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## Regional structures and mobility dispositions: A multilevel proportional- & partial-proportional odds approach

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on Multidisciplinary Panel Data Research

SOEP – The German Socio-Economic Panel Study at DIW Berlin

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Christoph Kern

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# Regional structures and mobility dispositions: A multilevel proportional- & partial-proportional odds approach

Christoph Kern\*

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**Abstract:** In the light of persistent regional disparities in Germany, a wide range of studies discuss the role of regional characteristics in explaining the mobility behavior of individuals. Although multi-stage mobility theories underline the importance of regional structures particularly within the first stage of the decision-making process – whereas the actual mobility behavior is often seen as being dependent on intervening factors and restrictions – only few studies consider contextual characteristics while modeling mobility intentions or dispositions. Above all the potentially varying subjective evaluation of local opportunity structures of different groups of actors is rarely taken into account in previous empirical investigations. In order to close this gap, the present study models mobility dispositions as a function of individual as well as regional covariates and also includes interactions between these two levels. With this approach, some light can be shed on the underlying mechanisms concerning regional structures in the decision-making process. The empirical findings show considerable main and interaction effects regarding the local labor market situation and, to a somewhat lesser extent, concerning the development of the regional economic climate. Formally, the empirical models are implemented using a multilevel proportional- as well as partial-proportional odds approach, whereby it is possible to relax the restrictive assumption of equal effects of the covariates at every stage of the ordered outcome variable. The incorporation of small scale structural features is enabled by the usage of SOEP-Geodata.

## 1 Introduction

Given the persistent regional disparities in Germany (e.g. Neu 2012), spatial mobility of labor market agents is often viewed as an adjustment mechanism to local labor market imbalances. At first sight, support for this presumption can be found especially when focusing on migration flows on a regional level, e.g. concerning emigration from East Germany (Niebuhr et al. 2011). Similar findings are reported by Buch (2007a), where an

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increase in spatial mobility is linked with a (modest) reduction of local unemployment for some occupational groups.<sup>1</sup> In contrast, positive selected out-migration can deteriorate the economic prospects of deprived regions, so that regional disparities are intensified (“brain drain” effect; Busch / Weigert 2010, Busch 2007). Micro-level evidence reinforces this concern by indicating that mostly the young and qualified leave declining regions (e.g. Mai 2006, 2007, Hunt 2006). Thus, spatial labor market mobility can have quite diverse regional-level effects which can work in opposite directions.

Against this background, a variety of studies discuss the role of regional characteristics (especially economic conditions) in explaining the mobility behavior of individuals. However, when considering regional mobility as a result of a decision-making process with multiple decision stages, it can be argued that regional opportunity structures play an important role especially within the first decision stage, i.e. regarding mobility intentions or dispositions. Furthermore, when analyzing the effects of regional features, the characteristics of the “evaluators” have to be taken into account. Following this perspective, the present study focuses (1) on the role of regional characteristics regarding individual mobility dispositions and (2) on the potentially group-specific effects of the included regional predictors. Thus, in this paper special attention is paid to the subjective evaluation of local opportunity structures in order to shed some light on the underlying mechanisms concerning regional structures in the decision-making process of regional mobility. The empirical models are carried out using a multilevel proportional- as well as partial-proportional odds framework, whereby the latter provides a fruitful modeling alternative when the parallel regression assumption is violated. Data is provided by the German Socio-Economic Panel (wave 2009), where regional predictors are incorporated via the linkage of SOEP-Geocodes with INKAR (BBSR 2011) data.

The paper is organized as follows: The next section (2) provides a short overview of previous findings concerning the effects of regional characteristics in mobility research and thereby discusses some theoretical considerations. In the following section (3), the data basis and variables are presented. Section 4 contains the description of the empirical framework, where both modeling approaches are outlined in more detail. Empirical findings are presented in section 5, which are summarized and discussed in the last section (6) of this paper.

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<sup>1</sup> However, it should be noted that only a small proportion of regional unemployment can be characterized as spatial mismatch-unemployment and thus can be reduced via regional mobility (Buch 2007a, 2007b).

## 2 Background

To evaluate the effects of regional opportunities concerning spatial mobility, a variety of studies consider regional predictors when analyzing individual mobility decisions. Given the potentially diverging effects of mobility flows on a regional level, special attention is paid to the effect of local economic conditions, especially concerning local unemployment. When including regional unemployment rates in the empirical investigations, diverse findings can be observed. On the one hand, some studies report positive effects, i.e. higher emigration from deprived regions (Tervo 2000, Melzer 2010, Mertens / Haas 2006 [concerning non-voluntary mobility]), whereas on the other hand also negative effects can be observed (Pissarides / Wadsworth 1989, Antolin / Bover 1997, Windzio 2004a, 2004b, Mertens / Haas 2006 [concerning voluntary mobility]).<sup>2</sup> The latter – at first sight counterintuitive – result can be explained by assuming that employed individuals assign a greater utility to their own position when jobs are locally rare (Windzio 2004a). Furthermore, it can be shown that unemployment benefits and labor market programs can induce considerable “locking-in” effects, as reported by Windzio (2010) as well as by Arntz and Wilke (2009). Focusing solely on the mobility behavior of the unemployed, Arntz (2005) additionally shows that only more skilled jobseekers respond to poor local economic conditions with an increase in regional mobility. However, when analyzing the effect of local job access, van Ham et al. (2001) observe a negative relationship between regional job access and the likelihood of accepting a job at a greater distance, thus their findings are in line with classic economic theory. Concerning the influence of further regional characteristics, e.g. regional income structures, positive effects of the local income level can be observed, whereas the regional income variance does not influence the likelihood of migration (Melzer 2010, Swain / Garasky 2007). In addition, estimated differentials between the potential destination and origin region operate as significant mobility predictors, where e.g. differentials in job stability rates induce migration to regions with relatively high job tenure (Rabe / Taylor 2012). Furthermore, considerable interactions between regional- and individual-level predictors can be observed when analyzing mobility decisions, whereas e.g. the negative effect of regional unemployment is weakened for jobseekers with long unemployment durations (Windzio 2004b).<sup>3</sup>

While the outlined studies focus on the mobility *behavior* of labor market agents, multi-stage mobility theories emphasize the role of regional characteristics particularly within the first stages of the decision-making process, i.e. concerning mobility inten-

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<sup>2</sup> Earlier findings are summarized by Greenwood (1997) and Herzog et al. (1993).

<sup>3</sup> Another example concerns the expected mobility distance, where the negative main effect of long distances is lower for highly qualified individuals (Windzio 2004a).

tions or dispositions (e.g. Kalter 1997). From this perspective, regional opportunities determine the overall utility which actors assign to their current location, whereas the actual mobility decision is additionally dependent on intervening factors and economic restrictions (e.g. Lu 1999, Kan 1999). Following this conceptualization, only a moderate amount of studies consider contextual characteristics while modeling mobility intentions. Drinkwater and Ingram (2009) report a higher willingness to move for individuals living in regions with poor job prospects (unemployment/vacancies ratio) and – in contrast – a positive effect of local average wages. When combining both aspects by the usage of a neighborhood status score, Feijten and van Ham (2009) inspect that higher scores are associated with lower moving intentions. In addition, an increasing percentage of ethnic minorities enhances moving wishes (Feijten / van Ham 2009, Permentier et al. 2009). When focusing on the willingness to move of unemployed individuals, Ahn et al. (1999) observe negative effects concerning the local vacancy rate as well as with respect to regional house prices. Considering these noticeable effects on the regional level, surprisingly few studies investigate interactions between regional- and individual-level predictors when analyzing mobility intentions. When comparing the effects of regional features between two age groups ( $< 50$ ,  $\geq 50$ ), the findings by Carlsen (2005; based on Norwegian data) reveal a stronger positive effect of the regional unemployment rate for respondents below 50, indicating that local job prospects play a more important role in the migration considerations of younger labor market agents. Focusing explicitly on group-specific regional effects, van Ham and Feijten (2008; using survey data from the Netherlands) show that the positive effect of a high percentage of ethnic minorities with respect to moving desires is lessened for respondents who are members of ethnic minorities themselves. Furthermore, similar patterns can be observed concerning the regional income structure and the percentage of rented dwellings in the form of negative interactions between the regional percentage of low-income households as well as rented dwellings and their individual-level counterparts.

