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Tax-benefit microsimulation models for Germany: A Survey

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Tax-benefit microsimulation models for Germany: A Survey

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Abstract

The paper carries out an up-to-date literature survey of household tax-benefit models for Germany and draws conclusions for future directions of work.

1 Introduction

Today, microsimulation models are used extensively throughout the industrialized countries, often for predicting immediate revenue and distributional impacts of tax-benefit policy changes. Such models often provide very detailed information about fiscal and distributional impacts, but less information about behavioral effects. My purpose in writing this update to Wagenhals (1999) is to summarize and evaluate recently used tax-benefit microsimulation models for Germany. These models are widely scattered in the literature and often unpublished. See Gilbert and Troitzsch (1999), Gupta and Kapur (2000) or Mitton, Sutherland, and Weeks (2000) for general views on the state of the art of microsimulation at the beginning of the 21st century.

2 Models

The aim of a tax-benefit microsimulation model is to map the choice sets of individuals and households in a population for any combination of market and non-market activities. Typically, the budget set is not observed completely. Therefore, some parts of the set have to be modelled. Tax-benefit models for Germany differ in the degree of complexity, the database used, the time-horizon and the potentiality to assess the impact of tax-benefit reforms on individual behavior.

2.1 GMOD

GMOD is a tax-benefit model developed by the author of this paper. Since the late 1980, GMOD has been developed in several stages from a simple GAUSS program reflecting the personal tax scale according to §32a of the German income tax law (EkSt, Einkommensteuergesetz) and the most important statutory deductions to a very detailed mapping of the complex rules and interactions of the German tax, social security and benefit system.

From a modelling perspective, GMOD has two major components: the model and a database.

Model. GMOD consists of a suite of STATA ado and help files. These modules simulate the policy rules of the major federal tax, social security and transfer programs, including eligibility, entitlement and interaction. The model simulates the payment of personal income taxes and social security contributions and the receipt of public transfers. It applies detailed statutory provisions to a database of income units representing the German population.

Database. The basefile comprises income units, the individuals of which are a representative sample of the German population. This database is constructed using GSOEP, the German Socio-Economic Panel (see Wagner, Burkhauser, and Behringer (1993)) and extensive juridical and other information. Each record in the basefile represents an income unit (mostly, but not always, a household) and contains information about the income unit as a whole and information on each person in the income unit. In 2002, the basefile consisted of 12,692 households with 23,892 persons.

Operating time. Currently, the model operates on data from 1983 to 2002. It allows to analyze changes in labor supply and wage structures over two decades using panel data methods. Recently, the model was extended and improved especially with respect to housing and social assistance benefit code, and with tax reform policy proposals up to 2010, so that it now can simulate the impact of many tax-benefit and social security reforms.

Behavioral equations. GMOD does not include behavioral equations routinely, because behavioral simulation results depend on additional sources of error such as sample variation or specification errors in behavioral relationships. However, combination with a variety of behavioral models is easy and has been done extensively. Users of

GMOD are free to use any behavioral model and may implement their own chosen approaches.

Applications. A series of GMOD based papers has been published, most of which allow for individual behavioral responses to changes in taxes, social security and benefit rules. Based on a variety of microeconometric models, these analyses include the impact of

- tax reform acts and proposals on the labor supply of married women (Wagenhals (1990), Wagenhals (1994), Wagenhals (1996b), Wagenhals (2000), Wagenhals (2001a), Wagenhals (2001b), Wagenhals (2001c)),
- tax and benefit reforms on the labor force participation and welfare dependence of single mothers (Staat and Wagenhals (1994), Laisney, Lechner, Staat, and Wagenhals (1999),
- income taxation on the intertemporal labor supply of married women (Laisney, Lechner, van Soest, and Wagenhals (1993)),
- a potential removal of the income tax splitting rule for married couples (Strøm and Wagenhals (1991), Wagenhals (1996a), Wagenhals and Kraus (1998)).

Brauchle (1998) shows that extrapolating GMOD results to population totals compares well with the benchmark figures published by the Federal Statistical Office (Fachserie 14: Finanzen und Steuern, Reihe 7.1).

