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The determinants of church attendance and religious human capital in Germany: Evidence from panel data

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The determinants of church attendance and religious human capital in Germany: Evidence from panel data*

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Abstract

This paper explores determinants of church attendance and the formation of ‘religious human capital’ in Germany within a Becker-style allocation-of-time framework. The analysis is based on data derived from the *German Socio-Economic Panel* (GSOEP). Taking advantage of the longitudinal structure of the data, we are able to control for unobservable heterogeneity by applying a random-effects ordered probit model to estimate separate attendance equations as well as ‘faith intensity’ equations for males and females. The results suggest support for previous findings based on British and North American data that age is a strong predictor for church attendance. Economic variables only weakly account for some of the variation inasmuch as high non-labour income releases time that can be devoted to religious activities. Results for differences in partnership status point to the complementary character of religious experience, whereas the findings for spouses with different religions are more ambiguous. Having at hand a presumably unique situation in the regional structure of religious traditions, we find, not too surprisingly, that strength of belief is much lower in the formerly atheistic East Germany. It is however not clear-cut that North–South or Protestant–Catholic divides exist in religious participation.

JEL Classification: D12, J29, Z12

Keywords: Religious behaviour, allocation of time, random-effects ordered probit model

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I. INTRODUCTION

Even though economists have increasingly addressed non-market situations in recent decades—sometimes entailing the accusation of the ‘imperialism of economics’—religious behaviour as a subject of scientific research has long been neglected. Among the reasons stated is the apparently widespread assumption that faith in a superior order rests upon irrationality and that research in this area should be left to more traditional scholars in this field such as sociologists or psychologists, if not primarily theologians. However, the growing economic literature (surveyed in Iannaccone, 1998) that addresses this aspect of human behaviour shows that economists nevertheless are able to provide fruitful contributions. Not only has previous research shown that religious behaviour does not rest on ‘primitive’ thought, neurotic impulses and social conditioning (Iannaccone *et al.*, 1998), but it has also shown that religious involvement influences such social and economic phenomena as the rate of divorce and the rate of non-payment of debts (Berggren, 1997) or the labour supply of married women (Lehrer, 1995).

The analysis in this paper focuses on the determinants of the frequency of attendance at services and the formation of so-called ‘religious human capital’. All results presented here are based on longitudinal individual data for Germany. We thus add to the research in this area in two ways, as previous articles have mainly exploited either cross-sectional or time-series data sources for the USA and the UK.

The structure of the paper is as follows: Section II outlines previous research and theoretical considerations of the study. The GSOEP and the data derived for this paper are presented in Section III, along with the econometric methodology and model specification. The discussion of the empirical results in Section IV is followed by summarizing conclusions in Section V.

II. PREVIOUS RESEARCH AND THEORETICAL FRAMEWORK

Inspired by the work of Becker (1965), the seminal contribution by Azzi and Ehrenberg (1975) employed an allocation-of-time model to examine church attendance in the USA. Using statewide church membership data and attendance data, they tested a model in which the ‘salvation motive’, i.e., the prospect of ‘afterlife consumption’, provided the main incentive for religious participation. Subsequent contributions can be divided roughly into two groups. The first group addresses the demand side, i.e., follow-on studies on attendance (Ehrenberg, 1977; Neumann, 1986; more recently Sawkins *et al.*, 1997; Cameron, 1999) and examinations within the club-theory framework (Wallis, 1990; Iannaccone, 1990, who also introduced the notion of ‘religious human capital’), or modelling churches as firms (Stark and Bainbridge, 1985, pp. 171-188; Ekelund *et al.*, 1996, explore the political economy of the medieval Catholic church). The second group of studies focuses on supply-side factors such as interdenominational competition and its application to the determination of financial contributions (Zaleski and Zech, 1992, 1995). Sullivan (1985), who simultaneously modelled the determination of financial contributions and church attendance, and subsequent authors de-emphasized Azzi’s and Ehrenberg’s afterlife expectations in favour of the assumption of immediate utility being sufficient to generate religious behaviour. Among the examples discussed are the potential individual advantages of network externalities that may not be religious in origin, e.g., when searching for a marital partner or enhancing one’s business prospects by meeting key individuals through church regularly.

Predominant results in these studies are higher levels of female participation in church-related activities, u-shaped age profiles and substitution effects that dominate income effects in such a manner that higher earnings across individuals lead to lower church attendance.

In this paper the relevant model for religious behaviour is the Azzi and Ehrenberg (1975) framework of lifetime (and afterlife) utility maximization subject to time constraints. Adopting the Sawkins *et al.* (1997) revision of this approach, the unit of account is the

individual rather than the household, and exercising religious activities generates immediate utility rather than just a prospect of afterlife consumption benefits. Formally, an individual is assumed to maximize an intertemporal utility function¹

$$U = U(C_1, C_2, \dots, C_t, \dots, C_n; R_1, R_2, \dots, R_t, \dots, R_n) \quad (1)$$

where C_t represents the individual (secular) consumption in period t and R_t the consumption value of religious participation in period t .

Individual secular consumption in each period is given by the individual's purchases of a composite good (x_{ct}) and the allocation of time to leisure (l_t). The overall religious experience R_t depends upon the individual's allocation of time to religion (r_t) and purchased goods (x_{rt}) devoted to religious activities. We can thus decompose the arguments of the utility function as follows:

$$\begin{aligned} C_t &= C_t(x_{ct}, l_t), \\ R_t &= R_t(x_{rt}, r_t). \end{aligned} \quad (2)$$

Combined with a standard lifecycle budget constraint, this framework, having taken into account differences in tastes, leads to two main conclusions. Firstly, religious activity should follow a u-shaped course with age: for young people, religious activities will tend to decline as opportunity costs increase with rising wages. Secondly, this framework implies stronger effects for women, whose age-earnings profiles tend to be flatter than men's.

