Separate taxation and married women's labor supply

A comparison of West Germany and Sweden

Siv Gustafsson *

University of Amsterdam, Department of Economics, Jodenbreestraat 23, 1011 NH Amsterdam, The Netherlands

Abstract. This paper uses Swedish and German micro data on wages, hours of work and human capital related variables for German and Swedish couples. When separate taxation was introduced in Sweden in 1971, incentives for married women to supply more labor to the market, was an important argument. A comparison with the behavior of German women, who are confronted with the high marginal taxes of split taxation, is a way of evaluating this policy. Effects of the specific tax systems are incorporated in logit analysis or married women's labor force participation. German and Swedish regressions differ significantly. Children are for example a major detering factor for German women's labor force participation but not for Swedish women.

1. Introduction

Sweden and Germany have chosen very different models for income-taxation of spouses. Sweden has a system of compulsory separate taxation with a high progressivity, whereas Germany has "split" income taxation with a substantial "marriage gain", i.e. couples are jointly taxed at a lower rate than single persons for a given before tax. In Sweden separate taxation and high progressivity increase the after tax wage for part-time work relative to full-time work and separate taxation is a strong incentive for married women to work part-time rather than being house-wives. The German wife, on the other hand, has to earn enough to offset the marriage gain, before she contributes to family income, and marginal earnings of the second wage earner are hit by a high tax rate.

Table 1. Labor force participation in Sweden and Germany

Year	West Germany (age 15 – 64 years)				Sweden (age 16 – 64 years)			
	Men	Women			Men	Women		
		all	not married	married		all	not married	married
1960	91.0	47.4	81.7	34.9				
1961	91.1	47.4	80.0	36.0				
1962	91.1	46.9	78.8	35.9				
1963	90.9	46.9	79.1	35.9	89.9	54.5	69.6	47.0
1964	90.4	46.8	78.3	36.5	89.6	54.0	68.6	47.1
1965	90.2	46.9	76.9	36.9	89.3	53.8	67.2	47.2
1966	90.6	46.7	74.7	36.3	89.0	55.1	66.7	49.3
1967	89.3	45.6	74.3	37.1	88.1	54.9	65.5	49.8
1968	89.6	45.9	72.4	37.8	88.0	56.4	66.1	51.8
1969	89.2	46.0	69.9	39.1	87.5	57.6	65.9	53.4
1970	88.5	46.2	68.9	40.0	87.0	59.3	65.9	56.1
1971	88.1	46.5	67.4	41.8	86.9	60.9	66.1	58.2
1972	87.4	47.5	64.9	43.2	86.6	62.0	66.1	59.8
1973	86.6	48.2	62.6	43.6	86.8	62.7	65.6	61.2
1974	85.8	48.1	64.4	43.6	87.5	65.2	68.1	63.6
1975	86.0	48.2	62.7	43.9	88.3	67.9	70.8	66.2
1976	85.0	48.3	61.9	44.7	88.6	69.1	71.5	67.7
1977	84.6	48.9	61.5	44.7	88.0	70.6	72.0	69.8
1978	84.5	49.0	62.4	45.2	87.6	72.1	72.5	71.8
1979	84.5	49.7	60.7	46.1	87.8	73.8	73.3	73.8
1980	81.4	50.2	60.6	46.8	87.7	75.1	74.4	75.6
1981	83.5	50.6	59.5	47.4	86.8	76.3	74.4	77.7
1982	83.0	51.0	58.5	47.3	86.3	76.9	74.3	78.9
1983	82.0	50.7	61.4	47.5	86.0	77.6	74.6	80.0
1984	81.4	51.7	58.8	47.5	85.6	78.2	75.0	80.9
1985	81.9	52.7	n.a.	47.8	86.0	79.2	76.0	82.0
1986	82.0	53.4	n.a.	48.4	85.9	80.0	76.7	82.9
1987	82.3	54.1	n.a.	48.5	85.7	81.1	n.a.	n.a.
1988	82.5	55.0	n.a.	49.4	86.2	81.8	n.a.	n.a.

Sources: Sweden: AKU., yearly averages, Statistics Sweden.
Germany: Statistische Jahrbücher, diverse Jahrgänge, Ergebnisse des Microzensus, 1983/1984 EG
Arbeitskräftestichprobe

The focus of this paper is an empirical analysis of the effects of taxation on women's incentives to contribute to family income. Data on earnings and individual characteristics in 1984 for married or cohabiting Swedish couples from the first wave of "HUS" (Klevmarken and Olovsson 1986) are used together with similar data on German couples from the first wave of SEP (Sozioökonomische Panel: Hanefeld 1987). The main features of the personal income taxation of the two countries have been programmed, and are used for simulating after tax incomes using both tax systems for both countries.

Separate taxation was introduced in Sweden in 1971. Labor force participation of married women has increased much more rapidly since then and is now 82%, whereas the German rate is 55% (see Table 1). Comparing Sweden and Germany provides an opportunity to evaluate the effect of separate taxation on married women's labor supply in the long run, when people have adjusted to the diverging incentives.

Schettkat (1987), analyzing time series of Swedish female labor force participation, using only the time trend and a dummy variable for 1971, finds no effect from the introduction of separate taxation except for the group of women aged 35 – 44 who have no children. His negative results are consistent with the notion that the change has been gradual.

Previous authors, analyzing taxes and labor supply in Sweden, have concentrated on the disincentives to overtime work for full-time workers (Hansson and Stuart 1985; Lindbeck 1981). Blomqvist (1983) concentrates on male labor supply. However Holst et al. (1988), using the same data set as the present study (SEP 1984), estimate that a switch from the current German joint taxation of earnings to a separate system with the same progressivity, increases labor force participation from 44.5% to 52.8% for women aged 25 – 59. Kaiser et al. (1989) also using SEP 1984 estimate that the tax reforms 1986 – 1990 in Germany increase labor supply of married women by 3.6%.

This paper is organized as follows. First, the budget sets under the two tax regimes, for a married women who increases her labor supply form zero hours to fulltime work at given earnings of her husband, is discussed. Second, the tax and income concepts employed in this study, are defined. The empirical section starts with a discussion of the comparability of variables between the two countries. Wage regressions for each country and for the pooled German and Swedish samples are carried out and the before-tax wage differential according to sex and country is decomposed. Next, logit analyses on the probability to work and to work full-time are carried out and labor force participation is predicted using the after tax wages and incomes of the other country.

2. The introduction of separate taxation in Sweden

The discussions and arguments that preceded the switch from joint to separate taxation in Sweden in 1971 are clearly and informatively analyzed by Elvander (1974). Criticism against joint taxation is almost as old as the system itself. Joint taxation was introduced in 1902 and the first parliament action in the Swedish Riksdag against it was issued in 1904, where it was argued that joint taxation was disruptive to marriage since a working woman would loose by marriage. Thus the system encouraged "sinful liaisons". In the fall of 1947 there was a strong movement of public opinion against the high marginal taxes on married women's earnings. That was because a system of tax at source had been introduced which did not fully consider the marginal taxes on married women's work, so people were charged afterwards for those earnings. A committee to consider the introduction of separate taxation was formed. In this committee, the representative of the conservative party, the female member of parliament, Ebon Andersson argued in favor of a split income taxation system similar to the present German one. The committee decided to keep joint taxation but to introduce a deduction for working married women called "förvärvsavdraget" (deduction for earnings) to compensate for the assumed fact that working women could do less economically important work around the house than housewives. The tax system introduced in 1952 also incorporated separate scales for married and single people, which in fact meant that 90% of the couples had split taxation.

