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# Do Hours Restrictions Matter ?

## A discrete family labor supply model with endogenous wages and hours restrictions

Elke Wolf

## Non-technical Summary

There already exists a rich empirical literature on labor supply. However, most of the labor supply studies are based on several restrictive assumptions. One crucial drawback of neoclassical labor supply models is the assumption that people can freely choose the quantity of working hours, that is, observed hours are supposed to equal desired hours. This only holds if there are no hours constraints within jobs and no mobility costs between jobs. Other drawbacks are the assumptions that time use is an individual decision, whereby spouses are assumed to maximize two individual utility functions and that the wage rate, which is one of the most important determinants of labor supply, does not depend on the quantity of hours worked. Because empirical studies show that these suppositions are not appropriate, we adapt the neoclassical labor supply model in the required way.

In the literature, we can already find several attempts to incorporate restrictions in the labor market. These studies differ in the way the household context is modeled, if at all. As we assume that the labor supply decisions of spouses are mutually dependent, we choose a family labor supply model which allows for hours restrictions, defined as deviations between actual and desired hours. We further take into account that the wage rate can differ between full-time and part-time jobs.

We conclude that the model with endogenous wages and hours restrictions fits the data much better than the standard neoclassical labor supply model. As expected, the estimation results imply that part-time jobs of women increase family utility provided that they are desired. On the other hand, if the part-time job does not correspond to the desired working hours of the spouses, the household suffers a decrease in utility, independent of whether the man or the woman faces the hours restriction. These results show that not all households in which the woman works part-time are worse off in terms of utility.

We can further show that the hours restrictions reduce the adjustment of hours due to wage fluctuations. Thus, we conclude that the consideration of hours restrictions not only improves the explanation of labor supply decisions but also has an impact on the derived wage elasticities, in short, hours restrictions do matter.

# Do Hours Restrictions Matter ?

A discrete family labor supply model with
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## Abstract

The labor supply of West German married and cohabiting couples is analyzed using a discrete choice model. Following van Soest (1995), the labor supply decision is based on a household utility function which is determined by the leisure of the two spouses and net household income. Furthermore, heterogeneity of preferences and the German tax and benefit system are taken into account. We extend the neoclassical labor supply model in two directions. First, we allow for endogenous wages and find that there exist substantial wage differences between part-time and full-time jobs. In view of the negative wage differentials of part-time jobs, the model with endogenous wages predicts lower part-time employment than the standard neoclassical model. Compared with the distribution of actual hours worked, the share of part-time jobs is highly underpredicted. In a second step, hours restrictions are accommodated, as a result of which the estimated wage elasticities of both spouses are substantially reduced.

JEL classification: J22, C25

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# 1 Introduction

There already exists a rich empirical literature on the labor supply. Most studies focus on the behavior of women. In contrast, less research is available on the time use of men, presuming that their supply decisions are hardly influenced by wages, the tax system or household demographics (e.g. Pencavel, 1986). In any event, most of the labor supply studies are based on several restrictive assumptions.

One crucial assumption of standard neoclassical labor supply models is that people can freely choose the amount of working hours, that is, observed hours correspond to desired hours. This assumption only holds if there are no hours constraints within jobs and no mobility costs between jobs. Actually, there is some evidence that this assumption does not hold. For one thing, this kind of labor supply model cannot explain the peak in observed working hours at about 40 hours a week and the smaller peak around 20 hours. For another, the results of several surveys indicate that people do not always work their desired hours, that is, they are constrained with respect to working hours. There have been different attempts to take such labor market constraints into account. Dickens and Lundberg (1993), for example, try to disentangle preferences and labor market restrictions using the distribution of observed working time. They find that people searching for a part-time job face severe hours restrictions. The problem with this approach is that the identification of the supply and demand side is based solely on information on the distribution of actual working hours, the outcome of desired and offered hours. Ilmakunnas and Pudney (1990), as well as Euwals and van Soest (1996), avoid this drawback by using information on both actual and desired working hours.

Secondly, the labor supply decision is typically treated as an individual decision, whereby spouses are assumed to maximize two individual utility functions. But there are strong arguments supporting the idea that the decisions of married or cohabiting couples depend on each other. In principle, there exist two competing theoretical approaches to model the intrafamily time use. One approach is to assume that spouses decide jointly about their labor supply and other household decisions, that is, they maximize a joint family utility function. Based on this supposition, Hausman and Ruud (1984) extended the individual labor supply model to a family labor supply model. Also Aaberge et al. (1997) and van Soest (1995) apply this research strategy and allow for hours restrictions as well. The alternative is a non-cooperative bargaining model (see for example, Ott, 1992). In this case, the spouses maximize individual utility functions which are mutually dependent, so that the outcome depends on the labor supply decision of the partner and on the individual bargaining power. Clear empirical evidence on which approach is superior is still lacking.

Thirdly, the wage rate, which is one of the most important determinants of labor supply, is often assumed to be independent of the hours worked. But there are several empirical studies indicating that wages do depend on the amount of hours worked. Tummers and Woittiez (1991) conclude that full-time employees in the Netherlands receive lower gross wage rates than do those working part-time, whereas the opposite holds for Great Britain, the USA and Finland (Main, 1988; Ermisch/Wright, 1993; Avarett/Hotchkiss, 1997; Ilmakunnas/Pudney, 1990). The previous results for Germany are in line with those in the latter countries (Schwarze, 1998).

In recognition of these deficiencies, we analyze a structural model of labor supply of West German couples with hours constraints and endogenous wages. Furthermore, we consider the labor supply as a joint decision of both spouses. More specifically, we extend the family labor supply model of van Soest (1995) by allowing the wage rate to depend on hours.

The paper is organized as follows. In the next section, we describe our family labor supply model and its extensions concerning the endogeneity of wages and the hours restrictions. The data and some descriptive numbers on labor supply are presented in Section 3. Section 4 presents the estimation results and the simulated wage elasticities. Section 5 concludes.

# 2 The econometric model

Unlike the classical labor supply model, in which the choice set of the decision-maker is continuous, we use a discrete choice model with a finite number of alternatives (see e.g. van Soest, 1995)[1]. Further, we assume that the corresponding household budget is determined by the working hours and the hourly wage rate, which, among other factors, also depends on hours worked. We also consider the impact of the German tax and benefit system. Finally we further extend the model and allow for hours restrictions.

## 2.1 The discrete labor supply model

In the discrete choice approach, we assume that each family can choose among a finite number of combinations of male and female working hours $\{(l_m, l_f)\}$. If the working hours of each family member is grouped in, say, five categories (including a category for zero hours), the family can choose among 25 labor supply alternatives – each corresponding to a certain family after-tax income. The family's after-tax income includes the men's and women's labor earnings, income from other

[1] In the following we use "couple" and "family" as synonyms for married and cohabiting persons

sources, potential unemployment benefits and other transfers less the taxes. How benefits and taxes depend on the family income and other characteristics of the household and the individuals is described in Section 2.2.2. One important advantage of the discrete labor supply model is that non-linear tax schedules and tax breaks due to joint filing and other regulations of the German tax and benefit system can be incorporated into the model relatively easily.

Following van Soest (1995), we assume that the direct utility function can be approximated by a translog specification

$$(1) \quad U(v) = v'Av + b'v ,$$

where $v = (\log y, \log l_m, \log l_f)'$ is a vector (in logs) of the components of the utility function. A is a symmetric 3x3 matrix with the elements $\alpha_{ij} (i, j = 1, 2, 3)$ and $b'$ is a 3x1 vector ($b = (\beta_1, \beta_2, \beta_3)'$). The variables $\alpha_{ij}$ and $\beta_j$ are parameters of the utility function which have to be estimated. While the parameters $\beta_j$ measure the direct effect of the goods $(\log y, \log l_m, \log l_f)$ on the family utility, the matrix A also captures the effect of the interactions between the three components of the utility function.

Individual preferences for leisure depend on the actual household situation (i.e. the labor supply of both household members and the family income), as well as on individual characteristics of the household such as the presence of young children. Thus, the impact of leisure on household utility is not the same for all men and women. The interaction between individual time preference and the actual labor supply of the household is already captured by the first part of the utility function $(v'Av)$. The impact of individual characteristics on the preference for leisure enter the utility function through the term $b'v$. Thus, the heterogeneity of preferences for leisure is incorporated through the parameters $\beta_2$ and $\beta_3$. We assume that the valuation of the man's leisure depends mainly on his age $(age_m)$. The contribution of the woman's leisure to the household utility depends further on the number of young children in the household (the variable *k3* counts all children up to the age of 3 years, *k16* measures the number of children between age 4 and 16).

Thus, we have,

$$(2) \quad \beta_2 = \beta_{20} + \beta_{21} \cdot age_m + \beta_{22} \cdot age_m^2$$

and

$$(3) \quad \beta_3 = \beta_{30} + \beta_{31} \cdot age_f + \beta_{32} \cdot age_f^2 + \beta_{33} \cdot k3 + \beta_{34} \cdot k16 .$$

Because labor income is determined by work preferences, which vary across households, we suppose that the impact of income on family utility itself ($\beta_1$) does not depend on household demographics.

