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State Dependence and Female Labor Supply in Germany: The Extensive and the Intensive Margin*

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Abstract

In this paper I develop an intertemporal discrete choice model of labor supply. The framework incorporates the nonlinearities in the household budget set and accounts for state dependence in labor supply. Based on panel data for Germany (SOEP), I estimate this model using a dynamic conditional logit panel data model with random effects. The estimation results show that state dependence is significantly positive at the extensive margin, yet modest or non existing on the intensive margin. Using the Markov chain property, I derive short and long term labor supply elasticities on both the intensive and extensive margin. The labor supply elasticities differ significantly between the short and long run.

Keywords: State Dependence – Labor Supply of Married Women – Panel Data – Unobserved Heterogeneity.

JEL Classification: C25, C33, J22.

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1 Introduction

Estimating labor supply elasticities on the extensive (labor market participation) and intensive margin (working hours) using a discrete rather than a continuous specification has become increasingly popular in the last years. The main advantage of the discrete choice approach compared to a continuous specification derives from the possibility to model nonlinearities in the budget function of a household. Most of the discrete choice literature is based on cross sectional data and focusses on static labor supply models. Yet, the assumption of static labor supply behavior has been rejected by numerous studies that find strong evidence for state dependence in the labor supply behavior, an early example is Heckman (1981a). The aim of this paper is to link the discrete choice labor supply framework with research on intertemporal labor supply behavior. The main focus of this study is the analysis of true state dependence and of the dynamics of labor supply behavior of married women on the extensive and the intensive margin.

There exist several studies on the labor supply behavior of women in an intertemporal setting, e.g. Hyslop (1999). Of particular interest for this paper are those few studies that focus on both the extensive and the intensive margin of labor supply. Prowse (2005) analyzes transitions of women between no work, part time and full time work in an intertemporal context. Using a multinomial probit, she shows that state dependence is present in both full time and part time employment. In a similar framework as employed in this study, Michaud and Vermeulen (2004) model the labor supply and retirement decision of households in the US. To the best of my knowledge, for Germany, this is the first study of labor supply behavior on the intensive and extensive margin in an intertemporal discrete choice setting. Previous work e.g. by Croda and Kyriazidou (2005) focusses on the labor market participation of married women in Germany over time based on data from the Socio-Economic Panel (SOEP). The authors employ several panel data estimators with fixed and random effects. Regardless of their specification, they find strong state dependence in the participation decision of married women.

This study extends previous work in several dimensions. First of all the focus is not only on the extensive but as well on the intensive margin. Although labor supply effects on the extensive margin tend to be more important (Heckman, 1993), it is necessary to study the intensive margin as well when analyzing the labor supply behavior. This is in particular important for the evaluation of welfare programs such as the EITC in the US, WFTC in the UK or the Mini-job reform in Germany, as these reforms provide opposite incentives for the labor market participation and the working hours (Steiner and Wrohlich, 2005). Further, my analysis is based on a detailed microsimulation model for Germany (STSM) which maps the relevant regulations of the German tax and benefit system. The striking advantage of microsimulation is that the work incentives of individuals can be accurately described in the household context. In this respect this analysis goes beyond most of the previous studies. Furthermore, I model the labor supply of both spouses in a joint utility model where the partners jointly maximize a household utility function. Thus, labor supply of the partner is not exogenously given but explicitly modeled within the framework (Killingsworth, 1983). The intertemporal discrete choice approach allows to study the dynamics of labor supply.

Labor supply elasticities in the short and long term can be derived. This yields important insights for the evaluation of policy reforms as not only the size of the labor supply effects of a given reform but also about the process of behavioral adjustment can be derived.

Based on data from the SOEP, I estimate an intertemporal discrete choice model for married women in Germany for the period 1999-2002. In the econometric analysis, I employ a dynamic conditional logit panel data model with random effects where the choice of discrete labor supply alternatives is estimated conditional on the labor supply of the last period, on individual and alternative specific variables and on unobserved heterogeneity. It is necessary to control for unobserved heterogeneity in order to disentangle true and spurious state dependence. The problem of initial conditions is explicitly taken into account. I follow Wooldridge (2005) and specify a model for the unobserved individual effect conditional on time constant individual covariates and the initial state. In the empirical analysis I test for true state dependence in labor supply behavior on the extensive and the intensive margin and derive supply elasticities on both margins. Using the Markov chain property, I distinguish between the adjustment of labor supply in the short and the long run.

My empirical findings are in line with previous studies indicating that true positive state dependence is significantly present in the labor supply behavior of married women. I show that state dependence is high at the extensive margin, yet modest or non existing on the intensive margin. This result can be found in the dynamics of labor supply elasticities. In the short run, labor supply elasticities on are negligible. In the long run, however, the influence of state dependence is relaxed and hence the behavioral adjustment markedly increases. Differentiated by groups, my findings indicate that women with low participation rates, such as women with young children or women living in the western part of Germany have the highest state dependence.

2 Theoretical Background

Discrete choice models of labor supply are based on the assumption that a household (i) is faced with a finite number (J) of discrete bundles of leisure and net household income which provide different levels of utility (U_j) at period t. In this model I assume that households do not save, thus consumption equals the net disposable income. I follow previous studies, e.g. van Soest (1995) or Blundell, Duncan, McCrae, and Meghir (2000) and model the labor supply decision of couples in a joint framework, by defining a joint utility function with combinations of discrete working hours of both spouses and the resulting disposable household income.[1] In a static discrete labor supply approach the utility is only conditioned on information of the present period t. To model

[1] In contrast to previous work on household labor supply, such as the recent work by Michaud and Vermeulen (2004), I do not consider a collective model where both spouses are involved in a bargaining process to determine their individual leisure and income. Based on the available information in the data strong assumptions about the bargaining process had to be imposed (Beblo, Beninger, and Laisney, 2003). Therefore, I stick to the joint utility model which lacks this flexibility but has been proven to be well identified and robust, e.g. van Soest (1995), Blundell, Duncan, McCrae, and Meghir (2000), or Haan and Steiner (2005).

the dynamics of labor supply, I introduce state dependence of labor supply by conditioning the utility in period t on the lagged labor market status of both spouses in period $t-1$. Note, the intertemporal framework proposed here does not describe the labor supply behavior over the life cycle. The agents are assumed to be myopic in the sense that they do only incorporate their past employment history yet not the future working behavior when maximizing their utility in the current period. In this respect, the model is similar to the intertemporal framework of labor market participation with structural state dependence developed by Heckman (1981c).

$$U_{ijt} = U(lf_{ijt}, lm_{ijt}, y_{ijt}, z_{it-1}, x_{it}, c_i, \epsilon_{ijt}). \tag{1}$$

