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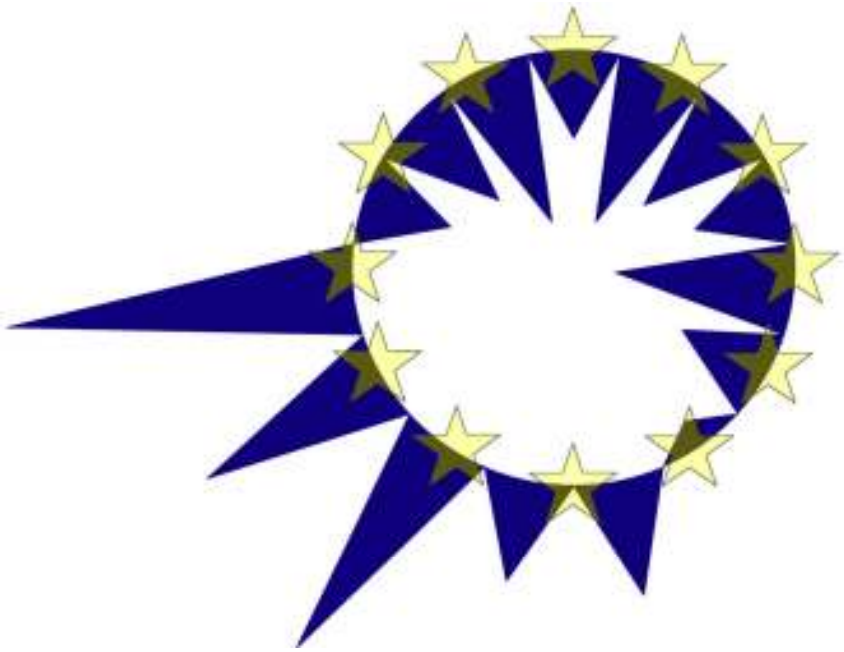

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LESSONS FROM BUILDING AND USING EUROMOD

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EUROMOD is continually being improved and updated and the results presented here represent the best available at the time of writing. Any remaining errors, interpretations or views presented are the authors' responsibility. EUROMOD relies on micro-data from twelve different sources for fifteen countries. This paper uses data from the European Community Household Panel (ECHP) User Data Base made available by Eurostat; the Austrian version of the ECHP made available by the Interdisciplinary Centre for Comparative Research in the Social Sciences; the Panel Survey on Belgian Households (PSBH) made available by the University of Liège and the University of Antwerp; the Income Distribution Survey made available by Statistics Finland; the Enquête sur les Budgets Familiaux (EBF) made available by INSEE; the public use version of the German Socio Economic Panel Study (GSOEP) made available by the German Institute for Economic Research (DIW), Berlin; the Living in Ireland Survey made available by the Economic and Social Research Institute; the Survey of Household Income and Wealth (SHIW95) made available by the Bank of Italy; the Socio-Economic Panel for Luxembourg (PSELL-2) made available by CEPS/INSTEAD; the Socio-Economic Panel Survey (SEP) made available by Statistics Netherlands through the mediation of the Netherlands Organisation for Scientific Research - Scientific Statistical Agency; the Income Distribution Survey made available by Statistics Sweden; and the Family Expenditure Survey (FES), made available by the UK Office for National Statistics (ONS) through the Data Archive. Material from the FES is Crown Copyright and is used by permission. Neither the ONS nor the Data Archive bears any responsibility for the analysis or interpretation of the data reported here. An equivalent disclaimer applies for all other data sources and their respective providers.

LESSONS FROM BUILDING AND USING EUROMOD

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Abstract

By the mid 1990s the potential and usefulness of microsimulation models for researching tax benefit systems had found widespread acceptance. Nevertheless models were not widely available for independent or academic research in all countries of the European Union (EU). Even more important, carrying out consistent comparative tax-benefit microsimulation analysis was still an apparently impossible task. The time seemed ready for a European-Union-wide tax-benefit microsimulation model.

This paper is devoted to explaining the reasons for building EUROMOD, its added value compared to existing models, the trade-offs faced by its builders and lessons that have been learnt from developing such an integrated model. Moreover, it aims to provide an insight into the wide range of possible applications of EUROMOD, underlined by summarising some indicative findings of studies, which have used the model.