Starting from this specification of the family utility function, we are interested in the decision process of the couples. We assume that each family chooses the regime which offers the highest utility. Thus, the observed labor supply decision is regarded as the utility maximizing choice between the 25 possible alternatives of the choice set; that is, $U^* = U^a > U^r$, for all $r \neq a$, where $a$ defines the actual choice and $r$ all other regimes. This discrete decision problem can be described by a conditional logit model (McFadden, 1974), which can be derived from a random utility maximization approach. The multinomial logit and the conditional logit model differ in that the choice probability of the former approach depends on choice characteristics as well as on individual attributes. In the conditional logit model the probability that regime $a$ is chosen is defined as

$$P\left[U^a > U^r, \forall r \neq a\right] = P\left[(v'Av)^a + (b'v)^a - (v'Av)^r - (b'v)^r > 0, \forall r \neq a\right]$$

(4)

$$= \exp(U(\log y^a, \log l_m^a, \log l_f^a)) / \sum_{r=1}^{25} \exp(U(\log y^r, \log l_m^r, \log l_f^r)) .$$

By solving equation (4) it becomes obvious that all variables, which are the same for all alternatives (e.g. the household characteristics), drop out. Therefore, all household specific variables have to be interacted with the alternative-specific variables, otherwise no individual effects could be estimated. Inserting (2) into equation (4), the parameters $\alpha_{ij}$ and $\beta_j$ can be estimated using maximum likelihood.

Given that every regime is defined by the male and female labor supply and the household net income, we now have to compute the corresponding net household income for each of the 25 regimes.

## 2.2 The Budget Constraint

The net household income of the majority of families is mainly determined by the individual wage rates of the family members and the German tax and benefit system. In the following we will briefly describe how wages, taxes and transfers enter the budget constraint.

### 2.2.1 Endogenous wages

The most important part of the household budget is labor income, which depends on the individual wage rates and the paid working hours of both spouses. Human capital theory implies that the individual hourly wage rate is mainly determined by the education level and labor market experience. But there are strong arguments that the number of hours worked also have a significant impact on the wage rate.

In the literature, we can find four (not mutually exclusive) explanations for wages dependent on hours. One idea is that the labor costs of the firm do not increase proportionally with hours worked. The hourly wage rate attached to part-time jobs may be lower compared to an equivalent full-time job, because part-time jobs cause relatively higher fixed costs to the firm (e.g. recruiting and training costs, arranging a work-place and coordination costs). On the other hand the working hours may also influence productivity. Reduced working hours may raise hourly productivity because they avoid the negative fatigue effect of a long working day or they lessen unproductive time, or "slack". A report by McKinsey (1994) comes to the conclusion that the higher labor costs for part-time employees are over-compensated mainly by higher productivity, improved capital utilization and the reduction of absenteeism. Therefore, gross part-time wages – given they are based on labor productivity – should be higher. Thus, we cannot exclude in advance that part-time wages exceed the hourly wage rate of full-time jobs. Tummers and Woittiez (1991), for example, show that part-time employees in the Netherlands earn higher hourly wages than people working full-time. The third explanation is based on the idea of compensating wage differentials. Ermisch and Wright (1993) argue that a large proportion of women who work part-time do so because they have home responsibilities, like children. Employers who offer part-time jobs can substitute the attribute of reduced hours, which correspond to the time preferences of many mothers, for a wage reduction because these women may accept a certain negative wage differential. Thus, the labor supply elasticity with respect to wages should be lower for part-time jobs. Finally it could be argued that a lack of part-time jobs in general decreases the wage rate for these scarce jobs. Empirical studies for several countries confirm these hypotheses (e.g. Ermisch/Wright, 1993; Avarett/Hotchkiss, 1997). In Germany, the lump sum taxation of jobs without social security coverage provides another reason for a negative wage differential for these jobs. Schwarze (1998) argues that employers shift the entire tax burden (15 percent of the gross wage rate) on to employees. In this case, the hourly wage rates of these jobs are about 15 percent below those for comparable full-time jobs.

Thus, there are reasons for supposing that there are substantial wage differences between full-time and part-time jobs also in Germany, and especially between insured and uninsured jobs. Firstly, subsidized community child care facilities are very limited and private child care is expensive in Germany, which is one of the main problems for mothers who are searching for a job (Engelbrech et al., 1997). Part-time jobs are often the only feasible employment for mothers. Merz (1990) shows that therefore children and other factors reflecting family circumstances have a stronger impact on the labor supply of married women than does the economic situation of the family. Secondly, part-time jobs are scarce, especially for qualified employees. Thus, we take into account the endogeneity of the wage rate when calculating the household income of the different labor supply regimes. Estimation results are presented in section 4.1.

### 2.2.2 The German Tax and Benefit System

Apart from labor income, household net income is also determined by the German tax and benefit system. A brief overview of the existing system in the year 1995, to which the empirical analysis refers, is next given.

In Germany couples have the choice between joint and separate filing of their incomes. Provided that spouses income differs, there are strong incentives for joint filing which is known as *Ehegattensplitting*. In this case, the incomes of the two spouses are added and divided by two. The appropriate tax rate is calculated on the basis of the resulting per capita income. The German tax system is further characterized by several deductions and allowances which reduce the tax base. First of all, a basic allowance is applied to guarantee the subsistence level. Further deductions exist for special expenses (e.g. own training and education), extraordinary expenses (e.g. educational expenses for children older than 18 years or people with disabilities) and losses. There also exist a variety of deductions mainly available to the high income earners, the self employed and those with non-labor earnings. In addition, tax allowances are given for each dependent child in the household. Finally, for single parents an additional household allowance can be deducted.

In a next step, the resulting net income is reduced by the social insurance premiums, which are mandatory for employees. The contribution for the three basic insurances (health and long-term care insurance, unemployment insurance and the old-age pension) is a fixed percentage of gross earnings for a certain income interval. Employees whose gross labor income is below the lower limit pay no social insurance premiums. There is also an upper limit on gross earnings, beyond which no contribution has to be paid any longer. In 1995, the upper limit was 7,800 DM gross earnings per month for the unemployment and the old-age insurance and 5,850 DM for the health insurance. The lower limit was 580 DM for all social insurances.

The German social benefit system is rather complicated. The most important elements are child benefits, social assistance and housing benefits. The child benefit is paid to all families with children younger than 16 years (or younger than 27 years, provided that they are still at school or university or in vocational training). Thus, the amount of the benefit depends on the number and the age of the children in the household. Apart from the benefits for the first child, the transfer for all other children are means-tested, the amount depending on annual household net income in the penultimate year. If the couple (the single parent) earned more than 26.600 DM gross (19.000 DM) in that year, the current transfer is reduced stepwise according to the excess of annual net income above this limit. In contrast to child benefits, social assistance may be claimed by all individuals whose income is below a certain limit and no other support is available. There exist two different types of social assistance: firstly, welfare assistance (*Hilfe zum Lebensunterhalt*) for people who are unable to work and, secondly, assistance for special circumstances (*Hilfe in besonderen Lebenslagen*), namely, for the sick or disabled persons and those in need of care. The level of social assistance transfer depends on the number and the age of the household members, their earned and unearned incomes (e.g. child benefits) and their needs. Furthermore, low income families may be entitled to housing allowances (*Wohngeld*).

In order to determine the exact budget set for the different labor supply regimes, various calculations are necessary. The first step is the simulation of the German tax and benefit system. Given its complexity, however, only the main features of the German tax and benefit system where considered.

In particular, the child benefits and the social assistance benefits are derived in a relative detailed way according to the legal regulations. In calculating the child benefit, we take into account the age of the children. The claim on social assistance is derived from the household net income (including child benefits). Potential transfers from other sources (e.g. divorced men or children) are ignored.

We estimate the net household income taking into account the main features of the existing tax system: the *Ehegattensplitting*, the basis tax allowance and some other deductions and the social security premiums. We assume that all married couples choose to split their income. Therefore, we estimate different tax functions for married and cohabiting couples. The estimation results are presented in Table A1 in the Appendix.

## 2.3 Hours restrictions

If individuals are restricted in choosing their working hours, the preceding model must be modified, because it only holds for the unconstrained choice. Several empirical labor supply studies show that models which do not allow for hours restrictions strongly overpredict the number of part-time jobs (e.g. Gerfin, 1991; van Soest et al., 1990; Dickens/Lundberg, 1993; and van Soest, 1995). This leads one to believe that hours restrictions may have a significant impact on labor supply.

Since this study is an extension of the labor supply model developed by van Soest (1995), we will briefly summarize the estimation results and the conclusions he derived. Van Soest (1995) estimated the basic discrete choice model (see section 2.1) for the Netherlands in the year 1987, taking into account the Dutch tax and benefit system. He argued that the overprediction of part-time jobs may be due to a lack of jobs offering reduced hours. The shortage of part-time jobs can be explained, for example, by fixed costs of hiring workers. Given a lack of part-time jobs, searching for such a rare job causes higher costs for the employees. This implies that people working part-time are worse off. Van Soest (1995) tries to correct for this by including alternative-specific constant terms in the utility function, indicating whether or not the man or the woman works part-time. The coefficients of these constant terms were all significantly negative, which confirms the hypothesis that hours restrictions matter.

