Good-bye Lenin On Our Bank Account? Within-Household Allocation in East and West German Couples

Holger Stichnoth
Paris School of Economics*

February 23, 2009

Abstract

Using data from the German Socio-Economic Panel for the years 1999–2004, I estimate a collective discrete choice model of female labour supply with non-participation and non-linear taxation. I use the model to infer the share of household net income that women in couples receive for their individual consumption. In particular, I study whether the within-household allocation is more egalitarian for women who grew up in the former East Germany. The key identifying assumption is that some (but not all) parameters of the utility function are identical for single women and women in couples. I find that women receive about 67% of household net income for their individual consumption. There is no statistically significant difference with respect to the woman's origin.

Keywords: Collective household models, labour supply, microsimulation, simulated maximum likelihood, Germany
JEL codes: D11, D12, J22

*Address: Paris School of Economics, 48 boulevard Jourdan, 75014 Paris, France. E-Mail: stichnoth@pse.ens.fr. I would like to thank Peter Haan and Victor Steiner for allowing me to use the microsimulation model STSM, and for their hospitality during my stay at DIW Berlin.

1 Introduction

This paper uses the framework of the collective model of labour supply to study whether women who lived in East Germany before reunification have greater bargaining power within the household than women from West Germany. Common wisdom in Germany suggests that they have, and the collective model allows to make this idea of power more precise. Studying the allocation within the household can also usefully supplement studies on East-West differences in attitudes towards redistribution by the state. East Germans have a reputation of being (and have been found to be) more egalitarian in the public sphere. For instance, Alesina and Fuchs-Schündeln (2007) show that East Germans are more supportive of redistribution, even controlling for material self-interest. The collective model allows to study whether this greater support for public redistribution is mirrored by a more egalitarian distribution of resources within the household.

Using data from the German Socio-Economic Panel for the years 1999–2004, I estimate a discrete choice model of female labour supply with non-participation and taxation. Net incomes at each alternative are calculated using the tax-transfer simulation model STSM developed at DIW Berlin. The model is estimated using conditional logit and mixed logit specifications. In the latter case, estimation is done by Maximum Simulated Likelihood.

The collective framework that I use is from Vermeulen (2006). He uses it to study the within-household allocation in Belgium in the 1990s. The main contribution of the present article lies in the application of the model to the question of East-West differences in Germany. I was also fortunate to be able to use a large panel data set and, courtesy of DIW Berlin, a well-established microsimulation model of the tax-transfer system.

I consider two types of households: women living alone and women living in childless couples. Women's preferences are assumed to be selfish; that is, they care only about their own consumption and their own leisure.

Recovering the preferences of women living alone is straightforward since

both hours worked and consumption can be calculated at each alternative. By contrast, for women in couples only *household* net income can be calculated, which means that the coefficient on the woman's individual consumption is no longer identified. A popular reaction is to estimate a unitary model, which aims to recover the *household's* preferences. However, the unitary model does not allow to shed light on what is happening within the household, and is therefore not suitable to answer my question about differences in bargaining power between East and West German women. As a result, I turn to the collective model (Chiappori 1988, 1992; Apps and Rees 1988; see also the surveys by Vermeulen 2002 and by Chiappori and Donni 2006). Its key assumption is that the allocation of leisure and consumption within the household is Pareto-efficient. In the framework of Vermeulen (2006) that I am using, there are no public goods in consumption, there is no leisure interaction, and male labour supply is exogenous. In this case, the assumption of Pareto-efficiency amounts to assuming that household net income is split up between the two spouses. Following Vermeulen, I assume that the woman gets an unobserved share κ of household net income. The goal of this article is to recover this share. In particular, I allow the share to differ between couples in which the woman is from the former East Germany, and couples in which the woman is from the West.

Under the assumption that there are no public goods in consumption, and under the key identifying assumption that the coefficient on *individual consumption* is the same for single women and women in couples, the difference in the estimated coefficient on *household net income* can be used to infer the allocation of consumption (and hence each spouse's bargaining power) within the household. Women in couples are estimated to care less about a unit of household net income than women who live alone (and who therefore get all of the household's income for themselves); I interpret this as reflecting the fact that women in couples get only part of household net income for their individual consumption. *How much* less they care about household net income is used to identify the share that they receive.

The assumption that certain coefficients of the utility function are identical

is key for the unique identification of the sharing rule. Note, however, that identification does not require *all* coefficients of the utility function to be identical. Since hours worked are observed also for women in couples, the coefficient on this variable (and functions of it) can be allowed to differ between the two groups of women. As a result, the marginal rate of substitution is *not* constrained to be the same, which makes the identifying assumption more convincing.

I estimate that women receive about 67% of household net income for their individual consumption. Contrary to what many people in Germany believe, there is no evidence that women who lived in East Germany in 1989 have greater bargaining power; if anything, there is evidence that the sharing rule is higher for women from the West. However, the difference is never statistically significant and is driven almost exclusively by the years 2000 and 2001.

The rest of this paper is organized as follows. In section 2 I derive the discrete choice model of female labour supply and discuss identification of the sharing rule. In section 3 I present the data. Section 4 reports the main results, and section 5 concludes.