Taking into account that the initial economic approach by Azzi and Ehrenberg (1975) largely ignored sociological observations such as religious upbringing or social and/or denominational ties, Iannaccone (1990, 1998) extended the model by the inclusion of 'religious human capital', S_t , which provides another possible explanation for growing participation over time as religion now becomes 'addictive'. Hence, the appreciation of religious commodities will not only depend on the inputs of time and goods, but also on religious knowledge, so that

$$R_t = R_t(x_{rt}, r_t, S_t), \quad (3)$$

where the capital stock S_t relies on the individual's past religion-specific experience,

$$\Delta S_t = f(r_{t-1}, x_{t-1}, S_{t-1}). \quad (4)$$

As denominations vary in rituals and styles of worship, most religious capital is quite specific. As, furthermore, parents and the religious institutions they support undertake the religious training of their children, the framework implies that young adults gravitate toward the belief and the denomination of their parents (Cameron, 1999).² Moreover, as religious experience can be viewed as an outcome of a complementary process within households (Iannaccone, 1995), individuals will tend to marry within their religion. When spouses do not share the same religion, religious activities might consequently be decreased.

III. DATA AND METHODOLOGY

The data used in this article were derived from three waves of the *German Socio-Economic Panel Study* (GSOEP) (SOEP Group, 2001), which is hosted by the German Institute for Economic Research (DIW), Berlin. Although information on church attendance is available for all the years 1994 to 1999, the analysis here was confined to data from 1994, 1998 and 1999, yielding 20,248 panel observations, with 9302 observations for men and 10,946 observations for women. These waves were chosen as in them the interviewees were asked about the importance of belief/religion to them³, which we strongly assume to play a major part in an individual's decision to participate in religious activities. We, however, unlike Sawkins *et al.* (1997) but instead following Cameron (1999) estimate separate 'faith intensity' equations as the formation of religious human capital becomes endogenous with the frequency of service attendance: besides other religious inputs such as devotional time spent praying or reading scriptures, a high level of church attendance contributes to form religious capital, which in turn increases the level of attendance because the satisfaction an individual receives from participation will increase with increasing religious capital.⁴ As church attendance and strength of belief will thus be determined simultaneously, the coefficients will

indicate the estimated net effects after the interactions between religious capital and attendance frequencies have been solved out.⁵

Moreover, the model is estimated separately for men and women. Similar to previous findings for the US (Hout and Greeley, 1987) and for the UK (Sawkins *et al.*, 1997; Cameron, 1999) there is evidence that women in Germany attend church more often than men.⁶

Denominational affiliation is assumed to be another indicator for religious behaviour, as different religions are considered to show varying ‘denominational strictness’ (Iannaccone, 1992). Expectations to attend services may, for example, be higher among Roman Catholics (*catholic*) and Muslims (besides others included in *othdenom*) compared to Protestants (*protest*). Unfortunately, denominational affiliation was asked for only in 1990 and 1997. However, as church membership tended to be rather stable between these two years—only membership in the Protestant Church has seen a decline of about 13%⁷—we include the information on denominational affiliation in 1997 in the estimation equations, willing to accept this potential source of, we believe small, bias.

As religious human capital and time devoted to religious activities is not sufficiently observable we use the ‘strength of belief’ variable (*faith*) and the frequency of church attendance (*attend*) as proxy variables. Given church attendance, which is inherently ordered, as the choice variable, we argue that it is appropriate to employ an ordered probit modelling framework to analyse the church attendance decisions of individual economic agents. As for the ‘faith intensity’ equations, recoding the original GSOEP question leads to a variable with a likewise ascending order.⁸

The random-effects ordered probit model is set up in the following way (see Butler and Moffitt, 1982; Greene, 2000). We consider a latent variable model, where Y_{it}^* is the unobserved dependent variable, i.e., time devoted to religious activities and the formation of religious human capital respectively, X a vector of explanatory variables, \mathbf{b} an unknown parameter vector and \mathbf{e} the error term, i indexes individuals and t indexes time periods:

$$Y_{it}^* = X_{it} \mathbf{b} + \mathbf{e}_{it} \quad (i = 1, \dots, N; t = 1, \dots, T),$$

$$Y_{it}^* = \begin{cases} 1 & \text{if } Y_{it}^* \geq 0 \\ 0 & \text{otherwise.} \end{cases} \quad (5)$$

However, Y_{it}^* is unobservable. We instead observe the following:

$$Y_{it} = \begin{cases} 0 & \text{if } Y^* \leq 0 \\ 1 & \text{if } 0 < Y^* \leq \mathbf{t}_1 \\ 2 & \text{if } \mathbf{t}_1 < Y^* \leq \mathbf{t}_2 \\ \cdot & \\ \cdot & \\ J & \text{if } \mathbf{t}_{J-1} \leq Y^* \end{cases} \quad (6)$$

where Y_{it} is the frequency of attendance or the reported strength of belief respectively of individual i at time t . \mathbf{t} is the vector of unknown cutpoint parameters which are to be estimated with the \mathbf{b} vector. Assume that the disturbances are generated by the permanent-transitory process $\mathbf{e}_{it} = \mathbf{m}_i + \mathbf{n}_{it}$, where $\mathbf{e}_{it} \sim N(0, \mathbf{S}^2)$. The log-likelihood function for the problem is

$$L = \sum_{i=1}^N \log[\text{prob}(Y_{i1}, \dots, Y_{iT})], \quad (7)$$

where

$$\text{prob}(Y_{i1}, \dots, Y_{iT}) = \int_{a_{i1}}^{b_{i1}} \dots \int f(\mathbf{e}_{i1}, \dots, \mathbf{e}_{iT}) d\mathbf{e}_{iT} \dots d\mathbf{e}_{i1} \quad (8)$$

and $a_{it} = -X_{it} \mathbf{b}$ and $b_{it} = \infty$ if $Y_{it} = 1$, $a_{it} = -\infty$ and $b_{it} = -X_{it} \mathbf{b}$ if $Y_{it} = 0$, and $f(\cdot)$ is the normal density function. Simplifying the integral by conditioning on the permanent component yields:

$$\begin{aligned} & \text{prob}(Y_{i1}, \dots, Y_{iT}) \text{prob}(Y_{i1}, \dots, Y_{iT}) \\ &= \int_{a_{i1}}^{b_{i1}} \dots \int_{a_{iT}}^{b_{iT}} \int_{-\infty}^{\infty} f(\mathbf{n}_{i1} | \mathbf{m}_i) f(\mathbf{m}_i) d\mathbf{m}_i d\mathbf{n}_{iT} \dots d\mathbf{n}_{i1} \\ &= \int_{-\infty}^{\infty} f(\mathbf{m}_i) \prod_{t=1}^T [F(b_{it} | \mathbf{m}_i) - F(a_{it} | \mathbf{m}_i)] d\mathbf{m}_i \end{aligned} \quad (9)$$

where $F(\cdot)$ is the normal cumulative distribution function. This expression can now be approximated using the Gauss-Hermite quadrature procedure so that maximum likelihood estimation is feasible.⁹

