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Optimal Taxation: The Design of Child Related Cash- and In-Kind-Benefits

Peter Haan
Katharina Wrohlich

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Peter Haan
DIW Berlin and FU Berlin

Katharina Wrohlich
DIW Berlin, FU Berlin and IZA

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IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

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ABSTRACT

Optimal Taxation: The Design of Child Related Cash- and In-Kind-Benefits*

This paper contributes to the debate about the optimal design of tax-transfer systems. Based on the theory of optimal taxation, combined with microsimulation and microeconometric techniques we derive the welfare function which makes the current German tax and transfer system for single women optimal. Furthermore, we compare the welfare function conditional on the presence and age of children and asses how reforms of in-kind childcare transfers would affect the welfare function. This analysis allows us to derive conclusions about the optimal design of child related transfers and in-kind benefits.

JEL Classification: C23, C25, J22, J64

Keywords: optimal taxation, labor supply behavior, transfers for children

Corresponding author:

Katharina Wrohlich
DIW Berlin
Mohrenstrasse 58
10117 Berlin
Germany
E-mail: kwrohlich@diw.de

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1 Introduction

This paper contributes to the debate about the optimal design of tax-transfer systems with a specific focus on cash and in-kind benefits for single parents with children. In most developed countries, governments channel a large share of their overall transfers towards households with children. However, the design of these child related transfers strongly differs between countries. Transfers range from child benefits, child tax allowances, generous out-of-work transfers for families with children, in-work transfers conditional on children, to subsidies - in-kind or cash - for childcare. In general, transfers generate equity for a society through redistribution of income, yet lead to inefficiencies through distortions. This describes the well known trade-off between equity and efficiency of income taxation and transfers.[1] The degree of equality induced by child related transfers and the associate distortions depend on the design of the country specific transfer programs. Whereas in several countries child transfers are seen as general support for families with children and as a way to alleviate poverty and increase equity, in other countries a large share of the transfers for households with children is conditioned on employment of the parents. A central purpose of the latter class of transfers is to increase efficiency by fostering employment of parents, in particular mothers who have in general a very low employment rate. These differences in the design of transfers highlight the general dilemma of public transfers. Means tested transfers for households with children unconditional on the employment status reduce inequality in a society by reducing poverty. However, on the other hand transfers unconditional on employment reduce work incentives, and thus lead to inefficiencies. Transfers conditional on employment have by definition a positive effect on efficiency in terms of employment, yet have no effect on the poverty of needy families who are out of work. Thus, the optimal design of the tax-transfer system depends on a society's preferences for equity and efficiency.

The central purpose of this paper is to empirically asses the optimal design of tax-transfer systems for single households with children in Germany. In particular, we will not only take cash transfers targeted at families with children, but also in-kind benefits into account. This is important since in Germany, child related in-kind transfers, that

[1] Note, in this paper we define efficiency only in terms of employment. Efficiency e.g. in terms of child rearing cannot be discussed in the proposed framework.

is transfer which are channeled directly to institutions and not to households, make up a large share of resources allocated towards families with children.

The starting point of our analysis are two observations. First, child related in-kind as well as cash benefits strongly depend on the age of the children. Thus, it seems that the society weights the equity-efficiency trade-off differently for families with children of different age groups. For example, in Germany single mothers with very young children are generally not expected to participate in the labor market and if, only for few hours, and are thus provided with relatively higher out-of-work transfers. Obviously, for this group, society is more concerned about equity than efficiency in terms of employment. Second, the design of in-kind benefits in terms of subsidized childcare are currently under rigorous reform in Germany. While subsidized childcare for children younger than three years has hardly been available in the past decades, at least in West Germany, recently several reforms have been introduced that aim at increasing childcare for this group of children conditional on employment of their parents.

The optimal design of transfer programs, and the trade-off between equity and efficiency has been intensively analyzed in the economic literature. The seminal theoretical contribution is Mirrlees (1971) which has been extended in several dimensions over the last decades. The theoretical extension which is central for this analysis is Saez (2002), who proposed a discrete model of optimal taxation where individuals can adjust their labor supply behavior along the extensive (participation) and the intensive (working hours) margin. The empirical literature on the optimality of taxation and transfers is still scarce, recent examples based on microsimulation techniques are Immervoll et al. (2007) and Bourguignon and Spadaro (2005). Blundell et al. (2007) combine microsimulation and microeconometric techniques and apply the theoretical model of optimal taxation of Saez (2002) to discuss the transfer system towards lone mothers in Germany and the UK.[2]

We apply the same empirical method as in Blundell et al. to discuss the optimal design of income taxation and transfers for single women conditional on children and

[2]There exists several empirical studies on welfare effects of tax reforms (e.g. Aarberge and Columbino (2005)). However these studies differ from the models closely linked to the optimal income tax theory as they are not derived from an optimal tax formula but rather from structural econometric models of labor supply behavior.

the age of children in Germany. We focus on single women for a number of reasons. First, lone mothers are eligible for generous transfer programmes, and the interaction of transfer programmes and the income tax system can generate budget constraints with high and variable effective marginal tax rates. Second, there is a (partly emotional) debate about the extent to which lone mothers should be supported by the state, even when they do not work, and about the support singles without children should receive from the government. This is in particular true for lone parents with pre-school age children. Moreover, in practical terms, focusing on lone adult households allows us to avoid the substantial complexity to both, models of labor supply, as well as optimal tax theory that arise when dealing with household decisions of labor supply. We extend the paper of Blundell et al. (2007) by comparing the optimal design conditional on the age of children and by explicitly accounting for in-kind subsidies of childcare.

In this paper, we do not derive an optimal tax schedule based on some normative assumption about the welfare function of a society. Instead, we follow the idea of Bourguignon and Spadaro (2005) and derive the welfare function of the society which makes the current German tax and transfer system of single women optimal. Furthermore, we compare the welfare function of the society conditional on the presence and age of children and asses how the reform of in-kind childcare subsidies affects the welfare function.

2 Institutional Background

The purpose of this section is to provide an overview about the German tax and benefit system with a particular focus on transfers and taxation of households with children. Moreover, we discuss the work incentives the current design of the tax and transfer system induces.