2 The model of labour supply

In this section, I briefly sketch the model of labour supply that I will estimate. As noted, the model is from Vermeulen (2006). There are two types of households: women living alone, and households consisting of one man and one woman; everybody is of working age. I will refer to the second type of households as couples, although the two partners are not necessarily married. As in Vermeulen (2006), I model only female labour supply; male labour supply is taken as given.

Following van Soest (1995), female labour supply is modeled as a discrete choice between J alternatives for weekly working hours. The assumption of

a discrete choice model will make it easier to incorporate a realistic (and hence highly complex) tax and benefit system. Also, non-participation is easily modeled in this framework as one of the J alternatives.

2.1 Preferences

The utility of alternative j for woman n has observed and unobserved components:

$$U_{nj} = V(c_{nj}, l_{nj}, \mathbf{d}_n) + \varepsilon_{nj}$$

where c_{nj} is woman's n consumption of goods and services at alternative j, and l_{nj} are weekly hours' worked. $\mathbf{d}_n$ is a vector of variables that capture observed heterogeneity in preferences ("taste shifters"): I include education (highest degree in four categories), age, and a dummy for whether the woman lived in East Germany in 1989.

Woman n chooses alternative j if and only if she derives higher utility from it than from all other alternatives.

Note that preferences are selfish: the woman cares only about her own leisure and her own consumption. This (strong) assumption follows in the tradition of the collective model; it is made in order to apply the second fundamental theorem of welfare economics that justifies the decentralization of the within-household allocation through a "sharing rule" (see below on the form of the sharing rule that is assumed in this application).[1]

I assume the following functional form for the observed part:[2]

$$V_{nj} = \beta_{\ell\ell}(\mathbf{d}_n)(\ell_{nj})^2 + \beta_{cl}\ell_{nj}c_{nj} + \beta_c c_{nj} + \beta_\ell(\mathbf{d}_n)\ell_{nj}$$

[1] The assumption of selfish preferences can be relaxed by assuming "caring" preferences. These still rule out direct externalities of consumption or leisure, but allow that the *utility* of the spouse enters one's own utility function.

[2] I tested this functional form assumption, in particular the constraint that the coefficient on consumption squared be zero. A likelihood ratio test gave a test statistic of 0.42. This is to be compared with the critical value of a χ^2 distribution with 1 degree of freedom. The p-value is 0.5168, which means that I cannot reject Vermeulen's restriction of a zero coefficient on consumption squared.

2.2 Assumptions about the error terms

The error terms ε_{nj} represent the influence of unobserved factors on the utility that woman n derives from alternative j.

The most convenient assumption about the error terms is that of the logit model, namely that the error terms are independent across individuals and alternatives, and that they are distributed as type I extreme value. This assumption is convenient because it gives rise to closed-form solutions for the choice probabilities (McFadden 1974); the model can therefore be estimated using Maximum Likelihood.

However, assuming that the error terms are independent alternatives implies restrictive substitution patterns between the alternatives (the "blue bus, red bus problem"). In addition to a logit model, I therefore also estimate a random parameters logit (a.k.a. mixed logit). In this model, there is random variation in the coefficients on ℓ and ℓ^2, conditional on the observed factors $\mathbf{d}$:

$$\begin{aligned} \beta_{\ell\ell}(\mathbf{d}_i^f) &= \beta_{\ell\ell 0} + \beta'_{\ell\ell 1}\mathbf{d}_i^f + \upsilon_{\ell\ell i} \\ \beta_{\ell}(\mathbf{d}_i^f) &= \beta_{\ell 0} + \beta'_{\ell 1}\mathbf{d}_i^f + \upsilon_{\ell i} \end{aligned}$$

The additional individual-specific error terms are assumed to be normally distributed with mean zero and variance-covariance matrix Σ, where

$$\Sigma = \begin{pmatrix} \sigma^2_{\upsilon\ell\ell} & \rho \\ \rho & \sigma^2_{\upsilon\ell} \end{pmatrix}$$

The elements of this matrix are additional parameters to be estimated. Following Vermeulen, I assume $\rho = 0$, which speeds up computation. In section 4 below I test the logit model against the random parameters logit by testing whether the estimated variances are jointly equal to zero.

The mixed logit model is less restrictive than the logit. However, the drawback is that the choice probabilities no longer have a closed-form solution.

The model is therefore estimated using Maximum *Simulated* Likelihood (see, for instance, Train 2003). The simulation of choice probabilities uses 50 Halton draws.

2.3 Private consumption

2.3.1 Single women

For women living alone, consumption c^f is equal to net income, which can be calculated for each of the J alternatives from knowledge of the wage offer (observed or predicted), of non-labour income, and of the tax-transfer system (see section 3.3 below for details). Likewise, hours worked at each alternative are known (in fact, it is hours worked that were used to define these alternatives in the first place). Since everything is observed, estimation of the discrete choice model is straightforward and allows to recover the parameters of the utility function for women living alone.

2.3.2 Women in couples

The case of women living in couples is different. Recall from above that it is assumed that only the woman's own consumption enters her utility function. However, unlike for women living alone, observing *household* net income is no longer enough to know the woman's individual consumption. As a result, the parameter of the woman's utility function are no longer identified.