The models are estimated based on the assumption that time has an opportunity cost that can be proxied by an appropriate wage rate for those who are of working age. Therefore, the samples used here include individuals between 16 and 65 years of age. The GSOEP data allows for derivation of a satisfactory wage variable—of course only for those individuals who are employed at the time of the interview. We bypass the resulting problem of the assignment of zero wages to those who are unemployed or out of the labour market by assessing a wage rate (*wage*) using a Heckman-selection-procedure.¹⁰ We expect the wage rate to have a negative effect on church attendance because of the rising opportunity costs with rising wages.¹¹

Besides wages we include other labour market-related variables: a dummy variable to control whether the individual is registered as unemployed (*unempl*) at the time of the interview, the non-labour income of the individuals (*nonlab*) that should return a positive coefficient, as with the decreasing importance of labour income time is set free that can be devoted to religious experience. The age variable (*age*) used is included on the basis of the religious human capital approach of the model.¹² Individuals will be better able to appreciate their religious experience when they have acquired a larger stock of religious human capital. It should thus be observable that age correlates positively with church attendance. In addition to the completed years of education (*yearsed*), qualificational dummies (*qual1*, *qual2*) are used to represent the highest educational level attained. In contrast to the widespread assumption of the validity of the ‘*secularization thesis*’, i.e., that religion must inevitably decline as science and technology advance, and that individuals become less religious as they acquire more education, we expect to replicate previous findings (Iannaccone *et al.*, 1998; Cameron, 1999;

Sawkins *et al.*, 1997) that a high level of education accounts for only part of the variation in the data.

Other socio-economic variables of interest are marital status (*married*) and related variables. The denominational strictness mentioned above is associated with different attitudes towards certain forms of behaviour, such as the acceptance or otherwise of cohabitation or divorce. For example, an individual who is divorced might no longer attend church for fear of the contempt he or she might experience from other ‘strict’ church members. The dummies included here (*divorce*, *cohab*) are therefore expected to return a negative effect on attendance. This should be valid also for mixed-faith marriages (*diffden*), as religious experience is to some extent a complementary process and can therefore be produced more efficiently when both spouses share the same religion (*eqden*) (Iannaccone, 1995). For instance, in such cases, opportunity costs are lower if spouses travel together to the nearest service site.

We furthermore include health information: self-assessed health¹³ (*hlthgood*, *hlthfair*), information on smoking behaviour¹⁴ (*smoke*) as a proxy for health habits, and a variable capturing whether the individual is registered as handicapped (*handicap*). Note that smoking behaviour or even health in general might be endogenous, as some denominations tend to be very strict on certain lifestyle-habits such as smoking or the consumption of alcohol. We however include smoking behaviour in the estimation as it has been shown to be highly related with time preference rates (Fersterer and Winter-Ebner, 2000). Individuals who smoke can then be seen as individuals who place low value on expectations of ‘afterlife’-consumption—which is assumed to be a function of the time spent in religious activities (Azzi and Ehrenberg, 1975)—and are thus expected to attend church less than individuals with higher expectations. Alternatively, if one is not willing to agree with the idea of ‘afterlife’ consumption, it is plausible to argue that individuals with higher time preferences are not

willing to bear their subsequent higher opportunity costs when attending church compared to individuals with less high time preference rates.

Information on whether the individual is widowed (*widow*) and whether the partner died some time before the interview (*deathpt*) are included as proxies for a negative external shock that might be accompanied by psychological strains that might cause individuals to turn to religion in a search for comfort. It should thus show a positive sign.

Variables on the number of children with different age-spans (*kid46*, *kid716*) are included to control for the empirical phenomenon (Sawkins *et al.*, 1997) that parents in general and mothers especially look after the religious upbringing of their children by taking them to church.

Finally, a set of dummy variables representing the federal state where the individual resides as well as a set of dummies capturing the municipal size is included. Here, it should be expected that the more Catholic south of West Germany (former FRG) as well as small communities (because of presumably close social ties) have a positive effect on the frequency of attendance and the intensity of belief in contrast to big and possibly more liberal (and maybe more hedonistic) cities and the former communist East Germany, where religion was banned from public life.¹⁵ In the latter case, it will then be possible to analyse better the effects of economic variables on time devoted to religious activities, as individuals will tend not to be affected by either parental or community traditions.

IV. RESULTS

Tables 1 and 2 sum the results from the maximum-likelihood estimation of the random-effects ordered probit model, with frequency of church attendance and strength of belief as dependent variables for women and men respectively.¹⁶

As expected, belonging to a denomination strongly accounts for the frequency of attendance of services as well as the intensity of belief, with nondenominational individuals being the reference group.

Age has a positive impact on attendance and strength of belief for both women and men. We thus find support for both the assumption of the addictive character of religion and the decreasing opportunity costs of time alongside the flattening wage profile on the upper end of the age scale.

The results for marital status and the (in)equality of denominations between partners are somewhat ambiguous. Whereas being married influences only male attendance rates positively, we find weak evidence that women attend church more often only if their partner has the same religion. While it might have been religion in the first place that helped the marital partners to meet, this finding still supports the idea that religious experience can be looked at as a complementary process to be shared by spouses. We similarly obtain no homogenous pattern for partners with different denominations, which might a priori be expected because of ‘denominational strictness’ such as a possible disinclination of some denominations against certain forms of relationships like ‘out-marriages’. Here, we find that being married to a partner with a different denomination restricts religious activities only for men whereas cohabitation affects only female participation negatively. Being divorced, on the other hand, does not influence church attendance.