2.1 Main characteristics of the German tax-transfer system

The main characteristics of the German tax-transfer system are a progressive income tax schedule with a basic allowance of 7,664.[3] Additionally, there exist child allowances amounting to 2,924 Euro per year per child. Married spouses can file jointly and make

[3] All numbers are for the fiscal year 2005.

use of full income splitting. Single parents can draw an additional single parents' tax allowance amounting to 1,208 Euro per year.

The most important cash transfer for families with dependent children in Germany is the child benefit ("Kindergeld") that amounts to about 150 Euro per month per child and is granted regardless of the family's income. For children younger than 3 years, there is an additional child rearing benefit ("Erziehungsgeld") of 300 Euro per month that can be drawn for a maximum period of 24 months. This benefit is means-tested and is only granted if one of the parents is on parental leave, i.e. not working more than 30 hours per week. The income thresholds up to which this benefit is granted differ by age of the child and amount to about 30,000 Euro in the first six months after childbirth and are reduced to about 16,500 Euro per year for children aged between 7 and 24 months. Above these income thresholds, the benefit is withdrawn at a rate of 62 percent based on household income.[4]

Besides these family related benefits, Germany has a quite generous system of out-of-work benefits. Unemployed individuals who are eligible for unemployment benefits within the social security system receive about 65% of their net earnings for several months, depending on their age and the time they have been contributing to the social security system. People who do not have claims to unemployment benefits receive social assistance. Social assistance has been rigorously reformed in 2005. Before this reform, there were two different benefits. Long-term unemployed persons who were eligible for transfers from the unemployment insurance were granted a transfer called "Arbeitslosenhilfe" that amounted to 53% of their net earnings prior unemployment. Persons who were not eligible to this transfer got "Sozialhilfe" which consisted of a basic transfer amounting to about 300 Euro per month with additional transfers for children, single parents etc. Costs for housing were paid extra, depending on the size of the household. In 2005, the two transfers "Arbeitslosenhilfe" and "Sozialhilfe" were combined into one transfer scheme called "Arbeitslosengeld II" that does not depend on previous earnings. This transfer now consists of a basic allowance of about 350

[4]In January 2007 the child rearing benefit was replaced by a new scheme of parental leave benefits called "Elterngeld". This new benefit is not means-tested but rather related to pre-birth earnings of the parent who is on parental leave. Parents who have not been working prior to the birth of their child receive a minimum amount of 300 Euro per month. The means test has been abolished, however the maximum duration period has been reduced to 14 months. For more details on this reform, see Spiess and Wrohlich (2008).

Euro per month. It is topped up by allowances for children, other family members as well as housing costs depending on household size. Single parents get an additional allowance. For a single mother with a child under 14 years these benefits add up to 676 Euro per month plus housing costs amounting to 350 Euro on average. Note that the child benefit is not added up to social assistance but counted as income that is fully withdrawn. In contrast, the child rearing benefit is granted on top of social assistance. Once recipients of "Arbeitslosengeld II" start working, the transfer is withdrawn at a rate of 70-85 % depending on the amount of wage income.

In contrast to countries such as the UK or the US, the tax and transfer system in Germany does not include large transfer programs which are conditional on employment, such as the Working Tax Credit (WTC) or the Earned Income Tax Credit (EITC). The only exception is the "Kinderzuschlag" which is a small transfer program for families with dependent children called. The scheme is targeted to families who have enough earnings such that the minimum subsistence level – defined by the amount of the "Arbeitslosengeld II" transfer – is met for the parents, however, not for the children. These families receive a transfer of 140 Euro per month per child that is withdrawn at a rate of 70%. The scheme is not very generous in terms of the number of recipients, since the income range of eligibility for this transfer is very small. Moreover, single mothers receiving maintenance payments for their children by the children's father are not eligible to this transfer. This is because the "Kinderzuschlag" is fully withdrawn if the child has income on his own, and maintenance payments are considered as income of the child.

The described design of the current German tax and transfer system does not lead to strictly defined "in-work credits" characterized by negative marginal tax rates as present e.g. in the US system. Hence, in Germany overall transfers in-work are strictly lower than transfers out-of-work. In this respect the German system has the optimal design according the theoretical model of Mirrlees.

2.2 Childcare institutions

Subsidies for childcare in Germany are mostly granted directly to childcare centers rather than to parents. Hence, these transfers can be characterized as in-kind transfers

rather than direct cash transfers to the households. [5] Childcare centers are either run by local authorities such as the communities or by private, mostly non-profit institutions such as churches or other associations who all receive subsidies. The parents' fees that are charged by childcare centers are income-dependent and make up 30 percent of total costs at most. On average, the parents fees amount to about 70 Euro per month for a part-time slot and 110 Euro per month for a full-time slot. While on the one hand parents' fees for subsidized childcare are relatively low compared to other European countries (see e.g. Immervoll and Barber (2005)), availability of childcare is limited, in particular for children under three years living in West Germany. The average availability rate of childcare slots for this group of children amounted to 3 percent in 2002. East Germany, however, has high availability ratios amounting to 37 percent on average (see Wrohlich (2007a) for more details on the availability of childcare by age group and different regions in Germany).

Previous empirical studies have shown that there is a considerable excess demand for subsidized childcare slots, in particular for children under three years. More than a third of all children under three years do not have access to a childcare slot although their parents demand one Wrohlich (2007b). These families thus have to rely on privately organized childcare that comes at markedly higher costs. On average, privately organized full-time care costs about 860 Euro per month, part-time care about 430 Euro per month. Based on this information, a sort of "expected" costs (ec) of childcare can be computed. These costs consist of a weighted average of the subsidized parents' fees (c^s) and the private costs (c^m), where the weights are calculated on the basis of the probability (π) that a child does not have access to subsidized childcare (see Wrohlich (2007a) for more details):

$$ec = c^s \cdot (1 - \pi) + c^m \cdot (\pi) \tag{1}$$

The individual rationing probability π is estimated on the basis of a partial observability model of demand and supply of subsidized childcare such as suggested in Wrohlich (2007b). Averages of these probabilities are reported in Table 1 for children

[5] The only exception is that childcare costs can be deducted from taxable income up to a maximum amount of 1,500 Euro per year per child. From January 2007 on, the possibility to deduct childcare costs from taxable income has been formulated more generously. The amount of deductable expenses has been increased up to 4,000 Euro per year per child.

of three different age groups. Rationing is highest for children in the youngest age group and it is also relatively high for school children who need afternoon care in the case that their mothers are working full-time.

