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Risk Aversion and Trade Union Membership

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Risk Aversion and Trade Union Membership*

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Abstract

In an open-shop model of trade union membership with heterogeneity in risk attitudes, a worker's relative risk aversion can affect the decision to join a trade union. Furthermore, a shift in risk attitudes can alter collective bargaining outcomes. Using German panel data (GSOEP) and three novel direct measures of individual risk aversion, we find evidence of a significantly positive relationship between risk aversion and the likelihood of union membership. Additionally, we observe a negative correlation between bargained wages in aggregate and average risk preferences of union members. Our results suggest that an overall increase in risk aversion contributes to wage moderation and promotes employment.

JEL Classification: J 51
Keywords: employment, membership, risk aversion, trade union

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1. Introduction

Trade unions provide public goods, such as wages above the market-clearing level or improvements in working conditions. The basis for achieving such outcomes is a powerful bargaining position. In the context of collective negotiations, union strength is often viewed as being determined by the size of its membership. However, an individual will only join a trade union if this makes him better off. Therefore, in the absence of a closed-shop and given the public good characteristic of many union-provided goods, trade unions also have to supply excludable goods solely to its members to entice workers to join. When deciding whether to become a trade union member, a worker will compare the costs—such as the membership fee—with the gain, for example, from the consumption of the excludable good provided by the trade union. The evaluation of costs and gain depends on individual preferences and is likely to vary with risk attitudes. However, the link between individual risk preferences and union membership is largely unexplored. This is challenging as individual membership decisions lead to variations of union density and bargaining power. In addition, such decisions might directly influence union preferences. Accordingly, knowledge of the relationship between risk attitudes and union membership can help to ascertain how collective negotiations are influenced by changes in the distribution of individual risk preferences. Such changes can, for example, result from a composition effect due to an increase in the shares of older or of female workers who are found to be more risk averse than their younger or male counterparts (e.g. Dohmen, Falk, Huffman, Sunde, Schupp, and Wagner 2005, Sahm 2007).

The analysis in this paper is based on an open-shop union model in the tradition of Booth (1985) and Booth and Chatterji (1995). We assume that a worker's willingness to pay for the private good which union membership entails varies with risk preferences. This establishes a relationship, albeit an ambiguous one, between risk aversion and the net gain from union membership. In the literature on open-shop models—surveyed, for example, by Schnabel (2003)—few papers have explicitly incorporated notions of risk aversion. These contributions assume workers to be heterogeneous with respect to the valuation of a union-provided good but do not allow for variations in individual risk attitudes, as is the case in our investigation. We also analyse the effect of risk aversion on bargained wages which is, again, theoretically indeterminate. The link between an individual's level of risk aversion and union membership status and the implications for collective bargaining outcomes are, hence, largely empirical issues. Using data from the German Socio-Economic Panel (GSOEP), a nationally representative longitudinal survey, containing a novel set of direct measures of individual risk attitudes, we empirically explore the impact of risk attitudes on union membership. To the best of our knowledge, no such investigation has been undertaken to date. We find that a worker is

more inclined to be a trade union member the more risk-averse he is. In addition, we analyse the correlation between aggregated wages and average risk preferences of union members. Our results suggest that an overall increase in risk aversion contributes to wage moderation and promotes employment.

In summary, this paper makes three contributions: First, it provides a theoretical analysis of the impact of a worker's risk attitude on the propensity to join a union, and the consequences for collective bargaining outcomes. Second, it offers an explicit empirical test of the membership effect of individual risk preferences. Third, it provides evidence on the wage effects of changes in risk preferences of union members. The paper unfolds as follows: Section 2 sets out the model of endogenous union membership. The analysis features one open-shop trade union and one firm. Section 3 contains the description of the data and our empirical specification. In Sections 4 and 5 we present the empirical results, while Section 6 summarises our findings.

2. Risk Aversion, Endogenous Union Membership, and Wage Bargaining

To investigate the relation between risk aversion and trade union membership we focus on the employment risk, because excessive wage claims are essential ingredients of trade union models. The framework is based on the German institutional setting in which there is no differential treatment of workers according to union membership status. Thus, a union wage premium or a lower dismissal probability cannot help to overcome the free-riding problem. Accordingly, the individual employment status is independent of union membership. The risk attitude then describes how an individual evaluates the income variation in different employment situations. Since our empirical proxies for risk mainly refer to variations in monetary payoffs, the theoretical approach provides a close match to the empirical application.

A number of previous contributions have related risk attitudes, union membership and collective bargaining outcomes by way of an insurance motive. In particular, trade unions have been assumed to insure their members against income variations (Agell and Lommerud 1992, Burda 1995) or to lower the probability of an arbitrary dismissal (Blanchflower, Crouchley, Estrin and Oswald 1990 and Moreton 1998, 1999). However, in open-shop settings, in which the membership decision is endogenous, a reduction in income variability represents a public good and provides no incentive for an individual to voluntarily join a trade union. Additionally, the assumption of offering insurance against arbitrary dismissal is not consistent with the institutional set-up in Germany from where our data stem.

Membership Decision

To generate an incentive to join the trade union, it is assumed that the union provides a private (i.e. excludable) good which each member consumes with certainty. This good may consist of legal advice, provision of insurance- or pension-plans at lower prices than available elsewhere, or of job-related information. Alternatively, members may conform to a social norm of being a trade union member. The nature of the private good is irrelevant for the analysis and will, hence, not be specified in detail. Let total utility be additively separable in the utility from income and from the private good. The utility from income is given by $w^{(1-\sigma_i)}/(1-\sigma_i)$ for $0 < \sigma_i \neq 1$ and by $\ln(w)$ for $\sigma_i = 1$, where w represents the wage and σ_i worker i's constant Arrow-Pratt measure of relative risk aversion. Our subsequent exposition focuses on the case of $\sigma_i \neq 1$. The measure of relative risk aversion is distributed on the interval $[\sigma_{min} + \varepsilon; \sigma_{max} + \varepsilon]$, $\varepsilon \geq 0$. Increasing ε from $\varepsilon = 0$ mimics a general rise in risk aversion. The effects of such a rise will be explored later on. The utility from consuming the private union good can differ for employed and unemployed workers and is denoted by C^e and C^u, respectively, $C^e, C^u > 0$. Theoretically, no restriction on the relative magnitude of C^e and C^u is feasible.

