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Boris Hirsch
University of Erlangen-Nuremberg

Claus Schnabel
University of Erlangen-Nuremberg

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Let's Take Bargaining Models Seriously:

The Decline in Union Power in Germany, 1992–2009*

Boris Hirsch and Claus Schnabel[a]

Abstract: Building on the right-to-manage model of collective bargaining, this paper tries to infer union power from the observed results in wage setting. It derives a time-varying indicator of union strength and confronts it with annual data for Germany. The results show that union power was relatively stable in the 1990s but fell substantially (by almost one-third) from 1999 to 2007. Two-thirds of this fall in union power follow from the reduction in the labour share relative to the capital share whereas changes in the gap between the net wage and the income when unemployed account for the remaining third.

Zusammenfassung: Dieser Beitrag versucht unter Verwendung des „right-to-manage"-Modells kollektiver Verhandlungen aus den beobachteten Lohnabschlüssen auf die entsprechende Gewerkschaftsmacht zurückzuschließen. Wir leiten einen zeitvarianten Indikator gewerkschaftlicher Stärke her und berechnen ihn mit Jahresdaten für Deutschland. Die Ergebnisse deuten darauf hin, dass die Gewerkschaftsmacht in den 1990er Jahren relativ stabil war, aber von 1999 bis 2007 deutlich (um fast ein Drittel) zurückging. Zwei Drittel dieses Rückgangs der Gewerkschaftsmacht gehen auf eine Verringerung der Lohnquote relativ zur Kapitaleinkommensquote zurück, während Veränderungen im Abstand zwischen dem Nettolohn und dem Einkommen bei Arbeitslosigkeit für das restliche Drittel verantwortlich sind.

Keywords: trade union power, wage bargaining, labour share, Germany

New JEL-Classification: J50, J51

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[a] University of Erlangen–Nürnberg, Chair of Labour and Regional Economics, Lange Gasse 20, 90403 Nürnberg, Germany, email: boris.hirsch@wiso.uni-erlangen.de; claus.schnabel@wiso.uni-erlangen.de

1 Introduction

In the last two decades, Germany has been characterised by a number of trends and developments which seem to suggest that trade union power has faded: Wages and unit labour costs have risen less than in other countries (see Schulten, 2008; Joebges *et al.*, 2009), real net wages have even fallen in some years (Horn *et al.*, 2008), and the labour share in national income has been reduced (Arpaia *et al.*, 2009). In addition, union membership and density have fallen substantially and bargaining coverage shows clear signs of erosion (Addison *et al.*, 2007; Ellguth and Kohaut, 2010).

While most observers might agree that these developments can be interpreted as indications of organised labour's limited success in achieving its goals, there is no generally accepted indicator of trade union power. To be sure, there exists a large and controversial literature on the concept and measurement of union militancy and power that can at the least be traced back to Chamberlain (1951).[1] But this literature has not resulted in a widely accepted concept of union power, influence, or strength. While some consensus has been achieved that a good indicator should be based on objective data (rather than subjective judgements), it has proved difficult or even impossible to develop an indicator that is unambiguously an index of union power or militancy and not capable of other interpretations (e.g., as a proxy for employer resistance in wage bargaining).

In the following, we therefore do not attempt the impossible, i.e. deriving an indicator that is only sensitive to variations in the degree of independent pressure exerted by trade unions. We rather take a well-known bargaining model seriously and attempt to infer the strength and power of the labour movement by drawing conclusions from its success in wage bargaining and wage setting. In doing so, we

[1] Building on insights and concepts by Hicks, Pigou, Commons, Dunlop, and others, Chamberlain (1951) defined union bargaining power by the ratio of the expected costs of disagreement with its terms for the employer to his expected costs of accepting them, but this ratio depends on subjective estimates and usually can hardly be measured. For detailed discussions on the concept and measurement of trade union militancy and power, see Purdy and Zis (1974), Armstrong *et al.* (1977), and Hirsch and Addison (1986, pp. 220–224). Recently, Pencavel (2009) has proposed a measure of union success or welfare that combines union density and the relative union–nonunion wage gap.

