here.

Unintended side effects

Reducing kindness may have (unintended) side effects on productivity. It should be clear that cooperation becomes more difficult due to conflicts be-

[23] Of course, they have a distribution as the r_i.

[24] More precisely $K^{UU}(x) \equiv K^{FF}(x)$ and $K^{UF}(x) \equiv K^{FU}(x)$.

[25] This analysis is performed in Akerlof (1980), Romer (1984) and Corneo (1996).

tween members and free riders. It is simple to see that a reduction of cooperation with free riders decreases the bargained wage. This were probably not the case if less cooperation affects only the productivity of free riders. However, then we have to check whether the firm has an incentive to lower wages for free riders. We resist the temptation to deepen this discussion. It would open Pandora's box.

It appears to be plausible that firms initiate a vitious circle by paying a bonus to free riders in a world with emotional and limited rational workers. Even if productivity effects are not intended at the outset, they may occur even at low levels of escalation. And the self-energising nature of many conflict strategies seems to be an empirical fact. Everyone knows that dog owners have to wipe the excrements of their dogs from sidewalks and playgrounds and that passengers should not throw away butts on playgrounds. But most people don't call on them to obey this rule if they catch dog owners red-handed. Parents, whose childs have digged out the excrements from the playground, behave often differently. In some cases they become even very aggressive though they know that sanctioning dog owners has no significant effect on the probability that their childs will find dog excrements again. Moral aggression is triggered if a perception threshold is exceeded. This perception threshold may be lower in local wage bargaining, since workers are more directly involved there.

Finally, note that union affiliation influences worker's perception of the labor relation, of other members and free riders. It determines the cannels of information he will use and the information filters which he will apply in future. Cognitive dissonance theory predicts that free riders will have to apply several strategies to justify their behavior in order to regain internal consistency of their mind, especially if they believe in the norm demanding support for the union. Our formal model does not account for such issues. In principle this could be tackled, see Akerlof & Dickens (1982).

Other problems with Corneo's approach

Corneo states the condition for a subgame perfect solution with a positive bonus formally, but fails to provide an assessment of whether the sufficient conditions are given in many cases. A closer look at the relevant formula of the proposition reveals, however, that the condition is not met in most cases. Consider (6.6)

$$R'(c/\Theta) > w_0 + \frac{1-\alpha}{\alpha}\, c$$

This means that the marginal revenue product of employing strike breakers $R'(c/\Theta) \equiv R'(1 - M(\delta))|_{\delta=0}$ during a strike must be above the outside wage.

This is not the case for firms where cooperation plays a significant role. In many cases production becomes unprofitable if only 20% of the workforce is missing, pushing the firm's thread point to zero.[26] Then bonus payment becomes unprofitable even with small union densities, and Corneo's argument becomes irrelevant.

A further effect reducing δ results if (union) workers have an aversion against discrimination, e.g. $u_i^U = w - r_i - c - l(\delta)$, with $l(0) = 0$ and $l'(\delta) > 0$. Even if union members cannot respond strategically to management opposition by sanctioning free riders, the contribution of $l(.)$ to the Nash product will reduce δ^*.

Last but not least, the probably most important effect in this context is a motivational one. If workers dislike discrimination, motivation will be affected negatively, *even if this motivational effect is not exploited strategically.* The implied reduction of productivity again prevents the firm from management opposition. Basically, this is a simple efficiency wage argument. Again it does not create centralisation effects but destroys them. This 'internal consistency' argument could explain why firms apparently don't discriminate if unions are established in a firm, but often try to prevent the formation of a union. As a consequence for model building, it appears more sensible to model an all-or-nothing scenario where the firm tries to discourage workers from organizing by paying them wages above the market clearing wage or slightly below the union wage.[27] But if a union is founded, the firm no longer does discriminate.

6.5 Conclusion

The shortcomings of all models discussed here (ours included) urge us to conclude with further qualifications and warnings. In principle, Corneo's as well as our arguments are drawn from thin air. Our knowledge of management opposition and union activities is too small to be a reliable guideline for model building. Corneo's model does not care for the structure of reputation effects and rests on several strong assumptions. Our main argument postulates that union members exploit kindness strategically. Probably this aspect is less important than other unintended motivational consequences of management opposition. Consequently, the main achievement of our 'smart workers model' is to show what is required in order to generate positive cen-

[26] It is evident that the linear revenue function in Corneo (1995) is used only for convenience. Anyway it is misleading, since it implies that workers can be replaced by free riders or even outsiders without adjustment cost.