JEL Classification: C8, I3

Keywords: European Union; Microsimulation; Model Building

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Introduction

EUROMOD is a tax-benefit microsimulation model covering all 15 pre-May 2004 Member States of the European Union (EU-15). It is a tool, which enables research on the effects of tax-benefit systems by allowing the assessment of their impact on incomes, poverty, inequality and social inclusion. In particular the model is designed to answer "What if" questions about different approaches to policy reform at European level.

In general, tax-benefit models are computer programs based on household micro-data from representative sources. They calculate disposable income for each household in the dataset. This calculation is made up of elements of income taken from the survey data (e.g. employee earnings) combined with components that are simulated by the model (taxes and benefits). An evident advantage of such models is the possibility of evaluating the effects of hypothetical changes to tax- or benefit-rules. In a certain sense tax-benefit microsimulation models are tools, which allow "laboratory experiments" concerning tax-benefit systems, as by simulating reforms their potential effects can be studied before their actual implementation.

While tax-benefit microsimulation techniques have been used extensively at the national level, EUROMOD is unique in being a research tool that is relevant both at the national level and as an integrated tool for European comparative social science research. EUROMOD does represent the first attempt at building this type of highly complex and ambitious multi-country infrastructure. The process of its design, construction and use has been based on "learning by doing", in many respects without prior or parallel experience to build or draw on. Due to this approach unforeseen challenges have been encountered, and on the other hand unanticipated research applications for the model have been identified.

The human effort and financial resources that have been invested in EUROMOD are considerable. The version of the model currently used is the result of almost ten years of work. Some 50 individuals in 20 research institutions across the 15 Member States are currently involved. Some 20 others have been in the past and most of these maintain contact.

This paper is the last of a series of papers describing EUROMOD (Immervoll (1999), Sutherland (2001a), Sutherland (2005)). While the previous ones offered a rich description of EUROMOD, including many technical features, this paper is devoted mainly to the explanation of the reasons for building EUROMOD and the questions it was though to answer, its added value compared to existing models, the trade-offs faced by its builders and lessons that have been learnt from developing such an integrated model. The paper is structured as follows. The first section presents the background reasons for the construction of an integrated European tax-benefit microsimulation model and its added value compared to existing experiences. The second section reports on the experiences in designing and implementing EUROMOD and the trade-offs, challenges and limitations faced by its builders. The third section provides an insight into the wide range of possible applications of EUROMOD, underlined by some indicative findings of studies applying the model. The last section presents on-going and future perspectives in using and extending the model.

1 Birth of a European Tax-Benefit Microsimulation Model

The main impulse for building an integrated European tax-benefit microsimulation model came from research questions in public economics and more precisely those investigating the characteristics of tax-benefit systems and the comparative impact of common reforms across Europe. Exercises of "policy swaps" or "system swaps" have for instance consisted of analyzing the redistributive impact of replacing the French tax-benefit system by the UK one on a representative sample of French households (Atkinson et al., 1988).[1] Callan and Sutherland (1997) have also compared the effects of different types of fiscal and social policies on the welfare of households in certain EEC countries. These crucial policy questions lead to the need for a more consistent tool in order to perform cross-country comparisons and making use of tax-benefit microsimulation techniques applied at European level appeared to be a promising approach.

Tax-benefit microsimulation models developed in parallel with the availability of computers. By the mid 1990s tax-benefit microsimulation models had spread out to many Western and some Eastern European countries.[2] They ranged from simple models used for teaching purposes to multi-purpose models designed to support governments' decision making. In the early 1990s Merz (1991) surveyed more than 40 major national models across Europe (mainly Germany) and the US, some built in the 1960s and 1970s. A few years later Sutherland (1995) described 19 static models already in use in five countries of the European Union. Examples of such early developments of tax-benefit microsimulation models at the national level in Europe are TAXMOD model in the UK, developed around Atkinson, King and Sutherland's work (Atkinson et al., 1983), and the SYSIFF model in France (Bourguignon et al., 1988).

Despite the growing availability of these tools and the widespread acceptance of their potential and usefulness the level of development and accessibility to researchers differed greatly among countries. Moreover, cross-country comparison remained a difficult task. The main obstacles in comparative analysis concerned data quality and consistency of data and definitions across countries.

