The Effects of Personal Income Taxation on Labor Supply, Employment and Welfare: Empirical Evidence for Germany

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Preface

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Contents

Chapter 1

Introduction

Economic Efficiency and Redistribution

Progressive income taxation and transfer programs are of great importance in almost all developed countries.[1] Although the structure of the tax and transfer system differs substantially across countries, personal income taxation is regarded as the centerpiece of the tax system. In most countries income taxes provide the largest source of revenue for the government. At the same time, a major share of the government's budget is spent on transfer programs to provide income support to the poor. The central idea of progressive income taxation and public transfer programs is to partly balance negative and positive effects of individual fortune and thus to promote equal opportunities of self-realization and to provide insurance against income risk (Corneo, 2005a).

Income taxation creates distortions that might lead to substantial disincentives and inefficiencies for the economy. It affects in particular the incentives for labor supply as it distorts the relative prices for leisure and consumption. Only a lump-sum tax does not distort the relative prices and is therefore fully efficient. However, as in this system all households regardless of their earnings pay the same lump-sum tax, it does not lead to any redistribution and thus provides no insurance against income risk. In contrast, progressive income taxation and transfer programs provide a certain level of equity and insurance by redistributing money from the rich to the poor, though the positive marginal rates create

[1] In this dissertation I focus only on the personal income taxation of private households and not on the income taxation of corporations and entrepreneurs.

distortions that cause work disincentives for both tax payers and transfer recipients. First, a progressive tax schedule provides negative incentives for tax payers through marginal tax rates. Second, transfer programs with high withdrawal rates create high positive marginal tax rates at the lower end of the earnings distribution and thus cause disincentives for labor market participation.

Therefore, optimal income taxation has to balance the negative consequences for the economic efficiency through distortions of the relative prices with the benefits in terms of equity and insurance through redistribution of incomes. This describes the often analyzed trade-off of income taxation between efficiency and equity.

Throughout this dissertation changes in distortions and the economic efficiency of income taxation are measured in terms of labor supply and employment effects. Equity is analyzed on basis of net household income and money metrics of welfare changes. Allocation inefficiencies induced by income taxation in terms of dead weight losses or based on the Pareto Criterion are not explicitly discussed here.[2] The evaluation of economic efficiency and equity is set in a positive and in a normative framework. Whereas the larger part of this dissertation deals with the estimation of labor supply, employment and welfare effects in a positive way, the last part discusses the optimality of income taxation in a normative setting.

The design of a tax and transfer system strongly depends on normative assumptions and values of a given society. A society needs to decide about the degree of income redistribution, the progressivity of a tax schedule, the guaranteed minimum income in terms of out-of-work benefits, financial incentives to foster labor supply or the tagging or targeting of specific groups. In general, welfare regimes can range from a *Rawlsian* to a *Utilitarian* society. In a *Rawlsian* society, the social planner cares only about the worst-off individual, whereas in a *Utilitarian* world, the social planner weights the utility of all individuals equally.

The normative values and assumptions in a society and the trade-off between equity and economic efficiency lead to a debate about the optimal design of a tax and transfer

[2]For a general discussion about the efficiency and welfare implication of income taxation, see Stiglitz (1988).

system as well as about tax reforms redesigning the current system. This dissertation is a contribution to the debate about the design of income taxation and transfer programs. It provides empirical evidence about the labor supply incentives induced by reforms of the German tax and transfer system and the resulting labor supply, employment and welfare effects. More precisely, it analyzes the labor supply, employment and welfare effects of the German Tax Reform 2000. The labor supply behavior is estimated in a static and in an intertemporal structural model such that the short- and long-run labor supply effects of the reform can be evaluated. Moreover, the dissertation examines the labor supply effects of extending transfers by introducing UK-style in-work support for the working poor. Finally, it sets out to assess the optimality of the current tax and transfer system and derives an optimal tax and transfer schedule under different normative settings.

Reform of Income Taxation

The German Tax Reform 2000 was introduced with the political aim of reducing the burden and distortions of taxation for both companies and private households, thereby fostering employment growth.[3] The tax reform was introduced in three steps, between 2001 and 2005. For private households the tax burden was markedly reduced by significantly decreasing the marginal tax rates and at the same time by increasing the basic tax allowance. By 2005, the top marginal rate of the personal income tax has been reduced to 42%, compared to 51% in 2000. In the same period, the lowest marginal tax rate decreased from 22.9% to 15%, and the basic tax allowance increased from 6,902 Euro to 7,664 Euro.

The German tax reform followed the example of several major income tax reforms in other countries over the last decades.[4] The most prominent examples are the tax reforms in the United Kingdom (UK) and the United States (US) during the 1980s and early

[3] In this dissertation I do not discuss effects of the Tax Reform 2000 on corporations and entrepreneurs. For a discussion of the effects see Homburg (2000) and Soerensen (2002).

[4] Corneo (2005a) provides an historical overview of income taxation in Germany and shows that following 1986 progressivity of income taxation was declining. During the 1990s the German government implemented several minor reforms which slightly reduced marginal tax rates and increased the basis tax allowance. However, these reforms are not comparable to the effect induced by the major reforms in other countries, nor to the effects of the Tax Reform 2000.

1990s. In the UK, the tax reform simplified the income tax schedule and was leading to a significant reduction in tax progressivity. The top marginal tax rate was reduced from 83% in 1978 to 40% in 1988, though only relevant for a small share of high income households, while at the same time the basic rate was falling from 33% to 25% (Adam and Browne, 2006). Similarly, income taxation in the US was reformed. According to Auerbach and Slemrod (1997), the Tax Reform Act 1986 (TRA86) was the most significant reform in the income tax system in the US after World War II. Comparable to the UK, the most distinctive feature of the reform was a dramatic reduction in marginal tax rates and a simplification of income taxation by reducing the number of tax brackets.

A large body of literature has focused on labor supply and employment effects of the tax reforms in both countries (Blundell and MaCurdy, 1999).[5] Amongst others, Blundell, Duncan, and Meghir (1998) analyze the effect of the tax reforms on work incentives in the UK by using the reform as a natural experiment to estimate labor supply responses of married women. They find positive, yet relatively moderate labor supply elasticities. Auerbach and Slemrod (1997) provide a survey of the studies analyzing the labor supply effects induced by the TRA86 in the US. They show that most studies find small positive behavioral responses following the tax reform.

Despite this moderate empirical evidence from the experience in the US and the UK, in the public debate and among politicians the German tax reform was expected to create large positive labor supply responses. In Chapter II and Chapter III, I show that the new design of income taxation due to the Tax Reform 2000 significantly affects the labor supply of households and increases overall employment. Yet, given the substantial tax relief of the reform, I conclude that the responses were fairly moderate. In this respect, my findings are congruent with the results found in the UK and US context.

Reforms of the Transfer System

As the Tax Reform 2000 was being implemented, the German government reformed the labor market policy to tackle the high level of unemployment in Germany. The so-called

[5] Wagenhals (2000a) estimates labor supply effects of the moderate tax reforms in Germany during the 80s and 90s and find small behavioral changes.

Hartz-Reforms affected active labor market policies, as well as the tax and transfer system. In particular two changes in the legislation are important for the design of the tax and transfer system: the reform of the social assistance and unemployment benefits and the Mini-Jobs reform.[6]

For households entitled to the insurance based transfer (the previous Arbeitslosengeld and Arbeitslosenhilfe) the Hartz-Reform had a significant effect on work incentives in an intertemporal context as the entitlement period was shortened. However, the transfer amount (60% of previous net income for a household without children) and the withdrawal design of the new insurance based transfer scheme (Arbeitslosengeld I) hardly differs from the previous legislation and thus in a static context the work incentives for most of these households were not affected.[7] The basic income support, now called Arbeitslosengeld II, remained fairly unaffected by the reform. This out-of-work transfer remains means tested with transfer-withdrawal rates close to 100% even at very low earnings. Thus, as I show in detail in Chapter IV, even after the Hartz-Reform for households with low earnings the net household income is only marginally affected when starting to work because of the design of the basic income support. This is in particular true for households with children.

The purpose of the Mini-Jobs reform was to increase incentives to take up work for individuals with low earnings by subsidizing employees' social security contributions (SSC). The central point of the reform was to extend previous subsidy schemes by abolishing the maximum hours restriction and by expanding the range of earnings exempted from SSC to 400 Euro per months. To avoid high marginal tax rates immediately above this threshold, a phasing-out of the exemption (or sliding pay-scale) was introduced: between 401 and 800 Euro, earnings are now subject to a modified SSC scheme, starting at 4% and increasing linearly up to 21% (Steiner and Wrohlich, 2005). The labor market and fiscal effects of the Mini-Jobs reform have been analyzed in previous work using

[6] In addition, the government introduced a child supplement which specifically targets working families with children. However, the transfers are fairly low and due to the withdrawal design it only affects a small number of households.

[7] An exception are households who used to be eligible to Arbeitslosenhilfe and who receive now Arbeitslosengeld II which can be markedly lower.

ex-ante evaluation methods, e.g. Steiner and Wrohlich (2005), Bargain, Caliendo, Haan, and Orsini (2006) or based on ex-post methods using the reform as a natural experiment (Caliendo and Wrohlich, 2006). Regardless of the methodology, these studies show that the reform had only a modest effect on the labor supply behavior.

Hence, in contrast to the US or the UK where major reforms of the transfer system were implemented over the last three decades, the Hartz-Reforms in Germany only slightly changed the design of the basic income support scheme and thus hardly affected labor supply of low-earnings households, at least in a static context. Drawing on the experience in the US and the UK, the introduction of in-work credits to induce positive work incentives for the working poor is still on the agenda in the current political debate and is discussed and evaluated in Chapter IV. In the US, the Earned Income Tax credit (EITC) was implemented in 1975 and in a series of major expansions the generosity markedly increased. Today, the EITC is the most generous cash transfer program for low income families with children. In contrast to other traditional transfer programs, the EITC is conditioned on positive family earnings. The amount of the credit depends on the earned income and on the number of children. It is designed with a phase in, a phase out, and a flat region where a family receives the maximum tax credit. A crucial feature of the transfer design in the US is that income from the EITC is not taken into account in the calculation of welfare benefits. This avoids high marginal tax rates at the bottom of the earnings distribution (Blundell and Hoynes, 2004).

In-work benefits have a long history as well in the UK, starting with the introduction of the Family Income Supplement FIS in 1971. The current in-work transfer scheme, the Working Tax Credit (WTC), an extension of the Working Family Tax Credit (WFTC), is not only conditioned on gross family earnings and number of children but also on working hours. Eligibility requires 16 hours of work per week, and for those working more than 30 hours, there exists an extra bonus. Generosity of the in-work credit depends on gross earnings and number of children living in the household. In contrast to the transfer system in the US, in-work credits in the UK count for the calculation of other welfare programs such as housing benefits. Thus, in the UK benefit system out-of-work transfers are in general more generous than transfers conditioned on working. This implies in general

that the WTC does not create negative marginal tax rates for the working poor which is different to the US where negative marginal tax rates are part of the transfer design as in-work transfers to the working poor are generally more generous than transfers to the non-working (Blundell and Hoynes, 2004). This difference is crucial for the analysis in Chapters IV and V. Whereas Chapter IV focuses on the labor supply effects of in-work support as designed in the UK, Chapter V discusses whether in-work transfers which create negative marginal tax rates comparable to the EITC are optimal from a welfare perspective.

Several studies evaluate the effects of the EITC and W(F)TC on labor supply, see e.g. Eissa and Liebman (1996) or Eissa and Hoynes (2004) for the US and Blundell, Duncan, McCrae, and Meghir (2000) for the UK. In general these studies find large positive labor supply effects to single households, in particular on lone or single mothers. As in-work credits in the US and in the UK are conditioned on family income most studies find ambiguous effects for the labor supply responses of couple households. Eissa and Hoynes (2004), for example, conclude that the EITC is effectively subsidizing married mothers to stay home because of the conditioning on household income.

Contribution of the Dissertation

The methodology applied throughout the dissertation combines microsimulation with microeconometric techniques. The appealing advantage of microsimulation is that the effect of the current tax and transfer system as well as the effect of hypothetical reforms in the system can be accurately described for each household observed in the data set. Thus, it is possible to asses the work incentives of different tax and transfer regimes. Given the information derived in the microsimulation model, the microeconometric methods allow for an estimation of behavioral responses of households. More precisely, I assess the labor supply responses of households to changes in the tax and benefit system based on estimates of static and intertemporal structural models of labor supply. The data basis for all analyses is the German Socio Economic Panel Study (SOEP). This data set includes detailed information about the socio-economic situation of about 12,000 households on a yearly basis that represent all private households living in Germany.

In Chapter II, I combine estimates of labor supply elasticities derived in a static structural labor supply specification with a framework of a partial equilibrium model of the labor market with flexible market wages to derive the labor supply and employment effects of the German Tax Reform 2000. Moreover, I make use of the estimated preferences for income and leisure derived from the structural model of labor supply to analyze the income and welfare effects of this tax reform. I find that about half of the estimated labor supply which would be induced at constant market wages results in additional employment. The total employment effects amount to 130,000 full time equivalents, while market wages are slightly reduced by the tax reform. Accounting for the behavioral adjustment of households, the income increases on average by nearly 450 Euro per year, whereas the welfare effects are markedly lower, and amount to approximately 330 Euro. Overall, I find that the Tax Reform 2000 has a regressive impact on the distribution of net household income.

In Chapter III, I extend the analysis of the labor supply effects of the tax reform by relaxing the assumptions of the static labor supply model. The static modelling of labor supply is based on the assumption that households immediately adjust their behavior given changes in work incentives. However, this crucial assumption of the static model has been rejected by numerous studies that find strong evidence for true state dependence in the labor supply behavior. State dependence measures the effect the previous working behavior on the current labor supply decision. Therefore, I develop an intertemporal structural model of labor supply. I explicitly model the effect of true state dependence by conditioning the labor supply of the current period on past employment and by controlling for unobserved heterogeneity in a flexible way. The intertemporal model allows me to study the labor supply behavior over time. Thus, I can analyze the short- and long-term labor supply effects of the tax reform. I apply the intertemporal framework to estimate the labor supply behavior of married and cohabiting women and I find that, in the short-run, the tax reform has only a moderate effect on the labor supply behavior which is significantly increasing over time. Moreover, I find very similar results of the long-run effect derived in the intertemporal labor supply model and when using a static specification as in Chapter II.

In Chapter IV, I analyze the work incentives and labor supply effects of a hypothetical reform changing the German transfer system towards the design implemented in the UK. More precisely, I estimate the labor supply effects of extending transfers for the working poor as designed in the WTC (see above). I find that the total labor supply effect of introducing UK-style in-work support in Germany is positive but modest, in the range of about 35,000 individuals. The estimates show that because of important income effects on secondary earners the simulated in-work support would have high negative implications for employment of individuals in couples - both men and women. These negative effects nearly outweigh the strong positive effects on lone parents.

Chapter V extends the positive analysis the economic efficiency of income taxation and deals with the optimality of the transfer system in a normative setting. I make use of the optimal tax theory to study the optimality design of the tax and transfer system for lone mothers in Germany. More precisely, I apply the theoretical model developed by Saez (2002) and derive the welfare function under which the current design of income taxation is optimal. Further, I derive the optimal tax and transfer schedule for lone mothers assuming several welfare scenarios. The key advance of this analysis, extending previous studies on the optimality of the tax and benefit system, is that I apply the theory of optimal taxation with both a country-specific tax and benefit microsimulation model and a structural model of labor supply. Thus, it is possible to fully recognize the complexity and heterogeneity of the German tax and transfer system. Moreover, the method allows to estimate, rather than calibrate, the key behavioral inputs in the expression for optimal tax rates, the labor supply elasticities. Hence, the extension of the employed method implies that the heterogeneity in household behavior is accounted for. This is, according to Saez (2002), crucial for the analysis of the optimal tax design. Numerical simulations of the optimal tax rule show that if the government has a relatively low taste of redistribution, in-work credits with negative marginal tax rates, such as the EITC in the US become optimal for the design of transfers towards lone parents. Moreover, I find that the current transfer system in Germany, not including in-work credits with negative marginal tax rates, is only optimal when the government has a high inclination towards redistribution aimed at non-working lone mothers.

In Chapter VI, I summarize the main findings of the empirical analysis of the German tax and transfer system. Further, I discuss potential shortcomings and problems of this analysis and provide an outlook for further research on the labor market and welfare effects of tax reforms.

Central policy implication

Is there a way to design or reform the tax and transfer system such that economic efficiency is increasing without any negative effects on equity?

This is the central policy question this dissertation tries to answer. I argue that the significant reduction in the tax burden of private households in the course of the Tax Reform 2000 did only create modest efficiency gains in terms of labor supply and employment. Yet, I find a negative effect on overall equity because of the reduction of income redistribution. On the other hand, I conclude that well targeted changes of the current transfer system which extend in-work transfers for working households at the lower end of the earnings distribution have the potential to increase efficiency in terms of labor supply and to a lesser extent in terms of employment, and at the same time might increase equity in the society. This conclusion is dependent on two crucial assumptions. First, in-work credits are only targeted at single households or such that they do not induce negative labor supply incentives for the secondary earner in couple households. Second, the society has a high value for the welfare of working households with low earnings.

Chapter 2

Labor Market and Welfare Effects of the German Tax Reform 2000[1]

2.1 Introduction

In the year 2000, the German government passed the most ambitious tax reform in post-war German history. The tax reform was introduced with the political aims to reduce the burden and distortions of taxation for both companies and private households, thereby fostering employment and economic growth in the German economy. According to estimates of the Federal Ministry of Finance (Bundesfinanzministerium), the tax reform was expected to reduce the tax burden in total by about 57 billion Euro, of which about 32 billion Euro is due to the reduction of personal income taxes, and the rest to reduction in the taxation of corporations and entrepreneurs.[2]

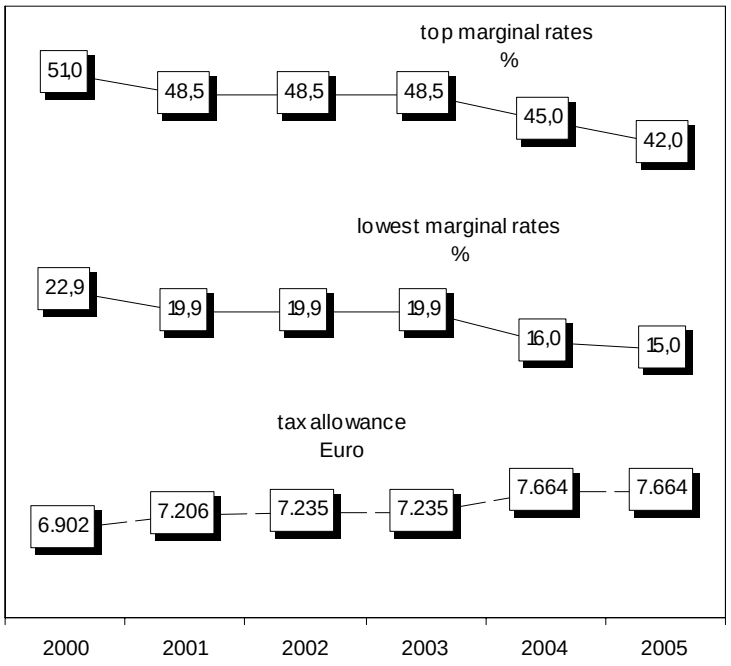
Amongst others, Homburg (2000) and Soerensen (2002) discuss and analyze the effects of the tax reform for corporations and entrepreneurs. In this analysis I focus solely on the part of the reform related to the personal income tax. The reform has been implemented in three steps starting in 2001 (see Figure 1).[3] Here, I do not separately asses the partial effects of the first two steps of the reform which were introduced in 2001

[1]The following analysis is based on joint research with Viktor Steiner which has been published in Haan and Steiner (2006).

[2]For a detailed discussion of the German Tax Reform 2000, see Bundesfinanzministerium (2003).

[3]I only consider the reduction in the marginal tax function. Reforms such as increasing child benefits or the reduction in the saving tax allowance were announced and implemented before the Tax Reform 2000.

Figure 2.1: Changes in the personal income tax 2000 - 2005



Source: Bundesfinanzministerium 2003.

and 2004 but focus on the full effect which has become effective from the beginning of the year 2005. The partial effects of the first two steps have been analyzed by Haan and Steiner (2005). By 2005, the top marginal rate of the personal income tax has been reduced to 42%, compared to 51% in 2000. In the same period, the lowest marginal tax rate decreased from 22.9% to 15%, and the basic tax allowance increased from 6,902 Euro to 7,664 Euro.

It is the purpose of this analysis to study the effect of changes in income taxation on the work incentive of households and the induced labor supply, employment and welfare effects. The analysis is based on a behavioral tax-benefit microsimulation model which embeds a static model of labor supply behavior in the household context. Microsimulation allows to simulate the changes in the tax legislation and thus it is possible to derive the induced work incentives of the tax reform for each household observed in the data. Given

the changes in the work incentives, I estimate labor supply effects both with respect to labor force participation and hours worked on the basis of a static structural household labor supply model. The employment effects of the reform are derived within the framework of a partial equilibrium model of the labor market by assuming flexible market wages. For this analysis I draw on empirically estimated labor supply and labor demand elasticities. Moreover, I make use of the estimated preferences for income and leisure derived from the structural model of labor supply to analyze the income and welfare effects of the tax reform. In this analysis, I control for bracket creeping which measures the real increase of household's tax payment due to a purely inflation related increase of the taxable income. As shown by Haan and Steiner (2005), this effect reduces cash gains of the tax reform, and thus work incentives, significantly.

My findings suggest that the tax reform has a substantial impact on the labor supply decision of households. I estimate that labor market participation is increasing by about 240,000 full time equivalents. The total hours effect amounts to over 14 million hours per week which is an increase of more than 1% of total weekly working time. Taking into account the induced reduction in market wages to reach a new equilibrium in the labor market, the results indicate that about half of the estimated labor supply which would be induced at constant market wages results in additional employment. Overall employment increases by roughly 130,000 full time equivalents or about 8 million additional hours of work, while market wages are slightly reduced by the tax reform. Accounting for the behavioral adjustment of households induced by tax reform, I analyze the resulting income and welfare effects of the tax reform. On average the income gain for a household amounts to nearly 500 Euro per year whereas the welfare effects are about 1/3 lower, and amount on average to approximately 330 Euro. In line with previous research, I find that both income and welfare effects are increasing with net-income and are higher in the western part of Germany.

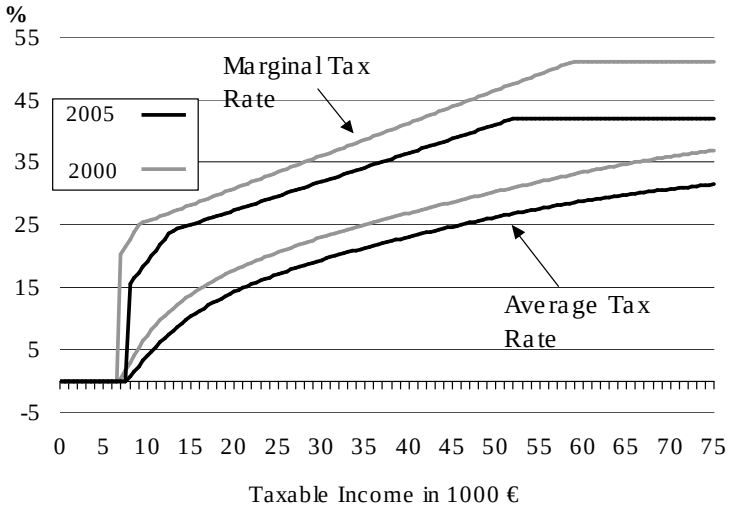
2.2 The German Tax Reform 2000

In theory, the German income tax is based on the principle of comprehensive income taxation. That is, the sum of a household's income from all sources is taxed at a single rate after several deductions have been applied. In practice, there are various exceptions to this rule, however, especially regarding the taxation of capital income and pensions. Since the beginning of the 1990s households pay in addition to the standard income taxes the "Solidaritaetszuschlag" a time limited tax supplement in course of the German reunification. During the period of interest, 2000 - 2005, the supplement amounts to 5.5% of the standard income tax. Another distinguishing feature of the German tax system is the principle of joint taxation of households, whereby the income tax of a married couple is calculated by applying the tax function to half of the sum of the spouses' incomes; this amount is then doubled to determine the tax amount of the couple.

Corneo (2005a) provides an historical overview of income taxation in Germany and shows that following 1986 progressivity of income taxation was declining. During the 1990s the German government implemented several minor reforms slightly reducing marginal tax rates and increasing the basis tax allowance (Bach, Corneo, and Steiner, 2006). These reforms however are not comparable to the effect of the Tax Reform 2000.

Figure 2.2 presents the marginal and average tax rates of the pre- and post- reform schedule. Over the whole distribution of taxable income marginal tax rates are lower in the post-reform schedule 2005 than under the fiscal regime 2000. Up to about 50,000 Euro taxable income, the changes in marginal tax rates are relatively similar. However, when taxable income reaches the top marginal tax rate the gains from the tax reform are increasing. This is due to the large drop of the top marginal tax rate from 51% to 42%. On the lower end, the increase in the tax allowance excludes households with taxable income lower 7664 form taxation. Before the reform, in the fiscal system of 2000, this threshold was at 6902 Euros. Both, the increase in the tax allowance, and the decreasing marginal tax rates lead to a lower average tax rate over the whole distribution of taxable income.

Figure 2.2: Marginal and average tax rates: 2000 - 2005



Tax schedule is for a single tax filer. The tax supplement is not included.
Source: own calculation. I thank Dagmar Svindland and Katharina Wrohlich.

There exist several ex-ante studies analyzing the effects of the German Tax Reform 2000 on household income and labor supply behavior.[4] Corneo (2005b) shows that the tax reform had a regressive impact on the income distribution as in particular high income households benefited from the reform. Previous findings of Wagenhals (2000b) and Haan and Steiner (2005) are in line with this result. Moreover these studies focus on work incentives, and labor supply effects induced by the tax reform and find that the reduction of the tax burden was leading to a significant, yet relative to the fiscal cost, to a modest increase in labor supply. In the following, I extend the previous literature by discussing in addition to the behavioral labor supply effects, the effective employment and welfare effect induced by the tax reform.

The German tax system is defined in nominal rather than in real terms. That implies a nominal increase of the taxable income leads to higher marginal tax rates, although in

[4]All mentioned studies, including the evaluation proposed here, analyze the tax reform from an ex-ante perspective by simulating the mechanical and behavioral effect of the tax reform. So far, an ex-post evaluation has not been conducted as the required data for the fiscal year 2005 are not yet available.

real terms, the income of the household remains unchanged. This phenomenon is known as bracket creeping in the public finance literature. To reimburse households for the loss due to bracket creeping, the government has to adjust the tax function over the years, either by reducing the marginal tax rates or increasing the amount of the basic tax allowance. As the cumulated inflation rate between 2000 and 2005 amounted to approximately 8.6%, this effect is certainly not negligible. When analyzing the impact of the tax reform, I control for bracket creeping following Haan and Steiner (2005) to calculate the real gains from the tax reform. Thus, I subtract the tax relief necessary to reimburse the households for the additional tax payments due to bracket creeping from the nominal gains attributable to the tax reform.[5]

2.3 Methodology

One important aim of the German Tax Reform 2000 was to improve work incentives, thereby raising effective labor supply and increasing employment. In line with the previous literature, I analyze the work incentive and labor supply effects on the basis of a behavioral tax-benefit microsimulation model for Germany which allows to perform an ex-ante evaluation of labor supply responses. Employment equals the labor supply effect only under the assumption of perfectly elastic demand for labor. Depending on the size of the labor supply effect, this may not be a very realistic assumption.

There exist several approaches in the literature to analyze the effect of an increase in effective labor supply on market wages and employment. Boeters, Feil, and Gürtzgen (2005) study labor supply, wage effects and employment on basis of a general equilibrium model. This approach has the appealing advantage that labor supply and labor demand is integrated within the same model. However, the drawback of the general approach is that the model is based on stylized households defined by aggregation of micro data rather than on real micro data. This is the advantage of the microsimulation approach combined with a partial equilibrium model applied here. I account for wage and employment effects on the basis of a partial equilibrium model of the labor market under the assumption

[5]Technically, I calculate the effect of bracket creeping by simulating the tax payments of households with inflated prices for the year 2005 implicitly assuming no increase in real wages, i.e. productivity.

of flexible wages. For this analysis I draw on the estimated labor supply elasticities derived from a structural household labor supply model and on empirical labor demand elasticities differentiated by skill group and gender, derived in Buslei and Steiner (1999).[6] The induced welfare effects of the tax reform are derived using the household specific estimates for income and leisure preferences. The analysis of welfare effects in terms of household utility is based on monetary measures, i.e the compensating variation.

Data and Sample Design

The tax-benefit microsimulation model STSM employed in this analysis and all micro-econometric estimations are based on micro data of the German Socio Economic Panel (SOEP). The SOEP is a representative sample of private households living in Germany with detailed information on household incomes, hours worked and the household structure.[7] The data set includes detailed information about the socio-economic situation of about 12,000 households that represent all private households living in Germany. For this analysis, I draw on data of the 2002 wave of SOEP which, for the first time, contains a disproportionately large sample of high-income households.[8] This high-income sample consists of over 1,200 households with monthly net incomes of at least 3,834 Euro. Given that the highest decile of taxable income contributes roughly 40% to the overall collected amount of personal income tax (Haan and Steiner, 2005), the inclusion of this group in the analysis is of greatest importance. The over-representation of this group in the sample is accounted for by adjusting estimation results by appropriate weighting factors available in the SOEP. A detailed description of the structure of the high-income sample and the weighting factors is provided by Haisken De-New and Frick (2005).

For the analysis, I restrict the sample to individuals aged between 20 and 65, not pensioner nor in any sort of schooling, training or university. Also self-employed people are

[6] An alternative approach would be to use estimates of the wage curve to derive the effect of an increase in employment (or a reduction of the unemployment rate) on the market wage. However, previous estimations of wage curves do not differentiate elasticities by skill group or gender, as required for the analysis, see, e.g. Baltagi and Blien (1998).