Given a membership fee Gw, $0 < G < 1$, disposable income of an employed worker amounts to $\tilde{w} := w(1 - G)$.[1] An unemployed worker receives unemployment benefits b. If he is a union member he will pay a membership fee as well and his disposable income will equal $0 < \tilde{b} < b < \tilde{w}$. An employed non-member also receives the wage w. The probability that a worker is employed equals N(w), assuming a random draw from the population of all workers, the size of which is normalised to unity. Hence, $0 < N(w) \leq 1$ also describes the employment level.

Worker i decides about membership, anticipating the (equilibrium) levels of union density and wages. The worker will join the union if the gain $Z(\sigma_i)$ from doing so is positive. To ensure the existence of the trade union, there is at least one worker i for whom $Z(\sigma_i) > 0$ holds. Since the utility from the private union good is assumed to be independent of risk attitudes for analytical simplicity, while the evaluation of incomes differs across workers, risk attitudes only affect the costs of union membership. As one consequence there is a measure of risk aversion denoted by σ which makes a particular worker indifferent to leaving the trade union or to remaining in it. It is defined by $Z(\sigma, \ldots) = 0$.

[1] This assumption is in line with the situation in Germany, where membership fees amount to 1% of the gross wage for employed workers. The subsequent results extend to a fee which is an increasing and weakly convex function G(w) of the wage w, $0 < G(w) < w$, $1 > G' > 0$, $G'' \geq 0$.

$$Z(\sigma,...) := N(w)\left[\frac{\tilde{w}^{1-\sigma}}{1-\sigma} + C^e - \frac{w^{1-\sigma}}{1-\sigma}\right] + (1-N(w))\left[\frac{\tilde{b}^{1-\sigma}}{1-\sigma} + C^u - \frac{b^{1-\sigma}}{1-\sigma}\right] = 0 \qquad (1)$$

The worker implicitly defined by equation (1) represents the marginal member. The derivatives of $Z(\sigma,\ldots)$ with respect to wages (Z_w) and the marginal member's measure of relative risk aversion (Z_σ), are given by:

$$Z_w = N'(w)\left[\frac{\tilde{w}^{1-\sigma} - w^{1-\sigma}}{1-\sigma} + C^e - C^u - \frac{\tilde{b}^{1-\sigma} - b^{1-\sigma}}{1-\sigma}\right] + N(w)\left[\tilde{w}^{-\sigma}(1-G) - w^{-\sigma}\right] \qquad (2)$$

$$Z_\sigma = N(w)\frac{-\tilde{w}^{1-\sigma}\ln\tilde{w} + w^{1-\sigma}\ln w - C^e}{1-\sigma} - (1-N(w))\frac{\tilde{b}^{1-\sigma}\ln\tilde{b} - b^{1-\sigma}\ln b + C^u}{1-\sigma} \qquad (3)$$

The consequences of higher wages on the (marginal member's) gain from trade union membership are ambiguous because the wage affects the employment probability N(w) and the payoff when having a job. Empirically, a worker's wage has not been found to alter the probability of union membership in Germany (see the estimates presented below and Wagner 1991, Fitzenberger, Ernst and Haggeney 1999, and Goerke and Pannenberg 2004). This implies $Z_w = 0$. The further theoretical analysis will make use of this finding to simplify the exposition. The gain from membership varies also with the measure of relative risk aversion σ in an ambiguous manner because the utility differential from membership in both employment states is altered differently. This ambiguity arises despite the fact that the utility C^e (or C^u) from consuming the private union good is certain, additive, and not subject to an employee's risk attitude.[2] More general assumptions on the nature of this good thus cannot clarify the relationship between union membership and risk aversion from a theoretical point of view. If the gain from membership rises with risk aversion, implying $Z_\sigma > 0$, all workers characterised by $\sigma_i > \sigma$ will benefit from membership so that the worker with the highest measure of relative risk aversion will be the first to join the union.

To relate our analysis to earlier contributions, note that the membership decision is independent of risk attitudes for a given wage in Booth's (1984) seminal paper. This is because an employed worker's gain from membership C^e is also subject to risk aversion, and a non-member is unemployed with certainty. In Moreton's (1998, 1999) set-up, a variation in risk aversion is modelled as a change in the second derivative of the utility function, holding constant the first

[2] If also the utility from consuming the private good were subject to risk aversion and, for example, the utility of an employed union member given by $(\tilde{w} + C^e)^{(1-\sigma)}/(1-\sigma)$, the sign of Z_σ would still be ambiguous and depend on the magnitude of σ.

derivative. Since the membership decision only depends on utility levels, it is unaffected by risk attitudes. Finally, Oswald (1982) presumes that the income of a union member is higher than that of a non-member who is employed with certainty. In this case, the benefits from forming and joining a union decline with the measure of relative risk aversion.

Wage Bargaining

The outcome of the wage bargain is determined by the (symmetric) Nash solution. The union's preferences are given by those of the median member, whose Arrow-Pratt measure of relative risk aversion is denoted by μ. The median member is employed with probability N(w) and in this case obtains $\tilde{w}^{1-\mu}/(1-\mu)+C^{e}$ as payoff, while he is unemployed with probability (1 – N(w)) and then receives $\tilde{b}^{1-\mu}/(1-\mu)+C^{u}$. The trade union's fallback payoff is defined by an unemployed worker's utility, so that the gain from bargaining amounts to N(w)Ω, $\Omega := (\tilde{w}^{1-\mu}-\tilde{b}^{1-\mu})/(1-\mu)+C^{e}-C^{u}$. The firm uses labour as the only input, while the output price is normalised to unity. Profit maximization leads to ∂Π/∂N = 0, ∂Π/∂w = -N(w) by the envelope theorem, and ∂N/∂w := N'(w) < 0. The fallback payoff of the firm is zero. The wage is consequently defined by:

$$V := \frac{N(w)\tilde{w}^{-\mu}(1-G)}{\Omega} - \frac{(N(w))^{2}}{\Pi} + N'(w) = 0 \qquad (4)$$

