Intertemporal Labor Supply and Involuntary Unemployment in a Rationed Labor Market*

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Abstract

In this paper we develop a model to consistently estimate the intertemporal labor supply behavior on both the extensive margin (participation decision) and the intensive margin (working hours decision). In this framework we distinguish between voluntary non-participation and involuntary unemployment which is caused by labor market rationing and model the dynamics of labor supply by accounting for true state dependence. In contrast to previous studies, this framework allows us to test for true state dependence of voluntary non-participation, involuntary unemployment, full-time work and over-time work. Moreover, we derive consistent estimates of intertemporal labor supply elasticities and asses the bias of elasticities derived in a pure choice model of labor supply.

Keywords: Intertemporal labor supply behavior, Transitions on the labor market, State dependence, Involuntary unemployment.

JEL Classification: C23, C25, J22, J64

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1 Introduction

In this paper we develop a model to consistently estimate the intertemporal labor supply behavior on both the extensive margin (participation decision) and the intensive margin (working hours decision). In this framework we distinguish between voluntary non-participation and involuntary unemployment which is caused by labor market rationing and we account for the effect of true state dependence. True state dependence measures the causal effect of the previous labor market states on the current outcome. The proposed model fills a gap in the existing literature on labor supply, since previous studies do either not reflect the dynamics in labor supply behavior or are based on the assumption of a pure choice model which implies that unemployment is voluntarily chosen.

Several studies have previously accounted for involuntary unemployment in labor supply estimations. The starting point is Blundell, Ham, and Meghir (1987) who extend the standard model of female labor supply by introducing a probability of rationing that results in a double-hurdle model. Hogan (2004) applies this approach to a panel structure, relaxing the IIA hypothesis through nested logit modeling. Bingley and Walker (1997), Duncan and MacCrae (1999) and Bargain, Caliendo, Haan, and Orsini (2006) combine a latent model for the probability of involuntary unemployment with a discrete-choice model of labor supply which captures both the extensive and the intensive margin. Laroque and Salanie (2002) model the labor supply of French women by introducing classical unemployment due to the censorship of the minimum wage; other involuntary unemployment is a residual category gathering all other explanations (frictional or business cycle unemployment). In a slightly different framework Euwals and van Soest (1999) suggest to use information about desired versus actual working hours of single men and women in the Netherlands to disentangle preferences and demand-side rationing. The findings of these studies emphasize the importance to control for involuntary unemployment when analyzing the labor supply behavior.

All above-mentioned studies model labor supply in a static framework. Yet, the assumption of a static labor supply behavior which implies that individuals can immediately adjust their labor supply, has been rejected by numerous studies that find strong evidence for true state dependence in the labor supply behavior, e.g Heckman (1981a) or Hyslop (1999). Of particular interest for this paper are those few studies that focus on both the extensive and the intensive margin. Prowse (2005) analyzes transitions of women between no work, part-time and full-time work. Using a discrete choice model, she shows that true state dependence is present in both full-time and part-time employment. Michaud and Vermeulen (2004) model the labor supply and retirement decision of households in the US in an intertemporal framework that accounts for the intensive and extensive margin. In a recent paper Haan (2006) estimates the labor supply of married and cohabiting women in Germany in an intertemporal discrete choice model and derives labor supply elasticities in the short and in the long run. He finds that state dependence is significantly present and explains the difference in short- and long-run labor supply effects. The shortcoming of all mentioned studies on the intertemporal labor supply behavior, however, is that the working behavior is modelled in a pure choice model not reflecting potential labor market restrictions.

The framework suggested in this paper combines the key features of both classes of models.[1] More precisely, we combine a structural intertemporal discrete choice model of labor supply with a reduced form risk model of demand side rationing. The econometric specification accounts for the non-randomness of the initial labor market state and captures unobserved effects non-parametrically and allows for free correlation between the different processes. The analysis is based on a detailed microsimulation model for Germany (STSM) which maps the relevant regulations of the German tax and benefit system. A detailed modeling of the net household income is in particular important for the estimation of the labor supply behavior as this is the most accurate way to describe work incentives in the household context (Laroque and Salanie, 2002). Moreover, the detailed modeling of the work incentives is necessary to capture persistence in the working behavior which is not due to true state dependence. In thus far, we go beyond most of the existing literature on state dependence which only considers gross wage of human capital effects but not the effects of the tax and transfer system.

The proposed model extends the previous literature in two dimensions. First, it provides a framework to consistently estimate the labor supply behavior over time. The second extension is the differentiation between the causal effect of voluntary and involuntary unemployment in the previous period on the current labor market status.

We apply the intertemporal labor supply models with demand side rationing to consistently estimate the labor supply behavior of men over time. We use panel data from the German Socio Economic Panel (SOEP) that yield detailed information about the employment behavior, the employment history and about socio-demographic and economic variables over time. To identify the rationing on the labor market we merge detailed regional labor market indicators to the micro data.

We find that true state dependence is significantly present between the different labor market states. Moreover, our results stress the necessity to account for involuntary unemployment when analyzing the intertemporal labor supply behavior, since state dependence differs significantly conditioned on involuntary unemployment and voluntary non-participation. We find that intertemporal labor supply elasticities significantly differ when accounting for involuntary unemployment. Elasticities derived in an unconstrained pure choice model are significantly upward-biased.

2 Data and Descriptive Statistics

This study is based on the SOEP which is a representative sample of over 12,000 households living in Germany with detailed information about the working behavior

[1] In addition to the above mentioned literature, there exist several studies analyzing the transition from unemployment to employment and non-participation in a duration framework, e.g. Frijters and van der Klaauw (2006). The main difference is, beyond the time framework, the inclusion of only one initial state (unemployment).

and socio-economic variables on a yearly basis.[2] For this analysis, we draw on unbalanced panel data for the years 2000 - 2005 which yield retrospective information for the fiscal years 1999 - 2004. The regional labor market indicators, which are necessary for the identification of involuntary unemployment, are collected by the Employment Office separately for 438 geographical regions.[3] This information can be exactly matched to the micro information of the households.