In the mid 1960s an increasing number of Swedish women entered higher education, and the prospect of not being able to afford a career seemed to con-

demn them as they saw it, to "lifetime imprisonment within the four walls of a home". Elvander notes, that the debate on separate taxation was not carried out along political party lines, but was enacted by individual women involved in the feminist movement. The governing social democrat party showed little interest in a reform in favor of separate taxation, arguing that it was a luxury problem, which had no impact for the majority of women. Elvander (1974) also emphasizes the importance of Eva Moberg and Sonja Lyttkens. Eva Moberg claimed that the system regarded women as only conditionally liberated, i.e. they were allowed to work, only if they held the upbringing of children and the home as their first duty. Sonja Lyttkens, a female mathematician from the University of Uppsala, showed that the right for the husband to deduct two basic allowances from his income when his wife does not participate in the labor market is equivalent to a large marginal tax and that this has a large discouraging impact on married women's labor supply, also for low income couples.

By very active argumentation and private meetings with powerful persons the feminists later persuaded the political parties and the powerful labor market organizations.[1] The medium term economic forecast of 1959 stated that, in the face of labor shortage, married women and particularly mothers of young children were the only important reserve of labor. The medium term survey of 1965 again stated the prospects of a growing shortage of labor. This was the argument that finally convinced the minister of fincance of the time, Gunnar Sträng, of the benefits of separate taxation. The consequent debate centered on the prospective adverse effects for one earner families. The solution became to compensate them with an extra deduction, "the housewife deduction", which was kept at its nominal value and finally abolished as late as the mid 1980s.

3. Conceptual framework

Assume a standard neoclassical model. The woman maximizes her utility:

$$u = u(X, L; Z) \, , \tag{1}$$

where X is a composite commodity of all goods and services except home time $L = T - h$, where T is total time available and h is hours of work in the market and Z is a vector of other variables e.g. presence and age of children. Conceptually $T - h$ also includes household work which is not equivalent to leisure (see Gronau 1977; Gustafsson and Willis 1990). In the literature the number of children and their ages have been shown to be the most important variables besides income and prices to affect married women's labor supply (Killingsworth and Heckman 1986; Gustafsson and Jacobsson 1985; Franz 1985). Those variables are included in the vector Z.

The utility function u is maximized subject to the budget constraint

$$X = w^n h + H \, , \tag{2}$$

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[1]   The representative of the labor union (LO) was Rudolf Meidner, then head of LO's economic research department. Elvander notes about him "He knew, that LO would not agree to separate taxation, but he decided in favor of it, because he was convinced and hoped, that time would prove him right".

where X is the composite commodity, the price of which is set equal to 1, w^n is the wage rate net of taxes of the wife and H is the exogenously given unearned income after tax. We take husband's income as exogenously given from the point of view of the wife. Killingsworth (1983) termed this type of model "the male chauvinist model" because the wife adjusts to husband's income, whereas the husband does not adjust to wife's hours of work and wage.

In this paper w^n and H are calculated under two different tax regimes namely the Swedish 1984 tax system and the German 1984 tax system. In Germany, incomes of husband and wife are added together and taxed at a joint tax rate under the "Splitting Tariff". The German split taxation can be described as follows:

$$X_2^G = (w_f h_f + w_m h_m) - t^G (w_f h_f + w_m h_m - 2b^G) , \tag{3}$$

where X_2^G = after tax income according to German tax (superscript G) of a couple with positive earnings of both husband and wife (subscript = 2), w_f denotes wage before tax of the secondary wage earner (f), h_f denotes hours of work of the secondary wage earner (f), w_m wage before tax of primary wage earner (m) and h_m hours of work of the primary wage earner (m); t^G is the tax rate which in the joint system depends on the joint earnings of husband and wife, b is the basic tax deduction per person. The tax rate t, because of progressivity, has a positive first derivative $t' > 0$. The specific property of the German split taxation system is that taxes are computed as if each spouse earned half of the income. There is therefore a progressivity advantage for a married person in comparison to a single person. A one earner couple according to the German tax system receives an income after tax according to formula (3) but with $h_f = 0$ i.e.:

$$X_1^G = w_m h_m - t^G (w_m h_m - 2b^G) , \tag{4}$$

where subscript 1 denotes a one earner couple.

In the Swedish separate taxation case, after tax income for the dual earner couple is given by:

$$X_2^S = (w_f h_f) - t_f^S (w_f h_f - b^S) + (w_m h_m) - t_m^S (w_m h_m - b^S) , \tag{5}$$

where superscript S denotes the Swedish tax system, and the other symbols have the same meaning as before. Note that the tax rates now depend only on the individual incomes, and the basic deduction can only be made from the individual income. Income after tax for a one earner couple under the Swedish system is, therefore, only

$$X_1^S = w_m h_m - t_m^S (w_m h_m - b^S) . \tag{6}$$

In terms of the budget constraint (2) formulas (3)–(6) can be substituted as follows:

$$H^i = X_1^i \quad \text{for} \quad i = G, S \tag{7}$$

and

$$w^n = (X_2^i - X_1^i)/h \quad \text{for} \quad i = G, S \tag{8}$$

w^n is, therefore, the wife's realized after tax wage.

In the following, we analyze under what conditions the two earner couple and the one-earner couple, respectively, receive a higher after-tax income by German tax than by Swedish tax, for given before-tax earnings.

If $\quad X_2^G > X_2^S$ $\hspace{10cm}$ (9)

then $\quad (w_f h_f + w_m h_m) - t^G(w_f h_f + w_m h_m - 2b^G) > w_m h_m - t_m^S(w_m h_m - b^S)$
$$+ w_f h_f - t_f^S(w_f h_f - b^S) \ . \hspace{3cm} (10)$$

Rearranging term, (10) simplifies to:

$$-t^G(w_f h_f + w_m h_m - 2b^G) > -t_m^S(w_m h_m - b^S) - t_f^S(w_f h_f - b^S) \ . \hspace{1.5cm} (11)$$

Let us assume that $b^G = b^S = b$, i.e. that the basic deduction per person is the same in the two tax systems. In the separate taxation system, $t_f^S = t_m^S$ only if $w_m h_m = w_f h_f$. Let us assume that $t^G = t_f^S = t_m^S = t$. Then, expression (11) becomes an identity; i.e., if husband and wife earn exactly the same income, they pay the same taxes under separate and split taxation.

But, separate taxation with progressive taxes, as in the Swedish 1984 tax system, implies that $t_f^S < t_m^S$ for all cases where $w_m h_m > w_f h_f$. Let us look at the case where $b^G = b^S = b$ and $t^G = t_m^S = t > t_f^S$ then devide all terms in (11) by t:

$$-w_f h_f + w_m h_m + 2b > -w_m h_m + b - \frac{t_f^S}{t}(w_f h_f - b)$$

and

$$-(w_f h_f - b) > -\frac{t_f^S}{t}(w_f h_f - b)$$

so

$$\frac{t_f^S}{t} > 1 \hspace{10cm} (12)$$

because $t_f^S < t$ by assumption it follows that (12) is not true and the inequality sign of (9) reverses. For this case the couple has a higher income after tax under separate taxation than under joint taxation.