The drawback of this approach is that the author implicitly assumes hours restrictions to be the same for all individuals in labor force. On the one hand, it is quite conceivable that a part-time job generates utility to the family because it allows a mother to participate in the labor market and earn extra money. On the other hand, there may be, apart from the possible negative wage differential, other disadvantages of part-time jobs, such as worse prospects of promotion or less social acceptance. Accordingly, the matter of hours constraints should vary across households.

In the presence of hours restrictions, observed working hours may not correspond to the utility maximizing choice in a world without restrictions. Thus, observed working hours cannot strictly be interpreted as revealed preferences. In the basic model (see equations (1) - (3)), the utility of leisure (or part-time work) depends on individual characteristics, such as age, the number of children, and other family characteristics. But people may accept a part-time job even if it is not utility maximizing. This could be the case if a full-time job is not available and the utility of working part-time exceeds the utility of the non-working situation: $U^* = U(c^*, l_m^*, l_f^*) > U^{p_m} = U(c^{p_m}, l_m^{p_m}, l_f^*) > U^{0_m} = U(c^{0_m}, l_m^{0_m}, l_f^*)$, where $U^*$ is the maximum feasible utility of the family, $U^{p_m}$ is the utility if the man works part-time and only the woman works the desired hours, and $U^{0_m}$ is the household utility if the man's labor supply is zero. This second-best choice can also be interpreted as a utility maximizing choice which is derived from a reduced choice set.

In short, part-time work may be detrimental to individuals who prefer working full-time but cannot find an adequate job. For other individuals, part-time work may be the optimal choice, because they want to spend more time for other activities (e.g. child care). Actual labor supply depends not only on the preferences but also on whether or not these preferences can be realized. In contrast with the basic model, we now allow for the case that the observed choice is not necessarily the utility maximizing choice. In order to identify those employees who do not work their desired hours, we use information about desired working hours contained in our data. It is assumed that only those part-time employees who are not satisfied with their working time suffer a utility reduction.

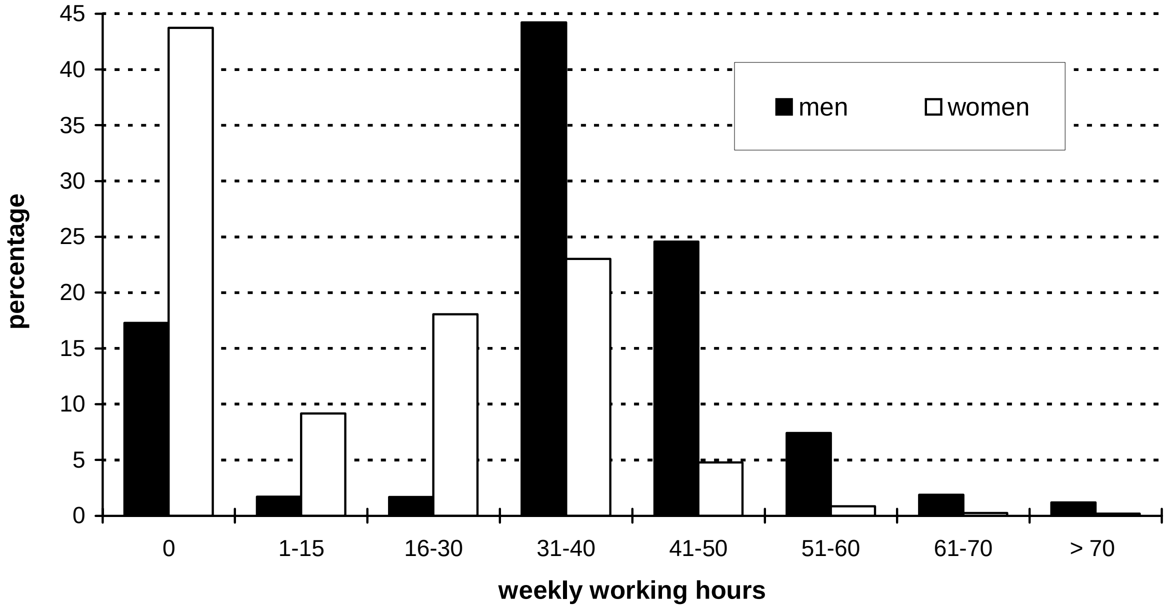
# 3 Data and Descriptive Analysis

Estimation of the model is based on data from the German Socio Economic Panel (GSOEP) for the year 1995. The GSOEP is a representative household survey for the German population conducted every year since 1984 in West Germany and, since 1990, also in East Germany. We restrict our analysis to West Germany, because the standard working hours differ between East and West Germany and because there are large differences in the labor supply behavior, especially between East and West German women. In the first wave, about 12,000 individuals in 6,000 households in West Germany were interviewed. The panel attrition during the following years is partly compensated for by including new households, if an individual of an initial panel household set up a new or moved to another household. In the West German survey of 1995 more than 10,000 individuals in about 5,000 households were interviewed.

For our empirical analysis, we defined the following subsample: at the outset we selected all couples who live in the same household. We then dropped couples if both spouses were older than 64 years, because their family labor supply is supposed to be zero. Further, we excluded foreigners for two reasons. Firstly, labor supply decisions, especially for women, are strongly determined by values and sex-role preferences which differ substantial between nationalities (Hakim, 1997). Therefore, including a foreigner dummy and interaction terms seem not sufficient to control for these differences. Secondly, guest workers, who represent a considerable part of all foreigners in Germany, are oversampled in the GSOEP. This can also cause problems for the analysis of the labor supply of couples (Laisney et al., 1993). We also excluded couples working in the farming and forestry sector, because they are often unpaid family workers. After these exclusions there remain about 2,380 couples in the sample, of which 300 are unmarried. Due to missing data we lost another 4 percent of these observations.

We now consider the distribution of actual and desired hours of this subsample. Figure 1 provides histograms of actual hours, separately for men and women. In contrast with the 5 categories in the family labor supply model described above, we now generate 8 groups, because there are more observations if we look at the individual labor supply. The first category (zero hours) includes all persons out of work, whereas the open category at the upper end of the distribution contains all persons who answered that they work more than 70 hours a week. Several men and also some women claimed that they worked more than 84 hours a week during the preceding month. Assuming that the productivity of the working hours exceeding 84 hours (12 hours a day) is zero or at least very low, we censored the number of actual working hours at this threshold.

**Figure 1: The distribution of actual weekly working hours in West Germany**




Source: Author's own calculations based on the German Socio Economic Panel, 1995.

The distribution of actual hours for men has a peak at 31-40 hours a week, which mainly represents standard full-time jobs (see Figure 1).[2] But also some 25 percent of men work between 41 and 50 hours, and 7.5 percent work between 51 and 60 hours. Only 3 percent work more than 61 hours a week. In view of the fact that agreed working hours never exceed 40 hours a week by law, at least 35 percent of the male sample evidently work overtime.

Women's working hours differ strongly from men's. Compared to men, there are many women working less than 31 hours a week. Almost 10 percent of all women in the sample work less than 16 hours, and are mostly not covered by social security (*geringfügige Beschäftigung*). Furthermore, about 18 percent of women work part-time. In this study, part-time employment is defined as 16-30 hours a week. Apart from the actual working hours, there are also strong differences between male and female participation rates. The share of women with zero hours of work is almost 45 percent in 1995, whereas the share of inactive men is about 17 percent.[3]

In addition to actual labor supply, the employees in the GSOEP are also asked how many hours they would like to work, taking into account the resulting income

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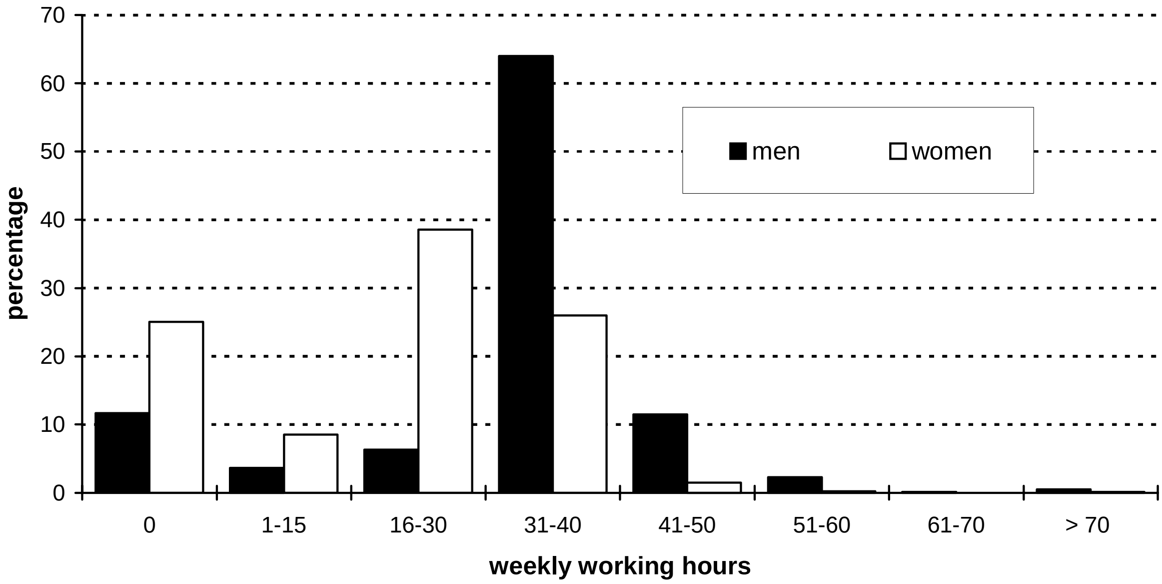
[2] Standard working hours are fixed by collective agreement and vary by sector between 35 and 40 hours per week (Bispinck, 1996). Exceptions are some big companies, such as Volkswagen AG, where the standard working week was 28 hours.