The utility function of a household (U_{ijt}) contains an observable and an unobservable component. The observable component includes the leisure time of both spouses (lf_{ijt} , lm_{ijt}) and the net household income (y_{ijt}). Further, individual, household and time specific characteristics of both spouses that are constant over the different labor supply alternatives, such as age or nationality (x_{it}) enter the utility function. These variables can be interpreted as taste shifters of the preferences. In addition, the utility is dependent on the realized working hours alternative of the previous period (z_{it-1}). This variable is constant over the alternatives and influences as well the preferences for leisure and income. The unobservable component consists of a household specific term c_i and of an random error term that varies over time, households and alternatives ϵ_{ijt}:

In this framework, the decision rule of a household has the following form: the spouses maximize jointly a household utility given the combination of both partners‘ leisure time and the household income and they choose the bundle (j) that provides the highest utility for the household in period (t):

$$\begin{aligned} Pr_{ijt} = Pr(U(lf_{ijt}, lm_{ijt}, y_{ijt}, z_{it-1}, x_{it}, c_i, \epsilon_{ijt}) > \\ U(lf_{imt}, lm_{imt}, y_{imt}, z_{it-1}, x_{it}, c_i, \epsilon_{imt})); \quad \forall m \neq j. \end{aligned} \tag{2}$$

According to the empirical distribution of female and male working hours, 13 discrete bundles ($J = 13$) of household income and female and male leisure hours are defined (Table 2). The maximization problem of the household is subject to a budget constraint as net household income depends on the working hours of the spouses, i.e the non-leisure time. The discrete choice model is driven by the probabilities to choose each alternative J. Given these probabilities, the optimal supply of weekly working hours can be determined as the sum of discrete working hours weighted by their probabilities. Due to changes in a households‘ budget function or due to changes of observed or unobserved characteristics that define the utility it might become optimal for the household to adjust labor supply over time. In a static model it is assumed that a household can adjust labor supply immediately. This assumption, however, is only justified if state dependence does not exists. State dependence in labor supply is present if, given the observed and unobserved characteristics, the working behavior of the last period affects the current labor supply decision. This could arise if the employment history is relevant for prices, preferences and constraints of future periods (Prowse, 2005). Intertemporally nonseparable preferences, human capital accumulation, or signalling and scarring effects explain why the current utility for leisure and income is affected by the previous employment history. Further, fixed costs of work such as search or transaction costs are potential sources of state dependence, as these might differ by the previous employment state Hyslop (1999) or Prowse (2005). State dependence can be positive or negative, yet as underlined by the given examples, the correlation of labor supply over time seems to be positive (Lee and Tae, 2005). In the empirical application, I will test whether the effect of true state dependence is positively significant in a model of labor supply. Therefore, I will distinguish between two sources of choice persistence: true or genuine state dependence and unobserved heterogeneity. Next to genuine state dependence and unobserved heterogeneity, there might be a third source of choice persistence in the data coming from autocorrelation in the error terms ϵ_{ijt}. Amongst others, Hyslop (1999) accounts for serial correlation. Yet, Croda and Kyriazidou (2005) and Michaud and Tatsiramos (2005) reject the hypothesis of a first order autoregressive process in a dynamic labor supply model using German data. Therefore, I assume ϵ_{ij1}, ..., ϵ_{ijT} to be uncorrelated over time.

Before discussing the data in more detail in the next section, a look at descriptive statistics of working transitions provides evidence of persistence in female labor supply, stemming either from unobserved or observed heterogeneity or true state dependence (Table 1).

[Table 1]

On the diagonal, the persistence of labor supply can be seen. During the time of observation, 1999 – 2002 the German tax and transfer system was affected by important reforms, the major one being the tax reform 2000. As Haan and Steiner (2005) show, this reform had an important impact on the net disposable income of households. In addition, changes in other variables affecting the preference for work, such as age or children, could lead to transitions in labor supply states. However, the diagonal shows a high persistence in the labor supply of women.

Note, in this study I do not differentiate between voluntary and involuntary unemployment, thus all women choose their hours points voluntarily without facing labor demand side restrictions. This addresses a general shortcoming of the labor supply literature. Following Blundell, Ham, and Meghir (1987), there have been several attempts to introduce involuntary unemployment into a structural labor supply model (Duncan and MacCrae, 1999) or (Bargain, Caliendo, Haan, and Orsini, 2005). Bargain, Caliendo, Haan, and Orsini (2005) derive labor supply elasticities with and without labor market constraints using the same data as employed in this study, and they find that elasticities accounting for involuntary unemployment are significantly lower for singles and men living in couples, yet not significantly different for women in couples. This is because the majority of the inactive married women chooses voluntarily not to work. Thus, the assumption of a pure choice model for this group is not too restrictive even in a country with high unemployment rates such as Germany.

3 Data Organization

In order to empirically analyze the above derived intertemporal model of labor supply it is necessary to employ panel data information of households. This study is based on the SOEP which is a representative sample of over 12 000 households living in Germany with detailed information about socio-economic variables on a yearly basis.[2] For this analysis, I draw on a balanced panel for the years 1999 - 2002. I concentrate on married couples where both spouses are aged between 20 and 55 years. Excluded are households where at least one spouse is in full time education, self employed or retired, because labor supply of these groups differ from the rest of the population.

After dropping households with missing information 1654 households remain which are observed over four periods. The first period is required to construct the initial state of labor supply. Thus, information of three periods enters the estimation proving variation over time and between the alternatives. Employment alternatives are defined according to the empirical distribution of working hours in the SOEP data; the working hours in each alternatives are the mean values within the given alternative (Haan and Steiner, 2005).

[Table 2]

The first three columns in Table 2 yield information about the working alternatives and the percentage of households choosing these categories. In Germany, part time work for men is very unusual. Therefore, the choice set for the male spouse is simply, no work, full time and over time. Women can choose between inactivity, two part time categories, full time and over time. Dropping two unusual combinations, where the women is working part time and the men is not working, 13 discrete choices of working hours have been defined. As expected, in this sample, the male labor market participation is far higher than the participation of women. Whereas about 95% of all men supply positive working hours, only about 75% of the women participate on the labor market.[3] Part time work is very important for women. More than 40% of the female population works part time. Interestingly, that holds not true for the eastern part of Germany which can be seen in the last column. This, and the higher female participation rate in east Germany point at the still very different labor market behavior in east and west Germany.