2.2 STSM

STSM is a tax-benefit microsimulation model originally developed in the late 1990s by the Centre for European Economic Research (ZEW) in Mannheim (see Buslei and Steiner (1999, chapter 6)) and now transferred to the DIW (German Institute for Economic Research) in Berlin.

Model and database. STSM models taxes, social security contributions and benefits including their complex interactions. The level of detail and database of STSM is comparable to GMOD. The status quo of the model is documented excellently in Jacobebbinghaus and Steiner (2003a).

Operating time. The complexity of the German unemployment assistance entitlement rules restricts the use of STSM to the 1998

cross-section, though the model requires data from 1995 to 1999. This means that all tax-benefit reforms coming into effect after this year have not been accounted for up to now.

Behavioral equations. STSM does not include a behavioral model automatically. In practical applications, STSM is combined with a flexible discrete choice model of household labor supply (van Soest (1995)) to simulate the joint responses of all household members assuming that each household acts such as to maximize a quadratic utility function given its budget constraint.

Applications. STSM has been applied to analyze a broad range of topics including many proposals for welfare reforms (see Steiner (2000), Steiner (2002), Steiner (2003), Steiner and Jacobebbinghaus (2001), Arntz, Feil, and Spermann (2003), Jacobebbinghaus and Steiner (2003b), Steiner and Jacobebbinghaus (2003), Steiner and Wrohlich (2003)).

2.3 SIMTRANS

Based on his dissertation, Kaltenborn (1998) developed SIMTRANS, a rather comprehensive microsimulation model based on GSOEP data. From a methodological point of view, the behavioral models based on SIMTRANS (see e.g. Kaltenborn (2000)) do not utilize the panel structure of GSOEP. Although the panel structure of his data set allows the use of more sophisticated microeconometric methods, Kaltenborn assumes - instead of tests - the poolability of the data and uses standard cross section procedures. However, pooability is easily rejected when actually tested on his data. Therefore, Kaltenborn's empirical results have to be regarded with considerable caution.

2.4 KiTs

KiTs is a tax benefit microsimulation model ("Kiel Tax-Benefit Microsimulation Model") developed and run by Thomas Drabinski and Carsten Schröder affiliated to the Lorenz-von-Stein-Institut für Verwaltungswissenschaften and the Forschungsstelle für nationale und internationale Finanzordnung, both at the University of Kiel.

Model. KiTs maps the German tax-benefit system in great detail. Drabinski (2001) and Drabinski and Schröder (2003) provide a good documentation. The model not only covers personal income taxes, social security contributions and benefits, but also some indirect taxes.

Database. KiTs is based on the 1998 Income and Consumption Survey (ICS, Einkommens- und Verbrauchsstichprobe) collected by the German Federal Statistical Office. The ICS is a triennial time-series of cross-sections, not a panel data set. The 1998 survey is a sample based on 49,720 households. There are some doubts about representativeness because of top income coding.

Applications. As KiTs started in 2000, up to now there are only a few applications such as an an equivalence scale based measurement of redistribution in Germany (Drabinski and Schröder (2001)).

2.5 Potsdam

The Potsdam microsimulation model was developed by Christhart Bork, currently affiliated to the "Institut für Finanzwissenschaft" at the University of Potsdam.

Model. The Potsdam model maps personal taxes, social security contributions, public transfers and indirect taxes in great detail. (See Bork (2000) for an excellent documentation.)

Database. The database is a merged data file derived from the Income and Consumption Survey of the Federal Statistical Office, the GSOEP, and the IAW tax panel described in section 2.6. The merged file consists of 51,535 tax-units and more than 1,339 variables. The most recent data set used refers to 1993, but an update to 1998 is planned.

Behavioral equations. None. However, it is possible to extrapolate the model by weighting the sample with respect to expected demographic developments including changes in labor force participation and employment.

Applications. Bork and Petersen (1999) and Bork (2001) analyze the distributional impacts of a various tax reform proposals. Bach, Bork, Krimmer, Raffelhüschen, and Schulz (2002) present simulations of tax revenues from private households according to different tax arrangements up to 2050. Bork (2003) analyzes distributive and fiscal impacts of various reforms of the German health-care system.