A popular way to deal with the fact that private consumption levels of each spouse are unobserved is to assume that the household acts as a single decision maker, and that it is total household net income that enters the household's utility function. One problem with this "unitary model" is that it implies that it should make no difference for labour supply whether non-labour income is received by the man or by the woman. However, this restriction of income pooling has been repeatedly rejected in the data.

Another drawback of the unitary model is that it does not allow to say anything about the allocation of consumption *within* the household. However, the purpose of this paper is precisely to use this allocation of consumption to study the respective bargaining power of East and West German women. A framework that allows to address these questions is that of the collective model (Chiappori 1988, 1992; Apps and Rees 1988; see also the surveys by Vermeulen 2002 and by Chiappori and Donni 2006). The collective model infers the unobserved allocation of consumption and hence of utility within the household from observed demand (here: labour supply) behaviour.

The key assumption of the collective model is that the household, through some bargaining process that is left unspecified, arrives at an allocation of leisure and consumption that is Pareto-efficient. In the framework of Vermeulen (2006) that I am using, there are no public goods in consumption, there is no leisure interaction, and male labour supply is exogenous. In this case, the assumption of Pareto-efficiency amounts to assuming that household net income x is split up into private consumption of the man and private consumption of the woman: $c^f + c^m = x$. This is certainly a strong assumption. I believe that is more plausible for couples without children, and I therefore restrict my sample accordingly in the empirical part.

2.4 The sharing rule

Following Vermeulen, I assume that the woman gets an unobserved share κ of household net income.

$$c^f_{nj} = \kappa x_{nj}, \quad 0 < \kappa < 1 \tag{1}$$

The goal of this article is to recover this share. In particular, I allow the share to differ between couples in which the woman is from the former East Germany, and couples in which the woman is from the West:

$$c^f_{nj} = (1 + \kappa_1 + \kappa_2 dEast1989_n)x_{nj} \tag{2}$$

The expressions $1+\kappa_1$ (for West German women) and $1+\kappa_1+\kappa_2$ (for East German women) should lie between 0 and 1; reassuringly, the estimated parameters actually fall in this range (see below). My hypothesis is that κ_2 is positive; that is, that East German women get a higher share of household net income for their private consumption than women from the West.

Note that other *distribution factors* such as the age difference between the spouses or the regional sex ratio could be included in the sharing rule as well; if these differ systematically between couples with women from the East and women from the West, this could partly explain any East-West difference. That is, if I find any difference between East and West German women (a significant κ_2), this need not reflect a direct causal effect of having been raised in the East, but could also be due to observable differences that have arisen since 1989. The aim of this paper is to *describe* the difference between East and West German women; explaining it is left for further research.

As noted above, for women living alone private consumption is observed and equals net income: $c^f_{nj} = x_{nj}$. Defining the indicator variable s_n (1 if in couple, 0 if living alone), one can write the the private consumption level at alternative j for all women (those living alone and those living in couples) in a single expression:

$$c^f_{nj} = (1 + \kappa_1 s_n + \kappa_2 s_n dEast1989_n) x_{nj} \tag{3}$$

2.5 Identification

Plug this expression for private consumption into the utility function, which can then be written as a function only of observed variables.

$$\begin{aligned} U^f_{nj} = \beta_{\ell\ell}(\mathbf{d}^f_n)(\ell^f_{nj})^2 + \beta_{c\ell}\ell^f_{nj}(1 + \kappa_1 s_n + \kappa_2 s_n dEast1989_n)x_{nj} \\ + \beta_c(1 + \kappa_1 s_n + \kappa_2 s_n dEast1989_n)x_{nj} + \beta_\ell(\mathbf{d}^f_n)\ell^f_{nj} + \varepsilon_{nj} \end{aligned} \tag{4}$$

In this discrete choice model one can identify (up to scale) the parameters

$$\beta_{\ell\ell}(\mathbf{d}_i^f), \beta_{c\ell}, \beta^*_{c\ell 1} = \beta_{c\ell}\kappa_1, \beta^*_{c\ell 2} = \beta_{c\ell}\kappa_2, , \beta_c, \beta^*_{c1} = \beta_c\kappa_1, \beta^*_{c2} = \beta_c\kappa_2 \tag{5}$$

The parameters of the sharing rule can then be calculated as functions of these parameters:

$$\kappa_p = \frac{\beta^*_{c\ell p}}{\beta_{c\ell}} = \frac{\beta^*_{cp}}{\beta_c}, \quad p = 1, 2 \tag{6}$$

The standard errors of the sharing rule parameters are calculated using the delta method.

These expressions make clear that to identify the sharing rule, further assumptions about the utility function are needed. I assume that the coefficients on the variables involving private consumption (β_c and $\beta_{c\ell}$) are identical for women living alone and women living in couples.[3]

Note that identification does *not* assume that preferences of women living alone and of women living in couples are perfectly identical. Hours worked are observed for both types of women, and the coefficients on hours worked and hours worked squared can therefore be identified without further assumptions. (In estimation, I include a dummy for living in a couple among the taste shifters $\mathbf{d_n}$ that capture observed heterogeneity in these two variables.) Since the coefficients on hours worked are allowed to differ, the marginal rate of substitution is allowed to differ as well between women living alone and women in couples.