As can be seen from Table 1 below, expected costs of childcare are considerably higher than average parents' fees and amount to about 350 Euro per month for a full-time slot for children of the younger age group. The difference between parents' fees and expected childcare costs is lowest for children aged 3 to 6, which is due to the low level of rationing of subsidized childcare for this group of children.

Table 1: Average estimated parents' fees for a subsidized slot and expected costs of childcare

	Children aged		
	0-2 years	3-6 years	7-10 years
Probability of being rationed with respect to center-based care	0.30	0.03	0.18
Parents' fees for center-based care:			
part-time	66	70	80
full-time	97	104	–
Expected costs of childcare:			
part-time	198	80	136
full-time	357	134	–
Expected childcare subsidies:			
part-time	264	357	289
full-time	540	739	–

Note: Euro per month.
Source: Own calculations on basis of SOEP, wave 2005.

In the empirical analysis, we will interpret the difference between the costs of privately organized childcare c^m and the expected costs of childcare ec as subsidies within the tax-transfer system. These "expected subsidies" es can thus be stated as

$$es = c^m - ec \tag{2}$$

and are also reported in Table 1. It becomes evident from this Table that the subsidies resulting from the in-kind provision of subsidized childcare are by far the largest child-related transfer for the group of families with children under 10 years.

Note that we assume that mothers with children from three to six years use part-time child care even if they are not working. This is in line with the empirical distribution of childcare utilization in Germany (see Wrohlich (2007a)). Mothers with children younger than three years, however, are assumed to purchase childcare only if

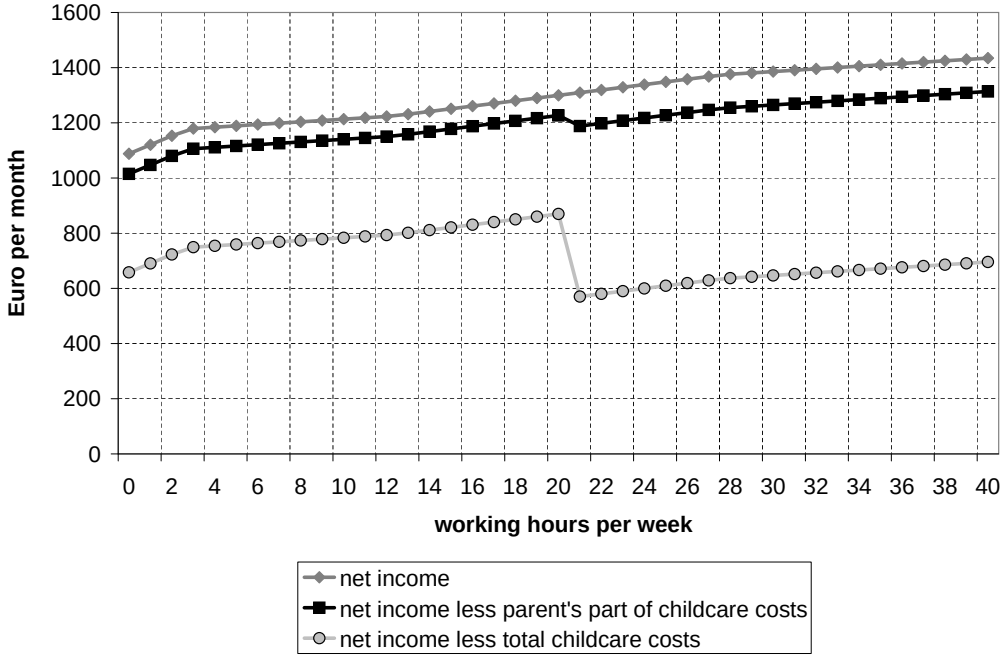
they are working. Thus, by definition, only those with children younger three who are working receive in-kind subsidies. We use a similar argument for mothers with children in primary school age, i.e 7-10 years. We assume that mothers only have to purchase childcare in the afternoon if they are working full-time. The costs and benefits of schooling are not considered in this paper.

2.3 Work incentives for single mothers with children

Given the relatively generous out-of-work benefits and the relatively high childcare costs that result from the excess demand for subsidized childcare slots, the work incentives for single mothers are relatively low. One way to summarize the structure of work incentives is to visualize budget lines for an example household. Figure 1 shows net household income of a single mother earning low wages (7.5 Euro per month, which corresponds to the 25th percentile of the female wage distribution) with a 4-year old child as a function of her working hours. The dark grey line on the top depicts net income as a function of working hours. The budget line of this household is very flat over the whole distribution of working hours which is due to the high withdrawal rate of the means tested transfers. If the mother increases working hours, net household income increases only by a very small amount. This is even more striking if childcare costs are taken into account. The light grey dotted line on the bottom depicts net income less total costs of childcare. As has been explained above, we assume that the mother with children between 3 and 6 years is purchasing part-time childcare even if she is not working. If her working hours exceed 20 hours, we assume that she needs to buy full-time care. This is the reason for the large kink in the budget line at the 21st hour. However, parents don't have to bear full childcare costs as has been explained above, but only "expected costs of childcare", i.e. parent's fees that are highly subsidized if they have access to such a slot, and full costs otherwise. Taking into account these subsidies that are incorporated in the "expected childcare costs" leads to the dark solid line in the middle. This line depicts the actual disposable income of a family. The difference between this line and the dotted line at the bottom can be interpreted as the amount of the childcare subsidies.