Providing further theoretical underpinning, Cadwallader (1989) explicitly emphasizes the subjective evaluation of regional opportunity structures as a key link between objective measures and the overall attractiveness which individuals assign to certain regions. Thus, in this framework objective macro-level variables are transformed into their subjective counterparts on the micro-level, where individual utility perceptions are formed. Following this perspective, the effect of regional opportunity structures should be modelled conditional on the attributes of the evaluator, e.g. through the inclusion of interaction terms between individual and contextual characteristics. Concerning the assortment of regional features, the present study focuses on local economic conditions

since the main focus is aimed at labor market related mobility. Furthermore, it can be argued that the individual evaluation of local opportunities is based on current regional characteristics and additionally on the local economic development (Feijten / van Ham 2009, Kearns / Parkes 2003). Consequently, dynamic indicators concerning the economic progress are introduced into the empirical models. Assuming that local economic conditions are particularly important concerning the mobility considerations of actors at the beginning of their working career (i.e. “vulnerable” labor market groups), interactions between age, training status and regional economic features are included. Finally, it can be hypothesized that the synchronization of multiple working careers is associated with additional demands concerning the local labor market, thus the partnership status is included in the interaction specifications.

### 3 Data & Variables

The following findings are based on data from the Socio-Economic Panel Study (SOEP), which is a longitudinal survey of the German population containing a wide spectrum of topics measured at both household and individual-level (Wagner et al. 2007). In order to incorporate regional characteristics in the empirical investigations, the dataset has been enriched with regional features from the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR 2011) through the usage of SOEP-Geocodes (e.g. Spieß 2005). With this setup, detailed information on the regional opportunity structure can be incorporated as level-2 predictors, whereas the individuals are nested in 96 “spatial planning regions”. Since the territorial delineation of these regions is based to a substantial degree on commuting patterns of employees, they are used as proxies for local labor markets in the following sections (Böltken 1996).

Within this study, the empirical investigations are based on SOEP-Samples A-I, using data from wave z (2009). Since the main research interest is aimed at labor market related mobility, the sample was restricted to individuals aged 18 to 65 and semi-retirees with zero working hours were excluded from the analysis. Furthermore, only private households are considered.

The *dependent variable* – denoted as mobility-disposition in the following chapters – is based on the question “Could you imagine moving away from here because of family or career reasons?”, which consists of three response categories (Yes/It depends, I wouldn’t discount it/No, out of the question, I would hardly dream of doing so). Considering the hierarchical structure of the response scale, the dependent variable is treated as ordinal in the subsequent investigations.



According to the preceding considerations, the mobility disposition is assumed to be influenced on two levels, i.e. is dependent on individual as well as regional characteristics and their interactions. The incorporated variables of both levels are summarized in Table 1. At *level-1*, various covariates are specified, which are derived from standard mobility theory and are based on previous findings. These variables mainly contain information with respect to employment, housing, regional embeddedness, economic resources and socio-demographic circumstances.

At *level-2*, several economic indicators concerning the local labor market structure are included. To measure local labor market tightness and average income prospects, the regional unemployment rate and the local income level are considered. In addition, the regional Gross Domestic Product serves as a proxy concerning the overall economic performance of a certain region. While the inclusion of these indicators provides a snapshot of local labor market conditions at a fixed point in time (2009), the development of the regional economic climate is additionally taken into account. Therefore, 96 region-specific linear regressions were carried out, where the outlined regional indicators over the course of the last decade represented the dependent and the respective years (1999-2009) the independent variables. Representing the best linear approximation of the economic development over time, the region-specific regression slopes serve as additional predictors in the following investigations.

To provide an intuitive interpretation of the specified interactions, all continuous predictors – excluding the variables concerning the number of (pre)school-age children and the dynamic level-2 indicators outlined above – were transformed using grand-mean centering.<sup>4</sup>

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<sup>4</sup> Following Enders and Tofghi (2007), grand-mean centered (with regards to the level-2 effects) as well as group-mean centered models (concerning the cross-level interactions) have been estimated. Since both specifications did not show substantial differences in terms of the interaction effects, the grand-mean centered results are reported.

Table 1: Description of exogenous variables

Variables	Description
<i>Level-1</i>	
Age	Age in years
Education	Education in years
HH-Size	Household size, Household size <sup>2</sup>
Owner	1 = Home owner, 0 = Renter
HH-Income	Household Income, Household Income <sup>2</sup>
Employment status	Employed, marginal Emp., in Training, Non-Working
Tenure	Housing tenure in years
Life Satisfaction	Overall life satisfaction
Risk Tolerance	Degree of willingness to take risks
Local ties	Degree of contact with neighbors
Children < 6 y.	Number of children < 6 years old
Children 6 - 16 y.	Number of children 6 - 16 years old
Mover 2008	1 = Moved last year, 0 = Lived at current address
Partner	1 = In Partnership, 0 = Single
<i>Level-2</i>	
Unemployment rate	% unemployed among the labor force
Income level	Household income per capita
GDP	Gross domestic product per employee
Δ Unemp. rate	Δ Unemployment rate 1999-2009
Δ Income level	Δ Income level 1999-2009
Δ GDP	Δ Gross domestic product 1999-2009

## 4 Empirical Framework

As illustrated above, the individual mobility disposition is measured using three ordered response categories. Following the ordered logit approach (e.g. Long 1997), the outlined  $y$ - variable can be linked to an unobserved latent variable  $y^*$  through a measurement model:

$$y_i = \begin{cases} 1 & \text{if } -\infty \leq y_i^* < \tau_1 \\ 2 & \text{if } \tau_1 \leq y_i^* < \tau_2 \\ 3 & \text{if } \tau_2 \leq y_i^* < \infty \end{cases}$$

Within this specification,  $y_i^*$  can be modeled using standard linear regression ( $y_i^* = \mathbf{x}_i' \boldsymbol{\beta} + \varepsilon_i$ ). Combining the measurement model with the latter structural model and assuming  $\varepsilon \sim \mathcal{L}(0, \frac{\pi^2}{3})$ , it follows:<sup>5</sup>

<sup>5</sup> with  $\Lambda(\varepsilon) = \frac{\exp(\varepsilon)}{1 + \exp(\varepsilon)}$ .

$$\begin{aligned}
P(y_i = 1) &= \Lambda(\tau_1 - \mathbf{x}'_i \boldsymbol{\beta}) \\
P(y_i = 2) &= \Lambda(\tau_2 - \mathbf{x}'_i \boldsymbol{\beta}) - \Lambda(\tau_1 - \mathbf{x}'_i \boldsymbol{\beta}) \\
P(y_i = 3) &= 1 - \Lambda(\tau_2 - \mathbf{x}'_i \boldsymbol{\beta})
\end{aligned}$$

With the additional specification of a multilevel structure, the multilevel proportional odds model is derived (e.g. Raudenbush / Bryk 2002):

$$P(y_{ij} = k) = \Lambda(\tau_k - (\mathbf{x}'_{ij} \boldsymbol{\beta} + \mathbf{z}'_{ij} \mathbf{u}_j)) - \Lambda(\tau_{k-1} - (\mathbf{x}'_{ij} \boldsymbol{\beta} + \mathbf{z}'_{ij} \mathbf{u}_j))$$

Here,  $\mathbf{z}'_{ij}$  represents the design vector for the cluster-level random effects  $\mathbf{u}_j$ , with  $\mathbf{u}_j \sim N(\mathbf{0}, \boldsymbol{\Sigma})$ .

Up to this point, we assume that the proportional odds assumption holds, implying equal effects of the  $\beta$ -coefficients at every stage of the ordered outcome variable. More precisely, we model:

$$P(y_{ij} \leq m) = \Lambda(\tau_m - (\mathbf{x}'_{ij} \boldsymbol{\beta} + \mathbf{z}'_{ij} \mathbf{u}_j))$$

where;

$$\boldsymbol{\beta}_{y \leq 1} = \boldsymbol{\beta}_{y \leq 2} = \dots = \boldsymbol{\beta}_{y \leq K-1}$$

In order to relax this assumption, the multilevel partial-proportional odds model can be specified as follows (Hedeker / Mermelstein 1998, Hedeker 2008):

$$P(y_{ij} \leq m) = \Lambda(\tau_m - ((\mathbf{x}^*_{ij})' \boldsymbol{\beta}_m + \mathbf{x}'_{ij} \boldsymbol{\beta} + \mathbf{z}'_{ij} \mathbf{u}_j))$$

In this expression,  $(\mathbf{x}^*_{ij})' \boldsymbol{\beta}_m$  allows heterogeneous threshold effects for  $\mathbf{x}^*_{ij}$ , where  $\boldsymbol{\beta}_m$  contains the effect deviations of the  $\mathbf{x}^*_{ij}$ - variables concerning their respective effects at the first stage of the ordered outcome.