The only attempt to compare tax benefit systems was for many years a periodical research on the impact of tax and benefit systems on household income of workers earning an average salary (average production worker), for different family types, carried out by the OECD.[3] Though this research contained a great deal of cross country information on tax-benefit

[1] De Lathouwer (1996) also simulates the effects of taxation of the unemployment benefit system, enforced in the Netherlands, on a sample of Belgian households, thus reflecting the importance of the socio-demographic characteristics of the population on the resulting effects.

[2] Bourguignon and Spadaro (2005) give a general overview of what can be achieved using microsimulation techniques.

[3] This kind of analysis is still published by the OECD as "Benefits and Wages – OECD indicators", though the series has changed contents and title.

systems, this method did not allow the investigation of inequality, poverty and other indicators that need to be computed on the whole population (or a representative sample).[4]

A study presenting consistent evidence for income distribution in a wide range of OECD countries, commissioned by the OECD in the early 1990s and released in 1995, represented a significant breakthrough (Atkinson et al., 1995). It was based on a large and consistent multi country database made available by LIS (Luxembourg Income Study).[5] This database is derived from national micro data provided by single institutions in the respective countries. Though national micro data are not uniform in terms of source (some from administrative sources, some from sample surveys), quality, objectives and definitions, the common LIS requirement for highly detailed data allows for a reclassification of income components, in order to obtain consistent income definitions across countries. Though there is still room for improvements - in fact, full cross country consistency is not an achievable goal when starting from different sources and in this sense comparability is still a matter of degree - with the LIS database a reasonable level of comparability across OECD countries was reached for the first time.

In this period also the European Community Household Panel (ECHP) was established. This survey covered a wide range of topics including income, housing, demographics and employment characteristics, and was conducted on yearly basis from 1994 to 2001. The ECHP covered a more limited number of countries than LIS, basically all (then) EU countries (at different levels of participation duration), but it was designed with comparability in mind. It was co-ordinated by Eurostat and was based on a standardized design and common technical and implementation procedures.[6]

After LIS and ECHP proved that the derivation of a consistent multi country database suitable for cross-country comparisons is possible, the use of tax-benefit microsimulation techniques seemed a natural step ahead. The microsimulation approach has two main advantages compared to solely applying a multi country database. The most obvious is that it is not restricted to analyses of existing tax benefit systems, but allows the study of a wide range of reforms and hypothetical tax-benefit approaches. In addition, microsimulation techniques may enhance comparability and the measurement of redistribution performed by tax-benefit systems. In fact, measuring redistribution effects of tax-benefit systems with ECHP and with some LIS data is not possible, given that all ECHP data and a number of LIS national databases do not provide information about taxes, a number benefits and gross incomes.[7] Even if available, micro-data on taxes and benefits are affected by response errors to an extent that depends on data quality and that is bound to vary across national databases. Thus it might be argued that the consistent application of policy rules ensured by a multi country model

[4] Analysis based on hypothetical family type methodology can be replicated with microsimulation models. An example of such an exercise carried out with EUROMOD is Berger et al. (2001).
[5] The LIS project began in 1993 and currently includes data for 25 countries. For more information see: http://www.lisproject.org/.
[6] For more information about ECHP see: http://forum.europa.eu.int/irc/dsis/echpanel/info/data/information.html.
[7] The use of imputation techniques, directly derived from microsimulation, is a possibility to obtain missing variables, see for example Immervoll and O'Donoghue (2001b).

makes tax and benefits comparison less vulnerable to the different quality of data across countries.

Different approaches to comparative tax-benefit microsimulation have been discussed in the literature, two of them are the comparison of published results from national simulations and the use of national models in parallel. However, published results reflect a vast range of different national priorities, classification systems and practices, and comparisons of originally independent studies at least raise some doubts on their consistency. Some experiments on using national models in parallel have been conducted. In general they suggest that, if the number of countries that are to be considered together becomes large, differences in modeling and in assumptions are too difficult to accommodate. If the range of possible approaches is also large, then difficulties in making the models comparable are clearly prohibitive. Callan and Sutherland (1997) used national tax-benefit microsimulation models for Ireland (SWITCH) and the UK (POLIMOD) to study the differential impact of comparable Basic Income Schemes. They found that data and model constraints limited the schemes that could be modeled and the ways in which the results could be presented considerably. They also found (Callan and Sutherland, 1996) that designing a realistic Basic Income Scheme that could be modeled and simulated consistently with only five national models (Belgium, France, Ireland, Italy and the UK) was in practice impossible.