In column (4), the mean disposable net household income in each alternative is tabulated. The net household income is derived on basis of the microsimulation model STSM (Steiner, Haan, and Wrohlich, 2005). The simulation model maps the German tax and transfer system in detail. Based on variables drawn from the SOEP that determine gross income and benefits for all household members, disposable net income is simulated at the household level. The largest share of gross income being working income is calculated on basis of the alternative specific working hours and a constant hourly gross wage.[4] The detailed modeling of the net household income is in particular

[2] For a detailed description of the data set, see Haisken De-New and Frick (2003).

[3] These participation rates exceed the participation rates of the whole working population as I focus on an age group with relatively high participation rates.

[4] For non working individuals hourly wages are estimated on basis of a Heckman selection model. For the specification and the results of the wage estimation, see Steiner, Haan, and Wrohlich (2005).

important for the estimation of labor supply effect as this is the most accurate way to describe the work incentives (Laroque and Salanie, 2002).

Comparing the net household income over the alternatives, it becomes obvious that due to non labor market income and due to the tax and benefit system in Germany the difference between the income in the categories is relatively moderate. Note, as in Germany, income is jointly taxed with full income splitting, additional hours of the spouse of a full time working partner do only slightly affect the net disposable household income. This is due to the high marginal tax rates which face the second earner in a married household (Steiner and Wrohlich, 2004).

Households‘ preferences for income and leisure might differ by individual and household specific characteristics such as age, region or the number of children. As the literature has shown, in particular the number of young children is important for labor supply of women. In Table 3 the share of households with children of a certain age group by hours categories is listed. These statistics provide strong evidence that women with young children do not work.

[Table 3]

Table 4 provides information about all individual and household specific variables employed in the estimations.

[Table 4]

4 Econometric Framework

In the following, I will develop the econometric model and discuss the estimation procedure in detail. As described in equation 1, the utility in period t is conditioned on the lagged dependent variable z_{it-1}. This leads to the problem of initial condition when estimating the model by maximum likelihood. This is a general problem of a dynamic specification which has been widely discussed in the econometric literature. In numerous empirical applications the initial conditions problem is tackled by modeling the initial state following the method suggested by Heckman (1981b). Lee and Tae (2005) and Croda and Kyriazidou (2005) follow a different approach: they employ a dynamic conditional logit model with fixed effects, developed by Honore and Kyriazidou (2000). The advantage of this approach is that the unobserved heterogeneity c_i is removed such that no assumptions about the erogeneity of the unobserved individual effects have to be imposed. As in this approach c_i drops out the initial conditions problem does not arise. However, this methods has several drawbacks (Wooldridge, 2005). The main restriction is that c_i can only be removed if the explanatory variables are constant over time. That implies variables such as net household income, age, number of children or time dummies can not be used as regressors. Further, the dependent variable is only allowed to be binary, such that the participation decision but not the decision about the hours of work can be estimated.

In order to solve the problem of initial conditions, I employ another estimation method that builds on the approach suggested by Chamberlain (1980) and Wooldridge (2005). This approach has been applied in similar studies, such as Michaud and Vermeulen (2004), Michaud and Tatsiramos (2005) or Lee and Tae (2005). It is based on the assumption that the conditional expectation of the unobserved individual effect c_i, $h(c|z_0, x; \delta)$, is correctly specified, conditional on the initial state (z_0) and on individual specific variables that are constant over time (x). In other words, the assumption implies that there exists a linear projection of exogenous variables, the initial state (z_{i0}) and further observed individual variables (x_i) and an error term a_i that explains the unobserved individual effect. Vector (x_i) includes the mean values of the individual and household specific variables, age, number and age of children and health status, region and nationality. The error term a_i is by definition uncorrelated with (z_{i0}) and (x_i). Inserting the model of the unobserved individual effect c_i into the above defined utility function, the utility of alternative j becomes:

$$U_{ijt} \quad = \quad U(lf_{ijt}, lm_{ijt}, y_{ijt}, z_{it-1}, x_{it}, c_i(z_{i0}, x_i, a_i), \epsilon_{ijt}). \tag{3}$$

Following McFadden (1974), I assume the error terms ϵ_{ijt} to follow a Gumble distribution. Then, a dynamic conditional logit model can be derived where the probability of choosing alternative j from all J alternatives conditional on the explanatory variables in period t, the chosen alternative of the previous period and the unobserved individual effect has the following form:

$$Pr(U_{it} = j) = \frac{\exp U(lf_{ijt}, lm_{ijt}, y_{ijt}, z_{it-1}, x_{it}, z_{i0}, x_i, a_i)}{\sum_{m=1}^{J} \exp U(lf_{imt}, lm_{imt}, y_{imt}, z_{it-1}, x_{it}, z_{i0}, x_i, a_i)}. \tag{4}$$

The individual unobserved heterogeneity a_i is specified in a parametric way assumed to be normally distributed, with $a_i \sim N(0, \sigma)$.[5].

The individual likelihood function for choosing alternative j is then:

$$L_i = \int \prod_{t=1}^{T} \frac{\exp(U(lf_{ijt}, lm_{ijt}, y_{ijt}, z_{it-1}, x_{it}, z_{i0}, x_i, a_i))}{\sum_m \exp(U(lf_{imt}, lm_{imt}, y_{imt}, z_{it-1}, x_{it}, z_{i0}, x_i, a_i))} f(a)da. \tag{5}$$

The model is estimated by Maximum Simulated Likelihood (MSL) to integrate over the unobserved heterogeneity. In this approach simulated probabilities are used instead of exact probabilities (Gourieroux and Monfort, 1993) or (Hajivassiliou and Ruud, 1994). In general, independent random draws from mixing distributions are used in simulation approaches. In this paper, I apply Halton Sequences as an alternative method, for details see e.g. Train (2003). The superior coverage compared to random draws and the negative correlation over the observations lead to a significant reduction in estimation time. For example Train (2000) and Bhat (2001) find in their studies that the results are more precise with 100 Halton draws than with 1000 random draws. In this paper I use 50 Halton draws per individual.

[5]Another way to specify the unobserved heterogeneity is to follow Heckman and Singer (1984) and specify a_i in a non parametric way. Yet, this led to convergence problems for more then 2 mass points and, therefore, a parametric specification was preferable.

Note, in the conditional logit framework variables which do not vary over alternatives, are not identified. Therefore, variables that are constant over alternatives (x_{it}, x_i) as well as the lagged dependent variables z_{it-1} and the initial state z_{i0} enter the specification as taste shifters of the preferences for income and leisure. State dependence is modeled in a flexible way as a vector of dummy variables where the category of inactivity of both spouses is the base category. The initial state enters in the same way. Unobserved heterogeneity is included as a random coefficient of the income term. For the specification of the utility function, I assume a quadratic utility function similar to Blundell, Duncan, McCrae, and Meghir (2000). Disposable net household income and the leisure of both spouses, their interaction and their quadratic terms enter the utility function.