[27] Lazear (1983) follows this approach in a very interesting model.

tralisation effects for firms. The other noteworthy benefit of the paper seems to be the indication that reputation effects should discussed in some detail before applying them to fill consistency gaps in union models.

The model can be interpreted as a (less satisfying) formal derivation of the common sense argument that centralisation of wage bargaining reduces conflicts and act as a 'pacifying' force. It is less satisfying since it likely captures only a secondary aspect of reputation. Other – possibly unintended – motivational effects of bargaining (i.e. the fact that local union members have to fight for wages and working conditions face-to-face with their managers) seem to me more important.

Thus the advice to be drawn from this section is to enforce quantitative *and* qualitative empirical research on industrial relations. An indirect test of Corneo's model (and the counterargument) could be performed by comparing the distribution of union membership at the firm level between centralised and decentralised bargaining institutions. Unfortunately, union density data at the firm level are not available for Germany.

Chapter 7

Conclusion

The header of this section is somewhat euphemistic: we cannot draw a clear conclusion from our investigations – at least not an unambiguous one. Theoretical reasoning cannot establish a universal 'optimum degree of centralisation'. Quite the contrary, the variety of theoretical models, dealing with a large number of possibly relevant details, at best enables us to give advice of the form *'it depends on...'* This advice is less helpful because empirical research does not deliver precise estimates of parameters *on which the results depend*. At best, empirical research delivers some *summary* information of the form 'centralisation seems to have reduced unemployment in the last twenty years, but we cannot tell why.' Though many empirical papers testing the hump-shape hypothesis pretend to check the relevance of output price externalities, they only deliver modestly stable partial correlations – without direct relation to price externalities.

Nevertheless, this investigation has attained its goal if we managed to show two points. Firstly, the diagnosis (sometimes put in a tone of utter conviction) that **de**centralised wage setting is a superior arrangement for collective wage setting is not backed up by a clear understanding of the relevant aspects of bargaining and a body of conclusive empirical evidence. Secondly, economic knowledge on centralisation of wage bargaining suffers from several blind spots, but these blind spots are not entirely god-given, but seem to persist because of prejudiced and biased research strategies. It suffices to mention two examples.

If economic investigations of centralisation issues culminate in the advice to adjust bargaining institutions, this advice is not based on a thorough investigation of the reasons why the bargaining parties are not able to realise the advantages of adjustment by themselves. E.g. the council of economic experts calls upon the government to change the legal framework for bargaining, or urges the bargaining parties to establish possibilities for individual firms

to deviate from collective agreements.[1] *But they do not ask why firms do not get rid of collective wage agreements by leaving the employers' association, why hardship clauses are not applied by firms though they were applicable, why some firms simply undercut standard wages with toleration of the workforce and the local union representatives, and why some firms (which are not members of the employers' association) nevertheless observe standard wages and fear that the general collective wage agreement could be abandoned.*[2] We think that a closer investigation of these issues would deliver some insights into the *effective* rigidity of institutions, on how complex organisations adjust to a changing environment, and how they react to influences from outside.

Again we stress Ronald Coase: "I think we should try to develop generalizations which would us give guidance as to how various activities should be best organized and financed. But such generalizations are not likely to be helpful unless they are derived from studies of how such activities are actually carried out within different institutional frameworks."

The second example concerns the custom to disregard transaction costs in theories of collective wage bargaining. They deliver a simple answer to the question 'why repeating the wage bargaining procedure in many firms again and again when differences between firms are moderate'? Unfortunately, the apparently trivial argument does not require a formal treatment, i.e. cannot pose challenges to mathematically oriented economists. On the other hand, it poses too high a challenge to empirical researchers since transaction costs, especially psychic costs, are extremely hard to quantify. These reasons explain why it is almost impossible to find even passing remarks on transaction costs in economic studies: There is no reason to talk about things which are almost unknown. Then, however, they should be added to a lengthy list of disclaimers in policy advice memoranda – but these lists are quite short or missing in many cases.