Furthermore, the level of development of national models that could potentially be used in the mid 1990s differed greatly: in some countries no model had been developed yet, in others all this activity took place within government, in others developments were in their infancy. As this seemed to suggest that the only way of carrying out consistent comparative tax-benefit microsimulation analysis was an integrated EU-wide model - with the side effect and strong motivation for countries without an own model that it could be used for national policy analyses as well – the time was right for the challenge of building EUROMOD.

EUROMOD is the result of almost ten years of work, starting with a preparatory study funded by the European Commission's Targeted Socio-Economic Research (TSER) program and carried out between March 1996 and May 1997. This study was aimed to assess the technical feasibility of constructing an integrated European tax-benefit microsimulation model.[8] It included an exercise to construct a *prototype* model for three countries: France, UK and Italy, based on the previous experience of Euromod reseachers gained on national models. This first model was used to simulate the impact of common reforms on the populations of those three countries (Bourguignon et al, 1997).

As all tax-benefit microsimulation models, EUROMOD is the object of the endless work of maintenance, revision and improvement, so that defining a date when it has been completed is to some extent arbitrary. The first fully working version of the model was available in 2001 and it has been updated and improved considerably since then. One might even argue that the model is not yet finalized, and never will be, as there is always room for improvement.

[8] Main findings and recommendations of the Preparatory Study are presented in a Final Report (see Sutherland, 1997).

The first full EUROMOD model was constructed within a project also funded by the TSER program called *EUROMOD: an integrated European benefit-tax model*. It was carried out in three years, from January 1998 to December 2000.[9] Between 2001 and 2004 a new project offered the chance to improve the model and use the full potential of EUROMOD: the MICRESA project (Micro-level Analysis of the European Social Agenda), funded by the European Commission's Improving Human Potential programme. This project studied the impacts of social and fiscal policies, and reforms to these policies, on poverty reduction by applying EUROMOD. In fact, most of EUROMOD's outcomes have been made possible by this pioneering research project.[10]

2 Building EUROMOD: Challenges and Limitations

Building EUROMOD involved a great deal of expertise and – unlike national models – a great number of experts spread across countries, so that the process required a clear planning of the procedures and steps necessary to complete the work and a clear division of labor among participants.

The process of construction was organized in four main, in general successive, but frequently overlapping tasks: (1) finding expert respondents and dealing with a large scale European coordination; (2) finding representative and comparable micro-databases for each country; (3) designing the model framework and implementing it (collection, coding and parameterization of policy rules for 15 tax-benefit systems); (4) testing, validating and documenting the model.

2.1 A European Cooperation

A first step consisted in finding expert respondents in each EU country, this meant involving some 40 researchers with 12 different mother languages from 18 institutions in 15 countries. EUROMOD's construction then was carried out following a flexible division of labor among national teams. Various issues and unexpected problems often had to be dealt with on a case-by-case basis. Given the number of participants and the different locations of teams, the project involved a great deal of coordination, achieved by Holly Sutherland and her team at the University of Cambridge (now at the University of Essex). They were also responsible for programming the core part of the model and designing and documenting common features. Each national team was responsible for providing data and information on tax and benefit rules necessary to model their national system. In collaboration with the model-building team they also carried out the testing and validation of the model for their country.

What is unusual, compared to other research projects, is the truly European diversity of the group and the longevity of the project. To be able to work together EUROMOD members had to go beyond national traditions and priorities to which they were accustomed and they had to establish new common practices. One important, though unintended, achievement of the

[9] See Sutherland (2001a).
[10] For further details see Sutherland (2005).

EUROMOD project was the creation of an international community able to communicate in a homogeneous (scientific) language with relative success.

