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Working Paper

Intertemporal Labor Supply Effects of Tax Reforms

DIW Discussion Papers, No. 669

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Suggested Citation: Haan, Peter (2007) : Intertemporal Labor Supply Effects of Tax Reforms, DIW Discussion Papers, No. 669, Deutsches Institut für Wirtschaftsforschung (DIW), Berlin

This Version is available at:
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Discussion Papers

669

Peter Haan

Intertemporal Labor Supply Effects of Tax Reforms

Berlin, March 2007

Intertemporal Labor Supply Effects of Tax Reforms*

Peter Haan †

March 2, 2007

Abstract

In the year 2000, the German government passed the most ambitious tax reform in post-war German history aiming at a significant tax relief for households. One central aim of this tax reform was to improve work incentives and, thereby, foster employment. In this paper, I estimate an intertemporal discrete choice model of female labor supply that allows to analyze the behavioral effects of the tax reform on the labor supply of married and cohabiting women over time. Using the Markov chain property, I analyze the dynamics of labor supply behavior and derive the short- and long-run labor supply effects of the tax reform.

Keywords: Intertemporal Labor Supply of Married Women – Tax reform – Panel Data – Microsimulation.

JEL Classification: C33, H24, H31, J22.

*This research project is financed by the German Science Foundation (DFG) in the priority program "Potentials for more flexibility on heterogenous labor markets" (project STE 681/5-1). I would like to thank Katharina Wrohlich, Viktor Steiner and Arne Uhlendorff. The usual disclaimer applies.

†Peter Haan is Research Associate at the DIW, Berlin, Koenigin Luise Str. 5, 14195 Berlin, Germany, email: phaan@diw.de

Opinions expressed in this paper are those of the author and do not necessarily reflect views of the institute.

IMPRESSUM
© DIW Berlin, 2007
DIW Berlin
German Institute for Economic Research
Königin-Luise-Str. 5
14195 Berlin
Tel. +49 (30) 897 89-0
Fax +49 (30) 897 89-200
http://www.diw.de

ISSN print edition 1433-0210
ISSN electronic edition 1619-4535

Available for free downloading from the DIW Berlin website.

1 Introduction

In the year 2000, the German government passed the most ambitious tax reform in post-war German history aiming at a significant tax relief for households of about 32 billion Euro per year. An important aim of this tax reform was to improve work incentives and, thereby, foster employment in the sluggish German economy. The following analysis focuses on the part of the reform related to the personal income tax which has been implemented in several steps starting in the year 2001.[1] By 2005, the top marginal tax rate was reduced to 42%, compared to 51% in 2000. In the same period, the lowest marginal tax rate was reduced from 22.9% to 15%, and the basic tax allowance increased from 6,902 Euro to 7,664 Euro.

Several studies have analyzed the distributional, fiscal and behavioral effects of the German Tax Reform 2000. Corneo (2005b) shows that this tax reform had a regressive impact on the income distribution, since in particular high income households benefit from the reduction of the marginal tax rates. Previous findings of Wagenhals (2000b) and Haan and Steiner (2005 and 2006) are in line with this result. Moreover the latter studies focus on the work incentives and labor supply effects induced by the tax reform and find that the reduction of the tax burden was leading to a significant, yet relative to the fiscal cost, to a modest increase in labor supply.[2] The mentioned studies employ a behavioral microsimulation model combined with a static discrete choice labor supply estimation. Based on the labor supply model, behavioral responses along the extensive margin (employment participation) and the intensive margin (working hours) can be analyzed in the household context. This methodology has become standard for ex-ante evaluations

[1] Amongst others, Homburg (2000) and Soerensen (2002) discuss and analyze the effects of the tax reform for corporations and entrepreneurs.

[2] All mentioned studies on the tax reform 2000, analyze the reform from an ex-ante perspective by simulating the mechanical and behavioral effect of the tax reform. So far, an ex-post evaluation has not been conducted as the required data for the fiscal year 2005 are not yet available.

of tax and transfer reforms as labor supply incentives can be accurately described and non-linearities in the budget set can be incorporated in a straightforward way (Blundell and MaCurdy, 1999). There exists numerous applications of this methodology for several countries, e.g. Aaberge, Dagsvik, and Stroem (1997) for Norway, Blundell, Duncan, McCrae, and Meghir (2000) for the UK, or Flood, Hansen, and Wahlberg (2004) for Sweden. In these studies a variety of important advances of the standard discrete choice labor supply approach have been suggested, i.e. the treatment of unobserved heterogeneity, the modelling of welfare participation (Flood, Hansen, and Wahlberg, 2004) or allowing for different job-wage-task packages (Aaberge, Dagsvik, and Stroem, 1997).

However, the shortcoming, common to all previous studies, is that the labor supply behavior is estimated in a static framework. The static modelling implies that households can immediately adjust their behavior given a change in the work incentives. This assumption, however, has been rejected by numerous studies that find strong evidence for true state dependence in the labor supply behavior, an early example is Heckman (1981a). True state dependence measures the effect the previous working behavior on the current labor supply decision.

The aim of this paper is to overcome this shortcoming of the aforementioned studies and to apply an enhanced framework for the ex-ante evaluation of policy reforms in the tax and transfer system. Instead of using the static approach, I employ an intertemporal discrete choice labor supply model that allows to estimate behavioral responses along the intensive and extensive margin in the household context, as proposed by Haan (2006b). In this framework true state dependence in labor supply is explicitly modelled. 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, household and alternative specific variables and on unobserved

heterogeneity. Unobserved heterogeneity is modeled nonparametrically as suggested by Heckman and Singer (1984). 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 following Wooldridge (2005).

I employ this framework to analyze the impact of the German Tax Reform 2000 on the labor supply behavior of married and cohabiting women. The analysis is based on the German Socio Economic Panel Study (SOEP), a representative longitudinal study containing socio-economic information of about 12,000 households. I estimate the short-run labor supply effects of the tax reform, and based on a first order Markov process I derive the effects in the long run, i.e. when households have fully adjusted their labor supply behavior. My results show that in the sort run, after the first year, the labor supply responses of women are modest as state dependence prevents the women to respond immediately to the incentives induces by the tax and benefit regime. In the long run, however, state dependence looses its significance and the women have fully adjusted and thus the labor supply effects markedly increase.

2 The German Tax Reform 2000

In theory, the German income tax is based on the principle of comprehensive income taxation. That is, the sum of a household's income from all sources is taxed at a single rate after several deductions have been applied. In practice, there are various exceptions to this rule, however, especially regarding the taxation of capital income and pensions. Since the beginning of the 1990s households pay in addition to the standard income taxes the "Solidaritaetszuschlag" a time limited tax supplement which has been implemented in the course of the German reunification. During the period of interest, 2000 - 2005, the supplement amounts to 5.5% of the basis income tax. Another distinguishing feature

of the German tax system is the principle of joint taxation of households, whereby the income tax of a married couple is calculated by applying the tax function to half of the sum of the spouses' incomes; this amount is then doubled to determine the tax amount of the couple.