Subsequently, an interior solution is assumed, implying $V_w < 0$, which yields a wage above the full employment level, so that 0 < N(w) < 1. The wage effect of an increase in the measure μ of relative risk aversion of the median member is then determined by:

$$V_{\mu} = -\frac{N(w)(1-G)\tilde{w}^{-\mu}}{\Omega^{2}}\left[(C^{e}-C^{u})\ln\tilde{w} - \frac{\tilde{b}^{1-\mu}}{1-\mu}\left(\ln\tilde{w}-\ln\tilde{b}\right)+\frac{\tilde{w}^{1-\mu}-\tilde{b}^{1-\mu}}{(1-\mu)^{2}}\right] \qquad (5)$$

The sign of V_{μ} is shaped by two effects: A greater relative risk aversion lowers the gain $\tilde{w}^{-\mu}$ from a higher wage in equation (4). Additionally, a rise in μ alters the median member's gain N(w)Ω from bargaining. The overall impact is negative for $\tilde{w} \geq \tilde{b}$ and $C^{e} > C^{u}$. However, an unemployed worker's gain from consuming the private good may exceed or fall short of the gain for his employed counterpart, so that the signs of $C^{e} - C^{u}$ and of V_{μ} are indeterminate.

Relating our findings to those of previous contributions, negative wage and positive employment effects of higher risk aversion have been derived in (closed-shop) collective bargaining models, for example, by Sampson (1983), McDonald (1991), Oswald (1982), and

Blair and Crawford (1984). The employment result extends to a setting in which the alternative income is endogenised (see Nickell 1990).

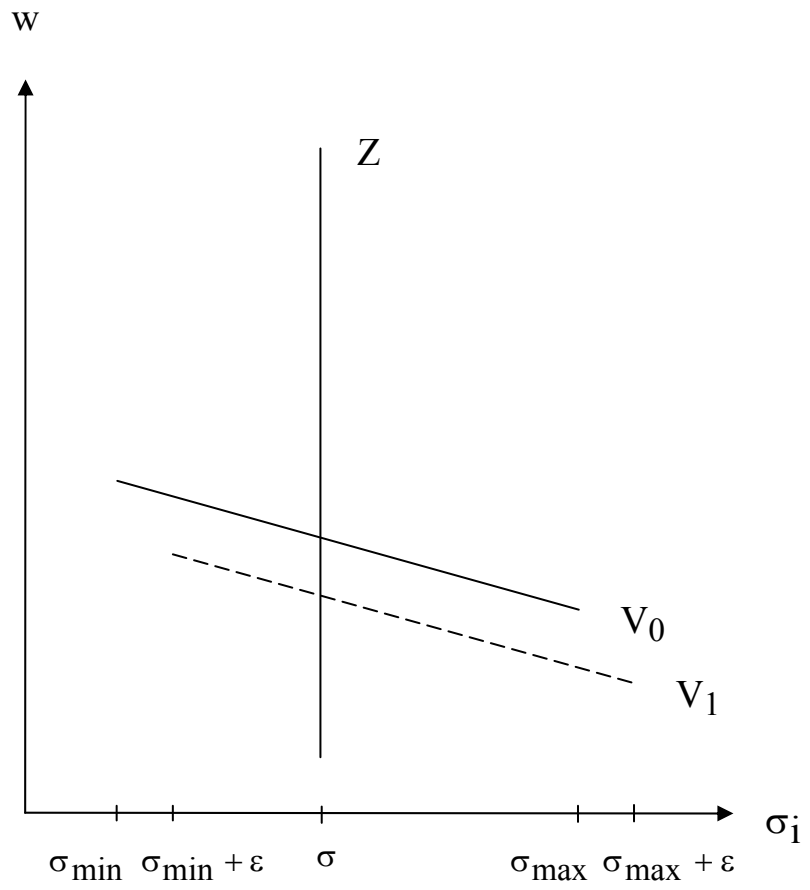
Comparative Statics

We start our comparative statics exercise by looking at the impact of a rise in the measure of relative risk aversion of all workers on the incentives to join a trade union. Subsequently, we investigate the consequences for wages. Because a change in the wage does not alter the probability of membership (that is, since $Z_W = 0$), the membership curve is vertical in the wage–risk aversion space. This implies that the marginal trade union member—and, hence, union density—are uniquely defined by $Z(\sigma,\ldots) = 0$. In particular, if the interval $[\sigma_{min} + \varepsilon; \sigma_{max} + \varepsilon]$, $\varepsilon \geq 0$, from which the measure of risk aversion stems, shifts to the right because ε rises from zero to $\varepsilon > 0$ as depicted in Figure 1, the new marginal member will be characterised by the same value of relative risk aversion as the original one ($\partial\sigma/\partial\varepsilon = 0$).[3] However, the level of risk aversion of the marginal member will be closer to the lower bound of the interval. For $Z_\sigma > 0$, this effect is equivalent to an increase in the number of union members. The result can be summarised as:

Proposition 1:
For $Z_W = 0$ and $Z_\sigma > 0$, a general rise in the Arrow–Pratt measure of relative risk aversion raises trade union density.

[3] Our subsequent results will also hold if all workers in the neighbourhood of the marginal and the median member become more risk-averse.

Figure 1: Equilibrium Wage and Marginal Member in Wage—Risk Aversion Space



Having established the relationship between individual risk aversion and the incentives to become a union member, we now turn to the link between collective bargaining outcomes and risk aversion. Given $V_w < 0$ and even assuming $V_\mu < 0$, the wage effects of a rise in risk aversion cannot be ascertained because the impact on the median member's measure of risk aversion μ is uncertain. The measure μ is likely to increase with a general shift of the distribution to the right (implying $\partial\mu/\partial\varepsilon > 0$), because everyone—including the median member—becomes more risk-averse. Theoretically, however, a fall in μ cannot be ruled out (that is, $\partial\mu/\partial\varepsilon < 0$). This is the case since the identity of the median changes. If a relatively large mass of the distribution of the measure of risk aversion lay to the left of the original marginal member but to the right of σ subsequent to the shift of the distribution, the median member's risk aversion might decline. This effect will not occur if the distribution is fairly symmetric around the positions of the original and new marginal member. Assuming, therefore, for analytical simplicity a uniform distribution, the median member's measure of relative risk aversion equals $\mu = [\sigma + (\sigma_{max} + \varepsilon)]/2$. Accordingly, a general increase in risk aversion also raises μ ($\partial\mu/\partial\varepsilon = 0.5$). In this case, the wage-bargaining curve V is unambiguously downward-sloping in the wage–risk aversion space, as depicted in Figure 1. Moreover, a general rise in

risk aversion shifts the curve downward from V_0 to V_1. The wage effect is given by $dw/d\varepsilon = -V_\mu/(2V_W)$. The employment consequences are determined by the wage change. We may then summarise:

Proposition 2:
Assume $V_\mu < 0$, that is, a negative relationship between the median member's measure of risk aversion and the bargained wage. If, in addition, $Z_W = 0$ holds and the Arrow–Pratt measure of relative risk aversion is distributed uniformly, a general rise in the measure of relative risk aversion will lower the bargained wage and raise employment.