Finally, equation (6) shows that because of the functional form of the utility function (in which consumption enters linearly and also interacted with hours worked), the parameters of the sharing rule can be calculated in *two* ways: either as the ratio of $\beta^*_{c\ell p}$ and of $\beta_{c\ell}$ or as the ratio of β^*_{cp} and β_c. Both ways should in theory give the same answer; the equality of the two ratios is therefore imposed as a constraint in the Maximum Likelihood estimation.

[3]This idea goes back to Barmby and Smith (2001) and was later used in a number of country studies that use the collective model for ex-ante simulation of tax reforms (see Vermeulen et al. 2006, for a description of the method used).

3 Data

3.1 The sample

I estimate the model with data from the German Socio-Economic Panel. The GSOEP is a large representative household panel that began in 1984 (Wagner et al. 2007). I use the years 1999 to 2004, a restriction that is dictated by the availability of the microsimulation model of the tax-transfer system. There are 150,424 observations, of which 78,099 observations for women.

As noted above, I study the labour supply of women who live alone and of women who live in two-person households (without necessarily being married). Since the assumption that household net income is split into private consumption of the man and private consumption of the woman is already rather strong, I choose to retain only two-person households without children; I believe that abstracting from public goods in consumption is less strong an assumption for these households. Finally, since I am interested in the difference in bargaining power between men and women in East and West, I restrict the sample to heterosexual couples; moreover, I include only respondents who were born in Germany and have German nationality.

Following usual practice in the literature, I select a subsample of women for which the model of labour supply choice seems most appropriate. I keep women between the age of 25 and 60 (both inclusive) who are either employed or non-participating (defined as unemployed and not looking for work). I exclude students and women on maternity leave, as well as the self-employed, the unemployed who are actively looking for work, civil servants, and the retired.

Using these criteria, the estimation sample consists of 10247 observations, of which 2398 observations for women living alone and 7849 observations for women in two-person households.

Figure 3 in the appendix shows the sample size by year and by origin of the women. Table 3, also in the appendix, shows descriptive statistics on

this estimation sample. Due to the listwise deletion of missing values, the actual number of observations may be somewhat lower depending on the specification.

3.2 Hours worked

The dependent variable is the number of contractual weekly working hours. As mentioned, I follow van Soest (1995) in modelling the labour supply choice as a choice among discrete categories.

I use five categories for women's weekly labour supply: zero hours (non-participation), (0; 15] hours, (15; 34] hours, (34; 39] hours, and more than 39 hours. Each category needs to be assigned a single value; I choose the median of each category in the sample: 0, 10, 25, 38, and 40 hours. This choice of categories follows previous studies that were conducted with the microsimulation model STSM at DIW Berlin.

Note that I assign this single value not only for the four hypothetical categories that the woman does not choose, but also for the category that she actually chooses. That is, a woman who is observed to work 23 hours (and thus falls into the third category) is assigned the value corresponding to this category (25 hours) and not the 23 hours she actually works.

Figure 1 shows the distribution of the hours variable in the sample, pooled over all waves from 1999 to 2004, before and after the categorization. The low share for the category 0 to 15 hours is explained by the fact that I include only women without children in my subsample.

3.3 Household net income

Apart from hours worked, the other variable that enters the utility function is private consumption. For women living alone, private consumption is equated with net household income, and is therefore observed in one-person

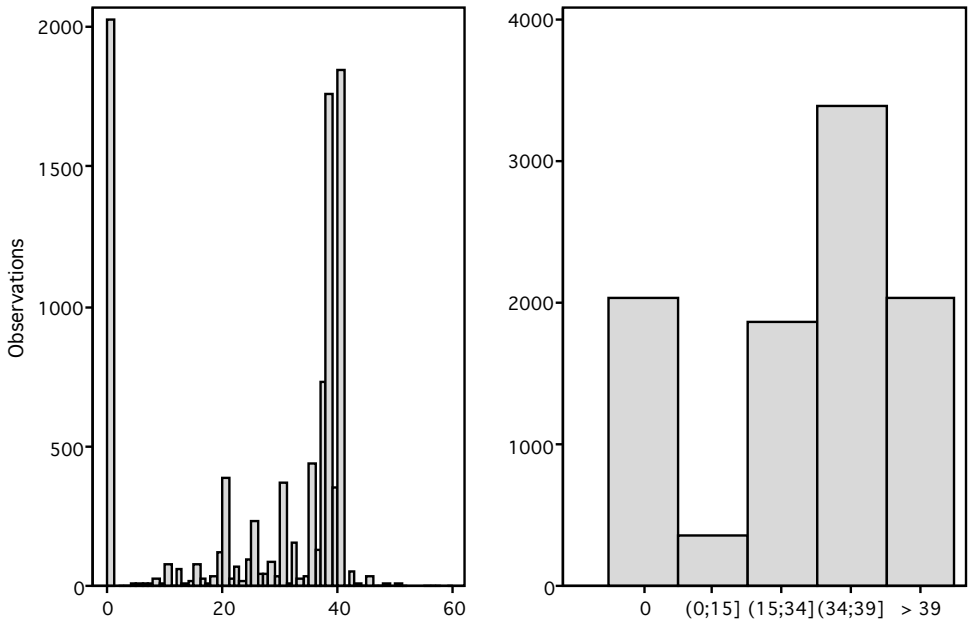

Figure 1: Contractual hours per week

households. For women living in couples, private consumption is assumed to be a share κ of household net income. That is, household net income needs to be calculated in both cases. This task is complicated by the fact that net income is (at best) observed for the category that the woman actually chooses (but even then, as just seen, I use a single value for hours for all women within the category and not the actual hours for each women). As a result, household net income has to be simulated for each alternative.

