Analysing Welfare Reform in a Microsimulation-AGE Model: The Value of Disaggregation

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This version: May 2006

Abstract

We present a combined, consistent microsimulation-AGE model that uses the labour market model PACE-L, data from the German Socio-Economic Panel and a discrete choice labour supply estimation. The model is used to analyse reform proposals designed to encourage labour force participation at the lower end of the wage distribution. We compare the fully disaggregated version of the model with an intermediate aggregation level. The results indicate that for a number of macroeconomic results the level of aggregation is of secondary importance. However, for certain subgroups of the households and for decomposition along the intensive and extensive margin, results differ substantially so that full disaggregation is an indispensable part of the analysis.

Keywords: applied general equilibrium, discrete working time choice, labour market, wage bargaining, labour market reform, logit model, microsimulation

JEL Code: D58, J22, J51

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Non-technical summary

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1 Introduction

Many European countries keep experimenting with reforms of labour market institutions and the tax and welfare system that target the low-skilled segment of labour supply and demand (for a recent overview see Orsini, 2005). Here, the general conditions for employment gains are particularly difficult because negative demand effects from skill-biased technological change and shifting world trade patterns meet with supply disincentives resulting from the tax and transfer schemes. A specific focus is on this latter "poverty trap" which is caused by a combination of a too small difference between the welfare benefits when non-employed and net earnings at low wage levels, and a too high transfer withdrawal rate. Concrete policy proposals that aim at an amelioration of this situation face two main difficulties. First, those who are not able to work can not compensate the reduction in the welfare payments by more intense search on the labour market. For this group income losses are considered to be inacceptable. Secondly, lower transfer withdrawal rates usually lead to windfall profits for those workers who are in the respective income bracket and already active in the labour market. These windfall profits and the ensuing tax revenue losses can be so large to make the reforms infeasible from a public budget point of view.

The ex-ante assessment of such reforms thus requires economic models that are capable of capturing the heterogeneous conditions on the labour market and the specific behaviour of different groups of workers. On the one hand, it is important to carefully target the relevant groups of workers and to cautiously equilibrate the exact values of the tax and transfer rates for a concrete labour market reform proposal to have prospects of gaining political support. As a consequence, such a tax reform will affect individuals in different ways and to a different extent. On the other hand, specifically tailored labour market reforms – if actually successful in stimulating the labour market – have potentially considerable macroeconomic repercussions through the adjustment of wages and unemployment, as well as the need to balance the public budget. We therefore need some kind of combined micro-macro analysis.

Most existing studies of policy reforms of the suggested type have been performed in the microsimulation tradition (for an overview see Gupta and Kapur, 2000). In general, this means that we estimate labour supply functions for a large set of individual data and then simulate the effect of the changes in the budget constraints

implied by the policy reform in question. Following van Soest (1995), models of discrete labour supply (in which labour supply is modelled as a discrete choice between a given number of pre-determined hours options) have become popular because they provide a relatively convenient tool to deal with the complexities of non-linear budget constraints and the distinction between the intensive and extensive margin of labour supply (hours of work versus participation). This type of model has been driven to a sophisticated level with respect to estimation methods (Haan, 2004) and with respect to intra-household interaction (Bargain, 2005). They remain, however, usually confined to the micro level and cannot address the macro issues of endogenously adjusting wages, unemployment and the public budget.[1]

On the other hand, we have models in the CGE tradition (Shoven and Whalley, 1984) that combine a standard CGE setup with a somewhat more detailed labour market module (Hutton and Ruocco, 1999; Böhringer et al., 2005). This generation of CGE models, however, cannot capture the heterogeneity of individual households because they only work with one representative household. This is problematic because it tends to blur the distinction between the extensive and the intensive margin of labour supply. There remains an ambiguity between a labour supply increase that is due to higher working hours and one that is due to higher participation. Clearly, this is an obstacle to the analysis of labour market reforms that aim at increasing participation levels among specific labour market segments such as low-skilled individuals. The distinction between the extensive and the intensive margin has been introduced in some models that explore the middle ground between aggregated CGE analysis and micro data: the Dutch MIMIC model (Graafland et al., 2001) and subsequent developments of PACE-L (Boeters, Gürtzgen and Schnabel, 2003, Boeters, Feil and Gürtzgen, 2004, Arntz et al., 2005). This generation of models uses a considerably enlarged number of households which are still thought to be representative for a certain type of household in the micro data set. This leaves the researcher with a number of difficult questions: how to construct the individual households, which properties to give them, how to calibrate them and how to determine the robustness of models with respect to the aggregation level. Models of this type that differ in the characteristics of the individual households can be shown to produce disquieting

[1] There are some studies that complement microsimulation models with some simple macroeconomic equations to capture feedback effects, e.g. Snower (1997).

divergent outcomes when confronted with the same tax reform (Arntz et al 2005).

In this paper, we present a full micro-macro linkage with a labour market focus as an alternative solution to the micro-macro dilemma.[2] We start from PACE-L and combine it with a microsimuation module based on the German Socio-Economic Panel (GSOEP) with about 3000 households. We are mostly interested in the principal feasibility of this approach and in its relative performance compared to more aggregated models. Therefore, we stick to a relatively simple approach to labour supply estimation and a relatively small data set. At the outset, we cannot say whether our model will be superior to those existing in the literature only because of its additional features. The essential question is: Does the fully linked modelling approach make a decisive difference? Whether this is the case or not can well be explored with the CGE module and the microsimulation module at hand, even though these modules are not quite at the forefront of the research in the respective area. Once we know the relevant features, we can go the next step and adjust the model accordingly.

In other fields or economic research, the approach of a micro-macro linkage has a longer tradition than in the analysis of labour market policies. One area where it is prominently featured is the intersection of international trade and distribution and poverty analysis. Similar to labour market modelling, one analyses policy measures (e.g. special forms of trade liberalisation) that affect both economic aggregates (here the trade and output of specific sectors) and different types of households in different ways. So neither of the levels – macro and micro – can be dispensed with. Papers in this tradition are Gørtz et al. (2000), Cockburn (2001) and Cororaton (2003). Rutherford et al. (2005) is a recent example that does not only impress through the mere size of the number of households considered, but is also quite explicit about the simulation techniques used. Furthermore, it provides a considerable section on sensitivity analysis. Like Rutherford et al. we are at the stage where we simply do not know yet which level of aggregation is best suited to the kind of analysis at hand. Our findings indicate that feedback effects are relatively small for most variables but – unlike Rutherford et al. – in our case an intermediate level of disaggregation seems not to be sufficient in important respects. To some extent, this is not surprising since

[2]Recent discussion papers that follow a similar approach but focus on other policy issues are Müller (2004) and Aarberge et al. (2004).

one important difference between our labour market analysis and the trade literature is an opposing direction of causality. While the trade literature models the impact from macro reforms (trade regime shifts) to the micro level (income of individual households), labour analysis focusses on reforms that aim at the individual level, but also affect the macro level (wage and unemployment reactions). Thus, the level of disaggregation in labour analysis may be of particular relevance.

The results of the comparison exercise between different aggregation levels turn out to be mixed. For quite a number of variables, the level of aggregation seems to be of secondary importance, so that an intermediate aggregation level seems justified. However, there are also variables that show quite pronounced differences, so that full disaggregation is necessary to uncover them. Broadly speaking, the effects tend to have a different direction for different sub-groups of households. This means that, as long as we are mostly interested in the overall macroeconomic effects, an intermediate level of disaggregation can be justified. Once we are also concerned with the reaction of specific sub-groups of the population and with decomposing the labour supply effect into changes along the intensive and extensive margin, full disaggregation becomes an indispensable part of the analysis.

The remainder of the paper is organised as follows. In Section 2, we describe in detail the two building blocks of the model – the discrete choice labour supply module and the CGE framework – and specifically comment on our way of linking them. Section 3 reports the results of the comparative scenario analysis. We simulate cuts in the social assistance level and changes in the transfer withdrawal rate and describe to what extent the results are sensitive to the level of disaggregation. In Section 4, we draw conclusions and sum up. An appendix provides additional information about the aggregation structure of the model and the German tax and transfer system.