Labor supply behavior differs between men and women and has to be analyzed separately. Labor market participation is significantly higher for men and while part-time work is relatively common for women, men tend to work full-time or over-time. In this study, we concentrate on the labor supply behavior of men. Partly, we focus on this group for technical reasons. When studying the working behavior of men it not necessary to account for peculiarities of part-time work and even more important for the potential endogeneity of fertility. Moreover, for men the impact of involuntary unemployment on the labor supply behavior is particularly strong. Bargain, Caliendo, Haan, and Orsini (2006) find that for groups with a relative large share of voluntary non-working, such as married women, labor supply elasticities do hardly change when accounting for involuntary unemployment. For men, in contrast, for which the share of involuntary unemployed is relatively large, they find a severe upward bias when not accounting for demand side rationing. We further restrict our sample to men older than 25 and younger than 59 years. This is motivated by the educational and the retirement schemes in Germany. Lastly, we exclude self-employed, retired and men in full-time education as their labor supply behavior substantially differs from the rest of the population.

Working Behavior of Men

Figure 1 shows the distribution of weekly working hours in our sample of men. We find that roughly 10% of the men do not work. This group includes both voluntary non-participants and involuntary unemployed. As stressed above, hardly any men work part-time. Only 3% of the working men work less than 35 hours per week. Thus, the vast majority of men works either full-time, defined as up to 40 hours per week, or over-time.

This distribution of male working hours motivates why we model the labor supply behavior of men on the extensive and intensive margin in a discrete framework rather than assuming a continuous specification of working hours. In addition, the discrete choice approach provides the advantage to model complex nonlinearities in the budget function of a household in a straight-forward way. Thus, to describe the male working behavior we distinguish between non-participation, full-time work and over-time work.[4]

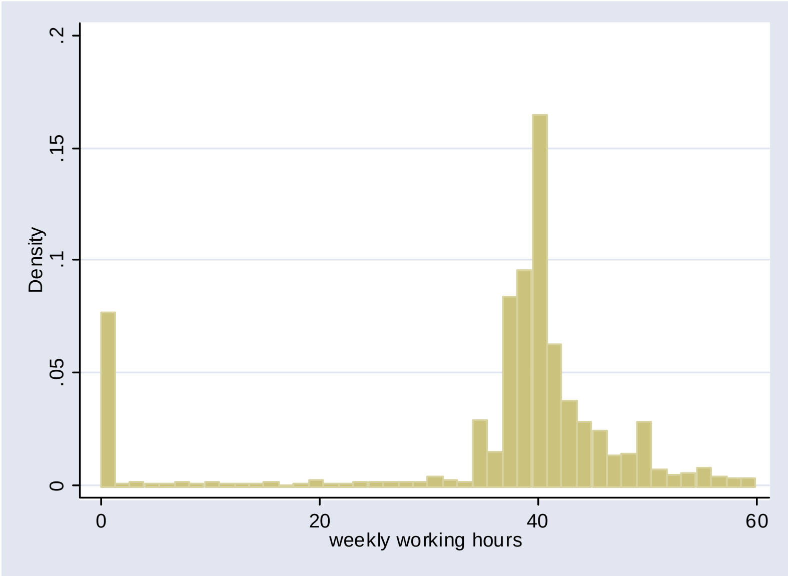
Table 1 shows the relative share of men observed at the discrete alternatives and the

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

[3] Source: Arbeitslose nach Kreisen, Bundesagentur für Arbeit.

[4] In previous research we have shown that labor supply elasticities are robust to the choice of the discrete working alternatives with and without part-time choices for men (Bargain, Caliendo, Haan, and Orsini, 2006).

Figure 1: Working behavior of men



Notes: Weekly working hours are reported contractual hours plus reported paid over-time. Men are aged between 25 and 59. The distribution is censored at 60 hours per week which excludes about 2% of the relevant population.

Source: SOEP, 2000 - 2005.

average working hours for each alternative. For full-time work the average amounts to about 35 hours per week, for over-time to about 49 hours. These average hours define the discrete working alternatives. Men at the different working alternatives differ by wages and in the age structure.[5] As expected, gross hourly wages are increasing with working hours, while the average age is with over 44 years higher for the non-working than for the working men.

Voluntary and Involuntary Unemployment

As stressed above, the group of non-working men consists of voluntary non-participants and of the involuntary unemployed. In this analysis we follow e.g. Bingley and Walker (1997) and define individuals as voluntary unemployed or not participating if they do not search for a job. The SOEP yields information to identify the involuntary unemployed. Each potential worker is asked (i) whether he has actively searched for a job within the last four weeks and (ii) whether he is ready to take up a job within the next two weeks. We follow the ILO definition and treat those unemployed who answer both questions positively as involuntary unemployed or rationed.

Table 2 shows that around half of the non-working men, or 5% of the overall popu-

[5]For persons not employed in the month preceding the interview, gross hourly wages are estimated by applying a two-stage estimation procedure with a Heckman sample selection correction. Estimation results can be obtained on request.

Table 1: Discrete Working Hours of Men

	Share	Working Hours	Uncond. Wages	Age
Non-Participation	0.10	0.00	14.83	44.24
Full-Time	0.52	36.94	21.95	42.22
Over-Time	0.38	47.33	23.30	41.72
Average		36.48	21.60	42.27

The following working hours classifications (weekly) are used: 0, 0-40, >40. Wage are unconditional gross hourly wages. Wages for the non-working have been estimated by applying a two-stage estimation procedure with a Heckman sample selection correction.
Low education is the share of men with less than 10 years of schooling.
Source: SOEP, wave 2000-2005.

Table 2: Discrete Working Hours of Men with Rationing

	Share	Working Hours	Uncond. Wages	Age
Vol. Non-Participation	0.05	0.00	14.98	45.97
Inv. Unemplyment	0.05	0.00	14.70	42.77
Full-Time	0.52	36.94	21.95	42.22
Over-Time	0.38	47.33	23.30	41.72
Average		36.48	21.60	42.27

The following working hours classifications (weekly) are used: 0, 0-40, >40. Wage are unconditional gross hourly wages. Wages for the non-working have been estimated by applying a two-stage estimation procedure with a Heckman sample selection correction.
Low education is the share of men with less than 10 years of schooling.
Source: SOEP, wave 2000-2005.

lation are involuntarily unemployed according to this definition.[6] While the expected gross hourly wages do hardly differ between the involuntary unemployed and the voluntary non-participants we find an interesting difference in the age structure. Voluntary non-participants are on average about three years older than involuntary unemployed or working men. This reflects that the search intensity of non-working men decreases when approaching retirement age.

Involuntary unemployed are rationed by the demand side of the labor market, since they do not find work given their productivity although their labor supply is positive. In the empirical analysis we identify the individual probability of rationing using aggregate variables describing the situation on the regional labor market and individual characteristics. The regional labor market indicator are collected on county level, 438 for Germany, and provide a large source of variation which is necessary for identification in the estimation.[7]

[6]Note that these rates differ from official unemployment statistics since their denominators contain some of the inactive population (precisely the voluntary unemployed) and also because of selection criteria.