This simulation is done using the tax-transfer simulation model STSM, which has been developed at DIW Berlin. I will only sketch the model here. The model is described in detail in Steiner et al. (2008); their documentation also contains references to a number of ex-ante simulations for which the model has been used. So far, these ex-ante simulations have relied exclusively on the unitary model of labour supply. This paper is the first one to use STSM for the collective model.

The calculation of net income requires gross income and, due to specific rules of the tax and transfer system, a set of other variables available in the GSOEP (e.g, marital status because of the possibility of joint filing). Gross income, in turn, is the sum of labour income plus non-labour income.

To calculate weekly labour income at each of the five alternatives, the number of hours worked (0, 10, 25, 38, or 40) are multiplied with the hourly wage that each individual can obtain. This wage offer is observed for most women who work (it is calculated as weekly labour earnings divided by contractual hours of work per week) and has to be predicted for those women who do not participate and for those who do participate but for whom labour earnings are missing.

If labour earnings are not observed, the gross hourly wage has to be predicted. I estimate a selection model under the assumption of joint normality of the errors. I exclude from the wage equation a dummy for being married and the woman's non-labour income. By contrast, I could not use children in the participation equation because my subsample contains only women without children in the household. The wage equation and the participation equation are estimated jointly using Maximum Likelihood. Due to different labour market conditions, the model is estimated separately for women currently living in the East and women currently living in the West. Results are available upon request.

Apart from labour income household can receive income from a number of other sources. These components of non-labour income are observed at the household level, and are, apart from public transfers, assumed to be exogenous. *Net* income is then calculated from gross income using the tax-transfer microsimulation program STSM (Steiner et al. 2008). The model takes into account not only taxes, but also transfers, many of which are conditional on other income and on past labour market behaviour.

4 Results

Table 1 shows parameter estimates for the utility function given in equation (4). The parameters were estimated using Maximum Likelihood under the assumption that the error terms are i.i.d. extreme value. This gives rise to the conditional logit model.[4] For the moment, all parameters are constrained to be the same across years.

xnet	.0012*	(.0004)	.0011*	(.0004)
xnet * dCouple	-.0004	(.00035)	-.00034	(.00036)
xnet * dCouple * dEast1989			-.0002	(.00022)
xnet * l	-.00003*	(9.9e-06)	-.000029*	(1.0e-05)
xnet * l * dCouple	9.9e-06	(8.8e-06)	8.5e-06	(8.9e-06)
xnet * l * dCouple * dEast1989			5.0e-06	(5.4e-06)
l	.3*	(.028)	.3*	(.028)
l * dReal	.033*	(.0094)	.033*	(.0094)
l * dAbi	-.02	(.014)	-.019	(.014)
l * dCollege	.052*	(.015)	.052*	(.015)
l * age	-.0066*	(.00052)	-.0066*	(.00052)
l * dEast1989	-.015	(.0097)	-.015	(.0097)
lSq	-.0027*	(.00058)	-.0026*	(.00058)
lSq * dReal	-.00036	(.00022)	-.00037	(.00022)
lSq * dAbi	.00065*	(.00032)	.00064*	(.00032)
lSq * dCollege	-.00072*	(.00032)	-.00072*	(.00032)
lSq * age	.000071*	(.000011)	.000071*	(.000011)
lSq * dEast1989	.00059*	(.00022)	.00054*	(.00023)
Log likelihood	-9045.98		-9045.56	
Observations	6391		6391	

Conditional logit, 1999–2004 pooled. *: statistically significant at the 5% level. Asymptotic standard errors in parentheses.

Table 1: Maximum Likelihood estimates for conditional logit model

[4] As noted above, I also estimate a random parameters logit model, which allows for correlation of the error terms across alternatives. The coefficients l and lSq are assumed to be (independently) normally distributed. The model is estimated using Maximum Simulated Likelihood with 50 Halton draws. A likelihood ratio tests allows to test whether the variances of these two coefficients are both equal to zero. The test statistic is 0.01. This is to be compared with the critical value of a χ^2 distribution with two degrees of freedom. The null hypothesis of zero variances cannot be rejected (p-value 0.9960). I therefore present only the results for the conditional logit in the table. Results for the random parameters logit are very similar. In particular, the estimated sharing rule (.667, with a 95% confidence interval of $[.293; 1.04]$) is almost identical to the one estimated in the conditional logit model and given in table 2.