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

[8] The data of the 2002 wave contain information about the fiscal year 2001 (retrospective information).

excluded since this groups might differ in labor supply behavior. It is certainly problematic to exclude self-employed when estimating the impact of the tax reform on labor supply. This group might be seen as the most flexible with respect to labor supply. However the used data provide not sufficient information about lab or supply of self-employed. In total, 7908 households are included in the analysis.

Tax and Transfer Microsimulation Model

Microsimulation or the simulation of the German tax and benefit system is central for this study as well as for the empirical analyses in the following chapters of this dissertation. I apply the tax-benefit simulation model STSM that includes all relevant components of the German tax and transfer system (Steiner, Haan, and Wrohlich, 2005). Gross income of a household is calculated by adding all income components of the household members collected in the data of the SOEP. Taxable income is then derived by deducting observed or lump sum income-related expenses from gross household income. The income tax is computed by applying the income tax function to taxable income of each person in the household or of the spouses' joint income, depending on marital status. Income tax, the tax supplement and employee's social security contribution rates are deducted from gross income, and social transfers are added to derive the net household income. Social transfers include child benefits, child-rearing benefits, education benefits for students, unemployment compensation, housing benefits and social assistance.

The base year for the analysis is the fiscal year 2000 as this was the last year before the tax reform has been implemented. In order to improve the representation of the population, as discussed above, I include the key information of high-income households and use the data collected in the 2002 wave of the SOEP. Drawing on these data, I simulate tax payments and net household incomes for all households on the basis of the tax legislation in 2000. This information serves as the basis for the following analysis. The pre-tax scenario is compared to simulated hypothetical post-reform tax payments and net incomes which differ solely due to the changes in the tax function. The post-reform scenario mimics the tax system of the year 2005. The difference between the net household income derived on basis of the pre- and post-reform legislation measures

the gross-mechanical effect of the Tax Reform 2000 which has to be adjusted for bracket creeping as described above in order to derive the net-mechanical effect of the reform which for simplicity will be referred to in the following as the mechanical effect.

Household Labor Supply Model

The mechanical effect of a tax reform captures the changes of the disposable net household income without any behavioral adjustment of households. To simulate the labor supply effects induced by the mechanical effect of the tax reform, I employ a discrete choice labor supply model. In Chapter III, I will present a more detailed description of this estimation method and provide a discussion about the underlying assumptions of this framework. The central idea of this method, is that a household's budget set can be approximated by a discrete number of working hours alternatives such that nonlinearities in budget constraints can be accurately accounted for, see e.g. van Soest (1995) or Blundell, Duncan, McCrae, and Meghir (2000). I model the labor supply decision of couple households under the assumption that both spouses jointly maximize a utility function in the arguments leisure of both spouses and net household income. The labor supply decision of single persons can be derived as a special case of the couple's labor supply decision.

Following e.g. van Soest (1995), I specify a household utility function depending on the leisure time of the household members and net household income in each discrete category. I assume that the household's utility index for a particular hours category k can be modelled by the following quadratic utility function:

$$U_k = x_k'\beta + x_k'Ax_k + \epsilon_k, \tag{2.1}$$

where $x = (y, lm, lf)'$. The components of x are net household income (y), leisure of the husband (lm) and leisure of the wife (lf). These components enter the utility function in linear, quadratic and cross terms. The matrix A, with elements $\alpha_{ij}, i, j = (1, 2, 3)$, contains the coefficient of the quadratic and the cross terms, the vector $\beta_j, j = (1, 2, 3)$, the coefficients of the linear terms. ϵ_k is a stochastic error term accounting for unobserved factors that affect household utility. Given the assumption of joint maximization

of household utility, the household will choose hours category k if, in probability terms, the associated utility index, U_k, exceeds the utility index in any other possible alternative.

Assuming that the error terms ϵ_k are distributed identically across all hours categories according to an extreme-value distribution, the difference of the utility index between any two hours categories follows a logistic distribution. This assumption with respect to the error terms is rather restrictive and results in the property of the independence of irrelevant alternatives (IIA). Random coefficient models, in contrast to the conditional logit model used here, allow for unobserved heterogeneity and, therefore, circumvent the restrictive IIA property. In the Appendix, I present a sensitivity analysis estimating discrete labor supply models with several specifications of unobserved heterogeneity for the sub sample of married couples. The findings indicate that the results (in terms of wage elasticities) from a random coefficient model do not differ significantly from the results obtained from a conditional logit model. Thus, for computational reasons, I employ the conditional logit model relying on the restrictive extreme value distribution for the following analysis.

Under this distributional assumption the probability of choosing alternative k relative to alternative l can be described following McFadden (1974) by:

$$P(U_k > U_l) = \frac{\exp(x_k'\beta + x_k'Ax_k)}{\sum_{m=1}^{J} \exp(x_m'\beta + x_m'Ax_m)}; \quad l \neq k, \tag{2.2}$$

where the summation sign is defined over all possible alternatives, i.e. hours categories. I control for observed heterogeneity in household preferences by including as control variables age and health status of both spouses, number and age of children in the household, region of residence (east or west Germany), and nationality. These variables can be interpreted as taste shifters of the preferences.

The definition of the hours categories is motivated by both, economic considerations and the actual distribution of hours in the sample. Because of the small number of men working part-time, only three categories could be specified for them, namely non-employment (unemployment and non-participation in the labor force), 1-40 hours and more than 40 hours (overtime). For women I specify five hours categories: non-

employment, two part-time categories, full time and overtime. One of the working alternatives is the realized choice of the household the others are hypothetical choices. The crucial information, the net household income, can be observed only at the realized choice, at the non-chosen alternative the income needs to be simulated on basis on the microsimulation model, described above.

Hypothetical yearly gross earnings for each of the hours categories are calculated by multiplying gross hourly earnings by the respective average number of working hours in each category used in the household labor supply model. For employed persons, it is assumed that the individual gross hourly wage in their actual hours category is constant in each hours category. For persons not employed in the month preceding the interview, gross hourly wages are estimated by applying a two-stage estimation procedure with a Heckman sample selection correction.[9] Estimation results are provided in the Appendix. Due to item non-response, wages are also missing for a non-negligible share of employed persons, for whom hourly wages are also imputed on the basis of these wage equations.

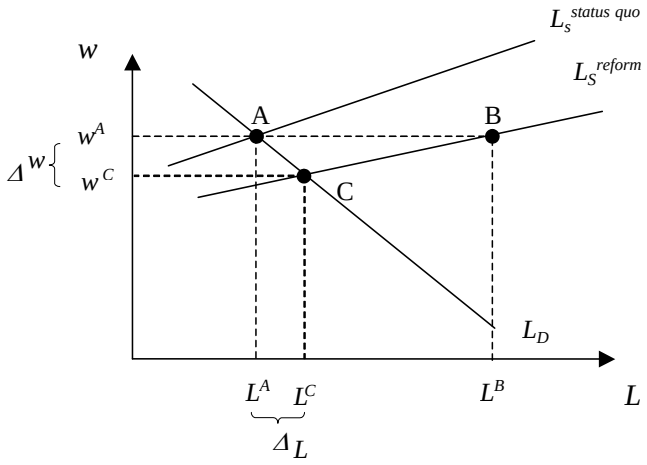
Wage and Employment Effects

The increase in the supply of labor induced by the tax reform will only affect employment at the same magnitude if the market wage stays constant, other things equal. This is a strong assumption that depends on the magnitude of the initial labor supply effect and on general labor market conditions. It may be argued that, given the high level of vacancies in Germany,[10] a relatively small increase in the effective supply of labor can be employed without wage reductions. As an alternative to this assumption which implies that firms' demand for labor is at least locally perfectly elastic, I will derive the employment effects of the tax reform under the assumption of flexible market wages and empirically estimated labor demand elasticities differentiated by skill groups and gender. Since I am interested in the potential wage effects of a shift in labor supply, the relevant elasticities are those

[9] In order to increase the variance of the predicted wages, I adjust the predicted wages by adding the normalized error term distribution of the regression of the observed wages.

[10] There are roughly 300 - 400 thousand vacancies registered at the labor offices even at the though of the business cycle. The real number of vacancies should be even higher. The Institute for Employment Research (IAB), the research institute of the Federal Labor Agency estimates that only about one third of all vacancies are registered at the local labor offices.

Figure 2.3: Wage and employment effects of the tax reform



referring to the demand for total hours rather than for the total number of workers. These elasticities have been derived in previous work by Buslei and Steiner (1999). For unskilled men they find an elasticity of -0.61 that differs from the one for skilled men -0.24. For women, the elasticities are of similar size for unskilled (-0.48) and for skilled women (-0.47). It is important to stress that in this analysis I solely focus on the reform of personal income taxation. Thus, the potential impact of the tax reform on companies and their demand for labor is not reflected in the demand elasticities.

The following figure explains the adjustment process. Before the reform the labor market equilibrium is in point A with wage w^A and employment L^A. Due to the tax reform the labor supply curve shifts outward (L_s^{reform}). If the wage remains constant at w^A there exists excess supply for labor at point L^B.

Drawing on the empirical demand elasticities referred to above, I calculate the adjustment of wages that define the equilibrium between labor demand and labor supply. In order to increase labor demand to reach labor supply L^B gross hourly wages have to

decrease according to the elasticities. Given this wage reduction labor supply becomes less attractive and is falling such there exists demand exes. Hourly wage at point C w^C equalizes the labor market. Technically I derive this point by iterating wage adjustment on the basis of the simulation model and labor demand elasticities until labor demand equals labor supply. This iteration is performed separately by gender, region and qualification groups.

Welfare Effects

Given the estimated employment responses of households to the change in the fiscal system, I derive the distributional and welfare effects of the Tax Reform 2000. Instead of drawing directly on the optimal tax literature following Mirrlees (1971), I apply a welfare analysis based on money metric utility as described in Preston and Walker (1999). Saez (2002) developed a framework for an empirical analysis of optimal taxation. However this model requires particular assumptions, even more so if it is applied to couple households. In Chapter V, I present an empirical application of Saez's framework to single household. Here, I apply a more general welfare analysis based on the estimated household specific preferences for income and leisure and conditional on the simulated employment effects.

As well documented in the economic literature e.g. King (1981), it is not informative to compare utility levels between household. Instead, the standard approach for determining the change in welfare resulting from tax reforms is to employ monetary measures of a household‘s utility such as the compensating or equivalent variation. These measures have the advantage that they include the households' preference for leisure and do not simply compare those households gaining and those losing in terms of household income. A welfare analysis requires a normative assumption about the government‘s taste for redistribution. This assumption determines how individual or household welfare is aggregated. In this application I assume a *Utilitarian* regime, that is the government assigns the same welfare weight to all households, thus households‘s utilities are simply aggregated.

As discussed above the Tax Reform 2000 leads to fiscal cost of about 32 billion Euro per year and as Haan and Steiner (2004) find the positive labor market incentives can

only balance a minor share of this budget deficit. How the full budget will be balanced in the long run is still an open question. Therefore, I assume that on the one side the government will cut expenditures and on the other side the reform is financed by deficit spending.[11] Hence, by definition for almost all households welfare will increase.

I derive the behavioral responses of households based on the probabilistic discrete choice framework, discussed above. That is, rather than directly estimating the amount of weekly working hours, I estimate the probability of a given working choice set. Therefore, I derive the expected income and welfare effects of a the tax reform. Thus, I simulate the income and welfare effects for each household at each discrete point of the choice set J and derive the expected values using the estimated household specific probabilities for each discrete point.

2.4 Estimation Results

Labor Supply Effects

I run separate estimations for couple households, single men (818) and single women (1050). I divide couple households in three groups, those where both spouses are assumed to be flexible regarding their labor supply behavior (4134), i.e. both spouses are neither pensioners, nor students, nor in maternity leave, nor self-employed, those where only the husband is assumed to be flexible (602) and those where only the wife is assumed to be flexible (1304). Rather than presenting and interpreting each coefficient of the labor supply estimation, I derive labor supply elasticities of labor market participation and working hours with respect to a 1% change in the gross hourly wage as this yields the crucial information about the labor supply behavior of households. Although a closed-form solution of elasticities is not available for the utility function estimated in the specification of the household labor supply model, elasticities can be calculated from the simulated changes in estimated hours and participation rates induced by changes in the gross hourly wages.

On average, for couple households elasticities with respect to working hours are about 0.35 for women households and 0.2 for men and participation elasticities are slightly

[11] This assumption is in line with the current political situation in Germany.

Table 2.1: Labor supply effects of a 1% increase in gross wages

	Couples, both flexible		Couples, one flexible		Singles	
	Women	Men	Women	Men	Women	Men
	Change in the participation rate (in percentage points)					
All couples/All singles	0.13	0.13	0.16	0.14	0.11	0. 18
	(0.12-0.15)	(0.11-0.14)	(0.12-0.20)	(0.08-0.19)	(0.07-0.14)	(0.13-0.19)
West Germany	0.14	0.12	0.17	0.12	0.11	0.16
	(0.12-0.16)	(0.11-0.14)	(0.12-0.21)	(0.07-0.17)	(0.07-0.15)	(0.11-0.20)
East Germany	0.1	0.14	0.13	0.19	0.1	0.26
	(0.08-0.13)	(0.10-0.18)	(0.08-0.18)	(0.11-0.28)	(0.06-0.14)	(0.18-0.34)
	Change in total hours worked (in percent)					
All couples/All singles	0.35	0.2	0.4	0.22	0.25	0.29
	(0.31-0.40)	(0.18-0.23)	(0.28-0.52)	(0.12-0.32)	(0.17-0.34)	(0.20-0.40)
West Germany	0.38	0.2	0.43	0.18	0.26	0.24
	(0.33-0.44)	(0.17-0.23)	(0.30-0.56)	(0.10-0.27)	(0.17-0.34)	(0.17-0.33)
East Germany	0.27	0.22	0.28	0.31	0.24	0.42
	(0.20-0.34)	(0.16-0.28)	(0.18-0.38)	(0.14-0.48)	(0.15-0.33)	(0.26-0.59)

Numbers in parentheses refer to 95-percent bootstrap confidence intervals (500 repetitions).
Source: SOEP, wave 2002.

lower. For single households elasticities are in the same range, though for single women they are lower than for single men.

The elasticities suffer from a general shortcoming of the discrete choice labor supply literature. In this framework I do not differentiate between voluntary and involuntary unemployment, thus all individuals choose their hours points voluntarily without facing labor demand side restrictions. Following Blundell, Ham, and Meghir (1987), there have been several attempts to introduce involuntary unemployment into a structural labor supply model. Bargain, Caliendo, Haan, and Orsini (2006) derive labor supply elasticities with and without labor market constraints using the same data as employed in this study, and they find that elasticities accounting for involuntary unemployment are significantly lower for single households and men living in couples, yet not significantly different for women in couples. This is because the majority of the inactive married women chooses voluntarily not to work. Therefore the estimated behavioral effects need to be interpreted as upper bound.

Despite this upward bias, the estimated wage elasticities are relatively modest. Yet the effect of the tax reform on labor supply may be substantial given the sizeable reductions in marginal tax rates and the resulting mechanical effect on net household incomes. The quantitative implications of the tax reform can best be described by deriving hours and participation elasticities with respect to changes in the tax function. The expected number of working hours as well as the labor force participation rates are calculated for each sample observation both on the basis of the pre- reform tax function in the year 2000 and on basis of the tax function as implemented in the year 2005.[12] The latter accounts for the effect of bracket creeping as discussed above. The relative difference of these numbers measures the labor supply effects of the tax reform in terms of elasticities of both participation rates and working hours. Next to the group specific mean of the labor supply effect, I present non-parametrically bootstrapped confidence intervals to provide significant test.

For all different groups by marital status, gender and region, estimated elasticities are positive and statistically significant. The elasticities vary between the groups, yet, according to the bootstrapped confidence intervals, the differences are statistically not significant in most cases. One important reason for the larger elasticities for women in couples is the German system of joint taxation. Steiner and Wrohlich (2004) show that the joint taxation is one important reason for the low labor market participation of women in Germany. As the advantage of joint taxation is markedly reduced when marginal tax rates decrease, the incentive for women to increase labor supply rises. This is not the case for single filers. For single men labor supply effects are larger than for single women. That is due to the fact that in general single men profit more from the tax reform as their taxable income is higher. Thus, single men have an higher incentive to increase their labor supply. Labor supply elasticities resulting from the tax reform differ little between east and west Germany which may be related to various factors. Since household

[12] Note, as mentioned above, for the empirical analysis I draw on data collected in the year 2002 and containing the fiscal information of the year 2001. Thus, I estimate the preferences for income and leisure based for this year. Identification of labor supply effects is therefore based on the assumption that preferences for income and leisure remain constant over time and do not change between the fiscal regimes.

Table 2.2: Labor supply elasticities of the tax reform

	Couples, both flexible		Couples, one flexible		Singles	
	Women	Men	Women	Men	Women	Men
	Change in the participation rate (in percentage points)					
All couples/All singles	0.96	0.74	0.64	0.64	0.46	0.9
	(0.84-1.08)	(0.66-0.83)	(0.35-1.03)	(0.41-0.89)	(0.31-0.62)	(0.62-1.19)
West Germany	1.01	0.71	0.69	0.61	0.49	0.81
	(0.87-1.16)	(0.62-0.81)	(0.35-1.03)	(0.36-0.86)	(0.33-0.66)	(0.49-1.12)
East Germany	0.78	0.86	0.44	0.76	0.36	1.2
	(0.60-0.96)	(0.65-1.06)	(0.25-0.63)	(0.44-1.07)	(0.22-0.50)	(0.85-1.55)
	Change in total hours worked (in percent)					
All couples/All singles	2.58	1.2	1.82	1.05	1.23	1.49
	(2.24-2.92)	(1.06-1.34)	(0.98-2.66)	(0.61-1.49)	(0.81-1.65)	(1.04-1.96)
West Germany	2.73	1.16	1.99	0.99	1.29	1.34
	(2.33-3.14)	(1.00-1.31)	(1.03-2.95)	(0.54-1.45)	(0.84-1.74)	(0.89-1.80)
East Germany	2.05	1.4	1.06	1.19	1.02	1.96
	(1.57-2.54)	(1.02-1.86)	(0.60-1.53)	(0.65-1.73)	(0.62-1.41)	(1.26-2.65)

Numbers in parentheses refer to 95-percent bootstrap confidence intervals (500 repetitions).
Source: SOEP, wave 2002.

income in west Germany is on average still substantially higher than in the east, west Germans benefit more from the reduction in marginal tax rates (Haan and Steiner, 2005). However, for couple households this effect is reduced by the indirect effects resulting from the system of joint taxation of married couples in Germany. As Steiner and Wrohlich (2004) show, west German couples benefit much more from the system of joint taxation with income splitting. For single households, in particular single men, I find higher labor supply responses in the east (Table 2.1). This implies the relatively strong behavioral responds in the East compensates the higher mechanical effect of the tax reform in the western part of Germany.

Population-weighted estimates of the effects of the tax reform on supplied labor force participation and on supplied hours of work for Germany as a whole are summarized in Table 2.3.

Although bootstrapped confidence bands are unfortunately quite large for the aggregated effect, simulated aggregate labor supply elasticities are significantly positive for

Table 2.3: Labor supply effects - aggregate numbers in 1000

		New Participants	Hours effect (per week)			New FTE
			Total	Ext. Margin	Int. Margin	
Couples	Women	121	5,620	3,222	2,398	84
		(102-148)	(4,911 -6,942)	(2,744-3,980)	(2,125-3,004)	(71-103)
	Men	96	5,107	3,941	1,166	102
		(79-111)	(4,339-5,880)	(3,259-4,538)	(987-1,435)	(84-118)
Singles	Women	23	1,541	766	775	20
		(16-32)	(1,077-2,095)	(526-1,060)	(518-1,088)	(14-28)
	Men	34	1,827	1,394	433	36
		(9-54)	(865-2,654)	(430-2,151)	(309-628)	(11-56)
Total		275	14,095	9,323	4,772	242
		(214-338)	(11,514-17,251)	(7,693-10,998)	(4,009-6,065)	(199-286)

Numbers in parentheses refer to 95-percent bootstrap confidence intervals (500 repetitions). Extensive margin: change in working hours due to new participants. Intensive margin: change in working hours of working population. FTE. are full time equivalents assuming 38.5 weekly working hours.

Source: SOEP, wave 2002.

all groups. Hence, the tax reform will unambiguously lead to an increase of labor supply. In total, the point estimate of the participation effect amounts to about 275,000 people, where women and men contribute roughly equally. The additional supply of working hours amounts to approximately 14 million additional hours per week. Since part-time employment is common among women while the majority of men works full-time or even overtime, a larger share of this additional hours effect is accounted for by men. Following the method suggested by McDonald and Moffit (1980), the total hours effect can be decomposed into a conditional hours effect and a participation effect. The decomposition in Table 2.3 (columns 3 and 4) shows that the participation effect is much larger than the conditional hours effect. About two third of the additional hours are supplied by persons who have not been participating in the labor market before the tax reform. The participation effect predominates for all groups, except for single women. This group differs from the other as participation is high and part time work is common. For the reason given above, the participation effect is relatively large for men. The last column of Table 2.3 presents the additional full time equivalents resulting from the participation effect. Dividing the number of working hours due to additional participation by 38.5 hours, I

Table 2.4: Wage effects by region, gender and skill

	West Germany		East Germany	
	Skilled worker	Unskilled worker	Skilled worker	Unskilled worker
	changes in %			
Women	2.37	1.88	1.91	1.55
Men	2.41	1.16	2.95	1.01

Source: SOEP (2002), Buslei and Steiner (1999), own calculations.

find that the tax reform results in additional labor supply of nearly 240,000 full time equivalents. The number of full time equivalents exceeds the total participation effect in column (1) for women, whereas for men the reverse holds. These gender differences result from differences in average working hours between men and women already referred to above.

Wage and Employment Effects

The estimated labor supply effects induced by the tax reform are derived under the assumption that the market wage stays constant and result in employment because of an infinitely elastic demand curve. In the following, I relax this strong assumption by considering negatively sloped demand curves for labor´according to the estimated labor demand elasticities by Buslei and Steiner (1999). I derive the employment separately for men and women and differentiate by skill and region.[13] Doing so, I assume that each group acts on separate labor markets. Table 2.4 contains the simulated effect of the tax reform on gross hourly wages using the above described iterative adjustment procedure.

On average, gross hourly wages have to fall by about 2% in order to equalize labor demand and labor supply. For the skilled people (about 85% of the population) the wage adjustment is relatively larger than for the unskilled, especially for men. That can be explained by demand and supply side factors. First of all, the labor supply effects of the tax reform are higher for skilled people as they are more effected by the reduction

[13]Unskilled people are defined as those without higher school degree (Haupt- und Realschule) and without any vocational degree.

of marginal tax rates (Haan and Steiner, 2005). Furthermore, for skilled men demand elasticities are markedly lower than for unskilled which implies a far higher wage drop for this group. Differences between men and women are mainly driven by the different demand elasticities. For the skilled, the reduction in wages is higher for men, whereas due to the high demand elasticity for unskilled men the wage effect is lower for this group than for unskilled women. Differences between east and west Germany are caused by labor supply effects. As Table 2.2 indicates, labor supply effects for women are higher in the west, thus the excess supply of labor is relatively higher. For men just the opposite holds true. In addition, the skill composition differs. In east Germany, there live less unskilled people (13%) than in the western part (16%). Thus, the demand elasticities are slightly higher in the eastern part of Germany.

Table 2.5: Employment effects - aggregate numbers in 1000

		New Participants	Hours effect (per week)			New FTE
			Total	Ext. Margin	Int. Margin	
Couples	Women	73	3,535	1,939	1,596	50
		(58-94)	(3,012-4,486)	(1,556-2,520)	(1,402-2,019)	(40-65)
	Men	49	2,660	2,000	660	52
		(40-57)	(2,262-3,307)	(1,643-2,322)	(552-819)	(43-60)
Singles	Women	12	887	398	489	10
		(8-16)	(613-1,199)	(263-547)	(333-669)	(6-14)
	Men	17	997	715	281	19
		(-3-30)	(240-1,157)	(-550-1,202)	(198-412)	(-1-31)
Total		151	8,078	5,052	3,026	131
		(106-194)	(6,346-10,061)	(3,978-6,022)	(2,256-3,879)	(103-156)

Numbers in parentheses refer to 95-percent bootstrap confidence intervals (500 repetitions). Extensive margin: change in working hours due to new participants. Intensive margin: change in working hours of working population. FTE. are full time equivalents assuming 38.5 weekly working hours.

Source: SOEP, wave 2002.

Turning to the employment effect of the tax reform, the results indicate that slightly more than half of the labor supply effects induced by the tax reform results in employment.[14] About 150,000 persons enter employment. The sum of additional weekly hours is about 8 million. That translates into an increase of about 0.7% of the pre reform working

[14]The un-weighted employment elasticities are shown in the Appendix (Table 2.11).

hours per week.[15] The larger drop in male wages because of the lower demand elasticity of skilled men becomes evident when comparing the results of the analysis assuming a perfectly elastic and a downward sloping demand curve. The decomposition effect as well as the full time equivalents have a similar structure as for the labor supply effects of the tax reform, however at a lower level. Overall, I find that the tax reform increases employment by 131,000 full time equivalents.

Welfare Effects

As stressed above, I assume that the government does not finance the budget by raising extra revenues but by expenditure cuts and deficit spending. Therefore, the majority of households gains in terms of net household income as well as in terms of welfare. Few households, however, are faced with negative income and welfare effects. Income effects are negative when the impact of the bracket creeping and in particular of the wage adjustment offsets the positive effects of the tax reform. As discussed above, and in more detail in Haan and Steiner (2005) negative effects will be present for households with low taxable income in particular when taxable income is below the tax allowance. These households will not or hardly benefit from the reduction of marginal tax rates but are still faced with bracket creeping and negative wage effects. Note, low taxable income can be either due to low wages or to low working hours. That is, households with a high probability of low working hours and households where the spouses have low wages are most likely negatively affected.

In addition to the expected money metric welfare measure, the compensating variation, I present the expected average income effects in terms of net household income. If the tax reform was behavioral neutral, that is, if the labor supply behavior remained constant, the expected income and welfare effects would be identical. Both effects have been equalized using the New-OECD equivalent scale. I derive the income and welfare effects disaggregated by family status and by region. Moreover, I calculate the income and welfare effects along the expected income distribution. A disaggregation based on

[15] In the year 2000 total working hours in Germany amount to about 1,100 million per week (own calculation based on the SOEP).

Table 2.6: Income and welfare: by region and family status

		Net income	Income effect	Welfare effect	Ratio
West	Couple	19,145	508	333	0.65
	Male single	19,416	682	492	0.72
	Female single	13,921	251	206	0.82
	All	18,572	491	330	0.67
East					
	Couple	15,584	271	146	0.54
	Male single	12,246	189	80	0.42
	Female single	11,265	127	98	0.77
	All	14,763	246	135	0.55
Mean		17,910	449	296	0.66

Income and welfare measures have been adjusted using the New-OECD equivalent scale. All numbers in Euro per year.

Source: SOEP, wave 2002.

the actual income distribution is problematic as I estimate a probability model and derive expected hours of work. Amongst others, Creedy and Duncan (2002) or Bonin and Schneider (2006) suggest to use calibration techniques to provide an analysis disaggregated by observed information. However the shortcoming of calibrating the residuals is that this procedure is not consistent with the theoretical model of the utility maximizing household.

On average the tax reform leads to an increase in the expected yearly household equivalent income of nearly 450 Euro. In line with Haan and Steiner (2005), I find that the income of households living in west Germany increases more than for households living in the eastern part. Whereas the average income effect in the east amounts to about 250 Euro, households in the west benefit with 491 Euros nearly twice as much from the tax reform. This difference is due to the still higher average taxable income in the west, thus the positive effect of the tax reform is by definition higher. Another interesting difference between east and west Germany is revealed when looking at the gains by household type and gender. In the west, single men experience markedly higher income gains (682 Euro) than single women (251 Euro). The comparable gains of couple households are with about 500 Euro in the middle. In the east, gender differences between single households are still

present, yet on a far lower scale. That implies the situation in east Germany is quite similar for single men and women and compared to the western part gains of the tax reform are similarly low for both groups. Couple households in the east have the highest income effects. Only one reason for this, is the relatively high share of households where both spouses work. This is in contrast to the west, where gains of couple households are lower than for single men.

As expected, I find welfare effects to be lower than income effects. This is because the positive working incentives lead to a loss of leisure time. The ratio, welfare gains relative to income gains, which is shown in the last column, is on average about 2/3. By region the results indicate a similar pattern as the income effects though even more extreme. The welfare effect in west (330 Euro) exceed the effects in the east (135 Euro) by about 2.5 times.

Groups with modest labor supply responses due to the tax reform have welfare/income ratio close to one. This is true in particular for single women in the western part. As shown in Table 2.2, single women have the lowest labor supply responds to the tax reform. In contrast, I find that single men and couple households in the east have a low welfare gain relative to their income effect, implying welfare/income ratio close to 0.5. The modest welfare effect in the east is mainly driven by the negative income effects induced by the tax reform, namely bracket creeping and wage adjustment, the latter is in particular true for east German men (see Table 2.4). As discussed above low wage households, and households with high probabilities of low working hours suffer losses from the tax reform. Hence, for this group it is likely that they experience an income loss and at the same time a reduction in leisure time as non working and even working low hours has become relatively unattractive.

Disaggregated by the hypothetical income distribution the results indicate a regressive impact of the tax reform. The equivalized income gains increase monotonically with net household income and the same holds true for the welfare effects. At each point of the income distribution, welfare effects are lower than income effects, in the lowest decile they are on average even negative. Except for the highest decile, the ratio between welfare and income effects is as well increasing. This is related to the strong work incentives

Table 2.7: Income and welfare by expected income

	Net income	Income effect	Welfare effect	Ratio
1	8,353	15.6	-0.2	-0.01
2	10,851	87.1	31.9	0.37
3	12,446	164.5	82.4	0.50
4	14,069	226.4	122.5	0.54
5	15,709	301.2	188.0	0.62
6	17,577	366.6	250.8	0.68
7	19,880	437.3	315.7	0.72
8	23,222	545.2	418.6	0.77
9	28,339	775.8	627.0	0.81
10	45,275	2695.0	1653.8	0.61
Mean	17,910	449	296	0.66

Income and welfare measures have been adjusted using the New-OECD equivalent scale.
The expected income distribution is derived using the probability weighted sum of the net household income at each discrete point.
All numbers in Euro per year.
Source: SOEP, wave 2002.

for this group and the relative high taste for leisure amongst people with high working hours. Overall, the welfare effects by income deciles suggest that the German tax reform has a regressive impact on the income distribution. Thus my findings support the results of previous studies on the effects of the German tax reform on private households, amongst others Corneo (2005b) who shows that the broadening of the tax base could not compensate for the regressive effect of the reduction of marginal tax rates.