[7]The key variable, the regional unemployment rates varies between about 2% to more than 30% with an average rate of 11.68 and a variance of 33.34.

Table 3: State Dependence: Descriptive Evidence

	Vol. Non-Participation	Inv. Unemployment	Full-Time Work	Part-Time Work
Vol. Non-Participation t-1	58.98	17.05	16.48	7.5
Inv. Unemployment t-1	16.56	47.86	23.93	11.65
Full-Time Work t-1	2.08	3.07	76.12	18.73
Part-Time Work t-1	1.41	2.31	26.42	69.86

The following working hours classifications (weekly) are used: 0, 0-40, >40.
All numbers are in %.

Source: SOEP, wave 2001-2005.

State Dependence in Labor Supply: Descriptive Evidence

We analyze the male labor supply behavior in an intertemporal framework. This allows us to study the persistence in the working behavior. More specific, we can analyze the effect of the previous working history on the current labor market state which is the state dependence in labor supply.

The following descriptive transition matrix of the male working behavior suggests a strong positive correlation between the working status in two consecutive periods. On the diagonal of the matrix we find very strong persistence in the working behavior over time. We find that more than 50% of the voluntary non-participants in period $t-1$ remain in this status in period t. For the involuntary unemployed this persistence is with close to 50% slightly lower. Conditional on working in the previous period the persistence of work is very high. More than 75% of the full-time working men and about 70% of those working over-time do not change their working status.

This descriptive evidence of working persistence does not only measure the effect of true state dependence. In addition to state dependence, observable and unobservable characteristics explain the persistence. Thus in order to disentangle the effect of true state dependence we need to control for these other sources of persistence.

3 Theoretical Background

In the following section, we present the theoretical framework for the empirical analysis of the intertemporal labor supply behavior of men. We start with the standard model of intertemporal discrete choice model of labor supply similarly to Haan (2006) and extend the model by combining the pure choice framework with a probability model of involuntary unemployment through demand constraints.

3.1 Intertemporal Labor Supply without Involuntary Unemployment

The standard discrete choice model of labor supply is 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 V_j at period t. As motivated in the previous section, we define three discrete choice alternatives, non-working (J=0), full-time work (J=1) and over-time work (J=2). In the pure choice model we assume that each household can freely choose from this set of alternatives and does not face any demand side constraints. In this set-up households do not save, thus consumption equals the net disposable income. In order to keep the complexity of the model feasible we follow e.g. Laroque and Salanie (2002), and assume that the labor supply of the partner, here the women is exogenously determined, thus men living in couples can be modeled as single decision makers in the same way as single men.[8]

In a static discrete labor supply approach the utility derived from a discrete bundle is only conditioned on information of the present period t. To model the dynamics of labor supply, we introduce state dependence by conditioning the utility in period t on the lagged labor market status in period $t-1$. Note, the intertemporal framework proposed here does not describe the labor supply behavior over the full life cycle as suggested by Keane and Wolpin (2002). 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).

We assume the following representation of the utility level at each choice alternative.

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

The utility function of a household U contains an observable and an unobservable component. The observable component includes the leisure time of the men lm_{ijt}, and the net household income y_{ijt} which is conditioned on the female income in couple households. Further, individual, household and time specific characteristics x_{it} that are constant over the different labor supply alternatives, such as age or nationality enter the utility function. Moreover, if available, x_{it} includes the leisure time of the partner. These variables can be interpreted as taste shifters of the preferences for income and leisure. In addition, the utility is dependent on the realized working behavior of the men in the previous period z_{it-1} which consists of full-time and over-time work, and voluntary non-participation. This variable is constant over the alternatives and affects the preferences in the current period. The unobservable component consists of a time constant household specific term c_{ij} that is different for the alternatives yet allowed to be correlated, and of a random error term that varies independently between time, households and alternatives ϵ_{ijt}. In this framework, the decision rule of a household has the following form: given the behavior of the spouse - if present - the man maximizes a household utility given his leisure time and the household net income and chooses the bundle j that provides the highest utility for the household in period t.

[8]This assumption is supported by Steiner and Wrohlich (2004) who show that changes in work-incentives of one spouse do hardly affect the working behavior of the partner. However, this is in contrast to e.g. van Soest (1995) who models the labor supply decision of couple households in a joint framework and even more to models that consider a collective model where both spouses are involved in a bargaining process to determine their individual leisure time and income (Vermeulen, 2002).

The maximization problem is subject to a household budget constraint, since the net household income depends on the working hours of the spouses, i.e the non-leisure time. In order to derive the net income for each household at the discrete working alternatives we apply the microsimulation STSM. Based on variables drawn from the SOEP that determine gross income and certain deductible expenses for all household members, disposable net income is simulated at the household level.[9] This detailed modeling of the net household income is central for the estimation of the labor supply behavior, since the work incentives can be accurately described in the household context In this respect we go beyond most of the empirical studies on intertemporal labor supply, e.g. Hyslop (1999) which do not explicitly model the net household income.

The discrete choice model is driven by the probabilities to choose each alternative j. Given these probabilities, the expected 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 of the household it might become optimal for the man 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 in the working behavior is not significantly present.

State Dependence in Labor Supply

State dependence in labor supply is present if, given the observed and unobserved characteristics, the labor market status 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 (Heckman and Willis, 1977). Examples are intertemporally nonseparable preferences or habit formation. 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.

3.2 Intertemporal Labor Supply Model Accounting for Involuntary Unemployment

As stressed above, a standard choice model of labor supply behavior is based on the assumption that each individual can freely choose his preferred labor market state and does not face any demand side constraints. Given the empirical relevance of involuntary unemployment, this seems to be a relatively strong assumption.

In order to relax this assumption we propose a more general framework of intertemporal labor supply behavior that accounts for the individual risk of involuntary

[9] Gross income of a household is calculated by adding all income components of the household members observed in the data. 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. For more detail, see Steiner, Haan, and Wrohlich (2005).

unemployment. This model is an extension of the pure choice model since we condition the individual labor supply choice on the individual probability of labor market rationing. In other words, a pure choice model is nested in the proposed framework of labor supply with demand side rationing. As we will show, both models are identical if there exists no rationing on the labor market, i.e. when the assumption of free choices is fullfilled.