2 The modules of the model and their linkage

Our model combines a discrete-choice (DC) model of labour supply of heterogeneous households with a multi-sectoral CGE analysis of an open economy. Both parts of the model are at the level of standard tools of applied economic research, but do not include the ramifications of the latest research in each field. With this paper we

want to emphasize linkages between both modules, so that too much complexity in each of the parts could easily distract from our core discussion. After presenting the two parts one by one, we focus on the channels through which the two models are linked and that we expect to produce feedback.

2.1 Labour supply: A logit discrete-choice approach

The ZEW microsimulation model combines a calculator for the household income under the current German tax and transfer system with a discrete choice labour supply estimation that follows van Soest (1995). In a first step, income-leisure combinations are being calculated for all households based on household information from the 1999 wave of the German Socio-Economic Panel (GSOEP). The subsequent labour supply estimation is based on these simulated income-leisure combinations. Each individual (single or spouse) can choose from a fixed number of discrete labour supply options. For married males, there are three labour supply options. For all other individuals (married women, single females and males) there are five options. The discrete options have been chosen so that they correspond to the empirical distribution of labour supply behaviour of the different types of individuals (Buslei and Steiner, 1999). The options are summarized in table 6 in the appendix.

From an econometric angle, the multinomial logit is a natural starting point for the discrete choice among a fixed number of working hours. Among the econometric tools for analysing discrete choices it is the simplest one and is often used as a benchmark for more advanced models (for an overview see Train, 2003). Adoptions of the logit model to an AGE setting are rare, however. Among the few exceptions are the TREMOVE model (De Ceuster et al, 2004), in which the logit approach is used for modelling the demand for different car types, and WorldScan (Lejour et al., 1999), where it is used for modelling international capital mobility. In a labour market context, Arntz et al. (2005) are the first to combine a discrete choice logit approach with AGE modelling.

According to this discrete choice setup, the utility of each alternative is a combination of a deterministic part $\bar{U}$ that depends on a vector of alternative-specific characteristics x_k and an additive stochastic term. For household j we then have

$$U_j(x_k) = \bar{U}_j(x_{j,k}) + \varepsilon_{j,k}.$$

The distinctive feature of the logit approach is that the error term, ε_k, is assumed to be independently standard extreme-value distributed. Under this assumption there is an explicit formula for the probability of preferring option k over all other options l from a set m (McFadden, 1974):

$$P(U_{j,k} > U_{j,l}) = \frac{\exp(\bar{U}_j(x_{j,k}))}{\sum_m \exp(\bar{U}_j(x_{j,m}))}, \quad \forall l \neq k$$

where $x_{j,k}$ refers to variables that vary across the alternative working hours. One characteristic feature of this basic logit approach is the independence of irrelevant alternatives (IIA) which results from assuming independently distributed error terms. As a consequence, increasing the attractiveness of one option in isolation, reduces the attractiveness of all other alternatives, not only the adjacent ones. Moreover, each of the other options looses probability exactly in proportion to the benchmark frequencies. Arntz et al. (2005) demonstrate the consequence of this feature in practical policy analysis compared to an alternative approach that allows shifting only between adjacent working time categories. This alternative approach to modelling discrete labour supply has been used for the Dutch MIMIC model (Graafland and de Mooji, 1999, Bovenberg et al., 2000, Graafland et al. 2001). Arntz et al. (2005) conclude that the fundamental difference in treating switches between alternatives leads to diverging results, but that the logit approach is preferable for its comparability with labour supply reactions in a standard microsimulation approach.

In this analysis, we stick to the logit approach, but introduce a new variant of linking estimation results from the discrete choice labour supply estimation and the AGE that incorporates the full heterogeneity of the labour supply estimation. While the labour supply estimation works at the level of individual households, heterogeneity between these households has only been incorporated by choosing a fixed number of representative households. In particular, Arntz et al. (2005) take account of 26 representative household types with flexible labour supply, 10 single households and 16 couple households, that differ by household composition and skill level (see appendix 5). Parameter estimates for the 26 representative households are calculated as unweighted arithmetic means of all individual households that belong to a certain household type.

This aggregation level will be the benchmark for the fully disaggregated specification that is presented in this paper. Instead of using arithmetic means for 26

household types, this full micro-macro linkage uses parameter values for all 3000 households that are included in the 1999 wave of the GSOEP. [Stefan: could you add some sentences on how these parameter estimates are linked to the AGE model? Or do you want to explain this in the next section?]. Thus, this specification fully incorporates the heterogeneity between households.

In order to receive parameter estimates for the logit analysis that reflect heterogenous preferences among the 3000 households, we allow for a relatively flexible specification of the deterministic part of the utility function $\bar{U}$. In particular, $x_{j,k}$ is a vector of characteristics of the hours-of-work options including disposable income and weekly hours of leisure time for men and women,

$$x_{j,k} = (log(C_j(h^f_{j,k}, h^m_{j,l})), log(T - h^f_{j,k}), log(T - h^m_{j,l})).$$

We follow van Soest (1995) in assuming a quadratic utility function with A and β as parameters that capture the quadratic and linear terms, respectively.

$$\bar{U}_j(x_{j,k}) = x'_{j,k} A_j x_{j,k} + \beta'_j x_{j,k}. \tag{1}$$

In addition, these parameters also include interactions between leisure, income and certain household characteristics (age, dummy for citizenship, East Germany, handicaps and children in certain age brackets). These interactions account for differences in the preferences of households and individuals for certain hours-of-work options. In addition, constant terms capture fixed costs of working. For singles we include a constant for all positive hours categories; for couples, there are two constants, one for positive working hours of the woman, the other for both spouses working. We estimate the coefficients separately for couples, female singles and male singles. Details on the estimation can be found in appendix A.3. The main objective of this paper is to explore the benefit of using this fully disaggregated linkage between the microsimulation and the AGE module compared to using a linkage with a medium level of aggregation. In particular, we want to examine to what extent a higher level of disaggregation contributes to an improved analysis of welfare reforms aiming at increasing participation rates among certain segments of the population.

2.2 The budget constraint

Due to the discrete choice set-up, the budget constraint has to be determined for a finite set of hours. For each hours category, we determine the disposable income based on the German tax-benefit-system using gross earnings and transfer income. First, we calculate net monthly earnings by deducting income taxes and social security contributions from gross monthly earnings. The disposable monthly income is obtained by adding transfer payments to net monthly labour earnings. We consider unemployment benefits (UB) and assistance (UA), social assistance and child benefits (see appendix A.4 for details).

For each individual or household, we compute the disposable income for all possible labour supply decisions. If labour supply is zero hours (voluntary unemployment), no unemployment compensation UC (UB or UA) is assigned. Each positive labour supply may result in three different probabilistic labour market states: employment (e), involuntary unemployment with unemployment compensation (b), or involuntary unemployment with social assistance (n). In Germany, UC are available for persons who have paid contributions to the mandatory unemployment insurance for at least one year. However, owing to the static nature of the model, we are not able to determine whether or not a person is entitled to unemployment compensation. Instead, we assume that an involuntarily unemployed person is entitled to UC with an exogenous probability P_{UC}.[3] In case of entitlement, the compensation is determined on the basis of the chosen category of hours supplied and the replacement ratio is calculated as a weighted average of UB and UA replacement rates. The (supplemental) social assistance benefit is calculated for the whole household and all possible labour market states of its members after earnings and other transfer incomes have been determined.

The distinction of three labour market states requires that the value of disposable income for a particular category of working time be calculated as an expected value. Since we make the simplifying assumption that worker households do not save, the expected disposable income equals expected consumption. For singles, the expected value of the disposable income for a particular category of hours of work supplied is

[3] We assume that P_{UC} uniform across households; it equals the empirical share of unemployed persons receiving unemployment compensation of 0.8 (IAB 2002).

determined as a weighted average of the disposable income values, y^D, in the three labour market states (e, b and n), with the respective probabilities, $P(i)$, $i = e, b, n$, as weights:

$$C_j\left(h_{j,k}\right) = E(y_j^D(h_{j,k})) = \sum_{i=e,b,n} P(i)\ y^D(h_{j,k}, i), \qquad i = e, b, n \tag{2}$$

More specifically, we have $P(w) = (1 - u_j)$, $P(b) = u_j P_{UC}$ and $P(n) = u_j(1 - P_{UC})$, with u_j representing (household type specific) unemployment rates. For couples, the expected disposable income for a particular combination of hours of work is determined by the weighted average of disposable incomes corresponding to the 9 combinations of labour market states:

$$C_j\left(h_{j,k}^f, h_{j,l}^m\right) = E(y_j^d(h_{j,k}^f, h_{j,l}^m)) = \sum_{i,g=e,b,n} P(i)P(g)y_j^D(h_{j,k}^f, h_{j,l}^m, i, g), \qquad i, g = e, b, n \tag{3}$$

For the policy simulations, we use a first-order approximation of the tax-transfer schedule. We disturb the calculations of disposable income marginally at all relevant points to calculate numerically local average and effective marginal rate of the total tax-transfer system, which are then transferred to the CGE model.