As can be seen from the Table above, expected childcare costs differ considerably between age groups of children because of different amounts of subsidies. Thus, dispos-

Figure 1: Net household income and childcare costs

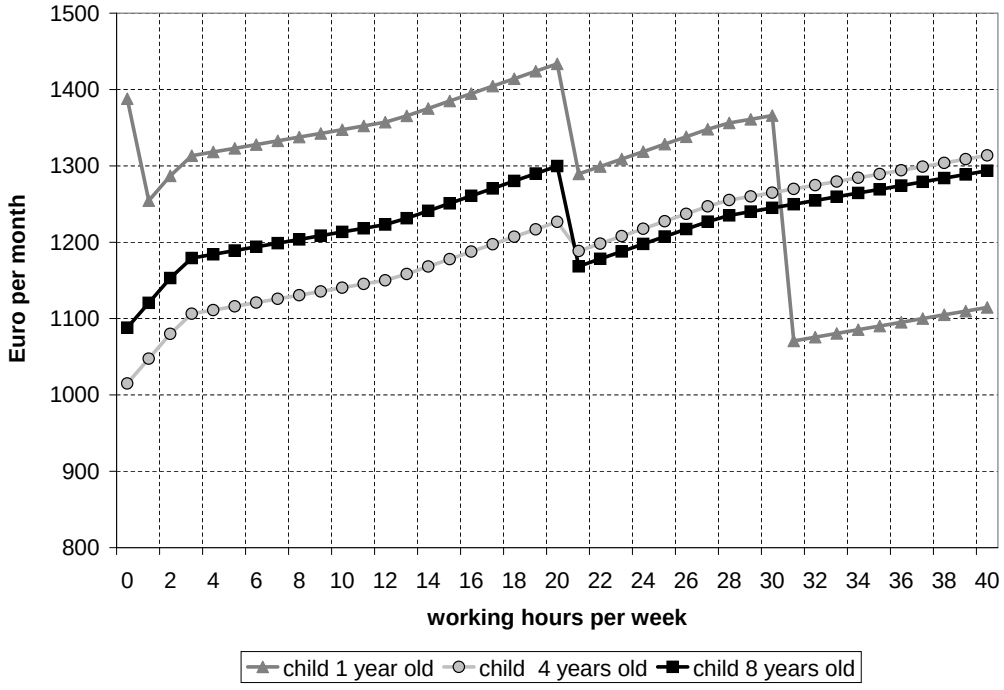


Source: Own depiction.

able income as a function of working hours looks differently for families with children in different age groups. Figure 2 summarizes budget constraints of a single mother with an hourly wage of 7.5 Euro for children of three different age groups. The uppermost line depicts disposable income of a mother with a 1-year old child. Income for this family type is highest because of the child-rearing benefit that is granted on top of social assistance and withdrawn only above a threshold of 16,500 Euro. However, this benefit is fully withdrawn once the mother's working hours exceed 30 hours, making full-time work for this group of individuals very unattractive. Note also that the budget line for this household types shows a large kink at the first working hour. The reason for this is that we assume that mothers with children in this age group do not use childcare if they are not working. Once they start to work, however, we assume that they need to buy at least part-time childcare.

The light-grey dotted line depicts the budget line for single mothers with a 4-year old child. In absolute terms, this household has a lower disposable income, however, work incentives are markedly higher than for women with younger children. First, the

Figure 2: Disposable income as a function of mother's working hours by age of child



Source: Own depiction.

child rearing benefit is not granted any more, and second childcare costs are much lower. The black line shows disposable income of a single mother with a child who is 8 years old. Since this child is attending school in the noon, we assume that childcare costs only occur if the mother's working time exceeds 20 hours. Since rationing of subsidized childcare is much more present for this group of children than for children aged 3 to 6, disposable income of mothers working more than 20 hours with children in this age group is lower than for mothers with children aged 3 to 6.

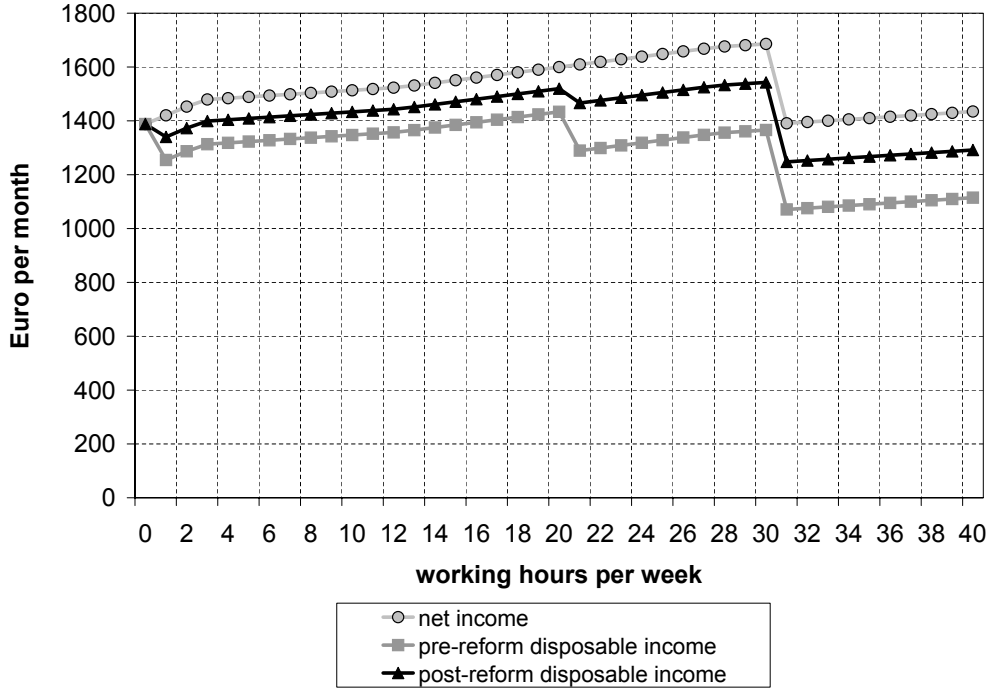
2.4 Recent childcare policy reforms

In the past couple of years, the German federal government has been stressing the importance of childcare opportunities, not least due to the declining fertility rates and the low labor force participation of mothers. At the center of the debate are children in the age group under three years. For children between three and six years, parents have a legal claim for a part-time slot regardless of their working status since 1996. For children below three years, however, availability of childcare slots is limited, as has

been explained above. In 2005, the government passed a law that aims at increasing the provision of childcare slots for children under three years. According to this law ("Tagesbetreuungsausbaugesetz – TAG"), childcare slots have to be provided for all children whose parents work or wish to work. The necessary additional number of childcare slots will be provided by 2010. Thus, this reform proposal can in fact be seen as transfer conditional on work similarly to the WFTC in the UK. However, in contrast to the UK this transfer is a work conditioned in-kind benefit. As a consequence of the reform, childcare costs for households with children under three years are markedly reduced if parents are working.