The presence of children in the age range 7 to 16 years affects attendance in a positive way. Whereas this is not too surprising for women, recognizing that it is mainly they who carry the responsibility of taking children to church, unlike Sawkins *et al.* (1997), we find that this is true also for men.

The findings for health-related variables are in line with expectations: compared to individuals with self-assessed poor health, fair or good health positively influences attendance, even though the statistical evidence tends to be weak, i.e., significance only at the

5% level. Again, it should be noted that this might be a result of an endogenous process, as the attitude of 'strict' denominations towards certain life-styles might influence the health behaviour of individuals. Connecting the clearly negative significant result for smoking with the latter hypothesis would in our opinion be quite farfetched, in that if smoking behaviour is bad, individuals who do smoke would absent themselves from church to avoid conflicts. We hence prefer to rely on the interpretation that smokers are individuals with high time-preference rates, and that it is then plausible to argue that they attend church less as they are not willing to accumulate religious human capital because of their higher opportunity costs. This is shown to be clear-cut both for men and women: being a smoker has a significantly negative effect on church attendance as well as on intensity of belief.

Handicapped women attend church less frequently, which can be explained by higher opportunity costs because of additional physical and/or monetary efforts that must be borne, such as paying for a taxi that is suitable for the handicapped. Single women who lost their partner some time before the interview attend church more often, presumably to look for comfort. This effect does not show for men, which is not difficult to understand, as it is plausible to assume that it is mainly women who outlive their partner.¹⁷

The assumption that 'religion is not the province of the poor or the uninformed' (Iannaccone, 1998) finds at least some support in the positive significant effect of a higher educational level on attendance frequency, individuals with only basic education being the reference group. As basic education tends not to lead to higher wages, we argue that the effect for higher-educated individuals shown here rather reflects the dominating income effect. However, the effect is somewhat weak for women.

This shows even more clearly for non-labour income where a high level affects attendance positively for women and somewhat weakly for men because of the higher level of disposable time not spent in work. Whereas being unemployed only weakly accounts negatively for participation for men, wage, which stands as an appropriate proxy for the opportunity costs of

time, does not imply a distinct decrease in church attendance, even though we at least find the expected sign for both men and women in addition to the statistical significance at the 10% level for the male wage coefficient.¹⁸

It is, however, interesting to note weak evidence that women who receive higher wages report lower degrees of belief. We can only speculate that these might be women who, because of their presumably permanent struggle in a business-world dominated by men, focus attention on more secular issues.

Turning to the regional dummies, we find neither a homogenous picture nor clear empirical evidence supporting a possible Protestant North–Catholic South divide. More in line with expectations are the findings for a West–East divide where women in Brandenburg, and to some extent also in Mecklenburg–Western Pomerania, tend to go to church less often than their Bavarian counterparts (the reference), with the three remaining federal state dummies representing the former GDR at least showing the expected sign.

More interesting are the results for the reported strength of belief. Referring to women in West Germany, being a resident of Bremen or Hamburg is exceptional in having a positive effect on the intensity of belief compared to female residents of Bavaria. Being a resident of East Germany where, because of the communist ideology, religion was not part of everyday life, affects faith mainly significantly negatively, except for women in Thuringia and Saxony.

The results for the effects of the size of the residential community are more or less in line with expectations. Using cities with 5000 to 20,000 inhabitants as the reference group, we find that for women and mostly also for men, living in bigger cities influences church attendance significantly negatively. We also find tendencies that this outcome is accompanied by a declining strength of faith, even if these are not significant overall, which could be explained by the subsequent absence of a stock of religious human capital. As outlined above, we argue that these effects arise because of the presumably more liberal attitudes of inhabitants of cities towards different life-styles and the subsequent absence of social pressures. However, and in

contrast to initial expectations, living in small communities of up to 2000 inhabitants is not reflected in increased attendance rates, compared to the reference group, whereas living in small towns with from 2000 to 5000 inhabitants does affect church attendance positively, although only weakly for men. One possible explanation here would be that villagers without a church face higher opportunity costs as they must travel further to the nearest location.

V. CONCLUSIONS

This paper adds to the economic analysis of religious behaviour within a conventional allocation-of-time framework using a subset of the GSOEP with 20,248 panel observations taken from three waves. Acknowledging the addictive character of religion, we estimate reduced-form equations for church attendance as well as for faith intensity separately for men and women as the latter show higher attendance frequencies. This and other findings are in line with previous North American and British empirical work. Besides age, we find that religious participation is positively correlated with denominational affiliation and to some extent also with educational attainment. Referring to economic variables, the results presented show little evidence that time spent on religious activities has an opportunity cost. We nevertheless argue that the economic analysis of religion is undoubtedly a valid and productive approach—if we remember to include the explanatory power of the sociological predictors of individual religious participation and faith, such as the family and denominational background of an individual.

Having uncovered basic determinants on religious behaviour in Germany, future research should now focus on the influence that religion exerts on individuals. Exploring links of religious attitudes and religious behaviour to issues like the labour supply of married women or marital stability should produce worthwhile insights into the behaviour of individuals.

¹ The assumption of an additive separable specification of the individual's utility function follows Azzi and Ehrenberg (1975).

² Using the unfortunately limited biographical information available in the GSOEP on the denominations of each individual's parents would have decreased the number of valid cases too greatly and has thus been omitted.

³ The question about the importance of belief/religion was to be answered on a scale from 1 'very important' to 4 'entirely unimportant'.

⁴ At the same time we avoid the coefficient bias problem that arises when treating 'strength of belief' as entirely exogenous.

⁵ Performing simultaneous regressions would of course be of interest. However, to our knowledge there exists no feasible computable panel estimator for ordered categorical dependent variables.