To identify the model, further constraints have to be specified in both approaches. Thus, the multilevel proportional-odds models are estimated setting  $\beta_0 = 0$  (parameterization used by Stata; StataCorp. 2013), while the multilevel partial-proportional odds models are carried out restricting  $\tau_1 = 0$  (MIXOR parameterization; Hedeker / Gibbons 1996).

## 5 Results

The results of the multilevel proportional odds (ordered logit) models are presented in Table 2. Model 1 only contains predictor variables at the individual-level, whereas

in model 2 level-1 interactions have been added. In model 3, additional independent variables at the contextual level have been included. Finally, model 4 contains cross-level interactions between both levels of explanation. In all models, random intercepts are specified.<sup>6</sup> The model estimation is based on  $n_i = 13644$  cases which are clustered in  $n_j = 96$  context-units.

The level-1 variables' logit-coefficients ( $\hat{\beta}$ ) of *model 1* mainly confirm findings of previous studies on regional mobility. On the one hand, increasing age, duration of residence and number of preschool-age children, home ownership, high levels of life satisfaction, close neighborhood contacts and a recent residential relocation are related to lower mobility dispositions. On the other hand, a higher willingness to move is more likely to occur in conjunction with higher education and higher levels of risk-acceptance. Two non-linear effects are manifested with respect to household size (U-shaped curve) and household income (inverted U-shaped curve; cf. Burda et al. 1998). Controlling for the aforementioned factors it can be shown that marginally employed as well as non-working agents – in contrast to the full- and part-time employed – exhibit higher mobility dispositions. This aligns with the substantial mobility incentives for these employment groups. In line with previous research, individuals in partnerships exhibit a lower willingness to move. Regarding the variance components, the present random intercept model shows a significantly better model fit than a comparable single-level model ( $\chi^2 : 207.55, p : 0.0000$ ). A spatial mapping of the contextual level residuals ( $\hat{u}_{0j}$ ) is illustrated in Figure A.1 (Concerning model 1 and the corresponding random intercept only model). The overall explanatory power of model 1 is 0.142 ( $r_{McKelvey \& Zavoina}^2$ ).

*Model 2* shows two interactions at the individual-level. Concerning the first interaction term, it becomes clear that the negative effect of home ownership is intensified considerably when a partnership exists. Therefore, the occurrence of both (location-related) ties has an additional negative effect on top of the respective main effects. Moreover, it can be shown that the effect of “Non-Working” is moderated by age. In this context, the – in comparison to full and part-time employment – positive effect of “Non-Working” on the mobility disposition decreases with increasing age.

In *model 3*, regional features are introduced. Controlling for the previously outlined characteristics, it becomes clear that individuals living in regions with higher unemployment rates are more likely to display lower mobility dispositions. Thus the direction of this effect is contrary to the assumptions of classical economic perspectives. However,

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<sup>6</sup> The inclusion of varying slopes for the level-1 variables which are involved in the cross-level interactions is not explanatory in all models. For a discussion of cross-level interactions in models without random slopes see LaHuis and Ferguson (2009).

the average household income per resident shows a negative effect with respect to the mobility disposition, indicating lower emigration incentives in regions with higher income levels. In contrast to this, a positive effect of the Gross Domestic Product can be observed. Therefore, when controlling for the aforementioned variables, higher mobility intentions can be examined in economically prosperous regions.<sup>7</sup> The additionally included average developments of the local unemployment rates ( $\Delta$  Unemp. rate) and average household incomes ( $\Delta$  Income level) do not show significant effects in the present specification. By contrast, a negative effect concerning the average change of the Gross Domestic Product ( $\Delta$  GDP) can be observed, indicating lower mobility intentions in regions with a positive economic development. Thus, in this case the expected negative effect of an improvement of the regional economic situation can be detected. However, it should be emphasized that this effect is comparably unstable (see footnote 7). When including the level-2 variables,  $r_{McKelvey\&Zavoina}^2$  increases to 0.162.

Along with the explanatory individual and contextual variables, *model 4* contains three cross-level interactions. As illustrated in Figure 2, the positive effect of “In Training” increases with increasing unemployment rates, indicating higher mobility intentions of trainees especially in regions with disadvantageous labor markets. Against the background of the expected entry into employment, the local labor market situation seems to be of particular importance for the mobility considerations of this group. Furthermore, the second interaction shows that the effect-sequence of the factor age varies conditional on the regional GDP. Figure 1 exemplifies this by illustrating the effect of age on the predicted probability of  $y = 3$  for two values of “GDP” (right graphic). On the other hand, the variation of the effect-sequence can be illustrated by the change of the age’s average marginal effect considering all GDP-values (left graphic). It can be shown that the age’s negative effect is weakened in economically strong regions, represented by a flatter effect-curve. Considering the positive main effect of “GDP”, the outlined findings thus contradict the expected higher willingness to move of young individuals in economically weak regions. Finally, the third cross-level interaction indicates that the negative effect of an existing partnership<sup>8</sup> is weakened in regions with relatively unfavorable labor market trends. While a negative partnership effect can be observed in regions that had average changes in unemployment rates from  $-0.75\%$  to  $-0.15\%$  within the last 10 years,

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<sup>7</sup> Because of contents overlap, multicollinearity issues arise at the contextual level (VIF’s; Unemp. rate: 2.83, Income level: 7.24, GDP: 4.72). Whereas the exclusion of “Income level” in model 3 and 4 does not have any consequences for the cross-level interactions, in this case the effect of “ $\Delta$  GDP” loses its explanatory power.

<sup>8</sup> cf. model 1. Because of the specified level-1 interactions, model 2 - 4 contain the conditional partnership-effect for tenants.

this effect no longer exists in the case of higher values of “ $\Delta$  Unemp. rate” (Figure 2). This indicates that in the latter regions, partnerships may constitute minor obstacles to mobility. In summary, the inclusion of the cross-level interactions induces a significant improvement in model-fit (Table 3).<sup>9</sup>

Figure 1: Age\*GDP Interaction

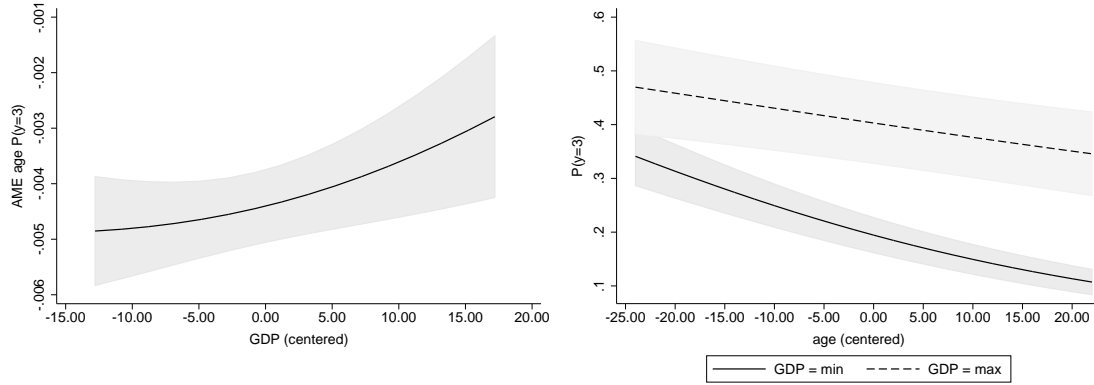
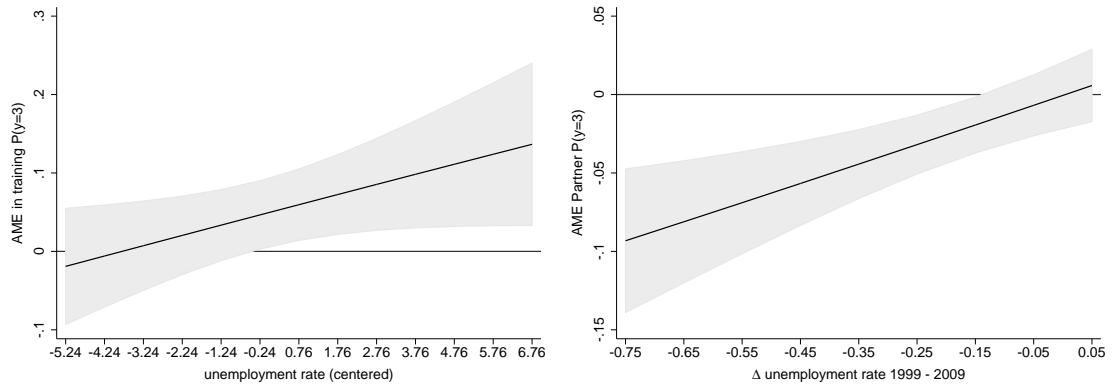