[3] The relatively low participation rates in our sample are partly due to the selection process. Because we did not exclude individuals older than 60 years, the data also contain the early retirees.

variation.[4] The distribution of desired working hours differs strongly from the distribution of actual hours in many respects (see Figure 2). Firstly, both for males and females, the desired participation rate is higher, that is, men as well as women are involuntarily unemployed to some extent. It is striking that most men want to work full-time (31-40 hours), whereas the majority of women who want to work prefers a part-time job (16-30 hours). The proportion of women working full-time is nearly identical to those who actually prefer a full-time job. However, we cannot conclude that all women who have a full-time job are satisfied with their working hours, because it need not be the same women who would like to work full-time.

**Figure 2: The distribution of desired weekly working hours in West Germany**




Source: Author's own calculations based on the German Socio Economic Panel, 1995.

In the presence of imperfect mobility or incomplete information, there may be a mismatch between actual and desired hours at the individual level even if the actual number of full-time jobs equals the number of desired full-time jobs in the aggregate. Table 1 shows the deviation of desired hours from actual hours. The shares represent the percentages of men (women) for each group of actual working hours who state that they desire to work a certain number of weekly working hours. For instance, 58.1 percent of the non-working women state that they do not want to work, and 28 percent of these women prefer to work part-time. The last column shows the number of observations for each category of actual hours. The framed cells indicate for each category of actual hours worked the category of desired hours preferred by the highest share of people in the respective category. For women,

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[4] The exact wording of the question is: "If you could choose your working time, taking into account that your income changes accordingly, how many hours would you like to work per week".

these cells are located mainly on the diagonal, that is, the majority of women are satisfied with their actual working hours. Nevertheless, the actual hours do not correspond to the desired hours in many cases. For example, only 62.4 percent of the full-time employed women are satisfied with their working hours. Almost 30 percent prefer a part-time job and another 5 percent would like to work up to 15 hours. This does not hold for men. With the exception of non-working men and those working between 16 and 30 hours, most of the men prefer a standard full-time job without overtime. Thus, almost all framed cells are in the row of desired hours between 31 and 40 hours.

**Table 1: Actual versus desired weekly working hours (in percent)**

| actual hours | desired hours | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| men | 0 h | 1-15 h | 16-30 h | 31-40 h | 41-50 h | 51-60 h | 61-70 h | >70 h | # obs. |
| 0 h | ***69.2*** | 0 | 1.5 | 29.2 | 0 | 0 | 0 | 0 | 390 |
| 1-15 h | 0 | 30.8 | 10.3 | ***48.7*** | 10.3 | 0 | 0 | 0 | 39 |
| 16-30 h | 0 | 7.9 | ***57.9*** | 28.9 | 5.3 | 0 | 0 | 0 | 38 |
| 31-40 h | 0 | 2.9 | 8.1 | ***80.9*** | 7.3 | 0 | 0 | 0.4 | 1014 |
| 41-50 h | 0 | 3.7 | 4.6 | ***70.2*** | 19.5 | 2.0 | 0 | 0 | 563 |
| 51-60 h | 0 | 6.5 | 2.4 | ***45.3*** | 31.2 | 13.5 | 0 | 1.2 | 170 |
| 61-70 h | 0 | 4.8 | 0 | ***47.6*** | 26.2 | 11.9 | 4.8 | 4.8 | 42 |
| >70 h | 0 | 3.8 | 0 | ***30.8*** | ***30.8*** | 23.1 | 3.8 | 7.7 | 26 |
| women | | | | | | | | | |
| 0 h | ***58.1*** | 0 | 28.0 | 13.9 | 0 | 0 | 0 | 0 | 1006 |
| 1-15 h | 0 | ***55.2*** | 36.2 | 7.6 | 0.5 | 0.5 | 0 | 0 | 210 |
| 16-30 h | 0 | 10.4 | ***81.9*** | 7.7 | 0 | 0 | 0 | 0 | 415 |
| 31-40 h | 0 | 4.8 | 29. | ***62.4*** | 3.0 | 0.2 | 0 | 0.4 | 537 |
| 41-50 h | 0 | 6.4 | 24.5 | ***58.2*** | 9.1 | 0.9 | 0 | 0.9 | 110 |
| 51-60 h | 0 | 10.5 | 10.5 | ***57.9*** | 21.1 | 0 | 0 | 0 | 19 |
| 61-70 h | 0 | 0 | 16.7 | 16.7 | 16.7 | ***50.0*** | 0 | 0 | 6 |
| >70 h | 0 | 0 | 25.0 | ***50.0*** | 25.0 | 0 | 0 | 0 | 4 |

Source: Author’s own calculations based on the German Socio Economic Panel, 1995.

As we are interested in the joint labor supply of couples, we now merge the information on both spouses’ actual labor supply within one household. We construct 25 possible labor supply regimes of the household, with five categories for men and women, respectively. Because of the difference between the hours distribution of men and women, the width of the intervals is not the same. For women, we can create two categories for part-time jobs: one for employment up to 15 hours a week (*geringfügige Beschäftigung*), which has become more and more popular in recent years, and a second group for standard part-time jobs. Full-time jobs are defined as jobs between 31 and 40 hours a week and all other jobs are put together into one "overtime category". Because of the small number of observations, there exist only one category for part-time jobs for men. On the other hand, we divide the "overtime category" of men into two groups, comprising those working up to 50 hours and the rest.

**Table 2: Actual distribution of the 25 labor supply regimes**

| | female labor supply (in weekly hours) | | | | | |
|---|---|---|---|---|---|---|
| male | 0 h | 1-15 h | 16-30 h | 31-40 h | 41-84 h | ∑ |
| 0 h | ***227*** | 16 | 49 | 81 | 14 | 387 |
| | 10.0 | 0.7 | 2.1 | 3.61 | 0.6 | 17.0 |
| 1-30 h | 25 | 10 | 16 | 20 | 5 | 76 |
| | 1.1 | 0.4 | 0.7 | 0.9 | 0.2 | 3.3 |
| 31-40 h | ***405*** | 108 | 194 | ***269*** | 40 | 1016 |
| | 17.8 | 4.7 | 8.5 | 11.8 | 1.8 | 44.6 |
| 41-50 h | ***239*** | 56 | 103 | 114 | 51 | 563 |
| | 10.5 | 2.5 | 4.5 | 5.0 | 2.2 | 24.7 |
| 51-84 h | 94 | 21 | 51 | 44 | 28 | 238 |
| | 4.1 | 0.9 | 2.2 | 1.9 | 1.2 | 10.4 |
| ∑ | 990 | 211 | 413 | 528 | 138 | 2280 |
| | 43.4 | 9.3 | 18.1 | 23.2 | 6.1 | 100.0 |
| ∑(part-time) | | 624 | | | | |
| | | 27.4 | | | | |

Source: Author's own calculations based on the German Socio Economic Panel, 1995.

The larger printed numbers in Table 2 show the number of observations within each of the 25 labor supply regimes of married and cohabiting couples. The most frequent occurrences are written in italics. The small numbers beneath present the shares of each regime with respect to all couples. We can see that in almost 10 percent of the selected households neither member receives labor income. The most frequent choice of household labor supply is one in which the man works between 31 and 40 hours and the woman is out of work (17.8 percent of the couples). In another 12 percent of households both men and women work full-time. The third most populous regime (about 10 percent of the couples) is where the man works between 41 and 50 hours a week and the wife has no paid work. These four regimes are printed in italic letters and we pay special attention to them in the following analysis.

# 4 Empirical results

## 4.1 Wage equations

Before estimating the family utility function, we present the fitted wage equations. Predicted wages are assigned to those individuals who do not participate in the labor market (about 17 percent of all men and 44 percent of all women in the sample), and for whom no wage rate can therefore be observed. Because wage determination can differ structurally by gender, we run separate regressions for males and females.[5] The wage equation is modeled on the basis of an extended human capital approach:

(5) $w_s = f(plme_s, educ_s, r_s, children_f, handic_s); \quad s = m, f$

where $plme_s$ measures potential labor market experience[6], $educ_s$ indicates the education level and $r_s$ captures regional differences in unemployment rates and other labor market conditions. According to human capital theory, each break in employment devaluates human capital, returns to qualifications decrease. For women, we try to correct for this impact by including the number of children ($children_f$) into the wage equation. Finally, we allow for the lower wages of handicapped people ($handic_s$). The dependent variable $w_s$ is defined as the log of the hourly gross wage rate.