2.2.1 An AGE framework with decentralised wage bargaining

The labour supply module is embedded into a computable general equilibrium model of Germany ("PACE-L"). In this section, we only sketch the other parts of the model. Most focus is on the wage determination module of PACE-L, which, through the wage bargaining mechanism, directly interacts with the labour supply decision of the households. An extensive, algebraic model description and a summary of the data sources used for calibration can be found in Böhringer et al (2005).

Labour Market

Wages are determined by sector-specific bargaining between an employers' association and a trade union. The bargaining outcome is represented as the maximisation of a Nash function, which includes the objective functions of both parties and their

respective fallback options. We adopt the "right to manage" approach: Parties bargain over wages, and firms determine labour demand on the basis of the bargained wage. The union represents two types of workers, high skilled and low skilled. For each skill type, the union's objective function is calculated as employment times the value of a job minus the value of unemployment. The values of the labour market states are recursively determined as weighted averages of the incomes in the case of employment and unemployment, where the weights are computed from the transition probabilities between the labour market states (see Pissarides, 1990, for an overview of the search-and-matching approach).

We assume that the trade union is utilitarian with respect to the individual households. The marginal tax rates and the values of the states of employment and unemployment are therefore calculated as weighted averages over all households and working-time categories. In turn, the wage that results from bargaining in general equilibrium is used to derive the income positions of all households in all possible labour market states. In order to preserve continuity of the model, this dependence is linearly approximated. We calculate an average and a marginal rate of the total tax and transfer effects for each household and labour market state in the benchmark. These are treated as parameters in the counterfactual policy simulations.

The two labour markets for low and high skilled labour are balanced by aggregating on the demand side over sectors and on the supply side over households. We assume that with respect to households the structure of labour demand is uniform across sectors. The households captured by the microsimulation model include all households with flexible time allocation and observable hours of work, which is about 60% of total labour supply. Pensioners, students, women on maternity leave, civil servants and the self-employed are excluded in the microsimulation model. In the general equilibrium model, they are represented by an additional aggregate household with fixed labour supply. Household-specific unemployment rates are aggregated into economy-wide unemployment per skill group. Changes in aggregate unemployment are distributed among households in proportion to their benchmark unemployment.

In a wage-bargaining setting, the wages respond to reforms in the tax and transfer system through two different channels. First, the reforms change the marginal burden of the total tax and transfer system (either through an explicit change of

tax rates or through lower transfer withdrawal rates). This bears on the bargaining outcome through the average skill-specific effective marginal tax rates. However, the effect of a specific reform on the average marginal tax rate is normally not clear a priori, because in most cases the marginal burden increases for some individuals while it decreases for others. With a constant average tax rate, an increase in the effective marginal tax rate raises the degree of tax progression, which leads to wage moderation on the part of the unions (Koskela and Vilmunen 1996). Second, reforms of the transfer system reduce expected income when being unemployed (and thus the fall-back position of unions) in two ways: directly through lower transfer payments and – if they succeed in stimulating labour supply – indirectly through a higher probability of unemployment (at given labour demand).

Firms

In each production sector, a representative firm produces a homogenous output. The production function is of the nested constant-elasticity-of-substitution (CES) type, combining intermediate inputs, capital and labour of the two skill types. Each individual firm is assumed to be small in relation to its respective sector. All firms in one sector interact through monopolistic competition. This means that firms can exploit market power in their respective market segment. Cost minimisation yields demand functions for the primary factors at the sectoral level and corresponding uncompensated (own and cross) price elasticities for labour that are used in the Nash bargaining FOCs. Capital is mobile across sectors, and the market for capital is perfectly competitive. In the simulations in Section 3 we additionally assume that capital is internationally immobile, which reflects a short- to medium-run model horizon.

Private households

We distinguish the about 3000 individual worker households with flexible labour supply, one dummy household with fixed labour supply, and a capitalist household. The capitalist household receives all capital and profit income. Capitalists decide over consumption and investment according to the approach of Ballard et al. (1985). Their utility function is calibrated to empirical saving elasticities. Worker households, by contrast, do not save. The structure of consumption is assumed to be identical across all households. Aggregate consumption is distributed among the

different consumption goods according to a CES function.

Government

The main focus in the model of this paper is on the complex tax and transfer system for private households, which are calculated in a special programme module (see Appendix A.4) and then linearly approximated through two sets of parameters: an average and a marginal tax and transfer rate for each household type in each labour supply category and each labour market state. Apart from the taxes and transfers for the private households, the government collects the following taxes: a uniform capital input tax, a profit tax, an output tax in production, and a differentiated consumption tax on all consumption commodities. The government budget contains the revenue from all these taxes, the public purchases of goods, and the balance of payments surplus or deficit.

Foreign Trade

Domestically produced goods are converted through a constant-elasticity-of-transformation function into specific goods destined for the domestic market and the export market, respectively. By the small-open-economy assumption, export and import prices in foreign currency are not affected by the behaviour of the domestic economy. Analogously to the export side, we adopt the Armington assumption of product heterogeneity for the import side. A CES function characterises the choice between imported and domestically produced varieties of the same good. The Armington good enters intermediate and final demand. Foreign closure of the model is warranted through the balance-of-payments constraint.

2.2.2 Linking the labour supply and AGE modules

The microsimulation module with its many households and labour market states, and with the detailed equations for the budget constraints at all relevant points proved to be too space-consuming to be fully integrated into the AGE framework (at the level of desktop PCs where we are working). The two model modules are therefore kept seperate and iterated to arrive at a global solution. In a policy simulation like the ones in Section 3, we start with the modified rules of the tax and transfer system and first simulate labour supply changes under the assumption of constant wages and

unemployment rates. The resulting labour supply is aggregated (by skill type) and transferred to the AGE model which is solved under the assumption of a constant labour supply. This results in changes in the wage and unemployment rates, which are fed back to the labour supply module for the next iteration. This proceeds until the two model modules converge.[4]

Three points in the linkage set-up need a closer look. First, in aggregating labour supply, we use efficiency weighting. That is, labour supply in hours is weighted with the respective wage rate of the initial situation. By assumption, all individual wage rates (of each skill group) move in parallel, so adjustment of the weights during the iteration is not an issue. Efficiency weighting corresponds to the assumption that all labour of the same skill type is perfect substitutable, except for the efficiency factor derived from the empirical wage. Second, when we move from the AGE module to the labour supply module, the individual unemployment rates need to be adjusted (adjustment of individual wages is straightforward). We assume that unemployment probabilities differ by household type (26 household types differentiated by household composition and skill level), but are equal within each household type. As the relative labour supply of the household types changes during the iterations of the model, a change in the overall unemployment rate (as an output of the AGE module) does not simply translate into proportional changes in the individual unemployment rates, but must be numerically calibrated. This is done in every iteration step at the transition from the AGE to the labour supply module. Third, the AGE model with constant labour supply needs a closure with respect to the public budget. In the intermediate iterations of the model we assume that all income changes that are due to adjustments of the wage rates are left untaxed and translate directly into consumption.

In general, we conceive the 3000 households in the model as representative for a larger group of households. This is relevant in two respects. First, we use the full distribution of hours in the calculations of the aggregated labour supply. (An

[4] As a stopping criterion, we use a change in the unemployment rate between two subsequent iterations of less than 10e-5. Usually, the model converge to this precision within less than ten iterations. Remarkably, the convergence in the aggregate labour supply is very fast, while the unemployment rates are more volatile, showing oscillating convergenge and overshooting their final value in the first iteration by about 100 per cent.

alternative often used in microsimulation studies is to use only the labour supply option with the highest probability.) Second, it is justified to use the probability of unemployment in the calculation of the expected household income at the different labour supply options, although each individual household member will *de facto* be either employed or unemployed.