Figure 2: In Training\*Unemp. rate & Partner\* $\Delta$  Unemp. rate



<sup>9</sup> Average marginal effects of the outlined predictors are presented in Table A.1. Furthermore, scale-corrected coefficients were computed and are displayed in the columns labelled  $\hat{\beta}_{sc}$  (cf. Hox 2010).

Table 2: Multilevel proportional-odds Models ( $y_{ij}$  = mobility-disposition)

	Model 1			Model 2			Model 3			Model 4		
	$\hat{\beta}$	se	$\hat{\beta}_{sc}$	$\hat{\beta}$	se	$\hat{\beta}_{sc}$	$\hat{\beta}$	se	$\hat{\beta}_{sc}$	$\hat{\beta}$	se	$\hat{\beta}_{sc}$
<i>Level-1</i>												
Age	-.028***	(.002)	-.026	-.020***	(.002)	-.019	-.020***	(.002)	-.017	-.021***	(.002)	-.019
Education (years)	.119***	(.007)	.110	.119***	(.007)	.110	.120***	(.007)	.111	.123***	(.007)	.113
HH-Size	-.107***	(.023)	-.100	-.130***	(.024)	-.128	-.135***	(.024)	-.125	-.135***	(.024)	-.125
HH-Size <sup>2</sup>	.038***	(.008)	.036	.042***	(.008)	.039	.042***	(.008)	.039	.045***	(.008)	.041
D_Renter	-Ref.-			-Ref.-			-Ref.-			-Ref.-		
D_Owner	-.449***	(.040)	-.416	-.146*	(.071)	-.135	-.141*	(.071)	-.130	-.153*	(.071)	-.142
HH-Income (*10 <sup>-3</sup> )	.126***	(.014)	.117	.121***	(.014)	.111	.115***	(.014)	.106	.110***	(.014)	.102
HH-Income <sup>2</sup> (*10 <sup>-6</sup> )	-.005***	(.001)	-.005	-.005***	(.001)	-.004	-.005***	(.001)	-.004	-.005***	(.001)	-.004
D_Employed	-Ref.-			-Ref.-			-Ref.-			-Ref.-		
D_marginal Emp.	.245***	(.071)	.227	.273***	(.071)	.252	.267***	(.071)	.247	.265***	(.071)	.244
D_In Training	.134	(.112)	.124	.285*	(.116)	.263	.281*	(.116)	.260	.269*	(.116)	.249
D_Non-Working	.174***	(.041)	.162	.205***	(.042)	.190	.205***	(.042)	.189	.195***	(.042)	.180
Tenure (years)	-.010***	(.002)	-.009	-.011***	(.002)	-.010	-.011***	(.002)	-.010	-.010***	(.002)	-.010
Life Satisfaction	-.091***	(.010)	-.084	-.090***	(.010)	-.083	-.092***	(.010)	-.085	-.094***	(.010)	-.086
Risk Tolerance	.098***	(.008)	.091	.098***	(.008)	.090	.098***	(.008)	.091	.099***	(.008)	.091
Local ties	-.178***	(.020)	-.164	-.174***	(.020)	-.161	-.173***	(.020)	-.160	-.174***	(.020)	-.160
Children < 6 y.	-.080 <sup>+</sup>	(.045)	-.075	-.073	(.045)	-.068	-.076 <sup>+</sup>	(.045)	-.071	-.086 <sup>+</sup>	(.045)	-.080
Children 6 - 16 y.	-.002	(.031)	-.002	.026	(.032)	.024	.019	(.032)	.018	.012	(.032)	.011
D_Stayer 2008	-Ref.-			-Ref.-			-Ref.-			-Ref.-		
D_Mover 2008	-.128*	(.064)	-.118	-.112 <sup>+</sup>	(.064)	-.103	-.115 <sup>+</sup>	(.064)	-.106	-.112 <sup>+</sup>	(.064)	-.104
D_Single	-Ref.-			-Ref.-			-Ref.-			-Ref.-		
D_Partner	-.152**	(.048)	-.141	.055	(.059)	.051	.059	(.059)	.054	.186**	(.067)	.172
Owner*Partner				-.409***	(.078)	-.378	-.409***	(.078)	-.378	-.398***	(.078)	-.368
Non-Working*Age				-.018***	(.003)	-.017	-.018***	(.003)	-.017	-.018***	(.003)	-.016
<i>Level-2</i>												
Unemployment rate				-.036*	(.015)	-.034	-.036*	(.015)	-.034	-.039**	(.015)	-.036
Income level				-.001**	(.000)	-.001	-.001**	(.000)	-.001	-.001**	(.000)	-.001
GDP				.036***	(.009)	.033	.036***	(.009)	.033	.035***	(.009)	.033
$\Delta$ Unemp. rate				.222	(.276)	.205	.222	(.276)	.205	-.270	(.308)	-.250
$\Delta$ Income level				-.000	(.007)	-.000	-.000	(.007)	-.000	.000	(.007)	.000
$\Delta$ GDP				-.246 <sup>+</sup>	(.135)	-.227	-.246 <sup>+</sup>	(.135)	-.227	-.255 <sup>+</sup>	(.135)	-.236
<i>Level-1*Level-2</i>												
In Training*Unemp. rate				.071*	(.034)	.071	.071*	(.034)	.071	.071*	(.034)	.066
Age*GDP				.001***	(.000)	.001	.001***	(.000)	.001	.001***	(.000)	.001
Partner* $\Delta$ Unemp. rate				.699***	(.191)	.699	.699***	(.191)	.699	.699***	(.191)	.645

Table 2 (continued)

	Model 1	Model 2	Model 3	Model 4
	$\hat{\beta}$	$\hat{\beta}$	$\hat{\beta}$	$\hat{\beta}$
$\tau_1$	-1.153 (.063)	-.990 (.068)	-1.284 (.228)	-1.193 (.229)
$\tau_2$	.824 (.063)	.994 (.068)	.699 (.227)	.796 (.229)
$\sigma_{u0}^2$	.090*** (.017)	.092*** (.018)	.053*** (.012)	.053*** (.012)
<i>SC-Factor</i>		.926	.924	.924
<i>LL</i>	-13729.114	-13697.255	-13679.741	-13655.556
<i>AIC</i>	27500.229	27440.509	27417.482	27375.112
<i>BIC</i>	27658.171	27613.494	27635.593	27615.786
$r^2_{\beta, \& z.}$	.142	.147	.162	.165
$\chi^2$	1722.712	1773.891	1810.606	1849.813
$p$	.000	.000	.000	.000
$n$	13644	13644	13644	13644

†:  $p \leq 0.1$ ; \*:  $p \leq 0.05$ ; \*\*:  $p \leq 0.01$ ; \*\*\*:  $p \leq 0.001$

Table 3: Likelihood-Ratio Tests

	Model 2 vs. Model 1	Model 3 vs. Model 2	Model 4 vs. Model 3
Likelihood-Ratio $\chi^2$	63.72	35.03	48.37
$p$	.0000	.0000	.0000



So far, all models presume the validity of the proportional odds assumption in form of equal effects of the independent variables at all levels of the ordered outcome. The results of a Brant-Test of this assumption are shown in Table A.2 (considering model 3).<sup>10</sup> If the proportionality assumption is valid, only small differences between the coefficients of both dichotomizations of the dependent variable should occur. Violations of the assumption are indicated by significant test results. In case of the present model, there is strong evidence of a violation of the proportionality assumption (global test;  $\chi^2 : 205.61, p : 0.000$ ). This can be attributed in particular to the significant differences concerning the effects of “Age”, “Education” and “Non-Working” as well as “GDP”, “ $\Delta$  Unemp. rate”, “ $\Delta$  Income level” and “ $\Delta$  GDP” between the dichotomies.