⁶ See Appendix, Tables A1, A2 and A4 for attendance frequencies of men and women in Germany.

⁷ See Appendix, Table A3.

⁸ The dependent variable 'faith' takes on values 1 for 'entirely unimportant' to 4 'very important'. See also Appendix Table B1 for a description of the variables and Appendix Table B2 for the descriptive statistics of the variables used for estimation.

⁹ The model equations here are estimated using STATA 7.0 and the module 'REOPROB' written by Guillaume R. Frechette (<http://www.econ.ohio-state.edu/frechette/html/econ.htm>).

¹⁰ Full details of the conventional wage equation are omitted here but are available from the author on request.

¹¹ We would expect that the u-shaped age-wage effects found in previous research (Sullivan, 1985; Sawkins *et al.*, 1997) would also be found here. Indeed, experiments with squared age-wage variables show a tendency in the results that an initial fall in church attendance appears with rising wage followed by increase in the frequency on the upper end of the wage scale. However, as the inclusion of squared age and wage variables raises problems of chronic multicollinearity and as, furthermore, most resulting findings are not well defined—exceptional here are women where wage and wage squared are nontrivial (age omitted) in the attendance equations—figures are omitted here, but are available from the author on request.

¹² For the use of age and age squared as proxy for the wage profile, see the preceding footnote.

¹³ Self-rated health can be shown to provide valid and reliable information on morbidity and mortality structures. See Schwarze *et al.* (2000).

¹⁴ Note that information on smoking was available only for 1998 and 1999. We used the information from 1998 to match with the 1994 observations and accepted the subsequent potential bias. However, as we consider individuals between 16 and 65, we are more likely to underestimate the effect of the attitude related with smoking behaviour as it can be shown that taking up smoking occurs mostly in teenage years and quitting occurs in later middle-aged years—Evans and Montgomery (1994) point out that findings from surveys from the late 1980s note that about 70% of all people who ever smoked began smoking at age 18—so that here a 1998 non-smoker might well be an ex-smoker, having been a smoker in 1994.

¹⁵ Experimenting with only West-German data did not yield improvements in the statistical inference.

¹⁶ Note that we do not interpret the results for coefficients that show a statistical significance at the 10% level. As these might simply be outcomes of the 'too-large-sample-size-problem' we thereby try to avoid jumbling 'significant' with 'meaningful' results. See Leamer (1978).

¹⁷ This phenomenon is reflected in the sample: out of the 9302 observations for men across the three waves used there are only 13 observations in which the partner died some time before the interview. Note that the female part of the sample, with a total number of 10,946 observations, lists 32 observations, i. e., deaths of spouse.

¹⁸ We again point out that this might merely show on grounds of the 'too-large-sample-size-problem'. See Leamer (1978).

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Table 1: Random-effects ordered probit model, results for women

| | dependent variable: attend | | dependent variable: faith | |
|---|--|-------------------|---|-------------------|
| | Coef. | (standard errors) | Coef. | (standard errors) |
| cathol | 3.183618*** | (.1115819) | 2.314859*** | (.0851382) |
| protest | 2.357889*** | (.1003922) | 1.835114*** | (.076014) |
| ochrist | 3.929133*** | (.1699165) | 3.277261*** | (.1466206) |
| othdenom | 2.492747*** | (.1467286) | 3.324714*** | (.1256345) |
| age | .0261746*** | (.0036925) | .0255361*** | (.0030641) |
| married | .0463503 | (.1190375) | .1525347 | (.0972407) |
| eqden | .2369263** | (.1025282) | .2145331** | (.0829485) |
| diffden | -.1050505 | (.1133617) | -.0958543 | (.092891) |
| widow | .2217517 | (.1630609) | .0982679 | (.1319988) |
| divorce | -.0383138 | (.1453644) | .2362581** | (.1086388) |
| cohab | -.4417467*** | (.1302931) | -.0140786 | (.1012377) |
| ki46 | .0649408 | (.0636482) | .0682537 | (.057482) |
| ki716 | .2782072*** | (.0342541) | .1227393*** | (.0301477) |
| hlthgood | .1097039* | (.0613548) | .0029404 | (.0522703) |
| hlthfair | .1196393** | (.0568416) | -.0412997 | (.0492182) |
| smoke | -.6523139*** | (.0621338) | -.3867407*** | (.0505353) |
| handicap | -.1921232** | (.085318) | -.0432673 | (.0733654) |
| deathpt | .760744** | (.3175563) | .5366126* | (.2854348) |
| yearsden | .0159739 | (.0210381) | -.0095904 | (.0174604) |
| qual1 | -.0089992 | (.0707752) | -.0080388 | (.0591192) |
| qual2 | .3457838** | (.1643326) | .06238 | (.1360832) |
| unempl | .0019388 | (.0712774) | -.012017 | (.0587578) |
| wage | -.2586316 | (.2122024) | -.3673987** | (.1773135) |
| nonlab | .0000583*** | (.0000114) | .0000291*** | (.0000099) |
| berlin | .0351522 | (.2099651) | -.1425408 | (.1690053) |
| schlhols | -.2301944 | (.2146715) | .054911 | (.1812109) |
| hamburg | .2923873 | (.3093364) | .6240589** | (.2557311) |
| lowsax | -.1048453 | (.132648) | .0888389 | (.111341) |
| bremen | .8934399* | (.4682566) | .6833687** | (.3396327) |
| hessen | -.2612306* | (.1376796) | .0121541 | (.1147489) |
| rhpfsaar | -.1838141 | (.140637) | .182219 | (.1171075) |
| badwuert | .2699452** | (.1105609) | .1856771** | (.0937997) |
| nrwest | .0691567 | (.1074009) | .0630961 | (.0884639) |
| meckpomm | -.5669134** | (.237927) | -.3435645** | (.1685146) |
| brandnbg | -.6383216*** | (.1842726) | -.5260479*** | (.1490775) |
| saxanhal | -.1854341 | (.1819892) | -.3679551*** | (.1371066) |
| thuring | -.201283 | (.1701538) | -.2160674* | (.11291094) |
| saxony | -.3035838* | (.1607777) | -.2328671* | (.1194519) |
| m02 | .1469479 | (.1047352) | -.0088188 | (.0857327) |
| m25 | .2547721*** | (.0975961) | .2169933*** | (.0833905) |
| m2050 | -.1612606* | (.0865024) | -.005445 | (.0703571) |
| m50100 | -.4182276*** | (.1052255) | -.1396442 | (.0875511) |
| m100500 | -.1950303** | (.0877199) | -.0485907 | (.0718474) |
| m500more | -.4369841*** | (.1117936) | -.1560867* | (.0942036) |
| year94 | .0606902 | (.0407433) | .1271559*** | (.0356358) |
| year98 | .0830059** | (.0350725) | .005146 | (.0309068) |
| _cut1 _cons | 2.81776*** | (.423981) | .2236647 | (.3555714) |
| _cut2 _cons | 4.84479*** | (.4275367) | 2.3722*** | (.3567933) |
| _cut3 _cons | 5.928066*** | (.4299325) | 4.414181*** | (.3593684) |
| rho _cons | .7240297*** | (.0096364) | .6657158*** | (.0099297) |
| | Log likelihood = -9356.0636 LR chi2(46) = 2307.80 Prob > chi2 = 0.0000 | | Log likelihood = -10897.57 LR chi2(46) = 2411.46 Prob > chi2 = 0.0000 | |
| Notes: *** 1%, ** 5%, * 10% significance; number of observations= 10946. Source: GSOEP, different waves. Calculations by the author. | | | | |