2.5 Conclusion

It was the purpose of this study to analyze the impact of the German Tax Reform 2000 on work incentive the resulting labor market effects and welfare implications. As with currently available data sources a reliable ex-post analysis of the reform can not be conducted, I employ an ex-ante analysis based on a behavioral microsimulation model which includes a microeconometrically estimated household labor supply model. Wage and employment effects of the reform are derived within the framework of a partial equilibrium model of the labor market based on empirically estimated labor demand elasticities. Given the

estimated preferences for income and leisure, I perform a welfare analysis by simulating the effects on household income and money metric utility.

I find that the tax reform has a positive impact on the labor supply decision of households. The estimations indicate that labor market participation is increasing by about 240,000 full time equivalents. The total hours effects amounts to over 14 million hours per week, which is an increase of more than 1% of weekly working time. At first glance these effects might be interpreted as substantial. However, given the massive reduction in the tax burden of households of about 32 billion Euro per year they appear to be relatively moderate. Further, the results indicate that about 50% of the labor supply results in additional employment. Thus, the total employment effects amount to about 130,000 full time equivalent or about 8 million additional hours of work, while market wages are slightly reduced (by about 2%) by the tax reform. Based on the employment effects I derive distribution and welfare effects of the tax reform. I find that on average welfare effects are about 2/3 of the income gains as households' leisure time is decreasing. This effect varies by region and family status. In line with previous studies, I show that welfare and income effects are higher in west Germany. The welfare analysis shows that in particular male single households and couple households in the east suffer from loss in their leisure time. For these groups the welfare/income ratio is lowest. By expected income deciles I show increasing welfare and income gains by income deciles which implies that the tax reform has a regressive impact of the income distribution.

2.6 Appendix

Sensitivity Analysis of the Discrete Choice Estimation[16]

The standard discrete choice approach, the conditional logit model, is based on the restrictive assumption of homogeneous error variances. This leads amongst others to the often discussed property of the independence of irrelevant alternatives (IIA) (McFadden, 1974). Econometric literature has suggested more general discrete choice models that relax the assumption of homogeneous error variances and that allow for effect heterogeneity, for example the random coefficient model (Revelt and Train, 1996). However, these less restrictive specifications have shown to incur very high computational cost and to result in serious problems with maximization.

It is therefore of particular interest for applied research in general, and more specific for the estimation of labor supply effects induced by the German tax reform which approach is more adequate when analyzing discrete choice models: the standard conditional logit model or more general random effect models accounting for unobserved heterogeneity. To the extent that effect heterogeneity is present in empirical models of labor supply functions, the application of a random effect model is necessary to derive consistent estimates. However, if such heterogeneity is nonexistent or the effect heterogeneity does not have a significant impact on labor supply elasticities, standard discrete choice models provide the more favorable choice.

In the following, I will provide a sensitivity analysis for the discrete choice labor supply estimation to test for differences in the results of specification with and without unobserved heterogeneity. Estimations are based on the sub sample of 2812 married couples.

[16] A more detailed version of this Analysis has been published in Haan (2006). This research was partly financed by the German Science Foundation (DFG) in the priority program "Potentials for more flexibility on heterogenous labor markets" (project STE 681/5-1).

Econometric Model

Before discussing the empirical results of the sensitivity analysis, it is necessary to understand the theoretical implications of the standard conditional logit framework and more flexible specifications accounting for random effects.

As described above, discrete choice models are based on the assumption of utility maximizing behavior of individuals. An individual or household i chooses among J alternatives that provide different levels of utility. The utility function U_{ij} consists of an observable part V_{ij} and random elements ϵ_{ij}:

$$U_{ij} = V_{ij} + \epsilon_{ij}. \tag{2.3}$$

The probability that individual i chooses alternative k is:

$$Pr_{ik} = Pr(U_{ik} > U_{im}); \quad \forall m \neq k. \tag{2.4}$$

In order to derive an operational model the crucial question is how to treat the unknown part of the utility function. McFadden (1974) showed that if (and only if) the error terms ϵ_{ij} are independently and identically distributed (iid) with type I extreme value distribution $F(\epsilon_{ij}) = \exp(-\exp(\epsilon_{ij}))$, with fixed variance $\frac{\pi^2}{6}$, the logit choice probability can be derived. Following, the probability of choosing alternative k becomes:

$$Pr_{ik} = \frac{\exp(V_{ik})}{\sum_{j=1}^{J} \exp(V_{ij})}; \quad k \in J. \tag{2.5}$$

If the observed part of the utility function is specified to be linear in parameters, $V_{ij} = X'_{ij}\beta$, where vector X_{ij} captures K observable variables of individual i in alternative j and vector β is a vector of coefficients, the standard conditional logit model emerges. The log likelihood function to be estimated has the following form:

$$l = \sum_{i=1}^{n} \sum_{j=1}^{J} d_{ij} \ln Pr(y_i = j). \tag{2.6}$$

where $d_{ij} = 1$ if individual i chooses alternative j and 0 otherwise. In econometric literature, conditional logit models are often employed and their desirable properties have been widely discussed (Greene, 2003). However, the conditional logit model has severe drawbacks. Train (2003) names three main limitations of conditional logit, those being repeated choices over time, taste variation and substitution patterns. The most prominent limitation of conditional logit models resulting from the iid assumption of the error terms is the property called independence of irrelevant alternatives (IIA). This restriction implies that the odds ratio of two alternatives, j and k, does not depend on other alternatives. Hence, if the assumption of the error term distribution does not hold, the conditional logit model leads to inconsistent estimates.

In recent years several more general discrete choice models have been developed that relax the strong error term assumption and circumvent the limitations of conditional logit. Examples are generalized extreme value models, probit discrete choice models and the random coefficient model (Train, 2003). In this application, I focus on the random coefficient model, as this model is often applied, and implemented in standard software packages such as SAS, GAUSS or Stata.

The difference between the conditional logit model and the random coefficient model is captured in the vector of coefficients to be estimated. In the random coefficient model the coefficient vector is denoted as β_i and can be decomposed into a fixed part β and a random part μ_i:

$$\beta_i = \beta + \mu_i. \tag{2.7}$$

The random part μ_i captures non observable individual effects, such as taste which can be modelled in a parametric or non-parametric way. The researcher can neither observe nor estimate β_i. Instead the distribution for β_i has to be estimated. Theoretically, it is possible to model the random coefficient specification in a very general way by assuming all coefficients to vary randomly. However, depending on the number of coefficients this becomes enormously complex as multiple integrals have to be solved. (Train, 2003). Moreover in an application with only cross sectional data high flexibility leads to problems

of identification and convergence. Therefore, in this application, I assume only one of the coefficients to be random.

In the parametric case it is assumed that β_i follows some continuous distribution $f(\beta_i|\beta, \sigma)$. In most applications, β_i is assumed to be normally distributed (Train, 2003). Therefore, in the parametric random coefficient specification, the probability to choose alternative k is the integral over all possible values of β:

$$Pr_{ik} = \int_{-\infty}^{\infty} \frac{\exp(X'_{ik}\beta_i)}{\sum_{j=1}^{J} \exp(X'_{ij}\beta_i)} f(\beta_i) d\beta_i; \quad k \in J. \tag{2.8}$$

Heckman and Singer (1984) have derived a more flexible specification of the random coefficient model without any distributional assumption of the unobserved terms. They suggest a non-parametric method which does not rely on a restrictive distribution assumption for β_i. Instead, it is assumed that the unobserved heterogeneity is described by an arbitrary discrete probability distribution $P_i(c^m)$ with a small number of mass points $c^m, \forall m(m = 1, 2, ...M)$, where $E(c) = \sum_{i=1}^{N} \sum_{m=1}^{M} P_i(c^m)c^m = 0$ and $\sum_{m=1}^{M} P_i(c^m) = 1$. The mass points c^m are discrete realizations of the unobservable part μ_i defined in equation 2.7. Mass points and their probabilities are jointly estimated with the parameters of the model using maximum likelihood. The estimation is based on the assumption that unobserved heterogeneity is independent of the explanatory variables. Note, due to the specification of the unobserved heterogeneity, only $m-1$ mass points and $m-1$ probabilities can be freely estimated. One mass point and its probability is derived according the above specified assumptions Steiner (2001). In a nonparametric specification, the decision rule for an individual i to choose alternative k becomes

$$Pr_{ik} = \sum_{m=1}^{M} P_i(c^m) \frac{\exp(X'_{ik}\beta_i)}{\sum_{j=1}^{J} \exp(X'_{ij}\beta_i)}; \quad k \in J. \tag{2.9}$$

Inserting equation (2.8) and (2.9) into equation (2.6), the log likelihood function for the parametric and nonparametric random coefficient models can be derived. The appealing flexibility of the random specifications, which circumvent the restrictions of the conditional logit models, has enormously high computational costs. Convergence and robustness of the estimation is often problematic even if only one coefficient is specified as

being random. In order to maximize the likelihood function of a random coefficient model, simulation procedures or numerical integration need to be applied. Haan and Uhlendorff (2006) provide a simulation study of numerical procedures comparing quadrature with simulation methods. They find that adaptive Gauss-Hermit quadrature, applied here is the most accurate method yet in comparison to simulation based on Halton draws very time consuming. Regardless of the method though, relative to the conditional logit model, estimations using random specification are cumbersome. Obviously, for applied research this might be a considerable disadvantage.

Sensitivity Analysis of Labor Supply Elasticities

In the following I perform a sensitivity analysis of the labor supply estimation for the sub sample of married couples drawn the SOEP data. More precisely, I estimate three different specifications, the standard conditional logit model, a parametric and a non-parametric random coefficient model, where I assume the random coefficient to vary with the household income.

For the numerical integration in the parametric random coefficient model (equation 2.8), 10 (adaptive) quadrature points were used. In the nonparametric specification the Akaike Criterion (AIC)[17] indicates that two mass points are required to model the unobserved heterogeneity which has also be found by Bargain (2005). Comparing the conditional logit model to the random specifications the estimation results strongly indicate the existence of unobserved heterogeneity in the model. In both specifications the AIC suggests that the random model is superior to the conditional logit model. Further, the significant impact of the standard error in the parametric specification and the significance of the mass point in the nonparametric model support this finding. That implies that the variances of the error terms are not constant, and thus the iid assumption of the error terms is violated. Thus, the conditional logit model leads to inconsistent estimation of the coefficients.

[17] I follow Steiner (2001) and use the Akaike Information Criterion rather the standard likelihood ratio test, as the latter violates standard regularity conditions and its parameter distribution is not known.

Table 2.8: Labor supply estimation: Conditional logit vs. random coefficient

	Conditional Logit		**Random Coefficient parametric**		**Random Coefficient nonparametric**	
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
Net Income	-8.570	-1.940	-16.646	-2.690	-9.972	-1.550
Net Income^2	1.240	4.830	1.672	4.640	1.404	3.650
Net Income*Leisure Man	-0.963	-3.060	-0.439	-1.190	-0.620	-1.770
Net Income*Leisure Woman	-0.602	-1.870	-0.480	-1.360	-0.828	-2.320
Leisure Man	59.225	10.750	57.203	9.590	64.272	10.560
Leisure Man^2	-4.379	-13.100	-4.324	-12.690	-4.608	-13.210
Leisure Woman	82.239	12.660	82.816	12.110	91.566	12.310
Leisure Woman^2	-7.154	-13.180	-7.104	-13.060	-7.426	-13.060
Leisure Man*LeisureWoman	-1.986	-4.600	-2.183	-4.660	-2.872	-5.490
Leisure Man*German	-1.072	-3.140	-1.093	-3.010	-1.086	-2.920
Leisure Woman*German	-0.218	-0.610	-0.240	-0.640	-0.202	-0.520
Net Income*German	7.896	2.330	14.235	2.780	12.124	2.260
Net Income^2*German	-0.590	-2.290	-1.001	-2.750	-0.865	-2.270
Leisure Man*East	-11.517	-4.840	-10.709	-4.200	-12.087	-4.600
Leisure Woman*East	-13.334	-6.010	-12.587	-5.280	-13.979	-5.680
Net Income*east	4.095	2.390	-0.210	-0.060	3.073	1.100
Net Income^2*east	-0.365	-2.650	-0.081	-0.330	-0.299	-1.440
Leisure Man*age	-0.396	-5.690	-0.456	-5.910	-0.480	-6.110
Leisure Man*age2	0.518	6.820	0.590	6.940	0.620	7.150
Leisure Woman*age	-0.616	-6.810	-0.656	-6.850	-0.692	-6.850
Leisure Woman*age2	0.843	8.040	0.895	8.040	0.946	8.030
Leisure Man*disabled	2.100	4.340	2.384	4.150	2.493	3.970
Leisure Woman*disabled	2.830	3.580	3.057	3.630	3.078	3.470
Leisure Woman*child6	4.215	15.690	4.331	15.390	4.491	14.770
Leisure Woman*child16	2.136	11.160	2.150	10.780	2.203	10.470
Leisure Woman*child17	0.512	2.740	0.542	2.770	0.543	2.660
Standard Deviation (income)	-	-	1.508	4.780	-	-
Variance (income)	-	-	2.275	0.951	-	-
Mass Point 1	-	-	-	-	-2.072	-4.730
Mass Point 2	-	-	-	-	3.025	-
log Pr. (Mass Point 1)	-	-	-	-	0.378	0.850
Pr. (Mass Point 1)	-	-	-	-	0.5935	-
Pr. (Mass Point 2)	-	-	-	-	0.4065	-
Log-Likelihood	-6044.168		-6038.912		-6032.448	
Akaike Criterion	4.3216		4.3183		4.3146	

Note: In the parametric estimation 10 adaptive quadrature points have been used. The non parametric distribution is described with 2 mass points. Log odds of the probabilities are estimated. The second mass point and its probability is calculated following the assumptions $E(c) = \sum_{i=1}^{N} \sum_{m=1}^{M} P_i(c^m)c^m = 0$ and $\sum_{m=1}^{M} P_i(c^m) = 1$. Variables: Income and leisure terms (lm, lf) are in logarithms. East and ger are dummy variables for East-Germany and German nationality. Dummy variables d2-d17 =1 for part time work. The sample consists of 2812 married households where both spouses have a flexible labor supply.

Source: SOEP, wave 2002.

Table 2.9: Labor supply elasticities for married couples

	Male wage +1%			*Female wage +1%*		
	C-logit	R-logit I	R-logit II	C-logit	R-logit I	R-logit II
	Change in participation rates (in percentage points)					
All Households	0.14	0.13	0.12	0.13	0.14	0.13
		(0.11 – 0.17)			*(0.11 – 0.15)*	
West Germany	0.15	0.14	0.13	0.15	0.16	0.15
		(0.13 – 0.18)			*(0.12 – 0.17)*	
East Germany	0.09	0.09	0.07	0.07	0.08	0.07
		(0.04 – 0.14)			*(0.03 – 0.10)*	
	Change in hours (in percent)					
All Households	0.22	0.2	0.19	0.34	0.39	0.39
		(0.18 – 0.26)			*(0.28 – 0.40)*	
West Germany	0.24	0.22	0.21	0.39	0.45	0.45
		(0.20 – 0.27)			*(0.33 – 0.46)*	
East Germany	0.14	0.14	0.11	0.16	0.2	0.19
		(0.07 – 0.21)			*(0.07 – 0.25)*	

Note: C-logit: Conditional logit, R-logit I: parametric random coefficient, R-logit II: non-parametric random coefficient. Numbers in parentheses are 95% bootstrap-confidence intervals (percentile method) based on 1,000 replications, which are derived from the conditional logit estimation.

Source: SOEP, wave 2002.

However, this criterion is not sufficient to reject the implications of the conditional logit model. As mentioned above, labor supply elasticities provide the most adequate interpretation of discrete choice labor supply models. Therefore, I will test in the following whether the elasticities derived within the random specifications and the conditional logit model differ significantly. The test is based on bootstrapped confidence intervals of the conditional logit labor supply elasticities. The test procedure is straight forward though powerful: If the elasticities derived within the random specification fall into the 95% confidence interval of the conditional logit elasticities, the hypothesis that the elasticities do not differ significantly, can not be rejected. Table 2.9 yields average labor supply elasticities with respect to participation and with respect to working hours derived in the three models. In addition, the bootstrapped confidence intervals of the conditional logit model are presented.

The elasticities are in line with those found in previous literature, e.g. Haan and Steiner (2004). Therefore, I omit a discussion of the elasticities. The key result for my

research question is that regardless of the region and of gender, all elasticities derived in both random specifications fall within the bootstrapped confidence intervals. Hence, the qualitative implication of the labor supply model resulting from the random specifications do not differ significantly from those derived within the conditional logit model.

Table 2.10: Estimation of gross hourly wages

	Women				Men			
	West		East		West		East	
	coeff.	t-stat.	coeff.	t-stat.	coeff.	t-stat.	coeff.	t-stat.
Wage equation								
Years of education	0.061	34.01	0.020	8.22	0.055	44.52	0.034	14.91
Years of full time work	0.008	3.22	-0.005	-2.31				
Years of full time work^2	-0.011	-1.62	-0.019	-3.99				
Years of part time work	-0.006	-2.01	-0.021	-9.04				
Years of part time work^2	0.022	1.71	0.026	2.70				
Age 25-34	-0.110	-5.58	-0.610	-14.06	-0.352	-27.12	-0.287	-12.57
Age 35-44	0.026	1.55	-0.378	-9.84	-0.145	-17.71	-0.092	-6.46
Age 45-54	0.085	6.36	-0.220	-7.31	-0.041	-5.31	-0.022	-1.58
Age 55-64	0.057	5.27	-0.104	-4.82	-0.011	-1.49	0.004	0.30
Tenure	0.004	1.43	0.017	10.65	0.010	5.71	0.003	2.31
Tenure^2	0.002	0.19	-0.023	-4.77	-0.025	-4.28	-0.004	-1.07
Loss of human capital	-0.052	-7.19	-0.097	-13.36	-0.064	-6.98	-0.159	-18.49
Years of education * German	0.000	0.16			0.005	5.24		
Years of full time work * German	0.004	1.61			-0.001	-0.58		
Years of full time work^2 * German	-0.015	-2.11			0.013	2.18		
Years of part time work * German	0.002	0.84			-0.083	-7.83		
Years of part time work^2 * German	-0.016	-1.16						
Tenure * German	0.010	3.46						
Tenure^2 * German	-0.019	-1.89						
Loss of human capital * German	0.009	1.13						
Civil servant	0.028	8.29	0.007	0.91	-0.010	-3.93	0.018	2.72
Constant	1.558	40.17	2.666	37.01	2.019	91.46	2.239	53.99
Selection equation								
Age 25-34	1.983	45.20	3.354	29.80	-0.252	-7.63	0.057	1.02
Age 35-44	2.317	63.27	3.494	37.29	0.773	28.27	0.993	21.87
Age 45-54	1.859	56.65	2.746	37.13	1.051	35.00	1.132	23.90
Age 55-64	1.239	44.63	1.690	32.13	1.047	37.48	1.061	25.86
Medium education degree	0.190	5.97	1.071	14.24	0.207	5.46	1.013	11.13
High education degree	0.513	16.54	1.422	20.27	0.234	6.89	1.245	16.35
Vocational training	0.481	21.18	0.897	14.47	0.657	25.20	1.066	15.40
Academic Education	1.082	34.96	1.979	25.37	1.093	31.85	1.832	21.64
Years of full time work	0.116	41.41	0.150	24.64				
Years of full time work^2	-0.141	-18.84	-0.150	-11.10				
Years of part time work	0.146	40.20	0.130	17.97				
Years of part time work^2	-0.274	-19.52	-0.161	-5.58				
German	0.027	1.19			0.202	8.43		
Bad health (medium)	-0.004	-2.28	-0.011	-3.46	-0.012	-7.98	-0.015	-4.84
Bad health (high)	-0.011	-4.85	-0.003	-0.74	-0.005	-2.65	-0.001	-0.26
Married	-0.116	-6.09	0.302	9.55	0.330	15.32	0.715	20.61
Child younger 3	-1.413	-43.22	-1.136	-17.80	0.023	0.61	-0.128	-1.84
Child between 3-6	-0.612	-23.32	-0.303	-5.30	-0.019	-0.54	0.001	0.01
Child between 7-16	-0.335	-17.10	-0.124	-3.54	0.027	1.12	0.039	1.02
Child older 17	-0.061	-1.68	-0.111	-1.87	-0.072	-1.63	-0.096	-1.48
Other household income/1000	0.000	-27.80	0.000	-22.02	0.000	-65.55	0.000	-36.14
Constant	-2.753	-41.87	-4.549	-33.21	-0.590	-10.21	-1.031	-11.10
Mills ratio	0.055	5.81	-0.040	-2.59	0.003	0.57	-0.024	-1.81
Number of observations								
Censored	19287		6125		9890		4494	
Uncensored	17816		6990		24462		7556	

Notes: Loss of human capital is a weighted measure of years of unemployment capturing depreciation of human capital.Estimation uses pooled data for the period 1995-2003. Time and region specific (Bundesland) dummies as well as dummies for industry sector and firms size have been included in the estimation.

Table 2.11: Employment elasticities of the tax reform

	Couples, both flexible		Couples, one flexible		Singles	
	Women	Men	Women	Men	Women	Men
	Change in the participation rate (in percentage points)					
All couples/all singles	0.64	0.38	0.26	0.29	0.23	0.44
	(0.56-0.71)	(0.34-0.43)	(0.01-0.51)	(0.16-0.42)	(0.15-0.31)	(0.27-0.61)
West Germany	0.69	0.4	0.28	0.33	0.25	0.45
	(0.59-0.78)	(0.34-0.45)	(0.0-0.57)	(0.18-0.48)	(0.16-0.34)	(0.23-0.66)
East Germany	0.46	0.35	0.17	0.18	0.16	0.42
	(0.35-0.56)	(0.26-0.44)	(0.03-0.32)	(0.04-0.31)	(0.09-0.24)	(0.28-0.52)
	Change in total hours worked (in percent)					
All couples/all singles	0.64	0.38	0.26	0.29	0.23	0.44
	(0.56-0.71)	(0.34-0.43)	(0.01-0.51)	(0.16-0.42)	(0.15-0.31)	(0.27-0.61)
West Germany	0.69	0.4	0.28	0.33	0.25	0.45
	(0.59-0.78)	(0.34-0.45)	(0.0-0.57)	(0.18-0.48)	(0.16-0.34)	(0.23-0.66)
East Germany	0.46	0.35	0.17	0.18	0.16	0.42
	(0.35-0.56)	(0.26-0.44)	(0.03-0.32)	(0.04-0.31)	(0.09-0.24)	(0.28-0.52)

Numbers in parentheses refer to 95-percent bootstrap confidence intervals (500 repetitions).

Source: SOEP, wave 2002.

Chapter 3

Short- and Long-Run Effects of the German Tax Reform 2000: Intertemporal Labor Supply of Married Women[1]

3.1 Introduction

Estimating labor supply elasticities on the extensive (labor market participation) and intensive margin (working hours) using a discrete rather than a continuous specification has become increasingly popular in recent years. The main advantage of the discrete choice approach compared to a continuous specification derives from the possibility to model nonlinearities in the budget function of a household. Most of the discrete choice literature is based on cross sectional data and focuses on static labor supply models. Yet, the assumption of static labor supply behavior has been rejected by numerous studies that find strong evidence for true state dependence in the labor supply behavior, an early example is Heckman (1981a).

The contribution of this analysis is to link the discrete choice labor supply model with research on intertemporal labor supply behavior. In the following, I develop an empirical framework that accounts for true dependence in labor supply and allows to evaluate

[1]This research was partly financed by the German Science Foundation (DFG) in the priority program "Potentials for more flexibility on heterogenous labor markets" (project STE 681/5-1).

the dynamics of labor supply behavior on the extensive and the intensive margin in an intertemporal context. I will apply this framework to estimate the intertemporal labor supply effects of married and cohabiting women induced by the German Tax Reform 2000. As discussed in Chapter II, several studies have analyzed the labor supply effects of the German Tax Reform 2000, e.g. Wagenhals (2000b) and Haan and Steiner (2005 and 2006). These studies find that the tax reform has a significant, yet relative to the fiscal cost, a modest positive effect on labor supply. The mentioned studies including the analysis in Chapter II employ microsimulation techniques combined with a static structural labor supply estimation. This methodology has become standard for ex-ante evaluations of tax and transfer reforms and there exists numerous applications in the literature (Blundell and MaCurdy, 1999). The advantage of this modeling for the evaluation of behavioral effects is that labor supply incentives induced by the current tax and benefit system and by hypothetical reform scenarios can be accurately described. However, one central shortcoming of this methodology is that the labor supply behavior is estimated in a static framework. The static modeling implies that households can immediately adjust their behavior given changes in work incentives and thus the labor supply effects estimated in the static framework can be only interpreted as the long run effects of a reform. However, this crucial assumption of the static model is only justified if true state dependence in labor supply is not significantly present which has been rejected by numerous studies.

In the following, I suggest an enhanced framework for the ex-ante evaluation of policy reforms in the tax and transfer system to overcome this shortcoming of the aforementioned studies. Instead of using the static approach, I develop an intertemporal discrete labor supply model that allows to estimate behavioral responses along the intensive and extensive margin in the household context.

There exist several studies on the labor supply behavior in an intertemporal setting, e.g. Hyslop (1999). Of particular interest for this analysis are those few studies that focus on both the extensive and the intensive margin of labor supply. Prowse (2005) analyzes transitions of women between no work, part-time and full-time work in an intertemporal context. Using a multinomial probit model, she shows that true state dependence is present in both full-time and part-time employment. In an intertemporal conditional

logit framework, Michaud and Vermeulen (2004) model the labor supply and retirement decision of households in the US. To the best of my knowledge, for Germany, the presented study is the first attempt to model the intertemporal labor supply behavior accounting for both the intensive and extensive margin in a discrete choice setting. A recent study on Germany by Croda and Kyriazidou (2005) focuses on the labor market participation of married women. The authors employ several panel data estimators with fixed and random effects. Regardless of their specification, they find strong state dependence of married women on the extensive margin.

The framework proposed here extends previous work in several dimensions. First of all the focus is not only on the extensive but as well on the intensive margin. Although labor supply effects on the extensive margin tend to be more important (Heckman, 1993), it is necessary to study the intensive margin as well when analyzing the labor supply behavior. Further, this analysis is based on a detailed microsimulation model for Germany (STSM) which maps the relevant regulations of the German tax and benefit system and explicitly accounts for child care costs. The striking advantage of microsimulation is that the work incentives of individuals can be accurately described in the household context. When analyzing female working behavior, the modeling of child care costs is very important as the labor supply of women is in particular affected by child care costs. In this respect, this analysis goes beyond most of the previous studies as I include the cost for child care when working. Furthermore, I model the labor supply of both spouses in a joint utility model where the partners jointly maximize a household utility function. Thus, when analyzing the female labor supply, the working behavior of the partner is not exogenously given but explicitly modelled within the framework. The intertemporal discrete choice approach allows to study the dynamics of labor supply. Labor supply elasticities in the short and long term can be derived. This yields important insights for the evaluation of policy reforms as not only the size of the labor supply effects of a given reform can be analyzed but also information about the process of behavioral adjustment can be provided.

I employ a dynamic conditional logit panel data model with random effects where the choice of discrete labor supply alternatives is estimated conditional on the labor supply of

the last period, on individual, household and choice specific variables and on unobserved effects. The unobserved heterogeneity is modelled nonparametrically as suggested by Heckman and Singer (1984). Next to observed characteristics, it is necessary to control for unobserved heterogeneity in order to disentangle the true and spurious state dependence of labor supply. The problem of initial conditions is explicitly taken into account following Wooldridge (2005).

Based on this framework I analyze the impact of the German Tax Reform 2000 on the labor supply behavior of married and cohabiting women. This sub group is of particular interest as the labor supply elasticities among this group are highest in the population (Blundell and MaCurdy, 1999). The analysis is based again the German Socio Economic Panel Study (SOEP). I estimate the short run labor supply effects of the tax reform, and based on a first order Markov process I derive the effects in the long run, i.e. when women have fully adjusted their labor supply behavior.

My results show that in the short run, that is after the first year, the labor supply responses of women are modest as state dependence prevents the women to respond immediately to the incentives induces by the new tax and benefit regime. The findings indicate that in the long run, after about the fifth period, state dependence is circumvented and the women have fully adjusted and thus the labor supply effects markedly increase. Further, I show that the long run effects derived in the intertemporal framework are similar to those found when using the previously employed static evaluation method.

3.2 Theoretical Background

In the following section I will develop the theoretical framework for the analysis of the intertemporal labor supply behavior of married and cohabiting women. To account for the non-linearities in a household's budget set, I model the labor supply of both spouses in a discrete framework rather than using a continuous specification of the working hours.

Intertemporal Discrete Choice Model

Discrete choice models of labor supply are based on the assumption that a household i is faced with a finite number J of discrete bundles of leisure and net household income which provide different levels of utility V_j at period t.[2] The household chooses that bundle j which yields the highest utility. I follow previous studies, e.g. van Soest (1995) or Blundell, Duncan, McCrae, and Meghir (2000) and model the labor supply decision of couples in a joint framework, by defining a joint utility function with combinations of discrete working hours of both spouses and the resulting disposable household income.[3] In a static model of labor supply a household's utility is only conditioned on information of the present period t. To model the dynamics of labor supply, I introduce state dependence of labor supply by conditioning the utility in period t on the lagged labor market status of both spouses in period $t-1$. Note, the intertemporal framework proposed here does not describe the labor supply behavior over the full life cycle. The agents are assumed to be myopic in the sense that they do only incorporate their past employment history yet not the future working behavior when maximizing their utility in the current period. In this respect, the model is similar to the intertemporal framework of labor market participation with structural state dependence developed by Heckman (1981c).