satisfy the requirement for a good indicator deemed most important by Purdy and Zis (1974, p. 47), namely that it 'should be justified in terms of a reasonably well formed theory of wage determination', in such a way overcoming one crucial deficit of existing indicators of union power (such as the labour share or union membership). Building on the right-to-manage model of collective bargaining by Nickell and Andrews (1983), which can be regarded as an adequate representation of wage bargaining in Germany, we try to infer the value of the union bargaining power parameter from the results in wage setting, taking account of further variables of interest such as taxation, unemployment benefits, and the labour market situation. We then confront our model with annual data for Germany and are able to calculate a time-varying index of union strength for the years 1992 to 2009. This index will show that union power has fluctuated substantially in Germany, exhibiting a marked fall in recent years.

Our paper fills a gap in the literature in that it derives an easily computable and time-varying indicator of union strength from a widely used bargaining model that takes account of the fact that in most European countries bargaining is over wages only whereas management retains the right to set employment unilaterally. We thus improve upon previous attempts of measuring union power that either used an efficient bargaining model assuming simultaneous bargaining over wages and employment (McDonald and Suen, 1992), tried to distinguish between bargaining power over wages and over employment (Sanfey, 1993), or estimated the union bargaining parameter econometrically by making strong exogeneity assumptions (Doiron, 1992) and constraining this parameter to be constant over time (Svejnar, 1986). Furthermore, by taking into account institutional factors such as taxation and unemployment insurance our approach gives a richer and more informative picture than standard one-dimensional proxies of union strength like the labour share or union density.

The outline of the paper is as follows: In Section 2 we sketch the institutional background of wage setting in Germany and develop our theoretical model. The

implementation of the model with data from Germany is described in Section 3. Section 4 presents the empirical results of our investigation, and Section 5 concludes.

2 Institutional Background and Economic Modelling

In Germany, the constitutionally protected principle of bargaining autonomy gives trade unions and employers the right to regulate wages and working conditions without state interference. Collective agreements are legally binding and may be concluded either as multi-employer agreements at sectoral level or as single-employer agreements at firm level.[2] Unlike the situation in the UK or the US, collective bargaining in Germany is still mainly conducted at the sectoral level between a single union and an employers association. Although sectoral negotiations mostly take place in regional bargaining units, the regional negotiations within one sector are closely coordinated by the officials of the appropriate sectoral trade union and employers association, so that variations between them are small. There is even a measure of cross-sectoral coordination by unions and employers, which has resulted in some uniformity in collective bargaining policy. Collectively agreed norms are minimum terms (and substitute for the lack of a legal minimum wage in Germany). This means that firms bound by (sectoral or firm-level) collective agreements cannot undercut, but only improve upon these terms and conditions. While a minority of firms do pay higher wages than stipulated in the collective agreements (for details on this wage cushion, see Jung and Schnabel, 2011), for most employees the wages set in collective agreements are of crucial importance, affecting the level and development of their actual wages. Despite a fall in bargaining coverage in the last decade, in 2009 still more than 80 percent of employees in Germany were directly or indirectly covered by the results of collective bargaining (see Ellguth and Kohaut, 2010, Table 1).

Collective bargaining in Germany takes place over a number of issues. It

[2] In addition, firms have the right not to conclude collective agreements, in which case they make use of individual contracts with their employees. About 50 percent of these individual contracts, however, use sectoral collective agreements as a point of reference (see Ellguth and Kohaut, 2010).

predominantly concerns wages, which usually are negotiated annually, but also determines job classifications, working time, and working conditions (over longer periods of time). Employment, however, is typically not a bargaining issue in Germany, not least since it would be almost impossible to set employment levels for individual firms in the sectoral multi-employer agreements which predominate.[3] This is in accordance with international evidence suggesting that typically 'unions and firms do not bargain simultaneously over wages and employment' (Booth, 1995, p. 128). In multi-employer as in single-employer agreements in Germany, firm management retains the right to determine employment unilaterally. This suggests that the right-to-manage model (as proposed by Nickell and Andrews, 1983), in which a single union and an employer (or employers association) bargain over wages and the firms are then free to choose any employment level at this bargained wage, is likely to fit the institutional setting in Germany better than alternative models such as the efficient bargaining model.