Corneo (2005a) provides an historical overview of income taxation in Germany and shows that following 1986 progressivity of income taxation was declining. During the 1990s the German government implemented several minor reforms slightly reducing marginal tax rates and increasing the basis tax allowance (Bach, Corneo, and Steiner, 2006). These reforms however are not comparable to the effect of the Tax Reform 2000.[3]

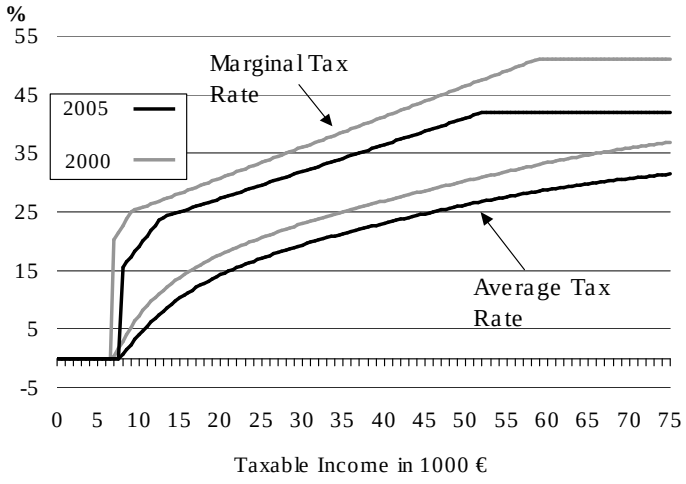
On July 6th 2000, the German government passed the law to implement the German personal income tax reform 2000. The tax reform followed the example of several major income tax reforms in other countries over the last decades. Prominent examples are the tax reforms in the United Kingdom (Blundell, Duncan, and Meghir, 1998), the Tax Reform Act 1986 (TRA86) in the United States (Auerbach and Slemrod, 1997) or the tax reform in Sweden (Agell, Englund, and Soedersten, 1996). The central purpose of the German Tax Reform was to stimulate private consumption and investment to foster economic growth and thus to increase employment (Bundesfinanzministerium 2003). In addition, it was the goal to reduce the distortional effects of high marginal tax rates on labor supply. According to calculations of the Federal Ministry of Finance the personal income tax reform results in a total tax relief of households by approximately 32 billion Euro.[4]

Figure 1 presents the marginal and average tax rates of the pre- and post-reform schedule. Over the whole distribution of taxable income, marginal tax rates are lower in

[3]Wagenhals (2000a) estimates labor supply effects of the moderate tax reforms in Germany during the 80s and 90s and find small behavioral changes.

[4]The tax reform 2000 was implemented in three steps, yet in this study, I focus solely on the total effect of the reform. The first step of the reform was implemented in the beginning of 2001, the second in 2004 and in 2005 the full reform was introduced.

Figure 1: Marginal and average tax rates: 2000 - 2005



Tax schedule is for a single tax filer and the tax supplement is not included.

the post-reform schedule 2005 than under the fiscal regime 2000. Up to taxable income of about 50,000 Euro, the changes in marginal tax rates are relatively similar. However, when taxable income reaches the top marginal tax rate, the gains from the tax reform are increasing. This is due to the large drop of the top marginal tax rate from 51% to 42%. On the lower end, the increase in the tax allowance excludes households with taxable income lower 7664 form taxation. Before the reform, in the fiscal system of 2000, this threshold was at 6902 Euros.

The German tax system is defined in nominal rather than in real terms. That implies a nominal increase of the taxable income leads to higher marginal tax rates, although in real terms, the income of the household remains unchanged. This phenomenon is known as bracket creeping in the public finance literature. To reimburse households for the loss due to the bracket creeping, the government has to adjust the tax function over the years, either by reducing the marginal tax rates or increasing the amount of the basic tax allowance. As the cumulative inflation rate between 2000 and 2005 amounted to approximately 8.6%, this

effect is certainly not negligible. When analyzing the impact of the tax reform, I control for bracket creeping following Haan and Steiner (2005) to calculate the real gains from the tax reform. Thus, I subtract the tax relief necessary to reimburse the households for the additional tax payments due to bracket creeping from the nominal gains attributable to the tax reform.[5]

3 Methodology

The research strategy applied in the empirical analysis combines microsimulation with a structural model of intertemporal labor supply behavior. Using microsimulation the work incentives of a given tax and benefit regime can be simulated. This mechanical effect of a tax reform captures the changes of the disposable net income without any behavioral adjustment of households. Given these mechanical effects which describe the changes in the work incentives, the behavioral effect of the tax reform can be evaluated using the parameters estimated from a structural intertemporal labor supply estimation.

Microsimulation

I apply the tax-benefit microsimulation model STSM that includes all relevant components of the German tax and transfer system (Steiner, Haan, and Wrohlich, 2005). Gross income of a household is calculated by adding all income components of the household members observed in the data. Taxable income is then derived by deducting observed or lump sum income-related expenses from gross household income. The income tax is computed by applying the income tax function to taxable income of each person in the household or of the spouses' joint income, depending on marital status. Income tax, the tax supplement and employee's social security contribution rates are deducted from gross income, and social transfers are added to derive the net household income. Social transfers in-

[5]Technically, I calculate the effect of bracket creeping by simulating the tax payments of households with inflated prices for the year 2005 implicitly assuming no increase in real wages, i.e. productivity.

clude child benefits, child-rearing benefits, education benefits for students, unemployment compensation, housing benefits and social assistance.

The base year for the analysis is the fiscal year 2000, since this was the last year before the tax reform has been implemented. As the empirical analysis is based on panel data spanning from 1999 to 2003, it is necessary to simulate tax payments and net household incomes on the basis of the tax legislation in 2000 for years with a different tax legislation. This simulated hypothetical information serves as the basis for the analysis. In addition, I simulate hypothetical post-reform tax payments for all households which differ solely due to the changes in the tax function and mimic the tax system of the year 2005. The difference between the net household income derived on basis of the pre- and post-reform legislation measures the gross mechanical effect of the tax reform 2000 which has to be adjusted for bracket creeping as described above in order to derive the (net) mechanical effect of the reform.

Econometric Specification

In the following, I will present the econometric model and the estimation procedure which has been proposed by Haan (2006b). Although the focus of this study is on the behavioral effect of married and cohabiting women, I model the labor supply of both spouses in a joint utility model. Thus, the labor supply of the husband or partner is not exogenously given but explicitly modeled within the framework. In the context of couple households, 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 working hours combinations of the two spouses and the resulting net household income which provide different levels of utility V_j at period t. In this model, I assume that households do not save, thus consumption equals the net disposable income.

In a static discrete labor supply approach the utility of a household is only conditioned

on information of the present period t. To model 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 $t-1$. The intertemporal framework applied here does not describe the labor supply behavior over the whole 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 (1981b). The level of of utility V_{ijt} at the different alternatives can be described as follows:

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

The utility function of a household U contains an observable and an unobservable component. The observable component includes the leisure time of both spouses, lf_{ijt} and 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 preferences. In addition, the utility is dependent on the realized working behavior of the previous period z_{it-1}. This variable is constant over the alternatives and affects the preferences for leisure and income in the current period. The unobservable component consists of a household specific term $c_i = (c_{im}, c_{if})$ that is allowed to vary for the spouses, and of a 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: both spouses maximize jointly 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. According to the empirical distribution

of female and male working hours, 13 discrete bundles ($J = 13$) of household income and female and male working hours are defined out of which the household chooses one bundle. In the data, only the income and working times of the chosen bundle can be observed. Given the hours distribution, I derive the net household income for the non chosen hypothetical hours points using the microsimulation model.[6]

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 household‘s 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 exist.

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). Haan (2006b) summarizes potential sources of state dependence, namely intertemporally nonseparable preferences, human capital accumulation, or signaling and scarring effects. 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). In the empirical analysis I will explicitly take account of child care costs which is the major financial

[6]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).

burden for women with young children and other fixed costs of work. Thus, child care costs are not part of potential state dependence. Further, I will distinguish between true choice persistence and unobserved heterogeneity. Hence in this framework, it is possible to analyze the effect of true state dependence.[7]

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. Bargain, Caliendo, Haan, and Orsini (2006) 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 single households 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 seems not to be restrictive even in a country with high unemployment rates such as Germany.

When estimating the above defined intertemporal utility function the problem of initial conditions needs to be accounted for, since the initial working choice might be not at random. As a solution, I follow Wooldridge (2005) and assume that the conditional expectation of the unobserved household effect $h(c_i|z_i0, x_i; \delta)$ is correctly specified, conditional on the initial state z_{i0} and on household and individual specific variables that are constant over time x_i. Vector x_i includes the mean values of all individual and household specific variables, age, number and age of children, health status, region and nationality.