I specify the level of utility V at each discrete point j in the following framework:

$$V_{ijt} = U(lf_{ijt}, lm_{ijt}, y_{ijt}, z_{it-1}, x_{it}, c_i, \epsilon_{ijt}). \tag{3.1}$$

The utility function of a household U contains an observable and an unobservable component. The observable component includes the leisure time of both spouses, lf_{ijt} and lm_{ijt}, and the net household income y_{ijt}. Further, individual, household and time specific characteristics of both spouses x_{it} that are constant over the different labor supply

[2] In this model, I assume that households do not save, thus consumption equals the net disposable income.

[3] In contrast to previous work on household labor supply, e.g. Michaud and Vermeulen (2004), I do not consider a collective model where both spouses are involved in a bargaining process to determine their individual leisure and income. Based on the available information in the data strong assumptions about the bargaining process had to be imposed (Beblo, Beninger, and Laisney, 2003). Therefore, I stick to the joint utility model which lacks this flexibility but has been proven to be well identified and robust, e.g. van Soest (1995), Blundell, Duncan, McCrae, and Meghir (2000), or Haan and Steiner (2005).

alternatives, such as age or nationality enter the utility function. These variables can be interpreted as taste shifters of the preferences for income and leisure time. In addition, the utility is dependent on the realized working hours alternative of the previous period z_{it-1}. This variable is constant over the alternatives and affects the preferences for leisure and income in the current period. The unobservable component consists of a household specific term $c_i = (c_{im}, c_{if})$ that is allowed to be different for the spouses and of an random error term that varies over time, households and alternatives ϵ_{ijt}. In this framework, the decision rule of a household has the following form: both spouses maximize jointly a household utility given the combination of both partners‘ leisure time and the household income and they choose the bundle j that provides the highest utility level V for the household in period t.

According to the empirical distribution of female and male working hours, 13 discrete bundles ($J = 13$) of household income and female and male leisure hours are defined (Table 3.1). The maximization problem of the household is subject to a budget constraint as net household income depends on the working hours of the spouses, i.e their non-leisure time. The discrete choice model is driven by the probabilities to choose each alternative J. Given these probabilities, the optimal supply of weekly working hours can be determined as the sum of discrete working hours weighted by their probabilities. Due to changes in a household‘s budget function or due to changes of observed or unobserved characteristics that affect the utility function it might become optimal for the household to adjust labor supply over time. In a static model it is assumed that a household can adjust labor supply immediately as state dependence is not accounted for. This assumption, however, is only justified if state dependence does not exists.

State Dependence in Labor Supply

State dependence in labor supply is present if, given the observed and unobserved characteristics, the working behavior of the last period affects the current labor supply decision. This could arise if the employment history is relevant for prices, preferences and constraints of future periods (Prowse, 2005). Intertemporally nonseparable preferences, human capital accumulation, or signaling and scarring effects explain why the current

utility for leisure and income is affected by the previous employment history. Further, fixed costs of work such as search or transaction costs are potential sources of state dependence, as these might differ by the previous employment state, for more detail see Hyslop (1999) or Prowse (2005). In the empirical analysis I will distinguish between child care costs which is the major financial burden for women with young children and other fixed costs of work. Child care costs are explicitly accounted for in the estimation and thus they are not part of potential state dependence. This is important when comparing the state dependence of women with and without young children.

State dependence can be positive or negative, yet as underlined by the given examples, the correlation of labor supply over time seems to be positive (Lee and Tae, 2005). In the empirical application, I will test whether the effect of true state dependence is positively significant in a model of labor supply. Therefore, I will distinguish between two sources of choice persistence: true state dependence and unobserved heterogeneity. Next to true state dependence and unobserved heterogeneity, there might be a third source of choice persistence in the data coming from autocorrelation in the error terms ϵ_{ijt}. Amongst others, Hyslop (1999) accounts for serial correlation. Yet, Croda and Kyriazidou (2005) and Michaud and Tatsiramos (2005) reject the hypothesis of a first order autoregressive process in a dynamic labor supply model using micro data for Germany. Therefore, I assume the error terms ϵ_{ij1}, ..., ϵ_{ijT} to be uncorrelated over time.

As discussed in Chapter II, standard discrete choice models of labor supply do not differentiate between voluntary and involuntary unemployment which can lead to biased labor supply elasticities. However, Bargain, Caliendo, Haan, and Orsini (2006) show that the assumption of a pure choice model for women in couple households is not too restrictive even in a country with labor market restrictions and high unemployment since the majority of the inactive in the group chooses voluntarily not to work.

3.3 Empirical Methodology

The empirical framework applied for evaluating the dynamic labor supply effects induced by the German Tax Reform 2000, follow the methodology discussed in Chapter II. Again,

I combine microsimulation with a structural model of labor supply behavior. The key difference though is that here I model the labor supply in a more realistic intertemporal framework.

The base year for the analysis is the fiscal year 2000 as this was the last year before the tax reform. In contrast to Chapter II, the empirical analysis is based on panel data spanning from 1999 to 2003. Thus it is necessary to simulate tax payments and net household incomes on the basis of the tax legislation in 2000 for household observed in years with a different tax legislation. This scenario serves as the basis for the analysis. The pre-tax scenario is compared to simulated hypothetical post-reform tax payments and net incomes which differ solely due to the changes in the tax function. The post-reform scenario mimics the tax system of the year 2005. The difference between the net household income derived on basis of the pre- and post-reform legislation measures the gross-mechanical effect of the Tax Reform 2000 which has to be adjusted for bracket creeping as described above in order to derive the net-mechanical effect of the reform which for simplicity will be referred to in the following as mechanical effect.

Econometric Specification

In the following, I will develop the econometric model for the estimation of the above described framework of intertemporal labor supply behavior.

Initial Conditions Problem

As described in equation (3.1), a household's utility in period t is conditioned on the lagged labor market status of both spouses which is the lagged dependent variable z_{it-1}. This leads to the problem of initial conditions when estimating the model because the initial of a spouses' labor supply cannot be assumed to be random. This is a general problem of a dynamic specification which has been widely discussed in the econometric literature. In numerous empirical applications the initial conditions problem is tackled by modeling the initial state following the method suggested by Heckman (1981b). Lee and Tae (2005) and Croda and Kyriazidou (2005) follow a different approach: they employ a

dynamic conditional logit model with fixed effects, developed by Honore and Kyriazidou (2000). The advantage of this approach is that the time constant unobserved effect c_i is removed such that no assumptions about the endogeneity of the unobserved effects need to be imposed. Thus, the initial conditions problem does not arise in the fixed effect model. However, this flexibility has several drawbacks one of them being that partial effects are not identified which is crucial to determine the amount of state dependence (Wooldridge, 2005).

In order to solve the problem of initial conditions, I employ a different estimation strategy that builds on the approach suggested by Chamberlain (1980) and Wooldridge (2005). This approach has been applied in similar studies, such as Michaud and Vermeulen (2004), Michaud and Tatsiramos (2005) or Lee and Tae (2005). It is based on the assumption that the conditional expectation of the unobserved household effect $h(c_i|z_i0, x_i; \delta)$ is correctly specified, conditional on the initial state z_{i0} and on household and individual specific variables that are constant over time x_i. In other words, the assumption implies that there exists a linear projection of exogenous variables, the initial state z_{i0} and further observed individual variables x_i and an error term a_i that explains the unobserved effect. Vector x_i includes the mean values of all individual and household specific variables, age, number and age of children, health status, region and nationality.[4] The unobserved household specific error term a_i captures the remaining unobserved heterogeneity that is by definition uncorrelated with z_{i0} and x_i. In the estimation I allow a_i to be different for both spouses, $a_i = (a_{im}, a_{if})$ and model potential correlation.

Unobserved Heterogeneity

The household specific error term $a_i = (a_{im}, a_{if})$ is specified nonparametrically following Heckman and Singer (1984). I assume that the household specific error term is described by a bivariate discrete distribution with two points of support (mass points) for husband (a_{m1}, a_{m2}) and wife (a_{f1}, a_{f2}).[5] Hence, the household specific effect is described by four combinations of the male and female heterogeneity points, G: (a_{m1}, a_{f1}), (a_{m1}, a_{f2}),

[4] This approach slightly differs from Wooldridge (2005) as means of the explanatory variables rather than the values at all points in time are included.

[5] Belzil (2001) employs a similar specification estimating a discrete duration model.

(a_{m2}, a_{f1}) and (a_{m2}, a_{f2}), which are assumed to be constant for all households. Each household has a probability for each combination of the unobserved heterogeneity. This specification is flexible as it captures the correlation of the spouses' characteristics which are not observed. Note, for identification, only one mass point for each spouse is freely estimated; the other point is normalized to zero. The probabilities π_k, k $\in \{1, 2, 3, 4\}$ for the four combinations follow a multinomial distribution to guarantee plausible results:

$$\pi_k = \frac{\exp(q_k)}{\sum_{j=1}^{4} \exp(q_j)}; \quad \sum_{k=1}^{4} \pi_k = 1, \tag{3.2}$$

where q_k are the transformed probability coefficients to be estimated. For identification q_1 is normalized to zero. Mass points and the transformed probabilities are jointly estimated with the parameters by maximum likelihood. Standard errors for the probabilities are derived using the delta method.

The Likelihood Function

Inserting the model of the unobserved household specific effect c_i into the above defined utility function, the utility of alternative j becomes:

$$V_{ijt} = U(lf_{ijt}, lm_{ijt}, y_{ijt}, z_{it-1}, x_{it}, c_i(z_{i0}, x_i, a_i), \epsilon_{ijt}). \tag{3.3}$$

Drawing on McFadden (1974), I assume the error terms ϵ_{ijt} to follow a Gumble distribution. Then, a dynamic conditional logit model can be derived where the probability of choosing alternative j from all J alternatives conditional on the explanatory variables in period t, the chosen alternative of the previous period and the unobserved individual effect has the following form:

$$Pr(V_{it} = j) = \frac{\exp U(lf_{ijt}, lm_{ijt}, y_{ijt}, z_{it-1}, x_{it}, z_{i0}, x_i, a_i)}{\sum_{r=1}^{J} \exp U(lf_{irt}, lm_{irt}, y_{irt}, z_{it-1}, x_{it}, z_{i0}, x_i, a_i)}. \tag{3.4}$$

The likelihood to be maximized is then[6]:

[6]The model is estimated using the -ml- command in Stata version 8.2.

$$L = \prod_{i=1}^{n} \sum_{k=1}^{4} \pi_k(a^k) \prod_{t=1}^{T} \prod_{j=1}^{J} Pr(Y_{it} = j)^{d_{itj}}, \tag{3.5}$$

where $d_{itj} = 1$ if j is the chosen alternative and 0 otherwise. In the conditional logit framework variables which do not vary over alternatives, are not identified. Therefore, variables that are constant over alternatives x_{it}, x_i including the lagged dependent variable z_{it-1} and the initial state z_{i0} enter the specification as taste shifters of the preferences for income and leisure. State dependence is modeled in linear and quadratic terms of both spouses' leisure time in the previous period. The initial state enters in a similar way. The household specific error term is included in a flexible way as random coefficient of the leisure terms of both partners allowing for correlation of unobservable characteristics shifting the taste for the spouses' leisure time.

Specification of the Utility Function

For the specification of the utility function, I assume a quadratic utility function similar to Blundell, Duncan, McCrae, and Meghir (2000). Disposable net household income and the leisure of both spouses, their interaction and their quadratic terms enter the utility function. Hence, the utility function to be estimated has the following form:

$$\begin{aligned} V_{ijt} = \alpha_1 y_{ijt} + \alpha_2 lf_{ijt} + \alpha_3 lm_{ijt} + \alpha_4 y_{ijt}^2 + \alpha_5 lf_{ijt}^2 + \alpha_6 lm_{ijt}^2 \\ + \alpha_7 y_{ijt} lf_{ijt} + \alpha_8 y_{ijt} lm_{ijt} + \alpha_9 lm_{ijt} lf_{ijt}. \end{aligned} \tag{3.6}$$

I assume that the marginal utility of income and leisure varies across households by age, education, number and age of children, region, health status, nationality, the lagged dependent variable, the initial state and the random effect:

$$\alpha_1 = \beta_1 + \gamma_1 x_{1it}, \tag{3.7}$$

$$\alpha_2 = \beta_2 + \gamma_2 x_{2it} + a_{fj}; \quad j \in \{1, 2\}, \tag{3.8}$$

$$\alpha_3 = \beta_3 + \gamma_3 x_{3it} + a_{mj}; \quad j \in \{1, 2\}, \tag{3.9}$$

where a_{f1} and a_{m1} are normalized to zero. The lagged dependent variable, the initial state and the mean values of all time varying characteristics are included in vectors x_{1it})and x_{2it} and enter the specification through the net household income and through the female leisure term. The previous employment state is defined as the realized leisure time in the previous period and enters in linear and quadratic terms.[7] To capture the disutility related to flexible arrangements, I follow van Soest (1995) and include dummy variables for the part time categories of women in vector x_{1it}.

3.4 Data Organization

In order to empirically analyze the above derived intertemporal model of labor supply it is necessary to employ panel data information of households. This study is based on the German Socio Economic Panel Study (SOEP). For this analysis, I draw on a balanced panel for the years 2000 - 2003 which contains retrospective information for the fiscal years 1999 - 2002. I concentrate on married couples where both spouses are aged between 20 and 55 years. Excluded are households where at least one spouse is in full-time education, self employed or retired, because labor supply of these groups differ from the rest of the population. After dropping households with missing information 1,645 households remain which are observed over four consecutive periods. The first period is required to construct the initial state of labor supply. Thus, information of three periods enters the estimation. As described above, the working alternatives are defined according to the empirical distribution of working hours. For each alternatives I calculate the average working hours which are assign to the all households.

The first three columns in Table 3.1 yield information about the working alternatives and the percentage of households choosing these categories. In Germany, part-time work for men is very unusual. Therefore, the choice set for the male spouse consist simply no work, full-time and over-time. Women can choose between inactivity, two part-time cat-

[7] More flexible specifications for the state dependence with vectors of dummy variables do not change the results of this analysis.

Table 3.1: Working hours, net household income and region

Alternative	Share %	Hours Women per Week	Hours Men per Week	Net Income in Euro	East Germany %
1	2.45	0	0	1280	42.15
2	1.52	19	0	1720	34.67
3	2.15	40	0	2166	40.57
4	13.56	0	37	2438	13.13
5	8.76	9.5	37	2672	4.85
6	17.69	24	37	2968	14.87
7	13.90	37	37	3205	36.39
8	3.46	45	37	3396	48.54
9	9.35	0	48	2845	16.23
10	5.16	9.5	48	3082	5.49
11	11.15	24	48	3386	20.15
12	7.29	37	48	3596	50.00
13	3.56	45	48	3794	46.59

The following working hours (weekly) classifications are used: men: 0, 0-40, >40; women: 0, 0-14, 15-34, 35-40, >40.
The overall share of households in east Germany is about 20%.
Net household income (monthly) is calculated on basis of the microsimulation model STSM. The net household income is the expected mean income in the given alternative.
Source: SOEP, wave 2000-2003, STSM.

egories, full-time and over-time. Dropping two unusual combinations, where the woman is working part time and the man is not working, 13 discrete choices of working hours have been defined. As expected, in this sample, the male labor market participation is far higher than the participation of women. Whereas nearly 95% of all men supply positive working hours, only about 75% of the women participate on the labor market.[8] Part-time work is very common for married women. More than 40% of the female population works part-time. Interestingly, that holds not true for the eastern part of Germany which can be seen in the last column. This, and the higher female participation rate in east Germany point at the still very different labor market behavior in east and west Germany.

In column (4), the average disposable net household income in each alternative is tabulated. The net household income is derived on basis of the microsimulation model STSM. Based on variables drawn from the SOEP that determine gross income and benefits for all household members, disposable net income is simulated at the household level. The

[8]These participation rates exceed the participation rates of the whole working population as I focus on an age group with relatively high participation rates.

largest share of gross income being working income is calculated on basis of the alternative specific working hours and a constant hourly gross wage.[9] The detailed modeling of the net household income based on microsimulation is in particular important for the estimation of the labor supply behavior as this is the most accurate way to describe work incentives in the household context (Laroque and Salanie, 2002). Actual child care costs are very high in Germany. This is due to the limited number of subsidized child care facilities (Wrohlich, 2006). For this analysis the actual child care costs for households with children younger than 6 years have been imputed.[10] The child care costs are subtracted from the simulated net household income for households with children younger than seven years.

Comparing the net household income over the alternatives, it becomes evident that due to non labor market income, such as capital income, and due to the tax and benefit system in Germany the net income increases only moderately with working hours. Note, as in Germany, income is jointly taxed with full income splitting, additional hours of the spouse of a full-time working partner do only slightly affect the net disposable household income. This is due to the high marginal tax rates which the secondary earner faces in a married household (Steiner and Wrohlich, 2004).

Households‘ preferences for income and leisure might differ by individual and household specific characteristics such as age, region or the number of children. As the literature has shown, in particular the number of young children is important for the labor supply behavior of women (Mroz, 1987). In Table 3.2 the share of households with children of a certain age group by hours categories is listed. These statistics provide strong evidence that women with young children do not work. In the last column the expected child care costs for household with children younger than seven years are shown. Following Wrohlich (2006), I distinguish between part-time and full-time care and assign the costs to those alternatives where both spouses are working and dependent on whether the wife is working full-time, over-time or part-time.

[9]For non working individuals hourly wages are estimated on basis of a Heckman selection model. For the specification and the results of the wage estimation, see the previous chapter and Table 2.10.

[10]Child care costs are estimated based on individual and regional information. They differ by age of the child. I thank Katharina for providing the data.

Table 3.2: Working hours and children

Alternative	Hours Women per Week	Hours Men per Week	Child 0-3 %	Child 3-6 %	Child Care Cost in Euro
1	0	0	13.22	22.31	0
2	19	0	2.67	10.67	0
3	40	0	6.60	11.32	0
4	0	37	16.87	18.96	0
5	9.5	37	5.54	17.78	214
6	24	37	2.06	8.81	214
7	37	37	0.29	5.09	614
8	45	37	1.17	3.51	614
9	0	48	19.05	25.76	0
10	9.5	48	7.45	11.37	214
11	24	48	2.90	10.89	214
12	37	48	0.56	4.17	614
13	45	48	1.14	5.11	614

The following hours classifications are used: men: 0, 0-40, >40; women: 0, 0-14, 25-34, 35-40, >40.
Share of households with at least one child in the given age interval.
Child care costs are expected monthly child care costs for households with children younger than 7 years (Wrohlich, 2006).
Source: SOEP, wave 2000-2003.

Further descriptive statistics about the individual and household specific variables, such as education, age, health status, regional information and nationality are provided in Table 3.11 in the Appendix.

Before discussion the effect of true state dependence in the next section, a look at descriptive statistics of working transitions provides evidence of persistence in female labor supply, stemming either from unobserved or observed heterogeneity or true state dependence. On the diagonal of the unconditional transition matrix the high persistence in the labor supply behavior of women can be seen.

Table 3.3: Persistence in the employment of women

	Inactivity	Part-time 1	Part-time 2	Full-time	Over-time	All women (t)
Inactivity	1,019	95	59	63	17	1,253
Part-time 1	127	460	89	7	5	688
Part-time 2	79	121	1,203	86	11	1,500
Full-time	35	11	84	894	129	1,153
Over-time	6	3	20	125	193	347
All women (t+1)	1,266	690	1,455	1,175	355	4,941

The following working hours classifications (weekly) for women are used: 0, 0-14, 15-34, 35-40, >40.
Source: SOEP, wave 2000-2003.

3.5 Empirical Results

Estimation Results

Table 3.4 contains the estimation results for the dynamic conditional logit panel data model with and without random effects. In addition to the above specified flexible model accounting for unobserved heterogeneity, I present results of an estimation where random effects enter in a more restrictive way. In the more restrictive specification, I assume that the household specific effect is described only by two combinations of the male and female heterogeneity points, G: (a_{m1}, a_{f1}) and (a_{m2}, a_{f2}).

The difference in the Akaike Information Criterion[11] between the different specifications, and the significance of the mass points and the probabilities, indicate that it is necessary to include random effects in a flexible way to capture unobserved individual effects. Therefore, for the following interpretation, I focus only on the model where unobserved heterogeneity is captured in a flexible way, by allowing for correlation between the unobserved effects of the spouses. However, despite of the significant difference between the specifications, the coefficients resulting from the different estimations are relatively similar. This finding is in line with Michaud and Vermeulen (2004) who argue that the initial state captures most of the individual unobserved heterogeneity. As mentioned above, state dependence can be disentangled in unobserved heterogeneity and true state dependence. This can be found when comparing the three specification: the better unobserved effects are captured the less important becomes the true state dependence, namely the coefficient of the lagged female leisure time. Preference for income and leisure vary with observed characteristics, such as education, number of children, age or region.[12] As expected, the presence of young children significantly increases preference for the leisure of women. In line with previous studies, women and men living in east Germany, and non

[11] The Akaike Information Criterion (AIC) rather than a standard likelihood ratio test has to be considered as under the null hypothesis the latter violates the regularity conditions, and thus its distribution is unknown. AIC is defined as $AIC = lnL - k$, where lnL is the log likelihood at the maximum and k the number of estimated parameters.

[12] As Wooldridge (2005) points out, effects of time constant variables such as education or the mean values of time variant explanatory variables cannot be identifies as they are partially correlated with the unobserved heterogeneity c_i.

Table 3.4: Estimation results: Intertemporal labor supply estimation

	Coef.	Std.	Coef.	Std.	Coef.	Std.
Net Income						
Age - Man	-38.062	12.568	-39.624	13.980	-36.8423	15.248
Age^2 - Man	46.775	14.487	48.687	16.11	45.7298	17.520
Age - Woman	17.773	9.4502	16.738	11.602	17.7893	12.080
Age^2 - Woman	-21.235	11.326	-19.705	13.897	-21.3965	14.478
Leisure t-1 - Man	-0.084	0.005	-0.0463	0.0058	-0.0502	0.0061
Leisure t-1 - Woman	-0.010	0.00	-0.0042	0.006	-0.0060	0.007
Leisure t-0 - Man	-0.050	0.005	-0.0546	0.0065	-0.0578	0.007
Leisure t-0 - Woman	-0.007	0.005	-0.018	0.006	-0.0124	0.007
Constant	11.420	2.441	11.672	2.846	11.0119	3.081
Net Income^2	-0.085	0.022	-0.135	0.0296	-0.1392	0.0310
Leisure Man						
Age - Man	0.1541	0.470	-0.030	0.5245	0.0820	0.544 9
Age^2 - Man	1.091	0.404	1.349	0.4760	1.218	0.4979
German - Man	0.024	0.028	0.0404	0.0289	0.037	0.0291
East German - Man	-0.0138	0.070	-0.0170	0.0892	-0.0161	0.0888
Health Status - Man	-0.0165	0.046	-0.001	0.0458	-0.0027	0.0455
Medium Education Degree - Man	-0.0241	0.007	-0.031	0.0085	-0.0303	0.008
High Education Degree - Man	-0.0471	0.008	-0.0485	0.0105	-0.047	0.010
Age - Man	-0.0096	0.003	-0.009	0.0033	-0.009	0.003
Health Status - Man	0.0395	0.048	0.016	0.0491	0.0177	0.0489
German - Man	-0.0342	0.028	-0.048	0.0293	-0.04513	0.02952
East German - Man	0.021	0.070	0.033	0.0893	0.032	0.0889
Constant	0.442	0.071	0.458	0.0909	0.4263	0.0947
Leisure Man^2	-0.002	0.000	-0.004	0.0001	-0.0044	0.0001
Leisure Woman						
Age - Woman	-0.2131	0.458	-0.347	0.4840	-0.1801	0.5469
Age^2 - Woman	0.5311	0.402	0.548	0.4281	0.3353	0.5101
German - Woman	-0.0040	0.046	-0.005	0.0461	-0.0027	0.0489
East German - Woman	-0.1570	0.116	-0.149	0.1156	-0.1710	0.1280
Health Status -Woman	-0.0660	0.048	-0.066	0.0488	-0.0739	0.0511
Child 0-3	0.1248	0.019	0.118	0.0192	0.1452	0.0213
Child 3-6	0.0143	0.011	0.013	0.0113	0.0231	0.0123
Medium Education Degree - Woman	-0.005	0.013	-0.003	0.0139	-0.0018	0.0170
High Education Degree - Woman	-0.0277	0.014	-0.023	0.0149	-0.025	0.0181
Leisure t-1 - Man	-0.0017	0.001	-0.002	0.0013	-0.0019	0.0012
Leisure t-1 - Woman	0.0114	0.001	0.011	0.0014	0.0064	0.0017
Leisure^2 t-1 - Man	0.0003	0.000	0.001	0.0011	0.001	0.0011
Leisure^2 t-1 - Woman	-0.0042	0.0011	-0.004	0.0011	-0.0008	0.0014
Leisure t-0 - Man	-0.0009	0.0002	-0.000	0.0002	-0.000	0.0003
Leisure t-0 - Woman	0.0036	0.0002	0.003	0.0002	0.0054	0.0003
Age - Woman	-0.0004	0.0031	0.000	0.0032	0.000	0.003
Child 0-3	0.0275	0.0214	0.027	0.02139	0.071	0.024
Child 3-6	-0.0287	0.013	-0.028	0.0135	-0.037	0.015
Health Status - Woman	0.0914	0.0542	0.087	0.0544	0.1182	0.0614
German - Woman	-0.000	0.046	0.002	0.0466	-0.0004	0.0497
East German - Woman	0.1488	0.1164	0.141	0.1158	0.1632	0.128
Constant	0.290	0.0793	0.323	0.0847	0.4433	0.101
Leisure Woman^2	-0.0074	0.0002	-0.007	0.0002	-0.008	0.000
Net Income*Leisure Man	0.0054	0.0030	-0.001	0.0038	-0.00193	0.0039
Net Income*Leisure Woman	0.0077	0.0022	0.005	0.002	0.0051	0.0029
Leisure Man*Leisure Woman	0.080	0.1525	-0.2795	0.169	-0.1674	0.1701
Part Time 1	-1.275	0.075	-1.283	0.0752	-1.302	0.0809
Part Time 2	-0.6245	0.0785	-0.6258	0.0785	-0.7342	0.0857
Mass point - Woman			0.0194	0.0074	-0.209	0.0156
Mass point - Man			0.3026	0.0125	0.303	0.013
p1			0.2717	0.0178	0.2340	0.0176
p2			0.7282	0.0178	.0307	.0078
p3					0.6896	.01953
p4					0.0456	.0123
Observations	4935		4935		4935	
Log-Likelihood	-8287.609		-8050.505		-7998.9504	
Derivatives						
$U_y > 0$	95%		95%		95%	
$U_{lf} > 0$	70%		70%		70%	
$U_{lm} > 0$	95%		75%		75%	

Time dummies for the year 2001 and 2002 have been included.
Variables in *italic* are the individual mean values.
Unobserved heterogeneity is assumed to follow a non parametric distribution. For both. men and women 1 mass points is freely estimated. Probabilities p2-p4 are estimated. p1 is derived following the underlining assumption $\sum_{m=1}^{M} P_i(a_i^m) = 1$. To guarantee plausible results a multinomial specification of the probabilities. rather than the probabilities p2-p4. has been estimated. The standard errors of the probabilities are derived using the delta method.
Source: SOEP, wave 2000-2003 and STSM.

German spouses prefer to work more. Education seems to increase the taste for work. This effect is significant for men yet not for women. Taste shifters related to age are not always significant and do not display clear patterns. Men with a poor health status have a higher preference for leisure while for women this effect is not significant. Part time dummies are significantly negative; as stressed above this captures the disutility related to flexible arrangements.

For the interpretation of effects with multiple interactions, such as income and leisure, marginal effects, derivatives or elasticities need to be considered. Empirical derivatives with respect to leisure and income show that the theoretical implications of the utility function are fulfilled (last panel of Table 3.4). For almost all households the concavity of the utility with respect to income is guaranteed. The derivatives with respect to leisure show that for a small part of the population an increase in leisure diminishes the utility; this result is line with previous studies and does not contradict the theoretical implications of the model (Euwals and van Soest, 1999).

The coefficients of the lagged dependent variables hint at positive state dependence in the labor supply behavior of women. Leisure time of the women in the previous period significantly increases the taste for leisure in the current period, yet at a decreasing rate as the quadratic term of the previous leisure term has a negative effect. The effect of the lagged leisure term of the male spouse on the wife‘s preference for leisure is very small and only weakly significant. The lagged leisure term of the man significantly reduces the preference for income in the current period which supports the hypothesis of state dependence. For the woman, this effect points in the same direction yet is not statistically significant. I have excluded potential effects of state dependence on the male labor supply as the focus of this paper is solely on female labor supply behavior.

True State Dependence on the Extensive and Intensive Margin

In order to provide a test for the hypothesis of positive true state dependence in female labor supply, I derive an intertemporal transition matrix of labor supply, conditioned

on observable and unobservable effects. This matrix is based on the household specific probabilities for each working category.

Posterior Probability of Discrete Alternatives

The household specific probabilities for each working category depend on the unobserved household specific effect. Therefore, it is necessary to draw from the posterior choice probability that is conditioned on the choice sequence of a household. This conditional probability explicitly accounts for the unobserved heterogeneity by assigning unobserved characteristics to each household (Skrondal and Rabe-Hesketh, 2004). I adapt the method described in Train (2003) who discusses the calculation of posterior probabilities assuming a continuous parametric distribution. I derive the posterior probabilities by calculating household specific weights for the four different mass point combinations. The weights w_{ik} are defined in the following way:

$$w_{ik} = \frac{P(\tilde{y}_{ik}|\mathbf{X_i}, a_i^k)}{\sum_{k=1}^{4} P(\tilde{y}_{ik}|\mathbf{X_i}, a_i^k)}, \tag{3.10}$$

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

True State Dependence

Conditioned on the estimated coefficients of the lagged dependent variable, I describe the transition process of labor supply by calculating a transition matrix $\mathbf{M}$. In the columns of the transition matrix the previous employment state is tabled, the rows show the choice of the working alternative in the current period. The transition matrix provides information about true state dependence as unobserved and observed characteristics are kept constant within each column except the lagged dependent variable. That implies all differences in the labor supply behavior conditioned on period $t-1$ can be attributed to the previous

Table 3.5: Transition matrix of labor supply: All women

	Inactivity (t)	Part-time 1 (t)	Part-time 2 (t)	Full-time (t)	Over-time (t)
Inactivity (t-1)	0.403	0.266	0.288	0.040	0.002
	0.014	*0.011*	*0.015*	*0.006*	*0.001*
Part-time 1 (t-1)	0.293	0.245	0.374	0.082	0.006
	0.008	*0.010*	*0.008*	*0.007*	*0.001*
Part-time 2 (t-1)	0.154	0.184	0.453	0.185	0.024
	0.010	*0.006*	*0.014*	*0.007*	*0.002*
Full-time (t-1)	0.065	0.104	0.444	0.319	0.067
	0.008	*0.010*	*0.010*	*0.013*	*0.005*
Over-time (t-1)	0.039	0.067	0.400	0.388	0.106
	0.007	*0.010*	*0.012*	*0.020*	*0.009*

The following hours classifications are used: 0, 0-14, 15-34, 35-40, >40.
Standard errors are given in *italic*. Standard errors are derived using bootstrapping with 100 replications.
Source: SOEP, wave 2000-2003.

employment status which is state dependence.[13] The estimated state dependence is simply the difference in the probability within an column.