The model we propose is an extension of the static double-hurdle model first suggested in this context by Blundell, Ham, and Meghir (1987). More precisely we combine the structural intertemporal choice model of labor supply described above with a reduced form intertemporal risk model of demand side rationing. Thus, we jointly account for state dependence and the individual risk of involuntary unemployment and provide therefore a model to consistently analyze the labor supply behavior over time.

The first part of the model, the structural intertemporal labor supply model is defined as above in the pure choice framework. The difference though is that in the framework here we treat voluntary non-participants and involuntary unemployed differently and assume for the latter that they obtain a higher utility when working than when not working.

The second part of the model reflects that each individual has a probability to be involuntary unemployed. Hence, despite a higher utility when working there is a risk not to realize the desired choice and to become involuntary unemployed. For a single men i, or the male spouse i in a couple, we specify the following intertemporal latent equation of involuntary unemployment:

$$I_{it}^{*} = \beta_d X_{it} + \lambda Z_{it-1} + \mu_i + \eta_{it} \tag{2}$$

as a stochastic function of characteristics X_{it} thought to influence the probability of getting a job. X_{it} includes individual specific variables such as education and age and demand side variables describing the situation on the regional labor market. Moreover, we condition the rationing risk on the labor market status in the previous period Z_{it-1} which varies between over-time, full-time, involuntary unemployment and voluntary inactivity. The unobserved component in this model consist of an individual unobserved effect μ_i that is time constant and random terms η_{it} which are assumed to be independently distributed.

State Dependence in Labor Supply with Involuntary Unemployment

One key advance of the proposed framework is to extend the analysis of state dependence by distinguishing between voluntary and involuntary unemployment. In this extended framework, state dependence affects both the demand and supply side of labor market. Thus, in addition to the above mentioned supply side examples, such as habit formation, state dependence might be due to human capital accumulation, or signaling effects.

State dependence might differ for voluntary non-participants and involuntary unemployment for several reason. Involuntary unemployment going along with an active searching for a job might have lower deterioration of human capital or induce different signals. By the same token, fixed costs might differ for the two labor market states.

Moreover, the job arrival rate should be higher for involuntary unemployed because they are actively looking for a job. This explanation of a causal effect of the previous labor market status on the current labor supply is different from the classical explanations of state dependence. Thus, when interpreting state dependence, or the causal effect of the previous labor market state in the empirical analysis this has to be taken into consideration.

State dependence can be positive or negative, yet as underlined by the given examples, the causal effect of last periods labor market status seems to be positive (Lee and Tae, 2005). In the empirical application, we test whether the effect of true state dependence is positively significant in a model of labor supply. Therefore, we distinguish between the above mentioned sources of choice persistence: true state dependence and observed and unobserved heterogeneity. In addition, 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. Moreover, since we account for the regional unemployment rate we capture all random shocks that affect the regional labor market. Therefore, we assume the error terms ϵ_{ij1}, ..., ϵ_{ijT} to be uncorrelated over time.

4 Econometric model

In this section we develop the econometric framework for the empirical analysis. First, we discuss the estimation of the standard intertemporal labor supply specification not considering involuntary unemployment which is the pure choice model of labor supply. Then, we develop the intertemporal labor supply framework and condition the labor supply choice on the risk of labor market rationing which allows us to consistently estimate the intertemporal working behavior of men.

4.1 Labor Supply Behavior I: The Pure Choice Model

As derived above, in the pure choice model of labor supply we assume that the level of utility at each discrete working alternative j, non-work, full-time work, over-time work, can be expressed as

$$V_{ijt} = U(lm_{ijt}, y_{ijt}, Z_{it-1}, x_{it}, c_{ij}, \epsilon_{ijt}). \tag{3}$$

Drawing on McFadden (1974), we assume the error terms ϵ_{ijt} to follow a Gumble distribution. Then, a discrete choice model can be derived where the probability of choosing alternative j from all J alternatives is conditioned on the explanatory variables in period t, the labor market state of the previous period and the unobserved individual effect. In fact here, we slightly extend the standard conditional or multinomial logit framework and model the choice probabilities in a mixed logit framework (Cameron and Trivedi, 2005). This is a more general framework which allows for alternative specific random intercepts and alternative specific effects of the lagged dependent variable and at the same time for alternative specific variables:

$$Pr(V_{it} = j) = \frac{\exp(\tilde{U}_{ijt} + Z_{it-1}\gamma_j + c_{ij})}{\sum_{r=0}^{J} \exp(\tilde{U}_{irt} + Z_{it-1}\gamma_r + c_{ir})}. \tag{4}$$

We model the lagged dependent variable as a vector of dummy variables consisting of non-working, full-time and over-time work and we allow the effect of the lagged dependent variable to vary between the alternatives. Similarly, we introduce the unobserved heterogeneity as random intercept that is different for each alternative. For identification it is necessary to restrict the coefficient vector of the lagged dependent variables γ_j as well as the random intercept for one category to zero which is here the non-working alternative. $\tilde{U}_{ijt}$ contains the alternative specific variables and individual and household specific characteristics that are modelled as taste shifters. Coefficients of these variables do not vary between the alternatives. More precisely, we assume $\tilde{U}_{ijt}$ to follow a quadratic utility function of income and leisure, conditional on individual specific characteristics similar to Blundell, Duncan, McCrae, and Meghir (2000). Disposable net household income and the leisure of the man, interaction and quadratic terms enter the utility function. Hence, the $\tilde{U}_{ijt}$ to be estimated has the following form:

$$\tilde{U}_{ijt} = \alpha_1 y_{ijt} + \alpha_2 lm_{ijt} + \alpha_3 y_{ijt}^2 + \alpha_4 lm_{ijt}^2 + \alpha_5 y_{ijt} lm_{ijt}. \tag{5}$$

We assume that the marginal utility of income and leisure varies across households by age, education, number and age of children, region, health status, nationality, and for couple households by information about the female spouse:

$$\alpha_1 = \beta_1 + \gamma_1 x_{1it}, \tag{6}$$

$$\alpha_2 = \beta_2 + \gamma_2 x_{2it}. \tag{7}$$

The observed intertemporal labor supply behavior does not coincide with the start of the stochastic process generating individual's labor supply dynamics and leads to the well known initial conditions problem. To take the non randomness of the initial working state into account we follow Heckman (1981b) and estimate a static reduced form discrete choice model for the initial labor market state ($t = 0$) without the lagged labor market status and different slope parameters. For better identification of the initial state we condition the first working state in addition on the education information of both parents.[10]

[10]Another approach to account for the non-randomness of the initial state is Wooldridge (2005). It is based on the assumption that the conditional expectation of the unobserved household effect $h(c_{ij}|z_{i0}, x_i; \delta_j)$ is correctly specified, conditional on the initial state z_{i0} and on household and individual specific variables that are constant over time x_i.