[7]Next to true 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 micro data for Germany. Therefore, I assume ϵ_{ij1}, ..., ϵ_{ijT} to be uncorrelated over time.

The unobserved household specific error term a_i captures the remaining unobserved heterogeneity that is by definition uncorrelated with z_{i0} and x_i. In the estimation I allow a_i to be different for both spouses, $a_i = (a_{im}, a_{if})$ and model potential correlation. Inserting the model of the unobserved household specific effect c_i into the above defined utility function, the utility of alternative j becomes:

$$V_{ijt} \quad = \quad U(lf_{ijt}, lm_{ijt}, y_{ijt}, z_{it-1}, x_{it}, c_i(z_{i0}, x_i, a_i), \epsilon_{ijt}). \tag{2}$$

Drawing on 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:

$$Pr(V_{it} = j) = \frac{\exp U(lf_{ijt}, lm_{ijt}, y_{ijt}, z_{it-1}, x_{it}, z_{i0}, x_i, a_i)}{\sum_{r=1}^{J} \exp U(lf_{irt}, lm_{irt}, y_{irt}, z_{it-1}, x_{it}, z_{i0}, x_i, a_i)}. \tag{3}$$

The household specific error term $a_i = (a_{im}, a_{if})$ is specified nonparametrically following Heckman and Singer (1984). I assume that the household specific error term is described by a bivariate discrete distribution with two points of support (mass points) for the husband (a_{m1}, a_{m2}) and the wife (a_{f1}, a_{f2}).[8] Hence, the household specific effect is described by four combinations of the male and female heterogeneity points, G: (a_{m1}, a_{f1}), (a_{m1}, a_{f2}), (a_{m2}, a_{f1}) and (a_{m2}, a_{f2}), which are assumed to be constant for all households which are chosen with some probability. This specification is flexible, because it captures the correlation of the spouses‘ characteristics which are not observed. Note, for identification, only one mass point for each spouse is freely estimated; the other point is

[8] Belzil (2001) employs a similar specification estimating a discrete duration model.

normalized to zero. The probabilities π_k, k $\in \{1, 2, 3, 4\}$ for the four combinations follow a multinomial distribution:

$$\pi_k = \frac{\exp(q_k)}{\sum_{j=1}^{4} \exp(q_j)}, \quad \sum_{k=1}^{4} \pi_k = 1, \tag{4}$$

where q_k are the transformed probability coefficients to be estimated. For identification q_1 is normalized to zero. Mass points and the transformed probabilities are jointly estimated with the parameters by maximum likelihood.[9] Standard errors for the probabilities are derived using the delta method. The likelihood to be maximized is then:

$$L = \prod_{i=1}^{n} \sum_{k=1}^{4} \pi_k(a^k) \prod_{t=1}^{T} \prod_{j=1}^{J} Pr(Y_{it} = j)^{d_{itj}}, \tag{5}$$

where $d_{itj} = 1$ if j is the chosen alternative and 0 otherwise. 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) including the lagged dependent variable 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 linear and quadratic terms of both spouses' leisure time in the previous period. The initial state enters in a similar way. The household specific unobserved effect is included in a flexible way as random coefficient of the leisure terms of both partners allowing for correlation of unobservable characteristics, see the Appendix for a detailed specification of the model.

4 Data

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

[9] The model is estimated using the -ml- command in Stata version 8.2.

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.[10] For this analysis, I draw on a balanced panel for the years 1999 - 2003. I concentrate on couples both married and cohabiting 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 1,645 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.

[Table 1: about here]

The first three columns in Table 1 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 woman is working part time and the man 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 nearly 95% of all men supply positive working hours, only about 75% of the women participate on the labor market.[11] Part-time work is very common for married 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

[10] For a detailed description of the data set, see Haisken De-New and Frick (2005).

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

at the still very different labor market behavior in east and west Germany.

In column 4, the expected disposable net household income in each alternative is tabulated. The expected net household income for each household is derived on basis of the microsimulation model. Actual child care costs are very high in Germany. This is due to the limited number of subsidized child care facilities (Wrohlich, 2006). For this analysis the actual child care costs for households with children younger then 6 years have been imputed.[12] The child care costs are subtracted from the simulated net household income for the relevant households.

Table 2 provides information about all individual and household specific variables employed in the estimations.

[Table 2: about here]

5 Empirical Results

Estimation Results

Table 3 contains the estimation results for the dynamic conditional logit panel data model with and without random effects. In addition to the above presented flexible model with unobserved heterogeneity, I present results of an estimation where random effects enter in a more restrictive way. In the more restrictive specification, I assume that the household specific effect is described only by two combinations of the male and female heterogeneity points, G: (a_{m1}, a_{f1}) and (a_{m2}, a_{f2}).

[Table 3 : about here]

[12] Child care costs are estimated based on individual and regional information. They differ by age of the child. I thank Katharina for providing the data.

The difference in the Akaike Information Criterion[13] between the different specifications, and the significance of the mass points and the probabilities, indicate that it is necessary to include random effects in a flexible way to control for unobserved individual effects. Therefore, for the following interpretation, I focus only on the model where unobserved heterogeneity is captured in a flexible way. However, despite of the significant difference between the specifications, the coefficients resulting from the different estimations are relatively similar. This finding is in line with Michaud and Vermeulen (2004) who argue that the initial state captures most of the individual unobserved heterogeneity. As mentioned above, state dependence can be disentangled in unobserved heterogeneity and true state dependence. This can be found when comparing the three specification: the better unobserved effects are captured the less important becomes the true state dependence, namely the coefficient of the lagged female leisure time.[14].

In order to analyze and quantify state dependence in female labor supply, I derive a transition matrix of labor supply choices **M** as described in Haan (2006b). The matrix is derived conditioning on the estimated coefficients of the lagged dependent variable holding all other observable characteristics and the unobserved heterogeneity constant.[15]

[Table 4 : about here]

The estimated state dependence is simply the difference in the probability within an column. The estimated transition matrix clearly supports the hypothesis of state dependence on the extensive margin as choice probabilities given the lagged status differ significantly. The probability of inactivity in the current period conditional on not working

[13]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.

[14]For a detailed discussion of the estimated coefficients, see Haan (2006b)

[15]To calculate the household specific unobserved heterogeneity I derive for each household posterior probabilities for the discrete mass points (Haan, 2006b).

in the period before is about 40%. For a woman who had been working in the last period this probability is according to the standard errors significantly lower. The difference increases with the number of working hours. For a full-time working woman the probability of inactivity in the next period is about 6% which is 34 percentage points lower; for a woman working over-time the difference amounts to more than 36 percentage points. For a woman who had been working part-time the difference in the probability not to work in the current period relative to the same average women who had been inactive, is lower, yet still important and significant. These findings are in line with the results of Prowse (2005); on the extensive margin she finds a higher level of genuine state dependence for full-time workers than for those in part-time work.

Mechanical Effect of the Tax Reform

In order to analyze the mechanical effect of the tax reform, I simulate the hypothetical tax payments and the resulting net household income for all households under the fiscal regime 2000 and 2005. The difference between the net household income in both scenarios measures the mechanical effect.

[Table 5 : about here]

Table 5 shows this effect of the tax reform by the discrete working choices. In addition to the average effect for the whole population, I present the mechanical effect by region, differentiating between east and west Germany. In line with the findings of Haan and Steiner (2005), the results show that the tax reform has a positive effect for almost all households. Small negative effect are related to the impact of bracket creeping. The mechanical effect of the tax reform increases the monthly net household income of the relevant population on average by nearly 138 Euro which amounts to a relative increase of more than 4%. By working hours the results show that absolute and relative gains increase

with the number of hours worked. This trend is not monotonic as labor income combines hourly wages and working hours, and moreover taxable income includes other sources of income such as income from rent, self employment or capital gains. In west Germany the mechanical gains of the tax reform are markedly higher than in east Germany, both in relative and in absolute terms. As Haan and Steiner (2005) point out this is due to the still better economic situation in the western part going along with higher gross income and taxable income. This implies that the gains of a reduction in the tax burden are by definition higher in west Germany.