We therefore start by setting out a simple right-to-manage model that serves as the backbone of our following analysis of union bargaining power. Consider a labour market consisting of a representative union and a representative employer engaged in collective bargaining. Assume first that the union is a utility maximiser, where its utility function $U(\omega, L)$ is both strictly increasing in the net wage paid to its members ω and in the level of employment L among its members. More specifically, we assume utilitarian union preferences

$$U(\omega, L) = L\omega + (1 - L)z = L(\omega - z) + z, \tag{1}$$

where z is the (expected) income when unemployed, the overall labour supply is normalised to unity, and every worker is supposed to be a union member.[4] The union

[3] Even in single-employer agreements at the firm level it is very rare to find instances of union–firm bargaining over both wages and employment. Some exceptions are the employment pacts (or 'alliances for jobs') negotiated in recent years in some large firms which sometimes include limitations in pay increases in exchange for employment guarantees. For more details on employment pacts we refer to Bellmann *et al.* (2008).

[4] The latter is assumed merely for convenience. If only a part of the working population was unionised, the same results would follow as long as union membership is exogenously given.

thus maximises its utility by maximising the overall income of both employed and unemployed (unionised) workers. Since U is linear in the net wage and the income when unemployed, this implies that the unions assumes workers to be risk neutral and thus maximises their expected income. For simplicity we consider a linear tax system, so the net wage ω is

$$\omega = w(1 - \tau_w), \tag{2}$$

where w is the gross wage and τ_w the sum of the income tax rate and the part of the payroll tax rate paid by workers.

Next, turn to the employer. The employer is assumed to use a constant-returns-to-scale Cobb-Douglas production technology. Its revenue function is

$$Y(K, L) = pL^{\alpha}K^{1-\alpha} \tag{3}$$

with the (exogenous) product price p, the labour and capital inputs L and K, respectively, and the output elasticity of labour α, where $0 < \alpha < 1$. For expositional convenience, we normalise in the following both p and K to unity.[5] The employer's profits are thus given by

$$\Pi(w, L) = Y(L) - w(1 + \tau_f)L - i, \tag{4}$$

where $Y(L) = L^{\alpha}$, τ_f is the part of the payroll tax rate levied from the employer, and i is the interest rate.

Now, turn to the wage bargaining in our simple right-to-manage model. In a first step, the union and the employer (or an employers association) are assumed to bargain over their joint surplus to determine w. After that, the employer is

However, things will differ if union membership and wages are simultaneously determined (e.g., Booth and Chatterji, 1995), so that the union will account for the consequences of its bargaining behaviour on membership development.

[5] Note that the assumption of an exogenously given price is consistent both with perfect competition and monopolistic competition (with a constant markup on marginal cost) on the goods market.

free to choose any employment level at this bargained wage. Obviously, he will choose an employment level that maximises his profits. For any given level of labour cost $w(1+\tau_f)$, the employer's employment level thus will lie on his labour demand schedule, which corresponds to the marginal revenue product of labour. Algebraically, the labour demand curve is thus given by

$$L^d[w(1+\tau_f)] = \left(\frac{\alpha}{w(1+\tau_f)}\right)^{\frac{1}{1-\alpha}}. \tag{5}$$