Following the findings of the outlined Brant-Tests, multilevel partial-proportional odds models were carried out, whereby the respective results are displayed in Table 4. Here, interactions between the variables, for which highly significant effect-differences between the respective stages were shown (Brant-Test  $p \leq 0.001$ ), and the threshold  $\tau_2$  are specified. Model 1 & 2 correspond to the initial proportional odds models 1 and 2, while varying effects at the individual-level are additionally taken into account. In case of the initial models 3 and 4, respectively two model variants are estimated, where at first only the individual-level effects (model 3 & 5) and thereafter effects on both levels are allowed to vary between the stages of the outcome variable (model 4 & 6). Thereby, the logit coefficients in the first section of Table 4 describe the respective effects of the interacted variables on the first dichotomization ( $y > 1$ ), whereas in the second section the interaction coefficients display the effect differences with regard to the impact on  $y > 2$ .

Considering the variables with a homogeneous effect structure, *model 1* only shows minor differences in comparison with the respective proportional odds model. However, regarding the effect of the status “Non-Working”, which is now integrated with a heterogeneous effect structure, non-working individuals do not exhibit a higher mobility disposition with respect to the first dichotomization. The positive interaction between “Non-Working” and  $\tau_2$  suggests that the effect displayed in the initial model is mainly attributable to the variable’s impact on the second dichotomization. Similarly, the included threshold-interactions of “Age” and “Education” are evidently important, whereby in comparison with the respective effects at the first stage, a weakened impact of both variables can be observed at the second dichotomization.

*Model 2* includes interactions at the individual-level, taking into account heterogeneous effects of “Age”, “Education” and “Non-Working”. In comparison with the partial-

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<sup>10</sup> For models 1, 2 and 4 similar results can be found.

proportional odds implementation of model 1, the (main) effect of “Non-Working” turns out to be relevant at the first dichotomization within this specification and the effect of “In Training” is now significant as well. When comparing these results with the initial specification of model 2, a better model-fit in terms of a minor deviance can be observed ( $-2LL_{\text{partial-proportional odds}} : 27265$ ,  $-2LL_{\text{proportional odds}} : 27395$ ).<sup>11</sup>

Incorporating heterogeneous effects in the subsequent models with independent level-2 variables induces substantial differences when comparing the latter with the corresponding proportional odds specifications. Concerning the effects at the contextual level of *model 3*, only the coefficients concerning the average income level and the regional Gross Domestic Product obtain the previously observed effect-structures. When the level-2 variables “GDP”, “ $\Delta$  Unemp. rate”, “ $\Delta$  Income level” and “ $\Delta$  GDP” are additionally approved for varying effects (*model 4*), then the impact of the average development of the GDP is mainly effective at the first dichotomization (significantly negative main-effect, significantly positive  $\tau_2$ -interaction). Highly significant effect differences can also be observed for “ $\Delta$  Unemp. rate” and “ $\Delta$  Income level”, whereby the threshold interaction of the development of the local unemployment rate points towards a substantial positive effect of this parameter at the second dichotomization.<sup>12</sup>

Finally, cross-level interactions were specified, whereby at first heterogeneous effects for level-1 variables (*model 5*) and subsequently for variables at both levels (*model 6*) are incorporated. In both models, the (main) effect of the employment status “In Training” loses its significance in comparison with the previous models (and the proportional-odds specification). In accordance with the missing effects of “In Training” and “Unemployment rate”, no significant interaction between these variables can be observed in the respective partial-proportional odds models. However, the cross-level interactions “Age\*GDP” and “Partner\* $\Delta$  Unemp. rate” are robust to the implemented re-specifications with heterogeneous threshold effects on both levels.<sup>13</sup>

In order to rule out the possibility that the observed contextual effects are only reflecting differences in terms of the average mobility dispositions between the structurally highly different old (West) and new (East) states of Germany, separate models for each group have been estimated (cf. Table A.3 and Table A.4). These could clarify that the effects of the average income level and of the GDP can be observed in East as well as in

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<sup>11</sup> The same applies to model 1 and 3 - 6.

<sup>12</sup> A separated modeling of  $y > 2$  shows a significant positive effect of “ $\Delta$  Unemp. rate”. In this case, an unfavorable development of regional unemployment is accompanied by an increased willingness to move.

<sup>13</sup> Although a separated modeling of both dichotomizations displays a significant “Age\*GDP”-interaction only at the first stage of the ordered outcome ( $y > 1$ ).

West Germany. Furthermore, it can be shown that for the western states the cross-level interactions “In Training\*Unemp. rate” and “Partner\* $\Delta$  Unemp. rate” are also significant. A 3-level specification of the outlined models (random intercept at the regional and household-level) additionally confirms the observed effect structures while taking into account clustering at both levels (Table A.5).

## 6 Conclusion

In the present study, mobility dispositions have been investigated, whereby individual-level and regional features as well as interactions between both levels have been incorporated as predictors. In the empirical analysis, the examination of mobility dispositions within an multilevel framework revealed substantial mechanisms concerning the effects of regional characteristics at the first stage of the decision-making process of regional mobility. First of all, it has been shown that the variation of the mobility dispositions between regions can be explained to a sizable degree by different economic conditions, especially in terms of different average incomes as well as Gross Domestic Products. However, only the effect of the regional income level exhibits the expected (negative) sign. Secondly, the development of the regional economic climate serves – to a somewhat lesser extent – as an important predictor when considering mobility intentions. Thirdly, significant interactions between the individual and the contextual level can be identified. These indicate that some contextual variables (especially the GDP and the development of the unemployment rate) moderate effect structures at the individual-level, i.e. the effect of age and partnership in the present case. As with the respective regional feature, the interaction between age and the GDP exhibits an unexpected effect structure which should be subject to further investigations.

Finally, from a methodological perspective, it can be concluded that the partial-proportional odds approach provides a flexible modeling alternative when the proportional odds assumption of equal effects of the covariates at every stage of the outcome variable is violated. In the present case, several individual-level as well as contextual predictors exposed heterogeneous threshold effects, which were explicitly taken into account in the partial-proportional odds framework.