3 Policy Simulations: What is the gain from disaggregation?

In this section, we apply the model to simulate a social welfare reform that is designed to stimulate labour market participation of low-income workers. We first explain the before and after-reform situations and then simulate the labour market effects of the reform in two different model versions. Our main interest is in the fully disaggretated version with all individual households. However, to set things into perspective, we complement this version with one at a higher aggregation level, which closely follows the logit model variant in Arntz et al. (2005). In this way, we get a clearer picture of the exact difference that is generated through the addition of a full-fledged microsimulation model. In addition, we distinguish between a partial and a general equilibrium perspective in order to be able to demarcate differences that are due to the basic labour supply setup from those that only result from general equilibrium feedback.

3.1 Status-Quo-System and Reform Scenario

Germany's social assistance system in its present state is particularly suited for our demonstration purposes since it produces strong labour market disincentives as discussed above. The benefit level is widely considered too generous from an incentive point of view, and transfer withdrawal results in effective marginal tax rates that are close to 100 percent at the bottom of the income distribution.

Figure 1 illustrates the relationship between gross and net monthly labour earnings as well as disposable income for a single person without children. The grey line depicts net earnings, whereas the black line (labelled 'status quo') represents

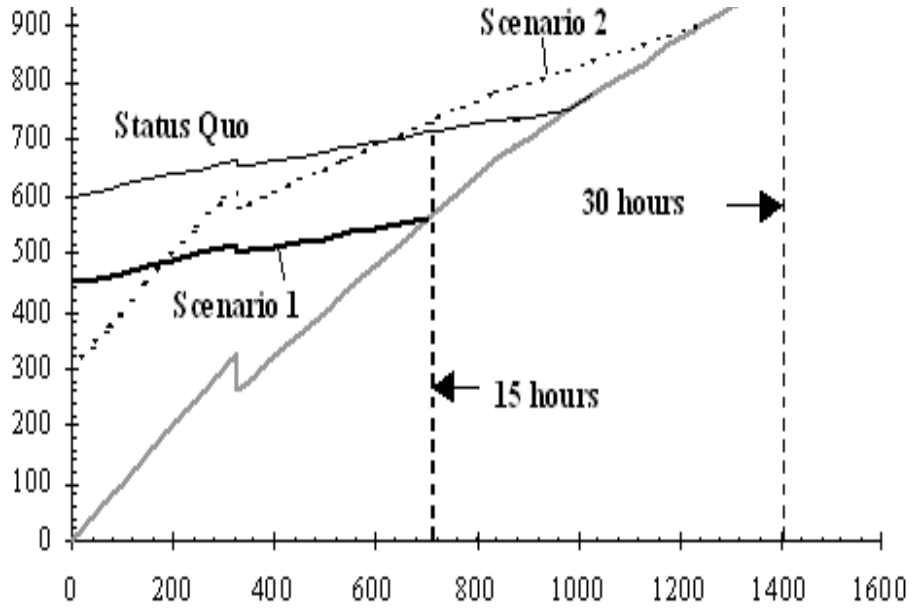

Figure 1: Income function of a single without children

disposable income in the benchmark. Disposable income starts at 600 €, which is the social assistance level for this household type. Benefits are phased out at a rate of approximately 80 per cent up to the break even income, where eligibility ends.[5]

Reform scenario

In our reform scenario, we fully abolish the basic social assistance rate for those welfare recipients who are able to work. With respect to employability, we assume that among those with flexible labour supply lone parents with more than one child and married women with more than one child are not required to work. For a single person without children, for example, the reform entails a 50 per cent cut in the benefit level (from roughly 600 € to 300 €). This is combined with cutting the transfer withdrawal rate to zero up to the net earnings level that is necessary to reach status-quo social assistance.[6] E.g., a single person without children may now

[5] "15" and "30 hours" in Figure 1 refer to a weekly labour supply of a worker with a gross hourly wage of 10.8 € , which corresponds to the mean hourly wage of a low-skilled individual.

[6] The transfer withdrawal rate for non-employable single individuals remains the same as in the status-quo system, whereas employable partners of non-employable persons in couple households face a lower transfer withdrawal rate.

earn 300 € net labour income that is not withdrawn. Net earnings in excess of this amount are subject to a transfer withdrawal rate of 50 per cent up to the break even income where net income corresponds exactly to disposable income. For a single person without children, eligibility for social assistance therefore extends up to net earnings of 900 € (see the dashed line in Figure 1). Compared to the benchmark, all positive working time categories become more attractive owing to the substantial reduction in the benefit level. Moreover, the lower transfer-withdrawal leads to a relatively larger gap in disposable incomes between non-participation and the lower working time categories. Hence, taking up a part-time job becomes relatively more attractive than a full-time job.

3.2 Partial equilibrium results

In this section, we first look at the partial equilibrium results, where gross wages are held fixed and the public budget is not balanced through adjustment of some tax. These results allow us to focus on the changes in the relative attractiveness of the labour supply options that directly result from the policy measure. To highlight the extent to which the results are sensitive to the specific level of disaggregation, we proceed as follows: First, we consider a medium level of disaggregation by using 26 representative household types with household-type-specific wages and parameter values of the utility function. The level of disaggregation allows us to consider household-type-specific reform proposals such as the exclusion of certain individuals from cuts in the social assistance level. We subsequently compare this medium level of disaggregation with the fully disaggregated linkage of the microsimulation and the AGE model. This highest level of disaggregation incorporates the full heterogeneity of the population under consideration in terms of preferences and the overall wage distribution.

Medium level of disaggregation

Column (3) of Table 1 exemplifies the labour supply responses for two subgroups of individuals for the medium level of disaggregation. The upper panel refers to low-skilled female singles, while the lower panel shows the results for high-skilled female singles. Compared to the benchmark distribution, the reform entails an increase in the share of all positive working time categories. The increase in the participation

rate is stronger for low-skilled female singles (+13.5 p.p.) as compared to their high-skilled counterparts (+7.2 p.p). The underlying mechanism here is that low-skilled individuals are more likely to be affected by the disincentives of labour supply, which are created by the status-quo system. For the low-skilled the relative increase is largest for the 30-hours working time category. The reason is that the cut in the transfer-withdrawal rate makes part-time jobs relatively more attractive than full-time jobs. For example, under our reform scenario low-skilled female singles with one child, who make up a relatively large proportion of low-skilled female singles, are still entitled to supplemental social assistance when holding a 30-hours job.

Table 1: Hours Distribution of Single Women

Hours category	Benchmark share (per cent)	Post-reform distribution	
		Medium disaggregation	Full disaggregation
		Low-skilled single women	
0	16.0	2.5	9.0
15	17.3	18.5	18.1
30	9.8	15.4	13.0
38	41.8	46.3	43.6
47	15.3	17.3	16.3
		High-skilled single women	
0	15.2	8.0	8.3
15	11.8	12.5	12.7
30	10.5	12.8	13.0
38	42.0	44.4	44.2
47	20.6	22.3	21.9

While Table 1 was confined to two particular subaggregates, columns (2) - (4) in Table 2 present the effects on participation rates, average working time and supplied hours of work for sub-groups of individuals. The effects for these sub-groups depend on the magnitude of the household-specific labour supply elasticities and the overall distribution of household types. Comparing low-skilled with high-skilled individuals, the aggregate participation reactions show a similar pattern to that in Table 1. Increases in participation rates are more pronounced among low-skilled individuals than among the high-skilled. In addition, the results indicate that the effects on labour supply are stronger among singles than among couple individuals.

Table 2: Partial Labour Supply Effects

Individual group	Medium level of disaggregation			Fully disaggregated level		
	PR	AWT	TLS	PR	AWT	TLS
Married men	1.06	-0.11	0.99	0.87	-0.03	0.88
Married women	0.21	0.01	0.37	-0.41	0.05	-0.34
Singles	6.34	-0.06	6.99	5.28	-0.28	5.64
Low-skilled	2.35	-0.05	2.90	1.07	-0.03	1.48
High-skilled	1.47	-0.06	1.64	1.12	-0.05	1.31
All	1.63	-0.06	1.85	1.11	-0.05	1.33

PR: participation rate (change in percentage points), AWT: average working time (change in per cent), TLS: total labour supply in hours (change in per cent)

One important reason is that couple households are less likely to be affected by the reform since they exhibit a larger share of households with more than one child, who face a relatively smaller reduction in the social assistance level. Column (3) of Table 2 reports changes in average working time. For most subgroups, switches are somewhat more concentrated on the lower working time categories, so that the increase in the participation rate comes along with a reduction in average working time. However, the overall change in labour supply is found to be positive for all groups since the increase in participation rates always dominates.