In the preceding wage bargaining, both parties take the employer's labour demand behaviour represented by equation (5) as given. The (gross) wage bargained w^* is assumed to follow from a generalised Nash bargaining solution. When no agreement is reached, the union's utility is z, which is the utility level – see equation (1) – when no worker is employed, whereas the employer's profits are $-i$, i.e. his fixed capital costs. Therefore, the union's net gain in the bargaining is the economic rents of its members, while the employer's net gain is the difference between his revenues and his variable costs. Accounting for the firm's optimal labour demand behaviour as given by equation (5), the Nash maximand becomes

$$\Omega(w) = \Big\{L^d[w(1+\tau_f)][w(1-\tau_w)-z]\Big\}^{\mu}\Big\{Y[L^d(w(1+\tau_f))]-w(1+\tau_f)L^d[w(1+\tau_f)]\Big\}^{1-\mu} \tag{6}$$

with $0 \leqslant \mu \leqslant 1$, which serves as a measure of the bargaining strength of the union. The bargained wage $w^* = \underset{w}{\operatorname{argmax}}\,\Omega(w)$ now solves the first-order condition $\Omega'(w^*) = 0$.[6]

Given w^* and the other parameters included in the Nash maximand (6), instead of solving $\Omega'(w^*) = 0$ for w^* we can alternatively solve it for μ to arrive at the implied bargaining power of the union. Doing this yields (for a full derivation, see

[6] This solution means that the union takes the income when being unemployed z as exogenously given and not to be influenced by the bargaining outcome. This notion is consistent with a general equilibrium in an economy consisting of many identical employer–union pairs that take outside options as given.

Appendix A)

$$\mu = \frac{\alpha}{1-\alpha}\frac{w^*(1-\tau_w)-z}{z}. \tag{7}$$

To grasp an intuition of equation (7), first note that labour cost equals the marginal revenue product of labour since we have a solution on the employer's labour demand curve – though at a lower level of employment compared to perfect competition. Hence, Euler's theorem applies, and α represents the labour share whereas $1-\alpha$ gives the capital share. Union power therefore depends, on the one hand, positively on the importance of the labour share relative to the capital share. In this sense, part of the union's bargaining strength is accounted for by just looking at the labour income share which has often served as a traditional proxy for union power. On the other hand, μ also depends positively on the gap between the net wage bargained and the income when unemployed and thus is influenced by all factors – including institutional factors – governing this gap.

3 Implementation of the Model

In order to implement the model and infer the union's bargaining strength from the data, it is useful to add some more structure to the model. This allows us to gain additional insight into the factors influencing the income when unemployed z and thus the determinants of union power. We follow Layard *et al.* (1991, p. 145) by imposing a simple search-theoretic structure. In every period, unemployed workers are assumed to search for a job and to receive unemployment benefits b. Suppose that (acceptable) job offers arrive with some exogenous probability λ. In a stationary environment, the value of being unemployed V_u is then given by

$$V_u = \frac{1}{1+r}[b + \lambda V_e + (1-\lambda)V_u] \tag{8}$$

with the worker's discount rate r. Equation (8) holds as the unemployed worker receives unemployment benefits b and finds a job yielding the value of being employed

V_e with probability λ, while he or she stays unemployed with converse probability $1-\lambda$ achieving the value of being unemployed V_u. Assume further that all jobs pay the bargained gross wage w^*, and workers are laid off at some exogenous probability δ. Then, the value of being employed is

$$V_e = \frac{1}{1+r}[w^*(1-\tau_w) + (1-\delta)V_e + \delta V_u]. \tag{9}$$

Equation (9) reflects that the employed worker receives the net wage $w^*(1-\tau_w)$ and is laid off with probability δ yielding the value of being unemployed V_u, while he or she stays in the job with the converse probability $1-\delta$ and achieves the value of being employed V_e.