Given the theoretical ambiguities underlying the Propositions, the relationships between risk aversion and (1) the individual incentives to become a trade union member and (2) collective bargaining outcomes ultimately become empirical issues. The multiplicity of possible effects indicates, in addition, that (1) a more sophisticated, that is non-linear, specification of the utility function, that (2) a more detailed treatment of the behaviour of unemployed or that (3) a more elaborate specification of the risk that workers face will not yield more precise predictions.

3. Data and Empirical Specifications

Data

In our theoretical model, wages result from negotiations between a trade union and employer. To capture this setting, matched employer–employee data with detailed information on firms and workers are desirable. However, the available linked employer–employee data sets for Germany provide no information on individual risk attitudes, which is pivotal for our analysis. Therefore, we utilise data from the German Socio-Economic Panel (GSOEP), a nationally representative longitudinal survey of the resident German population (Wagner, Burkhauser, and Behringer 1993, Wagner, Frick and Schupp 2007), containing a number of direct measures of individual risk attitudes, three of which we use. The 2003 survey included information on union membership, while the 2004 survey contained the risk indicators.[4] Our sample consists of full-time workers from West and East Germany with valid information on the relevant risk measures and union membership. Self-employed, apprentices and civil servants ('Beamte') are excluded. Using NACE one-digit industry classifications, union density in our sample ranges from 8% in the financial sector to 66% in 'mining and quarrying', with an average of 18.4%.

[4] The data used was extracted using the add-on package Panelwhiz v1.0 written by J. P. Haisken-DeNew (Haisken-DeNew, Hahn 2006; http://www.panelwhiz.eu) and plug-ins written by J. P. Haisken-DeNew and M. Hahn.

As argued above, the individual decision to join a trade union depends on income levels, the probability of employment, the utility of the private good provided by the trade union and the membership fee. Hence, information on how individual risk attitudes affect the evaluation of monetary payments is required. To meet this requirement we first utilise a survey question requiring respondents to indicate their willingness to take risks in financial matters. The exact wording of the question is: "People can behave differently in different situations. How would you rate your willingness to take risks in financial matters? Please tick a box on the scale where the value 0 means "*totally unwilling to take risk*" and the value 10 means "*fully prepared to take risks*" (own translation). Second, we employ a survey question corresponding more closely to one of the standard lottery measures used in experiments. In particular, information is collected on an individual's investment choices, based on a hypothetical lottery prize of €100,000. The respondent can invest the prize and purchase a risky asset for €100,000, €80,000, €60,000, €40,000, or €20,000 or can refrain from such an acquisition, with equal chances of doubling the amount invested or losing half of it after two years. Since the second measure is based on explicit stakes and probabilities, it holds risk perceptions constant across individuals. As a check of robustness, we additionally employ a survey question on the willingness to take risks in general, where again the eleven-point scale is used.

One might argue that respondents interpret the eleven-point scale of our risk questions differently. To minimize potential problems resulting from individual-specific interpretations of the scales we additionally employ a binary risk indicator variable for whether someone chooses a value of 5 or lower on the scale as a check of robustness. We interpret this dummy variable as an indicator that someone is “relatively unwilling to take risks” compared to a worker “relatively willing to take risk”.

The GSOEP risk measures have been validated in several experiments. Dohmen et al. (2005) find that questionnaire responses to the general risk question are reliable predictors of actual risk-taking behaviour in a field experiment with representative subject pools. Moreover, answers to the general risk question are strongly correlated with answers to the other two questions. In addition, Dohmen et al. (2005) demonstrate that the best predictor of a specific outcome is the risk measure most closely associated to the relevant context. Therefore, we are confident that the GSOEP risk measures are high-quality proxies for actual risk preferences in our specific context.

Due to data availability we link the information on individual risk attitudes in 2004 with data on union membership and its determinants measured in 2003. Hence, the crucial assumption of our empirical work is that individual union membership in 2003 does not alter peoples' risk attitudes until 2004. This requirement is consistent with evidence provided by Barsky, Juster,

Kimball, and Shapiro (1997), Sahm (2007), and Andersen, Harrison, Lau, and Rutström (2008) that risk preferences elicited from hypothetical lotteries in surveys are stable over time.

Empirical Specifications

Since we want to assess the effect of individual risk attitudes on trade union membership, that is the sign of Z_σ, we start with the following specification of a standard probit model:

$$P(U_{i,03} = 1 \mid R_{i,04}, X_{i,03}) = \Phi(\alpha R_{i,04} + \beta' X_{i,03}), \tag{6}$$

where $U_{i,03}$=1 if the individual is a union member (in 2003), $R_{i,04}$ is the relevant measure of individual risk attitudes (in 2004), $X_{i,03}$ is a vector of control variables (also measured in 2003), α, β' are (vectors) of unknown parameters and $\Phi()$ is the cdf of the standard normal distribution. Estimated marginal effects and standard errors robust with respect to clustering at the household level are documented.

As a first check of robustness, we address the potential endogeneity of our plain risk measures and employ an instrumental variable probit estimator (Wooldridge 2002, 472-477). Individual height is used as an instrument for individual risk attitudes, since height (i) is plausibly exogenous to the indicators of individual risk attitudes and has a significant impact on individual risk preferences, (ii) is not correlated with the error term in the union membership equation, and (iii) has no direct impact on the likelihood of being a union member.