Full disaggregation

Column (4) in Table 1 reports the hours distribution of female singles for the highest level of disaggregation. Comparing this post-reform distribution to that in column (3), one may see that the fully disaggregated model tends to lower the participation responses for both individual goups. However, the figures also reveal that the differential effect turns out to be much more pronounced among the low-skilled as compared to their high-skilled counterparts. In general, the differential effect under both disaggregation levels can be traced back to the underlying wage distributions. Figures 2 and **??** in Appendix A.5 show the distributions of hourly wages for these two subgroups of individuals. Figure 2 shows that a considerable proportion of low-skilled female singles receives an hourly wage that falls short of the average wage of

this individual group. Similarly, inspection of Figure **??** reveals that a large proportion of high-skilled female singles features wages below the corresponding average wage.

Assigning higher average wages to those individuals has two countervailing effects on the participation responses. First, for those working time categories where no entitlement to supplemental social assistance payments prevails, disposable incomes are generally overestimated. As a result, choosing these categories becomes relatively more attractive in the medium disaggregated as compared to the fully disaggregated case. Second, assigning average wage may render lower working time categories relatively less attractive. E.g., with a too high hourly wage, a 30-hours job may fall out of the gross income range where individuals are still entitled to supplemental social assistance payments in our reform scenario. Since this phenomenon is relatively more relevant for the high-skilled, the dampening effect on participation responses in the fully disaggregated case is much lower for this individual-group. Taking into account the wage distribution in the disaggregated model captures the relative increase in the incentive to take up a part time job in a more detailed manner. This is reflected in the two diverging post-reform hours distributions in Table 1. The figures show that for the high-skilled, the reform scenario in the fully disaggregated case entails a larger increase in the lower working-time categories as compared to the medium level of disaggregation. For a large part of low-skilled females, in contrast, this incentive is already captured in the medium disaggregated case. Here, the overestimation of disposable incomes in all working time categories dominates, which leads to a considerably larger participation response in the medium disaggregated case.

The last three columns in Table 2 show the effects on participation rates, average working time and supplied hours of work for the fully disaggregated model. Comparing all low- and high-skilled individuals, the same pattern emerges as for single females. While both skill groups exhibit lower participation responses in the fully disaggregated version, the relative decrease turns out to be considerably larger for the low-skilled. Since high-skilled individuals make up a relatively larger proportion of our underlying population (85 %), the overall redcution in the fully disaggregated case comes closer to that of the high-skilled. In couple households, the changes in average working time and labour supply differ among male and female spouses. Married women increase both average working time and labour supply in the reform

scenario, whereas men slightly decrease their average working time. These effects for married women are somewhat higher in the disaggregated model.

3.3 General equilibrium results

This section presents the general equilibrium effects of the reform scenario relative to the status-quo system, including equilibrium wage responses, labour demand reactions and the adjustment in the marginal income tax chosen to warrant revenue neutrality of the reforms. First, in Table 3, we report the labour supply changes due to the reform. In Table 4, we then show the most important macroeconomic results.

Medium level of disaggregation

The results from the medium disaggregated model are reported in the left panel of Table 3.

Table 3: Labour Supply Effects

Individual group	Medium level of disaggregation			Fully disaggregated level		
	PR	AWT	TLS	PR	AWT	TLS
Married men	0.94	-0.18	0.79	0.76	-0.07	0.73
Married women	0.03	-0.07	0.08	-0.52	0.01	-0.51
Singles	6.10	-0.16	6.59	5.10	-0.36	5.34
Low-skilled	2.16	-0.15	2.59	0.95	-0.08	1.28
High-skilled	1.31	-0.14	1.38	1.00	0.10	1.12
Total	1.47	-0.14	1.58	0.99	-0.09	1.15

PR: participation rate (change in percentage points), AWT: average working time (change in per cent), TLS: total labour supply in hours (change in per cent)

With 1.14 p.p., the change in total participation rate is smaller than in the partial equilibrium model, where it amounts to 1.61 p.p. Clearly, feedback effects, which are captured in general equilibrium, dampen the upward tendencies in participation rates observed in the partial equilibrium model. Average working times decrease for all sub-groups upon the implementation of the reform due to the increase in the

attractiveness of jobs with less working times. General equilibrium effects intensify the decrease in average working time: In the general equilibrium model, this decrease amounts to -0.14% compared to -0.03% in the partial equilibrium model. Yet, in total, labour supply grows by 1.17 % in the general equilibrium model, which is less than the growth in labour supply resulting from the partial model.

Table 4: General Equilibrium Effects

	Low skilled	High skilled	Total
Medium Disaggregated			
Gross wage	-4.40%	-1.63%	-2.91%
Labour supply (in 1,000 persons)	+150.94	+218.62	+369.56
Employment (in 1,000 persons)	+138.55	+165.87	+304.42
Unemployment rate (change in percentage points)	-0.56	0.20	0.13
Fully Disaggregated			
Gross wage	-3.62%	-2.15%	-2.84%
Labour supply (in 1,000 persons)	+103.50	+324.02	+427.52
Employment (in 1,000 persons)	+115.46	+290.39	+405.85
Unemployment rate (change in percentage points)	-0.93	0.06	-0.09

The first panel of Table 4 displays the effects on wages and employment in absolute terms for the medium disaggregated case. The results indicate that, as a consequence of the reform, gross wages fall for both low and high-skilled individuals, with the downward pressure on wages being larger for the low-skilled. This is due to the fact that low-skilled individuals exhibit stronger increases in participation rates, since they are more likely to be affected by the reform.

The second row of Table 4 reports the absolute increase in labour supply measured in 1000 persons. The labour supply of low-skilled individuals increases by about 151,000 persons, while the additional labour supply of the high-skilled amounts to 219,000 persons. As high-skilled labour represents a considerably larger fraction of our relevant population, the additional labour supply of high-skilled workers exceeds that of low-skilled workers in absolute terms. In contrast to the low-skilled wage reactions, the downward pressure on high-skilled wages is not sufficiently strong to

prevent additional labour supply from translating into higher unemployment. The unemployment rate of the high-skilled slightly increases by 0.2 p.p., whereas the unemployment rate of low-skilled individuals falls by 0.6 p.p. Thus, as can be seen from the third row in Table 4, the additional labour supply of the low-skilled is absorbed to a much larger extent by the labour market, with an additional employment of 139,000 low-skilled persons as compared to 169,000 high-skilled persons.

Full disaggregation

The right panel of Table 3 displays the results from the fully disaggregated model with about 3 000 individual households. The labour supply results are quite similar to those of the medium disaggregated case (see Table 2). Compared to the partial equilibrium model, the indirect effects that are at work in the general equilibrium framework again mitigate the stimulating effects on labour supply. In the fully disaggregated general equilibrium model, the participation rate increases by 1.63 p.p. as compared to 1.80 p.p. in the partial equilibrium model (see Table 3). Note that the dampening effect on participation rates is relatively smaller than in the medium disaggregated version, where participation increased by 1.14 p.p. in general equilibrium as compared to 1.61 p.p .in the partial equilibrium model. This can be traced back to the underlying wage reactions. On average, gross wages decline slightly more in the medium disaggregated model variant than in the fully disaggregated case (see Table 4).

Contrasting the participation reactions of low-skilled and high-skilled individuals under the two levels of disaggregation, the pattern of results is similar to what has been found in the partial equlilibrium case: Relative to the medium disaggregated case, the labour supply and employment effects are much more pronounced for high-skilled individuals in the fully disaggregated model variant. As noted earlier, taking into account the entire wage distribution in the fully disaggregated case leads to relatively higher participation reactions of high-skilled individuals as compared to the medium disaggregated case. By contrast, in the medium disaggregated case our reform scenario leads to higher labour supply reactions of low-skilled workers than in the fully disaggregated version. As a consequence, gross wages fall less for the low-skilled and more for the high-skilled in the fully disaggregated case as compared to the medium level of disaggregation. However, the decrease in low-skilled wages is still sufficiently strong that the additional employment of low-skilled employees

(115,000 persons) exceeds their additional labour supply (103,000 persons). In contrast, additional labour supply and employment of the high skilled amount to about 324,000 and 319,000 persons, respectively. To sum up, while labour supply and employment increase in both model variants, the shares of additionally employed low- and high-skilled individuals differ substantially across both levels of disaggregation. Since high-skilled labour makes up a considerably larger fraction of our population, the overall employment effect is substantially larger in the fully disaggregated case (406,000) as compared to the medium level of disaggregation (304,000).