If, instead, the German tax rate falls between the Swedish female rate and the male rate we have: $t_f^S < t^G < t_m^S$ and still assuming $b^G = b^S = b$ then we can rewrite (11)

$$(t_m^S - t^G) w_m h_m + (t_f^S - t^G) w_f h_f > (t_m^S + t_f^S - 2t^G) b$$

or

$$\frac{t_m^S - t^G}{t^G - t_f^S} > \frac{w_f h_f - b}{w_m h_m - b} \hspace{8cm} (14)$$

i.e., it depends on the differences between the tax rates. Assume $t^G = 30\%$, $t_f^S = 20\%$ and $t_m^S = 35\%$. Then, inserting into (14), it follows that, as long as taxable income is at least double that of the woman, the couple is better-off with split taxation. If the difference is larger, separate taxation is better.
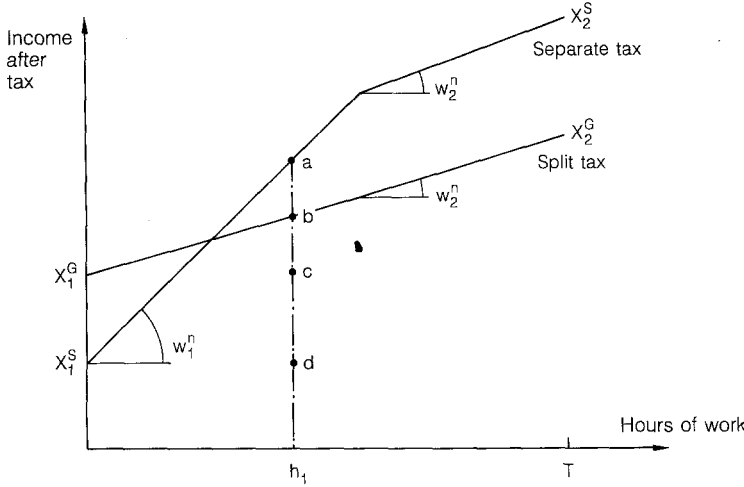
Fig. 1. Wife's budget sets under separate taxation and split taxation

For the one earner couple if:

$$X_1^G > X_1^S$$

then:

$$t_m^S(w_m h_m - b^S) > t^G(w_m h_m - 2b^G) \quad \text{or} \quad \frac{t_m^S}{t^G} > \frac{w_m h_m - 2b^G}{w_m h_m - b^S} \tag{15}$$

if $t_m^S = t^G$ split taxation is better as long as the Swedish per person basic deduction is not larger than $2b^G$.

Figure 1 illustrates the argument assuming given before-tax income of the husband (assumed to work full-time), given before-tax wage rate of the wife, and a given step-wise linear marginal tax rate. For simplicity, only two tax brackets are shown in the figure. Only for big earnings (i.e. long working hours) in the separate taxation case the wife will eventually hit a high tax bracket. For the split taxation case, however, already at her first hour of work she is taxed at a higher tax rate than in the separate taxation case, because she is taxed at the same tax rate as her fulltime working husband.

Let us define the proportion of family earnings earned by the wife as $0 \le p_y \le 1$ for before-tax earnings, and $0 \le p_x \le 1$ for after-tax earnings. This proportion will then be equal to zero if the wife does not participate in paid work, and equal to one if she is the only wage earner.

The proportion before tax is then:

$$p_y = (y_2 - y_1)/y_2 \tag{16}$$

and the proportion after tax is:

$$p_x^i = (X_2^i - X_1^i)/X_1^i \quad \text{for} \quad i = G, S \ . \tag{17}$$

Let us now investigate under what conditions the contribution of the wife to family income before tax and after Swedish and German tax systems differs. Assuming $b^S = b^G = b$.

If $p_x^S = p_y$ then:

$$\frac{X_2^S - X_1^S}{X_2^S} = \frac{y_2 - y_1}{y_2} \quad \text{or}$$

$$\frac{w_f h_f - t_f^S(w_f h_f - b)}{X_2^S} = \frac{w_f h_f}{y_2} \quad \text{or}$$

$$\frac{w_f h_f - t_f^S(w_f h_f - b)}{w_f h_f} = \frac{X_2^S}{y_2} \tag{18}$$

i.e. $p_x^S > p_y$ for all cases where the ratio of net to gross income of the wife is larger than the ratio of net to gross income of the couple (which in turn is true for all the cases where $w_f h_f < w_m h_m$ since then $t_f^S < t_m^S$).

If $p_x^G = p_y$, then:

$$\frac{X_2^G - X_1^G}{X_2^G} = \frac{w_f h_f}{y_2} \; .$$

Substituting for $X_2^G - X_1^G$ from (3) and (4),

$$\frac{w_f h_f - t^G(w_f h_f)}{w_f h_f} = \frac{X_2^G}{y_2} \; . \tag{19}$$

But, substituting for X_2^G according to (3),

$$\frac{(1 - t^G)w_f h_f}{w_f h_f} < \frac{(1 - t^G)y_2 + t^G 2b}{y_2}$$

implies that $p_x^G < p_y$ because $2b$ can be deducted from the family income.

Now assume that $X_2^G = X_2^S$. Then the inequality holds, in view of (18) and (19), if

$$t^G w_f h_f > t_f^S(w_f h_f - b)$$

or

$$\frac{t^G}{t_f^S} > \frac{w_f h_f - b}{w_f h_f} \; . \tag{20}$$

This will in general be true if $t^G \geq t_f^S$ since the right hand side of (20) is less than 1. Therefore (18), (19) and (20) imply that, for cases where $t_f^S < t_m^S$ and $t_f^S < t^G$ and $X_2^G = X_2^S$, we will have $p_x^S > p_y > p_x^G$.

If $p_x = p_y$ the tax system can be said to be neutral with respect to wife's earnings as a proportion of family income. In terms of Fig. 1, $p_x^S = ad/dh$ which is considerably larger than $p_x^G = bc/ch$.
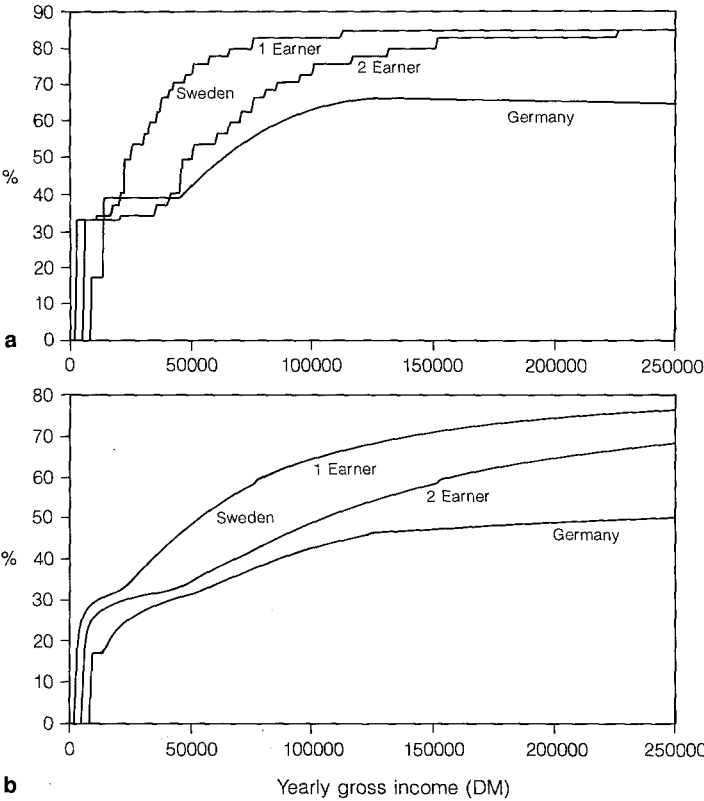
Fig. 2. a Marginal tax rate for married couples. **b** Avrage tax rate for married couples