The mechanical effect clearly indicates that the German tax reform provides incentives for increasing labor supply as long as the substitution effect exceeds the income effect. Thus, this mechanical effect is the driving force for the behavioral adjustment of households. Given the estimated preferences for income and leisure, and moreover the estimated true state dependence, I derive the dynamic behavioral effect of the tax reform in the following.

Dynamic Behavioral Effect of the Tax Reform

As the labor supply effects of the tax reform cannot be derived analytically within the employed discrete choice framework, I simulate the impact of the change in the fiscal rules on women's labor supply decision numerically based on the estimated preferences for income and leisure. The expected probability of each discrete working hour choice is predicted, for both the pre- and post-reform scenario.[16] Based on the predicted probabilities, I derive the transition matrix for each fiscal regime, $\mathbf{M_{2000}}$ and $\mathbf{M_{2005}}$ as described above.

Based on the transition matrix and assuming a first order Markov transition process, I calculate transition matrices for future periods. The advantage of this procedure is

[16] Hence, this method assumes that the preferences for income and leisure remain constant over time and regime.

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 power with degree $t+k$ of the transition matrix $\mathbf{M}^{t+k}$, where t describes the period of interest. Hence, the transition matrix after the second period 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.[17] 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. Thus, I can explicitly derive the impact of the tax reform on the number of working hours and the labor market participation after each period. 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 i.e. if they do not differ significantly.

Table 6 yields the labor supply effects of the German tax reform with respect to the relative change in weekly working hours and with respect to the relative change in the participation rate over time. In addition to the average population effect, I present bootstrapped confidence intervals.

[Table 6 : about here]

In line with previous research, I find that the behavioral effect of tax German tax reform is positive and significant.[18] Moreover, the results clearly indicate that behavioral responses to the tax reform are increasing over time. In the short-run, that is in the first

[17] Haan (2006b) describes this methodology in more detail and discusses the assumptions of a first order Markov process.

[18] In this analysis I do not consider potential effects of tax avoidance. Agell, Persson, and Sachlen (2004) show that tax avoidance reduces the labor supply effects of decreasing marginal tax rates. Therefore, the presented elasticities are on the upper bound of potential behavioral responses.

period, female labor market participation increases on average by 0.25%. The relative average increase of the the weekly working hours amounts to 0.75%. As discussed above, the significantly present state dependence in female labor supply restricts women to fully adjust their labor supply in the first period. In the second period the impact of state dependence is reduced. Thus, the relative effect of the tax reform in terms of participation and working hours markedly increases to 0.4% and 1.14%, respectively. Over time the adjustment process is further increasing yet at decreasing rates. With respect to the average elasticities, the results indicate that in the 5th period the adjustment process is completed and the participation and working hours are in equilibrium. The adjustment in further periods does not affect the average labor market behavior as point estimates of the elasticities are nearly constant over time. This implies, in the long run the tax reform leads to an increase in the participation rate of 0.5% and on average to an increase in working hours by 1.5%.

Unfortunately, the relatively large confidence intervals do not allow to draw strong conclusions about significant differences between the short- and the long-run effects. For both, the participation effect and the working hours, the confidence intervals of the first and the fifth period slightly overlap. This is in contrast to the findings in Haan (2006a). Comparing the short- and long-run effects of a uniform wage increase, he finds significant differences over time. Thus, the large confidence intervals are due to the heterogenous effects of the tax reform on different groups, ranging from negative effects for those only affected by bracket creeping to highly positive effects for those with high taxable income.

The behavioral effect of the tax reform by region exhibits the expected pattern. Due to the higher working incentives for women in the western part related to the higher mechanical effect of the tax reform, both the participation and the working hours effects are higher in western than in eastern Germany. In line with Haan (2006b) who finds a

higher state dependence for west German women, the difference between the short- and the long-run effects seems to be higher in the West. The average elasticity with respect to participation increases in the west from 0.25 in the short-run to 0.63 in the long run (in the 5th period), whereas in the east the difference of the same elasticity over time is with 0.2 (1st period) to 0.32 (5th period) relatively low. The same pattern holds true for the working hours elasticity. Yet, again due to the relatively large confidence intervals, it is not possible to draw strong conclusions about significant difference as the confidence intervals by region and over time slightly overlap.

6 Long Run Effects of the Tax Reform: Static vs. Intertemporal Modelling

As mentioned above, previous studies evaluating reforms in the tax and benefit system, such as the labor supply effects of the German tax reform (Wagenhals 2000, or Haan and Steiner 2005) or effects of in-work credits (Blundell, Duncan, McCrae, and Meghir, 2000), have been based on static specifications of labor supply. Static models do not account for potential effects of state dependence and it is assumed that households can immediately adjust to the new incentive system. Thus, although static models are misspecified if state dependence is significant, the behavioral effects derived in these models can be interpreted as long-run effects of a reform in the tax and benefit system.

In the following, I derive the labor supply effects of the tax reform using the static specification and compare the effects to the long-run effects derived above in the the intertemporal framework. For comparative reasons I will estimate the static model using the same specification as describes above however without accounting for state dependence, z_{it-1} and the initial state z_{i0}. Thus the utility function in the static framework has the following form:

$$\tilde{V}_{ijt} = U(lf_{ijt}, lm_{ijt}, y_{ijt}, x_{it}, c_i(x_i, a_i), \epsilon_{ijt}). \quad (6)$$

Unobserved heterogeneity enters in the same way as described above, hence the likelihood function can be derived analogously to the intertemporal framework. The estimation results of the static model are presented in the Appendix. Given the significant improvement in the estimation when allowing for a flexible structure of the random effects and for better comparison to the intertemporal specification, labor supply effects are derived based on this model.

The labor supply effects in the static model are derived numerically by simulating the labor market participation and working hours before and after the tax reform. The relative change given the reform are the elasticities of interest. In the following table, I present the average relative change in the labor market participation and the average relative change in working hours by region. The effect of the static model are compared to the long-run changes derived in the intertemporal model. In addition to the effects of the tax reform, I present as well the labor supply effects induced by a 1% increase in gross wages which described the labor supply in a more general way.

[Table 7 : about here]

In general, the elasticities derived in the static model exhibit the expected patter. Behavioral changes of married or cohabiting couples living in west Germany tend to be stronger both in terms of participation and working hours. The estimated labor effect of the tax reform is lower than found in previous studies (Wagenhals 2000, or Haan and Steiner 2005) . This difference is due to the flexible modelling of unobserved heterogeneity in this specification. Elasticities derived in a model without heterogeneity or in less flexible specifications of unobserved effects as suggested in Haan (2006a) are of the same size as

found in the previous studies. Thus, in contrast to Haan (2006a) my estimations suggest the modelling of unobserved does matter for estimating labor supply elasticities.

Comparing the results of the static model to the long-run effects derived in the specification accounting for state dependence, it is remarkable to find how similar the prediction of the long-run effects are for the whole sample and by differentiated by region. This results is robust to both the effects of the tax reform and the change in gross wages.