The choice probability of individual i to be in alternative j in the initial period $t = 0$ corresponds to:

$$Pr(V_{i0} = j) = \frac{\exp(\hat{U}_{ij0} + \nu_{ij})}{\sum_{r=0}^{J}(\hat{U}_{ir0} + \nu_{ir})}, \tag{8}$$

where $\hat{U}_{ij0}$ and $\tilde{U}_{ijt}$ differ in the slope parameters. In addition, $\hat{U}_{ij0}$ includes the parental education level. Again the random intercept of the base alternative is normalized to zero for identification. Further we assume, that the unobserved heterogeneity or random effects ν_{ij} are functions of the unobserved heterogeneity c_{ij}

$$\nu_{ij} = \alpha_\nu c_{ij}. \tag{9}$$

The normalized vector of unobserved heterogeneity is unknown and needs to be integrated out when calculating the likelihood function. Conditional on the unobserved effects c_{ij}, the conditional individual likelihood contribution has the following form:

$$L_{1i}|c_{ij} = \prod_{t=0}^{T}\prod_{j=0}^{J} Pr(Y_{it} = j)^{d_{ijt},(t>0)} Pr(Y_{it} = j)^{d_{ijt}(t=0)}, \tag{10}$$

where d_{itj} =1 if j is the chosen alternative in period t and 0 otherwise.

Unobserved heterogeneity

We assume that the unobserved effects can be described by a discrete distribution. Hence, we model the vector of unobserved effects c_i=(c_{i1}, c_{i2}) non-parametrically as a two-factor loading model, assuming that two unobserved factors V_1 and V_2 enter the model.[11] The specification of the unobserved heterogeneity is given by:

$$c_j = c_j^1 V_1 + c_j^2 V_2. \tag{11}$$

The unobserved factors follow a discrete distribution with a finite number of mass-points, following Heckman and Singer (1984). V_1 and V_2 are assumed to be independent and are distributed on the support {-1,1}. For 2 unobserved terms the distribution is described by four probabilities $P(V_1 = -1), P(V_1 = 1), P(V_2 = -1), P(V_2 = 1)$ and four factor loadings $c_1^1, c_1^2, c_2^1, c_2^2$. For identification, one of the factor loadings is set to be 0, hence 3 factor loadings and 2 probabilities have to be estimated.[12] This specification does not impose any constraint on the correlation matrix.

[11]For a general discussion of two-factor loading models in the context of multivariate hazard rate models see van den Berg (2001) for an application, see e.g. (Crepon, Dejeppe, and Gurgand, 2005).

[12]For the estimation procedure the probabilities are specified as logistic probabilities to ensure that the probabilities vary between 0 and 1 and that the two probabilities of each factor add up to one.

Likelihood Function

The unobserved terms are unknown. Therefore, the individual likelihood contribution consists of the weighted sum of the likelihood contributions conditional on the $l = 4$ combinations of the factors V_1 and V_2. The weights π_l correspond to the probabilities of the factor combinations. Hence, the sample likelihood is given by product of the weighted individual likelihood contributions:

$$L_1 = \prod_{i=1}^{n} \sum_{l=1}^{4} \pi_l L_{il}. \tag{12}$$

4.2 Labor Supply Behavior II: The Consistent Choice Model with Labor Marked Rationing

The consistent choice model is an extension of the pure choice model by conditioning the labor supply choice on the individual probability of labor market rationing. In other words, the pure choice model is nested in the consistent choice model as both models are equal if there exists no rationing on the labor market.

Denoting d the desired hours and p an indicator variable representing non-rationing, we can describe the working alternatives of men accounting for labor market rationing with three mutually exclusive states: to be voluntarily inactive with zero desired working hours ($Pr(d = 0)$), to be rationed but with positive desired working hours ($Pr(d > 0, p = 0)$) and to participate without being rationed ($Pr(d > 0, p = 1)$). Unfortunately, in the data we do not observe whether the involuntary unemployed would prefer full-time or over-time work. However, since they have positive desired hours their utility level when working must exceed their utility level of non-working. We use this information by describing the labor supply choice of the involuntary unemployed by $(1 - Pr(d = 0))$.

$$P_{it}^{VOL}|c_i = \Pr(d_{it} = 0)|c_i = \frac{\exp(\tilde{U}_{i0t} + Z_{it-1}\gamma_0 + c_{i0})}{\sum_{r=0}^{J}(\exp \tilde{U}_{irt} + Z_{it-1}\gamma_r + c_{ir})}, \tag{13}$$

$$\begin{aligned} P_{it}^{INVOL} \quad &|c_i, \mu_i = \Pr(d_{it} > 0, p_{it} = 0)|c_i, \mu_i \\ &= (1 - \frac{\exp(\tilde{U}_{i0t} + Z_{it-1}\gamma_0 + c_{i0})}{\sum_{r=0}^{J}(\exp \tilde{U}_{irt} + Z_{it-1}\gamma_r + c_{ir})})\Lambda(\beta_d X_{it} + \lambda Z_{it-1} + \mu_i), \end{aligned} \tag{14}$$

$$\begin{aligned} P_{it}^{EMP} \quad &|c_i, \mu_i = \Pr(d_{it} > 0, p_{it} = 1)|c_i, \mu_i \\ &= \sum_{j=1}^{J} \frac{\exp(\tilde{U}_{ijt} + Z_{it-1}\gamma_1 + c_{ij})}{\sum_{r=0}^{J}(\exp \tilde{U}_{irt} + Z_{it-1}\gamma_r + c_{ir})}[1 - \Lambda(\beta_d X_{it} + \lambda Z_{it-1} + \mu_i)], \end{aligned} \tag{15}$$

where Λ expresses that the error terms η_{it} of the latent model of labor market rationing (Equation 2) follow a logistic distribution.