4. The tax systems of Germany and Sweden

Both Germany and Sweden have progressive tax systems. Figure 2 pictures the average and marginal tax rates for the 1984 tax systems of the two countries. An important aspect of the separate taxation income is that the joint after-tax income, for a given before-tax income, is maximized if each spouse earns exactly half of the income. For the German split taxation system, it does not matter whether a given before tax income is earned by only one spouse or if it is earned in any combination by both spouses. Thus, in Fig. 2, we have only one tax schedule for the couple. In the Swedish tax system, there will be a series of tax schedules for a given before-tax family income depending on the proportion earned by each spouse.

In Fig. 2, the tax schedule marked "2 earner" is drawn on the assumption that each spouse earns exactly half of the income before tax (see Gustafsson and Ott 1987). The tax deductions considered here are given in the appendices A and B.

After-tax income in Germany is determined by a fourth degree function of the taxable income and does not vary by regions (see Appendix A).[2] The Swedish in-

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[2]   A printout of the tax programs for each country is available from the author. The German tax system has been programmed also by van Essen et al. (1986), p. 36 and Lendewig (1985) and Kaiser et al. (1989), where more detailed information on opportunities for tax deductions is used.

come taxes consist of a proportional community tax, that varies across the 285
communities, and of a progressive state tax (see Appendix B). [3] Social security
payments, amounting to about 36.5% of the sum of wages, are paid by employers
(the Swedish tax system and its likely effects on the economy are also discussed
by Andersson 1987; Burtless 1987; Gramlich 1987). The highest marginal tax in
the German 1984 tax system was 56% and it applied to incomes greater than
DM 130000 i.e. SEK 376300. The highest marginal tax in Sweden, in 1984, was
84% (30% community tax, plus 44% state basic tax and 10% state additional tax)
and it was applied at SEK 328500.

Both countries apply tax at source, and the tax authorities supply tax tables
to employers. In Germany, the main breadwinner is taxed at source according to
a low tax column (III), calculated on the assumption, that he or she is the only
wage earner, whereas the secondary wage earner is taxed according to a high-tax
column (V), which incorporates the total additional tax on marginal earnings (see
Brede 1986). Therefore, every German couple is fully aware of the low return on
additional earnings from a part-time working partner. The procedure taken by
German authorities is mimicked in calculating women's contribution to family
after tax income below. In other words, the tax program is run twice: first with
the wife's actual earnings, and second assuming she has no earnings. The dif-
ference between the two is her contribution to family income.

5. Data and variables

In this study, couples are included if the wife is aged between 20 and 59, and if
there are any positive earnings in the family. The German Sozioökonomische
Panel carried out 5969 interviews, of which 4554 had a German head of
household. Single person households made up 25% of the sample and, in 21%
of the cases, the head of the household was older than 65 (Hanefeld 1987, p. 184
and 199). For the German sample, the criterion that the wife is German is added,
because immigrants were over-represented in the sample.

The Swedish HUS sample was selected on the basis of individuals, and the
spouse of the selected individual was always also interviewed. Prospective inter-
viewees who did not speak Swedish were not interviewed. Altogether 2629 inter-
views were carried out in 1541 households, 1101 of which included a second
household member, who was a spouse or an unmarried cohabitant (Klevmarken
and Olovsson 1986). [4]

Most Swedes are paid by the month (71% of all employees in the HUS sam-
ple), although traditionally blue collar workers were paid by the hour, and some
still are (13% in HUS). People were asked to state their earnings, according to the
form they were paid, whether by the hour, week, month or year. In the SEP both

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[3]   The community tax in 1984 ranged between 26 and 33% and averaged 30%. In this study, the
average community tax is used, i.e. a 30% community tax is paid on the bottom of all incomes. The
state tax is calculated in two steps: the basic amount and the additional amount. The reason is that
there is an upper limit to deductions for interest paid on mortgage.
[4]   The proportion of all German individuals in the SEP sample that are married, not married
cohabitants and singles are respectively: 66%, 6% and 28%. In the Swedish HUS sample the cor-
responding figures are: 64%, 16% and 20%.

Table 2a. Education and hours of work in the micro data

	Sweden		Germany	
n	Wives 632	Husbands	Wives 1897	Husbands
Proportion with education				
Compulsory	0.620	0.563	0.718	0.621
High school	0.293	0.315	0.220	0.233
College	0.087	0.122	0.062	0.146
Hours of work/week				
All couples	24.9	36.8	15.6	40.1
Dual earner cpls	30.8	40.9	30.2	42.6
Proportion working in *hours interval*				
0	0.196	0.094	0.482	0.057
1 – 19	0.056	0.013	0.084	0.004
20 – 24	0.404	0.063	0.182	0.016
35 +	0.343	0.838	0.252	0.923

before and after tax monthly incomes are asked for.[5] Both HUS and SEP ask people to state their "normal hours of work per week including overtime", which may be partly unpaid. German marks have been translated into Swedish crowns by the purchasing power parity of 1984, which is 0.3455 DM/SEK.

Both HUS and SEP ask people to state their highest completed level of schooling, and, in addition, to give information on number of years of formal schooling completed.

Attempts to make levels of schooling strictly consistent across countries were not very successful. Therefore, I have used years of schooling completed as the basis for an educational grouping. To ease comparisons with the international literature, largely dominated by the USA, I have classed those with less than 12 years of schooling as having "compulsory" education, those with at least 12 years of schooling but less than 16 as "high school", and those with 16 or more years as "college".

In Table 2a, descriptive statistics are shown. In comparison to German couples, Swedish couples indeed have attempted to equalize human capital investments between them. Whereas 14.6% of German husbands had college education, only 6.2% of their wives had. In Sweden 8.7% of the wives had college education compared to 12.1% among their husbands. The simple correlation coefficient between years of schooling for husband and wife is 0.558 for Sweden and 0.534 for Germany.

Swedish men work shorter hours than German men. The average labor supply among women who are labor force participants is 30 h in both countries, although the proportion of full-time among workers is larger in Germany (48%) than in Sweden (41%). As a proportion of all women, there are more full-time workers in Sweden: 34.3% as compared to 25.2% in Germany.