Figure 3 shows how disposable income changes for a single mother with a 1-year old child. The light-grey dotted line at the top depicts net income without considering childcare costs. The grey line at the bottom depicts the family's disposable income before the reform, while the black line shows disposable income after the reform. Because availability of childcare is increased, mothers who did not get a childcare slot before the reform do not have to rely on the relatively expensive private childcare and thus childcare costs are markedly reduced.

Figure 3: Disposable income before and after childcare reform



Source: Own depiction.

In section 4, we will simulate this "Tag"-Reform. In a second step, we will extend the program also to children aged six to ten years. More specifically, we will assume that afternoon-care for children in primary school age will be provided at the current parents' fees for all children whose mothers are working.

3 Methodology

In the following section we present the methodological framework for the analysis of the optimality of the tax-transfer system including in-kind child related benefits. As stressed above the theoretical background for our analysis is the optimal tax model which has been derived by Saez (2002). We follow Blundell et al. (2007) and use microsimulation and microeconometric techniques to apply the theoretical model for an empirical analysis of the optimal design of income taxation.

3.1 The Theoretical Model

The problem of optimal income taxation can be described as follows: a social planner, e.g the government, maximizes a social welfare function given its budget constraint. The social welfare function is a transformed function of individual utilities which themselves depend on net household income, or consumption, and leisure. In the framework of optimal income taxation, the margin along which individuals can adjust their behavior is their labor supply. This leads to the above mentioned controversy between equity and efficiency. Whereas transfer programs, or negative tax payments, can increase the disposable income of the disadvantaged, and thus increase their well-being, financing these programs with positive income tax rates introduces disincentives to work, and, in general, will lead to a reduction in labor supply of the working population.

Saez (2002) sets up an optimal tax problem where there are $I + 1$ discrete groups in the labor market: I groups of individuals who do work, plus one group consisting of those who do not work. In the empirical analysis we distinguish the $I+1$ discrete groups by gross earnings. Individuals choose whether or not to participate (the extensive margin) and which group to choose (the intensive margin). In this framework, optimal taxation has the following form:

$$\frac{T_i - T_{i-1}}{C_i - C_{i-1}} = \frac{1}{\mu_i h_i} \sum_{j \geq i}^{I} h_j [1 - g_j - \eta_j \frac{T_j - T_0}{C_j - C_0}]. \quad (3)$$

In this expression, T_i is net tax paid by group i and C_i is the net household income of this group, so the term on the left-hand side is the extra tax paid when moving from group $i-1$ to i divided by the gain in net income. Non-workers receive benefits -T_0, by definition identical to C_0. The gross earnings of group i, equal to $C_i + T_i$, are exogenously fixed. h_i measures the share of group i in the population. The social welfare function is summarized by g_i, the weight the government assigns to group i. The intensive elasticity, μ_i, is defined as:

$$\mu_i = \frac{C_i - C_{i-1}}{h_i} \frac{dh_i}{d(C_i - C_{i-1})}. \quad (4)$$

This mobility elasticity captures the percentage increase in supply of group i when C_i-C_{i-1} is increased by 1%, and is defined under the assumption that individuals are restricted to adjust their labor supply to the neighboring choice.

Finally, η_i is a measure of the extensive elasticity, and is defined as the percentage of individuals in group i who stop working when the difference between the net household income out of work and at earnings point i is reduced by 1%:[6]

$$\eta_i = \frac{C_i - C_0}{h_i} \frac{dh_i}{d(C_i - C_0)}. \quad (5)$$

The main implication of the optimal tax rule above is that the optimal tax system depends heavily on whether labor supply responses are concentrated at the intensive or extensive margin. When the extensive elasticity is assumed to be zero, Saez' model gives results similar to Mirrlees', where negative marginal tax rates are never optimal. However, the greater is the extensive elasticity compared to the intensive elasticity, the more likely it is that the optimal schedule will feature relative smaller guaranteed income for non-workers, and negative marginal taxes at low levels of earnings.

[6] As discussed by Blundell et al., this is different from the conventional extensive elasticity, or elasticity of labor force participation, which is defined as the proportional increase in workers when net incomes rise by 1%.

3.2 Empirical Framework

The data base for the empirical analysis is the Socio Economic Panel (SOEP). The SOEP is a representative sample of private households living in Germany with yearly information on household incomes, hours worked and the household structure.[7] The data set includes detailed information about the socio-economic situation of more than 12,000 households that represent all private households living in Germany. For this analysis, we draw on an unbalanced panel of single women for the fiscal years 1999 - 2004.[8] We focus on women aged between 18 and 60 years, and exclude self-employed, retired and women in full-time education. Overall, this results in 5801 observations.

Table 2: Descriptive Statistics by Family Type

	Share	Employment	Education	Gross Wage	Age
Without Children	.57	.85	.31	17.89	40.50
Children >10	.24	.79	.18	16.54	44.47
Children 7 - 10	.06	.69	.21	15.13	37.89
Children <7	.11	.45	.13	12.91	33.44
All		.80	.26	17.08	40.53

Note: Employment measures the share of women with positive working hours. Education is the share with highest school degree (Abitur, Fachabitur). Gross Wage is the unconditional gross hourly wage in Euro. For non-working women the wage is estimated accounting for selectivity.
Source: Own calculations on basis of SOEP, wave 2000-2005.

Table 2 provides some descriptive statistics for the whole population and for the key sub groups of our analysis. Single women without children, with children in secondary school age or older, i.e. older than 10 years, with children in primary school age, aged 7 - 10 years, and single women with children aged 6 years or younger. As discussed above transfers differ for children younger than 3. On the one hand, child rearing benefits for this group are very generous and only withdrawn at high incomes. Yet, on the other hand, availability of public child care is very low for children in the youngest age group leading to high child care costs. Therefore, it would be interesting to further distinguish the group with children below three years. However, unfortunately the data yield too few observations for working women with very young children to guarantee a

[7] A description of the SOEP can be downloaded from www.diw.de/soep; see also Haisken De-New and Frick (2005).

[8] For the fiscal information we make use of the retrospective information. Thus, we use the waves 2000 - 2005.

reliable and robust analysis.