2.2 Data Comparability

The EUROMOD preparatory study (Sutherland, 1997) surveyed existing micro-data sources in terms of their general quality and suitability for being the basis for EUROMOD. The characteristics of data provided at the European level by Eurostat (ECHP) as well as national sources were discussed, with the conclusion that national teams selected which micro-data, among those available for their country were the most suitable for tax-benefit modeling. Therefore EUROMOD national datasets differ in origin and type (see Table 1) according to the different data availability and needs in each country[11]. The ECHP was chosen for reasons of comparability and homogeneity in several countries[12], but has the problem of small sample sizes. Other national datasets of good quality and larger size were chosen when available, especially if they proved to be reliable enough for tax-benefit microsimulation since they had been used in national models. Twelve separate data contracts with distinct conditions and requirements were signed.

Many of the general complications associated with collecting information on tax-benefit rules and using micro-data became particularly acute because of the multi country nature of EUROMOD. Solutions adopted in single countries were put into question when confronted with non-comparable approaches from other countries. A typical case is the level of detail of variables: this varies greatly across national data. Some countries have very detailed information that allows the modeling of taxes and benefits with precision, including those details less relevant when it is comparison that matters (for example taxes and duties at municipal level).[13] Some others can only access much less detailed data and they are often accustomed to a more schematic modeling of their tax-benefit systems. This problem was treated by defining as many "common variables" (variables available in all 15 datasets and needed for the simulation of many national systems) as possible, whereas a minimum possible number of "country-specific variables" were added to the databases, if they were necessary for the simulation of the national tax-benefit system, but were not available or needed for many other countries.

In general, national teams were responsible for dealing with data quality issues, such as exclusion from the sample, non-responses and under reporting. However, during the course of the project a number of technical problems had to be dealt with in a coordinated and common manner. Three issues emerged as being particularly important. First, the *reference time period* was an issue. The original data used for deriving the EUROMOD database refer to different time periods in different countries. Income is most commonly available on an annual basis,

[11] A "Database Robustness Assessment Exercise (DRAE)" was carried out in order to assess the quality of data. Country respondents were asked to answer a questionnaire about the databases and the responses were analysed and compared.

[12] For some countries a more comprehensive national version is used.

[13] Other examples are variables necessary to simulate certain country specific benefits, that can not be simulated for other countries (where such variables are not collected).

but in some countries for some variables the reference period is as short as a week. The month was chosen as the common reference period for the model output. Second, *imputation of gross incomes* was necessary since many of the micro datasets used by EUROMOD originally only contained incomes net of taxes and social insurance contributions.[14] Finally, *updating the databases* to allow simulations for different countries at the same point in time is an obvious requirement for comparability, but not all national sources are made available every year so that the available years among some countries did not correspond. Therefore a program for static up-dating was developed to adjust datasets to the same year and to later simulation periods.[15]

2.3 Design Issues: Ease of Use versus Flexibility

A multi country model like EUROMOD must permit all the tax-benefit systems that it covers to be simulated in a consistent way. This, together with the fact that the key issue is comparability, makes such a model necessarily complex. Moreover, while most national tax-benefit microsimulation models limit the range of reforms that can be simulated to national requirements to minimize complexity for the model developer and user. Such a limitation is much more difficult in a multi country framework, as there is no established tradition suggesting reasonable restrictions.[16] This means that there are trade-offs between flexibility and user friendliness and partly between flexibility and comparability. EUROMOD is in general a highly flexible tool and able to address a wide range of policy questions, though several limitations have been accepted at least temporary, to keep the development of the model a manageable task (see below).[17]

2.4 Test, Validation and Documentation

Currently EUROMOD contains tax-benefit rules for EU-15 for the years 1998 and 2001, and for the majority of them also for 2003.

To verify the quality of EUROMOD's outcomes country experts, in close collaboration with the model-building team, carried out testing and validation exercises. These exercises comprise mainly three sorts of checks. The first is case-by-case checking, which consists of comparing EUROMOD micro results for some observations with corresponding micro results obtained in a completely independent way. The second, aggregate validation, involves the comparison and reconciliation of aggregate indicators and statistics - such as the Gini coefficient for household incomes, poverty rates or aggregate budgetary amounts - produced by EUROMOD with corresponding statistics provided by external sources. Where national

[14] Net-to-gross imputation had to be performed in nine countries using a numerical inversion routine. See Immervoll and O'Donoghue, 2001b).