The estimation results are presented in Table A2 in the Appendix. The signs and magnitudes of most of the estimated coefficients are in line with the expected effects. Thus, the wage increases with education level and potential labor market experience. However striking is the result that handicapped women have significantly higher wages than healthy women. This is likely due to the fact that we do not correct for wage differences between industries and firm sizes, which are also important determinants of the wage rate.[7]

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5 The selection bias of the observed wage is not taken into account here. Steiner/Wagner (1997) test for selectivity bias in their earnings functions estimated on the GSOEP data for 1990 and 1995 by including a selectivity-correction term (Heckman, 1979). They show that the estimated parameters in the selectivity-corrected earnings equation change very little even when the selectivity term is significant.

6 Potential labor market experience is defined as: age - years of education - 6.

7 Handicapped women are, for instance, underrepresented in the trading and the private service sector, which are known as low-wage sectors. In addition, they are overrepresented in large firms, which pay higher wages in general. If we correct for firm size and sector differentials, the positive wage differential of handicapped women becomes insignificant. Even so, we do not

Up to this point, it has been assumed that the wage rate does not depend on the amount of hours worked. We now follow Ilmakunnas and Pudney (1990) and incorporate the endogeneity of the wage rate by further extending the standard human capital wage equation. As we suppose that the hourly wage rate also depends on the working hours ($h_s$), we estimate wage differentials between the different labor supply regimes separately for men and women using the following specification:

(6) $w_s = f(h_s, plme_s, educ_s, r_s, children_f, handic_s); \quad s = m, f$

In this paper we estimate equation (6) by OLS and ignore the potential simultaneity of working hours and wages. Since Ilmakunnas and Pudney (1990) conclude that an instrumental variable estimation generates comparable results, this seems to be an adequate first approach.

Based on the estimation results, we predict the wage rate of the spouses' observed labor supply $\left[w(l_m^a)\ and\ w(l_f^a)\right]$. The wage rates $w(l_m^r)$ and $w(l_f^r)$ of the three alternative labor supply situations of men and women are computed based on the estimated wage differentials. Accordingly, we predict wages for those individuals who currently do not participate in the labor market.

Factors other than human capital, hours worked and regional differences in labor market conditions, such as industrial sector and firm size, are also known to be important determinants of individual wages. Empirical studies also show that these wage differentials hardly change over time (for Germany see for example Steiner/Wagner, 1997). However, since we do not know which sector or firm size job movers (or those who return to the labor market) would choose, these factors cannot be taken into account in the estimated wage equation.

The estimation results presented in Table A2 in the appendix suggest that the hourly wage rate depends on labor supply even if we control for qualification and the other explanatory variables in the wage equation. Women working overtime receive a hourly wage rate which is on average 22.1 percent[8] below the wage rate of standard full-time jobs. Also, women with a part-time job accept wage reductions compared to full-time jobs and the disadvantages of jobs with less than 16 hours is even

include these variables into the wage equations, because we do not know which sector or firm size the currently non-working people would choose.

8 The percentages of the wage differentials are derived from the estimated parameters in the wage equation (see Table A2 in the Appendix). For example, the wage differential for women working overtime is $(\exp(0.20) - 1) \times 100$ = 22.1 percent.

higher (36.2 percent). These findings correspond to the results of Ermisch and Wright (1993) for Great Britain and Schwarze (1998) for Germany, even if our estimated wage differentials are a bit larger. So, these results should be taken with caution for the reasons mentioned earlier.[9] The findings are somewhat different for men. Only employees working more than 50 hours a week earn significantly less money per hour. Compared with other employees they accept, or have to accept, a negative wage differential of 18.5 percent. The other coefficients of the wage equation hardly change as compared with the first specification of the wage equation.[10]

## 4.2 Labor supply models

We now turn to the estimation of the utility function described in Section 2. We begin with the basic model, defined by the equations (1) through (3). Two important drawbacks of this specification are the assumptions that the individual wage rate is independent of the hours worked (see Section 2.2) and that all individuals can freely choose their working hours (see Section 2.3). Thus, we sequentially drop these restrictive assumptions and compare the estimation results from the extended specification with those from the basic model.

### 4.2.1 The standard neoclassical labor supply model

In this paper, we describe the family labor supply decision as a choice among 25 labor supply regimes which are defined by combinations of male and female working hours and the corresponding household income. The results of the maximum likelihood estimation of the basic model are presented in Table A3 (Model 1) in the Appendix. Given the characteristics of the individuals in the sample, the resulting coefficients describe a utility function which best explains the labor supply decisions of the families. The estimated parameters can be interpreted as implicit prices of the elements in the utility function, that is, positive coefficients indicate that the corresponding variable, such as income, increases the utility. At first glance, it is not clear whether the household utility increases with net income, because the linear term of the family's net income is both highly negative and strongly significant. Therefore, we calculated the derivative $\partial U/\partial y$, which is positive for all households. We can conclude that the utility function is quasiconcave in the relevant area, that is, household utility increases with net income. The

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[9] If we control for example for firm size and industrial sectors, the female wage differential between full-time jobs and part-time jobs with less than 16 hours falls to 25.9 percent and the coefficient of part-time jobs becomes insignificant

[10] Just as for women, the negative wage differential decreases (to -13.7 percent) if we include firm size and industrial sectors into the set of explanatory variables in the wage equation.

other parameters of the utility function have the expected signs. The parameters of the interactions between age and leisure ($l_m \times age, l_m \times age^2, l_f \times age, l_f \times age^2$) imply that the labor supply of men reaches a maximum when they are about 36 years old. Women reach their maximum 6 years earlier. The labor supply of women is further determined by the number of children in the household. Children younger than four years of age decrease female's labor supply significantly. Even if the impact of older children (between four and sixteen years) is much smaller, the coefficient is still significantly negative. The coefficient of the interaction between the man's and the woman's leisure ($l_m \times l_f$) can be interpreted as follows: given the labor supply of women, the valuation of their leisure increases with the leisure of their partners, so that male and female leisure are complementary. This seems to be a plausible result.

**Table 3: Relative deviations from the actual distribution based on the neoclassical model**

| | female labor supply (in weekly hours) | | | | | |
|---|---|---|---|---|---|---|
| male | 0 h | 1-15 h | 16-30 h | 31-40 h | 41-84 h | ∑ |
| 0 h | ***0.12*** | -1.00 | -0.98 | -0.93 | 0.57 | -0.27 |
| 1-30 h | 6.32 | 0.10 | -0.81 | 0.05 | 0.60 | 1.97 |
| 31-40 h | ***-0.25*** | 0.33 | -0.91 | ***-0.77*** | 4.05 | -0.28 |
| 41-50 h | ***1.71*** | 2.82 | -0.96 | -0.89 | 0.04 | 0.66 |
| 51-84 h | -0.82 | -0.95 | -1.00 | -0.98 | 2.11 | -0.55 |
| ∑ | 0.42 | 0.75 | -0.94 | -0.80 | 1.70 | 0.00 |
| ∑(part-time) | | -0.37 | | | | |

Note: The cells with italicized numbers indicate the relative deviations (see text) of the four most frequent labor supply regimes.

Table 3 presents the relative deviation between the actual and the predicted distribution of household labor supply. The measure of relative deviation is defined as

$$rd_r = \frac{(\text{estimated no. of choices} = r) - (\text{actual no. of choices} = r)}{\text{actual no. of choices} = r} \quad ; r = 1, \ldots, 25$$

where $r$ stands for the alternative labor supply regimes. The relative deviations between the sum of the rows and columns in Table 2 (e.g. the sum of all non-working women) and the estimated distribution of labor supply are calculated in the same way. As can be seen, the resulting values vary between minus one and 6.3. Zero implies perfect prediction, whereas minus one indicates strong underprediction and high positive values imply substantial overprediction.

Non-participation and jobs up to 15 hours (*geringfügige Beschäftigung*) of women, as well as the part-time share of men, are highly overpredicted. This result is in line with the findings of van Soest (1995). On the other hand, women working between

16 and 30 hours a week are strongly underpredicted (-0.94). Also striking is the overprediction of women working overtime. The regime where the man works between 41 and 50 hours and the women does not work is the worst predicted cell of the four most frequent labor supply choices (italicized numbers). Overall, the fit of the model is not satisfactory.

### 4.2.2 Labor supply model with endogenous wages

In the next step, we predict the household labor supply taking into account that wages also depend on hours worked (see section 4.1).[11] Even if the estimated coefficients differ considerably from those in the previous model, it still holds that the utility function is quasiconcave with respect to net income (see Model 2 in Table A2 in the Appendix). Also the predicted labor supply distribution changes significantly compared to the standard neoclassical model (see Table 4).