Both probit estimators require a distributional assumption to be made, i.e., a particular normality assumption. However, there is no prior knowledge on the validity of this assumption. As a second check of robustness, we therefore employ a semi-nonparametric estimator originally suggested by Gallant and Nychka (1987) and used in applied work, for example, by Gabler, Laisney and Lechner (1993) and Stewart (2005). Essentially, this estimator approximates the true distribution of the error terms by a Hermite series. The approximation can be expressed as the product of the normal density and a squared polynomial and thus nests the standard probit model of equation (6). It can be estimated by maximizing a pseudo-likelihood function and usual test procedures can be applied. We adopt the framework proposed by Stewart (2004) to test the validity of the distributional assumption of the probit model in our application and to estimate the parameters of interest.

The vector of control variables consists of the usual covariates that previous studies have found to affect the probability of union membership in Germany: age, age squared, tenure, tenure squared, and dummy variables for being a foreigner, being male, different firm size categories, having completed an apprenticeship, having a university degree, being a member of a works council, having preferences for the Social Democratic Party (SPD) or the Christian Democratic

Parties (CDU/CSU), the father being self-employed when the respondent was 15 years old, being a blue collar worker, the industry (NACE 1-digit) in which the respondent works, and the state of residence ('Bundesland').[5] Since we link data from the years 2003 and 2004, longitudinal sample weights are calculated and used to account for the design of the different subsamples of the GSOEP as well as panel attrition (cf. Pannenberg et al. 2004).

4. Results

Descriptive Evidence

Figure 2 shows the distribution of individual risk attitudes in financial matters by union membership status. Each bar in the histograms indicates the percentage of respondents choosing a number on the eleven-point scale, indicating their willingness to take risks in financial matters. The according reluctance is striking: 86% of non-members and 91% of union members choose a value of five or less on the eleven-point scale. Moreover, Figure 2 reveals that union members are more risk-averse than non-unionists. Figure 3 corroborates this impression with respect to the lottery measure: 64% of union members and 54% of non-members do not invest a positive amount of the hypothetical lottery prize in the risky asset.[6] With respect to general risk attitudes, Figure A1 (in the Appendix) documents that 63% of all workers choose a value of five or less on the eleven-point scale. However, for this measure we do not observe significant differences in the distributions of risk attitudes for members and non-unionists.

Regression Results

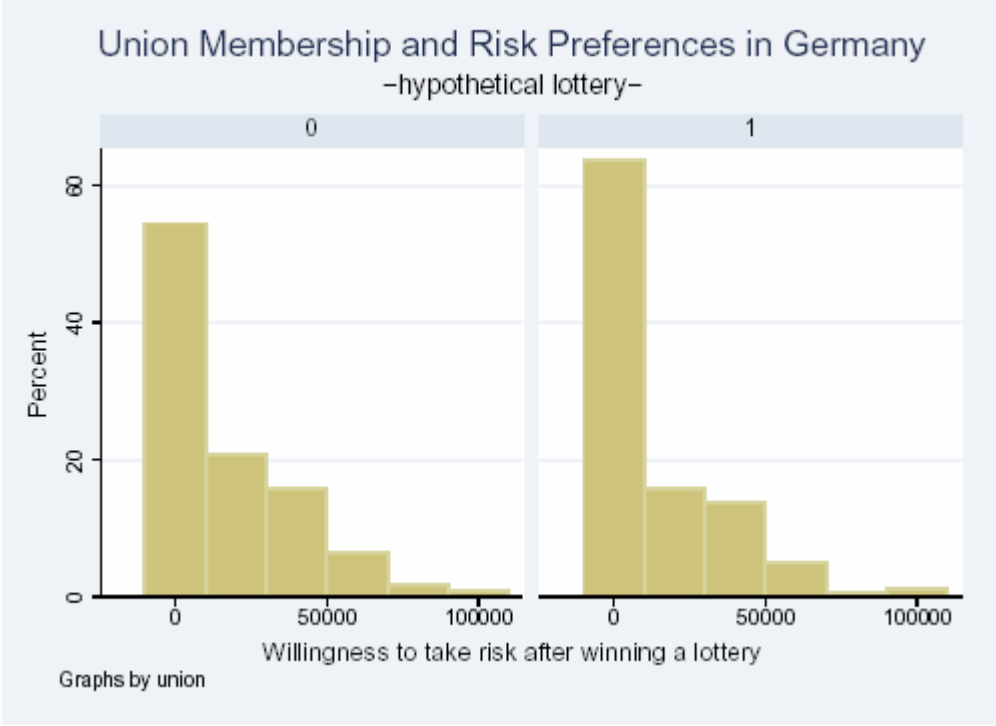
The descriptive evidence indicates that risk aversion is more prevalent among union members. We therefore use the standard weighted probit specification to assess whether individual risk attitudes have an impact on union membership. For the sake of a more intuitive interpretation we recoded the eleven-point scale of the two risk measures for our regression analysis in reverse order, i.e., '0' indicating strong risk-love and '10' total reluctance to take risks. Consequently, for all measures of risk a higher value indicates greater risk-aversion.[7]

[5] Descriptive statistics for all control variables are presented in Table A2 in the Appendix.
[6] Kolmogoroff/Smirnov tests reject the null hypothesis of equality of the distributions of risk attitudes for union members and non-members at the $\alpha = 0.002$ ($\alpha = 0.061$) level for the financial risk (lottery) question.
[7] With respect to the lottery measure, we do not have to recode our variable, since '1' indicates an investment of €100,000 and '6' indicates an investment of €0.

Figure 2:

0: non-member; 1: member of a trade union

Figure 3:



0: non-member; 1: member of a trade union

As a preliminary exercise, we estimated regressions also including the log of the monthly gross wage as covariate. Irrespective of the measure of individual risk aversion employed, we were able to replicate previous findings by Wagner (1991), Fitzenberger et al. (1999), and Goerke and Pannenberg (2004) that the individual gross wage does not influence the probability of membership.[8] Accordingly, the wage is not included in our main specifications. In terms of our theoretical model, the assumption $Z_W = 0$ captures the insignificant wage effect.