Table 4: Multilevel partial-proportional-odds Models ( $y_{ij}$  = mobility-disposition)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	$\hat{\beta}$	$\hat{\beta}$	$\hat{\beta}$	$\hat{\beta}$	$\hat{\beta}$	$\hat{\beta}$
	se	se	se	se	se	se
<i>Level-1</i>						
Age	-.036***	-.029***	-.029***	-.029***	-.029***	-.029***
	(.010)	(.010)	(.010)	(.010)	(.010)	(.010)
Education (years)	.143***	.144***	.145***	.144***	.148***	.147***
	(.024)	(.025)	(.026)	(.027)	(.027)	(.027)
HH-Size	-.115***	-.144***	-.139***	-.140***	-.139***	-.139***
	(.009)	(.010)	(.010)	(.011)	(.011)	(.012)
HH-Size <sup>2</sup>	.041***	.045***	.044***	.045***	.047***	.047***
	(.034)	(.067)	(.067)	(.074)	(.074)	(.076)
D_Renter	-Ref.-	-Ref.-	-Ref.-	-Ref.-	-Ref.-	-Ref.-
D_Owner	-.461***	-.155*	-.148*	-.146*	-.159*	-.159*
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
HH-Income (*10 <sup>-2</sup> )	.013***	.012***	.011***	.012***	.011***	.011***
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
HH-Income <sup>2</sup> (*10 <sup>-6</sup> )	-.005***	-.005***	-.005***	-.005***	-.005***	-.005***
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
D_Employed	-Ref.-	-Ref.-	-Ref.-	-Ref.-	-Ref.-	-Ref.-
D_marginal Emp.	.269***	.292***	.287***	.287***	.284***	.284***
	(.141)	(.163)	(.171)	(.176)	(.187)	(.189)
D_In Training	.179	.294 <sup>+</sup>	.291 <sup>+</sup>	.290 <sup>+</sup>	.280	.277
	(.048)	(.049)	(.050)	(.052)	(.052)	(.054)
D_Non-Working	.056	.107*	.107*	.108*	.096 <sup>+</sup>	.096 <sup>+</sup>
	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
Tenure (years)	-.009***	-.010***	-.010***	-.010***	-.010***	-.010***
	(.011)	(.011)	(.012)	(.012)	(.013)	(.014)
Life Satisfaction	-.089***	-.088***	-.090***	-.090***	-.092***	-.092***
	(.007)	(.007)	(.008)	(.008)	(.008)	(.009)
Risk Tolerance	.098***	.098***	.099***	.098***	.099***	.098***
	(.021)	(.022)	(.024)	(.026)	(.023)	(.025)
Local ties	-.180***	-.178***	-.176***	-.176***	-.176***	-.177***
	(.045)	(.047)	(.048)	(.049)	(.051)	(.053)
Children < 6 y.	-.095*	-.088 <sup>+</sup>	-.093 <sup>+</sup>	-.093 <sup>+</sup>	-.102*	-.102 <sup>+</sup>
	(.032)	(.034)	(.035)	(.036)	(.036)	(.037)
Children 6 - 16 y.	-.013	.013	.007	.008	.000	.002
	(.070)	(.075)	(.076)	(.081)	(.074)	(.080)
D_Stayer 2008	-Ref.-	-Ref.-	-Ref.-	-Ref.-	-Ref.-	-Ref.-
D_Mover 2008	-.108	-.094	-.097	-.093	-.094	-.091
	(.055)	(.063)	(.064)	(.066)	(.070)	(.078)
D_Single	-Ref.-	-Ref.-	-Ref.-	-Ref.-	-Ref.-	-Ref.-
D_Partner	-.138*	.063	.067	.066	.196*	.208*
	(.078)	(.078)	(.080)	(.085)	(.078)	(.082)
Owner*Partner		-.411***	-.410***	-.415***	-.400***	-.403***
		(.004)	(.004)	(.004)	(.004)	(.005)
Non-Working*Age		-.015***	-.015***	-.015***	-.015**	-.015**
		(.027)	(.027)	(.028)	(.030)	(.030)
<i>Level-2</i>						
Unemployment rate		-.032	-.032	-.032	-.035	-.034
		(.001)	(.001)	(.001)	(.001)	(.001)
Income level		-.001*	-.001*	-.001*	-.001*	-.001*
		.037***	.037***	.043***	.038***	.043**
GDP		.310	.310	.223	-.187	-.820 <sup>+</sup>
		(.002)	(.009)	(.009)	(.009)	(.010)
$\Delta$ Unemp. rate		-.243	-.243	-.419*	-.255	-.430 <sup>+</sup>
		(.196)	(.196)	(.206)	(.201)	(.222)
<i>Level-1*Level-2</i>						
In Training*Unemp. rate		.080	.080	.080	.080	.079
		(.001)**	(.001)**	(.001)**	(.001)**	(.001)**
Age*GDP		.726*	.726*	.726*	.726*	.836*
		(.295)	(.295)	(.295)	(.295)	(.332)
Partner* $\Delta$ Unemp. rate						

Table 4 (continued)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	$\hat{\beta}$	$\hat{\beta}$	$\hat{\beta}$	$\hat{\beta}$	$\hat{\beta}$	$\hat{\beta}$
	<i>se</i>	<i>se</i>	<i>se</i>	<i>se</i>	<i>se</i>	<i>se</i>
$\beta_0$	1.237 (.073)	1.077 (.077)	1.297 (.259)	1.227 (.283)	1.196 (.277)	1.091 (.311)
$\tau_2$	2.075 (.027)	2.068 (.030)	2.067 (.031)	1.888 (.103)	2.071 (.030)	1.876 (.108)
$\sigma_{u0}$	.301*** (.040)	.304*** (.042)	.233*** (.036)	.229*** (.036)	.236*** (.037)	.235*** (.037)
$\tau_2$ * Age	.015*** (.002)	.015*** (.002)	.015*** (.002)	.015*** (.002)	.015*** (.002)	.015*** (.002)
$\tau_2$ * Education	-.043*** (.010)	-.044*** (.011)	-.045*** (.011)	-.043*** (.011)	-.046*** (.012)	-.043*** (.012)
$\tau_2$ * Non-Working	.316*** (.057)	.269*** (.062)	.267*** (.062)	.265*** (.069)	.265*** (.065)	.263*** (.075)
$\tau_2$ * GDP				-.012+ (.007)		-.011 (.008)
$\tau_2$ * $\Delta$ Unemp. rate				1.037*** (.234)		1.124*** (.252)
$\tau_2$ * $\Delta$ Income level				-.013*** (.003)		-.012*** (.003)
$\tau_2$ * $\Delta$ GDP				.345*** (.097)		.335*** (.100)
<i>LL</i>	-13657.4	-13632.3	-13614.7	-13594.4	-13592.4	-13569.3
<i>-2LL</i>	27314.9	27264.5	27229.4	27188.7	27184.9	27138.7
<i>ICC</i>	.027	.027	.016	.016	.017	.016
<i>n</i>	13644	13644	13644	13644	13644	13644

†:  $p \leq 0.1$ ; \*:  $p \leq 0.05$ ; \*\*:  $p \leq 0.01$ ; \*\*\*:  $p \leq 0.001$

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## Appendix

Table A.1: Multilevel proportional-odds models: AME's

	Model 1		Model 2		Model 3		Model 4	
	<i>AME</i>	<i>se</i>	<i>AME</i>	<i>se</i>	<i>AME</i>	<i>se</i>	<i>AME</i>	<i>se</i>
<i>Level-1</i>								
Age	-.005***	(.000)	-.004***	(.000)	-.004***	(.000)	-.004***	(.000)
Education (years)	.021***	(.001)	.021***	(.001)	.021***	(.001)	.022***	(.001)
HH-Size	-.020***	(.004)	-.026***	(.004)	-.025***	(.004)	-.025***	(.004)
D_Renter	-Ref.-		-Ref.-		-Ref.-		-Ref.-	
D_Owner	-.080***	(.007)	-.076***	(.007)	-.076***	(.007)	-.076***	(.007)
HH-Income (*10 <sup>-4</sup> )	.222***	(.025)	.212***	(.025)	.201***	(.025)	.193***	(.025)
D_Employed	-Ref.-		-Ref.-		-Ref.-		-Ref.-	
D_marginal Emp.	.045***	(.014)	.050***	(.014)	.049***	(.014)	.049***	(.014)
D_In Training	.024	(.021)	.053*	(.022)	.052*	(.022)	.050*	(.022)
D_Non-Working	.031***	(.007)	.041***	(.008)	.041***	(.008)	.039***	(.008)
Tenure (years)	-.002***	(.000)	-.002***	(.000)	-.002***	(.000)	-.002***	(.000)
Life Satisfaction	-.016***	(.002)	-.016***	(.002)	-.016***	(.002)	-.017***	(.002)
Risk Tolerance	.017***	(.001)	.017***	(.001)	.017***	(.001)	.017***	(.001)
Local ties	-.031***	(.004)	-.031***	(.004)	-.030***	(.004)	-.031***	(.004)
Children < 6 y.	-.014 <sup>+</sup>	(.008)	-.013	(.008)	-.013 <sup>+</sup>	(.008)	-.015 <sup>+</sup>	(.008)
Children 6 - 16 y.	-.000	(.006)	.005	(.006)	.003	(.006)	.002	(.006)
D_Stayer 2008	-Ref.-		-Ref.-		-Ref.-		-Ref.-	
D_Mover 2008	-.022*	(.011)	-.019 <sup>+</sup>	(.011)	-.020 <sup>+</sup>	(.011)	-.019 <sup>+</sup>	(.011)
D_Single	-Ref.-		-Ref.-		-Ref.-		-Ref.-	
D_Partner	-.027**	(.009)	-.026**	(.009)	-.025**	(.009)	-.020*	(.009)
<i>Level-2</i>								
Unemployment rate					-.006*	(.003)	-.006*	(.003)
Income level (*10 <sup>-2</sup> )					-.020**	(.008)	-.020**	(.008)
GDP					.006***	(.002)	.006***	(.002)
Δ Unemp. rate					.039	(.049)	.035	(.049)
Δ Income level (*10 <sup>-2</sup> )					-.007	(.130)	.004	(.131)
Δ GDP					-.043 <sup>+</sup>	(.024)	-.045 <sup>+</sup>	(.024)