Table 2: Random-effects ordered probit model, results for men

| | dependent variable: attend | | dependent variable: faith | |
|--|--|-------------------|---|-------------------|
| | Coef. | (standard errors) | Coef. | (standard errors) |
| cathol | 2.973527*** | (.1192505) | 2.026395*** | (.0875459) |
| protest | 2.239515*** | (.1063851) | 1.531109*** | (.0788492) |
| ochrist | 3.645575*** | (.1907578) | 2.797011*** | (.1525108) |
| othdenom | 3.573561*** | (.1602615) | 3.422562*** | (.1321664) |
| age | .017124*** | (.0036953) | .017126*** | (.0030282) |
| married | .4791654*** | (.0996463) | .1964678** | (.0805413) |
| eqden | -.0587099 | (.0832449) | .0926247 | (.0667724) |
| diffden | -.4600247*** | (.1081429) | -.1808812** | (.085844) |
| widow | .8264502*** | (.2577639) | .3319844 | (.2177936) |
| divorce | .151728 | (.1440863) | .2286582** | (.1099013) |
| cohab | -.1483787 | (.1239482) | -.1975536** | (.0952886) |
| ki46 | .1821681** | (.0859514) | -.0308294 | (.0745644) |
| ki716 | .1460882*** | (.0461795) | .0035833 | (.0387919) |
| hlthgood | .1722206** | (.0744684) | .0574257 | (.0611253) |
| hlthfair | .1637519** | (.0719739) | .1098201* | (.0587351) |
| smoke | -.4293811*** | (.055408) | -.2888775*** | (.0450427) |
| handicap | -.0945871 | (.0855136) | .0676839 | (.0701796) |
| deathpt | -.3738837 | (.6489843) | -.1285585 | (.4882199) |
| yearsced | .0067235 | (.0207203) | -.0126917 | (.0170276) |
| qual1 | -.0062086 | (.0691384) | .0017325 | (.057522) |
| qual2 | .3961199*** | (.1410188) | .2037417* | (.1161454) |
| unempl | -.1534567** | (.0739197) | -.0437964 | (.0587605) |
| wage | -.3511799* | (.2115542) | -.2365574 | (.1764564) |
| nonlab | .0000306** | (.0000128) | -.0000098 | (.0000113) |
| berlin | -.0493544 | (.2226682) | -.085798 | (.174311) |
| schlhols | -.2739537 | (.2339555) | .0112733 | (.2035251) |
| hamburg | -.6096981* | (.3669543) | -.2856108 | (.2733156) |
| lowsax | -.2406526 | (.1469767) | -.1545279 | (.1175248) |
| bremen | -.213002 | (.3436737) | .542998* | (.3076112) |
| hessen | -.1129656 | (.1450299) | .0852308 | (.124244) |
| rhpfsaar | -.3346347** | (.167843) | .0274738 | (.1326293) |
| badwuert | .0416875 | (.1265429) | .0043766 | (.1004408) |
| nrwest | -.0318048 | (.1196863) | .0815312 | (.0990214) |
| meckpomm | -.2582834 | (.2129664) | -.576829*** | (.1708707) |
| brandnbg | -.6210873*** | (.2226352) | -.429036*** | (.1530148) |
| saxanhal | -.2391477 | (.1875597) | -.4419428*** | (.1470657) |
| thuring | .0225835 | (.1972599) | -.402117*** | (.1413116) |
| saxony | -.2606104 | (.1638478) | -.2775871** | (.1245068) |
| m02 | .1281092 | (.1169854) | .1119502 | (.0918547) |
| m25 | .1844953* | (.1063336) | .0637993 | (.0879112) |
| m2050 | -.194506** | (.0980151) | -.1082199 | (.0771237) |
| m50100 | -.3336995*** | (.1190907) | -.1262934 | (.0962893) |
| m100500 | -.0243556 | (.1006728) | -.1354469* | (.0799983) |
| m500more | -.3589487*** | (.1294682) | -.2734805** | (.1078473) |
| year94 | .0351004 | (.0469369) | .1171159*** | (.0394182) |
| year98 | -.0407077 | (.0400878) | -.0341601 | (.033836) |
| _cut1 _cons | 2.296154*** | (.4658332) | .238208 | (.3838846) |
| _cut2 _cons | 4.247004*** | (.4691957) | 2.270443*** | (.3855265) |
| _cut3 _cons | 5.240184*** | (.4719955) | 4.077479*** | (.3885507) |
| rho _cons | .7199614*** | (.0109829) | .6441224*** | (.0113426) |
| | Log likelihood = -7125.9979 LR chi2(46) = 1834.41 Prob > chi2 = 0.0000 | | Log likelihood = -9035.793 LR chi2(46) = 1983.77 Prob > chi2 = 0.0000 | |
| Notes: *** 1%, ** 5%, * 10% significance; number of observations= 9302. Source: GSOEP, different waves. Calculations by the author. | | | | |