Hence, the utility function to be estimated has the following form:

$$U_{ijt} = \alpha_y y_{ijt} + \alpha_{y^2} y_{ijt}^2 + \alpha_{lf} lf_{ijt} + \alpha_{lm} lm_{ijt} + \alpha_{lf^2} lf_{ijt}^2 + \alpha_{lm^2} lm_{ijt}^2 \\ + \alpha_{ylf} ylf_{ijt} + \alpha_{ylm} ylm_{ijt} + \alpha_{lmsf} lmsf_{ijt}. \tag{6}$$

I assume that the marginal utility of income and leisure varies across households by age, number and age of children, region, health status, nationality, the lagged dependent variable, the initial state and unobserved characteristics:

$$\alpha_y = \alpha_{y0} + \alpha_{y1} X_{1it} + \upsilon_y, \tag{7}$$

$$\alpha_{lf} = \alpha_{lf0} + \alpha_{lf1} X_{2it}, \tag{8}$$

$$\alpha_{lm} = \alpha_{lm0} + \alpha_{lm1} X_{3it}, \tag{9}$$

$$\alpha_{lmls} = \alpha_{lmlf0} + \alpha_{lmlf1} X_{4it}, \tag{10}$$

where υ_y follows a normal distribution. The lagged dependent variable, the initial state and the mean values are included in vector X_{4it}.

5 Estimation Results

Table 5 contains the estimation results for the dynamic conditional logit panel data model with and without random effects. Model I assumes that no unobserved heterogeneity was present, model II allows for unobserved characteristics assumed to vary with net household income.

The estimated unobserved heterogeneity in model II is significant at the 5% level. This, and the Akaike Information Criterion[6] indicate that it is necessary to control for unobserved individual

[6] The Akaike Information Criterion (AIC) rather than a standard likelihood ratio test has to be considered as under the null hypothesis the latter violates the regularity conditions, and thus its distribution is unknown. AIC is defined as $AIC = lnL - k$, where lnL is the log likelihood at the maximum and k the number of estimated parameters.

effects. Therefore, for the following interpretation, I focus only on this model. However, despite of the significant difference the coefficients are very similar in both specifications. This finding is in line with Michaud and Vermeulen (2004) who argue that the initial state captures most of the individual unobserved heterogeneity.

Preference for income and leisure vary with observed characteristics, such as number of children, age or region. As expected, the presence of young children significantly increases preference for leisure of women. In line with previous studies, women and men living in East Germany, and non German spouses prefer to work more. Taste shifters related to age are not always significant and do not display clear patterns. Men with a poor health status have a higher preference for leisure while for women this effect is not significant. The coefficients of the lagged dependent variables hint at positive state dependence in the labor supply behavior of women. As mentioned above, the lagged dependent variable enters as a vector of dummy variable, the base category being the inactivity of both spouses. The throughout significantly negative coefficients imply that employment in the previous period reduces the taste for leisure in the current period. This holds for both, men and women. The magnitude of the coefficient is the higher the more both spouses work.

An interpretation of the coefficients in a model with multiple interactions is not too informative. Marginal effects, derivatives or elasticities need to be considered in order to understand the impact of variables. Empirical derivatives with respect to leisure and income show that the theoretical implications of the utility function are fulfilled. For all households the concavity of the utility with respect to income is guaranteed. The derivatives with respect to leisure show that for a small part of the population an increase in leisure diminishes the utility; this result is line with previous studies and does not contradict the theoretical implications of the model (Euwals and van Soest, 1999).

5.1 State Dependence on the Extensive and Intensive Margin

In the following, I will test the hypothesis of positive state dependence in female labor supply and the impact of the dynamics of the labor supply elasticities. I concentrate on female labor supply behavior only as previous literature has shown that male working behavior is very inflexible (Blundell and MaCurdy, 1999). Given the coefficients of the lagged dependent variable, I describe the transition process of labor supply by calculating a transition matrix. This matrix provides information about genuine state dependence. Unobserved and observed characteristics are assumed to be constant. That implies all differences in the labor supply behavior can be attributed to the previous employment status which is state dependence.

[**Table 6**]

The elements in the transition matrices are the average one-period transition probabilities summing over all women independent of their observed working behavior in period $t-1$.[7] The

[7] This approach is similar to the simulation strategy suggested by Gong, van Soest, and Villagomez (2004). They derive a transition matrix for different labor market states (formal sector, informal sector, non-employment) conditional on the lagged labor market state for persons in urban Mexico.

estimated transition matrix clearly supports the hypothesis of state dependence on the extensive margin. The probability of choosing inactivity in the current period conditional on not working in the period before is nearly 30%. For a women who was working in the last period this probability is significantly lower. The difference increases with the number of working hours. For a full time working women the probability of inactivity in the next period is 14 percentage points (50%) lower; for a women working over time the difference amounts to more than 22 percentage points. For a women who was working part time the difference in the probability not to work in the current period relative to the same women who was inactive, is lower, yet still significant. These findings are in line with the results of Prowse (2005); on the extensive margin she finds a higher level of true state dependence for full time workers than for those in part time work.

In contrast to previous studies on state dependence in the labor supply behavior of women, the method suggested here allows to analyze state dependence not only on the extensive but as well on the intensive margin, that is the impact of last period‘s employment on the number of hours worked. Comparing the choice probabilities on the intensive margin conditional on last period‘s employment, the picture is not clear cut. In most cases, the impact of the previous working behavior is not significant. This is in particular true when comparing choices conditional on neighboring employment states, such as full time work vs. over time work in the last period.

The potential sources of state dependence, named above, explain the differences in the persistence between the extensive and the intensive margin. Fixed costs of work or other sources why the previous working history might affect preferences of the current labor supply, are more important on the extensive margin. Yet, with the similarity of the working alternatives the impact of these sources is decreasing.

As discussed above, the working behavior of women differs with respect to several observed characteristics. In the German context this is mainly due to differences between east and west Germany and to differences between household with and without young children. Therefore, it is of interest not only to analyze the transition behavior and state dependence of the mean married women but as well differentiated by region and family status.

[**Table 7**]

As found in Table 2, the main difference between east and west German women is the higher labor market participation in the East and the different attitude towards part time work. These differences can be mainly explained with the different historical background in both part of Germany and with a better child care system for young children in the eastern part. For both, east and west German women, state dependence is highly significant and positive on the extensive margin though at a different level and of different size. Whereas in East Germany the state dependence between over time and inactivity amounts to about 0.16 percentage points, for west Germany the comparable state dependence is close to 0.24. This result supports the finding of Michaud and Tatsiramos (2005) who show that South European countries with low labor market participation of women experience a higher state dependence than women in countries with higher participation rates, such as France or the UK. Turning to the intensive margin, again the effect of state dependence is either insignificant or ambiguous in both sub samples.

