The Swedish microsimulation model for income and transfer systems

by
Klas Lindström[1]

1 Introduction

The Swedish tax-benefit model FASIT (an abbreviation in Swedish for "Distributional Analysis System for Income and Transfer) is a microsimulation model developed to predict distributional and revenue effects of changes in the Swedish tax-benefit system. The FASIT is a static microsimulation model which means that no behavioural effects are assumed in the model.

The development of the FASIT started in the late 1980's at Statistics Sweden in close cooperation with the Ministry of Finance. During that time several investigations were initiated in order to propose substantial changes in the Swedish tax system. The Ministry of Finance needed therefore a tool to analyse the effects of different changes in the tax system. Substantial changes in the tax system were implemented in Sweden during the years 1990/91.

2 The FASIT

An objective of the FASIT is to give the users the opportunity to analyse effects of planned changes (new rules) in the Swedish tax-benefit system. This means that the users do the simulations whereas Statistics Sweden develops the FASIT. Statistics Sweden also updates the databases used in the FASIT, maintains existing rules and implements new rules (when a new rule has been *accepted* by the parliament). The FASIT has, during the years, been further developed to handle almost all parts of the Swedish tax and transfer systems.

The majority of the users of the FASIT are, as already implied, users outside Statistics Sweden. Due to this fact they are obliged to sign a contract to assure that all data in the FASIT will be kept in a safe way. A version of the FASIT, including databases and model programs, is then available for the users. Data on individuals included in the databases is made unidentifiable. At the moment the FASIT has the following main users:

- Government Offices of Sweden
- The Parliament
- Trade unions
- Confederation of Swedish Enterprise
- Swedish Association of Local Authorities and Regions
- The National Board of Housing, Building and Planning

[1] Statistics Sweden S-701 89 Örebro, Sweden. Email: klas.lindstrom@scb.se

- The Swedish Social Insurance Agency
- National Institute of Economic Research
- Swedish National Debt Office

3 Overview of the FASIT

The FASIT consists of two parts, model programs and databases.

3.1 Model programs

The model programs are developed to model the specific accepted rules in the Swedish tax-benefit system. The FASIT consists of a number of modules, one module for each transfer system. This means a module for; pensions, unemployment benefits, sickness benefit, parent's allowance, taxes, maintenance support, child benefit, housing allowance, housing allowance for pensioners, social assistance, fees for child care and fees for old-age care. A few years ago the possibility to simulate a number of the indirect taxes, for example Value Added Tax (VAT), was implemented into the FASIT. The possibility to do simulations on the value of received services was also implemented.

The FASIT is constructed in an integrated way so all the modules can be used together. This means that it is possible to analyse the interaction between the different transfer systems.

The model programs are developed in the SAS-language.

3.2 Databases

The simulations in the FASIT are based on information from three different databases. Each database includes information based on a sample of individuals taken from the Swedish Population register at the end of year (t) and the collected information refers to the year (t). The designs of the three samples are different. The databases have been constructed to provide a micro-statistically representative sample of Swedes and the type of simulation decides which database to use.

The databases are:
- Household Finance
- “Storurval”
- LINDA

3.2.1 Household Finance
Household Finance is a sample survey including a sample of about 37 000 individuals residing in approximately 18 000 households. The sample is a stratified simple random sample. In order to improve the coverage of the survey, a sample of deceased and emigrated individuals during the year (t) is added to the sample.

The data collection is made by telephone interviews and from registers. In a telephone interview questions are asked about household composition, type of housing, housing cost, housing condition and child care. The household composition is established from the information in the questionnaires. In the framework of the FASIT, non-response in the Household Finance survey is imputed.

In the Household Finance survey data related to economy and income, as well as information on unemployment and sickness benefit, is based on information collected from registers.

The majority of the simulations are based on this data base. The reason is that this database comprises information that makes it possible to simulate changes related to disposable income.