Roughly 60% of all singles have no children, about 25% have children older than 10 years, about 7% are lone mothers with primary-school age children, and less than 10% have children younger than 7 years. The descriptive statistics show the expected pattern: Employment rate is with over 85% highest for singles without children and only slightly lower when children are at school age. However, less than 45% of lone mothers with pre-school age children are employed. Furthermore, lone mothers with young children have on average the lowest share of high education, and as a consequence the lowest gross wages, and are on average about 10 years younger than the overall population mean.

In order to apply the above specified optimal tax model to analyze the design of the tax-transfer system in Germany, information about the tax and transfers, the gross earnings, the behavioral parameters and the distribution of the population along the discrete points is required. As stressed above, we define the $I+1$ discrete points along the gross earnings distribution. This is the relevant information, since governments mainly condition the tax schedule on gross earnings. We apply a microsimulation model for Germany (STSM) to derive the tax and transfer payment and the resulting net household income at each discrete point.[9] The behavioral parameters, i.e. preferences for income and leisure, that allow the calculation of the labor supply elasticities on the extensive and the intensive margin, as defined above, are estimated based on a static structural labor supply model.

3.3 Labor Supply Estimation

In line with Blundell et al. (2007) we do not calibrate the labor supply elasticities of various groups, but derive labor supply elasticities from a static structural discrete choice model of labor supply, as e.g in van Soest (1995). This allows us to account for heterogeneity of behavioral responses in the population which is crucial if we want to assess the design of transfers for the subgroups defined above, i.e. conditional on the presence and age of children.

As we focus only on single households the framework for labor supply is relatively

[9]The microsimulation model STSM includes all relevant components of the German tax and transfer system. For more detail, see (Steiner, Haan, and Wrohlich, 2005).

straightforward. For this group we define 6 discrete working choices, inactivity, three part time and two full time alternatives which describe the distribution of the working behavior.[10]

At each discrete hours point j, the household i in period t receives utility V_{ijt} which is assumed to depend on a function U of the woman's leisure Lf_{ijt}, her disposable income C_{ijt} and on observed and unobserved household characteristics, Z_{it} and a_i, and on a random term ϵ_{ijt}:

$$V_{ijt} = U(Lf_{ijt}, C_{ijt}, Z_{it}, a_i) + \epsilon_{ijt}. \tag{6}$$

Following McFadden (1974) we assume that the error terms ϵ_{ijt} follow an extreme value distribution, and therefore the discrete choice model can be estimated by conditional logit. The individual specific error term a_i is specified nonparametrically following Heckman and Singer (1984). We assume that a_i is described by a bivariate discrete distribution with two points of support (mass points) (a_1, a_2) which are constant for all households.[11] Each household has a probability π_k, k $\in \{1, 2\}$ for each point of the unobserved heterogeneity. The likelihood to be maximized is then:

$$L = \prod_{i=1}^{n} \sum_{k=1}^{2} \pi_k(a^k) \prod_{t=1}^{T} \prod_{j=1}^{J} Pr(Y_{it} = j)^{d_{itj}}, \tag{7}$$

where $d_{itj} = 1$ if j is the chosen alternative and 0 otherwise, and $Pr(Y_{it} = j)$ is the choice probability for alternative j. For the specification of the utility function, we assume a utility function quadratic in income and leisure, similar to Blundell, Duncan, McCrae, and Meghir (2000).

In the Appendix, we discuss the results of the estimation by providing information about the behavioral reactions of households induced by changes in work incentives.

4 Optimal Welfare Function

Given the theoretical model of Saez and the empirical strategy we discuss the optimality of the tax-transfer system for single mothers in Germany. Instead of deriving the

[10] The following hour classification is used: [0,5],]5,15],]15,22],]22,28],]28,35], >35.

[11] More flexible models with more points of support did either not affect the results or did not converge.

optimal tax schedule given an assumed welfare function, as e.g in Blundell et al. (2007), we follow Bourguignon and Spadaro (2005) and derive the welfare function which makes the current tax and benefit system for single women optimal.

At first glance it might seem problematic to derive an optimal tax schedule for a sub population, in our case single women. However, the government can positively or negatively discriminate single households and explicitly targets transfers towards singles with children.[12] In other words, in this analysis we discuss the optimality of income taxation for single women and take taxation of the rest of the population as exogenous and constant.

As stressed above, we define the $I + 1$ discrete groups along the gross earnings distribution, I groups for positive earnings, and in addition the group of non-workers who have zero gross earnings. For this application we define 4 income classes along the actual earnings distribution of the relevant group. As we assume that households adjust their behavior along J discrete working points, it is necessary to translate the changes in the working behavior to the I discrete earnings points. Given the individual wage and the actual working behavior we assign each woman to the discrete income point which has the minimum distance to her individual wage working hours combination.

We perform simulations for the whole population and separately for the above defined subpopulations, conditional on the presence and age of children. For the simulation of the subgroups we make a further *ceteris paribus* assumption, namely that households in all other groups are not affected and that their tax schedule remains constant.

As mentioned above, childcare subsidies by the government form the most important part of overall child related transfers. In our analysis we treat those subsidies in the same way as general child benefits and other benefits for single households. In the Appendix (Table 7) we provide simulations that do not take into account the income generated by in-kind childcare facilities.

Table 3: Optimal Welfare Function: Status Squo

Gross Earnings	Net Income	Net Tax	Marginal Tax	Int. Ela.	Ext. Ela.	Share	Optimal Weight
			All Households				
-8	200	-208				0.24	1
201	290	-89	0.62	0.17	0.17	0.21	0.37
354	342	12	0.65	0.04	0.10	0.33	0.45
462	404	58	0.45	0.03	0.12	0.21	0.47
			With Children younger 7 years				
-70	298	-368				0.54	1
41	331	-290	0.76	0.17	0.17	0.11	0.39
115	348	-233	0.86	0.06	0.15	0.23	0.29
177	383	-206	0.61	0.06	0.36	0.12	0.17
			With Children between 7 and 10 years				
0	289	-289				0.31	1
157	343	-187	0.67	0.18	0.18	0.16	0.32
243	374	-131	0.76	0.06	0.17	0.34	0.33
347	425	-79	0.56	0.05	0.14	0.19	0.40
			With Children older 10 years				
0	245	-246				0.24	1
220	319	-99	0.67	0.17	0.17	0.20	0.21
371	381	-11	0.59	0.05	0.11	0.34	0.38
486	440	46	0.50	0.02	0.12	0.22	0.40
			Without Children				
0	151	-151				0.17	1
265	248	17	0.63	0.14	0.14	0.23	0.27
416	318	98	0.54	0.03	0.07	0.38	0.42
545	389	155	0.44	0.03	0.10	0.22	0.41

Notes: Discrete points are defined along the group specific distribution of gross earnings. Earnings, incomes and transfers are given in Euro per week. Int. Ela. and Ext. Ela. measure the intensive and extensive elasticity as defined in Saez (2002). The optimal weights are expressed relative to the weight assigned to the group out of work.
Source: Own calculations on basis of SOEP, wave 2000-2005.