Combining equations (8) and (9) and solving for rV_u, the (flow) income when unemployed $z = rV_u$ is

$$z = \frac{r+\delta}{r+\lambda+\delta}b + \frac{\lambda}{r+\lambda+\delta}w^*(1-\tau_w) = b + \frac{\lambda}{r+\lambda+\delta}[w^*(1-\tau_w) - b], \tag{10}$$

i.e. a weighted average of unemployment benefits b and the net wage $w^*(1-\tau_w)$. Since in a steady-state environment the unemployment rate u is not changing, that is the flow into unemployment $\delta(1-u)$ equals the flow out of unemployment λu, we have $\delta = \lambda u/(1-u)$. Plugging this into equation (10), the expected income when unemployed becomes

$$z = b + \frac{1-u}{d(1-u)r+1}[w^*(1-\tau_w) - b], \tag{11}$$

where $d \coloneqq 1/\lambda$ gives the average unemployment duration.

Together, equations (7) and (11) allow us to infer the implied bargaining power μ of the union from data on (i) the labour share α, (ii) the net wage $w^*(1-\tau_w)$, (iii) unemployment benefits b, (iv) the steady-state unemployment rate u, (v) the average unemployment duration d, and (vi) the worker's discount rate r.[7] While

[7] Note that our assumption of a steady-state environment means that equation (11) is only valid as long as unemployment is not changing too rapidly, for otherwise the steady-state

the labour share represents technological factors determining the importance of labour in production, factors related to the economic and institutional environment, such as taxes, benefit generosity, structural unemployment etc., are captured in the other variables that determine the gap between the net wage and the income when unemployed. Hence, the development of the implied union bargaining strength μ should provide a richer and more informative picture than the standard look at the labour share.

The data used stem from a variety of sources and are calculated as follows: Labour share data (corrected for structural change by holding employment shares constant) are provided by the Federal Ministry of Labour and Social Affairs (2010). Data on average unemployment compensation per month are published by the Federal Employment Agency (2010). Correspondingly, we use net monthly wages per employee, which are taken from the National Accounts.[8] We deflate both series by the consumer price index of the Federal Statistical Office. The steady-state unemployment rate is approximated by applying a Hodrick–Prescott filter (with the usual smoothing parameter of 100) to the annual data for the unemployment rate published by the Federal Employment Agency (2010). Average unemployment duration is calculated using the data provided and the formula suggested by the Federal Employment Agency (2010, p. 36). The worker's discount rate is set at the conventional value of 0.05.[9]

4 Results

Figure 1 presents values for μ based on equations (7) and (11) and calculated using the annual data described above, which are available for the period 1992 to 2009.

approximation may work poorly.

[8] We thus have to use actual (or effective) wages rather than the bargained wages referred to in our theoretical model since data on the latter only exist in form of an index (but not in absolute values that are required for comparison with unemployment compensation); the consequences of this limitation are discussed below.

[9] Note that our results are not sensitive to choosing a different discount rate or to the way we approximate the steady-state unemployment rate. Applying different filters to the unemployment rate, utilising the NAIRU estimates provided by D'Auria *et al.* (2010), or using the actual unemployment rate does not affect our results substantially.

From the solid line it can be seen that union power in Germany was relatively stable in the 1990s with a slight peak in 1999. From 2002 to 2007, it fell substantially (by almost one-third), but has somewhat recovered since.