3.2.2 Storurval and LINDA
The other two databases are completely based on information collected from registers. The household composition, in those two data bases, is established only by register information and this means that number of single households will be over estimated. This is due to the fact that register information is not sufficient to establish the household composition correctly.

The “Storurval” is a sample of about 350 000 individuals residing in approximately 170 000 households. The main objective of the “Storurval” is to serve as input for detailed analyses of changes in the tax systems. The “Storurval” database consists of a stratified simple random sample of individuals (complemented with the rest of the individuals included in the household). To ensure the possibility of a detailed analysis of changes in the tax system the sample is stratified according to income; individuals with large income have a larger inclusion probability compared to the rest of the individuals.

The LINDA is a sample of about 800 000 individuals residing in approximately 350 000 households. The main objective of the LINDA database is to serve as input for detailed regional analysis. The LINDA database consists of a sufficiently large simple random sample of individuals (complemented with the rest of the individuals included in the household) to ensure regional analysis on a detailed level.

3.2.3 Different levels when collecting information
The information used in the FASIT is collected on three different levels: the individual level, the family level and the household level. What information is available depends on level. A household consists of individuals living in the same place and sharing the same economy. A family consists of two adult and their children in common aged less than 18 years old. The main difference between the household level and the family level is that children, 18 years and older, still living at home are considered as a family when the family level is used but part of the household when the household level is used.

4 New version of the FASIT

4.1 Updated information

Once a year the information in the databases is updated and a new version of the FASIT is created. This update means that information for a new base year is implemented into the FASIT. All databases in the FASIT are based on information referring to same year (t). A new version of the FASIT is normally available in March year (t+2) and this version is based on information referring to the year (t). For example, the current FASIT version (the year 2007) uses information referring to the year 2005 (the base year).

At three additional occasions during the year this March version of the FASIT is updated with complementary information, but referring to the same base year. Those additional updates also include updates of rules according to changes in the tax or transfer systems. As mentioned before, the updating of rules in the FASIT is made first when a new rule has been *accepted* by the parliament.

The FASIT can be used for simulations regarding the base year (at the moment the year 2005) and for simulation regarding the years 2006 to 2010. In the FASIT accepted rules for 2005, 2006 and 2007 are implemented but for the years 2008-2010 rules which are in force 2007 are used.

4.2 Data used for simulation

The users can do simulations regarding the base year, but also regarding five years ahead of the base year (so called model years). To improve the simulations regarding a model year the information in the databases is adjusted to reflect this specific model year. The information is adjusted in respect to individual variable values as well as in respect to structural changes of demographic type.

4.2.1 Adjusting variable values

The individual variable values in the database are so called “uprated”. By this is meant that the original variable values from the base year are replaced by new calculated variable values, and those values are produced in order to reflect the model year. For example, a number of economic variables are “uprated” by known or expected changes in an index correlated with the variable. Examples of indexes used for “uprating” are index of salaries and wages and the Consumer Price Index (CPI). Characteristics of an individual (for example age, nationality, residence) are not “uprated”.

4.2.2 Adjusting due to structural changes

As mentioned before, the FASIT can be used for simulations regarding the base year and regarding five model years (years ahead of the base year). At the moment the base year is 2005 and the last model year is 2010. During a time span of between one to five years demographic changes can be expected as well as changes in the labour market. Those kind of changes can be seen as coverage problems, due to differences between the frame population (the base year from which the samples were drawn) and the target population (the model year). A method called calibration[2] is used as a mean to reduce this coverage problem in the FASIT. As a result of the calibration the original inclusion probabilities are adjusted to make the simulation reflect the model year instead of the base year.

The calibration in the FASIT uses the following auxiliary information (referring to the model year): population by gender, population by age groups, population by number of employed in the public and in the private sector, number of unemployed in the population by gender, population by number of days with sick benefit, population by number of days with parental benefit, population by having activity and sickness compensation.