In both modelling regimes, the changes in the macroeconomic variables GDP and private consumption hardly differ from each other. Private consumption shrinks moderately, by about -0.3 % and -0.4 % in the medium- and fully-disaggregated case, respectively, that is, in almost the same extend. This decline is due to diminished gross wages that are not fully compensated by the increase of labour supply. Despite the reduction of private consumption, GDP grows by 0.6 % in the medium disaggregated case and by 0.7% in the fully disaggregated case. These growth rates originate from a shift towards investment demand that follows the functional redistribution from labour to capital income.

4 Conclusions

The model presented in this paper integrates a labour supply model in the microsimulation tradition and a computable general equlibrium model. The labour supply module captures a detailed depiction of individual budget constraints and a discrete-choice working-time choice. The general equilibrium model features differentiated production, consumption and international trade structures as well as a special labour market module with wage bargaining, search frictions and involuntary unemployment. In this framework, we analyse the consequences of revenue-neutral tax-and-transfer reforms that are designed to stimulate labour supply at the lower end of the wage distribution. To set the results in perspective, we compare the results of the fully disaggregated version with results at an intermediate disaggregation level that works with 26 representative household types and a uniform wage per skill group.

Compared to models with only one aggregate household (Hutton and Ruocco, 1999, Böhringer et al., 2005) the microsimulation-AGE model assembles the following advantages:

- The extensive and the intensive margin of labour can be distinguished. We can thus break down changes in total labour supply into changes in the participation rate and changes in the average hours of work supplied, as e.g. in Table 2 in Section 3.
- For each individual household a complex budget constraint is formulated, so that the details of national tax and transfer systems can be integrated in the model. This is especially important for couple households, for which tax and transfer rules depend on the household composition as well as the labour market status of both spouses.

Compared to pure microsimulation studies, the microsimulation-AGE model expands on:

- endogenous determination of the wage and unemployment rates,
- closure of the public budget (which is affected both directly by the reform measures and indirecty by macroeconomic repercussions) through the endogenous adjustment of a tax recycling instrument (in our case: the marginal income tax rate),
- sectoral effects: Labour supply changes affect different sectors of the economy differently, with sectoral factor demand and international trade consequences.

Turning to the comparison of the two model variants (intermediate level of disaggregation vs. full disaggregation), we obtain the following results:

- There is no uniform pattern in the magnitude of change between the different hours categories. In our examples, we observe more pronounced changes under medium disaggregation with low skilled individuals, whereas the opposite is the case with high skilled individuals. The main driver is here an

over-estimation of the group-specific wage rate through the average wage of the skill group. Assigning higher average wages to those individuals has two countervailing effects on the participation responses. First, in the upper working time categories disposable incomes are overestimated, so that taking up a full-time or over-time job becomes relatively more attractive than in the fully disaggregated case. Second, assigning averages wage makes lower working time categories relatively less attractive. E.g., with a too high hourly wage, a part-time job may fall out of the gross income range where individuals are still entitled to supplemental social assistance payments. While the latter phenomenon is relatively more relevant for the high-skilled, the former phenomenon dominates for low-skilled individuals. This leads to a larger participation response for the high-skilled in the fully disaggregated case than for the medium level of disaggregation, whereas the opposite is the case for the low-skilled.

- Aggregate labour supply reactions are higher under full disaggregation. The larger part of this effect is due to a higher increase in the average working time, but also the increase in participation contributes. Again, this overall effect is not uniform across labour market groups, but there are also sub-groups whose reactions are weaker under full disaggregation.

- General equilibrium feedback in general mitigates the labour supply reactions. This mitigation effect is moderate, but not negligible. The range of the mitigation effect is broadly the same with both levels of aggregation.

- The level of disaggregation affects the macroeconomic results for high and low skilled workers in a different direction. While for the low skilled the wage decrease is lower and the unemployment decrease is higher under full disaggregation, the opposite is the case for the high skilled.

The results of the comparison exercise between different aggregation levels are mixed. For quite a number of variables, the results are quite close, so that an intermediate disaggregation level seems justified. However, there are also variables that show quite pronounced differences, so that full disaggregation is necessary to uncover them. Broadly speaking, the effects tend to have a different direction for different subgroups of households. As a quite general rule we can therefore conclude that, as long

as we are mostly interested in the overall macroeconomic effects, an intermediate level of disaggregation can be justified. Once we are also concerned with the reaction of specific sub-groups of the population and with decomposing the labour supply effect into changes along the intensive and extensive margin, full disaggregation becomes an indispensable part of the analysis.

References

[1] Aaberge, Rolf, Ugo Colombino, Erling Holmøy, Birger Strøm and Tom Wennemo (2004): Population ageing and fiscal sustainability: An integrated micro-macro analysis of required tax changes, Discussion Paper No. 367, Statistics Norway

[2] Arntz, Melanie, Stefan Boeters and Nicole Gürtzgen (2005): Alternative Approaches to Discrete Working Time Choice in an AGE Framework, ZEW Discussion Paper No. 05-62, Mannheim

[3] Ballard, Charles L., Don Fullerton, John B. Shoven and John Whalley (1985): A General Equilibrium Model for Tax Policy Evaluation, The University of Chicago Press, National Bureau of Economic Research

[4] Bargain, Olivier (2005): On Modeling Household Labor Supply with Taxation, IZA Discussion Paper 1455, Bonn

[5] Blundell, Richard and Thomas MaCurdy (1999): Labor Supply: A Review of Alternative Approaches, in: Ashenfelter, Orley and David Card (eds.): Handbook of Labor Economics, Vol. 3, Amsterdam (Elsevier), 1559-1695

[6] Boeters, Stefan, Nicole Gürtzgen and Reinhold Schnabel (2003): Reforming Social Welfare in Germany – An Applied General Equilibrium Analysis, ZEW Discussion Paper 03-70, Mannheim

[7] Boeters, Stefan, Michael Feil and Nicole Gürtzgen (2004): Discrete Working Time Choice in an Applied General Equilibrium Model, ZEW Discussion Paper No. 04-20, Mannheim

[8] Böhringer, Christoph, Stefan Boeters and Michael Feil (2005): Taxation and Unemployment: An Applied General Equilibrium Approach for Germany, Economic Modelling 22, 81-108

[9] Bovenberg, A. Lans, Johan J. Graafland and Ruud A. de Mooij (2000): Tax reform and the Dutch labor market : an applied general equilibrium approach, Journal of Public Economics 78, 193-214

[10] Buslei, Hermann and Viktor Steiner (1999): Beschäftigungseffekte von Lohnsubventionen im Niedriglohnbereich, Baden-Baden: Nomos

[11] Cockburn, John (2001): Trade liberalization and poverty in Nepal: a computable general equilibrium micro simulation analysis, CREFA Working Paper 01-18, available at: http://www.crefa.ecn.ulaval.ca/cahier/0118.pdf

[12] Cororaton, Caesar B. (2003): Analysing the impact of Philippine tariff reform on unemployment, distribution and poverty using CGE-Microsimulation approach, available at: http://www.ifpri.org/events/seminars/2003/20031014/cororaton_EPIAM.pdf

[13] De Ceuster, Griet, Bart Van Herbruggen, Steven Logghe, Stef Proost (2004): TREMOVE, Report for European Commission, DG ENV, Transport & Mobility Leuven and K.U. Leuven

[14] Gørtz, Mette, Glenn W. Harrison, Claus Kastberg Nielsen and Thomas F. Rutherford (2000): Welfare Gains of Extended Opening Hours in Denmark, Working Paper, University of South Carolina and Copenhagen Economics

[15] Graafland, Johan J., Ruud A. de Mooij (1999): Fiscal Policy and the labour market: An AGE analysis, Economic Modelling 16, 189-219