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[5]   In a previous German survey, only after tax monthly income was asked since it was argued that people would be more likely to know it (Lendewig 1985), but in the SEP where both questions were asked, answers were obtained from most interview persons on both questions.

Table 2 b. Results from tax simulations

Family incomes (thousand Swedish 1984 crowns)

All couples	With actual hours of work of husband and wife		Simulated assuming that wife does not work	
	Sweden	Germany	Sweden	Germany
Before tax	155	146	116	101
After Swedish tax	92	82	63	57
After German tax	104	100	86	77

Table 2 c. Women's contribution to family earnings [%]

	All couples		Childless couples		Couples with at least one child under 7	
	Sweden	Germany	Sweden	Germany	Sweden	Germany
Before tax	36	20	36	31	32	12
After Swedish tax	38	22	39	33	34	13
After German tax	28	14	27	26	27	10

6. Results from tax simulations

Income before tax, averaged over all couples, is strikingly similar in Germany and Sweden when translated by purchasing power parity 0.3455 DM/SEK (Table 2 b). In spite of the fact that Swedish wives supply so much more labor to the market, this is compensated for by German men by their larger incomes and larger labor supply in comparison to Sweden. Income after Swedish tax and after German tax has been simulated using tax programs based on the assumption that couples have only earned income (unearned income is not included since it was not available in both samples). Both tax programs have been applied to both samples and some results are given in Table 2 b. Combined family income after tax is smaller in Sweden because of Sweden's higher tax. [6] On average, the German tax plus social security payments is 29% of before-tax family income, whereas the Swedish tax is 40 to 43%.

Swedes have adjusted their division of work within the family to their tax system, and Germans to theirs, in the sense that the average tax for either tax system is lower in the home country. The Swedish tax is, of course, always higher than the German tax, but Germans would pay 43% according to the Swedish

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[6]   Family income after tax, is often used as a measure of the standard of living. For two reasons this comparibility across the two countries, using results from this study, is imperfect. First, although there is a fair amount of detail in the descriptions of the personal income taxation, they are not complete: capital income, benefits and subsidies are not included. Second, the higher taxes in Sweden are used to a large extent for subsidizing childcare, free school lunches, paid parental leaves etc., which are important parts of Swedish standard of living. (On Swedish childcare see Gustafsson and Stafford 1991.)
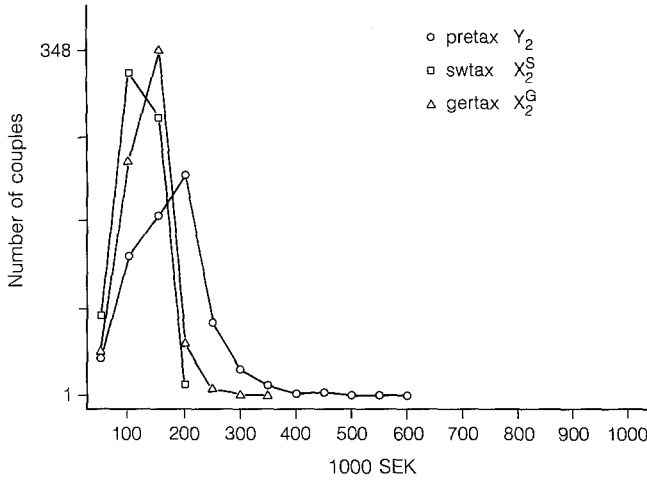
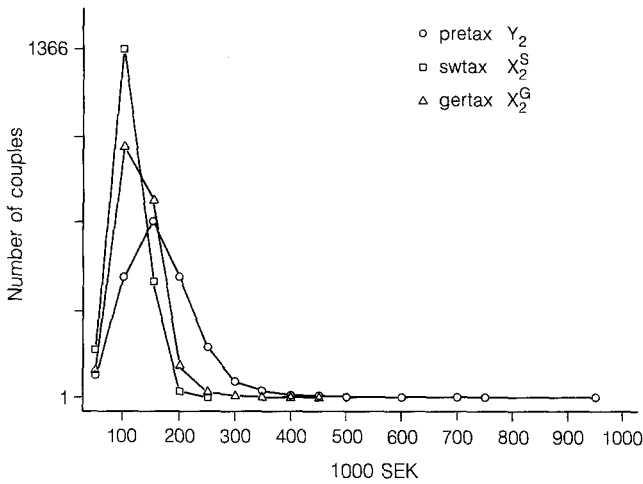**Fig. 3.** Family income distribution of Swedish couples before-tax and after-Swedish and German-taxes

Fig. 4. Family income distribution of German couples before-tax and after-Swedish and German-taxes

tax system, because there are more one earner couples, rather than 40% that Swedes actually pay.

Figures 3 and 4 show the distribution of family incomes over the samples included in the analysis.[7] The before-tax income distribution of Germany has a much longer right tail that of Sweden. The after-Swedish-tax distribution lies to the left of the after-German-tax distribution. The after-Swedish-tax distribution also truncates the right tail more than does the after German tax distribution.

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[7]   Figures 3−6 are graphs drawn with the computer package STATA. The procedure was to first group the variables before tax, after Swedish tax and after German tax and next get the frequencies by the command tabulate. The frequencies then are the variables in the new created summary data set and were plotted using the graph command.
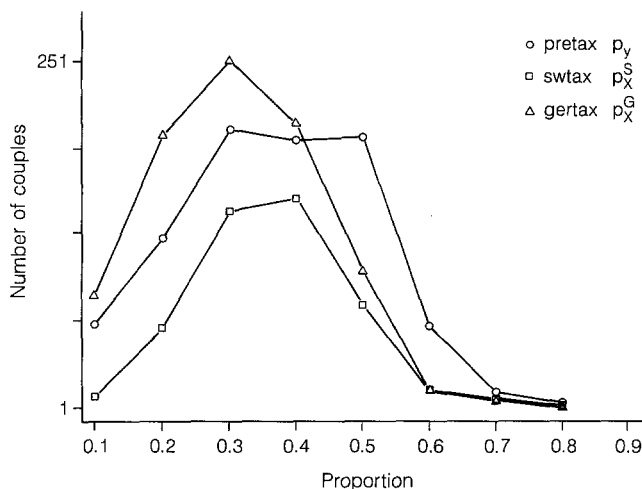
Fig. 5. Distribution of wife's proportion of family earnings of dual earner couples, before-tax, after-Swedish-tax and after-German-tax in Sweden
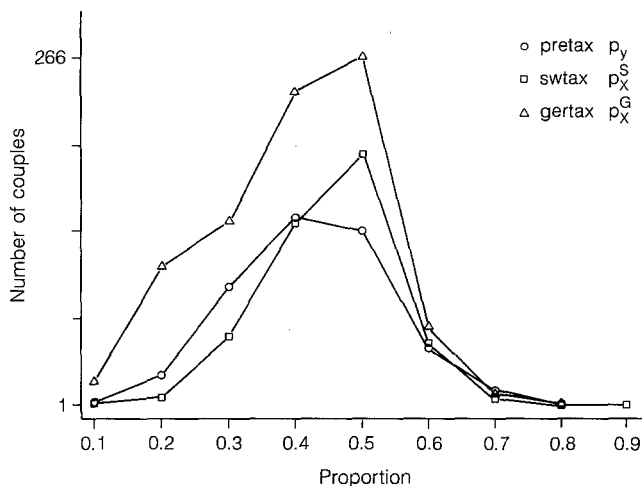