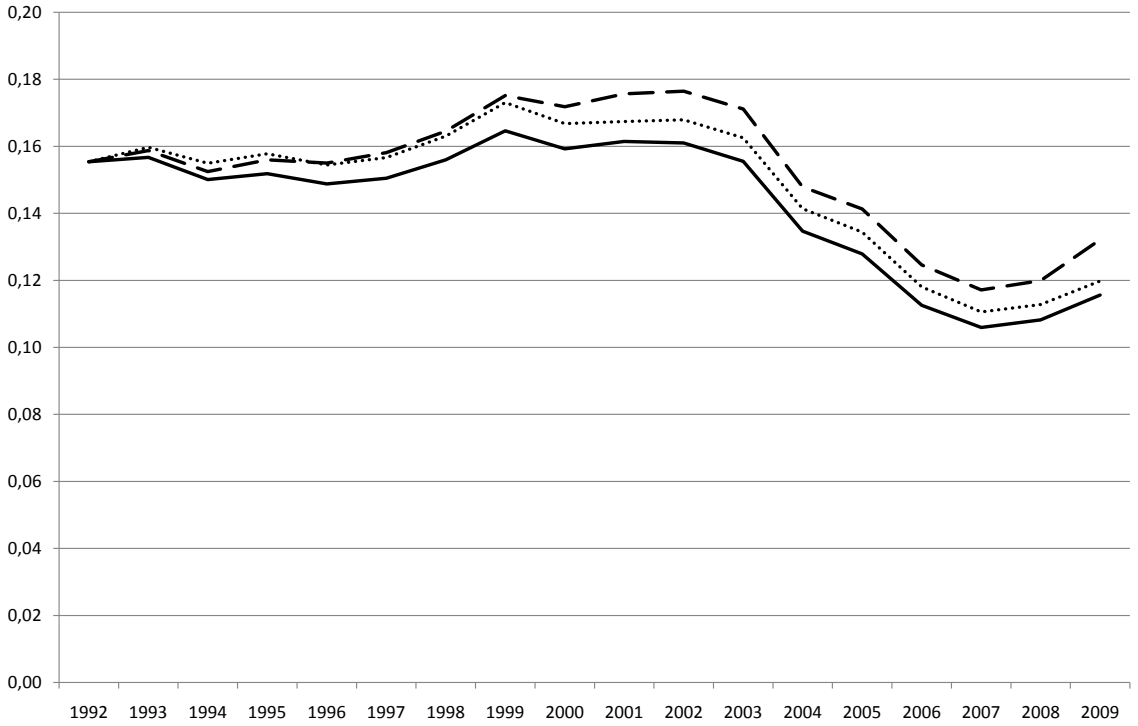

Figure 1: Union power (solid: calculated according to equations (7) and (11); dashed: corrected for changes in working hours; dotted: corrected for wage drift)

In order to take account of certain limitations of our data, we also present two alternative calculations of union power that can be regarded as a sort of robustness check. First, since we are only able to use monthly but not hourly wage data (because the corresponding unemployment compensation is only available per month), it could be argued that changes in working time also play a role for monthly wages. Average working hours per employee have fluctuated and have fallen substantially (by about 10 percent) in our period of observation. Taking crudely account of this by keeping working hours constant at their 1992 level results in the dashed line in Figure 1. While this line lies above the solid line, a similar pattern emerges, with union power being fairly high between 1999 and 2002, and then falling substantially until 2007.

Second, it is an open question whether union power should be assessed by looking

at the direct results of collective bargaining (i.e. bargained wages for those employees covered by collective agreements) or by looking at actual wages, which is what all employees in fact are paid. Whereas the first concept is closer to bargaining power in the strict sense of our theoretical model, the latter concept is wider, allowing for spillover effects (i.e. that employers not bound by collective agreements are also influenced by these when setting wages) and taking into account that even employers bound by collective agreements may not fully pass on bargained wage increases (if they have a wage cushion of higher wage levels than stipulated in collective agreements that can be reduced). As noted above, we have to use actual wages rather than the bargained wages referred to in our theoretical model since data on the latter only exist in form of an index but not in absolute values that are required for comparison with unemployment compensation. If changes in bargained wages usually transform almost exactly in changes in actual wages (as found for annual data in the cointegration analysis by Schnabel, 1997), this limitation is not serious. Note, however, that some negative wage drift seems to have occurred in recent years (i.e., actual wages for all employees rising less than bargained wages for employees covered, for instance because not all employers are bound by collective agreements). In this case, our indicator above relying on effective wages might overestimate the fall in union bargaining power. While in principle wage drift could be calculated using existing indices of (changes in) actual and bargained wages, the data bases of these indices are very different, and serious methodological problems suggest to be very cautious in interpreting such wage drift results (for details, see Schnabel, 1997, pp. 134–136). Nevertheless, we try to take account of wage drift by calculating the ratio of the Bundesbank index of bargained hourly wages and of an index of actual average hourly wages (obtained from the National Accounts) and correcting the actual wage used in our calculations accordingly. This exercise results in the dotted line in Figure 1. As expected, this line lies above the solid line, but the pattern is quite similar, with union power reaching a high in 1999, and then falling substantially until 2007.