The elements in the transition matrices are the average one-period transition probabilities summing over all women independent of their observed working behavior in period $t-1$. Standard errors of the probabilities have been estimated following Gong, van Soest, and Villagomez (2004) by repeating the simulation of the transition matrix for 100 draws from the estimated distribution of the parameter estimates. The estimated transition matrix clearly supports the hypothesis of state dependence on the extensive margin. The probability of inactivity in the current period conditional on not working in the period before, is about 40%. For a woman who had been working in the last period this probability is according to the standard errors significantly lower. The difference increases with the number of working hours. For a full-time working woman the probability of inactivity in the next period is about 6% which is 34 percentage points lower; for a woman working over-time the difference amounts to more than 36 percentage points. For a woman who had been working part-time the difference in the probability not to work in the current period relative to the same average women who had been inactive, is lower, yet still important and significant. These findings are in line with the results of Prowse (2005); on the extensive margin she finds a higher level of true state dependence for full-time workers than for those in part-time work.

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

In contrast to previous studies on state dependence in the labor supply behavior of women, the method employed here allows to analyze state dependence not only on the extensive but as well on the intensive margin, that is the impact of last period's employment on the number of hours worked. Comparing the choice probabilities on the intensive margin conditional on last period's employment, the picture is not clear cut. In most cases, the impact of the previous working behavior is not significant. This is in particular true when comparing choices conditional on neighboring employment states, such as full-time work versus over-time work in the last period. The potential sources of state dependence, named above, explain the differences in the persistence between the extensive and the intensive margin. Fixed costs of work or other sources why the previous working history might affect preferences of the current labor supply, are more important on the extensive margin. Yet, with the similarity of the working alternatives the impact of these sources is decreasing.

True State Dependence by Region and Age of Children

As discussed above, the working behavior of women differs with respect to several observed characteristics. In the German context, heterogeneity is mainly explained by differences between east and west Germany and differences between household with and without young children. Therefore, it is of interest not only to analyze the transition behavior and state dependence of the mean married women but as well differentiated by region and family status.

As found in Table 3.1, the main difference between east and west German women is the higher labor market participation in the east and the different attitude towards part-time work. These differences can be mainly explained with the different historical background in both parts of Germany and with the better child care facilities for young children in the eastern part. For both, east and west German women, state dependence is highly significant and positive on the extensive margin though at a different level and of different size. Whereas in east Germany the state dependence between full-time work and inactivity amounts to about 0.23 percentage points, for west Germany the

Table 3.6: Transition matrix of labor supply: East and west Germany

	Inactivity (t)	Part-time 1 (t)	Part-time 2 (t)	Full-time (t)	Over-time (t)
			West Germany		
Inactivity (t-1)	0.448	0.272	0.249	0.030	0.002
	0.016	*0.010*	*0.014*	*0.005*	*0.000*
Part-time 1 (t-1)	0.332	0.260	0.341	0.062	0.005
	0.009	*0.010*	*0.009*	*0.006*	*0.001*
Part-time 2 (t-1)	0.179	0.203	0.448	0.151	0.018
	0.010	*0.008*	*0.015*	*0.006*	*0.002*
Full-time (t-1)	0.078	0.119	0.469	0.280	0.054
	0.010	*0.011*	*0.012*	*0.013*	*0.004*
Over-time (t-1)	0.048	0.078	0.433	0.354	0.088
	0.009	*0.013*	*0.013*	*0.021*	*0.010*
			East Germany		
Inactivity (t-1)	0.256	0.246	0.417	0.077	0.005
	0.015	*0.014*	*0.015*	*0.012*	*0.001*
Part-time 1 (t-1)	0.171	0.193	0.476	0.146	0.013
	0.009	*0.010*	*0.011*	*0.015*	*0.002*
Part-time 2 (t-1)	0.080	0.123	0.458	0.295	0.045
	0.007	*0.006*	*0.016*	*0.013*	*0.005*
Full-time (t-1)	0.026	0.063	0.358	0.437	0.115
	0.005	*0.007*	*0.011*	*0.013*	*0.009*
Over-time (t-1)	0.012	0.038	0.292	0.486	0.172
	0.004	*0.008*	*0.014*	*0.015*	*0.014*

The following hours classifications are used: 0, 0-14, 15-34, 35-40, >40.
Standard errors are given in *italic*. Standard errors are derived using bootstrapping with 100 replications.
Source: SOEP, wave 2000-2003.

comparable state dependence is close to 0.36. This result supports the finding of Michaud and Tatsiramos (2005) who show that South European countries with low labor market participation of women experience a higher state dependence than women in countries with higher participation rates, such as France or the UK. Turning to the intensive margin, again the effect of state dependence is either insignificant or ambiguous in both sub samples.

The labor market participation of women with young children is very low in Germany, in particular for those with children younger than 3 years. One important reason for this is the low provision of subsidized child care facilities and the therefore high opportunity costs of women with young children (Wrohlich, 2006). Yet, as I have explicitly controlled for child care costs in the estimation, differences in the transition behavior of women with and without young children can not be related to different fixed costs of work due to children. State dependence on the extensive margin between the three groups, women with a child younger than three, a child between 3 and 6 years and without children or with children older than 6 exhibits the expected pattern. Yet compared to the very different labor market behavior - very low participation for women with children younger than 3 - the difference in state dependence between full-time and inactivity seems relatively modest. It varies from 33 percentage points for women without young children to about 42 percentage points for women with children between 3 and 6 years. The comparable state dependence for women with children younger than three is 38 percentage points. The same holds for the state dependence on the intensive margin. Between the three groups there exist strong differences in the working behavior conditional on participating on the labor market - if women with children younger than three work, they tend to choose the part-time categories whereas women without young children work more full-time and over-time. However, the state dependence on the intensive margin is either not statistically present or very similar between the groups.

Table 3.7: Transition matrix of labor supply: Age of children

	Inactivity (t)	Part-time 1 (t)	Part-time 2 (t)	Full-time (t)	Over-time (t)
			Household without young children		
Inactivity (t-1)	0.350	0.278	0.322	0.047	0.003
	0.015	*0.012*	*0.015*	*0.007*	*0.001*
Part-time 1 (t-1)	0.239	0.247	0.411	0.094	0.008
	0.009	*0.010*	*0.010*	*0.009*	*0.001*
Part-time 2 (t-1)	0.107	0.174	0.479	0.211	0.028
	0.008	*0.007*	*0.016*	*0.009*	*0.003*
Full-time (t-1)	0.032	0.090	0.446	0.355	0.077
	0.006	*0.011*	*0.011*	*0.014*	*0.005*
Over-time (t-1)	0.014	0.053	0.388	0.426	0.119
	0.004	*0.011*	*0.016*	*0.021*	*0.011*
			Household with children younger 3 years		
Inactivity (t-1)	0.874	0.105	0.021	0.000	0.000
	0.013	*0.010*	*0.005*	*0.000*	*0.000*
Part-time 1 (t-1)	0.811	0.140	0.048	0.001	0.000
	0.018	*0.011*	*0.009*	*0.001*	*0.000*
Part-time 2 (t-1)	0.672	0.189	0.131	0.008	0.000
	0.027	*0.014*	*0.017*	*0.002*	*0.000*
Full-time (t-1)	0.493	0.215	0.261	0.028	0.002
	0.041	*0.015*	*0.029*	*0.005*	*0.001*
Over-time (t-1)	0.389	0.214	0.341	0.050	0.006
	0.053	*0.014*	*0.039*	*0.010*	*0.002*
			Household with children between 3 and 6 years		
Inactivity (t-1)	0.590	0.238	0.156	0.015	0.001
	0.018	*0.009*	*0.013*	*0.003*	*0.000*
Part-time 1 (t-1)	0.479	0.253	0.232	0.033	0.003
	0.018	*0.009*	*0.013*	*0.005*	*0.001*
Part-time 2 (t-1)	0.305	0.238	0.363	0.085	0.010
	0.021	*0.009*	*0.020*	*0.007*	*0.001*
Full-time (t-1)	0.165	0.169	0.466	0.169	0.030
	0.020	*0.015*	*0.021*	*0.014*	*0.004*
Over-time (t-1)	0.115	0.126	0.482	0.227	0.051
	0.020	*0.017*	*0.015*	*0.024*	*0.007*

The following hours classifications are used: 0, 0-14, 15-34, 35-40, >40.
Standard errors are given in *italic*. Standard errors are derived using bootstrapping with 100 replications.
Source: SOEP, wave 2000-2003.

3.6 Effects of the German Tax Reform over Time

In the following, I will draw on the results from the estimation of the intertemporal model of labor supply to analyze the behavioral effect of the German tax reform over time. More precisely, I will derive the labor supply effects of the tax reform on married or cohabiting women in the short and in the long run. As described above, the estimated preferences for income and leisure are necessary to derive the labor supply behavior before and after the reform. The estimated impact of the true state dependence is necessary to derive the process of labor supply adjustment over time. This process describes the adjustment to the new optimal labor supply given the mechanical effect or the induced working incentives of tax reform.

Mechanical Effect of the Tax Reform

As described above, the mechanical effect of the tax reform is calculated by simulating the tax payments and the resulting net income for all households under the fiscal regime 2000 and 2005.

Table 3.8 shows the mechanical effect of the tax reform for couple households by the discrete working choices. In addition to the average effect for the whole population, I present the mechanical effect by region, differentiating between east and west Germany. In line with the findings of Haan and Steiner (2005), the results indicate that the tax reform has a positive effect on the net income for almost all households. As stressed in Chapter II, small negative effect are related to the impact of bracket creeping. The mechanical effect of the tax reform increases the monthly net household income of the relevant population on average by nearly 138 Euro which amounts to a relative increase of more than 4%. Differentiated by working hours, the results show that absolute and relative gains increase with the number of hours worked. This trend is not monotonic as labor income combines hourly wages and working hours, and moreover taxable income includes other sources of income such as income from rent, self employment or capital gains. I find that in west Germany the mechanical gains of the tax reform are markedly higher than in east Germany, both in relative and in absolute terms.

Table 3.8: Mechanical effect of the tax reform by working hours and by region

	All households			West Germany			East Germany		
	Income (in Euro)	Mechanical Effect (in Euro)	(in %)	Income (in Euro)	Mechanical Effect (in Euro)	(in %)	Income (in Euro)	Net Mechanical Effect (in Euro)	(in %)
1	1303	-0.06	-0.01	1408	-0.01	0.00	1057	-0.16	-0.02
2	1506	-2.42	-0.12	1576	-0.44	-0.04	1386	-5.83	-0.26
3	1899	49.49	1.86	2064	71.65	2.74	1516	-1.74	-0.16
4	2427	75.71	2.76	2493	82.75	3.00	1935	23.53	0.99
5	2632	83.88	2.89	2655	86.33	2.96	2131	31.34	1.37
6	2950	139.20	4.39	3026	145.96	4.54	2484	97.52	3.51
7	3025	182.56	5.34	3163	210.82	5.96	2691	114.41	3.86
8	3206	184.80	5.16	3310	222.31	5.96	3074	137.08	4.14
9	3005	121.14	3.48	3191	136.27	3.82	1853	27.73	1.34
10	3297	130.25	3.49	3314	132.69	3.55	3078	99.84	2.67
11	3449	191.61	5.06	3567	203.34	5.24	2935	140.40	4.27
12	3358	217.93	5.77	3656	269.64	6.69	2937	145.06	4.47
13	3444	224.48	5.84	3764	276.23	6.68	2898	135.95	4.41
All	2908	138.07	4.05	3009	148.67	4.28	2511	96.33	3.14

The discrete working hours are defined in table 3.1.
The mechanical effects accounts for the impact of bracket creeping for the years 2000 - 2005. The cumulated inflation rate is assumed to be 8.6%.
Income measures he average net household income. This and the mechanical effect are per months. Results have been derived using the simulation model STSM.

Source: SOEP, wave 2000-2003.

The findings of the mechanical effect indicate that the German tax reform provides incentives for increasing labor supply as relative gains of the tax reform tend to increase with working hours and thus inducing financial incentives to start working or increase working hours. This holds long as the substitution effect exceeds the income effect. Given the estimated preferences for income and leisure, and moreover the estimated true state dependencies, I will derive the dynamic behavioral effect of the tax reform in the following.

Dynamic Behavioral Effect of the Tax Reform

As the labor supply effects of the tax reform cannot be derived analytically within the employed discrete choice framework, I simulate the impact of the change in the fiscal rules on women's labor supply decision numerically based on the estimated preferences for income and leisure and conditional on the observed and unobserved characteristics. As preferences for income and leisure are estimated on panel data for different years, identification of labor supply effect relies on the assumption that the preferences remain constant over time and do not change between the fiscal regimes.

Given the pre- and post-reform net household income the expected probability of each discrete working hour choice is predicted, for both scenarios, before and after the tax reform.[14] Based on the predicted probabilities, I derive the transition matrix for each fiscal regime, $\mathbf{M_{2000}}$ and $\mathbf{M_{2005}}$ as described above. The advantage of this procedure is that stochastic transition matrices conditional on the previous labor market status can be simply derived not only for period t but as well for future periods k. Technically this is done by taking the power with degree k of the transition matrix $\mathbf{M}^k$, where k describes the period of interest. Hence, the transitions matrix after the second period is simply the square of the transition matrix of the first period, after period 3 the polynomial of the transition matrix to the power of three has to be calculated, and so on. The transition probabilities provide information about the average number of working hours and the average labor market participation rate at the end of each period. The average number of hours is calculated by taking the expected value of the working hours given the transition

[14] Hence, this method assumes that the preferences for income and leisure remain constant over time and regime.

probabilities and the mean hours in the different working categories which are listed in Table 3.1. The participation rate is simply defined as the probability of working. The transition probabilities provide information about the average number of working hours and the average labor market participation rate at the end of each period. Thus, I can explicitly derive the impact of the tax reform on the number of working hours and the labor market participation after each period. Elasticities derived after the first period are defined as the short term elasticities. A Markov process converges in the long run. In theory, the steady state is reached if $t \rightarrow \infty$. Empirically, the steady state is reached if a further period does not affect the transition matrix and the labor supply elasticities converge i.e. if they do not differ significantly.

Before turning to the interpretation of the elasticities, it is necessary to discuss the assumptions underlining a first order Markov process. As stressed above, the Markov process allows to predict transitions for future periods. This is possible as a time constant transition process is assumed. In other words, it is assumed that individuals adjust their labor supply in each period with a constant rate. This certainly is a strong assumption, as it is ex ante not clear how the adjustment process behaves over time. In order to relax this assumption a higher order Markov process could be considered which remains for future work.

Table 3.9 yields the labor supply effects of the German tax reform with respect to the relative change in weekly working hours and with respect to the relative change in the participation rate over time. In Table 3.12 in the appendix, I present as well the labor supply effects induced by a 1% change in gross hourly wages. This is a more general measure of the labor supply behavior and is better comparable to estimates which have been previously derived (Blundell and MaCurdy, 1999). In addition to the average population effect, I present bootstrapped confidence intervals.

In line with previous research, the behavioral effect of tax German tax reform is positive and significant. Moreover, the results clearly indicate that behavioral responses to the tax reform are increasing over time. In the short run, that is in the first period, female labor market participation increases on average by 0.25%. The relative average increase of the the weekly working hours amounts to 0.75%. As discussed above, the significantly

Table 3.9: Dynamic behavioral effect of the tax reform by region

Period	All Women		West Germany		East Germany	
	Part.	Hours	Part.	Hours	Part.	Hours
1	0.24	0.75	0.25	0.75	0.20	0.76
	(0.13 - 0.36)	(0.47 - 1.02)	(0.12 - 0.40)	(0.42 - 1.06)	(0.14 - 0.26)	(0.55 - 0.96)
2	0.40	1.14	0.46	1.22	0.28	1.04
	(0.24 - 0.60)	(0.73 - 1.59)	(0.24 - 0.74)	(0.72 - 1.74)	(0.19 - 0.32)	(0.74 - 1.34)
3	0.49	1.31	0.56	1.46	0.31	1.15
	(0.30 - 0.74)	(0.85 - 1.86)	(0.30 - 0.93)	(0.91 - 2.10)	(0.21 - 0.35)	(0.80 - 1.49)
4	0.53	1.38	0.60	1.57	0.32	1.19
	(0.33 - 0.81)	(0.91 - 1.98)	(0.33 - 1.01)	(1.01 - 2.26)	(0.22 - 0.36)	(0.83 - 1.55)
5	0.55	1.41	0.63	1.62	0.32	1.21
	(0.34 - 0.84)	(0.93 - 2.03)	(0.34 - 1.05)	(1.06 - 2.33)	(0.22 - 0.36)	(0.84 - 1.57)
6	0.56	1.42	0.63	1.64	0.32	1.22
	(0.35 - 0.86)	(0.94 - 2.06)	(0.34 - 1.07)	(1.08 - 2.36)	(0.22 - 0.36)	(0.84 - 1.58)
7	0.56	1.42	0.63	1.65	0.32	1.22
	(0.35 - 0.86)	(0.95 - 2.07)	(0.35 - 1.08)	(1.10 - 2.38)	(0.22 - 0.36)	(0.84 - 1.58)

Elasticity *Part.* measures the relative change (in %) in the labor market participation due to the tax reform.
Elasticity *Hours* measures the relative change (in %) in the working hours due to the tax reform.
The effects are mean-effects for the relevant population which are derived based on the mean transition matrices assuming a first order Markov process.
The 5th and 95th percentiles are given in brackets; they are derived using parametric bootstrapping with 100 replications.
Source: SOEP: wave 2000-2003.

present state dependence in female labor supply restricts women to fully adjust their labor supply in the first period. In the second period the impact of state dependence is reduced. Thus, the relative effect of the tax reform in terms of participation and working hours markedly increases to 0.4% and 1.14% respectively. Over time the adjustment process is further increasing yet at decreasing rates. With respect to the average elasticities, the results indicate that in the 5th period the adjustment process is completed and the participation and working hours are in equilibrium. The adjustment in further periods does not affect the average labor market behavior as point estimates of the elasticities are nearly constant over time. This implies, in the long run the tax reform leads to an increase in the participation rate of 0.5% and on average to an increase in working hours by 1.5%.

Unfortunately, the relatively large confidence intervals do not allow to draw strong conclusions about significant differences between the short and the long run effects. For both, the participation effect and the working hours, the confidence intervals of the first

and the fifth period slightly overlap. This is in contrast to the labor supply elasticities induced by a uniform wage increase which are presented in Table 3.12. Comparing the short and long run effects of the wage increase, I find significant differences in the adjustment process. This suggests that the large confidence intervals are due to the heterogenous effects of the tax reform on different groups, ranging from negative effects for those only affected by bracket creeping to highly positive effects for those with high taxable income.

The behavioral effect of the tax reform by region exhibits the expected pattern. Due to the higher working incentives for women in the western part related to the higher mechanical effect of the tax reform, both the participation and the working hours effects are higher in western than in eastern Germany. Due to the higher state dependence for west German women (Table 3.6), the difference between the long and the short run effects tend to be higher in the West. The average elasticity with respect to participation increases in the west from 0.25 in the short run to 0.63 in the long run (in the 5th period), whereas in the east the difference of the same elasticity over time is with 0.2 (1st period) to 0.32 (5th period) relatively low. The same pattern holds true for the working hours elasticity. Yet, again due to the relatively large confidence intervals, it is not possible to draw strong conclusions about significant difference as the confidence intervals by region and over time slightly overlap.

Long Run Effects of the Tax Reform: Static vs. Intertemporal Modeling

As mentioned above, previous studies evaluating reforms in the tax and benefit system, such as the labor supply effects of the German tax reform (Wagenhals 2000, or Haan and Steiner 2005) or effects of in-work credits (Blundell, Duncan, McCrae, and Meghir, 2000), have been based on static specifications of labor supply. Static models do not account for potential effects of state dependence and it is assumed that households can immediately adjust to the new incentive system. Thus, although static models are misspecified if state dependence is significant, the behavioral effects derived in these models might be interpreted as long run effects of a reform in the tax and benefit system.

In the following, I will derive the labor supply effects of the tax reform using the static specification and compare the effects to the long run effects derived above in the the intertemporal framework. For comparative reasons I will estimate the static model using the same specification as describes above, however, without accounting for state dependence, z_{it-1} and the initial state z_{i0}. Thus the level of utility at the J different choices in the static framework has the following form:

$$\tilde{V}_{ijt} = U(lf_{ijt}, lm_{ijt}, y_{ijt}, x_{it}, c_i(x_i, a_i), \epsilon_{ijt}). \tag{3.11}$$

Unobserved heterogeneity enters in the same way as described above, hence the likelihood function can be derived analogously to the intertemporal framework. The estimation results of the static model are presented in Table 3.13 in the Appendix. Given the significant improvement in the estimation when allowing for a flexible structure of the random effects and for better comparison to the intertemporal specification, I only focus on the static model where correlation in the unobservable effects of both spouses is captured.

The labor supply effects in the static model are derived numerically by simulating the labor market participation and working hours before and after the tax reform. The expected working hours and labor market participation is calculated with the alternative specific probabilities for each household. The derived elasticities measure the relative effect of the tax reform on the labor supply. In the following table, I present the average relative change in the labor market participation and the average relative change in working hours by region. The effect of the static model are compared to the long-run changes derived in the intertemporal model (Table 3.9). In addition to the effects of the tax reform, I present as well the labor supply effects induced by a 1% increase in gross wages (Table 3.12, Appendix).

In general the elasticities derived in the static model exhibit the expected patter. Behavioral changes of married or cohabiting women living in west Germany tend to be stronger both in terms of participation and working hours than in the east. Yet, the estimated labor supply effect of the tax reform is lower than found in previous studies

Table 3.10: Dynamic behavioral effect of the tax reform by region

Period	All Women		East Germany		West Germany	
	Tax Reform	1 % Wage	Tax Reform	1 % Wage	Tax Reform	1 % Wage
	Long run behavioral effects: Static Specification					
Part.	0.55	0.08	0.39	0.06	0.6	0.09
	(0.40 - 0.74)	(0.07 - 0.09)	(0.37 - 0.42)	(0.05 - 0.07)	(0.42 -0.83)	(0.083 -0.11)
Work. hours	1.26	0.19	1.18	0.14	1.28	0.20
	(0.89 - 1.65)	(0.16 - 0.21)	(1.06 - 1.31)	(0.12 - 0.16)	(0.85 - 1.76)	(0.17 - 0.27)
	Long run behavioral effects: Intertemporal Specification					
Part.	0.55	0.08	0.32	0.04	0.63	0.08
	(0.34 - 0.84)	(0.059) - 0.089)	(0.22 - 0.36)	(0.03 - 0.05)	(0.34 - 1.05)	(0.07 - 0.10)
Work. hours	1.41	0.18	1.21	0.12	1.62	0.19
	(0.93 - 2.03)	(0.15 - 0.2)	(0.84 - 1.57)	(0.09 - 0.15)	(1.06 - 2.33)	(0.16 - 0.23)

The long run elasticities derived with the intertemporal specification are the steady state elasticities after the 5th period.
Elasticity *Part.* measures the relative change (in %) in the labor market participation.
Elasticity *Hours* measures the relative change (in %) in the working hours.
The 5th and 95th percentiles are given in brackets they are derived using bootstrapping with 100 replications.
Source: SOEP, wave 2000-2003.

(Wagenhals 2000, or Haan and Steiner 2005). This difference is due to the flexible modeling of unobserved heterogeneity in this specification. Elasticities derived in a model without unobserved heterogeneity or in less flexible specifications of unobserved effects as suggested in Haan (2006) are of the same size as found in the previous studies. Thus, in contrast to Haan (2006) my estimations suggest the modeling of unobserved does matter for estimating labor supply elasticities.

Comparing the results of the static model to the long run effects derived in the specification accounting for state dependence, it is remarkable to find how similar the prediction of the long run effects are for the whole sample and differentiated by region. This results is robust to both the effects of the tax reform and the change in gross wages.

3.7 Conclusion

In contrast to previous ex-ante evaluations of reforms in the tax and transfer system, in this study I develop and employ an intertemporal specification of labor supply which is

applied to estimate the labor supply effects of married and cohabiting women induced by the German Tax Reform 2000. In line with the results derived in Chapter II my findings suggest that the marked reduction of marginal tax rates and a broadening of the tax base have a significant and positive effect on female labor supply which tends to be higher for women living in west Germany. Moreover, I find that significant state dependence in the labor supply behavior of women leads to a dynamic process in the labor supply adjustment. In the short run where state dependence prevents women for fully flexibly changing their behavior, the relative change of participation and working hours is modest. Over time state dependence is circumvented and the women fully adjust to their new equilibrium. Thus, long run effects of the tax reform are markedly higher. On average the participation elasticity doubles from 0.24 in the short run to 0.55 in the long run which I find to be after about 5 periods. The difference in the elasticity for working hours is similar, with 0.74 in the short and 1.42 in the long run.

When I compare the long run elasticities to elasticities derived in static models of labor supply not accounting for state dependence I find very similar results. This finding is encouraging for the application of both models. It suggests that elasticities of the static model can be interpreted as long run effects of a reform. Further, it implies that the relatively simple modeling of the dynamics in the intertemporal framework based on a first order Markov process seems to be sufficient to derive behavioral adjustment over time.

3.8 Appendix

Table 3.11: Descriptive statistics

	Mean	Std.	Mean	Std.	Mean	Std.
Fiscal Year	2000		2001		2002	
Monthly net household income in Euro	2944	1017	3101	1190	3162	1213
Age of the husband	41.92	6.84	42.93	6.84	43.93	6.83
Age of the wife	39.87	6.85	40.87	6.85	41.87	6.86
Share of German men	0.89	0.31	0.90	0.31	0.90	0.30
Share of German women	0.89	0.31	0.90	0.30	0.90	0.30
Share with no degree (husband)	0.02	0.14	0.02	0.14	0.02	0.14
Share with medium degree (husband)	0.78	0.42	0.78	0.42	0.78	0.42
Share with high degree (husband)	0.20	0.40	0.20	0.40	0.20	0.40
Share with no degree (wife)	0.02	0.13	0.02	0.13	0.02	0.13
Share with medium degree (wife)	0.83	0.37	0.83	0.37	0.83	0.37
Share with high degree (wife)	0.15	0.36	0.15	0.36	0.15	0.36
Share with bad health status (husband)[1]	0.01	0.10	0.01	0.11	0.02	0.12
Share with bad health status (wife)[1]	0.01	0.10	0.01	0.10	0.01	0.10
Share of couple living in East Germany	0.23	0.42	0.23	0.42	0.23	0.42
Share of household with child younger 3 years	0.07	0.26	0.06	0.24	0.06	0.23
Share of household with child between 3 and 6 years	0.16	0.37	0.13	0.33	0.08	0.27
Weekly working hours of husband in period t	39.94	10.23	38.69	10.97	37.63	12.12
Weekly working hours of husband in period t-1	39.13	10.47	39.94	10.23	38.69	10.97
Weekly working hours of husband in the initial state[2]	39.13	10.47	39.13	10.47	39.13	10.47
Weekly working hours of wife in period t	20.62	15.64	20.28	15.25	20.27	15.10
Weekly working hours of wife in period t-1	20.32	15.38	20.62	15.64	20.28	15.25
Weekly working hours of wife in the initial state[2]	20.32	15.38	20.32	15.38	20.32	15.38
Observations	1645		1645		1645	

1)Percentage of people who are with 100% disabled.
2)Initial state is the working behavior in the fiscal year 1999.
Source: SOEP, wave 2000-2003.

Table 3.12 contains the labor supply elasticities of a 1 % increase in gross wages for all women living in couple households, and separated by region and family status. Next to the average elasticities, bootstrapped values of the 5th and 95th percentiles are reported to perform significance tests. Elasticities are considered as being significantly different if the confidence intervals of the elasticities to compare do not overlap. The labor supply elasticities both in terms of participation and in terms of working hours are increasing over time for all groups. According to the bootstrapped confidence intervals, this increase is significantly different between the first and the second period for all women and for most of the sub groups. Between the first and the second period elasticities markedly increase, nearly doubling in terms of participation and in terms of working hours they increase on average by more than 50%. After the second period elasticities still increase but only relatively modest, and elasticities do not significantly differ between the second and the third period. Thus, these results imply that in the third period the new steady state is reached. Compared to the short run, in the long run the elasticities with respect to participation and hours of work approximately double. The differences between the short and the long run can be related to state dependence. In the short run, state dependence prevents the women to fully adjust their labor supply. However, in the long run state dependence is circumvent and thus, the labor supply can be fully adjusted to the new optimal working behavior. The size and the dynamics of labor supply elasticities varies by groups. In line with previous findings about the labor supply behavior of German women, women living in west Germany and women with young children have the highest labor supply response.