Fig. 6. Distribution of wife's proportion of family earnings of dual earner couples, before-tax, after-Swedish-tax and after-German-tax in Germany ·

Women's contribution to family income is given by Table 2c. On average, over all the couples included in this analysis, German women contribute 14% after tax according to their own tax system, and Swedish women contribute 38%. However, these same earnings of the Swedish wives would only have been worth 28% if the Swedish wives had been taxed by the German tax system and the German women's earnings would have been worth 22% instead of 14% if the German women were to be taxed at the Swedish tax system. If Swedish women were to leave the labor force, family incomes on average would be 38% lower, but a similar move from German women would lower family incomes by only 14%. For childless couples the difference between the two countries is not so large, but the

tax systems make a large difference. The largest difference between the two countries according to this measure of married women's economic independence is between women with pre-school children. Neither of the tax systems is thus neutral with respect to women's contribution to family income. The Swedish tax system increases the weight of women's earnings and the German tax system decreases it in the sense of formula (9) and (10) above since $p_y < p_x^S$ and $p_y > p_x^G$.

Figures 5 and 6 show the distributions of this measure for dual earner couples in the two countries. The effect of the Swedish tax system is to move the distribution to the right, making women's earnings a higher proportion of after-tax earnings than before-tax earnings. The effect of the German tax system is the opposite, making women's after-tax earnings a smaller proportion compared to before-tax earnings.

7. Econometric analysis of before tax wage differentials

Table 3 shows standard human capital regressions for German and Swedish women respectively, and for the joint sample of Swedish and German women jointly. The results of Table 3 show that the female to male wage ratio is smaller in Germany than in Sweden. Comparing earlier results for Germany (Lorenz and Watthauer 1986; Helberger 1983; Schasse 1986) with similar computations for Sweden (Gustafsson and Jacobsson 1985) confirms these findings.[8] An F-test proves that wages of German women react in a significantly different way from those of Swedish women.[9] At the chosen currency conversion rate, the dummy for German implies a more than 20% lower wage for a German than a Swedish woman with the same human capital. The wage regressions for Swedish and German women, respectively, have also been used to predict before-tax wages. The wage regressions which have been corrected for sample selection bias according to Heckman's (1980) method on the probability of having an observed wage (lambda in Table 3) have been used.

In Tables 3b and c, the before-tax wages have been decomposed according to the now standard method of decomposing (Oaxaca 1973). The wage differential

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[8]   Gustafsson and Jacobsson use the national longitudinal samples of the level of living investigations collected by the Institute for Social Reseach at the Stockholm University including about 6000 individuals that were reinterviewed in the 3 years of investigation. The wage differences between women and men decrease from 48% in 1968 to 33% in 1974 and 21% in 1980. The human capital standardized differences for the 3 years are 43, 27 and 18%. Lorenz and Vatthauer use the SEP and calculate the sex differential in monthly net income for full time working people in 1984 to be 48% which after standardizing for human capital variables decreases to 35%. The use of net monthly income, as is shown in the present study, exaggerates the gender differential in pay compared to before tax wages.

Helberger uses the "Arbeitseinkommensumfrage" which includes 2057 observations and was carried out in November 1980 through January 1981.

[9]   According to the formula: $(SSEC - SSE1 - SSE2)/k$ $(SSE1 + SSE2)/n + m2k$) where SSEC is residual sum of squares of combined regression and SSE1 and SSE2 are residual sum of squares of the regressions of the Swedish and German samples respectively, n and m are sample sizes and k is the number of parameters. The result is: $(259.8 - 39.7 - 214.5)/5$ 1.12 $(39.7 + 214.5)/571 + 868 - 10)$ 0.1778 6.29.

Table 3a. Wage regressions for Swedish and German wives OLS (*t*-values)

	Swedish wives		German wives		Joint (5)
	(1)	(2)	(3)	(4)	
Education years	0.034	0.034	0.055	0.059	0.48
	(5.7)	(9.1)	(3.2)	(9.1)	(9.3)
Experience years	0.024	0.021	0.028	0.025	0.129
	(1.3)	(4.2)	(1.6)	(4.4)	(4.5)
Experience squared	− 0.0004	− 0.0003	− 0.0005	− 0.0005	− 0.0005
	(− 0.9)	(− 2.5)	(− 2.2)	(− 3.8)	(− 4.3)
Years of part time	− 0.0029		− 0.0124		− 0.0082
	(− 1.1)		(− 2.5)		(− 3.7)
Lambada[a]	0.080		− 0.250		0.0925
if German	(− 0.6)		(− 0.2)		(0.28)
constant	3.04	3.08	2.84	2.65	− 0.181
	(4.2)	(50.3)	(3.5)	(29.0)	(− 4.5)
n	528	531	999	999	0.1527
R^2 (adj)	0.18	0.18	0.11	0.09	0.13
F	23.6	29.6	25.3	35.5	40.9

[a] Mill's ratio calculated by use of a probit regression on the probability of having an observed wage (see Heckman 1980). Similar regressions on husbands not presented here have been run

Table 3b. Decomposition of the male-female wage differential

	Sweden	Germany
Total differential $\ln (w^m) - \ln (w^f)$	0.220	0.444
Standard differential:		
a) by male characteristics	0.165	0.324
b) by female characteristics	0.119	0.364
c) by a dummy variable for sex in a pooled regression	0.140	0.372

Table 3c. Decomposition of the Swedish to German wage differential

	Women	Men
Total differential $\ln (w^S) - \ln (W^G)$	0.171	− 0.052
Standardized differential:		
a) by Swedish characteristics	0.157	− 0.034
b) by German characteristics	0.164	− 0.026
c) by a dummy variable for nation in a pooled regression	0.160	− 0.033

between men and women is considerably smaller in Sweden 24.6% (or 0.220 the natural logarithm as presented in the Table 3b) than in Germany 55.9% (0.444). After standardizing for human capital variables, the Swedish male/female wage differential decreases to between 12.6% (0.119) and 17.9% (0.165) whereas the German male female wage differential after standardizing is at least 38.3%

(0.324). Swedish women have higher wages than German women when translated by the purchasing pover parity of 1984 (0.3455 Swedish crown for German Mark), whereas for men the reverse is true according to Table 3 c.

8. Econometric analysis of female labor supply

Although the tax system is exogenous to the woman's labor supply, her actual marginal tax rate is not. Advanced econometric studies of labor supply attempt to model the full budget set and use methods where the likelihood function is maximized over the whole budget set. It is a standard result of econometric analyses of taxes and labor supply that estimates are not robust between methods and data sets (see Mroz 1987; Killingsworth and Heckman 1986).

Analyses of the effect of taxes and on labor supply in Sweden have been carried out by Aaberge et al. (1990) and by Blomqvist (1989). Both were asked to supply evidence for the tax reform planned for 1991 in Sweden, and they arrive at very different results. Klevmarken (1989) discusses the differences and arrives at the conclusion that, in the present state of knowledge, a simpler method can be used. Another complication that is not considered in the econometric analysis is that fertility may be an endogenous variable instead as in these estimations where it is assumed to be exogenous (see Cigno 1991, chapt. 7; Gustafsson and Willis 1990; Groot and Pott-Buter 1991).