[Table 8]

The labor market participation of women with young children is very low in Germany, in particular for those with children younger than 3 years. One important reason for this is the low provision of subsidized child care facilities and the therefore high opportunity costs of women with young children (Wrohlich, 2005). Therefore, the transition behavior of women with and without young children is very different. Those without or with older children have a relatively high participation rate and a lower state dependence on the extensive margin as women having young children. The state dependence is in particular high for women with children younger than three years. Conditional on overtime employment versus inactivity in the last period the difference is over 30 percentage points.

5.2 The Dynamics of Labor Supply Behavior

To analyze the implication of state dependence on the labor supply behavior of women, I derive labor supply elasticities over time and analyze the dynamics of these elasticities. This analysis provides information to what extent state dependence leads to different adjustment mechanism over time given a change in the net household income. If state dependence is strongly positive, it needs several periods to adjust labor supply. In contrast, if state dependence is only weakly present or non existent, changes in the net household income affect labor supply immediately or in the short run. As labor supply elasticities cannot be derived analytically within the employed discrete choice framework, I simulate the impact of an exogenous change of female gross hourly wage on her labor supply decision numerically. The elasticities are derived by calculating the simulated change in the predicted hours of work and in the participation rates induced by a 1% change in gross hourly wages. These gross wage elasticities are not directly comparable to often reported net wage elasticities. Gross wage elasticities capture both, the impact of the tax and transfer system as well as the behavioral adjustment of household. For the prediction of the working hours and the participation rate, I derive transition matrices under two different scenarios, the status quo and a simulated scenario that differs by a 1% higher hourly wage. Given the transition matrix and assuming a first order Markov transition process, I calculate transition matrices for future periods. The advantage of this method is that stochastic transition matrices conditional on the previous labor market status can be simply derived not only for period t but as well for future periods $t+k$. Technically this is done by taking the polynomial with degree t of the transition matrix, where t describes the period of interest. Hence, the transitions matrix after period 2 is simply the square of the transition matrix of the first period, after period 3 the polynomial of the transition matrix to the power of three has to be calculated, and so on. The transition probabilities provide information about the average number of working hours and the average labor market participation rate at the end of each period. The average number of hours is calculated by taking the expected value of the working hours given the transition probabilities and the mean hours in the different working categories which are listed in Table 2. The participation rate is simply defined as the probability of working. Given the average number of working hours and the average participation rate in the status quo and assuming a 1% increase of gross hourly wages, it is straightforward to derive labor supply elasticities after each period. The labor supply elasticity in terms of hours of work is simply the relative change in working hours. This is an unconditional elasticity which includes behavioral changes on the intensive and on the extensive margin. Elasticities derived after the first period are defined as the short term elasticities. A Markov process converges in the long run. Formally, the steady state is reached if $t \rightarrow \infty$. Empirically, the steady state is reached if a further period does not affect the transition matrix and the labor supply elasticities converge.

Before, turning to the interpretation of the elasticities, it is necessary do discuss the assumptions underlining a first order Markov process. As stressed above, the Markov process allows to predict transitions for future periods. This is possible as a time constant transition process is assumed. In other words, it is assumed that individuals adjust their labor supply in each period with a constant rate. This certainly is a strong assumption, as it is ambiguous how the adjustment process behaves over time. In order to relax this assumption a higher order Markov process could be considered which remains for future work.

[Table 9]

Table 9 contains the labor supply elasticities for women by region and family status. Next to the average elasticities, bootstrapped values of the 5th and 95th percentiles are reported to perform significance tests. The labor supply elasticities both in terms of participation and in terms of working hours are increasing over time. According to the bootstrapped confidence intervals this increase is significant for the whole population and most of the subgroups. In particular the difference between the first and the second period is important, ranging on the extensive margin from 20% for women in East Germany to over 45% for women with young children. With respect to working hours the increase in elasticities varies from 19% for women with children younger than three to 40% for west German women. After the second period elasticities increase only by less than 10% and after the third period elasticities remain constant. Thus, after the third period the long run elasticity is reached. The differences between the short and the long run can be related to state dependence. In the short run, state dependence prevents the women to fully adjust their labor supply. However, in the long run state dependence is circumvent and thus, the labor supply can be fully adjusted to the new optimal working behavior.

The size and the dynamics of labor supply elasticities vary by groups. According to previous findings about the labor supply behavior of German women, women living in west Germany and women with young children have the highest labor supply response. Women with children younger than three years have a very high elasticity on the extensive margin, yet with respect to working hours it is relatively modest. This is due to the high preference of part time work of this group. Interestingly, the elasticities in the long are very similar to those found in studies based on static discrete choice models Haan (2006). This can be see as support for the static specification. Although the static model is misspecified in the sense that it does not consider state dependence, it seems to adequately model the labor supply behavior in the long run.

6 Conclusion

In this paper I have developed an intertemporal discrete choice model of labor supply for married women. This model combines and extends previous studies by including state dependence in a structural discrete choice labor supply model that allows to study the extensive and the intensive margin of labor supply. Hence, behavioral changes of women over time with respect to labor market participation and working hours can be analyzed. The results of the empirical analysis support the hypothesis of positive state dependence in the choice of labor supply on the extensive margin. On the intensive margin state dependence is only modest or non existent. This is due to the fact that the impact of potential sources of state dependence, such as fixed cost, decrease with the similarity on the working behavior between two periods. Within the intertemporal model labor supply elasticities over time can be derived. Differentiated by groups the finding show that women with low labor market participation, women with young children and women living in west German, have the highest state dependence. I find that labor supply elasticities differ significantly between the short and the long run. State dependence prevents to immediately adjust the labor supply in the short run, yet after the third period the long run elasticity is reached and women have fully adjusted to their new optimal working behavior.

This study is not only interesting from a methodological point of view but as well for the evaluation of policy reforms. Employing the dynamic model it is possible to asses the short and long term labor supply effects of a reforms. In addition to the size of the labor supply effects this model can provide information about the process of adjustment of the labor supply behavior.