Table 1 presents the estimated marginal effects and their standard errors for the three measures of individual risk attitudes. Since our focus is on the relationship between risk aversion and union membership we do not discuss the parameter estimates for the set of control variables. They are in line with results from other studies.[9] Column 1 reveals that full-time workers who are more risk-averse in financial affairs exhibit a significantly higher probability of being a union member than their less risk-averse colleagues. The marginal effects imply that someone who switches from being extremely risk-loving ('0') to being extremely risk-averse ('10', after recoding) in financial matters exhibits a roughly seven-percentage-point higher likelihood of being a union member. The size of the estimated marginal effect is remarkable, since the unconditional mean of being a union member is slightly above 18% in our sample. Column 2 presents the estimates for the lottery measure of individual risk aversion. We observe a significant increase of similar magnitude in the probability of being a union member if someone decides not to invest a positive fraction of the hypothetical prize in the risky asset. If we use the more encompassing measure of individual risk attitudes, we do not find a significant effect (column 4). This is in line with evidence by Dohmen et al. (2005) that a context-specific measure of individual risk attitudes is the best predictor of actual behaviour in that context.

[8] Table A1 in the Appendix documents the parameter estimates for a specification with the measure of individual risk attitudes in financial matters.

[9] See, for example, Fitzenberger et al. (1999), Fitzenberger et al. (2006), Goerke and Pannenberg (2004), and Schnabel and Wagner (2003). Only the significantly positive effect works council membership has not generally been established yet. See Goerke and Pannenberg (2007) for further evidence on this relationship.

Table 1: Union Membership and Individual Risk Attitudes in Germany

- Probit Estimates -

	ME / s.e.	ME / s.e.	ME / s.e.
Risk Aversion_finance	0.007*	--	--
	(0.003)	--	--
Risk Aversion_lottery	--	0.013*	--
	--	(0.006)	--
Risk Aversion_general	--	--	-0.003
	--	--	(0.003)
Blue_collar	0.124**	0.125**	0.129**
	(0.020)	(0.019)	(0.020)
Father_self-employed	-0.051*	-0.057*	-0.054*
	(0.021)	(0.020)	(0.020)
Prefers SPD	0.105**	0.103**	0.101**
	(0.022)	(0.021)	(0.021)
Prefers CDU/CSU	-0.046**	-0.047**	-0.050**
	(0.016)	(0.016)	(0.016)
Member of works council	0.364**	0.360**	0.359**
	(0.044)	(0.043)	(0.043)
Tenure	0.010**	0.010**	0.010**
	(0.002)	(0.002)	(0.002)
Tenure (sqrd)	-0.000*	-0.000*	-0.000*
	(0.000)	(0.000)	(0.000)
Apprenticeship	0.017	0.017	0.016
	(0.026)	(0.025)	(0.025)
University degree	-0.042	-0.041	-0.044
	(0.027)	(0.027)	(0.027)
Firm size: 20 ≤ X < 200 workers	0.095**	0.094**	0.094**
	(0.027)	(0.027)	(0.026)
Firm size: 200 ≤ X < 2000 workers	0.189**	0.185**	0.186**
	(0.033)	(0.033)	(0.033)
Firm size: X ≥ 2000 workers	0.256**	0.253**	0.251**
	(0.035)	(0.035)	(0.035)
Male	0.029	0.027	0.020
	(0.016)	(0.015)	(0.016)
Foreigner	0.016	0.016	0.020
	(0.028)	(0.028)	(0.028)
Age	0.011+	0.011+	0.011+
	(0.006)	(0.006)	(0.006)
Age (sqrd)	-0.000+	-0.000	-0.000+
	(0.000)	(0.000)	(0.000)
Industry dummies & state dummies	*yes*	*yes*	*yes*
Wald_X	547.2**	547.0**	551.5**
N	5369	5370	5372

Source: SOEP 2003-2004. Longitudinal weights are used.
ME/s.e.: marginal effect/standard error. Robust standard errors also allow for clustering at the household level.
Wald_X: Wald test with H0: no joint significance of all regressors. (df=45)
Significance levels: ** (0.01), * (0.05), + (0.10).

In sum, we observe a significantly positive association between individual risk aversion in monetary affairs and the likelihood of being a union member. Hence, in terms of the theoretical discussion in Section 2, an overall increase in risk aversion is accompanied by an increase in union density, a finding which is consistent with a positive impact of the measure of risk aversion on the gain from trade union membership, i. e. with $Z_\sigma > 0$ and Proposition 1.

Checks of Robustness

The previous empirical specifications have assumed that the measures of individual risk attitudes are not correlated with the errors in the membership equation. However, one might argue that individual risk attitudes are endogenous. We test for the potential endogeneity of individual risk attitudes by means of the IV probit estimator, using the instrument 'individual height', as described above.[10] Wald tests, however, indicate that we cannot reject the hypothesis that the relevant measures of risk aversion are exogenous.[11] Hence, taking these results at face value, there is no need for an IV specification.

As pointed out above, there is no a priori evidence that the normality assumption underlying the probit models is appropriate. Performing likelihood ratio tests comparing the log-likelihoods of the probit and the semi-nonparametric specification of the union membership equation described above indeed indicate that the normality assumption of the probit model might not be upheld. Therefore, in Table 2 we additionally present the estimated parameters for the different risk measures based on the semi-nonparametric specification.[12]

The estimated parameters of the two measures of individual risk preferences on monetary issues are significantly positive and similar in size to the estimated parameters of the standard probit specification, not documented in Table 1. Hence, relaxing the distribution assumptions of our econometric specifications again leads to parameter estimates which confirm the finding of a positive correlation between individual risk aversion and trade union membership.

[10] Height is a valid instrument in terms of significantly negative parameter estimates for the two risk measures *Risk_finance* and *Risk_general* in reduced-form specifications with the two risk measures as dependent variable, confirming findings by Dohmen et al. (2005). The respective test statistics are $\chi^2(1) = 5.47$ and $\chi^2(1) = 3.96$. There is no significant correlation between height and the measure of risk aversion based on the hypothetical lottery.

[11] The respective test statistics are $\chi^2(1) = 1.76$ and $\chi^2(1) = 2.06$. These results are confirmed by the test statistics of the Rivers/Vuong test of exogeneity. See Wooldridge (2002, pp. 472) for a description of both tests. Note, that the IV results (not documented) confirm our previous findings.