It might be interesting to identify the driving forces between these developments. Recall that according to equation (7), union power μ depends positively on two factors: on the importance of the labour share relative to the capital share (i.e. $\alpha/(1-\alpha)$), and on the gap between the net wage and the income when unemployed (i.e. $[w^*(1-\tau_w)-z]/z$). The relative contribution of these two factors to the annual changes in the power index shown in Figure 1 can be calculated, and it is found to vary considerably from year to year. On average, in the period 1992 to 2009, changes in both factors contributed almost equally to the annual changes in the union power index observed: changes in the labour share relative to the capital share were responsible for 48 percent of the variation in the union power index, whereas changes in the gap between the net wage and the income when unemployed explain the remaining 52 percent. A closer look reveals that the small rise in union power observed in the period 1992 to 1999 was almost exclusively the result of increases in the gap between the net wage and the income when unemployed, whereas two-thirds of the fall in union power from 1999 to 2007 follow from the reduction in the labour share relative to the capital share. The small rise in our indicator of union power during the 'Great Recession' in 2008/09 is solely driven by an increase in the labour share (relative to the capital share) reflecting special circumstances: Due to massive government intervention (such as short-term work and fiscal stimuli) employment and the wage bill decreased less than expected given the size of the recession and also less than capital income.

Interestingly, union power remained relatively stable during the conservative-liberal coalition government of chancellor Helmut Kohl, which was in power until 1998 and was not regarded as particularly union-friendly. In contrast, the substantial fall in union power observed later started when a seemingly more pro-union coalition government led by the social-democratic chancellor Gerhard Schröder was in power (until 2005). Against massive union opposition, this government introduced the so-called 'Hartz reforms' aimed at improving labour market dynamics in Germany which became effective in three steps in the years 2003 to 2005 (for details, see, e.g.,

Fahr and Sunde, 2009). The impact of these reforms is ambiguous in our model: On the one hand, reductions in the availability and generosity of unemployment benefits b decrease the income when unemployed z. On the other hand, improved labour market prospects (i.e. a shorter average duration d and a lower incidence u of unemployment) increase z. Overall, z slightly decreased from 2004 onwards, but net wages fell even more, partly reflecting union wage moderation. Whereas this results in a fall of union power μ, it only accounts for one-third of the total reduction in union power (as pointed out above). The remaining two-thirds are due to the exceptionally steady fall in the labour share in Germany from 2000 to 2007 which occurred not only in an upswing but also during the preceding recession. While Arpaia *et al.* (2009, p. 2) show that 'labour share movements are driven by a complex interplay of demand and supply conditions of capital and different skill categories of labour, the nature of technological progress and imperfect market structures', the relative importance of these forces for the fall of the labour share in Germany is an open question and beyond the scope of this paper.

5 Conclusions

Building on the right-to-manage model of collective bargaining, which can be regarded as an adequate representation of wage bargaining in many European countries, we have tried to infer the value of the union bargaining parameter from the observed results in wage setting. We have derived a time-varying indicator of union strength and confronted it with annual data for Germany from 1992 to 2009. The results make clear that union power was relatively stable in the 1990s but fell substantially (by almost one-third) from 2002 to 2007.