The information, referring to a model year, is based either on updated information or based on forecasts. Available information is decided by selected model year; close to the base year means mainly updated information and well apart from the base year means mainly forecasts. The economic forecasts used in the FASIT are produced by The Swedish Social Insurance Agency and by the National Institute of Economic Research. Updated information (or forecasts) together with the “uprated” variable values are used as input to the calibration. Variable values related to characteristics are assumed unchanged in the calibration.

A new weight file is calculated after each update. The SAS-macro CLAN[3], developed at Statistics Sweden, is used for the calibration.

The calibration can also use auxiliary information tailor-made by the users. This tailor-made auxiliary information is based on the user’s own assumptions of expected changes in the future economy. This means that the user can calculate a weight file on there on based on there own assumptions for the future.

5 Modelling the tax and transfer systems

The computer programs in the FASIT are used to model the accepted rules. The computer programs divide the simulation into three phases, the individual phase, the family phase and the household phase. If the model year differs from the base year all the three phases starts with “uprating” of variable values. All tax and transfer systems that affect individuals are then modelled in the first phase. The output is a dataset consisting of individuals, sample weights and recalculated variable values, recalculated according to the simulation. Users who only are interested in analysing changes in systems referring to individuals (and not taking into account possible effects on the families/households) often stop the simulation here. If the main objective of the simulation is to study the cost of a reform it is also appropriate to stop after this phase. But a complete analyses of a reform requires that the following two phases are processed.

---

[2] Deville, J.C. and Särndal, C.E. (1992). Calibration estimators in survey sampling. *Journal of the American Statistical Association* **87**, pp. 376-382.

[3] A SAS-program for computation of point- and standard error estimates in sample surveys, Claes Andersson and Lennart Nordberg, Statistics Sweden

In the second phase all transfer system that affect families are simulated. The output is a dataset consisting of families, sample weights and recalculated variable values, recalculated according to the simulation. In the third phase all transfer systems that affect households are simulated and an output dataset (like the two mentioned above) is created.

The three phases uses a module in common. In this module a number of parameters are specified for the tax and transfer systems used in all three phases. This module also includes a number of variables which are used by more than one phase.

5.1 Modelling tax and transfer systems for individuals

Regarding individuals a number of tax and transfer systems are modelled in the FASIT, almost all systems currently used in Sweden. The computer programs are as mentioned before constructed as modules, one for each tax and transfer system. Changes in a rule in one specific tax or transfer system often affect other systems. This means that when simulating all modules is executed even though a change is made only in one module. This also means that the order, in which the modules are executed are important. The following tax and transfer systems regarding individuals are modelled in the FASIT (and executed in this particular order):

Pensions
This module is the largest module in the FASIT due to the fact that it has to handle both the old pension system, which was in use until the year 2003, and the transformation into the new pension system. In the new pension system individuals just becoming pensioners will receive one part of the pension according to the old system and the remaining part according to the new system

Activity and sickness compensation
Individuals aged between 19 and 64 years whose capacity for work is permanently reduced by at least one quarter can receive activity or sickness compensation. The activity and sickness compensation is simulated based on the individuals who during the base year received sickness or activity compensation. For a model year the expected number of individuals receiving activity or sickness compensation (regarding this specific model year) is used as auxiliary information in the calibration. Expected number of individuals receiving activity or sickness compensation is based on forecasts produced by the Swedish Social Insurance Agency.

Unemployment benefit
Unemployment benefit is simulated based on the individuals unemployed during the base year. For those individuals, number of days of unemployment together with information on previous salary or wages serves as input to the simulation. As mentioned before, for a model year the expected number of unemployed (regarding this specific model year) is used as auxiliary information in the calibration.

Sickness benefit
Sickness benefit is simulated based on individuals who have been sick during the base year. For those individuals, information on the number of sick days serves as input to the simulation. Due to different governmental actions, in order to lower number of sick days ahead, it can be expected that number of days with sickness benefit will decrease regarding the model years. In order to reflect this, the calibration uses expected number of days with sickness benefit for a specific model year (forecasts produced by the Swedish Social Insurance Agency) as auxiliary information.