Again in the intertemporal model of labor supply with involuntary unemployment, the non-randomness of the initial state has to be accounted for. Similar to the intertemporal specification of the pure choice model, we estimate a static discrete choice model for the initial labor market state without the lagged labor market status, different slope parameters, and the parental education variables. In addition, the initial state of the rationing risk has to be specified. We model the risk in the initial period without the lagged labor market status and allow for different slopes of the coefficients and of the random intercept. Thus, the working behavior of men in the initial state $t = 0$ can be expressed as conditional probabilities of the different labor market states:

$$P_{i0}^{VOL}|\nu_i = \Pr(d_{i0} = 0)|\nu_i = \frac{\exp(\hat{U}_{i00} + \nu_{i0})}{\sum_{r=0}^{J}(\exp \hat{U}_{ir0} + \nu_{ir})}, \tag{16}$$

$$\begin{aligned} P_{i0}^{INVOL} \quad & |\nu_i, \kappa_i = \Pr(d_{i0} > 0, p_{i0} = 0)|\nu_i, \kappa_i \\ & = (1 - \frac{\exp(\hat{U}_{i00} + \nu_{i0})}{\sum_{r=0}^{J}(\exp \hat{U}_{ir0} + \nu_{ir})})\Lambda(\beta_{d0} X_{i0} + \kappa_i), \end{aligned} \tag{17}$$

$$\begin{aligned} P_{i0}^{EMP} \quad & |\nu_i, \kappa_i = \Pr(d_{i0} > 0, p_{i0} = 1)|\nu_i, \kappa_i \\ & = \sum_{j=1}^{J} \frac{\exp(\hat{U}_{ij0} + \nu_{ij})}{\sum_{r=0}^{J}(\exp \hat{U}_{ir0} + \nu_{ir})}[1 - \Lambda(\beta_{d0} X_{i0} + \kappa_i)]. \end{aligned} \tag{18}$$

The unobserved effects ν_{ij} are modelled as functions of the unobserved heterogeneity c_{ij} as described above, and similarly we assume the following relationship between the unobserved effects in the risk of rationing for the initial state and the dynamic process:

$$\kappa_i = \alpha_\kappa \mu_i. \tag{19}$$

The conditional individual likelihood contribution L_{2i} is described by the above defined conditional probabilities of the employment states:

$$L_{2i}|c_i, \mu_i = \prod_{t=1}^{T} \prod_{j=1}^{J} Pr(Y_{it} = j)^{d_{itj}(t>0)} Pr(Y_{i0} = j)^{d_{i0j}(t=0)}, \tag{20}$$

where d_{itj} =1 if j is the chosen alternative in period t and 0 otherwise.

Unobserved heterogeneity

Again we assume that the unobserved effects, c_i and μ_i, can be described by a discrete distribution in a two-factor loading model, assuming that two unobserved factors V_1 and V_2 enter the model. In the true intertemporal labor supply specification the unobserved heterogeneity is described by four probabilities $P(V_1 = -1), P(V_1 = 1), P(V_2 = -1), P(V_2 = 1)$ and six factor loadings, for the choice model $c_1^1, c_1^2, c_2^1, c_2^2$, and for the rationing model μ^1, μ^2. For identification, one of the factor loadings is set to be 0, hence in total 5 factor loadings and 2 probabilities have to be estimated.[13] Here the advantage of our modeling of the unobserved heterogeneity becomes obvious. We allow for full flexibility in the variance covariance matrix, and relative to the pure choice model, only 2 additional mass points need to be estimated.

The sample likelihood for the intertemporal model accounting for involuntary unemployment is given by the product of the weighted individual likelihood contributions:

$$L_2 = \prod_{i=1}^{n} \sum_{l=1}^{4} \pi_l L_{2il} \tag{21}$$

5 Empirical Results

5.1 Estimation Results

Table 3 yields the estimation results of the above specified intertemporal labor supply models with and without rationing. We present the estimation of both models to illustrate the implications of the different assumptions and to assess the potential bias of the estimated labor supply behavior in a pure choice model, which is discussed in detail at the end of this section.

[**Table 3: about here**]

In addition to the specifications controlling for unobserved effects we present results derived from estimations without unobserved heterogeneity. As expected, we find for both classes of models a significant improvement in the likelihood function and a large difference in the Akaike Information Criterion when introducing unobserved heterogeneity.[14] Unobserved effects partly explain the persistence in the labor supply behavior of men. Therefore, we find a significantly reduced effect of the lagged labor market status on the current working behavior when accounting for unobserved heterogeneity.

The variance-covariance matrices of the unobserved heterogeneity of the model without involuntary unemployment and with involuntary unemployment are reported in Tables 4 and 5, respectively. The results show that unobserved factors increasing the probability of working full-time are positively correlated with factors increasing the propensity of over-time work. This positive correlation holds in both models, although it is higher in the simple model (0.44 vs. 0.24). In the model with involuntary unemployment the unobserved terms increasing full-time and over-time work are both

[13]For the estimation procedure the probabilities are specified as logistic probabilities to ensure that the probabilities vary between 0 and 1 and that the two probabilities of each factor add up to one.

[14]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.

negatively correlated with the unobserved factors increasing the probability of being involuntary unemployed (-0.89 and -0.65). HIER BRAUCHEN WIR NOCH PROSA.

Table 4: Variance Covariance matrix of unobserved heterogeneity

	Full-Time Work	Over-Time Work
Full-Time Work	2.05	0.95
	0.15	*0.21*
Over-Time Work	0.95	2.32
	0.21	*0.28*

Unobserved heterogeneity is assumed to follow a non parametric distribution.

Table 5: Variance Covariance matrix of unobserved heterogeneity, full model

	Non-working	Full-Time Work	Over-Time Work
Non-working	3.21	-2.02	-1.50
	0.42	*0.22*	*0.23*
Full-Time Work	-2.02	1.59	0.39
	0.22	*0.13*	*0.24*
Over-Time Work	-1.50	0.39	1.63
	0.23	*0.24*	*0.37*

Unobserved heterogeneity is assumed to follow a non parametric distribution.

For the interpretation of effects with multiple interactions, such as income and leisure, marginal effects, derivatives or elasticities need to be considered. Empirical derivatives with respect to leisure and income show that the theoretical implications of the utility function are fulfilled. For the majority households the concavity of the utility with respect to income and leisure is guaranteed.

Preference for income and leisure vary with observed characteristics, such as education, number of children, age or region. Regardless of the specification, references for income do hardly vary significantly with observed characteristics. As expected, men with a working partner have a lower preference for income. In contrast, preferences for leisure significantly differ across the population. The effects are similar in the pure choice model and in the labor supply model accounting for involuntary unemployment. Better educated men have a significant higher inclination for work, while we find that a bad health status increases the taste for leisure. The estimation exhibit the expected age pattern, taste for work is increasing yet at a diminishing rate. Non-German men have a slightly higher taste for work than German men, while we find a lower taste for men living in east Germany. This effect, however, is reduced when we control for the labor market constraints which capture the higher risk of unemployment in the eastern part. In contrast to studies on the labor supply of women, e.g. Bargain, Caliendo, Haan, and Orsini (2006), we do not find different preferences for single men and men living in couple households, and we find no significant effects of young children. A working partner increases the taste for work which supports the hypothesis of equal mating of spouses and rejects the hypothesis that the working hours of spouses are substitutes.