Between the blind spots, we find areas which are investigated extensively, for example macroeconometric studies of centralisation effects on unemployment. But it seems that macroeconomic studies deliver about the same information on the functioning of bargaining institutions as a look at the clock yields on the functioning of its clockwork mechanism. And even this 'outside' evidence is inconclusive. Besides that, the challenges to the standard hump-shape hypothesis, raised by theories on the interaction of centralisation and central bank independence, suggest that is was a good idea to abstain from rash conclusions.

We think that this strategy (i.e. to abstain from rash conclusions) re-

[1] See, Sachverständigenrat (2003), §462-§466.

[2] Most of these questions are asked in the empirical study Oppolzer & Zachert (2000).

mains sensible in face of the current state of our knowledge on bargaining institutions and centralisation effects, and we invite economists to take a laissez-faire attitude towards bargaining institutions, to investigate their potential to adjustment instead of trying to optimise them now *from outside* in an excessive desire for action.

Darwinian evolution theory tells us that real world evolution processes generate perfect adaption of species to their environment only in exceptional cases, and that perfectly adapted species suffer from extreme risks to die out. Everyone acquainted with genetic optimisation algorithms knows that a considerable number of suboptimal individuals in the population makes the procedure more 'creative' and protects it from being caught in local maxima. You may object that evolutionary algorithms are bad examples: They are unconscious processes, functioning without knowledge of the function to be maximised. After the stocktaking in the survey of this book, we contend that they are a not so bad approximation to the work of economics.

Appendix A

Synopsis of Some Centralisation Indicators

	OECD (1994,1997)			CD	TAR	JLN	
	CENT	COOR	COMB			UCO	ECO
Austria	2	3	3	1	1	3	3
Belgium	2	2	2	8	7	2	2
Germany	2	3	3	6	2	2	3
Denmark	3 $\searrow$ 2	3	3	4	4	3	3
France	2	2	2	11	9	2	2
Finland	3 $\searrow$ 2	2	3 $\searrow$ 2	5	6	3	3
Italy	1, 3 (92)	2, 3 (92)	1, 3 (92)	13	12	2	1
Netherlands	2	2,3 (82)	2, 3 (82)	7	6	2	2
Sweden	3 $\searrow$ 2	3 $\searrow$ 1, 2 (91)	3 $\searrow$ 2	3	4	3	3
UK	2 $\searrow$ 1	1	2 $\searrow$ 1	12	11	1	1
Switzerland	2	2	2	15	3	1	3
Norway	3	3	3	2	4	3	3
Australia	2, 1 (88)	2, 1 (88)	2, 1 (88)	10	6	2	1
Canada	1	1	1	17	7	1	1
Japan	1	3	1	14	3	2	2
New Zealand	2,1 (91)	1	2,1 (91)	9	8	2	1
USA	1	1	1	16	7	1	1

Sources: OECD (1997), Elmeskov et al. (1998), Calmfors & Driffill (1988), Layard et al. (1991).
Note: Since we present the OECD indicator values as reference for our strike incidence estimations, we report here the *recoded* values from Elmeskov et al. (1998) instead of the *original* indicator values from OECD (1994,1997). The reason is that the OECD tables show intermediate values (e.g. 2+) in some cases which 'cancel out' after recoding into three dummy variables.

Legend:
The notation $x \searrow y$ indicates a gradual change of the indicator value from x to y. The notation $x, y(z)$ indicates a 'jump' change of the indicator value from x to y in year $19z$.

Shorthands

CD	Calmfors & Driffill ranking (1988)
TAR	Tarantelli's (1986) corporatism indicator
JLN	Jackman et al. (1991)
CENT	centralisation indicator
COOR	coordination indicator
COMB	combined indicator (CENT $\cup$ COOR)
UCO	union coordination
ECO	employer coordination

Table A.1: Synopsis of some centralisation indicators

Appendix B

Empirical Evidence on Bargaining Structures

Brown & Ashenfelter (1986), Card (1986), MaCurdy & Pencavel (1986), and Bean & Turnbull (1988) try to find out with econometric methods whether efficient bargaining or right-to-manage is the more relevant bargaining structure in practice. Though their findings are in favour of efficient bargaining, a closer look at the applied empirical strategies reveals severe weakness. Let us explain.