7 Conclusion

In contrast to previous ex-ante evaluations of tax reforms, this study employs a intertemporal structural model of labor supply to estimate the labor supply effects of the German Tax Reform 2000. In line with previous studies my findings suggest that the marked reduction of marginal tax rates and a broadening of the tax base have a significant and positive effect on the labor supply of married and cohabiting women. Moreover I find that significant state dependence in the labor supply behavior of women leads to a dynamic process in the labor supply adjustment. In the short run where state dependence prevents women for fully flexibly changing their behavior, the relative change of participation and working hours is modest. Over time state dependence looses its significance and the women fully adjust to their new equilibrium. Thus long-run effects of the tax reform are markedly higher. On average the participation elasticity doubles from 0.24 in the short run to 0.55 in the long run. The difference in the elasticity for working hours is similar, with 0.74 in the short and 1.42 in the long run.

When I compare the long-run elasticities derived in the intertemporal specification to elasticities estimated in static models of labor supply which do not control for state dependence, I find very similar results. This finding is encouraging for the application of both models. It suggests that elasticities of the static model can be interpreted as

long-run effects of a reform. Further, it implies that the relatively simple modelling of the dynamics in the intertemporal framework based on a first order Markov process seems to be sufficient to derive behavioral adjustment over time.

References

Aaberge, R., J. Dagsvik, and S. Stroem (1997): "Labor Supply Responses and Welfare Effects of Tax Reforms," *Scandinavian Journal of Economics*, 97, 635–659.

Agell, J., P. Englund, and J. Soedersten (1996): "Tax Reform of the Century - The Swedish Experiment," *National Tax Journal*, 49, 643–64.

Agell, J., M. Persson, and H. Sachlen (2004): "The effects of tax refrom on labor supply, tax revenue and welfare when tax avoidance matters," *European Journal od Political Economy*, 20, 963–982.

Auerbach, A., and J. Slemrod (1997): "The Economic Effects of the Tax Reform Act of 1986," *Journal of Economic Literature*, XXXV, 589–632.

Bach, S., G. Corneo, and V. Steiner (2006): "Top Incomes and Top Taxes in Germany," *DIW-Discussion Paper*, 532.

Bargain, O., M. Caliendo, P. Haan, and K. Orsini (2006): "'Making Work Pay' in a Rationed Labour Market," *IZA Discussion-Paper*, 2033.

Belzil, C. (2001): "Unemployment Insurance And Subsequent Job Duration: Job Matching Versus Unobserved Heterogeneity," *Journal of Applied Econometrics*, 16, 619–636.

Blundell, R., A. Duncan, J. McCrae, and C. Meghir (2000): "The Labour Market Impact of the Working Families' Tax Credit," *Fiscal Studies*, 21(1), 75–104.

Blundell, R., A. Duncan, and C. Meghir (1998): "Estimating Labor Supply Using Tax Reforms," *Econometrica*, 66, 827–861.

Blundell, R., J. Ham, and C. Meghir (1987): "Unemployment and female labour supply," *Economic Journal*, 97, 44–64.

Blundell, R., and T. MaCurdy (1999): "Labor Supply: A Review of Alternative Approaches," in *Handbook of Labor Economics, Vol. 3A*, ed. by O. Ashenfelter, and D. Card, pp. 1559–1695. Elsevier, Amsterdam, North Holland.

Corneo, G. (2005a): "The Rise and Likely Fall of the German Income Tax, 1958-2005," *CESifo Economic Studies*, 1, 159–186.

——— (2005b): "Verteilungsarithmetik der Rot-Gruenen Einkommensteuerreform," *Journal of Applied Social Science Studies*, 125, 299–314.

Croda, E., and E. Kyriazidou (2005): "Intertemporal Labor Force Participation of Married Women in Germany: a Panel Data Analysis," Discussion paper.

Flood, L., J. Hansen, and R. Wahlberg (2004): "Household Labor Supply and Welfare Participation in Sweden," *The Journal of Human Resources*, XXXIX, 1009–1032.

Haan, P. (2006a): "Much ado about nothing: Conditional logit vs. random coefficient models for estimating labour supply elasticities," *Applied Economics Letters*, 13, 251 – 256.

——— (2006b): "Slowly but Changing: How Does Genuine State Dependence Affect Female Labor Supply On The Extensive And Intensive Margin?," *JEPS Working paper*, 0602.

Haan, P., and V. Steiner (2005): "Distributional Effects of the German Tax Reform 2000 - A Behavioral Microsimulation Analysis," *Journal of Applied Social Science Studies*, 125, 39–49.

——— (2006): "Labor Market Effects of the German Tax Reform 2000," in *Determinants of employment - the macroeconomic view*, ed. by C. Dreger, H. Galler, and U. Walwei, pp. 101–117. Nomos, Baden-Baden.

Haisken De-New, J., and J. Frick (2005): *Desktop Compendium to The German Socio-Economic Panel Study (SOEP)*. DIW, Berlin.

Heckman, J. (1981a): "Heterogeneity and State Dependence," in *Studies in Labor Markets*, ed. by S. Rosen, pp. 91–139. Chicago Press, Chicago, IL.

——— (1981b): "Statistical Models for Discrete Panel Data," in *Structural Analysis of Discrete Data with Econometric Applications*, ed. by C. Manski, and D. McFadden, pp. 114–178. MIT Press, Cambridge, MA.

Heckman, J., and B. Singer (1984): "A Method for Minimizing the Distributional Assumptions in Econometric Models for Duration Data," *Econometrica*, 52, 271–320.

Homburg, S. (2000): "German Tax Reform 2000: Description and Appraisal," *FinanzArchiv*, 57, 504–513.

Hyslop, D. (1999): "State dependence, serial correlation and heterogeneity in intertemporal labor force participation of married women," *Econometrica*, 67, 1255–1294.

McFadden, D. (1974): "Conditional Logit Analysis of Qualitative Choice Behavior," in *Frontiers in Econometrics*, ed. by P. Zarembka. Academic Press, New York.

Michaud, P., and K. Tatsiramos (2005): "Employment Dynamics of Married Women in Europe," *IZA Discussion-Paper*, 1704.

Michaud, P., and F. Vermeulen (2004): "A collective retirement model: identification and estimation in the presence of externalities," *IZA Discussion-Paper*, 1294.

Prowse, V. (2005): "State Dependence in a Multi-State Model of Employment Dynamics," *IZA Discussion-Paper*, 1623.

Soerensen, P. (2002): "The German Business Tax Reform of 2000: A General Equilibrium Analysis," *German Economic Review*, 3, 347–378.

Steiner, V., P. Haan, and K. Wrohlich (2005): "Dokumentation des Steuer-Transfer-Mikrosimulationsmodells 1999-2002," *Data Documentation 9*.

van Soest, A. (1995): "Structural Models of Family Labor Supply: A Discrete Choice Approach," *Journal of Human Resources*, 30, 63–88.

Wagenhals, G. (2000a): "Arbeitsangebotseffekte des Steuer und Transfersystems in der Bundesrepublik Deutschland," *Jahrbücher für Nationalökonomie und Statistik*, 220, 191–213.

——— (2000b): "Incentive and Redistribution Effect of the German Tax Reform 2000," *FinanzArchiv*, 57, 316–322.

Wooldridge, J. (2005): "Simple Solutions to the Initial Conditions Problem for Dynamic, Nonlinear Panel Data Models with Unobserved Heterogeneity," *Journal of Applied Econometrics*, 20, 39–54.

Wrohlich, K. (2006): "Labor Supply and Child Care Choices in a Rationed Child Care Market," *IZA Discussion-Paper*, 2053.