All women The first column shows parameter estimates from which an overall sharing rule (that is, for all women, regardless of their origin in East or West Germany) can be calculated. The interaction of *xnet* and *dCouple* is negative, which suggests that women in couples put less value on one unit of household net income than do women living alone. Under the assumptions stated above, this is interpreted as a female share of total household consumption of less than 1, which is only plausible. However, note that the interaction of *xnet* and *dCouple* is not statistically significant; this will show up in the sharing rule, for which the 95% confidence interval includes the values of 1 (the woman receives everything), but also of 0.5 (equal sharing of consumption).

The parameters of interest have to be calculated from these Maximum Likelihood estimates. Their standard errors are calculated using the delta method. More precisely, and as noted in equation (6), the sharing rule can be calculated as

$$\frac{b[xnet] + b[xnet * dCouple]}{b[xnet]} \tag{7}$$

Or, equivalently, as

$$\frac{b[xnet * l] + b[xnet * l * dCouple]}{b[xnet * l]} \tag{8}$$

where $b[\cdot]$ stands for the estimated coefficient on the variable given in brackets. The two ratios are *constrained* to be the same.

The results of these calculations are shown in the first row of table 2. The table shows the estimated share of household net income that the woman gets for her individual consumption. For all women, regardless of their origin in East or West Germany, I estimate a share of about 67%. Unfortunately, the estimate is rather imprecise. As noted, I cannot reject the hypothesis that the woman gets *all* of the household's net income. Nor can I reject a share of 0.5, which would be the expression of equal bargaining power.

	Coef.	SE	CI lower	CI upper
Net income				
All	.667	.191	.293	1.041
West	.705	.214	.286	1.125
East	.531	.219	.102	.960

Table 2: Estimated sharing rules

East-West difference In column 3 of table 1, the coefficient on the interactions of $xnet$ and $xnet*l$ with $dCouple$ are allowed to differ by the origin of the woman. I find that women who lived in East Germany in 1989 care even less about household net income when living in a couple than do women who lived in West Germany in 1989. However, the difference is not statistically significant. The second and third row of table 2 show the sharing rules than can be calculated from these Maximum Likelihood estimates. I estimate a share of about 71% for women from the West and of 53% for women from the East. The lower sharing rule for women from the East reflects the negative interaction term of table 1. I conclude that contrary to what is widely believed in Germany, there is no evidence of a stronger position of East German women within couples.

Evolution over time In the model of table 1, I constrained the coefficients to be the same across all years from 1999 to 2004. I re-estimated the model, allowing for different sharing rules in each year. The results are shown graphically in figure 2. I find that the difference in the point estimate of table 2 is driven almost exclusively by the years 2000 and 2001. In all other years, the estimated sharing rules are practically indistinguishable for East and West German women. The lower panel of figure 2 shows that the difference is never statistically significant.

Comparison with related studies To put my results into perspective, I compare them with two related studies. As noted, the study that is most

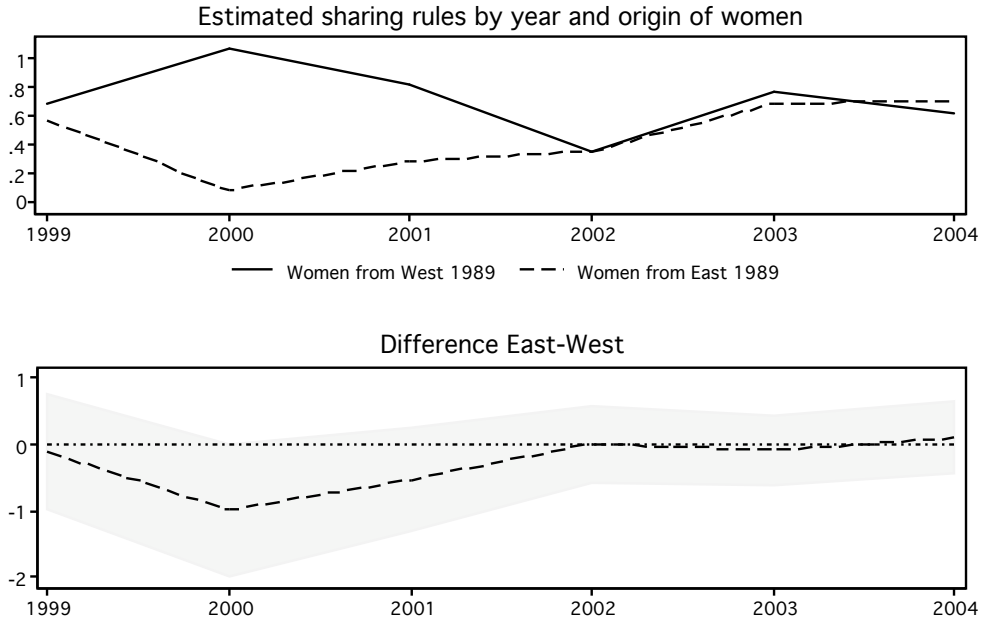

Figure 2: Sharing rules by year (point estimates and 95% confidence band)

closely related is by Vermeulen (2006). In fact, I estimate almost exactly the same equation that he does; in particular, I use the functional form for the utility function that he proposes. Using data on Belgium for the 1990s, Vermeulen finds that women in childless couples behave as if they received about 18% of total household consumption for zero earnings capacity; this share is estimated to rise with earnings capacity (0.00047 for each euro). Earnings capacity is defined as "the difference between total household consumption when the female works full-time, and total household consumption when she does not participate in the labour market" (p. 103). This result implies that at an earnings capacity of 100 euros, women are estimated to receive 22.4% of household net income. At an earnings capacity of 500 euros, the share is 41.2%, and at 1000 euros it rises to 64.7%. These estimates are close to what I find for Germany.