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Table 1: Persistence in the employment of women

	Inactivity	Part-time work 1	Part-time work 2	Full-time work	Over-time work	All women (t)
Inactivity	1,019	95	59	64	17	1,254
Part-time work 1	127	460	89	7	5	688
Part-time work 2	79	121	1,209	86	11	1,506
Full-time work	35	11	85	905	130	1,166
Over-time work	6	3	20	125	194	348
All women (t+1)	1,266	690	1,462	1,187	357	4,962

The following working hours classifications (weekly)for women are used: 0, 0-24, 25-34, 35-40, >40 .
Source: SOEP, wave 1999-2003

Table 2: Working hour categories

alternative	Share	Hours Women	Hours men	Net income	East-Germany
	%	per week	per week	in Euro	%
1	2.25	0	0	1279	40.94
2	1.56	19	0	1719	33.01
3	2.07	40	0	2165	42.34
4	13.72	0	37	2435	13.00
5	8.68	9.5	37	2707	5.75
6	17.62	24	37	3003	15.09
7	14.39	37	37	3313	36.97
8	3.26	45	37	3504	47.22
9	9.43	0	48	2842	16.03
10	5.14	9.5	48	3117	5.00
11	10.88	24	48	3421	19.86
12	7.42	37	48	3704	48.88
13	3.57	45	48	3902	46.61

The following working hours (weekly) classifications are used: men: 0, 0-40, >40 women: 0, 0-24, 25-34, 35-40, >40 .
Net household income (monthly) is calculated on basis of the microsimulation model STSM. The net household income is the mean income in the given alternative.
Source: SOEP, wave 1999-2003, STSM

Table 3: Children by working hour categories

alternative	Hours Women	Hours men	child 0-3	child 3-6	child 7-16
	per week	per week	%	%	%
1	0	0	14.09	23.49	54.36
2	19	0	6.80	12.62	57.28
3	40	0	6.57	10.95	43.07
4	0	37	17.07	23.24	63.00
5	9.5	37	5.57	18.12	69.86
6	24	37	2.06	10.12	54.37
7	37	37	0.95	5.67	32.35
8	45	37	1.39	2.78	28.70
9	0	48	20.03	27.24	65.87
10	9.5	48	6.18	16.76	76.76
11	24	48	3.89	12.64	56.94
12	37	48	1.02	4.48	29.94
13	45	48	1.69	4.24	30.51

The following hours classifications are used: men: 0, 0-40, >40 women: 0, 0-24, 25-34, 35-40, >40 .
Share of households with at least one child in the given age interval.
Source: SOEP, wave 1999-2003

Table 4: Descriptive Statistics by Year

	Mean	Std.	Mean	Std.	Mean	Std.
Year	2000		2001		2002	
Monthly net household income in Euro	2963	1015	3117	1190	3174	1215
Age of the husband	0.42	0.07	0.43	0.07	0.44	0.07
Age of the wife	0.40	0.07	0.41	0.07	0.42	0.07
Husband is German in %	0.89	0.32	0.89	0.31	0.90	0.30
Wife is German in %	0.89	0.31	0.90	0.30	0.90	0.30
Health status of husband[1]	0.01	0.09	0.01	0.11	0.02	0.12
Health status of wife[1]	0.01	0.09	0.01	0.10	0.01	0.10
Couple living in East Germany in %	0.23	0.42	0.23	0.42	0.23	0.42
Household with child younger 3 years in %	0.07	0.26	0.06	0.24	0.06	0.23
Household with child between 3 and 6 years in %	0.16	0.37	0.13	0.33	0.08	0.27
Weekly working hours of husband in period t	39.92	10.26	38.69	10.95	37.62	12.13
Weekly working hours of husband in period t-1	39.10	10.49	39.92	10.26	38.69	10.95
Weekly working hours of husband in the initial state[2]	39.10	10.49	39.10	10.49	39.10	10.49
Weekly working hours of wife in period t	20.68	15.64	20.34	15.25	20.30	15.10
Weekly working hours of wife in period t-1	20.37	15.37	20.68	15.64	20.34	15.25
Weekly working hours of wife in the initial state[2]	20.37	15.37	20.37	15.37	20.37	15.37
Observations	1654		1654		1654	

1)Percentage of people who are with 100% disabled.
2)Initial state is the working behavior in the year 1999
Source: SOEP, wave 1999-2003 and STSM

Table 5: Estimation Results

	Coef.	Std.	Coef.	Std.
Net Income				
Age - Man	-40.9646	10.7155	-41.5734	11.7466
Age^2 - Man	48.5745	12.1216	49.8908	13.3686
Age - Women	24.9634	9.9072	28.0940	10.9238
Age^2 - Women	-28.8595	11.4380	-32.7168	12.7260
Constant	3.7331	2.2484	3.1325	2.4068
Net $Income^2$	-0.0148	0.0240	-0.0206	0.0274
Leisure Man				
Age - Man	-0.9992	0.3511	-1.0184	0.3616
Age^2 - Man	1.3540	0.4062	1.3971	0.4187
German - Man	0.0202	0.0094	0.0205	0.0096
East German - Man	-0.0334	0.0131	-0.0379	0.0135
Health Status - Man	0.0285	0.0137	0.0283	0.0141
Constant	0.7361	0.0781	0.7471	0.0803
Leisure Man^2	-0.0038	0.00013	-0.0039	0.0001
Leisure Woman				
Age - Women	0.1803	0.2569	0.2385	0.2644
Age^2 - Women	-0.0647	0.3095	-0.1142	0.3183
German - Women	0.0086	0.0068	0.0093	0.0069
East German - Women	-0.0554	0.0099	-0.0612	0.0104
Health Status - Woman	-0.0051	0.0139	-0.0056	0.0143
Child 0-3	0.1148	0.0084	0.1177	0.0086
Child 3-6	0.0313	0.0048	0.0326	0.0049
Constant	0.4063	0.0552	0.4074	0.0566
Leisure $Woman^2$	-0.0027	0.0001	-0.0028	0.0001
Net Income*Leisure Man	0.0026	0.0031	0.0062	0.0033
Net Income*Leisure Women	0.0063	0.0018	0.0076	0.0019
Leisure Man*Leisure Woman				
Lagged State2	-0.4931	0.1668	-0.4730	0.1720
Lagged State3	-0.8595	0.1888	-0.7857	0.1964
Lagged State4	-0.5701	0.1152	-0.5377	0.1190
Lagged State5	-0.8503	0.1407	-0.7786	0.1469
Lagged State6	-1.9457	0.1580	-1.8669	0.1654
Lagged State7	-2.7936	0.1868	-2.6707	0.1964
Lagged State8	-3.5742	0.2762	-3.4201	0.2889
Lagged State9	-1.0351	0.1390	-0.9348	0.1448
Lagged State10	-1.3502	0.1794	-1.1925	0.1904
Lagged State11	-2.5750	0.1763	-2.3972	0.1895
Lagged State12	-3.8296	0.2217	-3.6466	0.2347
Lagged State13	-4.8808	0.3136	-4.6537	0.3296
Initial State2	-0.0839	0.1742	-0.1219	0.1814
Initial State3	-0.4328	0.2003	-0.5058	0.2114
Initial State4	-0.1659	0.1266	-0.2274	0.1327
Initial State5	-0.4452	0.1545	-0.5427	0.1647
Initial State6	-0.6332	0.1596	-0.7838	0.1738
Initial State7	-1.4145	0.1852	-1.6450	0.2069
Initial State8	-1.7679	0.2901	-2.0366	0.3171
Initial State9	-0.6223	0.1503	-0.7554	0.1621
Initial State10	-1.1128	0.1922	-1.3310	0.2133
Initial State11	-1.3428	0.1808	-1.6282	0.2098
Initial State12	-1.9282	0.2151	-2.2464	0.2467
Initial State13	-2.1075	0.2985	-2.4694	0.3334
Age - Women	0.0053	0.0101	0.0037	0.0107
Child 0-3	0.0880	0.1155	0.1308	0.1243
Child 3-6	-0.2637	0.0952	-0.2726	0.1018
Health Status - Woman	0.3663	0.1970	0.4098	0.2125
German - Women	-0.2784	0.1141	-0.2913	0.1244
East - Women	0.8530	0.2182	0.9654	0.2273
Age - Man	-0.0100	0.0115	-0.0095	0.0119
Health Status - Man	-0.1761	0.2425	-0.1573	0.2575
German - Man	-0.1712	0.1395	-0.1875	0.1477
Constant	-0.2838	0.4387	-0.2766	0.4531
$\log(\sigma)$			-0.4250	0.1824
Observations	4962		4962	
Log-Likelihood	-9742.76		-9735.04	
Derivatives				
$U_y > 0$	100%		100%	
$U_{lf} > 0$	99%		99%	
$U_{lm} > 0$	95%		95%	