Table 3.12: Labor supply elasticities by region and family Status

Period	All Women	West Germany	East Germany	No young child	Children 0-3	Children 3-6
			Labor Market Participation			
1	0.0332	0.0351	0.0278	0.0287	0.1807	0.0326
	(0.0269 - 0.0390)	(0.0290 - 0.0405)	(0.0227 - 0.0347)	(0.0225 - 0.0339)	(0.1291 - 0.2328)	(0.0232 - 0.0433)
2	0.0564	0.0638	0.0355	0.0464	0.3281	0.0640
	(0.0460 - 0.0655)	(0.0534 - 0.0736)	(0.0291 - 0.0430)	(0.0377 - 0.0554)	(0.2111 - 0.3806)	(0.0414 - 0.0878)
3	0.0681	0.0784	0.0385	0.0555	0.3343	0.0757
	(0.0548 - 0.0800)	(0.0663 - 0.0905)	(0.0312 - 0.0463)	(0.0444 - 0.0673)	(0.2114 - 0.3719)	(0.0456 - 0.1054)
4	0.0732	0.0848	0.0397	0.0597	0.3246	0.0786
	(0.0584 - 0.0868)	(0.0720 - 0.0980)	(0.0318 - 0.0476)	(0.0472 - 0.0731)	(0.2062 - 0.3573)	(0.0460 - 0.1092)
5	0.0754	0.0874	0.0401	0.0616	0.3234	0.0791
	(0.0599 - 0.0898)	(0.0744 - 0.1011)	(0.0320 - 0.0481)	(0.0483 - 0.0758)	(0.2045 - 0.3528)	(0.0457 - 0.1093)
			Working Hours			
1	0.0921	0.0969	0.0799	0.0868	0.2334	0.0868
	(0.0751 - 0.1087)	(0.0790 - 0.1150)	(0.0637 - 0.0969)	(0.0718 - 0.1028)	(0.1642 - 0.3018)	(0.0613 - 0.1147)
2	0.1419	0.1541	0.1085	0.1304	0.4197	0.1385
	(0.1161 - 0.1636)	(0.1264 - 0.1830)	(0.0842 - 0.1311)	(0.1050 - 0.1536)	(0.3099 - 0.5559)	(0.0908 - 0.1731)
3	0.1650	0.1812	0.1187	0.1503	0.4258	0.1577
	(0.1350 - 0.1869)	(0.1487 - 0.2152)	(0.0905 - 0.1429)	(0.1188 - 0.1765)	(0.3260 - 0.5501)	(0.0986 - 0.1881)
4	0.1750	0.1928	0.1224	0.1592	0.4107	0.1630
	(0.1430 - 0.1963)	(0.1581 - 0.2290)	(0.0924 - 0.1470)	(0.1243 - 0.1867)	(0.3165 - 0.5252)	(0.0996 - 0.1894)
5	0.1793	0.1976	0.1237	0.1631	0.4057	0.1641
	(0.1464 - 0.1999)	(0.1619 - 0.2346)	(0.0929 - 0.1484)	(0.1266 - 0.1911)	(0.3125 - 0.5182)	(0.0994 - 0.1886)

Elasticities are gross wage elasticities, that is the relative change in participation and working hours induced by a 1 % increse in gross hourly wages.
The 5th and 95th percentiles are given in brackets they are derived using bootstrapping with 100 replications.
Source: SOEP, wave 2000-2003.

Table 3.13: Estimation results: Static labor supply estimation

	Coef.	Std.	Coef.	Std.	Coef.	Std.
Net Income						
Age - Man	-46.15607	9.396685	-81.385	14.35303	-88.73868	16.16961
Age^2 - Man	53.97168	10.75089	95.87257	16.60322	105.0521	18.68873
Age - Woman	13.45448	8.299583	25.31031	9.626845	28.83561	12.16644
Age^2 - Woman	-17.56247	9.874616	-31.09971	11.5006	-35.75927	14.55331
Constant	9.790931	1.986592	13.0114	2.60192	15.12427	3.134458
Net Income^2	-0.1199752	0.0202699	-0.0632672	0.022597	-0.1450344	0.030437
Leisure Man						
Age - Man	0.1371018	0.3914165	-0.5598075	0.4527031	-0.5895849	0.5174154
Age^2 - Man	0.8477751	0.3347316	1.650443	0.4009794	1.850803	0.4777305
German - Man	0.0583797	0.028294	0.0541524	0.0280716	0.0612455	0.0305388
East German - Man	0.004594	0.0747284	-0.0030424	0.0678476	-0.006188	0.1063871
Health Status - Man	0.022123	0.041764	0.0232425	0.0415753	0.0249544	0.0476873
Medium Education Degree - Man	-0.0213231	0.0067121	-0.0222985	0.0067905	-0.0303093	0.0085484
High Education Degree - Man	-0.032272	0.0081122	-0.0369526	0.0082668	-0.0327359	0.010469
Age - Man	-0.0077445	0.0026285	-0.0072849	0.0029398	-0.0084656	0.0032131
Health Status - Man	0.0030631	0.0439511	0.0010223	0.0440871	-0.0137679	0.050507
German - Man	-0.0704752	0.0284816	-0.0647706	0.0282918	-0.0693295	0.0308361
East German - Man	-0.0051762	0.0748184	0.0003896	0.0679405	0.0169816	0.10649
Constant	0.5036835	0.0601937	0.59033	0.0711679	0.9424887	0.0879882
Leisure Man^2	-0.00272	0.0001085	-0.0025287	0.000111	-0.0050191	0.0001787
Leisure Woman						
Age - Woman	0.4050487	0.310614	1.551821	0.5123565	1.313344	0.5647459
Age^2 - Woman	-0.5479297	0.2716625	-1.659246	0.5144604	-1.64587	0.5767619
German - Woman	-0.0020594	0.0289125	0.0043455	0.0418048	0.0034721	0.0414075
East German - Woman	-0.0591318	0.0791017	-0.1224367	0.1149999	-0.1190275	0.1139247
Health Status -Woman	-0.0239274	0.0288824	-0.0511784	0.043786	-0.0496212	0.0432932
Child 0-3	0.0352977	0.0114357	0.1089184	0.0165189	0.1040021	0.0167005
Child 3-6	0.0072122	0.0068998	0.0337881	0.0106537	0.0318582	0.0107427
Medium Education Degree - Woman	-0.0001685	0.0081515	0.0151436	0.0219745	0.0217637	0.0187667
High Education Degree - Woman	-0.0271396	0.0087718	-0.0573288	0.0234748	-0.0523167	0.0208829
Age - Woman	0.0016906	0.0021244	0.0001122	0.0028896	0.0023706	0.0030826
Child 0-3	0.0398004	0.0130337	0.0776569	0.0213674	0.0757309	0.0217333
Child 3-6	0.0304647	0.0082138	0.0315605	0.0145916	0.0354325	0.0149102
Health Status - Woman	0.021653	0.0316066	0.0494054	0.0516589	0.0420571	0.0506113
German - Woman	-0.0069329	0.0291663	0.0150691	0.0424926	0.0106493	0.0421974
East German - Woman	0.0196338	0.0791527	0.0404037	0.1154575	0.0293842	0.1141058
Constant	0.3395846	0.0502068	0.2644332	0.0893861	0.288241	0.0986961
Leisure Woman^2	-0.0034692	0.0001841	-0.0058541	0.0002382	-0.0060157	0.0002289
Net Income*Leisure Man	-0.0106433	0.0027733	-0.0036909	0.0030263	-0.0120518	0.0038875
Net Income*Leisure Woman	0.0014668	0.0014731	0.0104661	0.0024811	0.0069293	0.0026166
Leisure Man*Leisure Woman	-0.2690029	0.113016	-0.5002491	0.1893915	-0.1591214	0.1479671
Part Time 1	-1.322631	0.0669319	-1.056761	0.08065	-1.120036	0.0755335
Part Time 2	-0.7532578	0.0741605	-0.4861816	0.0817561	-0.5186073	0.0798842
Mass point - Woman			0.2198366	0.0063166	0.2188472	0.0062605
Mass point - Man			0.02684	0.0063814	-0.3262338	0.0103602
p1			0.585642	.0176174	.3958597	.01636
p2			0.41435	.0176174	.3017989	.0148805
p3					.1797322	.0129811
p4					.1226091	.0106845
Observations	4935		4935		4935	
Log-Likelihood	-10752.957		-9882.1273		-9428.132	
Derivatives						
$U_y > 0$	100%		95%		95%	
$U_{lf} > 0$	70%		70%		70%	
$U_{lm} > 0$	95%		75%		73%	

Time dummies for the year 2001 and 2002 have been included.
Variables in *italic* are the individual mean values.
Unobserved heterogeneity is assumed to follow a non parametric distribution. For both men and women 1 mass points is freely estimated. Probabilities p2-p4 are estimated, p1 is derived following the underlining assumption $\sum_{m=1}^{M} P_i(a_i^m) = 1$. To guarantee plausible results a multinomial specification of the probabilities, rather than the probabilities p2-p4, has been estimated. The standard errors of the probabilities are derived using the delta method.
Source: SOEP, wave 2000-2003 and STSM.

Chapter 4

Introducing UK-style In-work Support in Germany[1]

4.1 Introduction

This analysis is a contribution to the discussion on the role financial incentives play in determining individual labor supply behavior, and on the importance of the design of income taxation and transfer programs as an effective way towards increasing employment. More precisely, in this chapter I provide a cross country comparison of the tax and transfer system in Germany and the United Kingdom (UK). Moreover, I evaluate labor supply effects of a hypothetical welfare reform changing the German transfer system by extending transfers or in-work support for the working poor as designed in the Working Tax Credit (WTC).[2] As stressed in Chapter I, there exists a central difference in the design of the transfer system in both countries. Whereas in Germany welfare schemes rely on the more traditional means-tested out-of-work transfers which are withdrawn at high rates and thereby causing high positive marginal tax rates at the bottom of the earnings distribution, the UK channels a large share of overall welfare at low income working

[1]The following analysis is based on joint research with Michal Myck which is forthcoming in Haan and Myck (2007). This research financed by the Anglo German Foundation (AGF) under the project "Optimal Income Transfer Programmes, Work Incentives, and Welfare in an Ageing Society - Britain and Germany Compared".

[2]In this paper by "in-work" support I refer to government transfers which are conditional on employment. In Germany people can receive government transfers while working but there exist no transfers which are strictly conditional on being employed (the only minor exception to this is the so called child-supplement (Kinderzuschlag).

families through in-work credits. In-work benefits have a long history in the UK, starting with the introduction of the Family Income Supplement FIS in 1971 and the importance of in-work support has grown substantially over the past decades.

The key question of the following analysis is in how far the efficiency of the German transfer system in terms of labor supply changes when introducing UK-style in-work support. In contrast to Chapter V which focuses on the normative evaluation of the design of transfer programs, the analysis conducted here is positive, namely in terms of the labor supply effects induced by a reform of the current transfer schemes.

To provide a better understanding of the current tax and transfer system in Germany and the UK and the induced financial incentives to take up employment, I conduct a detailed analysis of the budget sets for several stylized family types under the German and UK tax and benefit systems. Then, I combine financial incentives together with individual preferences in a model of labor supply to estimate the labor supply response to the introduction of UK-style in-work support into the German transfer design following the discrete choice method applied in the previous chapters.

The analysis of the design of income taxation clearly reflects the two most important differences between the tax and benefit systems: joint taxation of married couples in Germany versus individual taxation in the UK and in-work support in the UK versus out-of-work transfers with high marginal tax rates in Germany. The move from joint to individual taxation in the UK was completed in 1999 with the abolition of a couples' tax allowance and its replacement with a child-related tax credit in April 2000. In Germany couples can still file a joint tax claim and the system benefits one-earner couples and two-earner couples where the difference between partners' earnings is high. Steiner and Wrohlich (2004) discuss in detail positive and negative work incentives for first and secondary earners in married couples induced by joint taxation in Germany. They find that the employment rate of secondary earners in Germany would markedly increase following a move from joint to individual taxation.

The main part of the analysis however, focuses on the second difference between the tax and benefit systems in the two countries, namely in-work support. This fiscal instrument which aims at subsidizing low pay employment, has been operational in several

countries (e.g. US, Canada and the UK) and there have been suggestions that in-work support could be used to make employment more attractive in Germany as well (see, e.g. Bonin, Kempe, and Schneider (2003) or Ochel (2003)). The empirical analysis of labor supply responses to a change in the design of the German transfer system which includes in-work support, follows the analysis of Blundell, Duncan, McCrae, and Meghir (2000) who estimate the behavioral effects of the Working Families' Tax Credit (WFTC) in the UK. In a similar study for France, Germany and Finland, Bargain and Orsini (2006) simulate the effects of in-work credits on labor supply of women. This analysis extends this study by allowing both men and women to respond to changes in financial incentives. Since behavioral responses of men are not negligible, this turns out to be of decisive importance when evaluating the impact of in-work credits in Germany. The analysis takes account of the recent labor market reforms in Germany, the so-called Hartz-Reforms which were intended to increase labor market participation. As stressed in the introduction, in course of the Hartz-Reforms the design of income taxation has been changed, yet the main feature of the German transfer system, namely relatively high out-of work transfer programs with high withdrawal rates are still present.

I find that the total labor supply effect of introducing UK-style in-work support in Germany is positive but modest given the cost of the reform (in the range of about 35,000 individuals). The estimates show that because of important income effects on secondary earners the simulated in-work support would have high negative implications for employment of individuals in couples - both men and women. These negative effects nearly outweigh the strong positive effects on lone parents.

Showing individuals' responsiveness to changes in financial incentives, my findings indicate that it is possible to encourage employment in Germany by changing the structure of the tax and benefit system. However, given the strong negative employment response among couples, my results support the findings about the experience with in-work support in other countries such as in the US (Eissa and Hoynes, 2004) and imply that in-work support based on total family incomes would be an ineffective way of increasing overall employment.

4.2 Income Taxation in Germany and the UK

Before turning to the empirical evaluation of the effects of in-work support on labor supply in Germany, I discuss the differences of the transfer system in Germany and the UK. I look at examples of budget constraints which different types of families face in both countries. First, I focus on the tax and benefit system of the year 2002/03 and will then separately discuss the change in work incentives induced by the Hartz-Reforms by showing the changes in the German transfer system implemented between 2002 and 2005.

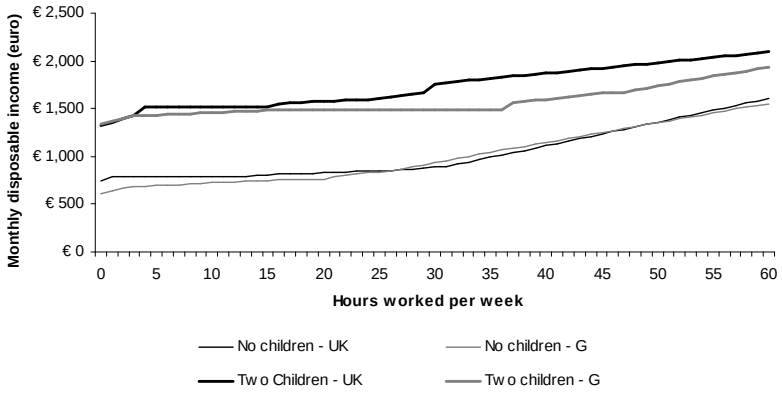
The analysis sheds some doubt on the popular view that the level of the basic income support in Germany is significantly higher than in the UK. In contrast, I find that disposable incomes at various levels of employment intensity are very similar for the two countries.[3] The only noticeable differences in the shape of the budget constraint are for secondary earners in couples and for families with children eligible for in-work support in the UK.[4]

Figure 4.1 presents comparisons of budget constraints for two types of families: a single woman without children, and a single woman with two children. The budget lines are drawn under the assumption that the woman is earning the 25th percentile gross wage for women (specific for each country). Similar budget lines are drafted for one-earner couples (Figure 4.2) and two earner couples (Figure 4.3). For one-earner couples I assume that the man is working at a country specific 25th percentile gross wage for men, while for two-earner couples I present budget lines for the second earner assuming that she earns the 25th percentile gross wage for women and that her partner works full

[3]Monetary values used for comparative purposes are expressed in euros using the PPP corrected exchange factor of EURO/POUND = 0.6365 (calculated as the ratio of the UK PPP factor to the German PPP factor from the OECD PPP tables on www.oecd.org/std/ppp). To express weekly values of net incomes and benefits (as is standard practice in the UK) in monthly terms (as is standard in Germany) I multiply weekly values by a factor of 4.35 - the average number of weeks in a month. (=365.25/12/7).

[4]Note, this comparison needs to be interpreted carefully as I focus only on the tax and benefit system but leave out a comparison of important institutions, such as labor market institutions, the education system, child-care, the generosity and quality of public health care and other types of public expenditure. Further, for better comparison, I assume in all examples for Germany that individuals are not eligible for the insurance based unemployment benefit (Arbeitslosengeld) as this is not a permanent transfer. Instead, households receive means-tested social benefits which are the equivalent to the UK's Income Support.

Figure 4.1: Budget constraints in 2002: Germany vs. UK - single woman



Notes: For each country I consider a single woman working at 25th perc. hourly wage, renting at the cost of median rent. 25th perc. wage for women in the UK is Euro 8.32 and in Germany Euro 9.92.

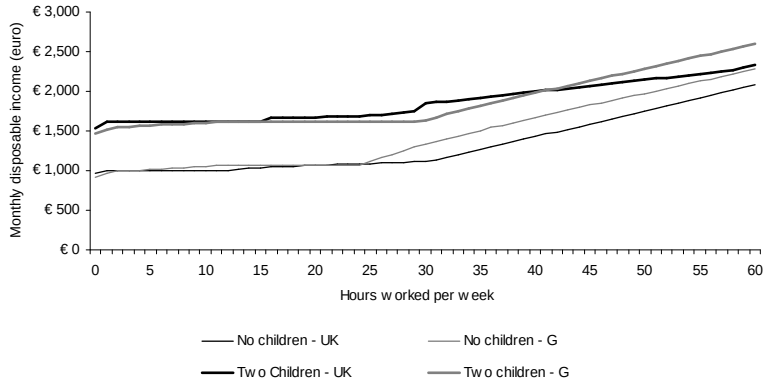
Source: authors' calculations using TAXBEN and STSM.

time (40 hours per week) earning the 25th percentile wage for men. As for single people I present the budget lines for families without children and with two children.

Figure 4.1 and Figure 4.2 show that at the lowest levels of earnings, i.e. in scenarios where the families qualify for the basic means-tested support, disposable incomes of families in Germany and the UK, conditional on family type are almost identical. Budget lines for single people without children are very similar for all levels of presented employment intensity, while for lone parents and one-earner couples differences become apparent only at hours levels beyond about 20 per week. In the UK income of lone parents with two children are higher almost over the entire range of presented working hours.[5] The difference is highest at points of receipt of in-work support which these families are eligible for in the form of the WFTC, and at the level of 37 hours of work per week is as high as Euro 334 per month.

[5]The same applies to lone parent families with one child (not shown in Figure 4.2).

Figure 4.2: Budget constraints in 2002: Germany vs. UK - one-earner couple



Notes: For each country I consider a one earner couple where the man is working at the 25th perc. hourly wage, renting at the cost of median rent. 25th perc. wage for men in the UK is Euro 11.22 and for Germany Euro 12.99.

Source: authors' calculations using TAXBEN and STSM.

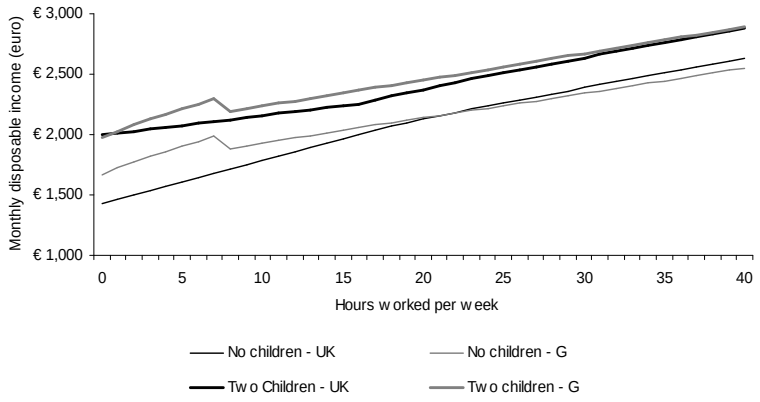
Beyond the level of about 25 hours of work a one-earner couple without children in Germany is better off than in the UK in the given example. A couple with two children would be better off in Germany at hours level beyond 42, and the difference in disposable income is especially high when the earner in the couple works beyond 55 hours per week. The principal reason is that from about this point onwards the UK example family no longer receives in-work support.

There are significant differences for one-earner families without children between Germany and the UK. At 36 hours of work per week the UK one-earner couple receives Euro 249 less per month than the couple in Germany and the difference remains at above Euro 200 per month for higher levels of hours. The difference in the underlying nominal gross wages is only partly responsible for this. The most important determinant of these differences is joint taxation for individuals in married couples in Germany versus individual taxation in the UK.[6]

Interesting features of the two tax and benefit systems can be seen in the budget constraints for second earners in couples. In the UK system, in the lower range of hours of work the income of couples with two children is almost identical when the second partner is out of work. This is due to the support through the WFTC. As a result of withdrawal of in-work support, gains resulting from part-time work of the second earner are minimal in the UK. On the other hand in Germany work at low number of hours can bring considerable gains due to the exemption of the social security contributions (SSCs) and income taxation to a certain threshold of individual gross earnings. However, beyond this threshold (which in 2002 was Euro 325 per month) all earnings are due to SSCs and to income taxation which results in marginal tax rates in excess of 100%. This is reflected in a kink in the budget line of the secondary earner for Germany. From this point on even modest income of the secondary earner is immediately taxed at the marginal rate of the first earner in the couple which results from joint taxation. The German system therefore

[6]The higher disposable incomes of families with children in Germany relate - next to income splitting for one-earner couples - to the receipt of the universal Kindergeld which in 2002 was Euro 154 for each of the two children per month. The universal Child Benefit in the UK in 2002 was lower at the level of Euro 107.65 for the first child and Euro 72.10 for each subsequent child in the family.

Figure 4.3: Budget constraints in 2002: Germany vs. UK - two-earner couple



Notes: For each country I consider a two earner couple where the man is working 40 hours at the 25th perc. male hourly wage, and present changes in family income as a result of the woman working at different hours points (wage for the woman is 25th perc. female hourly wage). 25th perc. wage for men in the UK is Euro 11.22 and for Germany Euro 12.99, while for women respectively Euro 8.32 and Euro 9.92.

Source: authors' calculations using TAXBEN and STSM.

provides strong disincentives for the secondary earner to take up work beyond the level exempt from taxes and SSCs.

4.3 "Importing" In-work Support to Germany

As highlighted above, one of the main differences in the tax and benefit design between the UK and Germany is the system of in-work support. In the following, I focus on this difference in more detail by analyzing the work incentives and labor supply effects induced by introducing in-work support in the current German tax and transfer system. Since 2002/03, Germany has seen important changes in the design of the tax and benefit system. Both, income taxation and the benefit system have been reformed aiming to improve incentives on the labor market. However, I will argue that the implemented reforms did not affect the design of the basic income support in a significant way and thus the work incentives for low-income households have hardly changed. I show, in contrast, that "importing" the UK system of in-work support into the tax and transfer system as currently implemented (2005) would induce strong positive and negative work incentives in particular for low-income families with children.

Recent Reforms in Germany

On the taxation side between the year 2000 and 2005 the German government introduced the most ambitious income tax reform in the German post war history as discussed in detail in the previous chapters.

On the transfer side the Hartz-Reforms, implemented between 2003 and 2005, affect work incentives in particular those of low income households. For the analysis mainly three policies of the Hartz legislation are of importance: the Mini-Jobs reform, the reform of income support and the introduction of a child supplement. The Mini-Jobs reform extended the threshold for subsidies of the social security contributions and the exemption from income taxation to individual gross earnings up to Euro 400 per month. Further, high marginal tax rates on earnings above this threshold were decreased, by introducing

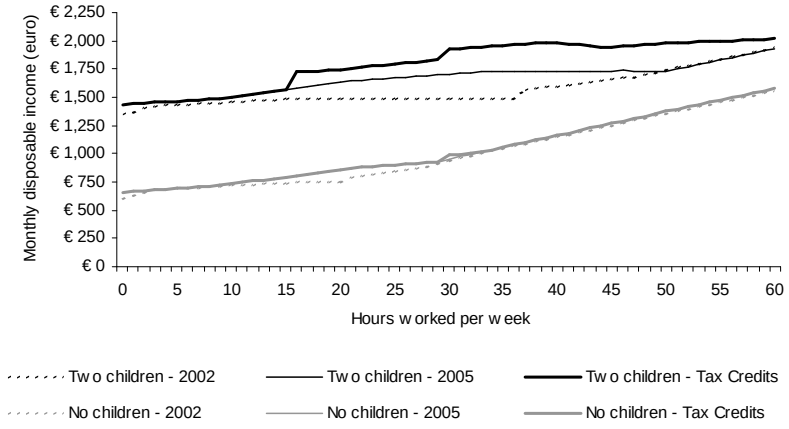
a modified subsidy up to Euro 800 per month. In the course of the Hartz-Reforms the previous means-tested social assistance has been combined with unemployment assistance. Relative to the year 2002, the income support out-of-work in 2005 is slightly more generous and the withdrawal rate has changed, yet still under the new legislation the design of income support creates high marginal tax rates when starting to work. As pointed out in Chapter I, the Hartz-Reforms had a significant effect on work incentives of households entitled to the insurance based transfers (Arbeitslosengeld) in an intertemporal context as the entitlement period for the benefits has been shortened. As in this analysis, I focus on the transfer system in a static context, this reform can not be accounted for. The child supplement is an in-work benefit as it is conditioned on employment. However, due to the withdrawal design of this instrument in combination with the existing income support, the child supplement hardly affects work incentives for families with children.

Introducing UK In-work Support to the German System

The structure and the generosity of the in-work support system which I simulate is based on the 2005 system in the UK, and is made of the Child Tax Credit (CTC), available only to families with children, and the Working Tax Credit (WTC), available to those with and without children. These two instruments were introduced in April 2003. Although the reform constituted a significant change in the administration of transfers, the values of in- and out-of-work benefits changed little, with the exception of in-work support for individuals without children who became eligible for it for the first time. Both the CTC and the WTC are means-tested, and WTC eligibility is conditional on the number of weekly working hours (16 hours for those with children and 30 for those without). The system contains also a full-time premium available to those working 30 hours or more.

This new UK in-work support system is "imported" into the German tax and benefit system as in 2005. The system is implemented maintaining the rules which concern the interaction of in-work support (henceforth called Tax Credits or TCs) with other means-tested benefits. Specifically, I assume that, in contrast to the Earned Income Tax Credit

Figure 4.4: Work incentives of transfer reforms: single households



Notes: We consider a single woman working at 25th perc. hourly wage, renting at the cost of median rent. 25th perc. wage in Germany Euro 9.92.

Source: authors' calculations using TAXBEN and STSM.

in the US, income from Tax Credits is included in the means test for income support which is withdrawn at the rate of 100%.

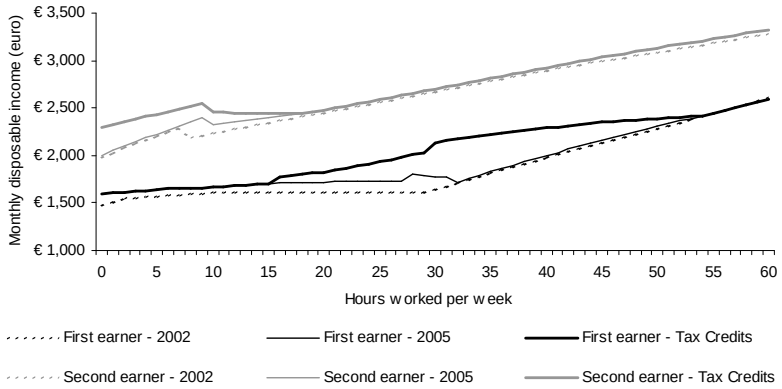
The resulting changes in the budget constraint are demonstrated on Figures 4.4 and 4.5, for single people and couples respectively. Figure 4.4 shows budget constraints for a single person with and without children, working at the 25th percentile female hourly wage. In Figure 4.5 I present budget lines for a couple household with one child. One set of lines shows the budget constraints under the assumption that only one partner is working at the 25th percentile wage for men, while the other set shows constraints for the second earner working at the 25th percentile female wage, under the assumption that the first earner works full time at the median wage for men. For all example families, I show budget constraints as they were in 2002 (expressed in 2005 prices) to highlight the effects induced by the Hartz-Reforms. Then I present the constraints of the baseline - 2005 - system, and finally the budget constraints which would result from introducing the Tax Credits in Germany.

Single individuals without children would be only marginally affected by the introduction of Tax Credits, and the same is true for childless couples who would not be affected at all even if the earner received a wage as low as the 25th percentile wage (I therefore do not present budget constraints for childless couples in the figures). Tax Credits, however lead to substantial income increases for lone parents and couples with children. A lone parent with two children earning 25th percentile female hourly wage would see her income rise by EURO 145.40 per month at 16 hours of work and by Euro 250.50 at 39 hours of work (Figure 4.4). A one earner couple with two children (Figure 4.5) could see its income rise by as much as Euro 456 per month (at 32 hours of work). An interesting point to note is that the combination of withdrawal of subsidies of social security contributions and the Tax Credits implies that the difference in family disposable income resulting from the full time work (40 hours per week) of the second earner falls from Euro 923.20 to Euro 633.70 per month as a result of introducing the Tax Credits. As I will show this income effect would lead to important withdrawals from employment among two earner couples.

Fiscal Cost and Distributional Effects

Disregarding behavioral effects of such a reform and assuming full take-up, the overall net cost of introducing Tax Credits in Germany is about Euro 11 billion. The government would need to spend about Euro 19 billion on the Tax Credits, but the cost of the means-tested income benefits (Arbeitslosengeld II) would fall by about Euro 8 billion. The reforms would have a rather clear distributional effect - with families in the second and third decile gaining most (respectively Euro 52.10 (4.0%) and Euro 60.00 (3.7%) per month on average) and the gains falling for households higher up the income scale. Families in the first decile would gain on average only about Euro 25.80 (3.4%). This is because first of all there are fewer families with children in the first decile, and secondly because many of the poorest families do not meet the hours condition to be eligible for Tax Credits.

Figure 4.5: Work incentives of transfer reforms: couple households



Notes: I consider a two earner couple where the man is working 40 hours at the 25th perc. male hourly wage, and present changes in family income as a result of the woman working at different hours points (the assumed wage for the woman is 25th perc. female hourly wage). 25th perc. wage for Germany is Euro 12.99, while for women respectively Euro 9.92.

Source: authors' calculations using TAXBEN and STSM.