The strategy allowing to discriminate between the both game structures is based on the fact that the wage equals marginal revenue for a right-to-manage solution and that it equals the sum of marginal revenue and the union's marginal rate of substitution between wage and employment $(u(w) - u(b))/u'(w)$ for a efficient bargaining solution (see e.g. Booth, 1995). A testable implication of this is that the outside wage b has explanatory power for marginal revenues in a regression model only if efficient bargaining applies. This can be tested (after application of some simplifying assumptions) with a reduced form wage equation. The authors above interpreted significant coefficients of the alternative wage in line with this logic as evidence in favour of efficient bargaining

This strategy is prone to several identification and specification problems. Firstly, the outside wage may become significant even in a right-to-manage solution because of specification problems (nonlinearity, incorrect specification of the union utility function, omission of relevant variables which are correlated with the outside wage).[1] Secondly, the outside wage appears also in an efficiency wage framework, and third, the outside wage can prevail also in right-to-manage solutions. One example for this is (Lockwood & Manning,

[1] Booth (1995) contain a more comprehensible discussion on pages 134–140.

1989). The outside reappears in their model because of adjustments costs for employment changes. Carruth & Oswald (1985) give another example by showing that the contract curve of efficient bargaining lies on the labour demand curve if the union maximises only the utility of *employed* members. This situation applies if unemployed members leave the union.

Appendix C

Computation of the Bootstrap and Monte Carlo Confidence bounds

Here we describe the computation of confidence bounds for Iversen's (1998, 1999) estimation results reported on page 104 in section 2.5.4.

The *long run* (or steady-state) impact of C and I on unemployment is computed from Iversen's estimated equation above as

$$\bar{u}_{cet.par.} = \frac{1}{1 - b_7} \left\{ b_1 \bar{C} + b_2 \bar{C}^2 + b_3 \bar{C} \bar{I} + b_5 \bar{C}^2 \bar{I} + b_6 \bar{I} + \bar{x} \beta \right\}$$

Because of the highly nonlinear form of the relationship, the algebraic formula (delta-method, based on a Taylor series approximation) for the computation of confidence intervals may be biased significantly (for an example see Staiger, Stock, & Watson, 1996). Therefore we use three alternative methods. (1) a wild bootstrap, (2) a monte carlo method, and (3) an algebraic formula for a static version of Iversen's model.

The bootstrap confidence bounds were computed by replicating Iversen's estimation with 10000 resamples (generated by independent draws with replacement). Coefficient and regressor values were substituted into the equation above to obtain the effect (for different values of C and I) for each replication. Confidence bounds were computet as 5% and 95% quantiles from the saved vector of impact realisations. A problem with the bootstrap procedure here is that is does not account for correlation of the residuals (see Vinod, 1993; Kim & Maddal, 1998).

This problem is not present in the monte carlo procedure. It is based on the (heteroscedasticity and panel-correlation- corrected) covariance matrix estimated from the original sample. We draw 10000 realisations from the

multinormal distribution of this matrix and compute the nonlinear effect in each replication. The computation of confidence bounds is then analogous to the bootstrap case.

As an additional check, we compute confidence bounds from a static specification, i.e. we estimate Iversen's equation after elimination of the lagged endogenous variable.[1] With the static version, the denominator $1 - b_7$ in the impact formula above drops out, and the remaining effect is linear *in the coefficients*. This allows us to compute the standard deviation of the effect by the formula

$$\sqrt{z' \Sigma_b z}$$

with $z = (C, C^2, C\,I, C^2\,I)$ and the variance-covariance matrix Σ_b of the coefficients $b = (b_1, b_2, b_3, b_4)$. As can be seen from the graphs in figure 2.1, the change of the specification leads to moderate changes of the point estimates. The estimation of the confidence bounds, however, appears to be quite robust.

As a qualification we should note that the graphs for accommodating and non-accommodating monetary policy relate to values of the independence indicator one standard deviation below and above of the indicator's mean for the sample. The mean of the index is 0.43 and the standard deviation 0.21. The range of the indicator in the sample (i.e. the realised values) is $[0.035; 0.98]$. The regimes (mean $\pm$ one standard deviation) represent already nearly *polar* cases, since the 10% quantile and 90% quantile of the empirical distribution of I in the sample are 0.2 und 0.6, respectively. Since the shapes and locations of the graphs above respond only slightly to changes of I, choice of somewhat more distant regimes (for example mean $\pm$ one 2 standard deviations) would have minor impact on the outcomes and interpretation of Iversen's empirical model.

[1] This should have no severe detrimental effects on inference, since we account for serial correlation of the residuals by application of the Prais-Winsten transformation.

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