[16] Graafland, Johan J., Ruud A. de Mooij, André G.H. Nibbelink and Ate Nieuwenhuis (2001): MIMICing Tax Policies and the Labour Market, Amsterdam: Elsevier

[17] Gupta, Anil, and Vishnu Kapur (ed.) (2000): Microsimulation in Government Policy and Forecasting, Amsterdam: Elsevier

[18] Haan, Peter (2004): Discrete Choice Labor Supply: Conditional Logit vs. Random Coefficient Models, DIW Discussion Paper 394, Berlin

[19] Haan, Peter, and Viktor Steiner (2004): Distributional and Fiscal Effects of the German Tax Reform 2000: A Behavioral Microsimulation Analysis, DIW Discussion Paper 419, Berlin

[20] Hutton, John P., and Anna Ruocco (1999): Tax Reform and Employment in Europe, International Tax and Public Finance 6, 263-287

[21] IAB (Institut für Arbeitsmarkt- und Berufsforschung, 2002): IAB-Zahlenfibel – Ergebnisse der Arbeitsmarkt- und Berufsforschung in Tabellen, Nürnberg

[22] Koskela, Erkki and Jouko Vilmunen (1996): Tax Progression is Good for Employment in Popular Models of Trade Union Behaviour, Labour Economics 3, 65-80

[23] Lejour, Arjan, Nico van Leeuwen, Ton Manders, Guido van Steen, Hans Timmer and Gerard Verweij (1999): WorldScan – the core version, CPB Netherlands Bureau for Economic Policy Analysis, Den Haag

[24] McFadden, Daniel (1974): Conditional logit analysis of qualitative choice behavior, in: P. Zarembka (ed.), Frontiers in Econometrics, New York: Academic Press, 105-142

[25] Müller, Tobias (2004): Evaluating the economic effects of income security reforms in Switzerland: an integrated microsimulation – computable general equilibrium approach, Working Paper, University of Geneva

[26] Orsini, Kristian (2005): The 2001 Belgian Tax Reform: Equity and Efficiency, Discussion Paper 05.04, Center for Economic Studies, University of Leuven.

[27] Pissarides, Christopher A. (1990): Equilibrium unemployment theory, Oxford: Basil Blackwell

[28] Rutherforld, Thomas F., David Tarr and Oleksandr Shepotylo (2005): Poverty effects of Russia's WTO accession: modeling "real" households and endogenous productivity effects, World Bank Policy Research Working Paper 3473

[29] Shoven, John B., and John Whalley (1984): Applied General-Equilibrium Models of Taxation and International Trade: An Introduction and Survey, Journal of Economic Literature 22, 1007-1051

[30] Snower, Dennis J. (1997): The Simple Economics of Benefit Transfers, in: D.J. Snower and G. De La Dehesa (eds.): Unemployment Policy: Government Options for the Labour Market, Cambridge, S.163-198

[31] Steiner, Viktor, and P. Jacobebbinghaus. (2003): Reforming Social Welfare as we know it? A Microsimulation Study for Germany, ZEW Discussion Paper 03-33, Mannheim

[32] Train, Kenneth (2003): Discrete Choice Methods with Simulation, Cambridge: Cambridge University Press

[33] van Soest, Arthur (1995): Structural models of family labor supply : a discrete choice approach, Journal of human resources, 30, 63-88

A Appendix

A.1 Household classification for labour supply module

Abbreviation	Definition
CijxK	couple, woman skill group i, man skill group j, x children
Mi0	male single, skill group i, no children
Wi0	female single, skill group i, no children
xKi	single (male or female), skill group i, x children

i = L (low skilled), H (high skilled), x = 0, 1, 2 or more

Table 5: Household Disaggregation

A.2 Working hours options for different household types

Individual	Hours Options				
men, married or single without children	0			38	49
men, single with children	0	15	30	38	47
women, single	0	15	30	38	47
women, married	0	9.5	24	38	47

Table 6: Discrete Working Hours by Household Types

A.3 Estimation results from the microsimulation model

	Coef.	SE	z	P>z
Net household income	-6.44	1.85	-3.48	0.001
Net household income^2	0.43	0.08	5.22	0.000
Net hh income X leisure	0.48	0.30	1.63	0.103
Leisure X East Germany	-0.96	0.29	-3.32	0.001
Leisure X nationality	0.23	0.41	0.57	0.566
Leisure	77.59	14.10	5.50	0.000
Leisure^2	-9.96	1.80	-5.55	0.000
Leisure X age	-1.11	0.31	-3.65	0.000
Leisure X age^2	0.10	0.04	2.42	0.016
Leisure^2 X age	0.59	0.12	4.83	0.000
Leisure X handicapped	-0.17	0.90	-0.18	0.853
Leisure X children <6 years	4.99	0.60	8.32	0.000
Leisure X children 7-16 years	1.50	0.35	4.29	0.000
Leisure X children >=17 years	-0.48	0.31	-1.53	0.127
Dummy for employment	-2.13	0.25	-8.67	0.000
Number of obs.		540		
Log Likelihood		-636.0		

Conditional logit with five hours-of-work options (0, 15, 30, 38, 49), SOEP 1999

Table 7: Maximum Likelihood Estimates for single females

	Coef.	SE	z	P>z
Net household income	6.76	2.73	2.48	0.013
Net household income^2	-0.019	0.10	-0.19	0.848
Net hh income X leisure	-1.42	0.44	-3.21	0.001
Leisure	169.71	20.03	8.47	0.000
Leisure ^2	-21.13	2.60	-8.12	0.000
Leisure X East Germany	-0.05	0.33	-0.15	0.881
Leisure X nationality	0.29	0.48	0.60	0.547
Leisure X age	-0.74	0.32	-2.34	0.019
Leisure X age^2	0.41	0.12	3.35	0.001
Leisure^2 X age	0.06	0.04	1.46	0.143
Leisure X handicapped	1.32	0.83	1.60	0.110
Dummy for employment	-9.96	1.13	-8.78	0.000
Number of obs.		952		
Log Likelihood		-1286.7		

Conditional logit with five hours-of-work options (0, 15, 30, 38, 49), SOEP 1999

Table 8: Maximum Likelihood Estimates for single males

	Coef.	SE	z	P>z
Net household income	8.95	5.11	1.75	0.080
Net household income^2	-0.003	0.26	-0.01	0.989
Net hh income X leisure of male spouse	-1.46	0.42	-3.46	0.001
Net hh income X leisure of female spouse	-0.43	0.38	-1.14	0.253
Net hh income X nationality	-6.92	3.82	-1.81	0.070
Net hh income^2 X nationality	0.56	0.27	2.09	0.036
Net hh income X East Germany	5.50	1.87	2.94	0.003
Net hh income^2 X East Germany	-0.49	0.14	-3.37	0.001
Leisure of male spouse	56.72	7.15	7.94	0.000
Leisure of male spouse^2	-4.06	0.47	-8.66	0.000
Leisure of male spouse X nationality	-0.40	0.41	-0.98	0.328
Leisure of male spouse X East Germany	-6.05	2.80	-2.16	0.031
Leisure of male spouse X age	-0.36	0.08	-4.31	0.000
Leisure of male spouse X age ^2	0.48	0.10	4.99	0.000
Leisure of male spouse X handicapped	0.76	0.72	1.06	0.290
Leisure of female spouse	79.98	7.00	11.43	0.000
Leisure of female spouse^2	-8.40	0.53	-15.77	0.000
Leisure of female spouse X nationality	0.27	0.40	0.67	0.501
Leisure of female spouse X East Germany	-7.10	2.59	-2.74	0.006
Leisure of female spouse X age	-0.39	0.09	-4.18	0.000
Leisure of female spouse X age^2	0.58	0.11	5.26	0.000
Leisure of female spouse X handicapped	0.97	0.71	1.36	0.175
Leisure of female spouse X children <6 years	4.63	0.31	14.98	0.000
Leisure of female spouse X children 7-16 years	2.13	0.22	9.59	0.000
Leisure of female spouse X children >=17 years	-0.56	0.22	-2.56	0.011
Leisure of male spouse X Leisure of female spouse	-1.50	0.55	-2.72	0.006
Leisure of male spouse X Leisure of female spouse X nationality	0.26	0.14	1.78	0.075
Leisure of male spouse X Leisure of female spouse X East Germany	1.03	0.70	1.47	0.142
Dummy for employment of female spouse	-2.55	0.25	-10.09	0.000
Dummy for employment of both spouses	0.61	0.24	2.54	0.011
Number of obs.		1910		
Log Likelihood		-4186.1		

Conditional logit with fifteen hours-of-work options (female spouse: 0, 9.5, 24, 38, 47; male spouse: 0, 38, 49), SOEP 1999

Table 9: Maximum likelihood estimates for couples

A.4 Calculation of disposable income

Gross monthly earnings are obtained by multiplying the gross hourly wage with monthly hours of work corresponding to the respective category of weekly labour supply. While the fully disaggregated model accounts for the full distribution of gross hourly wages, the medium disaggregated version distinguishes two average wages for low and high-skilled labour. Low-skilled workers are defined as persons without any formal vocational training, whereas individuals holding a vocational or university degree are assumed to be high-skilled. Average gross hourly wages for the respective qualification levels are taken from the German SOEP for the year 2000 and amount to 10.8 € for low skilled and 16.8 € for high skilled.