2.6 SIMST

SIMST is a tax microsimulation model developed by the Institute for Applied Economics (Institut für Angewandte Wirtschaftsforschung, IAW) in Tübingen.

Model. SIMST maps the sources and the total amount of earnings, taxable income, income tax to be paid, marginal and average tax rates. It does not account for social security contributions and/or transfers. See Gottfried and Schellhorn (2001a) for a detailed description.

Database. SIMST is based on the IAW income tax panel. This data set comprises more than 40,000 tax payers in the fiscal years 1988-1991. It is a random sample of taxpayers from the federal state of Baden-Württemberg. Moreover, the IAW has access to a time series of cross section data for the fiscal years 1984-1994 with very detailed information especially with respect to income-related expenses but with few data on socio-economic characteristics (see Hochmuth and Kleimann (1994) for details).

Applications. Bork and Kleimann (1997) have used SIMST to assess distributional and revenue effects of a tax reform proposed by the German Green party. Recently, the model has been applied to estimate the elasticity of taxable income in West Germany (see Gottfried and Schellhorn (2001b)).

2.7 MICSIM

Basic research by a Special Research Collaboration between the Universities of Mannheim and Frankfurt called "Microanalytical Foundations of Social Policy" was pioneering for tax benefit microsimulation modeling in Germany (see Spahn, Haller, Kaiser, Kassella, and Merz (1992), Hauser, Hochmuth, and Schwarze (1994) and Hauser, Ott, and Wagner (1994) for general surveys). As one of the leading researchers of this project, Joachim Merz developed MICSIM, a user friendly PC microsimulation model (see Merz (1996b) for details).

Database. Up to the mid 1990s, MICSIM was based on GSOEP. Currently, MICSIM uses anonymized microdata records of the German Income Tax Statistic. They consist of a stratified 10 per cent sample of the 1995 German Wage and Income Statistic (EStS) (Zwick (2001),

Behavioral Relations. Up to the mid 1990s, MICSIM was used for behavioral studies (e.g. Merz (1989), Merz (1990), Merz (1996a)). Today, the model is combined with a behavioral model not any longer. Currently, MICSIM covers neither social security contributions nor benefits, but its maps personal income tax rules in far more detail than e.g. GMOD or STSM.

Applications. Recently, MICSIM has been used to assess the distributional effects of tax reforms and tax reform proposals (see e.g. Merz, Stolze, and Zwick (2002) or Merz and Zwick (2002)).

2.8 Maiterth

At the Department of Business and Economics of the Humboldt University in Berlin, Ralf Maiterth has developed a tax only microsimulation model (Maiterth (2001), Maiterth (2003)).

Database. Like MICSIM, the model is based on the 10 per cent stratified random sample from 1995 tax assessment data collected by the Federal Statistical Office (EStS).

Applications. Maiterth (2001) and Maiterth and Müller (2003) analyze the impact of a recent tax reform proposals, Maiterth (2003) examines the distributional consequences of various family benefits.

2.9 BMF

Model. Currently, the German Federal Ministry of Finance (BMF) uses an undocumented tax only microsimulation model developed by the "Fraunhofer-Institut für Angewandte Informationstechnik" (formerly GMD). According to Bach and Schulz (2003), the BMF plans to develop a new income tax microsimulation model in collaboration with the DIW.

Database. According to Zwick (2001), p. 645, the database is a one per cent sample drawn from the wage and income statistics tax statistics for 1995 and 1998.

Applications. In a paper based on a joint project between the Federal Ministry of Finance and the German Institute for Economic Research Bach, Buslei, Svindland, Baumgartner, Flach, and Teichmann (2003) analyze the present system of income tax splitting in Germany. It is a major drawback of this approach that it ignores all

behavioral effects, especially on labor supply participation and on the desired working hours of already participating women. Wagenhals and Kraus (1998) and Althammer (2000) show that these incentive effects are considerable and should not be ignored.