**Table 4: Relative deviations from the actual distribution based on the model with endogenous wages**

| | female labor supply (in weekly hours) | | | | | |
|---|---|---|---|---|---|---|
| male | 0 h | 1-15 h | 16-30 h | 31-40 h | 41-84 h | ∑ |
| 0 h | ***0.86*** | -1.00 | -1.00 | -0.79 | 0.00 | 0.17 |
| 1-30 h | 0.88 | -1.00 | -1.00 | 0.40 | -1.00 | -0.01 |
| 31-40 h | ***-0.28*** | -0.99 | -0.92 | ***0.03*** | 0.00 | -0.39 |
| 41-50 h | ***2.73*** | -0.79 | -0.98 | 0.51 | -0.90 | 0.92 |
| 51-84 h | -0.97 | -1.00 | -1.00 | -1.00 | 0.46 | -0.82 |
| ∑ | 0.67 | -0.94 | -0.96 | -0.06 | -0.28 | 0.00 |
| ∑(part-time) | | -0.95 | | | | |

Note: see Table 3.

The most striking thing about this outcome is the overprediction of non-working women (0.67). On the other hand, the underprediction of part-time jobs for women is severe (-0.94 for jobs between 1 and 15 hours and -0.96 for other part-time jobs). Due to the negative wage differentials of female part-time jobs it seems reasonable that women partly prefer not to work if they cannot find or accept a full-time job. The share of the two groups of full-time jobs is predicted quite well. This does not hold for men. Whereas the underprediction of jobs with more than 50 hours can be

[11] Starting from the observed wage rate $\left[w(l_m^a), w(l_f^a)\right]$, we compute the wage rates of the three other labor supply categories of men and women $\left[w(l_m^r), w(l_f^r)\right]$ based on the estimated wage differentials between full-time and part-time jobs. If no wage rate is observed, we use the predicted wage rates from Table A2 in the Appendix.

explained by the negative wage differentials of these jobs, the interpretation of the high estimated share of men working between 41 and 50 hours is somewhat difficult. These results differ from the findings of van Soest (1995) for the Netherlands. Estimates from his basic model (more or less equivalent to our standard neoclassical model) yield an overprediction of part-time jobs up to 10 hours and also for jobs with more than 45 hours a week. The altering results probably reflect the assumption that wages do not depend on labor supply.

The crucial question is thus: why do women tend to choose part-time jobs even if they have to accept substantial wage reductions? Probably these jobs have non-pecuniary characteristics which compensate the employees for the wage differential (see for example, Ermisch/Wright, 1993). One of these characteristics may be that a part-time job is the only feasible employment for mothers, because it allows them to reconcile working with child caring. Further, accepting a part-time job can prevent a longer employment break after the birth of a child, which may also cause significant wage reductions compared with the wage rate before the employment break. Thus, the bad fit of the previous labor supply models cannot necessarily be blamed on hours restrictions in the German labor market. There are grounds for supposing that restrictions inside the household are also responsible for the underprediction of part-time work.

### 4.2.3 Labor supply model with endogenous wages and hours restrictions

Since the heterogeneity of the preferences cannot be captured in a sufficient way by our simple specification (see equations (2) and (3)), we add further direct information on working time preferences to the utility function. The utility function is now defined as

$$(1') \quad \mathrm{U} = \mathrm{U(v)} + \delta_{1c} \cdot pt_m^c(1-30\ \mathrm{h}) + \delta_{2c} \cdot pt_f^c(1-15\ \mathrm{h}) + \delta_{3c} \cdot pt_f^c(16-30\ \mathrm{h}),$$

where $c = d,u$ indicates whether the part-time job is *d*esired or *u*ndesired. Thus, unlike van Soest (1995), we do not assume that all part-time jobs generate the same disutility. Because part-time jobs are scarce (relative to full-time jobs), we expect that part-time work generates additional utility to the household where it is desired. On the other hand, undesired part-time work is assumed to decrease family utility. The information about desired hours allows us to distinguish between desired and undesired part-time work. Thus, we create six dummy variables for the desired and undesired part-time jobs of men and women (see Table 5). Almost every second man working part-time or woman working less than 16 hours a week is not satisfied with his or her working time, meaning that they are restricted. But only 20 percent of women are dissatisfied with their actual part-time job.

**Table 5: Share of desired and undesired part-time jobs**

| | women (1-15 hours) | | women (16-30 hours) | | men (1-30 hours) | |
|---|---|---|---|---|---|---|
| | absolute | in % | absolute | in % | absolute | in % |
| desired | 112 | 53.1 | 335 | 80.5 | 40 | 51.9 |
| undesired | 99 | 46.9 | 81 | 19.5 | 37 | 48.1 |
| total | 211 | 100.0 | 416 | 100.0 | 77 | 100.0 |

The estimation results for the modified utility function are presented in Table A3 in the Appendix (Model 3). In general, the estimated coefficients support our hypothesis. As long as women can realize their preferences for part-time work, family utility increases. However, there is no significant impact of desired male part-time employment on family utility. As soon as the part-time job of women or men does not correspond with the individual preferences, the household utility level decreases. [12]

Finally, we want to check if the predictions based on this labor supply model fit the data better than the previous models. Table 6 shows almost no underprediction of female part-time work. The sole exception are jobs of up to 15 hours (-0.14). At the same time, the labor supply of the men decreases, that is, time is reallocated within the household.[13] A plausible explanation for the overprediction of the overtime jobs of men in the previous models is due to the fact that the share of non-working women was also seriously overpredicted. Because there are no significant negative wage differentials for men working between 41 and 50 hours a week, they increase their labor supply in order to compensate for the reduction in household income associated with the low earnings of their spouses in part-time employment. If we now allow for the specific effects of desired and undesired part-time jobs, the pecuniary incentives which reduce part-time work for women become less important.

As with the distribution of the actual labor supply, the most likely choice is the regime where the man works between 31 and 40 hours and the woman is out of work. Except for the regime where neither the man nor the woman works, the other three most frequent labor supply choices (cells with italic numbers) are predicted quite well. Also the pseudo $R^2$ implies a substantial improvement in the fit of the model.

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[12] We also ran a regression without the distinction between desired and undesired part-time work, but with dummy variables for part-time work by gender. Similar to van Soest (1995), all such coefficients were negative (see Model 4 in the Appendix).

[13] Compared with the model without hours restrictions (Table 4), the relative deviation from the actual hours distribution for men working between 41 and 50 hours falls from 0.92 to -0.11.

**Table 6: Relative deviations from the actual distribution based on the model with endogenous wages and hours restrictions**

| | female labor supply (in weekly hours) | | | | | |
|---|---|---|---|---|---|---|
| male | 0 h | 1-15 h | 16-30 h | 31-40 h | 41-84 h | ∑ |
| 0 h | ***0.74*** | 0.25 | -0.61 | -0.56 | -0.86 | 0.22 |
| 1-30 h | -0.80 | -0.70 | -0.94 | -0.55 | -1.00 | -0.76 |
| 31-40 h | ***0.23*** | 0.03 | 1.19 | ***-0.13*** | -1.00 | 0.25 |
| 41-50 h | ***0.30*** | -0.16 | 0.09 | -0.72 | -1.00 | -0.11 |
| 51-84 h | -0.90 | -1.00 | -0.96 | -0.98 | -0.68 | -0.91 |
| ∑ | 0.23 | -0.14 | 0.35 | -0.41 | -0.92 | 0.00 |
| ∑(part-time) | | 0.18 | | | | |

Note: see Table 3.

## 4.3 Elasticities

The previous results indicate the fact that hours restrictions do influence the labor supply decision of West German couples. Accordingly the wage elasticities of the standard neoclassical model and the extended labor supply model will also differ. Table 7 gives computations of the average uncompensated elasticities due to a increase in the gross wage rate of men or women. The advantage of the family labor supply model is that we can not only calculate own wage elasticities but also cross elasticities. The wage rate itself is not an element of the utility function, so that it is pretty complicated to calculate the elasticities from the estimated parameters. The results are thus derived from several simulations.

**Table 7: Uncompensated gross wage elasticities**

| | male wage rate + 10% | | female wage rate + 10% | |
|---|---|---|---|---|
| | male elasticity | female elasticity | male elasticity | female elasticity |
| Model 1 | 0.53 | ***-0.07*** | ***0.12*** | 0.77 |
| Model 3 | 0.29 | ***-0.17*** | ***0.02*** | 0.42 |
| Elasticities based on Model 3 | | | | |
| 1 - 15 hours | | | ***0.05*** | 0.18 |
| 16 - 30 hours | 0.19 | ***-0.14*** | ***0.03*** | 0.32 |
| 31 - 40 hours | 0.24 | ***-0.18*** | ***-0.06*** | 0.43 |
| 41 - 50 hours | 0.19 | ***-0.16*** | ***-0.04*** | 0.19 |
| > 50 hours | 0.17 | ***-0.18*** | | |

Note: Cross elasticities are marked with italic numbers.