Time dummies for the year 2001 and 2002 have been included.
Variables in *italic* are the individual mean values.
The lagged dependent variable and the initial state enter as dummy variables of the working hours alternatives. For the definition of the alternatives, see table 2.
$\log(\sigma)$ is the log. of the standard deviation of the normal distribution of the random coefficient Net Income.
Estimation has been performed using Maximum Simulated Likelihood using 50 Halton Draws.

Table 6: Transition Matrix of Women: all Women

	Inactivity (t)	Part-time work 1 (t)	Part-time work 2 (t)	Full-time work (t)	Over-time work (t)
Inactivity (t-1)	0.281	0.323	0.266	0.102	0.028
	(0.010)	*(0.005)*	*(0.005)*	*(0.005)*	*(0.003)*
Part-time work 1 (t-1)	0.228	0.322	0.278	0.128	0.044
	(0.009)	*(0.006)*	*(0.005)*	*(0.006)*	*(0.005)*
Part-time work 2 (t-1)	0.186	0.282	0.292	0.164	0.076
	(0.008)	*(0.005)*	*(0.005)*	*(0.005)*	*(0.005)*
Full-time work (t-1)	0.141	0.234	0.288	0.210	0.127
	(0.007)	*(0.006)*	*(0.005)*	*(0.006)*	*(0.007)*
Over-time work (t-1)	0.057	0.135	0.267	0.297	0.245
	(0.007)	*(0.011)*	*(0.008)*	*(0.009)*	*(0.017)*

The following hours classifications are used: 0, 0-24, 25-34, 35-40, >40.
Standard errors are given in *italic*. Standard errors are derived using bootstrapping with 100 replications.
Source: SOEP, wave 1999 -2003

Table 7: Transition Matrix of Women: by region

	Inactivity (t)	Part-time work 1 (t)	Part-time work 2 (t)	Full-time work (t)	Over-time work (t)
	West Germany				
Inactivity (t-1)	0.310	0.341	0.247	0.082	0.021
	0.012	*0.006*	*0.006*	*0.005*	*0.002*
Part-time work 1 (t-1)	0.256	0.344	0.263	0.105	0.032
	0.010	*0.005*	*0.006*	*0.006*	*0.003*
Part-time work 2 (t-1)	0.213	0.306	0.284	0.139	0.058
	0.008	*0.006*	*0.005*	*0.005*	*0.004*
Full-time work (t-1)	0.162	0.258	0.289	0.188	0.104
	0.008	*0.006*	*0.005*	*0.006*	*0.006*
Over-time work (t-1)	0.069	0.156	0.283	0.280	0.212
	0.009	*0.014*	*0.009*	*0.011*	*0.020*
	East Germany				
Inactivity (t-1)	0.184	0.258	0.331	0.170	0.057
	0.012	*0.010*	*0.007*	*0.011*	*0.006*
Part-time work 1 (t-1)	0.129	0.248	0.330	0.208	0.085
	0.010	*0.011*	*0.006*	*0.012*	*0.009*
Part-time work 2 (t-1)	0.102	0.203	0.316	0.246	0.133
	0.009	*0.009*	*0.006*	*0.009*	*0.009*
Full-time work (t-1)	0.070	0.156	0.283	0.286	0.205
	0.007	*0.007*	*0.005*	*0.007*	*0.009*
Over-time work (t-1)	0.018	0.066	0.208	0.350	0.357
	0.003	*0.009*	*0.013*	*0.005*	*0.022*

The following hours classifications are used: 0, 0-24, 25-34, 35-40, >40 .
Standard errors are given in *italic*. Standard errors are derived using bootstrapping with 100 replications.
Source: SOEP, wave 1999 -2003