In this paper I use such a simpler econometric method. The budget set is only studied at two points, i.e. the net wage is calculated under the assumption that the wife works 10 h and under the assumption that she works 40 h, and logit regressions are run on the probability of participation in the labor force and participation in the fulltime labor force respectively. For comparison, a logit regression on the before tax wage is included. Husband's income is regarded as exogenous as explained in Sect. 3 above. Wife's net wage is calculated as in (8). I first calculate family income after tax for the two earner couple and then for the one-earner couple. The difference between family income after tax assuming the wife works 40 h, minus family income after tax assuming she works 0 h, divided by 40, is the average after-tax wage at 40 h of work. Similarly, family income after tax if she works 10 h, minus family income after tax if she works zero hours, divided by 10, is her wage after tax at 10 h of work.

This is the variable corresponding to w^n in the budget constraint (2) and net family income if the wife does not work is the income variable corresponding to H in the budget constraint (2). The results are given in Tables 4a and b for Swedish and German wives respectively.

The last column of Tables 4a and b, respectively, gives the means of the variables. It can be seen that the before-tax wage is 41.3 Crowns per hour for wives and 37.3 crowns per hour for German wives. Average after-tax wage at 10 h of work is 31.6 crowns for Swedish wives and 22.5 crowns per hour for German wives. At 40 h of work, the net wage decreases to 25.8 crowns and 20.6 crowns for Swedish and German wives respectively.

In all participation equations, the income variable is negative and significant. Thus, the size of the family income has a depressing effect on wife's labor force participation as well as on her participation in the full-time labor force (more than 30 h a week). The net wage after tax at 10 h of work has a considerable and positive effect on labor force participation in both countries. However the wage

Table 4a. Labor supply of Swedish wives (logit) (*t*-values in parenthesis)

	(1) Probability to work hours > 0	(2) Probability to work hours > 0	(3) Probability to work hours ≥ 30	(4) Means
Mean of dep. variations	0.802	0.802	0.454	
Variable (t-value)				
Before tax wage	0.048 (3.82)			41.3
Average after tax wage at 10 h		0.073 (3.98)		31.6
Average after tax wage at 40 h			0.026 (1.54)	25.8
Net family earnings if wife does not work in the market (1000 skr)	− 0.020 (− 3.82)	− 0.021 (− 3.63)	0.011 (− 3.11)	56.6
Wife's age	0.080 (0.957)	0.074 (0.089)	− 0.017 (− 0.256)	
Wife's age squared	− 0.001 (− 0.970)	− 0.001 (− 0.909)	0.000 (0.048)	
Number of children under 13	0.080 (0.691)	0.087 (− 0.752)	0.086 (0.978)	0.828
Youngest child under 3	− 0.976 (− 2.33)	− 0.941 (− 2.23)	− 1.10 (− 2.72)	0.062
Youngest child aged 3 − 6	− 0.005 (− 0.013)	− 0.020 (− 0.050)	− 0.527 (− 1.67)	0.098
Youngest child aged 7 − 12	0.503 (1.04)	0.498 (1.02)	− 0.232 (− 0.723)	0.082
Constant	− 0.827 (− 0.520)	− 1.03 (− 0.640)	0.460 (0.350)	
Log likelihood	− 295	− 294	− 425	
Number of observations	632	632	632	
Mean of wage elast. (Standard deviation)	0.338 (0.148)	0.394 (0.175)	0.366 (0.083)	
Mean of income elasticity (Standard deviation)	− 0.253 (0.175)	− 0.258 (0.179)	− 0.363 (0.170)	

at 40 h of work does not seem to have an influence on participation in the full-time labor force. The coefficient is not significant either for Swedish or for German wives, and for German wives it is even negative.

The biggest difference between Swedish and German women's labor supply is that the effect of children is strongly negative for German women's labor supply, whereas it has actually no effect on Swedish women's labor supply. The Swedish

Table 4b. Labor supply of German wives (logit) (*t*-values in parenthesis)

	(5) Probability to work hours > 0	(6) Probability to work hours > 0	(7) Probability to work hours ≥ 30	(8) Means
Mean of dep. variations	0.503	0.503	0.278	
Variable (t-value)				
Before tax wage	0.011 (2.95)			37.3
Average after tax wage at 10 h		0.036 (4.81)		22.5
Average after tax wage at 40 h			− 0.004 (− 1.64)	20.6
Net family earnings if wife does not work in the market (1000 skr)	− 0.011 (− 6.86)	− 0.008 (− 5.16)	− 0.013 (− 6.33)	86.2
Wife's age	0.102 (2.07)	0.091 (1.83)	− 0.016 (− 0.30)	39.5
Wife's age squared	− 0.002 (− 3.49)	− 0.002 (− 3.26)	− 0.001 (− 1.20)	
Number of children under 13	− 0.323 (− 4.29)	− 0.313 (− 4.15)	− 0.557 (− 5.75)	0.991
Youngest child under 3	− 1.93 (− 8.67)	− 1.99 (− 8.87)	− 1.87 (− 6.86)	0.114
Youngest child aged 3 − 6	− 1.30 (− 6.54)	− 1.33 (− 6.68)	− 1.63 (− 6.35)	0.125
Youngest child aged 7 − 12	0.808 (− 4.76)	− 0.814 (− 4.79)	− 1.00 (− 4.63)	0.154
Constant	0.892 (0.959)	0.502 (0.535)	3.30 (3.24)	
Log likelihood	− 1146	− 1138	− 901	
Number of observations	1897	1897	1897	
Mean of wage elast. (Standard deviation)	0.205 (0.111)	0.383 (0.174)	− 0.209 (− 1.17)	
Mean of income elasticity (Standard deviation)	− 0.501 (0.347)	− 0.384 (0.269)	− 0.796 (0.439)	

system of subsidized childcare can explain why Swedish women can work even when they have children (see Gustafsson and Stafford 1991).

Wage and income elasticities have been evaluated at each observation and means and standard deviations of these are given at the bottom of Table 4.