Comparing the basic model with the one that also accounts for endogenous wages and hours restrictions, we can see that the elasticities are much smaller in the extended model. This outcome is in line with the results of van Soest (1995). The elasticity of men is 0.53 in the standard neoclassical model and falls to 0.29 in Model 3. Compared with previous results in the literature this is a relatively high estimate. Female elasticities are higher, but also decrease from 0.77 to 0.42 once we allow for endogenous wages and hours restrictions. The cross elasticity of women is negative, that is, women reduce their labor supply if the male wage rate increases. In contrast, men almost do not react to changes in the woman's wage rate if we allow for endogenous wages and hours restrictions. This also confirms our previous finding that male and female leisure are not perfect substitutes.

If we analyze the elasticities for the different groups of employees, it emerges that the relatively high elasticity of men is determined by the reaction of non-working people. Employed men increase their labor supply only by about 2 percent if their gross wage rate increases by 10 percent. Those who already work more than 50 hours a week tend to react less to a wage rise. Also interesting is the low wage elasticity (0.18) of women working less than 15 hours. This behavior is probably due to the social security system or the non-availability if adequate part-time jobs.

**Table 8: Adjustment of the participation rate**

| | male wage rate + 10% | | | | female wage rate + 10% | | | |
|---|---|---|---|---|---|---|---|---|
| | $pr(m)_{t0}$ | $pr(m)_{t1}$ | $pr(f)_{t0}$ | $pr(f)_{t1}$ | $pr(m)_{t0}$ | $pr(m)_{t1}$ | $pr(f)_{t0}$ | $pr(f)_{t1}$ |
| Model 1 | 80.1 | 84.6 | ***27.4*** | ***25.3*** | ***80.1*** | ***81.2*** | 27.4 | 33.7 |
| Model 4 | 79.3 | 82.4 | ***46.4*** | ***45.0*** | ***79.3*** | ***79.9*** | 46.4 | 48.2 |

Note: $pr(m)_{t0}$ [$pr(m)_{t0}$] indicates the estimated participation rate of men [women] in the present situation and $pr(m)_{t1}$ [$pr(m)_{t1}$] is the corresponding simulated participation rate after the increase of the gross wage rate. Adjustments due to changes in the partner's wage are marked with italic letters.

A further indicator of labor supply adjustment due to an exogenous shock is the participation rate (see Table 8). In line with the elasticities, the change of the participation rate is much lower in model 4. If we account for endogenous wages and hours restrictions, the simulated labor force participation of men increases by about 3 percentage points while women reduce their participation by 1.6 percentage points, given a 10% rise in male wages. In contrast to the elasticities, however, women adjust their participation less to their own wage rise than do men. The simulated female participation rate increases only about 1.6 percentage points. The cross adjustment of men can be neglected.

# 5 Conclusion

In order to detect hours restrictions on the West German labor market we presented a labor supply model of married and cohabiting couples. Following van Soest

(1995), the labor supply decision is derived from a household utility function which is determined by the leisure of the two partners and the household income. The choice set of each couple contains 25 labor supply regimes, defined by the labor supply of the two spouses and the corresponding household budget. Using this discrete labor supply approach allows us to incorporate the main features of the German tax and benefit system in a straightforward way. We have estimated two extensions of the basic model, one allowing for endogenous wages and the other also taking into account hours restrictions.

We conclude that the model with endogenous wages and hours restrictions fits the data much better than the two alternative model specifications. As expected, the estimation of the utility function implies that part-time jobs of women increase family utility provided that they are desired. This outcome differs from the findings of van Soest (1995), where all part-time jobs reduce the family utility. Looking at the uncompensated average wage elasticities, we show that the model which allows for endogenous wages and hours restrictions predicts smaller reaction of the labor market participants than does the neoclassical model. The same holds for the simulated participation rates. Thus, we conclude that the consideration of hours restrictions not only improves the explanation of labor supply decisions but also has an impact on the derived wage elasticities. In short, hours restrictions do matter.

Even if we already dropped some of the restrictive assumptions of standard labor supply models, there remain several problems, which should be tackled in further research. Firstly, when estimating the extended wage function (see equation 6), the potential endogeneity of working hours should be taken into account. In principle, the wage equation and the utility function can be estimated simultaneously. An alternative is to use an instrumental variable estimation of the wage equation (e.g. Ilmakunnas/Pudney, 1990). A third approach would be to estimate the wage differential between full-time and part-time jobs by running separate regressions for both types of employment, and then decomposing the difference in expected hourly wage rates into two components. One component would reflect the differences in attributes between part-time and full-time employees, and the other would capture the differences in rewards to individual characteristics. Since the employment status is not random, the endogeneity of the selection process should also be accommodated (Main, 1988).

The second point concerns the implementation of the hours restrictions, which is ad hoc. Provided that hours restrictions are modeled in a structural way, we can learn how people adapt their labor supply if these constraints were relaxed in a specific way. This extension would be extremely interesting for policy purposes. Relatedly, more emphasis should be placed on the simulation of the German tax and benefit system.

## References


Aaberge, R., U. Colombino and S. Strøm, 1997, Joint Labor Supply Decisions of Married Females and Males: An Empirical Analysis Based on Italian Household Data, *Memrandum from Department of Economics*, University of Oslo.

Avarett, S. L. and J. L. Hotchkiss, 1997, Female Labor Supply with a Discontinuous, Nonconvex Budget Constraint: Incorporation of a Part-Time/Full-Time Differential, *The Review of Economics and Statistics*, Vol. 79, p. 461-470.

Bispinck, R., 1996, Immer kürzer und immer flexibler, Tarifliche Regelungen zur Arbeitszeit und ihrer Gestaltung, *Informationen zur Tarifpolitik*, Wirtschafts- und Sozialwissenschaftliches Institut in der Hans-Böckler-Stiftung, Düsseldorf.

Dickens, W. T. and S. J. Lundberg, 1993, Hours Restrictions and Labour Supply, *International Economic Review*, Vol. 34, No. 1, p. 169-192.

Engelbrech, G.; Gruber, H. and M. Jungkunst, 1997, Erwerbsorientierung und Erwerbstätigkeit ost- und westdeutscher Frauen unter veränderten gesellschaftlichen Rahmenbedingungen, *Mitteilungen aus der Arbeitsmarkt- und Berufsforschung*, Vol. 30, No. 1, p. 150-169.

Ermisch, J. F. and R. E. Wright, 1991, Wage Offers and Full-time and Part-time Employment by British Women, *The Journal of Human Resources*, Vol. 25, No. 1, p. 111-133.

Euwals, R. and A. van Soest, 1996, Desired and Actual Labour Supply of Unmarried Men and Women in the Netherlands, *Discussion Paper, No. 9623*, Center for Economic Research, Tilburg University.

Gerfin, M., 1991, *Arbeitsangebot, Steuern und Stundenbeschränkungen, Eine empirische Untersuchung für die Schweiz unter Verwendung von diskreten Wahlmodellen*, Dissertation der Hochschule St. Gallen für Wirtschafts-, Rechts- und Sozialwissenschaften, Bamberg.

Hakim, C., 1997, A Sociological Perspective on Part-Time Work, in: Blossfeld, H.-P. and C. Hakim (eds.): *Between Equalization and Marginalization – Women Working Part-Time in Europe and the United States of America*, Oxford University Press.

Hausman, J. and P. Ruud, 1984, Familiy Labour Supply with Taxes, *American Economic Review*, Vol. 74, p. 242-248.

Heckman, J. J., 1979, Sample Selection as a Specification Error, *Econometrics*, Vol. 47, p. 153-161.

Ilmakunnas, S. and S. Pudney, 1990, A Model of Female Labour Supply in the Presence of Hours Restrictions, *Journal of Public Economics*, Vol.41, p. 183-210.

Laisney, F., Lechner, M., Van Soest, A. and G. Wagenhals, 1993, A Life Cycle Labour Supply Model with Taxes Estimated on German Panel Data: The Case of Parallel Preferences, *The Economic and Social Review*, Vol. 24, No. 4, p. 335-368.

Main, B. G. M., 1988, Hourly Earnings of Female Part-Time Versus Full-Time Employees, *The Manchester School*, Vol. 56, No. 4, p. 331-344.

McFadden, D., 1974, Conditional logit analysis of qualitative choice behavior, in: P. Zarembka (ed): *Frontiers in Econometrics*, p. 105-142, New York: Academic Press.

McKinsey , 1994, Teilen und Gewinnen, Das Potential der flexiblen Arbeitszeit-verkürzung, McKinsey Company, Inc.

Merz, J., 1990, Female Labour Supply: Labour Force Participation, Market Wage Rate and Working hours of Married and Unmarried Women in the Federal Republic of Germany, *Jahrbücher für Nationalökonomie und Statistik*, Bd. 207, p. 240-270.

Ott, N., 1992, *Intrafamily Bargaining and Household Decisions*, Berlin/New York.

Pencavel, J., 1986, Labor Supply of Men: a Survey, in: O. Ashenfelter and R. Layard (eds.): *Handbook of Labor Economics*, Vol. 1, New York.

Schwarze, J., 1998, Wer trägt die pauschale Lohnsteuer bei geringfügiger Beschäftigung ? Eine Analyse der Stundenlöhne erwerbstätiger Frauen, in: Galler, H. P. and G. Wagner: (eds.): *Empirische Forschung und wirtschafts-politische Beratung*, Campus Verlag, Frankfurt.