Turning to the estimation of the rationing risk, we find a strong and significant impact of the regional labor market indicators on the individual rationing risk. The risk increases significantly with regional unemployment rates and with the share of youth-unemployment. The individual characteristics have the expected pattern. The risk of rationing is significantly lower for single men, better educated and for natives.

The coefficients of the lagged dependent variables hint at positive state dependence in the labor supply behavior of men, though the interpretation can be only seen as indicative. We find positive and significant effects of employment in the previous period on working in the current period. This holds true for both models, with and without accounting for involuntary unemployment.

5.2 State Dependence in Labor Supply Behavior

In order to analyze the effect of true state dependence in male labor supply behavior, we derive an intertemporal transition matrix of working behavior conditional on observable and unobservable effects. This transition matrix of working behavior is calculated based on the conditional probabilities for each working category.

Posterior Probability of Discrete Alternatives

The conditional probabilities for each working category depend on the unobserved individual specific effects. Therefore, it is necessary to draw from the posterior choice probability that is conditioned on the individual choice sequence. This conditional probability explicitly accounts for the unobserved heterogeneity by assigning unobserved characteristics to each individual (Skrondal and Rabe-Hesketh, 2004). We derive the posterior probabilities by calculating household specific weights for the four different mass point combinations. The individual specific weights w_{il} are defined in the following way:

$$w_{il} = \frac{P(\tilde{y}_{il}|\mathbf{X_i}, a_i^l)}{\sum_{l=1}^{4} P(\tilde{y}_{il}|\mathbf{X_i}, a_i^l)}, \tag{22}$$

where vector $(\tilde{y}_{il})$ captures the chosen sequence of working alternatives conditioned on mass point combination l and matrix $\mathbf{X}_i$ that includes all explanatory variables over the observed period. The higher the probability of the chosen sequence given the mass point combination the higher the weight assigned to the combination. Skrondal and Rabe-Hesketh (2004) provide a detailed description of this method, sometimes referred to as *Empirical Bayes*, and discuss the properties of the prediction.

State Dependence in a Rationed Labor Market

Conditional on the estimated coefficients of the lagged dependent variables, we describe the transition process of labor supply by calculating a transition matrix **M** (Table 6). In the columns of the transition matrix the previous employment state is tabled, the rows show the probability of the working alternative in the current period. The matrix yields the average of the predicted individual conditional probabilities.

Since unobserved and observed characteristics are kept constant within each column and only the lagged labor market status is varied, the transition matrix provides information about true state dependence. Hence, all differences in the labor supply behavior conditioned on period $t-1$ can be attributed to the previous employment status which is the effect of true state dependence.[15] The estimated true state dependence between the working categories is simply the difference in the probability within a column.

More formally, state dependence e.g. in full-time work conditional on full-time work in the previous period versus voluntary non-participation is calculated as:

$$Pr(j_t|j_{t-1}) - Pr(j_t|k_{t-1}), \tag{23}$$

where, in this example, j represents full-time work and k voluntary unemployment.

One key advance of the suggested framework is the possibility to empirically analyze state dependence in the labor supply behavior of men in a rationed labor market. Thus, it is possible to derive state dependence not only between work and non-work, but between voluntary non-participation, involuntary unemployment, full-time and part-time work. As we find significant difference in the state dependence between voluntary participation and involuntary unemployment, we only consider the transition matrix of the model accounting for involuntary unemployment. For comparison, we present the transition matrix of the pure choice model in the Appendix.

According to the bootstrapped standard errors, all conditional probabilities are very precisely estimated. The transition matrix shows that true state dependence is significantly present between all working states. We find a striking difference in the state dependence for full-time work conditional on being voluntary (0.134) or involuntary unemployed (0.043) in the previous period. For over-time work the state dependence is higher for both groups and is with about 0.2 fairly similar. Overall, this result implies that involuntary unemployed men who actively search for a job have a significantly higher probability of working in the next period. Moreover, we show that the conditional probability of voluntary non-participation is significantly different for both groups. Whereas the probability of voluntary inactive to remain in this alternative is about 20%, the probability for this alternative is about 5% for previously involuntary unemployed. As mentioned above, this different causal effect of the previous labor market status could be explained by the classical reasons of state dependence, but might be as well related to higher search-intensity and job arrival rates for involuntary

[15] Uhlendorff (2006) applies a similar approach when testing for state dependence in income dynamics.

Table 6: Statedependence with Involuntary Unemployment

	Vol. Non-Participation	Inv. Unemployment	Full-Time Work	Over-Time Work
Vol. Non-participation (t-1)	0.203	0.050	0.482	0.265
	0.016	*0.010*	*0.024*	*0.025*
Inv. Unemplyoment (t-1)	0.053	0.087	0.571	0.288
	0.005	*0.017*	*0.019*	*0.021*
Full-time (t-1)	0.032	0.018	0.615	0.335
	0.002	*0.004*	*0.008*	*0.005*
Over-time (t-1)	0.026	0.013	0.478	0.483
	0.003	*0.002*	*0.007*	*0.008*

The following working hours classifications (weekly) are used: 0, 0-40, >40.
All numbers are in shares.
Source: SOEP, wave 2000-2005.

unemployed.

Conditional on full-time and over-time work we find very low probabilities of both voluntary or involuntary inactivity. In contrast, we show that the conditional persistence of work is very high. Still, on the intensive margin, state dependence between full-time and over-time work we find a significantly different effect of the previous labor market status. This suggests that the above discussed sources of state dependence, such as intertemporally non-separable preferences, affect not only labor market participation but as well the intensive margin when working.

Labor Supply Elasticities

In order to analyze the effects of work incentives on the labor supply behavior we derive labor supply elasticities. This is the variable of central interest when discussing labor supply, since this is the channel where policy might affect the working behavior. In this analysis we only focus on the short run labor supply effects, that is on the effects after one period. In the short run, state dependence prevents individuals to fully adjust their labor supply and only in the long run when state dependence looses its significance, labor supply fully adjusts to a new steady state (Haan, 2006).