In Tables 5 a and b, I analyze the effect of a change from the Swedish tax system to the German tax system for Swedish wives and of a change from the Ger-

Table 5a. Predicted labor force participation and participation in full-time labor force for Swedish wives if confronted with German taxes

According to regression in Table 4a	(1) hours > 0	(2) hours > 0	(3) hours > 30
Mean net wage increase (Standard deviation)	0	− 6.32 (4.29)	− 2.32 (4.48)
Mean income increase 1000 Swedish crowns (Standard deviation)	20.04 (16.8)	20.04 (16.8)	20.04 (16.8)
Actual outcome (Table 4a)	0.802	0.802	0.454
Predicted outcome due to change in tax system	0.732	0.604	0.385

Table 5b. Predicted labor force participation and participation in full-time labor force for German wives if confronted with Swedish taxes

According to regression in Table 4b	(5) hours > 0	(6) hours > 0	(7) hours > 30
Mean net wage increase Swedish crowns (Standard deviation)	0	6.57 (4.30)	3.23 (3.91)
Mean income increase 1000 Swedish crowns (Standard deviation)	− 23.3 (17.8)	− 23.3 (17.8)	− 23.3 (17.8)
Actual outcome (Table 4b)	0.503	0.503	0.278
Predicted outcome due to change in tax system	0.605	0.600	0.306

man tax system to the Swedish tax system for German wives, on women's labor force participation by simply predicting labor force participation from Tables 4a and b respectively. Actual labor force participation for Swedish wives can be written

$$lfp = \frac{\exp(y)}{1 + \exp(y)} \tag{21}$$

and

$$y = \alpha^S + \beta^S X^S + \gamma^S Z^S + \varepsilon^S$$

where $\beta^S X^S \equiv \beta_1^S w^{n,S} + \beta_2^S H$

according to the symbols used in (1)−(20) above; that is the net wage of the wife and the income of the family if the wife does not work are the variables that would change if the tax system were changed. γ^S is the vector of regression coef-

ficients on the age and children variables, Z^S are those characteristics of the Swedish wives, and α^S is the constant therm.

Predicted labor force participation under the assumption that the Swedish couples would be confronted with the tax system of the other country is computed according to

$$\hat{y} = \alpha^S + \beta^S X^G + \gamma^S Z^S \; , \tag{22}$$

where X^G are the wages and incomes after tax for the Swedish couples if they had been confronted with the German tax system, and y is then substituted into (21).

Similarly, for German wives their actual labor force participation is given by:

$$y = \alpha^G + \beta^G X^G + \gamma^G Z^G \; , \tag{23}$$

where symbols are analogous to those of relation (21). Predicted labor force participation of German wives, under the assumption that they would be confronted by Swedish taxes, is calculated according to

$$\hat{y} = \alpha^G + \beta^G X^S + \gamma^G Z^G \; , \tag{24}$$

where X^S are the wages and incomes after Swedish tax of the German couples.

The mean values of $X^G - X^S$ for Swedish wives are given in Table 5 a distinguished into mean net wage increase and mean income increase. The mean values of $X^G - X^S$ are given in Table 5 b for the German wives. The income variable is the same in all regressions because it is computed as the income the couple would have if the wife did not earn any income. Swedish couples would on average have 20 000 more Swedish crowns after tax in the case of one earner couples and German couples would have 23 300 Swedish crowns less if the wives did not earn any income. The net wage would be decreased for Swedish wives by 6.3 crowns per hour for a 10 h working week and by 2.3 crowns per hour for a 40 h working week.

The results point in the expected direction. Swedish wives would decrease their labor force participation from 80.2% to 60.4% if confronted with the German tax system (column 2) and German wives would increase their participation from 50.3% to 60.0% if confronted by the Swedish tax system. The after tax income variable is more important than the wage variable in this comparison.

7. Concluding remarks

International trends in income taxation are towards decreasing progressivity, and the tax effects studied in this paper are more pronounced the higher the progressivity. In Germany, in 1985, the "law on incentive stimulating tax reductions and relief of families" was passed (Drengel 1987), which reduces progressivity, and increases the basic family based tax deductions in the direction of taxing according to the number of people, who live off the family income. The German system, therefore, goes more in the direction of more family dependence rather than more individual taxation. However, the marginal tax rates are reduced giving somewhat increased incentives for married women to work (see Kaiser et al.

1989). In Sweden the maximum marginal tax rate has been lowered from 84% in 1984 to 75% by 1988. Separate taxation is however not questioned by any of the political parties. The tax reform of 1991 marks a drastic change making taxes proportional for most tax payers and the maximum marginal tax rate will be 55%.

Joint or split taxation tends to conserve sex roles and make women more dependent on their husbands by decreasing married women's economic remunerations from participating in the labor force and make market-related human capital investments. Econometric evidence reported in this paper shows that German wives would increase labor force participation if faced with Swedish taxes, and that Swedish women would decrease their participation if faced with German taxes. Since the tax systems in fact also have effects on returns to human capital, part of the before-tax wages are also explained by differences in the tax systems. A full account of indirect effects would therefore ascribe a higher proportion of the differences in women's labor force participation to the tax systems. Therefore, the difference between the Swedish and German tax systems is an important factor in explaining why Swedish women participate more than German women in the labor market, although paid parental leaves and subsidized childcare are other important explanations for the Swedish situation.

Appendix A

Taxes and social security payments in Germany in 1984

The following deductions have been made:
  employee deduction (Arbeitnehmer) 480 DM
  (Christmas deduction only for self employed)

  earnings cost deduction (Werbungskosten) at least 564 DM

  deduction for special costs (Sonderausgabenfreibetrag) 270 DM

  Child deduction (432 DM per child)

The tax is calculated from taxable income i.e. after deductions according to:

define: y = taxable income
        $x = (y\text{-}18\,000)/10\,000$
        $z = (y\text{-}60\,000)/10\,000$

income:	*tax*
$4212 < y \leqslant 18\,000$	$0.22y - 926$
$18\,000 < y \leqslant 60\,000$	$(((3.05x - 73.76)x + 695)x + 2200)x + 3034$
$60\,000 < y \leqslant 130\,000$	$(((0.09z - 5.45z + 88.13)z + 5040)z + 20\,018$
$130\,000 < y$	$0.56y - 14\,837$

Social security payments per month are calculated according to:

M = monthly gross earnings
sick security

$M \leqslant 390$	0
$390 < M \leqslant 3900$	$0.055M$
$3900 < M$	DM 214.50

pension + unemployment:

$M \leqslant 390$	0
$390 < M \leqslant 5200$	$0.116 M$
$5200 < M$	DM 603.20

Appendix B

The Swedish tax system 1984

1. Community tax, proportional and different for each of the 285 communities average over communities is 30%

2. *Basic state income tax*
   Basic amount equals 7300 SEK = b
   this is the basic deduction
   y = taxable income

   interval nr.

1	+ 3%	on	$b < y < 4b$
2	+ 4%	on	$4b < y < 7b$
3	+ 7%	on	$7b < y < 8b$
4	+10%	on	$8b < y < 9b$
5	+19%	on	$9b < y < 10b$
6	+23%	on	$10b < y < 12b$
7	+26%	on	$12b < y < 13b$
8	+29%	on	$13b < y < 14b$
9	+32%	on	$14b < y < 15b$
10	+36%	on	$15b < y < 17b$
11	+38%	on	$17b < y < 19b$
12	+39%	on	$19b < y < 20b$
13	+40%	on	$20b < y < 26b$
14	+41%	on	$26b < y < 30b$
15	+44%	on	$30b < y$

3. Additional State tax

   interval nr.

1	+ 3%	on	$19b < y < 20b$
2	+ 5%	on	$20b < y < 23b$
3	+ 7%	on	$23b < y < 26b$
4	+ 8%	on	$26b < y < 45b$
5	+10%	on	$45b < y$

The reason the state tax is split into "basic" and "additional" is that a limitation on mortgage interest deductions applies to additional state tax.

A deduction if there is at least one child aged 16 and younger is allowed for the secondary wage earner for a maximum of 2000 SEK.

Union fees can be deducted at a maximum of 500 SEK.

Source: Skatte — och taxeringsförfattingarna 1985

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