4.1 Optimality of the Tax and Benefit System: The Current System

In the first panel of Table 3 we present the simulation results for the population of all single women. As discussed above, we assume that lone mothers with children aged between 3 and 6 years use child care even when not working. Therefore, on average

[12]The income tax legislation in Germany mainly discriminates between households with and without children, and by marital status.

gross earnings out of work are negative. The in-kind transfers which households receive for child care are included in the net taxes. For the non-working women and the women at the lowest earnings point net taxes are negative, thus they receive higher transfers than the income taxes they pay. For the groups at higher earnings taxes exceed transfers. This explains why the net incomes are more equally distributed over the population than the gross earnings. Comparing the elasticities on the intensive and the extensive margin, we find that behavioral responses are stronger on the extensive margin which suggests that in work credits might be optimal Saez (2002). The weights that make the current tax and benefit system optimal are shown in the last column. For better interpretation we present the welfare weights normalized, relative to the optimal weight for the single women that are non working. In line with Blundell et al. (2007) our results show that the current tax and transfer system is only optimal when the government assigns lower welfare weights to the working population than to the non working population. We find that on average, the optimal weight for the working population are about 40% of the value for the non working population.

The picture slightly changes when focusing only on lone mothers with children younger than 7 years and assuming taxation of all other groups to be constant. In general, this is the group that receives the highest amount of transfers. On average transfers are higher than income taxation at all earnings points. This is reflected in the relatively even distribution of net household incomes. As mentioned above we assume that childcare subsidies for children younger than three years are conditioned on positive working hours of the mother. As can be seen from columns 5 and 6, the difference between the intensive and the extensive elasticity is in particular strong for the group of lone mothers with children younger 7 years and the difference is increasing over the earnings points. This explains the pattern of the welfare function which makes the current tax system optimal for this group. For the women working at the highest earnings points, the welfare weights are very low, about 10%. In addition to the high marginal tax rates even at the higher earnings points, this result is related to the relatively high elasticity at the extensive margin which might justify in work credits at this point, or at least higher transfers conditional on work. Thus, given the theory of optimal taxation, the only way to rationalize the current tax system are the low welfare weights the government assigns to this group.

The simulated welfare function for lone mothers with older children hardly differs from the optimal weights for single women without children. Relative to the weight assigned to the non working women, the welfare weights for the working women are relatively low. In contrast to lone mother with very young children, the welfare weight at the lowest earnings point is the lowest. At higher earnings points welfare weights are slightly increasing. This is related to the high marginal tax rates at low earnings. Most of the transfers are withdrawn at rates close to 100% and therefore marginal tax rates are highest when starting to work.

Comparing the welfare function conditional on the presence and age of children we find two main results. Society values the welfare of non-working lone mothers with pre-school age children relatively high and has a particular low value for women at higher earnings points who are mainly full-time working women. If children are older, society still has a high value for the non-working women but has stronger valuation for women at the higher earnings points. Moreover, when comparing these results to a simulation where in-kind childcare benefits are not explicitly modelled as part of the tax and transfer system, we find an important difference. Without consideration of in-kind benefits, we find that weights for working mothers with children under 7 years are negative (see Appendix). This rather strange result vanishes if we explicitly include in-kind childcare benefits.

4.2 Optimality of the Tax and Benefit System: Reforming Childcare Subsidies

In the following, we derive the welfare weights that would justify a reform of the childcare subsidies as discussed in section 2. This analysis is partly static, i.e. without behavioral changes. We assume that the distribution of women at the defined gross earnings points is not affected, yet we simulate the elasticities given the new incentives of the childcare reform. For this analysis we focus only on the overall population and the subgroups the reforms are targeted at, namely lone mothers with children younger than school age and and for the second reform, mothers with children in primary school age.

Table 4 yields the results of the TAG reform that is currently implemented. The changes for the overall population are relatively moderate as only the group with

Table 4: Optimal Welfare Function: Reform I

Gross Earnings	Net Income	Net Tax	Marginal Tax	Int. Ela.	Ext. Ela.	Optimal Weight
		All Households				
-8	200	-208				1.00
199	291	-92	0.56	0.17	0.17	0.39
352	343	8	0.66	0.04	0.10	0.46
459	406	54	0.42	0.03	0.12	0.48
		With Children younger 7 years				
-70	298	-367				1.00
33	337	-304	0.62	0.19	0.19	0.49
103	359	-255	0.69	0.06	0.15	0.45
161	398	-237	0.32	0.07	0.37	0.37

Note: see Table 3.

children younger than 7 are affected. For this group, however, we find marked changes. First, the reform increases work incentives. On average, net household income increases at all working points and the changes are increasing with gross earnings. The relative increase at the highest earnings point amounts to about 4%. The stronger incentives are reflected in the slightly increased labor supply elasticities, both on the extensive and the intensive margin. Yet, as discussed above, even for the group of lone mothers with young children behavioral responses to changes in income are moderate. In comparison to the status quo scenario, the relative weights for working lone mothers increase. The relative weight at the first earnings point increases from 0.39 to 0.49. Changes become even more relevant at higher earnings points where lone mothers make use of full time child care. This is in particular true for the last point, where the weights increase from 0.17 to 0.37.