Steiner, V. and K. Wagner, 1997, East-West German Wage Convergence - How far have we got*? ZEW-Discussion Paper No. 97-25*, Zentrum für Europäische Wirtschaftsforschung, Mannheim.

Tummers, M. P. and I. Woittiez, 1991, A Simultaneous Wage and Labor Supply Model with Hours Restrictions, *The Journal of Human Resources*, Vol. 26, No. 3, p. 393-423.

Van Soest, A.; Woittiez, I. and Arie Kapteyn, 1990, Labor Supply, Income Taxes, and Hours Restrictions in the Netherlands, *The Journal of Human Resources*, Vol. 25, No.3, p. 517-558.

Van Soest, A., 1995, Structural Models of Family Labour Supply, A Discrete Choice Approach, *The Journal of Human Resources*, Vol. 30, No.1, p. 63-88.

White, H., 1980, A heteroscedasticity-constant covariance matrix estimator and a direct test for heteroscedasticity, *Econometrica*, Vol. 48, p. 817-838.

# Appendix

**Table A1: Estimation of the tax function**

| | married couples | | cohabiting partners | | | |
|---|---|---|---|---|---|---|
| | | | men | | women | |
| log(net income) | coef | t-value | coef | t-value | coef | t-value |
| constant | 66.17 | 0.3 | 766.2* | 5.3 | 470.4* | 5.0 |
| log(gross income) | 0.77* | 10.6 | 0.47* | 9.6 | 0.50* | 16.0 |
| log(gross income)$^2$/1000 | 0.01* | -2.1 | 0.05 | 1.3 | 0.07* | 4.0 |
| social security premiums | -298.90* | -6.7 | -230.0* | -2.4 | -162.2* | -2.0 |
| children | 115.14* | 8.8 | – | – | 179.5* | 5.3 |
| transfer to divorced partner | 837.20 | 0.8 | 679.0* | 3.8 | – | – |
| transfer to children | 83.27 | 1.4 | 53.7 | 0.7 | 522.0* | 2.1 |
| no. of observations | 1385 | | 208 | | 199 | |
| F-test (gross income) | F(2,1378) = 2023.7 | | F(2,202) = 403.9 | | F(2,193) = 2595.1 | |
| adjusted $R^2$ | 0.89 | | 0.91 | | 0.93 | |

Note: The tax function is estimated by OLS, where the standard errors are corrected for heteroscedasticity (White, 1980). The dependent variable is defined as the log of the household net income for married couples and the individual net income respectively. * denotes significance at the 0.05 level.

**Table A2: Estimation results of the wage functions**

| | men | | women | | men | | women | |
|---|---|---|---|---|---|---|---|---|
| log(wage rate) | coef | t-value | coef | t-value | coef | t-value | coef | t-value |
| constant | 2.78* | 62.4 | 2.61* | 48.3 | 2.77* | 62.9 | 2.64* | 49.0 |
| hours 1 | – | – | – | – | -0.01 | -0.2 | -0.31* | -6.2 |
| hours 2 | – | – | – | – | 0.02 | 1.5 | -0.06* | -2.6 |
| hours 4 | – | – | – | – | -0.17* | -5.3 | -0.20* | -4.7 |
| exp | 0.03* | 8.7 | 0.03* | 6.4 | 0.03* | 9.1 | 0.03* | 6.9 |
| $exp^2/100$ | 0.05* | -7.1 | -0.06* | -5.7 | -0.06* | -7.5 | -0.07* | -6.4 |
| unskilled | -0.15* | -5.4 | -0.15* | -4.5 | -0.15* | -5.8 | -0.14* | -4.4 |
| master craftsman | 0.07* | 3.6 | 0.06* | 2.1 | 0.06* | 3.5 | 0.06* | 2.0 |
| graduate | 0.39* | 17.7 | 0.45* | 10.3 | 0.40* | 17.6 | 0.46* | 10.6 |
| handicapped | 0.04 | -0.6 | -0.21* | 2.4 | -0.06 | -0.9 | 0.18* | 2.3 |
| no. of children | – | – | -0.05* | -4.1 | – | – | -0.03* | -2.7 |
| no. of obs. | 1649 | | 1110 | | 1649 | | 1110 | |
| F-test (region) | 1.95 | | 1.48 | | 1.69 | | 1.46 | |
| $R^2$ | 0.25 | | 0.18 | | 0.27 | | 0.24 | |

Note: The wage equation is estimated by OLS, where the standard errors are corrected for heteroscedasticity (White, 1980). The dependent variable is defined as the log of the hourly gross wage rate. The base category for the qualification level are the skilled employees. [a] hours 1: 1-30 h [1-15 h] for men [women]. [b] hours 2: 31-40 h [16-30 h] for men [women]. [c] hours 4: > 50 h [> 40 h] for men [women]. The coefficients of the regional dummies are not reported in the table. * denotes significance at the 0.05 level.

**Table A3: Maximum likelihood estimates of the utility function**

| variables | Model 1 coef | Model 1 t-value | Model 2 coef | Model 2 t-value | Model 3 coef | Model 3 t-value | Model 4 coef | Model 4 t-value |
|---|---|---|---|---|---|---|---|---|
| net income | -112.01* | -15.7 | -66.31* | -10.2 | -71.56* | -11.3 | -68.60* | -10.9 |
| net income$^2$ | 3.1* | 16.2 | 2.64* | 12.7 | 2.32* | 11.6 | 2.24* | 11.2 |
| net income · $l_m$ | 8.13* | 15.8 | 3.73* | 8.0 | 5.04* | 10.9 | 4.84* | 10.5 |
| net income · $l_f$ | 5.08* | 10.5 | 2.67* | 5.8 | 3.42* | 7.5 | 3.27* | 7.2 |
| $l_m$ | 115.95* | 6.2 | 159.77* | 8.7 | 143.33* | 8.1 | 147.23* | 8.3 |
| $l^2_m$ | 1.46* | 3.5 | 0.26 | 0.6 | 0.45 | 1.2 | 0.38 | 1.0 |
| $l_m \times$ age | -125.77* | -13.4 | -114.77* | -12.3 | -116.71* | -13.0 | -117.38* | -13.1 |
| $l^2_m \times$ age | 17.49* | 13.8 | 16.04* | 12.7 | 16.21* | 13.3 | 16.30* | 13.4 |
| $l_f$ | 80.92* | 3.6 | 93.80* | 4.3 | 116.91* | 5.6 | 129.53* | 6.1 |
| $l^2_f$ | 2.32* | 4.1 | 3.57* | 6.6 | -0.74 | -1.1 | -0.77 | -1.1 |
| $l_f \times$ age | -100.68* | -8.5 | -92.84* | -7.9 | -92.47* | -8.3 | -98.88* | -8.8 |
| $l_f \cdot\times$ age$^2$ | 14.64* | 8.9 | 13.55* | 8.3 | 13.38* | 8.7 | 14.34* | 9.2 |
| $l_f \cdot\times$ k3 | 6.92* | 9.3 | 6.68* | 9.3 | 5.79* | 9.4 | 5.50* | 9.2 |
| $l_f \cdot\times$ k16 | 2.42* | 13.9 | 2.41* | 13.9 | 2.31 | 13.7 | 2.31* | 14.0 |
| $l_f \times l_m$ | 7.48* | 12.8 | 3.36* | 6.1 | 5.25* | 9.4 | 5.13* | 9.2 |
| part-time$_m$ | | | | | – | – | -1.96* | -16.0 |
| part-time$_f$ (1-15 hours) | | | | | – | – | -1.30* | -15.9 |
| part-time$_f$ (16-30 hours ) | | | | | – | – | -0.30* | -3.7 |
| desired pt$_m$ | | | | | -0.03 | -0.1 | – | – |
| undesired pt$_m$ | | | | | -2.60* | -15.3 | – | – |
| desired pt$_f$ (1-15 hours) | | | | | 1.21* | 7.8 | – | – |
| undesired pt$_f$ (1-15 hours) | | | | | -2.01* | -18.3 | – | – |
| desired pt$_f$ (16-30 hours) | | | | | 0.69* | 7.5 | – | – |
| undesired pt$_f$ (16-30 hours) | | | | | -1.57* | -12.2 | – | – |
| Pseudo $R^2$ | 0.15 | | 0.16 | | 0.26 | | 0.20 | |
| $\chi^2$ | $\chi^2(15)$= 2188.8 | | $\chi^2(15)$= 2273.5 | | $\chi^2(21)$= 3783.7 | | $\chi^2(18)$= 2991.1 | |
| log likelihood | -6242 | | -6199 | | -5444 | | -5840 | |

Note: The reference group for the part-time dummies are all households, where neither the man nor the woman works part-time. * denotes significance at the 0.05 level. The $\chi^2$ -test refers to all explanatory variables of the model. The pseudo $R^2$ is defined as $1-L_1/L_0$, where $L_1$ is the log-likelihood value of the model with all exogenous variables and $L_0$ is the log-likelihood value of the model which includes only a constant term.