<sup>+</sup>:  $p \leq 0.1$ ; \*:  $p \leq 0.05$ ; \*\*:  $p \leq 0.01$ ; \*\*\*:  $p \leq 0.001$

Table A.2: Brant-Test (Model 3)

	y>1	y>2	$\chi^2$	p
Age	-.031744	-.010864	48.59	.000
Education (years)	.139703	.100410	16.06	.000
HH-Size	-.153230	-.129582	0.53	.467
HH-Size <sup>2</sup>	.037247	.047300	0.93	.334
D_Owner	-.175918	-.117012	0.35	.553
HH-Income	.000137	.000090	6.10	.014
HH-Income <sup>2</sup> (*10 <sup>-6</sup> )	.006565	.003190	7.85	.005
D_marginal Emp.	.363405	.241095	1.44	.230
D_In Training	.260570	.270620	0.00	.955
D_Non-Working	.125930	.348178	15.31	.000
Tenure (years)	-.008132	-.010992	1.24	.265
Life Satisfaction	-.100021	-.080947	2.02	.155
Risk Tolerance	.093260	.101526	0.60	.440
Local ties	-.164285	-.166677	0.01	.931
Children < 6 y.	-.165739	-.029068	5.29	.021
Children 6 - 16 y.	.012373	.005926	0.02	.882
D_Mover 2008	-.261802	-.014312	8.18	.004
D_Partner	.074902	.057132	0.05	.829
Owner*Partner	-.402158	-.402256	0.00	.999
Non-Working*Age	-.013496	-.017696	1.12	.289
Unemployment rate	-.026690	-.037546	0.80	.371
Income level	-.001569	-.000765	6.30	.012
GDP	.044933	.019168	16.69	.000
$\Delta$ Unemp. rate	-.015770	.801116	15.46	.000
$\Delta$ Income level	.014203	-.007618	14.82	.000
$\Delta$ GDP	-.452631	.007120	20.90	.000
			205.61	.000

Table A.3: Multilevel proportional-odds models: West Germany

	Model 1		Model 2		Model 3		Model 4	
	$\hat{\beta}$	<i>se</i>	$\hat{\beta}$	<i>se</i>	$\hat{\beta}$	<i>se</i>	$\hat{\beta}$	<i>se</i>
<i>Level-1</i>								
Age	-.024***	(.002)	-.018***	(.002)	-.018***	(.002)	-.019***	(.003)
Education (years)	.128***	(.008)	.128***	(.008)	.127***	(.008)	.127***	(.008)
HH-Size	-.088***	(.027)	-.115***	(.027)	-.113***	(.027)	-.113***	(.027)
HH-Size <sup>2</sup>	.033***	(.010)	.037***	(.010)	.037***	(.010)	.037***	(.010)
D_Renter	-Ref.-		-Ref.-		-Ref.-		-Ref.-	
D_Owner	-.437***	(.046)	-.154 <sup>+</sup>	(.082)	-.151 <sup>+</sup>	(.082)	-.166*	(.082)
HH-Income (*10 <sup>-3</sup> )	.085***	(.016)	.081***	(.016)	.081***	(.016)	.081***	(.016)
HH-Income <sup>2</sup> (*10 <sup>-6</sup> )	-.003***	(.001)	-.003**	(.001)	-.003**	(.001)	-.003**	(.001)
D_Employed	-Ref.-		-Ref.-		-Ref.-		-Ref.-	
D_marginal Emp.	.214**	(.078)	.235**	(.078)	.235**	(.078)	.239**	(.078)
D_In Training	.156	(.130)	.255 <sup>+</sup>	(.134)	.249 <sup>+</sup>	(.134)	.529**	(.170)
D_Non-Working	.186***	(.047)	.210***	(.048)	.208***	(.048)	.206***	(.048)
Tenure (years)	-.009***	(.002)	-.010***	(.002)	-.010***	(.002)	-.009***	(.002)
Life Satisfaction	-.093***	(.011)	-.091***	(.011)	-.092***	(.011)	-.092***	(.011)
Risk Tolerance	.106***	(.009)	.106***	(.009)	.106***	(.009)	.106***	(.009)
Local ties	-.149***	(.023)	-.147***	(.023)	-.147***	(.023)	-.148***	(.023)
Children < 6 y.	-.062	(.051)	-.056	(.051)	-.057	(.051)	-.057	(.051)
Children 6 - 16 y.	-.036	(.035)	-.014	(.036)	-.017	(.036)	-.018	(.036)
D_Stayer 2008	-Ref.-		-Ref.-		-Ref.-		-Ref.-	
D_Mover 2008	-.099	(.073)	-.086	(.073)	-.086	(.073)	-.085	(.073)
D_Single	-Ref.-		-Ref.-		-Ref.-		-Ref.-	
D_Partner	-.061	(.056)	.128 <sup>+</sup>	(.069)	.126 <sup>+</sup>	(.069)	.184*	(.074)
Owner*Partner			-.382***	(.090)	-.379***	(.090)	-.361***	(.091)
Non-Working*Age			-.013***	(.003)	-.013***	(.003)	-.013***	(.003)
<i>Level-2</i>								
Unemployment rate					.006	(.019)	.002	(.019)
Income level					-.001*	(.000)	-.001*	(.000)
GDP					.027**	(.009)	.027**	(.009)
$\Delta$ Unemp. rate					-.392	(.412)	-1.102*	(.527)
$\Delta$ Income level					-.001	(.007)	-.001	(.007)
$\Delta$ GDP					-.134	(.151)	-.136	(.151)
<i>Level-1*Level-2</i>								
In Training*Unemp. rate							.170**	(.061)
Age*GDP							.000	(.000)
Partner* $\Delta$ Unemp. rate							.935*	(.440)
$\tau_1$	-1.174	(.070)	-1.029	(.076)	-1.165	(.233)	-1.116	(.234)
$\tau_2$	.756	(.069)	.906	(.076)	.770	(.232)	.821	(.234)
$\sigma_{u0}^2$	.062***	(.015)	.062***	(.015)	.046***	(.013)	.046***	(.013)
<i>LL</i>	-10459.3		-10443.1		-10437.3		-10429.9	
<i>AIC</i>	20960.6		20932.2		20932.5		20923.8	
<i>BIC</i>	21112.6		21098.7		21142.4		21155.4	
$\chi^2$	1200.3		1228.2		1241.5		1253.4	
<i>p</i>	.000		.000		.000		.000	
<i>n</i>	10276		10276		10276		10276	

<sup>+</sup>:  $p \leq 0.1$ ; \*:  $p \leq 0.05$ ; \*\*:  $p \leq 0.01$ ; \*\*\*:  $p \leq 0.001$