[12] The other parameter estimates are available from the authors on request.

Table 2: Union Membership and Individual Risk Attitudes in Germany

- Semi-Nonparametric Estimates (SNP) -

	Risk Aversion _finance	Risk Aversion _lottery	Risk Aversion _general
$\hat{\alpha}$	0.035*	0.067*	-0.008
(s.e.)	0.017	0.033	0.015
LR_D	17.1**	15.5**	14.4**
Wald_X	877.4**	953.0**	900.6**
N	5369	5370	5372

Source: SOEP 2003-2004. Longitudinal weights are used.
$\hat{\alpha}$: Parameter estimate of particular risk measure.
s.e.: standard error. Robust standard errors.
Significance levels: ** (0.01), * (0.05), + (0.10).
Hermite polynomial is of order 3, i.e., three additional parameters are estimated.
Set of covariates is identical to specifications in Table 1.
LR_D: Likelihood-Ratio test of Probit-Model against SNP extended model. (df=1)
Wald_X: Wald-Test with H0: no joint significance of all regressors. (df=45)

Furthermore, it might be surmised that wealth can affect the decision to join a union. In order to check this conjecture, we additionally use information on the individual stock of wealth collected in a special SOEP module in 2002 in a further regression analysis. We find that wealth has no significant impact on the decision to join the union, while our other results remain stable.

Finally, respondents might interpret the scale of the risk questions differently. As mentioned above, we additionally employ a binary risk aversion indicator variable in our regression analysis to tackle this issue. Our main results are unaffected by including a binary instead of an eleven-point risk aversion indicator into the regressions.

In conclusion, there is substantial evidence that the probability of trade union membership of German full-time workers rises with their aversion to risk, particularly in monetary matters.

5. Further Correlation Analysis

The theoretical model shows that the degree of risk aversion of the median trade union member has an impact on the bargained wage and, consequently, on employment. Our estimates indicate that an overall increase in the degree of risk aversion raises the individual probability of union membership and, ceteris paribus, union density, while the wage has no effect ($Z_W = 0$; see Table A1 in the Appendix). As a consequence, the bargained wage will fall and employment increase if $V_\mu < 0$ and $\partial\mu/\partial\varepsilon > 0$ hold, i.e., if, firstly, there is a negative relation between the

bargained wage and the measure of risk aversion of the median member and, secondly, a general increase in risk aversion also makes the (new) median member more risk averse (see Proposition 2).

Due to the lack of matched employer–employee data with information on risk attitudes, we proceed in three steps to gain a crude grasp of the sign of $V_\mu \partial\mu/\partial\varepsilon$. First, we generate a set of cell dummies indicating combinations of union-specific industry dummies (eight unions), whether an individual lives in West or East Germany and has either of three occupational qualifications (low, medium, high). These 48 dummies mimic the bargaining structure in Germany. Second, we specify standard Mincer earnings regressions at the individual level including these 48 cell-specific dummies as well as the following covariates: age, age squared, tenure, tenure squared and dummy variables for being a foreigner, being male, different firm size categories, different occupation dummies (ISCO 1-digit), having completed an apprenticeship, having a university degree, being member of a works council and being a blue collar worker. In a third step, we use the estimated parameters of the cell-specific dummies and regress these adjusted average wage differentials on the cell-specific average risk preferences of union members as well as on union density. The observations are weighted by the size of the particular cell. Table 3 documents the parameter estimates of the third step.

Table 3: Gross Wages and Risk Attitudes of Union Members in Germany

	ME / s.e.	ME / s.e.	ME / s.e.
Risk Aversion_finance_cell	-0.116*	--	--
	(0.051)	--	--
Risk Aversion_lottery_cell	--	-0.158+	--
	--	(0.089)	--
Risk Aversion_general_cell	--	--	-0.055
	--	--	(0.050)
Union density_cell	0.006	0.006	0.006
	(0.005)	(0.005)	(0.005)
N	43	43	43
R^2	0.14	0.06	0.06

Source: SOEP 2003-2004. Cell-specific weights are applied.
OLS-Regression of cell-specific adjusted average wage differentials on a cell-specific average of individual risk aversion of union members and cell-specific union density. We do not observe union members in 5 of our 48 cells.
Significance levels: ** (0.01), * (0.05), + (0.10).

We observe significantly negative correlations between adjusted cell-specific (log) gross monthly wages and both averaged measures of the individual willingness to take risks in financial affairs for union members.[13] Our finding of a negative correlation is consistent with

[13] Bonin, Dohmen, Falk, Huffman, Sunde (2007) find a significantly negative correlation of individual wages and individual risk preferences for Germany.

the assumption of $V_\mu \partial\mu/\partial\varepsilon < 0$. Moreover, the parameter estimates reveal a positive correlation between industry-specific union densities and wages, but this correlation is not significantly different from zero.

Our simple correlation exercise provides supportive evidence for the two effects of individual risk aversion in the theoretical model: higher risk aversion is correlated with lower wages while it also leads to a rise in union density, which tends to increase bargained wages. This finding is consistent with the interpretation that a general increase in individual risk aversion changes the preferences of the median member, which unions take into account when bargaining over wages and which ceteris paribus has a negative impact on wages.

6. Summary

Why do workers belong to trade unions? Our theoretical analysis is based on the assumption that a union provides its members with an excludable good. We show theoretically that the net gain from membership varies with the extent of risk aversion. As a consequence, individual risk aversion alters the propensity to be a trade union member. Our empirical findings, based on the German Socio-Economic Panel (GSOEP), support this prediction. More specifically, we find that the probability of union membership increases significantly and by a sizeable amount with indicators of individual aversion to risk in monetary affairs. Hence, more risk-averse individuals are more likely to be a member of a trade union. In a collective bargaining set-up, a change in risk aversion will then have two effects. First, the median member's preferred wage (and employment) outcome changes. In addition, the variation in the level of union membership will alter the identity of the median member. Accordingly, variations in risk aversion have wage and employment effects. A simple correlation analysis with aggregated data from the GSOEP suggests that wages may fall and employment may rise with an increase in risk aversion of the labour force. This empirical finding is consistent with the predictions obtained in a monopoly union model in which trade unions provide insurance against income variations (Agell and Lommerud 1992, Burda 1995), as well as with the results of a general equilibrium model of search with risk aversion (Acemoglu and Shimer 1999).