2.10 Kiel

The "Kiel model" is a wage tax microsimulation model developed originally in the mid 1980s by Alfred Boss affiliated to the Institute for World Economics (Boss (1986)). Recently, in collaboration with the Institut für Betriebswirtschaft at the University of Kiel, the model has been revitalized.

Model. The Kiel model maps alternative income tax schedules and several statutory deductions with respect to wage income. It does not account for income from other sources such as independent work or assets. Unlike all other microsimulation models described in this survey, the Kiel model is based on aggregate wage income tax data. Boss and Elendner (2000) and Boss and Elendner (2004, section B) present a comprehensive documentation.

Database. The current version of the model is based on the distribution of all tax units subject to wage tax on all tax classes and on 40 gross wage groups. These figures, published by the Federal Statistical Office (Fachserie 14: Finanzen und Steuern, Reihe 7.1), refer to 1995 and 1998 and are updated to 2003.

Applications. Boss and Elendner (2000) use the gross wage income distributions for different groups of taxpayers in 1995 to derive income distributions for 2000–2003 assuming different tax rules. Boss and Elendner (2003) continue this research and derive wage income distributions for 2001–2006. Finally, Boss and Elendner (2004) simulate the impact of various taxation rules on fiscal revenues.

Table 1: Major tax-benefit microsimulation models in Germany

Model	All income sources	Transfers	Behavior	Sample	Base period
GMOD	yes	yes	yes	GSOEP	1983-2002
STSM	yes	yes	yes	GSOEP	1995-1999
SIMTRANS	yes	yes	yes	GSOEP	1986-1996
KiTs	yes	yes	no	ICS	1998
Potsdam	yes	yes	no	IAW tax panel	1993
SIMST	yes	no	no	IAW tax panel	1988-1991
MICSIM	yes	no	no	EStS	1995
Maithert	yes	no	no	EStS	1995
BMF	yes	no	no	EStS	1995
Kiel	no	no	no	EStS aggregates	1998

3 Comparison

Table 1 summarizes the main features of recent German tax-benefit microsimulation models.

All models described in this survey allow actual and counterfactual assessments based on alternative income tax rules. The Kiel model only accounts for income from dependent work, all other models include income from all sources including asset income. Half of the models covered in this survey allow for benefits and their complex interactions. Currently, only GMOD, STSM and SIMTRANS permit the inclusion of behavioral relations, and only GMOD has been used to estimate and test dynamic intertemporal panel data models.

The databases used and their periodicity used vary considerably. The databases of German tax-benefit models are constructed from one or more of the following three data sources: the German Socio-Economic Panel (GSOEP), the Income and Consumption Survey (ICS), and a sub-sample of the triennial Wage and Income Tax Statistic (EStS) collected by the Federal Statistical Office. Two models (Potsdam, SIMST) are based on statistically matched data, all other models rely on just one database. Most models have been designed to operate on surveys of individuals and households. Four models use data on tax-units only and thus ignore low-income households.

Most models operate on one year only. This is mainly due to different survey periods. But even models using the same database may differ widely in their periodicity. For example, GMOD and STMS are based on the same dataset, but STMS operates on 1998 data only, while GMOD is based on almost 20 years of panel data.

In practical applications, the databases of almost all models are updated using external information to keep the simulations on track.

4 Conclusions

From this brief overview of the most relevant German household tax-benefit models it is clear that much needs to be done. I concentrate on three topics only: the need for statistical matching of separate data sets to renew and broaden the models' database, the need for sophisticated behavioral modelling, and the need to improve the transparency especially of the simulation models used by the Federal Government.

4.1 Data fusion

Samples of tax returns such as the EStS allow to simulate many types of tax deductions. However, these data are collected to assess taxes and therefore only cover those individuals who have to pay tax. Thus they tend to under-represent low income households. By contrast, the GSOEP survey cover the whole population, but income and tax data are less detailed and only approximations of the government policy rules can be simulated.

As a compromise, the Institute for Applied Economics in Tübingen constructed the IAW tax panel currently used by SIMST and by the Potsdam model. Although there are disadvantages of any matching procedure from a purely statistical point of view, the answers to many practical policy questions require the use of such matched data, which make use of the strengths of detailed tax assessment and representative economic and socio-demographic data (see Rässler (2002)).