Beninger et al. (2006) and Beninger et al. (2007) use the 1998 wave of the German Socio-Economic Panel to estimate a less restrictive collective model in which male labour supply is endogenous and in which a leisure interaction term is included in the spouses' utility functions. As in the present paper, labour supply is modeled as a discrete choice, and non-linear taxation is taken into account. By contrast, the sharing rule is not estimated, but identified through a mix of estimation and calibration. Beninger et al. (2006) and Beninger et al. (2007) make the same assumption as in Vermeulen (2006) and in the present article that singles' preferences can be used to identify certain parameters of the utility function of people in couples. After this estimation stage, they calibrate the measure of bargaining power (as well as the coefficient on the leisure interaction term) so as to minimize, for each couple, the difference with observed labour supply behaviour. The calibrated "power index" reported by Beninger et al. (2007) suggests very equal bargaining power for the majority of couples: the normalized male power index has a mean of 0.51 , with a standard deviation of 0.08, a minimum of 0.33 and a maximum of 0.93 (the normalized male and female power indices sum up to 1). That is, Beninger et al. (2007) find a more equal distribution of bargaining power than the point estimates in the present article. However, recall from above that my 95% confidence interval also includes the value of 0.5.

Using a very similar approach for the 2004 wave of the German Socio-Economic Panel, Beninger (2006) finds a slightly less equal distribution of bargaining power between the two spouses. The mean of the normalized male power index is 0.57 for West Germany and 0.54 for East Germany, with standard deviations of 0.08 and 0.075. These findings go in the opposite direction of my result (for 1999–2004) that *women* have a stronger position in the West, even though this difference is not statistically significant. However, Beninger, uses current region of residence, not where the persons lived in 1989.

5 Conclusion

In this paper I estimate a collective model of female labour supply with non-participation and non-linear taxation. The framework is from Vermeulen (2006); the main contribution of the paper is the application of the model to differences in bargaining power between East and West German women. The data are from the German Socio-Economic Panel for the years 1999–2004. The sharing rule is identified using preferences of singles.

I estimate that women receive about 67% of household net income for their individual consumption. Contrary to what many people in Germany believe, there is no evidence that women who lived in East Germany in 1989 have greater bargaining power; if anything, there is evidence that the sharing rule is higher for women from the West. However, the difference is never statistically significant and is driven almost exclusively by the years 2000 and 2001.

These estimates are in a plausible range, comparable to the results of Vermeulen (2006) for Belgium and the results of Beninger et al. (2006), Beninger (2006), and Beninger et al. (2007) for Germany. However, they find a more equal distribution of bargaining power; Beninger actually finds a stronger position for the man, which runs counter to the point estimate of 67% for the *woman* that I find. However, recall from above that my 95% confidence interval also includes the value of 0.5. Finally, Beninger (2006) finds that women have *greater* bargaining power in East Germany, which also runs counter to the results of the present article. In future work, I plan to combine their richer framework (which allows for endogenous labour supply of the man and for leisure interaction between the spouses) with the larger sample (for 1999–2004) and with the microsimulation model that I use in the present article in order to explore these differences in the results.

References

Alesina, A. and N. Fuchs-Schündeln (2007). Good-bye Lenin (or not?): The effect of communism on people's preferences. *American Economic Review 97*(4), 1507–28.

Apps, P. F. and R. Rees (1988). Taxation and the household. *Journal of Public Economics 35*, 355–369.

Barmby, T. and N. Smith (2001). Household labour supply in Britain and Denmark : some interpretations using a model of Pareto optimal behaviour. *Applied Economics 33*, 1109–1116.

Beninger, D. (2006). A discrete choice estimation of a collective model of household labour supply: an application for Germany. Unpublished, ZEW Mannheim.

Beninger, D., O. Bargain, M. Beblo, R. Blundell, R. Carrasco, M.-C. Chiuri, F. Laisney, V. Lechene, E. Longobardi, N. Moreau, M. Myck, J. Ruiz-Castillo, and F. Vermeulen (2006). Evaluating the move to a linear tax system in germany and other european countries. *Review of Economics of the Household 4*, 159–180.

Beninger, D., F. Laisney, and M. Beblo (2007). Welfare analysis of a tax reform for Germany: a comparison of the unitary and collective models of household labour supply. *Journal of Population Economics 20*, 869–893.

Chiappori, P.-A. (1988). Rational household labor supply. *Econometrica 56*, 63–89.

Chiappori, P.-A. (1992). Collective labor supply and welfare. *Journal of Political Economy 100*, 437–467.