Thus, our findings indicate that the current reform of in-kind benefits is only optimal when the society shifts higher welfare weights to the working lone mothers relative to those mother who do not work. Moreover, work at high earnings points which is mainly full time work receives the highest relative increase in the welfare function. Given the higher labor market participation rate of women and in particular mothers in several neighboring countries, e.g. France, and the current normative discussion about the compatibility of children and work, this shift in the welfare function seems plausible.

Table 5 shows the results for the second reform. This reform is in addition targeted to the group of lone mothers with children at primary school. Again, the overall effects

Table 5: Optimal Welfare Function: Reform II

Gross Earnings	Net Income	Net Tax	Marginal Tax	Int. Ela.	Ext. Ela.	Optimal Weight
		All Households				
-7	199	-206				1.00
197	291	-94	0.55	0.17	0.17	0.41
349	344	5	0.66	0.04	0.10	0.47
457	406	50	0.42	0.02	0.12	0.49
		With Children between 7 and 10 years				
0	285	-285				1.00
153	343	-189	0.63	0.17	0.17	0.32
228	385	-157	0.43	0.07	0.16	0.46
328	440	-112	0.45	0.05	0.15	0.48

Note: see Table 3.

are moderate, as the major share of single mothers is not affected by this reform. The more generous in-kind transfers for this sub group increase the work incentives as the net household income increases with gross earnings. This is only true for full time work, as part time child care is not affected by the reform. As discussed above, we do not account for neither costs nor subsidies for schooling. Therefore, we find most of the changes for this group at the higher earnings points, where women tend to work full time. For the households with children at primary school we find the expected pattern: Since part time working women do not benefit from the second reform the relative weight at the first earnings point remains relatively low with 32%. At the higher points however the relative weights are increasing due to the reform when comparing the weights to the status quo regime. The relative valuation for this group at higher working points increases from 40% to nearly 50%. Thus, again these results imply that a reform of the in-kind transfers for the group of lone mothers with primary aged school children, is only optimal if the society shifts higher relative welfare values to the working mothers.

5 Conclusion

This paper contributes to the empirical literature on optimal taxation. We combine a theoretical model of optimal taxation with microsimulation and behavioral econometric model to analyze the optimal design of the tax and transfer system of single women in

Germany. Two empirical observations motivate our analysis. First, the different design of transfer programs conditional on the presence and age of children and, second, current political reforms which aim at increasing the in-kind benefits for child care conditional on employment.

Our empirical results suggest that in general, German society has a relatively strong taste of redistribution towards non-working single women. The welfare weights for non working women are clearly higher than for the working, and this results holds regardless of the presence and age of children. The interesting difference conditional on children is that society seems to value part-time work of lone mothers with children younger than school age relatively higher than full-time work, whereas for women with older or without children, the opposite is true. For these groups full time work is valued stronger. We further find that a reform of in-kind childcare subsidies conditioned on employment markedly changes the welfare function of the society for the targeted groups. The "TAG" reform which is currently implemented in Germany with the aim to provide subsidized childcare slots for all children under three years with working parents, is only optimal from a welfare perspective if society increases welfare weights for full-time work, or more precisely work at higher earnings point. The second hypothetical reform, suggesting to extend child care facilities for part-time care of school-aged children leads to a similar result. This reform is only optimal if society increases the relative welfare weights for the working lone mothers and thus slightly shifting from the valuation of equity to efficiency.

However, even under the two reforms that allocate more subsidies towards working single mothers, the tax-transfer system is only optimal if the weights for non-working mothers are higher than for working mothers. Thus, we find that the system with higher work-conditioned in-kind transfers is only optimal if society still has a strong taste for equity, or a relative high welfare weight for the non-working single mothers.

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Appendix

Estimation Results

Instead of interpreting the coefficients estimated in the discrete choice model, we analyze the labor supply behavior by calculating labor supply reactions given a change in gross wages. The labor supply reactions are derived numerically based on the estimated preferences of the labor supply model. The gross-wage elasticities presented here can be interpreted as a general measure to understand how individuals react to changes in work incentives. Note, that these effects differ from those defined by Saez which will be derived in the following section, as the changes in work incentives differ.

The following table summarizes labor supply elasticities with respect to changes in labor market participation and with respect to working hours. In general, the labor supply responses of single women are very moderate. Only lone mothers with pre-school age children strongly react to changes in work incentives. The average elasticities with respect to participation is about 2 times larger than the overall population mean and the elasticity with respect to working hours even 3 times.

Table 6: Gross Wage Elasticities by Family Type

	Participation Elasticity	Working Hour Elasticity
Without Children	0.06	0.06
Children >10	0.09	0.09
Children 7 - 10	0.08	0.16
Children <7	0.15	0.24
All	0.07	0.08

Note: Elasticities are the relative change in Participation and Working Hours given a 1% increase in gross hourly wages.
Source: Own calculations on basis of SOEP, wave 2000-2005.

Table 7: Optimal Welfare Function - Without Child Care Subisdies

Gross Earnings	Net Income	Net Tax	Marginal Tax	Int. Ela.	Ext. Ela.	Share	Optimal Weight
			All Households				
0	200	-200				0.24	1
234	290	-56	0.62	0.17	0.17	0.21	0.30
383	342	41	0.65	0.04	0.10	0.33	0.42
496	404	92	0.45	0.03	0.12	0.21	0.44
			With Children younger 7 years				
0	298	-298				0.54	1
136	331	-195	0.76	0.17	0.17	0.11	0.40
265	348	-83	0.86	0.06	0.15	0.23	0.01
355	383	-28	0.61	0.06	0.36	0.12	-0.15
			With Children between 7 and 10 years				
0	289	-289				0.31	1
167	343	-176	0.67	0.18	0.18	0.16	0.35
295	374	-79	0.76	0.06	0.17	0.34	0.20
411	425	-15	0.56	0.05	0.14	0.19	0.32
			With Children older 10 years				
0	245	-245				0.24	1
224	319	-95	0.67	0.17	0.17	0.20	0.20
375	381	-7	0.59	0.05	0.11	0.34	0.37
490	440	51	0.50	0.02	0.12	0.22	0.39
			Without Children				
0	151	-151				0.17	1
265	248	17	0.63	0.14	0.14	0.23	0.27
416	318	98	0.54	0.03	0.07	0.38	0.43
545	389	155	0.44	0.03	0.10	0.22	0.41

Note: see Table 3.