Table 4.1: Distributional effect of Tax Credits in Germany

Income deciles	Overall effect		East Germany		West Germany	
	in %	in Euro	in %	in Euro	in %	in Euro
Poorest	3.36	25.78	4.86	39.72	2.77	20.84
2	4.00	52.12	4.22	54.6	3.39	44.28
3	3.77	59.97	3.42	54.34	2.92	46.39
4	1.55	28.48	0.83	14.51	1.29	24.01
5	0.69	14.33	0.81	16.37	0.51	10.58
6	0.40	9.4	0.33	7.51	0.31	7.44
7	0.23	5.96	0.11	3.08	0.22	5.76
8	0.19	5.46	0.04	1.16	0.20	5.87
9	0.05	1.75	0.11	3.92	0.04	1.41
Richest	0.03	1.75	0.00	0.06	0.03	1.86

The distributional effects are derived assuming constant labor supply behavior of households. Deciles are in household equivalized income. Absolute effects shown as average gains per decile in euro per month.

Source: SOEP, wave 2003.

4.4 Tax Credits and Labor Supply

In order to evaluate the behavioral effects of introducing the Tax Credits in Germany I estimate the labor supply responses of households. As discussed and applied in the previous chapters, I simulate the changes in working hours and labor market employment on the basis of a discrete choice labor supply model. I estimate the model on a restricted sample of households where both spouses are aged between 25 and 59, not in education and not self-employed. The database is the SOEP, wave 2003. At the time of the analysis this had been the most recent data available. Hence, I estimate the preferences for work and disposable income for the fiscal year 2002.

Based on the labor supply estimation I simulate the labor supply effects resulting from the introduction of the Tax Credits. Using the microsimulation model STSM that accounts for the details of the German tax and benefit system (Steiner, Haan, and Wrohlich, 2005), I simulate the net household income for two scenarios at the defined discrete hours points: i) the fiscal system of the year 2005 that includes the implemented reforms between 2002 and 2005, and ii) a hypothetical scenario in which I introduce the Tax Credits into the system of 2005 as described above. For each household I calculate the probabilities of choosing each point for the status quo scenario 2002 and the two simulated scenarios. The differences in the probabilities yield the labor supply responses induced by the respective reforms. In order to disentangle the work incentives resulting from the introduction of the Tax Credits, I calculate the difference of the employment effects induced by the two simulated scenarios. The following tables present the labor supply effects by household types and region both regarding changes in employment and working hours.

4.4.1 Single Households

As discussed above the Tax Credits provide positive labor supply incentives for single households, in particular for lone parents as TCs are most generous for this group. I simulate that the overall employment of single women increases by more then 95,000 or about 2.9% (Table 4.2). This effect is almost exclusively borne by lone mothers. Single

Table 4.2: Effect of Tax Credits on single individuals (in 000s)

	Change in employment		**Change in working hours**	
	absolute:	**in %:**	**absolute**	**in %:**
Women:				
- without children (West)	0.4	0.019	28.6	0.041
- with children (West)	59.4	6.474	1676.4	5.953
- without children (East)	1	0.356	63.2	0.588
- with children (East)	34.5	15.002	1244.8	15.166
All	95.3	2.914	3013	2.583
Men:				
- without children	7.2	0.273	287.4	0.26
- with children	2.4	1.728	67.8	1.634
West	3.9	0.167	132.5	0.139
East	5.7	1.239	222.7	1.209
All	9.6	0.344	355.2	0.312

Notes: Simulation built by drawing 100 times from the distribution of the unobserved heterogeneity and allocating each observation to the alternative that yields maximum utility (see Blundell et al., 2000). Absolute change in employment rounded to nearest 100.

Source: SOEP, wave 2003.

women without children in the western part of Germany hardly change their labor supply behavior. The same group in the east reacts slightly more. This is due to the higher gains from the Tax Credits reform for east Germans as their average earnings are markedly lower than in the western part of the country. The same holds true for lone mothers. The relative change in employment in east Germany (at 15%) is more than twice as high as the change for west German lone mothers (6.5%). A very similar picture emerges when I look at the changes in the weekly working hours.

For single men the effects of the Tax Credits are modest. This is because the number of lone fathers in Germany is very low and as shown above single people without children do not gain much from the introduction of the Credits. The overall employment effect amounts to about 10,000 which implies an increase in employment of about 0.3%. Again, effects in east Germany are higher, both in relative and in absolute numbers. The impact on the working hours of single men is moderate, as well. Weekly working hours increase by about 0.3%.

Table 4.3: Effect of Tax Credits on individuals in couples (in 000s)

	Change in employment		**Change in working hours**	
	absolute:	**in %:**	**absolute**	**in %:**
Women				
- without children (West)	0.1	0.005	4.9	0.006
- with children (West)	-43	-1.33	-1033.3	-1.405
- without children (East)	0	-0.002	1.1	0.008
- with children (East)	-12.6	-1.499	-635.7	-2.169
all women	-55.5	-0.813	-1663	-0.85
Men				
- without children (West)	-0.1	-0.004	-5	-0.005
- with children (West)	-2	-0.044	-956.7	-0.494
- without children (East)	-0.1	-0.016	-3.7	-0.019
- with children (East)	-11.3	-1.268	-656.9	-1.708
all men	-13.4	-0.163	-1622.2	-0.46

Notes: Simulation built by drawing 100 times from the distribution of the unobserved heterogeneity and allocating each observation to the alternative that yields maximum utility (see Blundell et al., 2000). Absolute change in employment rounded to nearest 100.

Source: SOEP, wave 2003.

4.4.2 Couple Households

The overall effect of the Tax Credits on the labor supply of men and women living in couples is negative (Table 4.3). As discussed above this is because the Tax Credits are based on household rather than on individual earnings and for eligibility only one spouse needs to fulfill the working requirements. The total employment among women in couples decreases by more than 55,000 which is a fall of about 0.8%. Again the effect is mainly borne by women with children. The effect on women in couple households without children is basically zero. As for single women, the effect on the employment rate and the relative change in working hours for women in east Germany are higher. For men living in couples, I find smaller negative effects of the Tax Credits. Employment among men in couple households decreases by about 13,000 or 0.2%. The reduction in working hours is relatively high (-0.5%), as the share of men working full time or over time in the baseline scenario is high.

Table 4.4: Effect of Tax Credits on couples conditional on combination of partners employment in 2002 (in 000s)

	Employed individuals by couple type			**Empl. effect**
	2002 system	**2005 system**	**TCs**	**Effect of TCs**
Women				
No earner	0	23.6	32	8.5
Single earner man employed	0	82.6	76.3	-6.3
Single earner woman employed	478.3	473.8	469.9	-3.9
Two earner	6339.8	6314.1	6260.3	-53.8
Men				
No earner	0	27	53.1	26.1
Single earner man employed	2093.9	2079.8	2072	-7.8
Single earner woman employed	0	35.3	33.5	-1.8
Two earner	6121.2	6097.4	6067.6	-29.9

Notes: Simulation built by drawing 100 times from the distribution of the unobserved heterogeneity and allocating each observation to the alternative that yields maximum utility (see Blundell et al., 2000). Note, the difference between the number of employed men and women in two-earner couples is due to weighting factors. Absolute change in employment rounded to nearest 100.

Source: SOEP, wave 2003.

4.4.3 Effect by Employment Status of the Spouses

To accurately present the effect of the Tax Credits by employment status of the spouses, I have to compare the employment effect relative to the scenario in 2002 since employment status can be only observed in this year. In Table 4.4, I first give the number of employed individuals by each of the four couple types determined by partners' employment status in 2002. The subsequent two columns present the number of employed individuals under the simulated systems of the fiscal year 2005 and under the hypothetical system including the Tax Credits. In both cases these are presented conditional on the couple type in 2002. Thus for example, the results suggest that about 83,000 women who under the 2002 system were in couples where only the man worked, would move into work as a result of the introduction of the 2005 system. In order to disentangle the effect of the Tax Credit in terms of employment status, I take the difference between the two simulated systems (given in the last column of Table 4.4).

As a result of introducing the Tax Credits I observe a positive employment effect for couples where both spouses were not working in 2002. Relative to the fiscal system

in the year 2005 this effect is particularly high for men (26,000) but is also non-negligible for women (8,500). This positive employment effect is clearly outweighed by the negative effect of the Tax Credits on the other groups. In particular the number of employed individuals among couples where both spouses used to work in the year 2002 markedly decreases which reflects the strong income effects resulting from increases in family incomes in one-earner scenarios (see Figure 4.5). The effect of the Tax Credits implies that more than 50,000 women and nearly 30,000 men leave this group. The effect on one earner couples is relatively small. In comparison to the effects of the fiscal system in 2005, the impact of the Tax Credits slightly reduces employment within these groups, both for men and women. Notice this does not imply that the number of one-earner couples falls. In contrast, given the incentive structure of the Tax Credits it is in fact most likely that both no-earner and two-earner couples would become one-earner couples as a result of the reform. The negative effects indicate that either some individuals who were the earners in one-earner couples leave employment (as a result of changes in out-of-work income which could be a consequence of the reform), or that as a result of the Tax Credits it is less likely to become the secondary earner relative to the 2005 system. The decomposition by employment status of the couple households underlines the importance to estimate not only the labor supply effects of women but also of men. I find that the Tax Credits have a strong effect on male employment decision, positive or negative, dependent on their initial employment state.

Overall, for couple households the results imply that UK-style in-work support based on family income enforces the negative work incentives of secondary earners already present in the German income tax system through joint income taxation.

4.4.4 Labor Supply Effects of In-work Support in other Studies

Bargain and Orsini (2006) simulate the labor supply effects of the British WFTC as it was implemented in 1999 for single women and women in couples for several countries, amongst others for Germany. In general, my results point in the same direction as their findings. Bargain and Orsini (2006) show that the in-work credit have a positive effect on the labor

supply behavior of single women and a negative effect on behavior of women living in couples. However, they find that the negative effects of women in couples outweighs the positive effect of singles. This may be a result of modelling different generosity of the simulated in-work credits, but may also relate to a different modelling strategy of the authors. This result of Bargain and Orsini (2006) is also quite surprising given that in all UK studies, as in this analysis, the overall effect on employment of women is positive.

In comparison to the study of Blundell, Duncan, McCrae, and Meghir (2000) which focuses on the effects of the WFTC reform 1999 in the UK, I find greater labor supply effects which is not surprising since I model the introduction of the full system and not only increases in its generosity (as is the case in these two studies). The important difference between the results for UK and Germany are results for couples. Blundell, Duncan, McCrae, and Meghir (2000), as well as subsequent estimates of the effect of the WFTC, e.g. Brewer, Duncan, Shephard, and Suarez (2006) or Myck and Reed (2005) find positive net effects on employment of men in couples. For Germany, I show that over 13,000 men living in couples would leave employment. Moreover if I take the overall employment effect on individuals living in couples measured as a proportion of the positive effect on single individuals, it is -19% in the case of Blundell et. al (2000). For Germany, I find that the negative effect on couples is -66% of the effect on single people. This suggests a very different (relative) responsiveness among individuals in couples in Germany and calls for a lot of caution in applying means-tested policies based on total family income.

4.5 Conclusion

Estimates of labor supply effects of recent UK reforms in the area of direct taxes and benefits show that policy can have significant influence on the level of employment. This is confirmed in a simulation of in-work support system on German data. The simulation results suggest that introducing UK-style in-work support in Germany would increase employment of single individuals by over 105,000 but it would result in a reduction of labor supply among individuals in couples by about 70,000. More precisely, the results of the simulations suggest that Tax Credits would result in significant reductions of labor

supply both among women and men in two-earner couples. These reductions would not be matched by increases in labor supply among one-earner or no-earner couples, so the overall labor supply effects would be negative for both men and women.

These estimated effects call for a high degree of caution as far as "importing" UK-style Tax Credits to Germany is concerned. In line with findings for the UK (Blundell, Duncan, McCrae, and Meghir, 2000) and the US (Eissa and Hoynes, 2004), I show that in-work support based on family income increase the proportion of one-earner couples and reduce employment levels of both men and women living in couples. When it is the political agenda to increase overall labor supply and employment, the empirical findings of this analysis call for a high degree of caution as far as "importing" UK-style Tax Credits to Germany is concerned. However, while in-work support conditional on joint family income may not be the best solution from the point of view of increasing overall employment rates, this does not mean that every form of in-work support would fail. In fact the simulation results for singles, in particular lone mothers, are encouraging. If the government is mainly concerned with increasing employment rates of specific target groups, such as lone parents, UK-style in-work support seems to be an effective policy.

In the following Chapter, I will discuss in how far reforms of the transfer system effective in increasing labor supply, are as well optimal in terms of welfare. Thus in addition to the positive analysis of reforms in the transfer system conducted here, I will provide a normative evaluation of changes in the design of income taxation.

Chapter 5

Optimal Income Taxation of Lone Mothers: Empirical Evidence for Germany[1]

5.1 Introduction

Government managed transfer and redistribution programs are of major importance in most developed countries. Almost all these countries spend large amounts of public funds to provide income support to the poor. As expenditures on public income support programs count for a sizeable share of the government's budget in welfare states, and because of their alleged negative work incentive effects, there is an ongoing public debate about policy reforms in this area. As discussed in Chapter I, this controversy can be best described by the trade off between equity and efficiency income taxation, and here in particular the transfer system, has to deal with. Whereas income transfers increase the disposable income of the disadvantaged, and thus increases their well-being, these programs introduce distortions that might lead to substantial disincentives on the labor market and thus affect economic efficiency.

[1]The following analysis is based on a joint project with Richard Blundell, Mike Brewer and Andrew Shephard, on optimal income taxation of lone mothers: an empirical comparison for Britain and Germany. This chapter discusses solely the results for Germany. This research financed by the Anglo German Foundation (AGF) under the project "Optimal Income Transfer Programmes, Work Incentives, and Welfare in an Ageing Society - Britain and Germany Compared".

The aim of this chapter is to extend the previous analysis of labor supply effects of in-work support and to provide a more normative discussion about the optimal design of a transfer system. The central question is hereby in how far transfers specifically targeted at the working population, namely in-work credits, are optimal for the welfare of a society. Throughout the analysis, I define in-work credit as transfers that characterize a tax system that redistributes more to people with strictly positive earnings than it does to those who do not work, similarly as the EITC in the US. Hence, a tax system designed with in-work credits does imply negative marginal tax rates. In this sense, the UK-style in-work support evaluated in Chapter IV, which is conditioned on working yet is in general lower than out-of-work benefits, is not understood as in-work credits.

The 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). In this framework, which focuses exclusively on the intensive margin, it can be shown that negative marginal tax rates can never be optimal, ruling out in-work credits. Diamond (1980) extended the Mirrlees model of optimal income taxation by focusing only on the extensive labor supply margin. In this framework, the optimality results derived by Mirrlees no longer hold. Instead, Diamond shows that for some income ranges, optimal marginal taxes may be negative. Saez (2002) suggested a model that combines the ideas in both Mirrlees and Diamond, and allows for workers to choose whether and (to a degree) how much to work; he shows that it is more likely that optimal tax rates may turn negative when the extensive elasticity is larger relative to the intensive elasticity. Although labor supply effects on the extensive margin tend to be more important (Heckman, 1993), it is necessary to study the intensive margin as well when analyzing the labor supply behavior. This is in particular important for the evaluation of welfare programs such as 'making work pay' policies, as these reforms might provide opposite incentives for the labor market participation for those out of work and for the working hours of the already employed.

The aim of this chapter is to apply the theoretical model presented in Saez (2002) for analyzing empirically the design of the income taxation in Germany. More specifically,

I want to assess and discuss the optimality of the design of transfer programs for lone or single mothers and analyze whether in-work credits are optimal for this group.

The focus on lone mothers is interesting for a number of reasons. First as shown in Chapter IV, in Germany, lone mothers are eligible for generous transfer programs, and the interaction of transfer programs and the income tax system can generate budget constraints with high and variable effective marginal tax rates. Second, there is a mainly normative debate about the extent to which lone mothers should be supported by the state, even when they do not work. This is in particular true for lone parents with pre-school children. Moreover, in practical terms, focusing on lone adult households it is possible to avoid the substantial complexity to both models of labor supply as well as optimal tax theory that arise when dealing with the decision of labor supply for couples. So far, the optimal tax literature has not suggested a theoretical framework accounting for the simultaneous decision of partners in couple households that can be empirically analyzed.[2] Lastly, concentrating on lone mothers who are in general a relatively low-skilled, low-wage group gives greater justification to studying exclusively labor supply responses to taxation, rather than responses involving other factors that might affect taxable earnings (Gruber and Saez, 2002).

Lone mothers are of important size. According to the German population survey, in 2003 more than 16% of all families with the youngest child below 18 years are households with a single parent (Statistisches Bundesamt, 2004). This implies that about 15% of all children younger 16 are raised by single parents. In general, lone parents are mothers, only a minor share of less than 10% of all lone parents households have a father. Therefore, I focus solely on lone mothers.

In this study, I address two questions. First, following Bourguignon and Spadaro (2005), I want to assess the welfare weights that a social planner assigns to different groups, given their estimated labor supply elasticities, such that the current German tax and transfer system for lone mothers is optimal. Second, I want to derive the design of an optimal tax schedule for lone mothers given various assumed normative social welfare

[2] In a recent study Kleven, Kreiner, and Saez (2006) suggest a theoretical framework for the optimal taxation of couple households.

functions. The working behavior of lone mothers with and without pre-school children is very different. Therefore, I will extend the analysis for lone mothers, by providing a separate analysis of optimal taxation by the age of the youngest child.

Based on the theoretical literature of optimal taxation, there exist several empirical studies employing microsimulation models that analyze and compare welfare and tax systems of different countries.[3] Atkinson, Bourguignon, and Chiappori (1998) study the impact of a reform which introduces elements of the British tax system into the French system. Amongst others, Callan and Sutherland (1997) follow this approach when comparing the introduction of the same welfare reform in different European countries. In a more recent study Immervoll, Kleven, Kreiner, and Saez (2006) apply a basic framework of optimal taxation to the analysis of two different transfer programs for 14 Western European countries: the first reform is a traditional means-tested transfer that covers all; the second reform proposal is an in-work tax credit that focuses exclusively on the working poor. The authors use the microsimulation model EUROMOD that mimics the current welfare and tax system of 14 European countries, and calibrate labor supply elasticities on the intensive and extensive margin. Their results are strongly in favor of the in-work tax credit: they conclude that in particular in countries with large current welfare programs, such as Germany, a purely means-tested benefit program is not desirable. Eissa, Kleven, and Kreiner (2005) evaluate the welfare effects of four tax reform acts on single mothers in the United States over the last 20 years. They find that the tax reforms reduced the tax burden for this group and thereby causing welfare gains. Yet, as in Immervoll, Kleven, Kreiner, and Saez (2006) this study does not allow for heterogeneity in the behavior of individuals by estimating their labor supply elasticities, but assumes labor supply effects to be constant at some given rate.

Thus, the key advance in this study, in contrast to the previous literature on optimality of the tax and benefit system, is that here, I apply the theory of optimal taxation with both a country-specific tax and benefit microsimulation model and a structural model of

[3]There exist numerous empirical studies on welfare effects of tax reforms, see 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.

labor supply. Thus, it is possible to recognize fully the complexity and heterogeneity in the tax and transfer system in Germany. Furthermore, the method provides the possibility to estimate, rather than calibrate, the key behavioral inputs in the expression for optimal tax rates, the labor supply elasticities. Hence, the extension of the employed method implies that the heterogeneity in household behavior is accounted for which is according to Saez (2002) crucial for the analysis of the optimal tax design.

5.2 The Theoretical Model

The empirical analysis is based on the framework outlined in Saez (2002), slightly modified for the research questions.

Generally, 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. As discussed in Chapter I, the functional form of the social welfare function is based on normative assumptions ranging from a *Rawlsian* to a *Utilitarian* welfare function.

In the framework of optimal taxation, the margin along which individuals can adjust their behavior is their labor supply. This leads to the 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. 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:

$$\frac{T_i - T_{i-1}}{C_i - C_{i-1}} = \frac{1}{\mu_i h_i} \sum_{j \geq i}^{I} h_j [1 - g_j - \eta_j \frac{T_j - T_0}{C_j - C_0}]. \tag{5.1}$$

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:

$$\mu_i = \frac{C_i - C_{i-1}}{h_i} \frac{dh_i}{d(C_i - C_{i-1})}. \tag{5.2}$$

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%:[4]

$$\eta_i = \frac{C_i - C_0}{h_i} \frac{dh_i}{d(C_i - C_0)}. \tag{5.3}$$

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.

I apply the model outlined above to the analysis of optimal income taxation in Germany for lone mothers. At first glance it might seem problematic to derive an optimal tax schedule for a sub population. However, the government can positively discriminate

[4] As I show empirically in the following section, 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%.

lone mothers and explicitly targets transfers towards this group. The income tax legislation in Germany discriminates between households with and without children, and by marital status. In other words, in this analysis I derive a tax schedule for single adults with children, taking taxation of the rest of the population as exogenous and constant. As Saez (2002), I define the groups by gross earnings. A first-best solution of income taxation would be based on measures of skill or productivity captured by the hourly wage. Yet, in practice this measure cannot be observed and a first-best solution is not feasible. Therefore, optimal tax models assume that the income tax has to be a function solely of gross earnings.

5.3 Lone Mothers in Germany: The Tax and Transfer System and Labor Market Behavior

Employment of Lone Mothers

Overall, in Germany the female employment rate is in comparison to other OECD countries relatively low.[5] In the year 2003, about 58.8% of all women in working age had been employed (OECD, 2005). However, as Haan and Myck (2007) show, the picture is different for lone mothers. They find that in comparison to married or cohabiting mothers, as well as relative to other OECD countries, e.g the UK, employment rates are relatively high for this group. This is partly due to compositional differences - lone mothers in Germany tend to have older children - but it is also due to the relative high employment rate conditional on the age of their children. Table 5.1 gives more detail about the employment behavior of single mothers, based on the samples used in the subsequent empirical analysis.

The data base for this analysis is again the SOEP which has been used and is discussed in the previous chapters. For the empirical analysis, I draw on an unbalanced panel for the survey years 2002 - 2004 which include retrospective income information for the fiscal years 2001 - 2003. The population consists of lone women aged between 20 and 60 with at least one dependent child. Excluded are adults in full-time education,

[5]Employment rates are defined as the share of employed and self-employed people over the whole population in this age group.

Table 5.1: Employment of lone mothers by age of children

	Share in %	Empl. Rate in %	Work Hours per week	Low Edu. in %	Age
with children younger 17		71.37	29.81	34.55	39.2
with children: youngest 0-3	9.06	27.96	19.9	40.29	32.86
with children: youngest 4-6	19.18	53.81	27.05	36.78	33.56
with children: youngest 7-16	71.76	81.55	30.92	33.11	41.72

In Germany, roughly 16% of families with children are lone parents households.
Low education is defined as having no degree or the lowest degree (Hauptschul Abschluss).
Working hours are conditional on employment.
Source: SOEP, wave 2002-2004.

the self-employed or retired, and households with missing information, leaving 1,009 lone mothers.

With 28%, only a small minority of lone mothers with children younger than 4 years work in Germany. Yet, employment rates markedly increase when children grow older. Employment for lone mothers with children between 4 and 6 years is about 54% and once children start school it is above 80%. The overall employment rate which amounts to slightly over 70 %, is mainly driven by the last group, as in more than 70% of all lone mother households the youngest child is at or above school age. Regarding the working hours, a similar picture emerges. Weekly working hours, conditional on employment, increase with the age of the youngest child and amount on average to about 30 hours per week. Differences in the educational background have the expected pattern. Among lone mothers with children younger than 4 years, about 40 % have no degree or only the lowest school degree (Hauptschule). This share is decreasing with the age of the youngest child.

The German Tax and Transfer System for Lone Mothers

As discussed in Chapter IV, over the last decades several OECD countries have introduced transfer schemes specifically targeted at the working population. Most prominent examples are the Earned Income Tax Credit (EITC) in the US, and the Working Tax Credit (WTC) in the UK. These programs are designed to increase the incentives for the non-working population to take up employment. In contrast, the German transfer

system almost exclusively relies on traditional means-tested social assistance, with very high withdrawal rates. Thus, the German transfer system is mainly targeted towards the non-working poor. For lone mothers this is even stronger, as means-tested out-of-work benefits are more generous due to an extra transfer for children. In Chapter IV (Figure 4.1) I outline the different working incentives for a lone parent household induced by the German transfer design and by transfer schemes including specific programs conditioned on the working.

For the following empirical analysis I will employ the tax and transfer model STSM to simulate the amount of tax payments and transfers and the resulting disposable net household income for all lone mothers I observe in the data. I derive the net income distribution for the lone mothers under the current tax legislation and for hypothetical reform scenarios which is necessary to derive the optimal tax schedule as defined above.[6] When simulating the net household income, I explicitly model child care cost which can be of substantial size. In Germany child care is heavily subsidized, yet availability of child care slot is scarce. Therefore, I follow Wrohlich (2006) and estimate the expected child care cost according to regional availability of child care facilities.

5.4 Labor Supply Estimation

One key innovation of this analysis is that, rather than calibrating the labor supply elasticities of various groups, I make use of labor supply elasticities derived from a static structural model of labor supply. As shown in the Chapter III, elasticities derived in the static model can be interpreted as behavioral responses of households in the long run. The estimation strategy of the discrete choice labor supply estimation has been discussed in detail in Chapter III. In this application I focus only on single households thus the complexities of joint labor supply do not need to be considered. Precisely, the utility V_{ijt} derived by household i from making choice j in period t is assumed to depend on a

[6] As described in the previous chapters, for the non-working it is necessary to estimate gross hourly wages to simulate their counterfactual income when working, see Table 2.10 in the Appendix of Chapter II.

Table 5.2: Distribution of working hours

	Working hours per week	Share	Monthly net income in Euro
Inactivity	0	0.29	1049
Part time 1	10	0.06	1308
Part time 2	20	0.11	1436
Part time 3	25	0.07	1569
Full time 1	30	0.13	1655
Full time 2	38	0.34	1856

Notes: Germany: the following intervals for working hours have been chosen 0-5, 5-15, 15-22, 22-28, 28-35, 34+. The monthly net household income is simulated using STSM.

Source: SOEP, wave 2002-2004

function U of the mother'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}:

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

The individual specific error term a_i is specified nonparametrically following Heckman and Singer (1984). I 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.[7] 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:

$$L = \prod_{i=1}^{n} \sum_{k=1}^{2} \pi_k(a^k) \prod_{t=1}^{T} \prod_{j=1}^{J} Pr(Y_{it} = j)^{d_{itj}}, \tag{5.4}$$

where $d_{itj} = 1$ if j is the chosen alternative and 0 otherwise. For the specification of the utility function, I assume again a quadratic utility function similar to Blundell, Duncan, McCrae, and Meghir (2000).

For the lone mothers, I define 6 discrete choices for working hours, inactivity, three part time and two full time alternatives. Table 5.3 yields information about the working hours alternative and the average net household income.

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

About half of the lone mothers in the sample work full time, about 20% have part time jobs and less than one third is not working. Differences in the net household income by working hours, are relatively modest. That is due to the generous out-of-work support for lone mothers which is withdrawn at high rates.

Labor Supply Elasticities on the Extensive and Intensive Margin

Instead of interpreting the coefficients estimated in the discrete choice model, I analyze the labor supply behavior for lone mothers by calculating labor supply elasticities given a change in net-household income. The labor supply elasticities are derived numerically based on the estimated preferences of the labor supply model. As mentioned above, to analyze the optimal design of the tax and transfer system in the discrete model, I define discrete groups along the distribution of gross earnings per week. However, the discrete choice labor supply model is defined with respect to working hours as this is the margin along which households can adjust their behavior. Therefore, I first derive extensive and intensive labor supply elasticities for each single mother along the discrete distribution of working hours. These elasticities are then transferred to the discrete gross earnings distribution by taking the average elasticity within the defined interval of gross earning. Weekly gross earnings are the combination of working hours and gross hourly wages. Hence, average elasticities at the low gross earning points include elasticities of high wage lone mothers which work few hours, and low wage lone mothers with high working hours. This procedure mimics the reality as the government only observes the gross earnings distribution.[8]

Note, Saez' definition of the extensive elasticities differs from that of the conventional extensive elasticity, sometimes called the participation elasticity, or the elasticity of labor force participation, which measures the proportional increase in labor force participation in response to a 1% increase in net income in work. For comparison with other studies, therefore, I derive as well values of this conventional elasticity of labor force participation.[9]

[8] One drawback from having to perform this translation is that the estimated intensive elasticity is not identical to the estimated extensive elasticity in the first gross earnings interval.

[9] In practice, I estimate this by increasing net incomes at all positive hours choices.

Table 5.3: Labor supply elasticities by working hours

	Working hours per week	Share	Labor Supply Elasticity Extensive	Intensive
Part time 1	10	0.06	0.1	0.1
Part time 2	20	0.11	0.12	0.01
Part time 3	25	0.07	0.18	0.03
Full time 1	30	0.13	0.17	0.01
Full time 2	38	0.34	0.18	0.05
Elasticity of LFP.			0.63	

Notes: The following intervals for working hours have been chosen 0-5, 5-15, 15-22, 22-28, 28-35, over 34+.

Source: SOEP, wave 2002-2004

Before discussing the design of the tax system along the gross earnings distribution, I present the elasticities defined above as well the elasticity of labor force participation along the discrete hours distribution.

Most important is the striking difference between the intensive and the extensive margin. At each discrete point, except by definition at the first, the extensive elasticity outweighs the elasticity on the intensive margin. Whereas the latter is close to zero the extensive elasticity increases over working hours to about 0.2. The estimated elasticity of labor force participation implies that an increase of the net income when working by 1% leads to increase of the labor force participation of 0.6%. This is in line with elasticities for single mothers found in previous studies (Blundell and MaCurdy, 1999).

5.5 Numerical Simulation

For the numerical simulation of the optimal tax schedule I define the I+1 discrete groups along the gross earnings distribution, I groups for positive earnings, and in addition the group of non-workers which have zero gross earnings.[10] In the following, I focus on simulations with 6 discrete groups, the non-working and the working by quintiles of the positive earnings distribution. In the Appendix (Table 5.7 and Table 5.8), I provide

[10] The income classes are defined to be deciles/quintiles of a hypothetical earnings distribution. The hypothetical earnings distribution is constructed by assuming that each lone mother has a 20% probability of working at the 5 discrete working choices, and then estimating the resulting distribution of weekly earnings.

results of simulation using deciles of the earnings distribution instead to allow for more heterogeneity.