Parental benefit
Parental benefit is simulated based on the individuals who during the base year received some kind of parental benefit. Parental leave connected with child birth as well as parental leave because of child sickness is simulated.

Direct taxes and general payroll taxes
After all the taxable incomes have been simulated the direct taxes are simulated as well as general payroll taxes.

Maintenance support
For children not living with both parents, maintenance support is simulated. This module simulates the maintenance support entitled to the parent with whom the child is living as well as the maintenance support the other parent is obliged to pay.

Finally, a number of tax deductions are simulated and an number of income components are created.

5.3 Modelling tax and transfer systems for families

Also regarding families a number of tax and transfer system are modelled in the FASIT, almost all systems currently used in Sweden. The modelling is constructed the same way as for individuals. The following tax and transfer systems regarding families are modelled in the FASIT (and executed in this particular order):

Child allowance
Child allowance is simulated. A family receives child allowance regarding all children in the family aged between 0 and 15 years. For older children in the family a child allowance supplement is available.

Housing allowance
Families with children as well as individuals without children aged between 18 and 28 may have housing allowance. For those simulations information on dwelling size and housing cost is needed. This means that this kind of simulation must be based on the Household Finance database. A problem connected to this kind of simulation is that more families are entitled to housing allowance compared to the number of families actually receiving it. The reason is that you are obliged to apply for housing allowance. In the

FASIT it is possible for the user to specify the so called “take up rate” in the simulation.

Housing supplement for pensioners
A pensioner can be entitled to housing supplement, which is a means-tested supplement. This means that the amount payable for a specific pensioner is based on the individual accommodation cost and income. The same problem as for the housing allowance is connected to the housing supplement for pensioners. More pensioners are entitled to housing supplement compared to the number of pensioners actually receiving it. The reason is, as in the housing allowance case, that you are obliged to apply for housing supplement. In this module it is also possible for the user to specify the so called “take up rate” in the simulation.

Maintenance support for the elderly individuals
A low pension, for example due to a short period of residence in Sweden, can make it possible to get elderly support. Accommodation cost and income will affect the size of this benefit.

Social assistance
In this module the social assistance is simulated. Social assistance is difficult to simulate in a correct way because all income values in the FASIT is referring to a whole year. An individual can receive social assistance during a short period due to a very low income during that period. But the individuals’ total income during that particular year might be too large for making the individual entitled to social assistance. In this module a monthly income is calculated and used to simulate social assistance. As for housing allowance, social assistance also is afflicted by the so called “take up problem”. The user can specify “take up rates” in the simulation.

Child welfare fee
A family has to pay a fee to the local authority in order to have children at day nursery or at a youth recreation centre. This fee differs due to different local authorities and in this module the fee is calculated according to the rules applied by the local authority where the family live.

Home help services fee
Elderly individuals are entitled to home help service. Those individuals have to pay a fee and this module simulates this fee.

5.4 Modelling tax and transfer systems for households

On the household level the only simulation is of VAT and some other indirect taxes. In this phase the household’s disposable income and equivalised disposable income is calculated based on simulated values.

6 Marginal effects calculations

In the political debate the question of marginal effects often is raised. The FASIT can be used to address this kind of questions by calculating the marginal effects on disposable income, tax, housing allowance and social assistance. This calculation is based on a salary raise regarding all adults in a household by (for example) 1 000 SEK and then it is possible to analyse the marginal effects. This analyse can also be made for different groups (for example families, households and different income groups).

7 Type cases

The purpose of the type case is to make it possible to study a family of a specific type. In the type case the user specifies a number of characteristics of the family. The specification includes type of family (single, married with or without children and age of children), wages and salaries, number of sick days, number of days of unemployment, number of days with parental leave, rent paid by the family and the municipality where the family resides. The FASIT is then used to calculate all taxes and benefits that the specified family is entitled to. The result is presented in the SAS-output window or in EXCEL.