8 Appendix

Specification of the Utility Function

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:

$$V_{ijt} = \alpha_1 y_{ijt} + \alpha_2 lf_{ijt} + \alpha_3 lm_{ijt} + \alpha_4 y_{ijt}^2 + \alpha_5 lf_{ijt}^2 + \alpha_6 lm_{ijt}^2 \tag{7}$$
$$+\alpha_7 y_{ijt} lf_{ijt} + \alpha_8 y_{ijt} lm_{ijt} + \alpha_9 lm_{ijt} lf_{ijt}.$$

I assume that the marginal utility of income and leisure varies across households by age, education, number and age of children, region, nationality, the lagged dependent variable, the initial state and the random effect:

$$\alpha_1 = \beta_1 + \gamma_1 x_{1it}, \tag{8}$$

$$\alpha_2 = \beta_2 + \gamma_2 x_{2it} + a_{fj}, \quad j \in \{1, 2\}, \tag{9}$$

$$\alpha_3 = \beta_3 + \gamma_3 x_{3it} + a_{mj}, \quad j \in \{1, 2\}, \tag{10}$$

where a_{f1} and a_{m1} are normalized to zero. The lagged dependent variable, the initial state and the mean values of all time varying characteristics are included in vectors (x_{1it}) and (x_{2it}) and enter the specification through the net household income and through the female leisure term. The previous employment state is defined as the realized leisure time in the previous period and enters in linear and quadratic terms.[19] To capture the disutility

[19] More flexible specifications for the state dependence with vectors of dummy variables do not change the results of this analysis.

related to flexible arrangements, I follow van Soest (1995) and include dummy variables for the part time categories of women in vector (x_{1it}).

[Table 8 : about here]

Table 1: Working hours, net household income and region

Alternative	Share %	Hours Women per Week	Hours Men per Week	Net Income in Euro	East Germany %
1	2.45	0	0	1280	42.15
2	1.52	19	0	1720	34.67
3	2.15	40	0	2166	40.57
4	13.56	0	37	2438	13.13
5	8.76	9.5	37	2672	4.85
6	17.69	24	37	2968	14.87
7	13.90	37	37	3205	36.39
8	3.46	45	37	3396	48.54
9	9.35	0	48	2845	16.23
10	5.16	9.5	48	3082	5.49
11	11.15	24	48	3386	20.15
12	7.29	37	48	3596	50.00
13	3.56	45	48	3794	46.59

The following working hours (weekly) classifications are used: men: 0, 0-40, >40; women: 0, 0-14, 15-34, 35-40, >40.
The overall share of households in east Germany is about 20%.
Net household income (monthly) is calculated on basis of the microsimulation model STSM. The net household income is the expected mean income in the given alternative.
Source: SOEP, wave 2000-2003, STSM.

Table 2: Descriptive statistics

	Mean	Std.	Mean	Std.	Mean	Std.
Fiscal Year	2000		2001		2002	
Monthly net household income in Euro	2944	1017	3101	1190	3162	1213
Age of the husband	41.92	6.84	42.93	6.84	43.93	6.83
Age of the wife	39.87	6.85	40.87	6.85	41.87	6.86
Share of German men	0.89	0.31	0.90	0.31	0.90	0.30
Share of German women	0.89	0.31	0.90	0.30	0.90	0.30
Share with no degree (husband)	0.02	0.14	0.02	0.14	0.02	0.14
Share with medium degree (husband)	0.78	0.42	0.78	0.42	0.78	0.42
Share with high degree (husband)	0.20	0.40	0.20	0.40	0.20	0.40
Share with no degree (wife)	0.02	0.13	0.02	0.13	0.02	0.13
Share with medium degree (wife)	0.83	0.37	0.83	0.37	0.83	0.37
Share with high degree (wife)	0.15	0.36	0.15	0.36	0.15	0.36
Share with bad health status (husband)[1]	0.01	0.10	0.01	0.11	0.02	0.12
Share with bad health status (wife)[1]	0.01	0.10	0.01	0.10	0.01	0.10
Share of couple living in East Germany	0.23	0.42	0.23	0.42	0.23	0.42
Share of household with child younger 3 years	0.07	0.26	0.06	0.24	0.06	0.23
Share of household with child between 3 and 6 years	0.16	0.37	0.13	0.33	0.08	0.27
Weekly working hours of husband in period t	39.94	10.23	38.69	10.97	37.63	12.12
Weekly working hours of husband in period t-1	39.13	10.47	39.94	10.23	38.69	10.97
Weekly working hours of husband in the initial state[2]	39.13	10.47	39.13	10.47	39.13	10.47
Weekly working hours of wife in period t	20.62	15.64	20.28	15.25	20.27	15.10
Weekly working hours of wife in period t-1	20.32	15.38	20.62	15.64	20.28	15.25
Weekly working hours of wife in the initial state[2]	20.32	15.38	20.32	15.38	20.32	15.38
Observations	1645		1645		1645	

1)Percentage of people who are with 100% disabled.
2)Initial state is the working behavior in the fiscal year 1999.
Source: SOEP, wave 2000-2003.

Table 3: Estimation results: Intertemporal labor supply estimation

	Coef.	Std.	Coef.	Std.	Coef.	Std.
Net Income						
Age - Man	-38.062	12.568	-39.624	13.980	-36.8423	15.248
Age^2 - Man	46.775	14.487	48.687	16.11	45.7298	17.520
Age - Woman	17.773	9.4502	16.738	11.602	17.7893	12.080
Age^2 - Woman	-21.235	11.326	-19.705	13.897	-21.3965	14.478
Leisure t-1 - Man	-0.084	0.005	-0.0463	0.0058	-0.0502	0.0061
Leisure t-1 - Woman	-0.010	0.00	-0.0042	0.006	-0.0060	0.007
Leisure t-0 - Man	-0.050	0.005	-0.0546	0.0065	-0.0578	0.007
Leisure t-0 - Woman	-0.007	0.005	-0.018	0.006	-0.0124	0.007
Constant	11.420	2.441	11.672	2.846	11.0119	3.081
Net Income^2	-0.085	0.022	-0.135	0.0296	-0.1392	0.0310
Leisure Man						
Age - Man	0.1541	0.470	-0.030	0.5245	0.0820	0.544 9
Age^2 - Man	1.091	0.404	1.349	0.4760	1.218	0.4979
German - Man	0.024	0.028	0.0404	0.0289	0.037	0.0291
East German - Man	-0.0138	0.070	-0.0170	0.0892	-0.0161	0.0888
Health Status - Man	-0.0165	0.046	-0.001	0.0458	-0.0027	0.0455
Medium Education Degree - Man	-0.0241	0.007	-0.031	0.0085	-0.0303	0.008
High Education Degree - Man	-0.0471	0.008	-0.0485	0.0105	-0.047	0.010
Age - Man	-0.0096	0.003	-0.009	0.0033	-0.009	0.003
Health Status - Man	0.0395	0.048	0.016	0.0491	0.0177	0.0489
German - Man	-0.0342	0.028	-0.048	0.0293	-0.04513	0.02952
East German - Man	0.021	0.070	0.033	0.0893	0.032	0.0889
Constant	0.442	0.071	0.458	0.0909	0.4263	0.0947
Leisure Man^2	-0.002	0.000	-0.004	0.0001	-0.0044	0.0001
Leisure Woman						
Age - Woman	-0.2131	0.458	-0.347	0.4840	-0.1801	0.5469
Age^2 - Woman	0.5311	0.402	0.548	0.4281	0.3353	0.5101
German - Woman	-0.0040	0.046	-0.005	0.0461	-0.0027	0.0489
East German - Woman	-0.1570	0.116	-0.149	0.1156	-0.1710	0.1280
Health Status -Woman	-0.0660	0.048	-0.066	0.0488	-0.0739	0.0511
Child 0-3	0.1248	0.019	0.118	0.0192	0.1452	0.0213
Child 3-6	0.0143	0.011	0.013	0.0113	0.0231	0.0123
Medium Education Degree - Woman	-0.005	0.013	-0.003	0.0139	-0.0018	0.0170
High Education Degree - Woman	-0.0277	0.014	-0.023	0.0149	-0.025	0.0181
Leisure t-1 - Man	-0.0017	0.001	-0.002	0.0013	-0.0019	0.0012
Leisure t-1 - Woman	0.0114	0.001	0.011	0.0014	0.0064	0.0017
Leisure^2 t-1 - Man	0.0003	0.000	0.001	0.0011	0.001	0.0011
Leisure^2 t-1 - Woman	-0.0042	0.0011	-0.004	0.0011	-0.0008	0.0014
Leisure t-0 - Man	-0.0009	0.0002	-0.000	0.0002	-0.000	0.0003
Leisure t-0 - Woman	0.0036	0.0002	0.003	0.0002	0.0054	0.0003
Age - Woman	-0.0004	0.0031	0.000	0.0032	0.000	0.003
Child 0-3	0.0275	0.0214	0.027	0.02139	0.071	0.024
Child 3-6	-0.0287	0.013	-0.028	0.0135	-0.037	0.015
Health Status - Woman	0.0914	0.0542	0.087	0.0544	0.1182	0.0614
German - Woman	-0.000	0.046	0.002	0.0466	-0.0004	0.0497
East German - Woman	0.1488	0.1164	0.141	0.1158	0.1632	0.128
Constant	0.290	0.0793	0.323	0.0847	0.4433	0.101
Leisure Woman^2	-0.0074	0.0002	-0.007	0.0002	-0.008	0.000
Net Income*Leisure Man	0.0054	0.0030	-0.001	0.0038	-0.00193	0.0039
Net Income*Leisure Woman	0.0077	0.0022	0.005	0.002	0.0051	0.0029
Leisure Man*Leisure Woman	0.080	0.1525	-0.2795	0.169	-0.1674	0.1701
Part Time 1	-1.275	0.075	-1.283	0.0752	-1.302	0.0809
Part Time 2	-0.6245	0.0785	-0.6258	0.0785	-0.7342	0.0857
Mass point - Woman			0.0194	0.0074	-0.209	0.0156
Mass point - Man			0.3026	0.0125	0.303	0.013
p1			0.2717	0.0178	0.2340	0.0176
p2			0.7282	0.0178	.0307	.0078
p3					0.6896	.01953
p4					0.0456	.0123
Observations	4935		4935		4935	
Log-Likelihood	-8287.609		-8050.505		-7998.9504	
Derivatives						
$U_y > 0$	95%		95%		95%	
$U_{lf} > 0$	70%		70%		70%	
$U_{lm} > 0$	95%		75%		75%	