Table A.4: Multilevel proportional-odds models: East Germany

	Model 1		Model 2		Model 3		Model 4	
	$\hat{\beta}$	<i>se</i>	$\hat{\beta}$	<i>se</i>	$\hat{\beta}$	<i>se</i>	$\hat{\beta}$	<i>se</i>
<i>Level-1</i>								
Age	-.045***	(.004)	-.030***	(.005)	-.030***	(.005)	-.023*	(.009)
Education (years)	.113***	(.016)	.113***	(.016)	.116***	(.016)	.116***	(.016)
HH-Size	-.147**	(.052)	-.191***	(.053)	-.189***	(.053)	-.190***	(.053)
HH-Size <sup>2</sup>	.056**	(.019)	.063**	(.021)	.063**	(.021)	.063**	(.021)
D_Renter	-Ref.-		-Ref.-		-Ref.-		-Ref.-	
D_Owner	-.515***	(.081)	-.121	(.145)	-.117	(.145)	-.121	(.146)
HH-Income (*10 <sup>-3</sup> )	.223***	(.036)	.211***	(.036)	.207***	(.036)	.206***	(.036)
HH-Income <sup>2</sup> (*10 <sup>-6</sup> )	-.005	(.008)	-.004	(.008)	-.004	(.008)	-.004	(.008)
D_Employed	-Ref.-		-Ref.-		-Ref.-		-Ref.-	
D_marginal Emp.	.382*	(.179)	.416*	(.178)	.423*	(.178)	.420*	(.178)
D_In Training	.069	(.222)	.362	(.231)	.374	(.231)	-.233	(.741)
D_Non-Working	.147 <sup>+</sup>	(.086)	.172*	(.087)	.172*	(.087)	.171*	(.087)
Tenure (years)	-.012**	(.004)	-.013***	(.004)	-.013***	(.004)	-.013***	(.004)
Life Satisfaction	-.112***	(.021)	-.116***	(.021)	-.115***	(.021)	-.116***	(.021)
Risk Tolerance	.081***	(.017)	.079***	(.017)	.082***	(.017)	.082***	(.017)
Local ties	-.269***	(.041)	-.258***	(.042)	-.258***	(.042)	-.260***	(.042)
Children < 6 y.	-.232*	(.096)	-.214*	(.097)	-.215*	(.096)	-.217*	(.096)
Children 6 - 16 y.	.073	(.072)	.132 <sup>+</sup>	(.073)	.138 <sup>+</sup>	(.073)	.138 <sup>+</sup>	(.073)
D_Stayer 2008	-Ref.-		-Ref.-		-Ref.-		-Ref.-	
D_Mover 2008	-.290*	(.137)	-.270*	(.137)	-.247 <sup>+</sup>	(.137)	-.245 <sup>+</sup>	(.138)
D_Single	-Ref.-		-Ref.-		-Ref.-		-Ref.-	
D_Partner	-.340***	(.100)	-.075	(.123)	-.069	(.123)	.077	(.247)
Owner*Partner			-.531***	(.160)	-.531***	(.160)	-.522**	(.160)
Non-Working*Age			-.030***	(.006)	-.031***	(.006)	-.031***	(.006)
<i>Level-2</i>								
Unemployment rate					-.104**	(.036)	-.109**	(.036)
Income level					-.005**	(.002)	-.005**	(.002)
GDP					.084***	(.017)	.084***	(.017)
$\Delta$ Unemp. rate					-.129	(.301)	-.358	(.454)
$\Delta$ Income level					.060**	(.019)	.060**	(.019)
$\Delta$ GDP					-.339 <sup>+</sup>	(.175)	-.343 <sup>+</sup>	(.175)
<i>Level-1*Level-2</i>								
In Training*Unemp. rate							.147	(.173)
Age*GDP							.001	(.001)
Partner* $\Delta$ Unemp. rate							.331	(.492)
$\tau_1$	-1.090	(.122)	-.860	(.136)	.173	(.537)	.241	(.556)
$\tau_2$	1.095	(.122)	1.340	(.138)	2.375	(.539)	2.444	(.558)
$\sigma_{u0}^2$	.023 <sup>+</sup>	(.014)	.025 <sup>+</sup>	(.014)	.000	(.000)	.000	(.000)
<i>LL</i>	-3194.0		-3175.6		-3166.4		-3165.5	
<i>AIC</i>	6429.9		6397.2		6388.9		6392.9	
<i>BIC</i>	6558.5		6538.0		6560.3		6582.7	
$\chi^2$	615.0		636.2		667.0		667.8	
<i>p</i>	.000		.000		.000		.000	
<i>n</i>	3368		3368		3368		3368	

<sup>+</sup>:  $p \leq 0.1$ ; \*:  $p \leq 0.05$ ; \*\*:  $p \leq 0.01$ ; \*\*\*:  $p \leq 0.001$

Table A.5: 3-Level proportional-odds models

	Model 1		Model 2		Model 3		Model 4	
	$\hat{\beta}$	<i>se</i>	$\hat{\beta}$	<i>se</i>	$\hat{\beta}$	<i>se</i>	$\hat{\beta}$	<i>se</i>
<i>Level-1</i>								
Age	-.041***	(.003)	-.031***	(.003)	-.031***	(.003)	-.031***	(.003)
Education (years)	.137***	(.010)	.138***	(.010)	.140***	(.010)	.143***	(.010)
D_Employed	-Ref.-		-Ref.-		-Ref.-		-Ref.-	
D_marginal Emp.	.226*	(.093)	.256**	(.093)	.252**	(.093)	.246**	(.093)
D_In Training	.075	(.146)	.233	(.151)	.232	(.151)	.211	(.151)
D_Non-Working	.164**	(.054)	.191***	(.054)	.191***	(.054)	.181***	(.055)
Life Satisfaction	-.111***	(.014)	-.111***	(.014)	-.114***	(.014)	-.116***	(.014)
Risk Tolerance	.125***	(.011)	.125***	(.011)	.126***	(.011)	.126***	(.011)
D_Single	-Ref.-		-Ref.-		-Ref.-		-Ref.-	
D_Partner	-.301***	(.071)	.004	(.088)	.010	(.088)	.192*	(.097)
Non-Working*Age			-.020***	(.004)	-.020***	(.004)	-.020***	(.004)
<i>Level-2</i>								
HH-Size	-.136***	(.038)	-.179***	(.039)	-.173***	(.039)	-.173***	(.039)
HH-Size <sup>2</sup>	.046***	(.013)	.053***	(.013)	.052***	(.013)	.055***	(.013)
D_Renter	-Ref.-		-Ref.-		-Ref.-		-Ref.-	
D_Owner	-.620***	(.064)	-.199*	(.102)	-.189 <sup>+</sup>	(.102)	-.204*	(.102)
HH-Income (*10 <sup>-3</sup> )	.194***	(.022)	.185***	(.022)	.174***	(.022)	.168***	(.022)
HH-Income <sup>2</sup> (*10 <sup>-6</sup> )	-.007***	(.002)	-.007***	(.002)	-.007***	(.002)	-.007***	(.002)
Tenure (years)	-.015***	(.003)	-.016***	(.003)	-.015***	(.003)	-.015***	(.003)
Local ties	-.245***	(.032)	-.242***	(.032)	-.240***	(.032)	-.241***	(.032)
Children < 6 y.	-.119 <sup>+</sup>	(.072)	-.108	(.071)	-.114	(.071)	-.129 <sup>+</sup>	(.071)
Children 6 - 16 y.	-.028	(.052)	.012	(.053)	.001	(.052)	-.008	(.053)
D_Stayer 2008	-Ref.-		-Ref.-		-Ref.-		-Ref.-	
D_Mover 2008	-.131	(.099)	-.110	(.098)	-.117	(.098)	-.115	(.099)
<i>Level-1*Level-2</i>								
Owner*Partner			-.583***	(.109)	-.582***	(.109)	-.567***	(.109)
<i>Level-3</i>								
Unemployment rate					-.048*	(.021)	-.051*	(.021)
Income level					-.002**	(.001)	-.002**	(.001)
GDP					.051***	(.012)	.050***	(.012)
Δ Unemp. rate					.309	(.374)	-.382	(.418)
Δ Income level					.000	(.010)	.001	(.010)
Δ GDP					-.357 <sup>+</sup>	(.183)	-.371*	(.184)
<i>Level-1*Level-3</i>								
In Training*Unemp. rate							.108*	(.044)
Age*GDP							.001***	(.000)
Partner*Δ Unemp. rate							1.012***	(.270)
$\tau_1$	-1.741	(.098)	-1.508	(.104)	-1.914	(.312)	-1.785	(.314)
$\tau_2$	1.031	(.094)	1.269	(.102)	.862	(.311)	1.000	(.313)
$\sigma_{y-HH}^2$	2.542***	(.159)	2.523***	(.158)	2.523***	(.158)	2.530***	(.159)
$\sigma_{u-Region}^2$	.152***	(.033)	.154***	(.033)	.079***	(.022)	.079***	(.022)
<i>LL</i>								
<i>LL</i>	-13361.5		-13334.8		-13316.3		-13291.1	
<i>AIC</i>	26767.0		26717.6		26692.7		26648.2	
<i>BIC</i>	26932.5		26898.1		26918.3		26896.4	
$\chi^2$	1298.9		1335.8		1364.3		1390.9	
<i>p</i>	.000		.000		.000		.000	
<i>n</i>	13644		13644		13644		13644	

<sup>+</sup>:  $p \leq 0.1$ ; \*:  $p \leq 0.05$ ; \*\*:  $p \leq 0.01$ ; \*\*\*:  $p \leq 0.001$

Figure A.1: Context effects  $\hat{u}_{0j}$