Merz (2003) has convincingly pleaded for an integrated micro-data file using the income and consumption survey (ICS) and the Wage and Income Statistics (EStS). We extend his plea and suggest to include the German Socio-economic Panel and revive the IAW tax panel based on the most recent data as of summer 2004. Currently, such a data fusion project is under way at the Department of Economics of the University of Hohenheim.

4.2 Behavioral Modelling

By altering appropriate parameters, users of any model surveyed in this paper may assess the immediate effects of policy changes, i.e. before behavioral second round impacts. Seven of the ten models surveyed in this paper make no attempt to account for any influence which government policy has on behavior. These models assume that behavior does not change after a tax or benefit reform. It is reasonable to make this assumption in absence of data as to how people react to changes in their economic environment. The modelling of behavioral

responses is technically difficult and requires considerable care in its construction and maintenance.

However, many tax-benefit reforms are specifically targeted to affect work incentives. In these cases, behavioral models are indispensable. For example, a reduction of marginal tax rates combined with a broadening of the tax base will change marginal net wages for many households. This influences labor supply participation and desired hours of work. Commodity demands may change in response to changes in commodity taxes. Finally, changes in the benefit system may affect the decision to apply for benefits to which an individual or a household is entitled.

Most German tax-benefit microsimulation models have the potential to be used as a platform for behavioral analyses. But only GMOD, STSM, SIMTRANS and - formerly - MICSIM have ever been used for such exercises. None of these models incorporates behavioral relationships that are "hard-wired" into the model. Applications of STSM are based on the same discrete choice model of quadratic utility maximization in a static economic environment. Behavioral applications of SIMTRANS are not based on modern microeconometric standards. Only GMOD has been used on a very large set of alternative behavioral approaches, and only applications based on GMOD have fully capitalized on the panel structure of GSOEP which spans almost two decades.

4.3 Transparency

The transparency of the tax-benefit microsimulation models summarized in this paper varies considerably. Good documentation exists only sometimes. The overall transparency of the model of the Federal Ministry of Finance (BMF) is very low. This is deplorable, because the results are often used in the public discussion. In principle, the model should be useful to assess first round revenue effects of tax reforms. But to an outside observer the model works as a "black box" (Bareis (1998)). Independent reproduction of the BMF results is impossible.

This may have serious impacts on public opinion. For example, there is a strong suspicion that the Federal Ministry of Finance (see Finanzbehörden (2004)) miscalculated the impact of Paul Kirchhof's widely discussed recent tax reform proposal by using a wrong basic tax allowance (see Müller (2004)). Relying on the "black box" of the Federal Ministry of Finance suggests that this tax reform proposal is "expensive" and "anti-social" — an opinion quickly accepted and propagated by the media (see e.g. Schrinner (2004)). However, scientific studies obtain quite different results. For example, the results

derived by Wagenhals (2001b) show that a majority of families profit from this reform, women with children tend to work less, inequality increases (but mainly due to a redistribution towards families with children not due to a redistribution from the "poor" to the "rich"), and relative cash gains decline with increasing gross household incomes. Summing up, the main winners of the reform are families with children. Thus, by looking at the BMF results only, public opinion may be seriously misguided.

This example shows that the availability of scientific quality control is indispensable in the assessment of tax-benefit reforms. Improved documentation is necessary to allow the reproduction of results by independent researchers. Bönte and Lucke (2004) generalize this demand. They point out general problems of quality control in economic consultancy and suggest to establish a referee system in order to improve research quality.

5 Summing up

During the last few years, there has been a surge of tax-benefit microsimulation models for Germany. Such models have gained an active role in the public discussion and evaluation of tax-benefit-policies. The models, their databases, operating horizons and range of applications vary widely, and not all of them are up to modern international standards. Main topics on the agenda for future work include the statistical matching of the databases, a strengthening of behavioral aspects and last not least an improvement of quality control especially with respect to the "black box" models used by the Germany Federal Ministry of Finance. It is expected that tax-benefit microsimulation models will continue to be of use for the evaluation of a wide range of economic and social policy proposals in the near future.

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