Time dummies for the year 2001 and 2002 have been included.
Variables in *italic* are the individual mean values.
Unobserved heterogeneity is assumed to follow a non parametric distribution. For both. men and women 1 mass points is freely estimated. Probabilities p2-p4 are estimated. p1 is derived following the underlining assumption $\sum_{m=1}^{M} P_i(a_i^m) = 1$. To guarantee plausible results a multinomial specification of the probabilities. rather than the probabilities p2-p4. has been estimated. The standard errors of the probabilities are derived using the delta method.
Source: SOEP, wave 2000-2003 and STSM.

Table 4: Transition matrix of labor supply: All women

	Inactivity (t)	Part-time 1 (t)	Part-time 2 (t)	Full-time (t)	Over-time (t)
Inactivity (t-1)	0.403	0.266	0.288	0.040	0.002
	0.014	*0.011*	*0.015*	*0.006*	*0.001*
Part-time 1 (t-1)	0.293	0.245	0.374	0.082	0.006
	0.008	*0.010*	*0.008*	*0.007*	*0.001*
Part-time 2 (t-1)	0.154	0.184	0.453	0.185	0.024
	0.010	*0.006*	*0.014*	*0.007*	*0.002*
Full-time (t-1)	0.065	0.104	0.444	0.319	0.067
	0.008	*0.010*	*0.010*	*0.013*	*0.005*
Over-time (t-1)	0.039	0.067	0.400	0.388	0.106
	0.007	*0.010*	*0.012*	*0.020*	*0.009*

The following hours classifications are used: 0, 0-14, 15-34, 35-40, >40.
Standard errors are given in *italic*. Standard errors are derived using bootstrapping with 100 replications.
Source: SOEP, wave 2000-2003.

Table 5: Mechanical effect of the tax reform by working hours and by region

	All households			West Germany			East Germany		
	Income (in Euro)	Mechanical Effect (in Euro)	(in %)	Income (in Euro)	Mechanical Effect (in Euro)	(in %)	Income (in Euro)	Net Mechanical Effect (in Euro)	(in %)
1	1303	-0.06	-0.01	1408	-0.01	0.00	1057	-0.16	-0.02
2	1506	-2.42	-0.12	1576	-0.44	-0.04	1386	-5.83	-0.26
3	1899	49.49	1.86	2064	71.65	2.74	1516	-1.74	-0.16
4	2427	75.71	2.76	2493	82.75	3.00	1935	23.53	0.99
5	2632	83.88	2.89	2655	86.33	2.96	2131	31.34	1.37
6	2950	139.20	4.39	3026	145.96	4.54	2484	97.52	3.51
7	3025	182.56	5.34	3163	210.82	5.96	2691	114.41	3.86
8	3206	184.80	5.16	3310	222.31	5.96	3074	137.08	4.14
9	3005	121.14	3.48	3191	136.27	3.82	1853	27.73	1.34
10	3297	130.25	3.49	3314	132.69	3.55	3078	99.84	2.67
11	3449	191.61	5.06	3567	203.34	5.24	2935	140.40	4.27
12	3358	217.93	5.77	3656	269.64	6.69	2937	145.06	4.47
13	3444	224.48	5.84	3764	276.23	6.68	2898	135.95	4.41
All	2908	138.07	4.05	3009	148.67	4.28	2511	96.33	3.14

The discrete working hours are defined in table 1.
The mechanical effects accounts for the impact of bracket creeping for the years 2000 - 2005. The cumulated inflation rate is assumed to be 8.6%.
Income measures he average net household income. This and the mechanical effect are per months. Results have been derived using the simulation model STSM.
Source: SOEP, wave 2000-2003.

Table 6: Dynamic behavioral effect of the tax reform by region

Period	All Women		West Germany		East Germany	
	Part.	Hours	Part.	Hours	Part.	Hours
1	0.24	0.75	0.25	0.75	0.20	0.76
	(0.13 - 0.36)	(0.47 - 1.02)	(0.12 - 0.40)	(0.42 - 1.06)	(0.14 - 0.26)	(0.55 - 0.96)
2	0.40	1.14	0.46	1.22	0.28	1.04
	(0.24 - 0.60)	(0.73 - 1.59)	(0.24 - 0.74)	(0.72 - 1.74)	(0.19 - 0.32)	(0.74 - 1.34)
3	0.49	1.31	0.56	1.46	0.31	1.15
	(0.30 - 0.74)	(0.85 - 1.86)	(0.30 - 0.93)	(0.91 - 2.10)	(0.21 - 0.35)	(0.80 - 1.49)
4	0.53	1.38	0.60	1.57	0.32	1.19
	(0.33 - 0.81)	(0.91 - 1.98)	(0.33 - 1.01)	(1.01 - 2.26)	(0.22 - 0.36)	(0.83 - 1.55)
5	0.55	1.41	0.63	1.62	0.32	1.21
	(0.34 - 0.84)	(0.93 - 2.03)	(0.34 - 1.05)	(1.06 - 2.33)	(0.22 - 0.36)	(0.84 - 1.57)
6	0.56	1.42	0.63	1.64	0.32	1.22
	(0.35 - 0.86)	(0.94 - 2.06)	(0.34 - 1.07)	(1.08 - 2.36)	(0.22 - 0.36)	(0.84 - 1.58)
7	0.56	1.42	0.63	1.65	0.32	1.22
	(0.35 - 0.86)	(0.95 - 2.07)	(0.35 - 1.08)	(1.10 - 2.38)	(0.22 - 0.36)	(0.84 - 1.58)

Elasticity *Part.* measures the relative change (in %) in the labor market participation due to the tax reform.
Elasticity *Hours* measures the relative change (in %) in the working hours due to the tax reform.
The effects are mean-effects for the relevant population which are derived based on the mean transition matrices assuming a first order Markov process.
The 5th and 95th percentiles are given in brackets; they are derived using parametric bootstrapping with 100 replications.
Source: SOEP: wave 2000-2003.