Our analysis is open to some criticism. From a theoretical point of view, although the assumptions of a Cobb-Douglas production technology, a linear tax system, and a steady-state environment are pretty standard in the literature, they may be regarded as quite restrictive. Moreover, our analysis is based on the assumption

that the equilibrium outcome lies on the labour demand curve.[10] Empirically, it may be questioned whether an aggregate analysis is really the best way to investigate union power, but unfortunately disaggregate data of the sort needed in our framework (in particular net wages and unemployment benefits) are not available for Germany. Another data-related problem is that we have to analyse actual rather than bargained wages. Yet, this can also be seen as an advantage since it reflects a wider concept of union power and influence allowing for spillover and wage drift effects of bargained wages. Nevertheless, given suitable data it would of course also be interesting to analyse bargained wages and thus get a better understanding of union bargaining power in a narrower sense. For this sort of exercise, the sectoral level would seem to be the most appropriate level of analysis.

While it would be interesting to extend the analysis to micro data, even an aggregate analysis of the type presented here does have some advantages over previous attempts to measure union power. It is based on an established theory of wage determination, it takes account of factors such as taxation, unemployment benefits, and the labour market situation, and it is more informative than just looking at the labour income share, union density, or bargaining coverage. A case in point is that the substantial reduction in the labour share does only explain two-thirds of the fall in union power in Germany observed after 1999, whereas changes in the gap between the net wage and the income when unemployed account for the remaining third.[11] Given that in many countries the labour share has fallen and the punch of the labour movement seems to have weakened in recent years, a comparative analysis across European countries with right-to-manage bargaining may be a promising avenue of future research.

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[10] This assumption may not be that restrictive given that some theoretical papers show that efficient outcomes may also lie on the labour demand curve and that the (mostly Anglo-Saxon) empirical evidence on this point is inconclusive (for an overview, see Booth, 1995, pp. 134–141). What is more, the institutional setting in Germany clearly justifies making such an assumption.

[11] Note also that our indicator of union power is positively but not perfectly correlated with the other traditional one-dimensional proxies. The respective correlation coefficients are 0.66 for union density and 0.80 for multi-employer bargaining coverage.

A Derivation of Equation (7)

In order to derive expression (7) for union bargaining power μ, we first derive the first-order condition of $\max_w \Omega(w) = \max_w \ln \Omega(w)$ with $\Omega(w)$ as given by equation (6), where the logarithmic transformation substantially eases the following steps. Plugging $Y(L) = L^\alpha$ and $L^d[w(1+\tau_f)] = [\alpha/w(1+\tau_f)]^{1/(1-\alpha)}$ into (6), the problem $\max_w \ln \Omega(w)$ gets

$$\begin{aligned}
&\max_w \Bigg\{ \mu \ln \left[\left(\frac{\alpha}{w(1+\tau_f)} \right)^{\frac{1}{1-\alpha}} [w(1-\tau_w) - b] \right] \\
&\qquad + (1-\mu) \ln \left[\left(\frac{\alpha}{w(1+\tau_f)} \right)^{\frac{\alpha}{1-\alpha}} - w(1+\tau_f) \left(\frac{\alpha}{w(1+\tau_f)} \right)^{\frac{1}{1-\alpha}} \right] \Bigg\} \\
&= \max_w \Bigg\{ \mu \ln \left[\left(\frac{\alpha}{1+\tau_f} \right)^{\frac{1}{1-\alpha}} \left[w^{-\frac{\alpha}{1-\alpha}} (1-\tau_w) - w^{-\frac{1}{1-\alpha}} b \right] \right] \\
&\qquad + (1-\mu) \ln \left[(1-\alpha) \left(\frac{\alpha}{w(1+\tau_f)} \right)^{\frac{\alpha}{1-\alpha}} \right] \Bigg\}.
\end{aligned} \tag{A.1}$$

After some straightforward simplifications on the first-order condition of problem (A.1) the bargained wage w^* is implicitly given by

$$\frac{\mu\left(\frac{1}{1-\alpha} b - \frac{\alpha}{1-\alpha} w^*(1-\tau_w)\right)}{w^*(1-\tau_w) - b} - (1-\mu)\frac{\alpha}{1-\alpha} = 0. \tag{A.2}$$

Solving (A.2) for μ yields (7). □

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