Appendix, Table A1: Church attendance in Germany 1994 through 1999, shares in percent of all women

| Church attendance | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|-----------------------|------|------|------|------|------|------|
| At least once a week | 13.1 | 14.3 | 13.0 | 13.2 | 12.7 | 11.7 |
| At least once a month | 10.0 | 10.5 | 9.2 | 9.8 | 10.8 | 10.0 |
| More seldom | 28.4 | 27.7 | 31.1 | 30.1 | 30.9 | 31.5 |
| Never | 48.5 | 47.5 | 46.7 | 46.9 | 45.6 | 46.8 |
| | 100 | 100 | 100 | 100 | 100 | 100 |

Source: GSOEP, waves 1994 to 1999. Calculations by the author.

Appendix, Table A2: Church attendance in Germany 1994 through 1999, shares in percent of all men

| Church attendance | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|-----------------------|------|------|------|------|------|------|
| At least once a week | 9.2 | 9.5 | 8.4 | 9.3 | 9.4 | 8.5 |
| At least once a month | 7.5 | 8.4 | 7.9 | 7.2 | 8.4 | 7.2 |
| More seldom | 27.9 | 26.6 | 29.3 | 29.3 | 29.4 | 30.6 |
| Never | 55.4 | 55.5 | 54.4 | 54.2 | 52.8 | 53.7 |
| | 100 | 100 | 100 | 100 | 100 | 100 |

Source: GSOEP, waves 1994 to 1999. Calculations by the author.

Appendix, Table A3: Religious affiliation in Germany 1990 and 1997, shares in percent of all adults

| Religious affiliation | 1990 | | | 1997 | | |
|---------------------------|------|--------|------|------|--------|------|
| | male | female | all | male | female | all |
| Catholic | 33.1 | 34.1 | 33.6 | 32.2 | 32.6 | 32.4 |
| Protestant | 39.0 | 44.4 | 41.9 | 32.7 | 39.8 | 36.5 |
| Other Christian community | 1.9 | 2.2 | 2.0 | 1.9 | 2.3 | 2.1 |
| Other religious community | 2.5 | 2.0 | 2.2 | 4.2 | 3.5 | 3.8 |
| No denomination | 23.5 | 17.3 | 20.3 | 29.0 | 21.8 | 25.2 |
| | 100 | 100 | 100 | 100 | 100 | 100 |

Source: GSOEP, 1990 and 1997. Calculations by the author.

Appendix, Table A4: Religious affiliation and church attendance in Germany 1997, row percentages

| Religious affiliation | Church attendance | | | | | | | | | |
|---------------------------|-------------------|--------------|-------------|-------|-----|-------------|--------------|-------------|-------|-----|
| | Men | | | | | Women | | | | |
| | Once a week | Once a month | More seldom | Never | | Once a week | Once a month | More seldom | Never | |
| Catholic | 18.1 | 12.0 | 36.7 | 33.2 | 100 | 25.8 | 14.4 | 30.8 | 29.0 | 100 |
| Protestant | 4.6 | 7.7 | 42.4 | 45.3 | 100 | 7.9 | 11.1 | 42.7 | 38.3 | 100 |
| Other Christian community | 38.8 | 14.9 | 23.9 | 22.4 | 100 | 43.9 | 10.0 | 23.6 | 22.5 | 100 |
| Other religious community | 28.7 | 11.0 | 18.9 | 41.4 | 100 | 17.9 | 10.8 | 22.3 | 49.0 | 100 |
| No denomination | 0.1 | 0.5 | 8.3 | 91.1 | 100 | 0.2 | 0.5 | 8.9 | 90.4 | 100 |

Source: GSOEP, 1990 and 1997. Calculations by the author.