Table 8: Transition Matrix of Women: by family status

	Inactivity (t)	Part-time work 1 (t)	Part-time work 2 (t)	Full-time work (t)	Over-time work (t)
	Household without young children				
Inactivity (t-1)	0.241	0.318	0.290	0.117	0.034
	0.012	*0.006*	*0.006*	*0.006*	*0.004*
Part-time work 1 (t-1)	0.189	0.313	0.302	0.146	0.051
	0.010	*0.007*	*0.006*	*0.007*	*0.005*
Part-time work 2 (t-1)	0.150	0.267	0.311	0.184	0.087
	0.007	*0.005*	*0.006*	*0.005*	*0.005*
Full-time work (t-1)	0.108	0.215	0.301	0.232	0.143
	0.007	*0.006*	*0.006*	*0.006*	*0.007*
Over-time work (t-1)	0.033	0.109	0.266	0.320	0.272
	0.005	*0.010*	*0.011*	*0.007*	*0.018*
	Household with children younger 3 years				
Inactivity (t-1)	0.650	0.287	0.058	0.005	0.001
	0.019	*0.012*	*0.007*	*0.001*	*0.000*
Part-time work 1 (t-1)	0.598	0.328	0.065	0.007	0.001
	0.021	*0.012*	*0.008*	*0.002*	*0.000*
Part-time work 2 (t-1)	0.549	0.347	0.088	0.014	0.003
	0.022	*0.010*	*0.010*	*0.003*	*0.001*
Full-time work (t-1)	0.479	0.364	0.121	0.027	0.009
	0.024	*0.007*	*0.012*	*0.005*	*0.002*
Over-time work (t-1)	0.333	0.380	0.196	0.065	0.026
	0.030	*0.008*	*0.018*	*0.012*	*0.006*
	Household with children between 3 and 6 years				
Inactivity (t-1)	0.428	0.348	0.173	0.041	0.009
	0.013	*0.007*	*0.007*	*0.004*	*0.001*
Part-time work 1 (t-1)	0.372	0.369	0.188	0.055	0.015
	0.014	*0.005*	*0.008*	*0.005*	*0.002*
Part-time work 2 (t-1)	0.321	0.348	0.219	0.082	0.030
	0.013	*0.007*	*0.008*	*0.006*	*0.003*
Full-time work (t-1)	0.259	0.315	0.244	0.122	0.060
	0.014	*0.008*	*0.007*	*0.009*	*0.007*
Over-time work (t-1)	0.140	0.237	0.282	0.207	0.134
	0.014	*0.016*	*0.006*	*0.014*	*0.016*

The following hours classifications are used: 0, 0-24, 25-34, 35-40, >40 .
Standard errors are given in *italic*. Standard errors are derived using bootstrapping with 100 replications.
Source: SOEP, wave 1999-2003

Table 9: Labor Supply Elasticities by Region and Family Status

Period	All Women	West Germany	East Germany	No young child	Children 0-3	Children 3-6
			Labor Market Participation			
1	0.074	0.082	0.051	0.069	0.180	0.087
	(0.064 - 0.081)	(0.071 - 0.090)	(0.042 - 0.058)	(0.062 - 0.076)	(0.141 - 0.210)	(0.075 - 0.099)
2	0.102	0.116	0.062	0.093	0.240	0.127
	(0.086 - 0.111)	(0.102 - 0.128)	(0.050 - 0.071)	(0.082 - 0.104)	(0.188 - 0.285)	(0.110 - 0.141)
3	0.110	0.126	0.065	0.101	0.240	0.134
	(0.093 - 0.120)	(0.113 - 0.139)	(0.052 - 0.076)	(0.089 - 0.115)	(0.189 - 0.286)	(0.117 - 0.146)
4	0.113	0.128	0.066	0.104	0.239	0.135
	(0.095 - 0.123)	(0.116 - 0.141)	(0.053 - 0.078)	(0.091 - 0.118)	(0.188 - 0.285)	(0.118 - 0.146)
5	0.114	0.129	0.067	0.105	0.239	0.135
	(0.095 - 0.124)	(0.117 - 0.142)	(0.054 - 0.079)	(0.091 - 0.119)	(0.188 - 0.285)	(0.118 - 0.146)
6	0.114	0.129	0.067	0.105	0.239	0.135
	(0.096 - 0.124)	(0.117 - 0.142)	(0.054 - 0.079)	(0.092 - 0.120)	(0.188 - 0.285)	(0.118 - 0.146)
7	0.114	0.129	0.067	0.105	0.239	0.135
	(0.096 - 0.124)	(0.117 - 0.142)	(0.054 - 0.079)	(0.092 - 0.120)	(0.188 - 0.285)	(0.118 - 0.146)
8	0.114	0.129	0.067	0.105	0.239	0.135
	(0.096 - 0.124)	(0.117 - 0.142)	(0.054 - 0.079)	(0.092 - 0.120)	(0.188 - 0.285)	(0.118 - 0.146)
9	0.114	0.129	0.067	0.105	0.239	0.135
	(0.096 - 0.124)	(0.117 - 0.142)	(0.054 - 0.079)	(0.092 - 0.120)	(0.188 - 0.285)	(0.118 - 0.146)
10	0.114	0.129	0.067	0.105	0.239	0.135
	(0.096 - 0.124)	(0.117 - 0.142)	(0.054 - 0.079)	(0.092 - 0.120)	(0.188 - 0.285)	(0.118 - 0.146)
			Working Hours			
1	0.208	0.228	0.160	0.204	0.270	0.236
	(0.175- 0.232)	(0.194- 0.256)	(0.124 - 0.185)	(0.178- 0.227)	(0.205- 0.326)	(0.191- 0.275)
2	0.285	0.318	0.203	0.278	0.323	0.326
	(0.239- 0.317)	(0.280- 0.352)	(0.154 - 0.231)	(0.244- 0.307)	(0.249- 0.395)	(0.271- 0.390)
3	0.310	0.345	0.217	0.302	0.317	0.342
	(0.259- 0.343)	(0.308- 0.377)	(0.164 - 0.245)	(0.266- 0.333)	(0.248- 0.388)	(0.289- 0.410)
4	0.317	0.352	0.222	0.310	0.315	0.343
	(0.265- 0.350)	(0.317- 0.384)	(0.167 - 0.248)	(0.273- 0.341)	(0.247- 0.386)	(0.293- 0.411)
5	0.319	0.354	0.223	0.312	0.315	0.343
	(0.267- 0.352)	(0.319- 0.385)	(0.167 - 0.250)	(0.276- 0.344)	(0.247- 0.386)	(0.293- 0.411)
6	0.319	0.354	0.224	0.313	0.315	0.342
	(0.267- 0.352)	(0.320- 0.385)	(0.168 - 0.250)	(0.277- 0.345)	(0.247- 0.386)	(0.293- 0.410)
7	0.320	0.354	0.224	0.313	0.315	0.342
	(0.268- 0.353)	(0.320- 0.385)	(0.168 - 0.250)	(0.277- 0.345)	(0.247- 0.386)	(0.293- 0.410)
8	0.320	0.354	0.224	0.313	0.315	0.342
	(0.268- 0.353)	(0.320- 0.385)	(0.168 - 0.250)	(0.277- 0.345)	(0.247- 0.386)	(0.293- 0.410)
9	0.320	0.354	0.224	0.313	0.315	0.342
	(0.268- 0.353)	(0.320- 0.385)	(0.168 - 0.250)	(0.277- 0.345)	(0.247- 0.386)	(0.293- 0.410)
10	0.320	0.354	0.224	0.313	0.315	0.342
	(0.268- 0.353)	(0.320- 0.385)	(0.168 - 0.250)	(0.277- 0.345)	(0.247- 0.386)	(0.293- 0.410)

The 5th and 95th percentiles are given in *brackets*, they are derived using bootstrapping with 100 replications.
Source: SOEP, wave 1999-2003