Chiappori, P.-A. and O. Donni (2006). Les modèles non unitaires de comportement du ménage : un survol de la littérature. *L'Actualité économique 82*, 9–52.

McFadden, D. (1974). Conditional logit analysis of qualitative choice behavior. In P. Zarembka (Ed.), *Frontiers in Econometrics*, pp. 105–142. New York: Academic Press.

Steiner, V., K. Wrohlich, P. Haan, and J. Geyer (2008). Documentation of the Tax-Benefit Microsimulation Model STSM : Version 2008. Data Documentation 31, DIW, Berlin.

Train, K. E. (2003). *Discrete Choice Methods with Simulation*. Cambridge: Cambridge University Press.

van Soest, A. (1995). Structural models of family labor supply : a discrete choice approach. *Journal of Human Resources 30*, 63–88.

Vermeulen, F. (2002). Collective household models: Principles and main results. *Journal of Economic Surveys 16*(4), 533–564.

Vermeulen, F. (2006). A collective model for female labour supply with non-participation and taxation. *Journal of Population Economics 19*, 99–118.

Vermeulen, F., O. Bargain, M. Beblo, D. Beninger, R. Blundell, R. Carrasco, M.-C. Chiuri, F. Laisney, V. Lechene, N. Moreau, M. Myck, and J. Ruiz-Castillo (2006). Collective models of labor supply with nonconvex budget sets and nonparticipation: A calibration approach. *Review of Economics of the Household 4*, 113–127.

Wagner, G. G., J. R. Frick, and J. Schupp (2007). The German Socio-Economic Panel Study (SOEP): Scope, evolution and enhancements. *Schmollers Jahrbuch 127*, 139–169.

A Appendix

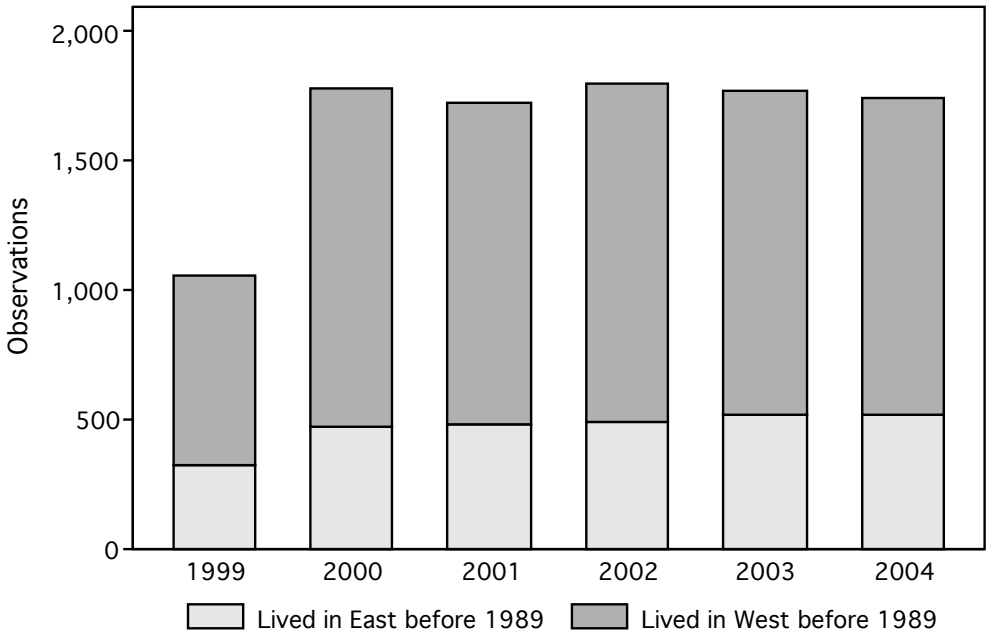

Figure 3: Sample size, by year and region in 1989

Table 3: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Working	0.8	0.4	0	1	10247
Agreed Upon Weekly Work Time	34.09	8.29	2	60	7640
Gross hourly wage (observed)	14.78	8.01	0.14	178.83	7585
Gross hourly wage (predicted)	13.27	3.71	0.45	36.42	9598
Asset income (week)	44.66	236.95	0	11641.68	10247
Public transfers (week)	21.5	57	0	1248.58	10247
Private transfers (week)	2.37	20.3	0	789.15	10247
Public pensions (week)	54.84	134.32	0	1710.38	10247
Total non-labour income (week)	123.38	276.12	0	11641.68	10247
Total non-labour income, incl. earnings of spouse (week)	402.91	504.43	0	11641.68	10247
Lives in two-person household	0.77	0.42	0	1	10247
Married	0.58	0.49	0	1	10247
Age	44.97	11.39	25	60	10247
Lives in East	0.24	0.43	0	1	10247
Lived in East in 1989	0.28	0.45	0	1	9861
No degree	0.01	0.08	0	1	10002
Hauptschule	0.36	0.48	0	1	10002
Realschule	0.39	0.49	0	1	10002
Abitur	0.24	0.43	0	1	10002
Higher education	0.18	0.38	0	1	10127
Potential experience	26.88	12.29	1	47	10088

Note: Monetary values are in 2005 euros.