To obtain net earnings per month, income taxes and social security contributions are deducted from gross monthly earnings. The share in social security contributions borne by employees is taken to amount to 20 per cent of gross monthly earnings. In 2000, gross monthly earnings of 325 € were exempted from social security contributions. Income taxes are calculated on the basis of taxable income, which is obtained by subtracting a standard deduction from gross earnings. To determine income taxes paid by each household type, we apply the German income tax schedule from the benchmark year 2000 to taxable earnings. For couple households, income tax legislation allows for marital income splitting: According to this method, the tax schedule is applied to half of the joint taxable income, while the resulting tax amount is doubled to obtain total income taxes paid by the couple.

Finally, disposable monthly earnings are obtained by adding transfer payments to net monthly labour earnings The most important transfer payments in Germany include unemployment insurance, unemployment assistance, social assistance, housing benefits and child benefits. In our model, we account for unemployment benefits and assistance, social assistance and child benefits, while housing benefits are neglected. In Germany, unemployment benefits (UB) are available for persons who have paid contributions to the statutory unemployment insurance for a minimum of one year. In particular, the duration of unemployment benefits depends on the unemployed person's former labour market experience and age. The monthly amount received equals a constant fraction of previous net monthly earnings. At present, the replacement rate for persons without children is 60 per cent and for persons with children 67 per cent. Unemployment benefits are not means-tested. The entitlement to unemployment benefits is thus completely independent from the labour or transfer income received by the respective spouse.

For those persons who do not have enough experience to obtain unemployment benefits or who have exhausted their unemployment benefits, unemployment assistance (UA) and social assistance (SA) become relevant. The replacement rate for UA payments for persons without children is 53 per cent and for persons with children 57 per cent. In contrast to unemployment benefits, both welfare payments are means-tested, i.e. payments are reduced if either the unemployed person or remaining household members receive other incomes. While UA is only available for those persons who have exhausted their unemployment benefits, eligibility for SA does not require any former entitlement to unemployment benefits. Our model takes into account the means-tested nature of SA payments, but neglects the means-tested nature of UA payments.

A.5 Hourly-Gross-Wage Distribution of Female Singles

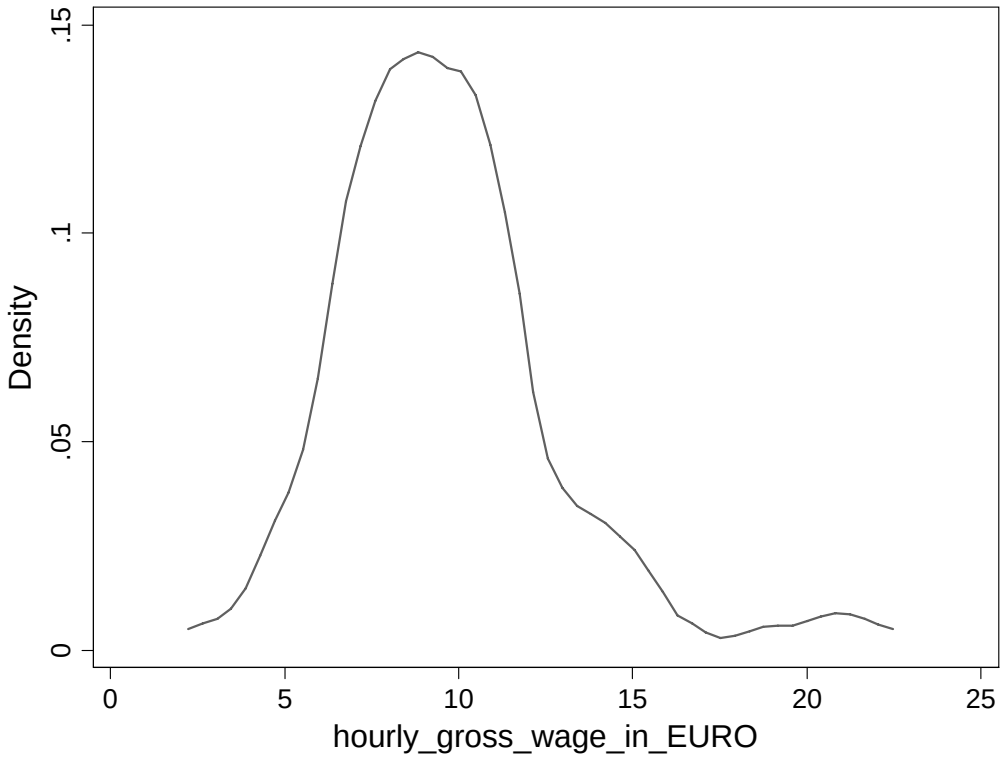

Figure 2: Low skilled female singles

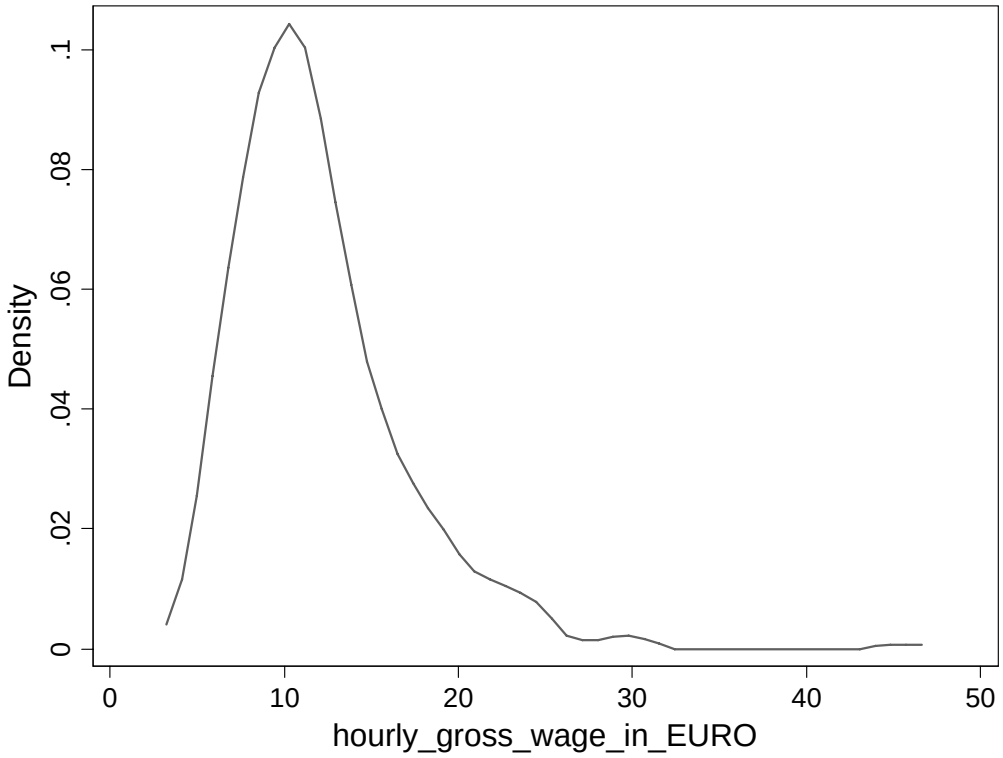

Figure 3: High skilled female singles