Table B1: Description of variables

| Variables | Description |
|------------|--|
| attend = | frequency of church attendance, 1=never, 2=seldom, 3=at least once a month, 4=at least once a week |
| faith = | importance of belief/religion, 1= entirely unimportant, 2=unimportant, 3= fairly important, 4=very important |
| cathol = | 1, if individual is member of the Roman Catholic church, 0 else |
| protest = | 1, if individual is member of the Protestant church, 0 else |
| ochrist = | 1, if individual is member of any other Christian church, 0 else |
| othdenom = | 1, if individual has any other denomination, 0 else |
| nodenom = | 1, if individual is without denomination, 0 else; Reference category (RC) |
| age = | age in years |
| married = | 1, if individual is married, 0 else |
| eqden = | 1, if partners share the same denomination, 0 else |
| diffden | 1, if partners have different denominations, 0 else |
| widow = | 1, if individual is widowed, 0 else |
| divorce = | 1, if individual is divorced, 0 else |
| cohab = | 1, if individual is cohabitating, 0 else |
| ki03 = | number of children up to three years of age; RC |
| ki46 = | number of children between four years and six years of age |
| ki716 = | number of children between seven years and sixteen years of age |
| hlthgood = | 1, if individual's self-assessed health is good or very good, 0 else |
| hlthfair = | 1, if individual's self-assessed health is fair, 0 else |
| hlthpoor = | 1, if individual's self-assessed health is less than fair or poor, 0 else; RC |
| smoke = | 1, if individual is smoker, 0 else |
| handicap = | 1, if individual is reported handicapped, 0 else |
| deathpt = | 1, if individual has recently lost his or her partner, 0 else |
| yearsed = | duration of education in years |
| qual0 = | 1, if individual has no formal qualification except basic school, 0 else; RC |
| qual1 = | 1, if individual has a vocational qualification, 0 else |
| qual2 = | 1, if individual has further qualification, 0 else |
| unempl = | 1, if individual is reported unemployed, 0 else |
| wage = | wage rate in log form, corrected for selectivity bias |
| nonlab = | non-labour income |
| berlin = | 1, if individual is resident of Berlin, 0 else |
| schlhols = | 1, if individual is resident of Schleswig-Holstein, 0 else |
| hamburg = | 1, if individual is resident of Hamburg, 0 else |
| lowsax = | 1, if individual is resident of Lower Saxony, 0 else |
| bremen = | 1, if individual is resident of Bremen, 0 else |
| hessen = | 1, if individual is resident of Hessen, 0 else |
| rhpfsaar = | 1, if individual is resident of Rheinland-Pfalz or Saarland, 0 else |
| badwuert = | 1, if individual is resident of Baden-Württemberg, 0 else |
| nrwest = | 1, if individual is resident of North Rhine Westphalia, 0 else |
| bavaria = | 1, if individual is resident of Bavaria, 0 else; RC |
| meckpomm = | 1, if individual is resident of Mecklenburg-Western Pomerania, 0 else |
| brandnbg = | 1, if individual is resident of Brandenburg, 0 else |
| saxanhal = | 1, if individual is resident of Saxony-Anhalt, 0 else |
| thuring = | 1, if individual is resident of Thuringia, 0 else |
| saxony = | 1, if individual is resident of Saxony, 0 else |
| m02 = | 1, if municipal size is less than 2000, 0 else |
| m25 = | 1, if municipal size is greater than 2000 and less than 5000, 0 else |
| m520 = | 1, if municipal size is greater than 5000 and less than 20000, 0 else; RC |
| m2050 = | 1, if municipal size is greater than 20000 and less than 50000, 0 else |
| m50100 = | 1, if municipal size is greater than 50000 and less than 100000, 0 else |
| m100500 = | 1, if municipal size is greater than 100000 and less than 500000, 0 else |
| m500more = | 1, if municipal size is greater than 500000, 0 else |
| year94 = | 1, if observation from 1994, 0 else |
| year98 = | 1, if observation from 1998, 0 else |
| year99 = | 1, if observation from 1999, 0 else; RC |

Source: GSOEP, different waves. Calculations by the author.

Table B2: Descriptive statistics of the variables used for model-estimation

| Variable | Mean | Std. Dev. | Min | Max |
|-----------|----------|-----------|----------|----------|
| attend | 1.730541 | .9518935 | 1 | 4 |
| faith | 2.185747 | .9505584 | 1 | 4 |
| cathol | .2908435 | .4541627 | 0 | 1 |
| protest | .2913374 | .4543898 | 0 | 1 |
| ochrist | .0396089 | .1950432 | 0 | 1 |
| othdenom | .0663769 | .248946 | 0 | 1 |
| nodenom | .3118333 | .4632536 | 0 | 1 |
| age | 41.35949 | 13.78709 | 16 | 65 |
| married | .6328526 | .4820391 | 0 | 1 |
| eqden | .4885915 | .4998822 | 0 | 1 |
| diffden | .1628803 | .3692655 | 0 | 1 |
| widow | .0244962 | .1545877 | 0 | 1 |
| divorce | .0543264 | .2266661 | 0 | 1 |
| cohab | .0810944 | .2729868 | 0 | 1 |
| ki03 | .0857863 | .3174195 | 0 | 3 |
| ki46 | .0757112 | .2876197 | 0 | 3 |
| ki716 | .3101541 | .661892 | 0 | 5 |
| hlthgood | .5330897 | .4989162 | 0 | 1 |
| hlthfair | .3158337 | .4648585 | 0 | 1 |
| hlthpoor | .1510766 | .3581324 | 0 | 1 |
| smoke | .3382556 | .4731277 | 0 | 1 |
| handicap | .0956144 | .2940689 | 0 | 1 |
| deathpt | .0022224 | .0470915 | 0 | 1 |
| yearsced | 11.34888 | 2.382748 | 7 | 18 |
| qual0 | .2686685 | .4432781 | 0 | 1 |
| qual1 | .6571019 | .4746895 | 0 | 1 |
| qual2 | .0944291 | .292432 | 0 | 1 |
| unempl | .0965527 | .2953551 | 0 | 1 |
| wage | 2.677105 | .2574304 | 1.776714 | 3.206085 |
| nonlab | 2872.957 | 2110.975 | 0 | 30000 |
| berlin | .0354603 | .1849447 | 0 | 1 |
| schlhol | .0203477 | .1411901 | 0 | 1 |
| hamburg | .0101245 | .1001122 | 0 | 1 |
| lowsax | .0815389 | .2736677 | 0 | 1 |
| bremen | .0064204 | .0798717 | 0 | 1 |
| hessen | .0645496 | .2457355 | 0 | 1 |
| rhpf Saar | .056697 | .2312684 | 0 | 1 |
| badwuert | .1300869 | .3364073 | 0 | 1 |
| nrwest | .1953279 | .3964627 | 0 | 1 |
| bavaria | .1250988 | .3308391 | 0 | 1 |
| meckpomm | .0328427 | .1782293 | 0 | 1 |
| brandnbg | .0464243 | .2104075 | 0 | 1 |
| saxanhal | .0538819 | .22579 | 0 | 1 |
| thuring | .0551659 | .2283095 | 0 | 1 |
| saxony | .0860332 | .28042 | 0 | 1 |
| m02 | .0997629 | .2996911 | 0 | 1 |
| m25 | .0976393 | .2968336 | 0 | 1 |
| m520 | .233307 | .4229464 | 0 | 1 |
| m2050 | .1772027 | .3818496 | 0 | 1 |
| m50100 | .0935895 | .2912639 | 0 | 1 |
| m100500 | .1753753 | .3802972 | 0 | 1 |
| m500more | .1231233 | .3285868 | 0 | 1 |
| year94 | .3385026 | .473212 | 0 | 1 |
| year98 | .3469972 | .4760266 | 0 | 1 |
| year99 | .3145002 | .464328 | 0 | 1 |

Source: GSOEP, different waves. Calculations by the author.