Table 7: Dynamic behavioral effect of the tax reform by region

Period	All Women		East Germany		West Germany	
	Tax Reform	1 % Wage	Tax Reform	1 % Wage	Tax Reform	1 % Wage
	Long run behavioral effects: Static Specification					
Part.	0.55	0.08	0.39	0.06	0.6	0.09
	(0.40 - 0.74)	(0.07 - 0.09)	(0.37 - 0.42)	(0.05 - 0.07)	(0.42 -0.83)	(0.083 -0.11)
Work. hours	1.26	0.19	1.18	0.14	1.28	0.20
	(0.89 - 1.65)	(0.16 - 0.21)	(1.06 - 1.31)	(0.12 - 0.16)	(0.85 - 1.76)	(0.17 - 0.27)
	Long run behavioral effects: Intertemporal Specification					
Part.	0.55	0.08	0.32	0.04	0.63	0.08
	(0.34 - 0.84)	(0.059) - 0.089)	(0.22 - 0.36)	(0.03 - 0.05)	(0.34 - 1.05)	(0.07 - 0.10)
Work. hours	1.41	0.18	1.21	0.12	1.62	0.19
	(0.93 - 2.03)	(0.15 - 0.2)	(0.84 - 1.57)	(0.09 - 0.15)	(1.06 - 2.33)	(0.16 - 0.23)

The long run elasticities derived with the intertemporal specification are the steady state elasticities after the 5th period.
Elasticity *Part.* measures the relative change (in %) in the labor market participation.
Elasticity *Hours* measures the relative change (in %) in the working hours.
The 5th and 95th percentiles are given in brackets they are derived using bootstrapping with 100 replications.
Source: SOEP, wave 2000-2003.

Table 8: Estimation results: Static labor supply estimation

	Coef.	Std.	Coef.	Std.	Coef.	Std.
Net Income						
Age - Man	-46.15607	9.396685	-81.385	14.35303	-88.73868	16.16961
Age^2 - Man	53.97168	10.75089	95.87257	16.60322	105.0521	18.68873
Age - Woman	13.45448	8.299583	25.31031	9.626845	28.83561	12.16644
Age^2 - Woman	-17.56247	9.874616	-31.09971	11.5006	-35.75927	14.55331
Constant	9.790931	1.986592	13.0114	2.60192	15.12427	3.134458
Net Income^2	-0.1199752	0.0202699	-0.0632672	0.022597	-0.1450344	0.030437
Leisure Man						
Age - Man	0.1371018	0.3914165	-0.5598075	0.4527031	-0.5895849	0.5174154
Age^2 - Man	0.8477751	0.3347316	1.650443	0.4009794	1.850803	0.4777305
German - Man	0.0583797	0.028294	0.0541524	0.0280716	0.0612455	0.0305388
East German - Man	0.004594	0.0747284	-0.0030424	0.0678476	-0.006188	0.1063871
Health Status - Man	0.022123	0.041764	0.0232425	0.0415753	0.0249544	0.0476873
Medium Education Degree - Man	-0.0213231	0.0067121	-0.0222985	0.0067905	-0.0303093	0.0085484
High Education Degree - Man	-0.032272	0.0081122	-0.0369526	0.0082668	-0.0327359	0.010469
Age - Man	-0.0077445	0.0026285	-0.0072849	0.0029398	-0.0084656	0.0032131
Health Status - Man	0.0030631	0.0439511	0.0010223	0.0440871	-0.0137679	0.050507
German - Man	-0.0704752	0.0284816	-0.0647706	0.0282918	-0.0693295	0.0308361
East German - Man	-0.0051762	0.0748184	0.0003896	0.0679405	0.0169816	0.10649
Constant	0.5036835	0.0601937	0.59033	0.0711679	0.9424887	0.0879882
Leisure Man^2	-0.00272	0.0001085	-0.0025287	0.000111	-0.0050191	0.0001787
Leisure Woman						
Age - Woman	0.4050487	0.310614	1.551821	0.5123565	1.313344	0.5647459
Age^2 - Woman	-0.5479297	0.2716625	-1.659246	0.5144604	-1.64587	0.5767619
German - Woman	-0.0020594	0.0289125	0.0043455	0.0418048	0.0034721	0.0414075
East German - Woman	-0.0591318	0.0791017	-0.1224367	0.1149999	-0.1190275	0.1139247
Health Status -Woman	-0.0239274	0.0288824	-0.0511784	0.043786	-0.0496212	0.0432932
Child 0-3	0.0352977	0.0114357	0.1089184	0.0165189	0.1040021	0.0167005
Child 3-6	0.0072122	0.0068998	0.0337881	0.0106537	0.0318582	0.0107427
Medium Education Degree - Woman	-0.0001685	0.0081515	0.0151436	0.0219745	0.0217637	0.0187667
High Education Degree - Woman	-0.0271396	0.0087718	-0.0573288	0.0234748	-0.0523167	0.0208829
Age - Woman	0.0016906	0.0021244	0.0001122	0.0028896	0.0023706	0.0030826
Child 0-3	0.0398004	0.0130337	0.0776569	0.0213674	0.0757309	0.0217333
Child 3-6	0.0304647	0.0082138	0.0315605	0.0145916	0.0354325	0.0149102
Health Status - Woman	0.021653	0.0316066	0.0494054	0.0516589	0.0420571	0.0506113
German - Woman	-0.0069329	0.0291663	0.0150691	0.0424926	0.0106493	0.0421974
East German - Woman	0.0196338	0.0791527	0.0404037	0.1154575	0.0293842	0.1141058
Constant	0.3395846	0.0502068	0.2644332	0.0893861	0.288241	0.0986961
Leisure Woman^2	-0.0034692	0.0001841	-0.0058541	0.0002382	-0.0060157	0.0002289
Net Income*Leisure Man	-0.0106433	0.0027733	-0.0036909	0.0030263	-0.0120518	0.0038875
Net Income*Leisure Woman	0.0014668	0.0014731	0.0104661	0.0024811	0.0069293	0.0026166
Leisure Man*Leisure Woman	-0.2690029	0.113016	-0.5002491	0.1893915	-0.1591214	0.1479671
Part Time 1	-1.322631	0.0669319	-1.056761	0.08065	-1.120036	0.0755335
Part Time 2	-0.7532578	0.0741605	-0.4861816	0.0817561	-0.5186073	0.0798842
Mass point - Woman			0.2198366	0.0063166	0.2188472	0.0062605
Mass point - Man			0.02684	0.0063814	-0.3262338	0.0103602
p1			0.585642	.0176174	.3958597	.01636
p2			0.41435	.0176174	.3017989	.0148805
p3					.1797322	.0129811
p4					.1226091	.0106845
Observations	4935		4935		4935	
Log-Likelihood	-10752.957		-9882.1273		-9428.132	
Derivatives						
$U_y > 0$	100%		95%		95%	
$U_{lf} > 0$	70%		70%		70%	
$U_{lm} > 0$	95%		75%		73%	

Time dummies for the year 2001 and 2002 have been included.
Variables in *italic* are the individual mean values.
Unobserved heterogeneity is assumed to follow a non parametric distribution. For both men and women 1 mass points is freely estimated. Probabilities p2-p4 are estimated, p1 is derived following the underlining assumption $\sum_{m=1}^{M} P_i(a_i^m) = 1$. To guarantee plausible results a multinomial specification of the probabilities, rather than the probabilities p2-p4, has been estimated. The standard errors of the probabilities are derived using the delta method.
Source: SOEP, wave 2000-2003 and STSM.