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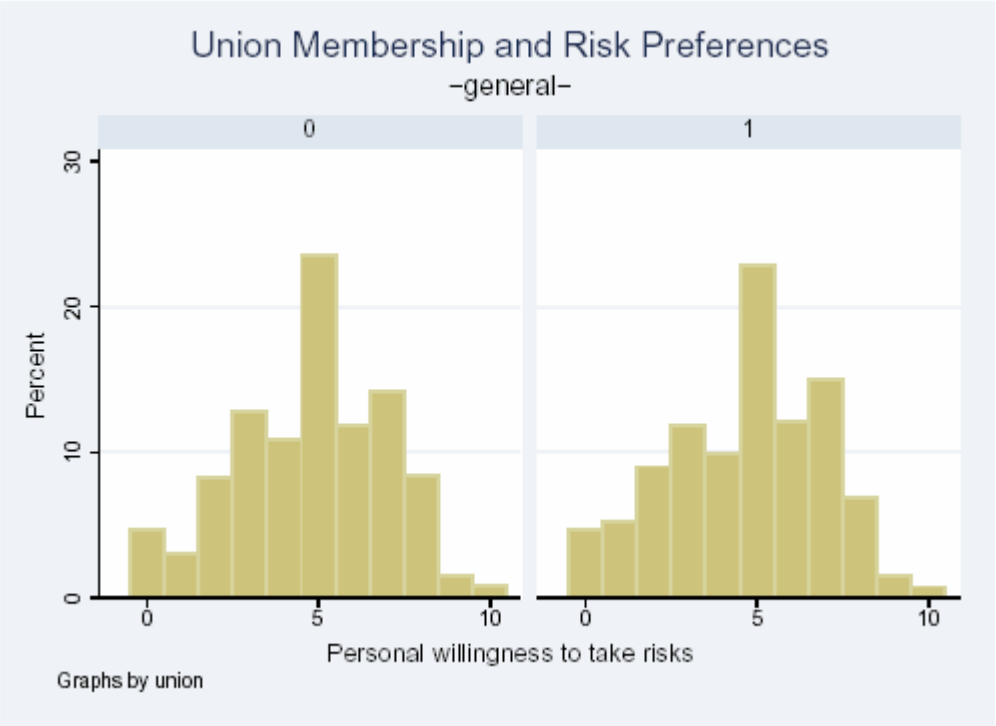
Appendix

Figure A1:



0: non-member; 1: member of a trade union

Table A1: Union Membership and Individual Risk Attitudes in Germany
- Probit Estimates -

	ME / s.e.
Risk_finance	0.007*
	(0.003)
Log (gross wage)	-0.028
	(0.025)
Male	0.043*
	(0.017)
Foreigner	0.002
	(0.028)
Age	0.011
	(0.006)
Age (sqrd)	-0.000
	(0.000)
Tenure	0.012**
	(0.003)
Tenure (sqrd)	-0.000*
	(0.000)
Apprenticeship	-0.008
	(0.027)
University degree	-0.050
	(0.028)
Prefers SPD	0.106**
	(0.022)
Prefers CDU/CSU	-0.048**
	(0.017)
Blue_collar	0.110**
	(0.022)
Father_self-employed	-0.030
	(0.022)
Firm size: $20 \leq X < 200$ workers	0.099**
	(0.028)
Firm size: $200 \leq X < 2000$ workers	0.198**
	(0.035)
Firm size: $X > 2000$ workers	0.255**
	(0.038)
Member of works council	0.355**
	(0.047)
Industry dummies & state dummies	*yes*
N	4881
Wald_X	500.2**

Source: SOEP 2003-2004. Longitudinal weights are used.
ME/s.e.: marginal effect/standard error.
Robust standard errors also allow for clustering at the household level.
Wald_X: Wald-Test with H0: no joint significance of all regressors. (df=45)
Significance levels: ** (0.01), * (0.05), + (0.10)

Table A2: Descriptive Statistics of Covariates

Variable	Mean	Std. Dev.
Male	0.631	0.482
Foreigner	0.078	0.267
Age (*in years*)	41.089	10.75
Tenure (*in years*)	10.512	9.666
Apprenticeship	0.658	0.474
University degree	0.212	0.409
Prefers Social Democrats (*SPD*)	0.191	0.393
Prefers Christian Parties (*CDU/CSU*)	0.185	0.388
Blue collar worker	0.367	0.482
Father was self-employed	0.101	0.302
Firm size: $20 \leq X < 200$ workers	0.305	0.460
Firm size: $200 \leq X < 2000$ workers	0.247	0.431
Firm size: $X \geq 2000$ workers	0.235	0.424
Member of works council	0.040	0.197
Schleswig-Holstein	0.033	0.181
Hamburg	0.025	0.156
Lower Saxony	0.085	0.279
Bremen	0.007	0.087
North Rhine-Westphalia	0.219	0.414
Hesse	0.065	0.247
Rhineland-Palatinate, Saarland	0.054	0.226
Baden-Wuerttemberg	0.134	0.341
Bavaria	0.160	0.366
Berlin (East)	0.015	0.122
Mecklenburg / Western Pomerania	0.019	0.139
Brandenburg	0.030	0.173
Saxony-Anhalt	0.029	0.169
Thuringia	0.034	0.182
Saxony	0.055	0.229
Agriculture/fishing	0.016	0.124
Mining /quarrying	0.005	0.072
Manufacturing	0.339	0.473
Electricity / gas/ water supply	0.014	0.117
Construction	0.082	0.274
Wholesale and retail trade/ repair	0.112	0.316
Hotels / restaurants	0.019	0.136
Transport, storage / communication	0.061	0.239
Financial intermediation	0.051	0.220
Real estate / renting / business	0.076	0.265
Public administration/ defence	0.059	0.235
Education	0.039	0.192
Health/social work	0.092	0.289
Individual height (cm)	174.297	9.116

Source: SOEP 2003-2004. Longitudinal weights are used. N=5908.