In the applied discrete choice framework it is not possible to derive elasticities analytically. Instead we simulate numerically changes in the labor market participation and weekly working hours induced by a 1% increase in net-household income when working. We derive the labor supply elasticities for both models, the pure choice framework and the framework where we account for involuntary unemployment. The comparison of these elasticities illustrates the biased of labor supply effects induced in a pure choice model.

The modeling of the rationing risk is reduced form. Therefore, we cannot assess directly the impact of changes in the net household income on the rationing risk e.g.

Table 7: Labor Supply Elasticities with Involuntary Unemployment

	LS with Involuntary Unemployment	LS without Involuntary Unemployment
	Relative Change of Working Hours in %	
All	0.01833	0.07682
	(0.00434 - 0.03241)	(0.05282 - 0.09715)
East Germany	0.02238	0.10486
	(0.00290 - 0.03878)	(0.06562 - 0.13651)
West Germany	0.01706	0.06821
	(0.00389 - 0.03061)	(0.04872 - 0.08489)
	Relative Change of Labor Market Participation in %	
All	0.01819	0.07142
	(0.00692 - 0.03012)	(0.04979 - 0.09045)
East Germany	0.02221	0.10161
	(0.00706 - 0.03758)	(0.06493 - 0.13075)
West Germany	0.01693	0.06218
	(0.00697 - 0.02783)	(0.04543 - 0.07931)

The 5th and 95th percentiles are given in brackets they are derived using bootstrapping with 100 replications. Elasticities are numerical derived, calculating the relative increase in the expected weekly working hours and in the probability of participation given a 1% change of net-income when working.

Source: SOEP, wave 2000-2005.

through wage adjustment or changes in vacancy rates simultaneous to labor supply responses. Our analysis is partial in this respect, since we must assume that the individual rationing probability is not affected. Still this framework provides the possibility to derive in addition to labor supply elasticities, employment elasticity that reflects the individual rationing risk. Employment and labor supply elasticities differ, since the latter focuses solely on the working choice of individuals. Potential labor market constraints are not relevant for this measure. In the following, we concentrate the analysis on labor supply elasticities, since this measure is comparable for both specifications, with and without modeling involuntary unemployment.[16].

In Table 7, we present the labor supply elasticities with respect to weekly working hours and to the labor market participation. In addition to the overall effects, we present elasticities separately for east and west Germany. In general all elasticities are relatively small, since we consider only a 1% increase in net-household income and, as stressed above, in the short-run, state dependence prevents to fully adjust labor supply behavior. However, even when comparing the short-run effects of a minor reform, the striking difference between labor supply elasticities which have been consistently estimated allowing for involuntary unemployment and which are estimated in the pure choice specification becomes evident. We find that elasticities are significantly upward biased when not reflecting involuntary unemployment. Elasticities derived in the pure choice model are about three times higher. Elasticities derived separately for east

[16]Given the low labor supply response to the induced work incentives in the short run, employment and labor supply elasticities hardly differ. As stressed above on average less than 5% of men with positive desired hours are restricted and this probability would explain the difference.

and west Germany show in both specifications higher responds of east German men, though the level is significantly different with and without accounting for involuntary unemployment. These results highlight the bias of the estimated labor supply behavior when not properly accounting for demand side constraints. In line with the findings of Bargain, Caliendo, Haan, and Orsini (2006) we show that estimates of labor supply responses are significantly upward biased in the pure choice model, and this bias is of important size even when only considering a small change in the work incentives and accounting for the effects of state dependence in the short run.

The intertemporal choice model of labor supply without demand side constraints might be biased for several reasons. First, as outline above the model is misspecified because involuntary unemployed with positive desired hours are treated as voluntary inactive. This leads to inconsistent estimates of the preferences for income and leisure. Moreover, the dynamic transition process between the labor market status is not correctly described in a model without involuntary unemployment. As we have shown state dependence significantly differs between voluntary and involuntary unemployment. By the same token, the initial labor market status can only be consistently estimated when accounting for demand side constraints.

6 Conclusion

In this paper we propose a model to consistently estimate the intertemporal labor supply behavior. In this framework we distinguish between voluntary non-participation and involuntary unemployment which is caused by labor market rationing and account for the effect of true state dependence. The proposed model extends previous studies on labor supply since they either not reflect the dynamics in labor supply behavior or are based on the assumption of a pure choice model which implies that unemployment is voluntarily chosen.

We apply the proposed intertemporal labor supply models with demand side rationing to consistently estimate the labor supply behavior of men over time. We find that true state dependence is significantly present between the different labor market states. Moreover, our results stress the necessity to account for involuntary unemployment when analyzing the intertemporal labor supply behavior, since state dependence differs significantly conditioned on involuntary unemployment and voluntary non-participation. Furthermore, we find that intertemporal labor supply elasticities significantly differ when accounting for involuntary unemployment.

Elasticities derived in an unconstrained pure choice model are significantly upward-biased because of misspecification. Furthermore, labor market transitions and the initial state are incorrectly described when not accounting for involuntary unemployment due to labor market restrictions.

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Appendix

Table 8: Descriptive Statistics by Working Alternatives

	Share	Low Education	German	East German	Bad health	Single	Children
Vol. Non-Participation	0.05	0.23	0.88	0.26	0.22	0.23	0.14
Inv. Unemplyment	0.05	0.17	0.87	0.37	0.11	0.29	0.16
Full-Time	0.52	0.10	0.91	0.17	0.08	0.21	0.18
Over-Time	0.38	0.06	0.94	0.18	0.04	0.17	0.20
Average		0.1	0.92	0.19	0.08	0.20	0.18

The following working hours classifications (weekly) are used: 0, 0-40, >40.
Low education is the share of men with less than 10 years of schooling.
German is the share with German nationality.
East German is the share living in East Germany.
Bad health is the share of men disability higher 50%.
Single is share of single households.
Young Children is share of households with children younger than 6 years.
Source: SOEP, wave 2000-2005.

	Non-Work	Full-Time Work	Over-Time Work
Non-Work (t-1)	0.256	0.484	0.259
	0.012	*0.015*	*0.015*
Full-Time Work (t-1)	0.076	0.595	0.329
	0.003	*0.005*	*0.005*
Over-Time Work (t-1)	0.067	0.469	0.464
	0.004	*0.007*	*0.006*

The following working hours classifications (weekly) are used: 0, 0-40, >40.
All numbers are in shares.
Source: SOEP, wave 2000-2005.