Given the derived elasticities and the defined discrete earnings points, I apply Saez' framework of optimal taxation to analyze the transfer and tax schedule for lone mothers in Germany. Therefore, I need to solve the optimal tax schedule defined in equation 5.1 subject to two constraints:

$$\sum_{0}^{I} h_i T_i = H, \tag{5.5}$$

$$\sum_{0}^{I} h_i g_i = 1. \tag{5.6}$$

The first is the government's budget constraint, that is, the weighted sum of net taxes has to sum up to the governments budget H. As stressed above, for lone parents the budget constraint is negative. In total, lone parents receive a positive net transfer financed by the rest of the society. The second constraint is a normalization necessary for identification.

I make use of the duality of the model for optimal income taxation and analyze two questions. First, I follow Bourguignon and Spadaro (2005) and derive the welfare weights assigned to the different groups along the income distribution that make the actual tax and transfer system in both countries optimal. Second, assuming a specific welfare function, I design the optimal tax and transfer system for lone mothers in Germany.

5.5.1 Optimal Welfare Weights

In an application for France, Bourguignon and Spadaro (2005) invert the Mirrlees model and find that, if intensive elasticities are low, the French tax and transfer schedule is optimal under a Paretian government. However, when assuming higher elasticities, they show that the actual French tax and transfer system is only optimal if the authority imputes negative social welfare weights to individuals at the upper end of the income distribution. I follow this approach and derive the weights that make the given tax and

Table 5.4: Optimal welfare weights by gross earnings

	Gross Earn.	Net Income	Net Tax	Share	Labor Supply Elasticity		Optimal Weight	
					Intensive	Extensive	absolute	relative
0	0	244.54	-244.54	0.29	0	0	1.73	1
1	108.4	297.08	-188.68	0.08	0.1	0.13	0.79	0.46
2	192.63	328.39	-135.75	0.06	0.03	0.17	0.79	0.46
3	264.39	351.15	-86.75	0.12	0.01	0.22	0.7	0.41
4	347.94	386.07	-38.13	0.15	0.03	0.27	0.63	0.36
5	553.54	488.53	65	0.31	0.03	0.21	0.77	0.45

Notes: All income and tax information are the mean average values per week. Cut off points for the positive weekly earnings points (in Euro): 153, 228, 300, 405.

Source: SOEP, wave 2002-2004.

transfers system in Germany optimal using the above estimated labor supply elasticities along the extensive and the intensive margin.

Table 5.4 shows for each group mean net tax payments, mean net income, mean elasticities, and the actual share of the population located in each band. The share of lone mothers at the discrete earnings points varies markedly. About one third of all lone mothers are not working and have zero earnings, about 40% is at the low- to middle-earnings points, and the remaining lone mothers, about one third are at the highest quintile. Except for lone mothers in the last quintile, all other lone mothers receive on average higher transfers than they pay taxes. Thus, as mentioned above, the government targets transfers generously to lone mothers. As shown in column 3, average transfers are decreasing over the deciles and most important the transfer system does not provide larger benefits to the working poor than to non-workers. Thus, in the current German tax and benefit system, in-work credits with negative marginal tax rates are not implemented. This finding is not surprising as in the tax and transfer system implemented in 2002, no substantial transfers are conditioned on working. Turning to the average labor supply elasticities by gross earnings, a similar picture as described above emerges. The extensive elasticity at each earnings point is clearly higher than the intensive elasticity.

The weights under which the current German tax and transfer system for lone mothers is optimal, given the estimated labor supply elasticities, are presented in the last two columns of Table 5.4. To provide a better comparison between the earnings points, I

present the derived optimal weights in absolute terms and relative to the welfare weight assigned to the non-workers.

The results suggest that the current German tax and transfer systems is optimal only if the government has strong concern for redistributing towards non-workers: the weights for non-working lone mothers are relatively high, and those for working lone mothers are low, and are fairly constant across positive earnings. In relative terms, the welfare weight the government assigns to the working lone mothers amount to about 40% of the weight for non-working. It is worth considering how this result arrives: it is driven by the relatively high elasticities on the extensive margin. This implies that a shift in the tax burden from the working poor lone mothers to the non-working would induce a relatively large numbers of lone parents to take up work because extensive elasticities are high. On the other hand, this would not have a large negative impact on the labor supply of those already in work because intensive elasticities are low. However, as discussed above, in Germany out-of-work transfers are fairly high and are withdrawn at high marginal tax rates when working. Thus the only way that the design of the current tax and transfer system is optimal is when the government has a strong taste for redistribution towards the non-working lone mothers.

Optimal Welfare Weights by Age of Children

As shown in 5.1, the working behavior of lone mothers markedly differs by age of the youngest child. For women with children younger than school age participation rates are very low. Moreover, from a normative point of view, there exist arguments that a government should provide high out-of-work transfers for women with children younger than school age, such that they have time to care for their children during early childhood. On the contrary, as this is one of the groups with the lowest participation rates, 'making work pay' policies should be most promising amongst this group. Therefore, I derive optimal weights separately for lone mothers with children younger than school age and with school aged children. I calculate the weights separately for each group, treating the taxation of the rest of the lone mothers as exogenous.

Table 5.5: Optimal welfare weights by gross earnings and age of youngest child

	Gross Earn.	Net Income	Net Tax	Share	Labor Supply Elasticity		Optimal Weight	
					Intensive	Extensive	absolute	relative
Lone mothers with children younger 6 years								
0	0	277.49	-277.49	0.54	0	0	1.38	1
1	103.88	300.51	-196.63	0.09	0.05	0.07	0.6	0.43
2	193.26	338.57	-145.31	0.07	0.01	0.18	0.61	0.44
3	263.12	348.24	-85.12	0.1	0.01	0.25	0.35	0.25
4	345.51	370.84	-25.33	0.07	0.02	0.14	0.58	0.42
5	544.29	444.61	99.68	0.12	0.01	0.16	0.63	0.46
Lone mothers with children older 6 years								
0	0	230.45	-230.45	0.19	0	0	2.03	1
1	110.82	286.6	-175.78	0.08	0.11	0.14	0.82	0.41
2	192.25	309.5	-117.25	0.06	0.04	0.16	0.79	0.39
3	264.98	334	-69.02	0.13	0.03	0.23	0.64	0.32
4	348.87	373.7	-24.83	0.17	0.04	0.21	0.75	0.37
5	555.65	485.02	70.63	0.38	0.05	0.14	0.79	0.39

Notes: All income and tax information are the mean average values per week. Cut off points for the positive weekly earnings points (in Euro): 153, 228, 300, 405.

Source: SOEP, wave 2002-2004.

Findings in Table 5.5 show the expected pattern of average net taxes, net household income, and of the shares at the discrete earnings points by the age of the youngest child. Lone mothers with children below school age tend to receive higher transfers and are more likely not to work. The distribution along the earnings distribution for lone mothers with school aged children however is rather different. More than one third of this group is located at the highest quintile of the earnings distribution and less than 20% are not working. Despite these differences I find that the labor supply behavior in both groups does not markedly differ. Along the extensive margin, I find relative higher elasticities compared to those on the intensive margin. Turning to the weights the government assigns to each discrete group to make the current system optimal, the results show a very similar patter for both groups of lone mothers as well as for the whole population of lone mothers. To make the current system optimal, the government reveals higher preferences for the non-working relative to the working population. On average the government assigns 40% of the weight for the non-working population in each class to the working population and this result seems to be rather constant along the earnings distribution.

5.5.2 The Optimal Tax and Transfer System

As discussed in the previous section, the Germany tax and transfer system is not designed with in-work credits leading to negative marginal tax rates. However, as shown by Saez (2002) negative marginal tax rates can become optimal when extensive elasticities are relatively important compared to intensive elasticities. It is therefore of interest to find out under what social welfare functions would increased transfers to the working poor become optimal. Recall that rationalizing the current transfer system in Germany requires the government to have relatively strong desires to redistribute to non-working lone mothers.

In the following, I will derive the optimal tax schedule across the gross earnings points under a class of social welfare weights, g_i, that decrease with gross earnings as follows:

$$g_i = \frac{1}{exp(\tilde{y} - k)}, \tag{5.7}$$

where $\tilde{y}$ is the gross earnings at point i relative to the gross earnings at the highest earnings point, k is a shifting parameter. The redistributive taste of the government is expressed with v: the higher v, the higher is the redistributive taste. I provide three scenarios with varying taste for redistribution: a scenario with low redistributive taste, v=0.5, one with medium taste v=1, and one with high redistributive taste v=2.[11] For better comparison, I derive the weights in absolute terms and relative to the weight given to the non-workers. Results of simulation by earnings deciles can be found in Table 5.8 in the Appendix. The findings are in line with the results of the following simulation.

Assuming a low redistributive taste of the government (first panel of Table 5.6), the simulation results show that negative marginal tax rates become optimal. In this scenario it is optimal to transfer higher benefits to the working poor, that is to those earning at the lowest quintile of the gross earnings distribution than to those lone mothers which are not working. For lone mothers above the lowest quintile, transfer remain lower than out-of-work transfers, yet in comparison to the status quo (see Table 5.4), transfers increase

[11] I have experimented with several functional forms of a welfare function decreasing with gross earnings. The results are robust to the choice of the functional form. For these results I have chosen k=0.25. More extreme taste parameters v=0.1 and v=4 yield the expected results.

Table 5.6: Optimal tax rates for lone mothers by gross earnings and age of children

	Abs. Weights	Rel. Weight	Opt. Net Tax	Abs. Weights	Rel. Weight	Opt. Net Tax	Abs. Weights	Rel. Weight	Opt. Net Tax
					All lone mothers				
		v=0.5			v=1			v=2	
0	1.33	1	-206.49	1.33	1	-275.59	1.33	1	-299.96
1	1.17	0.88	-256.47	1.03	0.78	-239.87	0.81	0.61	-242.1
2	1.06	0.8	-183.6	0.86	0.64	-165.53	0.57	0.43	-185.43
3	0.98	0.74	-120.78	0.73	0.55	-101.94	0.43	0.32	-89.05
4	0.89	0.67	-49.54	0.62	0.46	-26.98	0.31	0.23	-14.71
5	0.71	0.54	100.92	0.41	0.3	139.48	0.14	0.11	156.01
					Lone mothers with children younger 6 years				
		v=0.5			v=1			v=2	
0	1.33	1	-212.15	1.33	1	-267.91	1.33	1	-287.39
1	1.17	0.88	-329.48	1.03	0.78	-257.78	0.81	0.61	-222.02
2	1.06	0.8	-244.3	0.86	0.64	-177.61	0.57	0.43	-160.45
3	0.98	0.74	-175.59	0.73	0.55	-110.27	0.43	0.32	-87.55
4	0.89	0.67	-101.15	0.62	0.46	-34.9	0.31	0.23	-11.89
5	0.71	0.54	84.1	0.41	0.3	148.47	0.14	0.11	167.29
					Lone mothers with children older 6 years				
		v=0.5			v=1			v=2	
0	1.33	1	-201.72	1.33	1	-279.81	1.33	1	-309.19
1	1.17	0.88	-243.55	1.03	0.78	-239.82	0.81	0.61	-238.55
2	1.06	0.8	-180.85	0.86	0.64	-172.41	0.57	0.43	-168.55
3	0.98	0.74	-117.87	0.73	0.55	-106.91	0.43	0.32	-101.87
4	0.89	0.67	-50.82	0.62	0.46	-38.51	0.31	0.23	-33.99
5	0.71	0.54	108.14	0.41	0.3	135.35	0.14	0.11	145.26

Note: Notes: Cut off points for the positive earnings points (in Euro): 153, 228, 300, 405. All income and tax information are the mean average values per week.
Source: SOEP, wave 2002-2004.

for all working except for those in the highest quintile. Thus, the higher transfers for the working are financed by the lone mothers out of work, and by those earning in the top quintile.

When increasing the redistributive taste of the government, designing in-work credits is not optimal anymore. This is true for both the medium and the high redistributive scenario. The higher the taste for redistribution, the higher become the transfers for the lone mothers out of work. As I assume the welfare weights monotonically to decrease with gross earnings, transfers for the working poor remain high as well in comparison to the status quo. In contrast, taxes for lone mothers increase as the redistributive taste rises.

Optimal Taxation by the Age of Children

In the lower panel of Table 5.6 I present results for simulations of the optimal tax schedule for lone mothers by age of the youngest child. This analysis is based on the assumption that the government conditions taxation not only on gross earnings but as well on the age of the youngest child. Again, when deriving the optimal tax and transfer system for the sub group of lone mothers, I hold taxation of the rest of the population constant.

In a society where the government has a low distributive taste, in-work credits are optimal for both groups. Yet, the design of the tax credits differs by the age of the youngest child. In-work transfers for lone mothers with pre-school children are more generous than for working single mothers with older children. It is optimal for the government to provide in-work transfers towards the working at the first two quintiles and these transfers are of substantial size. In contrast, for lone mothers with older children in-work credits are only optimal at the first earnings point, and the credit is markedly lower for this group. Assuming a medium or high taste for redistribution, the results suggest that in-work credits for neither of the groups are optimal. In general, the findings suggest that in Germany it is more optimal to design in-work credits for lone mothers with pre-school children. This result is mainly driven by the low participation rate in this group and hence making work pay policies affect a large part of the relevant population.

5.6 Conclusion

The idea of this study was to apply the optimal tax rule developed by Saez (2002) and to empirically discuss the optimal tax and transfer design for lone mothers in Germany. The key advance of the methodology is that I apply the theoretical model of optimal taxation using microsimulation and a structural estimation of labor supply behavior. Thus, it is possible to allow for heterogeneity between groups regarding their behavioral adjustment on the labor market rather than calibrating an overall labor supply elasticity for the whole population.

When focusing on lone parents, I have shown that in-work credits for this group are optimal from a social welfare perspective with relatively low taste for redistribution. This result is driven by relatively high elasticities on the extensive margin which imply a high positive participation response of the non-working lone mothers. Further, I provide evidence that given the same taste for redistribution, it is optimal for the government to provide higher in-work credits for mother with children younger school age. This result is mainly driven by the low participation rate in this group and hence making work pay policies affect a large part of the relevant population.

By the same token, I show that the current tax and transfer schedule in Germany that is designed without in-work credits, is only optimal if the government has a high welfare value for the non-working lone mothers and a relatively low taste for redistribution towards the working lone mothers.

Overall, these findings imply that in-work support well-targeted at specific groups, such as lone mothers, does not only induce positive working incentive and positive labor supply effects, as shown in Chapter IV, but can improve the optimality of the transfer system. In other words, the results derived in Chapter IV and Chapter V imply that there exist tax and transfer reforms that have the potential to increase the efficiency of income taxation through higher labor supply without negative effects on equity.

5.7 Appendix

Table 5.7: Optimal welfare weights by gross earnings

	Gross Earn.	Net Income	Net Tax	Share	Labor Supply Elasticity		Optimal Weight	
					Intensive	Extensive	absolute	relative
0	0	244.54	-244.54	0.29	0	0	1.66	1
1	86	294.98	-202.59	0.05	0.12	0.12	1.07	0.64
2	129.84	299.09	-164.34	0.03	0.08	0.14	0.43	0.26
3	173.68	320.02	-139.91	0.02	0.05	0.13	0.82	0.5
4	211.04	336.52	-116.36	0.04	0.01	0.2	1.13	0.68
5	246.44	343.98	-82.63	0.05	0.01	0.2	0.22	0.14
6	282.22	358.27	-65.58	0.07	0.01	0.24	0.55	0.33
7	321.93	380.23	-42.94	0.06	0.04	0.31	0.72	0.43
8	373.03	391.7	-7.63	0.08	0.03	0.22	0.7	0.42
9	447.39	430.04	28.41	0.11	0.04	0.29	0.68	0.41
10	659.19	546.76	123.45	0.2	0.03	0.13	0.86	0.52

Notes: All income and tax information are the mean average values per week. Cut off points for the positive weekly earnings points (in Euro): 1 107, 153, 193, 228, 264, 300, 344, 405, and 502.

Source: SOEP, wave 2002-2004.

Table 5.8: Optimal tax rates for lone mothers by gross earnings

	Abs. Weights	Rel. Weight	Opt. Net Tax	Abs. Weights	Rel. Weight	Opt. Net Tax	Abs. Weights	Rel. Weight	Opt. Net Tax
		v=0.5			v=1			v=2	
0	1.33	1	-186.6	1.33	1	-268.7	1.33	1	-304.08
1	1.22	0.92	-304.96	1.12	0.84	-304.6	0.95	0.72	-266.61
2	1.17	0.88	-273.9	1.03	0.78	-278.72	0.81	0.61	-233.68
3	1.12	0.84	-233.17	0.95	0.71	-241.87	0.69	0.52	-196.04
4	1.08	0.81	-197.86	0.89	0.67	-211.12	0.61	0.46	-168.51
5	1.05	0.78	-164.83	0.83	0.62	-188.1	0.54	0.4	-145.99
6	1.01	0.76	-131.11	0.78	0.58	-85.82	0.48	0.36	-86.336
7	0.97	0.73	-94.18	0.72	0.54	-49.66	0.42	0.31	-49.287
8	0.93	0.7	-48.18	0.66	0.5	-3.4	0.35	0.26	-1.9297
9	0.87	0.65	13.32	0.58	0.44	59.75	0.28	0.21	63.135
10	0.71	0.54	195.33	0.41	0.3	250.52	0.14	0.11	258.3

Note: Notes: Cut off points for the positive earnings points (in Euro): 107, 153, 193, 228, 264, 300, 344, 405, and 502. Source: SOEP 2002-2004. All income and tax information are the mean average values per week.

Source: SOEP, wave 2002-2004.

Chapter 6

Concluding Discussion

The design of income taxation and transfer programs does affect the labor supply behavior of households. This is true for households in the upper part of the earnings distribution through changes in marginal income tax rates and holds true for households at the lower end of the earnings distribution through changes in the design of transfer programs. Moreover, state dependence significantly affects female labor supply behavior and therefore women can only fully adjust their labor supply in the long run. Finally, depending on the normative assumption about the welfare regime, in-work support for lone mothers with negative marginal tax rates have the potential to increase economic efficiency and to increase the overall welfare for the society. These are the key findings of this dissertation.

Summary and Discussion of Main Results

Using microsimulation and microeconometric techniques, I analyze the labor supply, employment and welfare effects of the German Tax Reform 2000. In the course of that reform, households experienced a significant drop in marginal tax rates, and at the same time, an increase in the tax allowance which reduced the tax burden of households by over 30 billion Euro per year. Part of the tax reduction is seen as a measure to offset the negative effect of bracket creeping on household income. This effect is taken into account when analyzing the labor market and welfare effects of the tax reform. Based on a static structural labor supply model which allows to estimate a household's preferences for income and leisure, I evaluate the labor supply responses of households induced by

the tax reform. I find that the reduction in the tax burden leads approximately to an increase in labor supply of 240,000 full time equivalents in terms of participation. Moreover, I estimate an overall increase in working hours of nearly 1% (14 million per week), both due to new participants (extensive margin) and, to a lesser extent, due to increases in working hours of those already employed (intensive margin). Given potential demand side constraints it is a strong assumption that all labor supply results in effective employment. Therefore, I derive the employment effects of the tax reform within the framework of a partial equilibrium model of the labor market with flexible market wages. For this analysis I draw on empirically estimated labor supply and labor demand elasticities. The findings imply that about half of the labor supply results in effective employment. The total employment effects amount to about 130,000 full time equivalents and the realized increase in working hours sums up to about 0.6%, while market wages are slightly reduced (by about 2%). Given the estimated behavioral responses of the households, distribution and welfare are analyzed. The results suggest that the tax reform is regressive both in terms of household income and welfare. I show that the absolute and relative gains of the tax reform are monotonically increasing with net household income. Overall, the welfare effects are significantly lower than the income gains as households' leisure time is reduced.

Studies evaluating labor supply effects of tax reforms on the basis of static behavioral models very much rely on the assumption of full flexibility of behavioral adjustment, since these studies do not account for state dependence in labor supply. In Chapter III, I propose an intertemporal structural model of labor supply behavior to relax this assumption and to overcome the potential inconsistencies of the static framework. Using a discrete choice panel data model with random effects and assuming a first order Markov process, I derive the labor supply effects of married and cohabiting women induced by the tax reform. I find that in the short run, state dependence in labor supply prevents women to fully adjust their labor supply behavior. Only in the long run, state dependence looses its significance and thus the labor supply behavior can fully adjust to the new optimal steady state. Moreover, my findings suggest that labor supply effects derived in the static model can in fact be interpreted as the long run behavioral effects. I show that labor supply elasticities estimated in the static model are almost identical to the long-run labor supply responses

found in the intertemporal framework. This finding holds true for the labor supply effects induced by the tax reform for effects induced by a 1% increase in gross hourly wages, which is a more general measure of labor supply behavior.

The focus of the second part of the dissertation is on the design of the transfer system. Chapter IV is a comparative study about the transfer system in the UK and in Germany. The central question that is addressed in this analysis is how UK-style in-work support would affect the German transfer system in terms of working incentives and labor supply. Based on the same methodology as applied in Chapter II, I show that introducing UK-style in-work support in Germany would increase employment of single individuals by over 105,000 but it would result in a reduction of labor supply among individuals in couples by about 70,000. The negative effect for couple households is driven by the induced negative incentives for secondary earners. As in the UK, the design of in-work support is assumed to be dependent on joint family income which implies that the secondary earner is encouraged for staying home. Therefore, the estimated effects call for a high degree of caution with regard to importing UK-style Tax Credits to Germany. However, while in-work support conditional on joint family income may not be the best solution from the point of view of increasing overall employment rates, I conclude that not every form of in-work support would fail. In fact the simulation results for singles, in particular lone mothers, are encouraging. If the government is mainly concerned with increasing employment rates of specific target groups, such as lone parents, UK-style in-work support seems to be an effective policy.

In addition to the analyses of tax reforms in positive terms, I provide a normative discussion about the optimality of income taxation. In Chapter V, I make use of the theory of optimal taxation to derive conclusions about the welfare effects and the optimality of the tax and transfer system in Germany. More precisely, I apply the theoretical model developed by Saez (2002) to focus on the optimality of the transfer system in Germany for lone mothers, one of the key groups for welfare programs. This methodology allows me to derive two main results. First, I show that the current tax and transfer system which is characterized by relatively generous out-of-work transfers with high marginal tax rates when entering the labor market, is only optimal when the government assigns

a high welfare value to non-working lone mothers and significantly lower weights to the welfare of working lone mothers. The second result is based on normative assumptions about the redistribution in a society. Assuming that the government has a relatively low inclination for redistribution, I find that the optimal design of transfers for lone mothers would dramatically change relative to the current system. In this scenario, it is optimal to introduce in-work credits with negative marginal tax rates, similar to the EITC in the US. This implies that lone mothers with low earnings receive higher transfers than lone mothers out of work. The optimal design, however, changes when I assume a medium or high redistributive taste of the government. In these scenarios, a strictly monotonous transfer system becomes optimal. In fact the transfer system in the scenario with high inclination for distribution is very similar to the currently implemented transfer design.

All analyses conducted in this dissertation are set in a partial equilibrium framework. Hence, I cannot study the overall effects of the reforms for society. This is particularly problematic for the discussion of the efficiency gains of the Tax Reform 2000 as this reform might affect consumption, saving and investment of private households and thereby labor demand and labor supply. For the evaluation of in-work support this seems to be less crucial as the targeted low income households mainly adjust their behavior along the labor supply and, in general, the consumption and saving behavior of these households is fairly constant. This implies the following policy implications have to be interpreted with caution and baring in mind that the estimated efficiency effect of the tax reform are at the lower bound.

Policy Implications

As stressed above, my findings indicate that the design of income taxation and transfer programs does affect the labor supply behavior of households. However, as I have shown, the responsiveness of the labor supply behavior is relatively modest, in particular in the upper part of the income distribution. Relative to the enormous relief in the tax burden of private households and the high fiscal costs, I find only relatively moderate reactions on the labor market. One reason for this is the low responsiveness of labor supply to

financial incentives in general. Moreover, I find that only half of the labor supply effect results in effective employment. This implies that a central purpose of the tax reform, namely to generate employment in Germany, seems to be at most partly fulfilled. In other words, the reduction in distortions of income taxation induced by the tax reform seem only partly to result in higher efficiency of the economy through increasing employment.

On the other hand, my findings indicate that the tax reform has a strong impact on the distribution of net household income. As I show, income and welfare gains increase in absolute and relative terms with net household income. For some households at the lower end of the income distribution the effects can be even negative because of the estimated negative wage effect and the compensation for bracket creeping. This implies the tax reform has a regressive effect on income distribution. As mentioned above, it is difficult to derive welfare effects of a tax reform for the whole society without a normative analysis. However, given the relatively small positive effect of the tax reform on economic efficiency going along with negative distributional effects on equity, my findings suggest that the Tax Reform 2000 did not help to balance the consequences for economic efficiency and the distribution of incomes.

In contrast, when studying the labor supply effects and the optimal design of transfer programs, my findings suggest that the labor supply responses of well designed welfare programs targeted at specific groups, can be of importance. As stressed in Chapter I, the distortions induced by the current tax and transfer system are partly due to the high marginal tax rates at the lower end of the earnings distribution. In-work credits which provide transfers conditional on working might reduce the distortions and thus can lead to efficiency gains in terms of labor supply. In terms of efficiency my results provide strong support for the introduction of the in-work credits for single households, in particular for lone parents. In contrast, I show that the UK-style in-work support based on family income reduces the efficiency of the transfer system by subsidizing secondary earners for staying home.

The findings about the effect of in-work credits on equity are promising. For lone mothers, I show that in-work credits, even with negative marginal tax rates, could have a positive effect on equity due to the increasing welfare of working lone mothers with low

earnings. This result, however, is dependent on the normative assumption regarding the inclination for redistribution of the society.

The results about the optimality of the tax and transfer system have been derived only for a sub-group of the population. It is questionable in how far these findings are applicable to other groups. As I find higher labor supply responses along the extensive margin than at the intensive margin for all groups, in-work credits conditioned on individual income could increase the overall efficiency of the tax system. Individualized in-work credits avoid the negative effects for the second earner and therefore increase labor supply as well in couple households. However, these in-work credits might create enormous fiscal costs which could be only kept affordable by tagging or targeting specific groups. Thus, again depending on the social welfare function, targeted individualized in-work support might lead to higher efficiency in terms of labor supply without negative effects on equity.

Further Research

This dissertation is part of a growing literature of empirical research in public economics. There are still numerous ways and lines along which to extend and to improve the presented analyses.

One central problem of the empirical economic literature, in general, is the estimation of behavioral effects. In this dissertation I have extended the standard static structural discrete choice model of labor supply by introducing state dependence. As I show, this is extremely important as short-run effects and the process of labor supply adjustment can be analyzed. However, this can be only seen as a first step to capture the dynamics of the labor supply behavior. Extensions range from better modelling the transition process by allowing for a higher order Markov process, or allowing for autocorrelation in the error terms as a further potential source of state dependence, to the estimation of fully dynamic structural models following Keane and Wolpin (2001). Furthermore, the discrete choice modelling of labor supply relies on the strong assumption about voluntarily chosen inactivity. In other words, in the standard model involuntary unemployment is not considered. In the static model, several studies have controlled for

involuntary unemployment, e.g. Bargain, Caliendo, Haan, and Orsini (2006), however, in the intertemporal model applied here, this still remains to be accounted for.

There is a general critique with respect to evaluations of policy reforms based on structural models. The main criticism is that preferences for income and leisure are not clearly identified by this method as a simple model of labor supply cannot capture all complexities of the behavioral process. One possibility to circumvent this problem is to avoid estimating the preferences and to focus on ex-post analyses instead. The idea of an ex-post analysis is to use tax reforms as natural experiments to study the labor supply responses to a given reform. The identifying assumption of this methodology is that the researcher can distinguish a treatment and a control group that are identical except for the effect of the tax reform. In the empirical literature there exist numerous applications of ex-post evaluations of tax reforms, e.g. Eissa and Liebman (1996) or Eissa and Hoynes (2004) for the US and Blundell, Duncan, and Meghir (1998) for the UK. Despite potential methodological problems (Triest, 1998), it will be of great interest to conduct an ex-post evaluations of the German Tax Reform 2000. The results could be compared to the employment effects derived here using the structural framework. So far, however, the required data to evaluate the overall effect of the Tax Reform 2000 on labor supply from an ex-post perspective are not available. Yet, despite these advantages, ex-post analyses have a severe shortcoming ex-ante evaluations based on structural models are not suffering from. Extrapolations to the labor supply of other groups not affected by the analyzed reform, or to the labor supply effects of hypothetical future reforms can not be made. Hence, reliable predictions of the effects of hypothetical tax reforms are difficult to make. An analysis about the optimality of the transfer system, as in Chapter V, would be impossible to perform without labor supply elasticities derived in structural labor supply models.

Following Feldstein (1995), a new body of literature has emerged that emphasizes the importance of the elasticity of taxable income, see e.g. Gruber and Saez (2002). This elasticity measures the effect of a change in income taxation on taxable income. In contrast to the elasticity of labor supply which has been analyzed in this dissertation, this is a broader measure of behavioral responses of households which includes all sources of

income. Thus, as an extension of the labor supply and employment effects derived here, an analysis of the impact of the Tax Reform 2000 on taxable income would be of great interest.

The research about the optimal design of the tax and transfer system needs further development. First of all, it is important to extend the analysis to groups other than single mothers. As stressed during the analysis, this causes several problems, the main being the theoretical modelling of the optimal tax rule with several decision makers. The recent study of Kleven, Kreiner, and Saez (2006) is one of the first extensions in this direction. Moreover, the discrete modelling as suggested by Saez (2002) is relatively restrictive. Another possibility has been suggested by Blundell (2006). He makes use of the classical model of Mirrlees (1971) to study the welfare effects for the society by directly maximizing the utility of households. These methods should be applied to further hypothetical reform scenarios. As stressed above, individualized in-work credits targeted at specific groups might be a promising policy to change the transfer design. To evaluate the optimality of this reform, the applied methodology, further extended as discussed above, would be crucial.

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