[15] The possibility of applying static aging techniques was also explored in Immervoll et al., 2005.

[16] In many countries changes involve reprogramming part of national models; there are exceptions, such as the Spanish national model, EspaSim (available at: http://selene.uab.es/espasim) and the Irish national model, SWITCH (Callan, O'Donoghue and O'Neil, 1996).

[17] Appendix 1 provides insight how these issues are dealt with in EUROMOD.

models were accessible to EUROMOD members, EUROMOD results were compared with national model results as well.

The aggregate validation and comparisons against national models are documented in Country Reports, which also contain comprehensive documentation on the manner in which each tax-benefit system is implemented in EUROMOD.[18] In addition, two aggregate validation exercises, encompassing all 15 countries, were carried out by comparing EUROMOD results with ECHP statistics, with reassuring results on reliability.[19]

2.5 Limitations and New Developments

As mentioned above, several limitations have been accepted, at least temporary, to limit complexity and to keep model building a manageable task. The most important are: non take-up of benefits is considered only to a very limited extent and tax evasion is not accounted for; EUROMOD is a static tax-benefit microsimulation model, therefore long-term effects of policy reforms are not accounted for since behavioral responses to policy reforms, such as the changing of labor supply behavior, are generally not considered.

Moreover, not all tax benefit instruments can be simulated. Generally speaking, the following instruments are simulated in all countries: income taxes (national and local); social insurance contributions (paid by employees, employers and the self-employed); family benefits; housing benefits; social assistance and other income-related benefits. The following instruments are generally not simulated: capital and property taxes; real estate taxes; disability benefits; and finally – due to absence of information of previous work history in most datasets – contributory benefits, most importantly pension/survivor benefits and unemployment benefits. These instruments that are not simulated are nevertheless taken into account in EUROMOD's output concept of disposable income, as they can be derived from the original data.[20]

However, EUROMOD is an on-going project and there are several new developments, which promise to tackle some of the limitations discussed above. One planned project will investigate possibilities to take account of non-cash incomes, tax evasion and non take-up of benefits and methods for imputation of expenditure data for analyzing indirect taxes.[21] Great effort has been and is put in making EUROMOD a suitable tool for research on the impact of tax-benefit policies on work incentives and labor supply (see section 3.4 for more details). One main focus of a recently started new project is to further enhance ease of use.[22] In fact, user friendliness is a fundamentally important issue if the model is to be widely used.

[18] See http://www.iser.essex.ac.uk/msu/emod/countries/.
[19] See Mantovani and Sutherland, 2003 and Lietz and Sutherland, 2005.
[20] This income concept is however based on monetary income and does not include non-cash benefits, such as free health care, child care provision and public housing. Also indirect taxes, most importantly consumption taxes, cannot be analyzed with the current version of EUROMOD.
[21] FP6 Specific Targeted Research Project on "Accurate Income Measurement for the Assessment of Public Policies" (AIM-AP).
[22] FP6 Research Infrastructures Design Study on "Improving the Capacity and Usability of EUROMOD" (I-CUE).

Therefore a User Group, composed of frequent EUROMOD users as well as less experienced users has been constituted, which will meet on regular basis to discuss model improvements. Finally, EUROMOD is frequently revised on the basis of feedback provided by model users. Since EUROMOD started to be used, the group of users has increased, including new people who were not involved in the construction of the model, all of them making a valuable contribution in testing the model and in validating results.

3 The Scope of a European Tax-Benefit Microsimulation Model

EUROMOD has been conceived to be a tool that enables a wide range of questions about the impact of social and fiscal policy on the population of the EU to be answered, and allows a large variety of conceptual frameworks and assumptions to be adopted. The numerous research projects that have been carried out on several different subjects and applying different approaches show that this aim has been achieved to a large extent.

EUROMOD offers the classic features of a tax-benefit microsimulation model like (i) case study analysis (e.g. drawing budget curves for any family type); (ii) information at the individual or aggregate level (total tax revenue, total cost of an instrument, a reform, etc.); (iii) analysis of the redistributive potential of a system (inequality and poverty indices) or the contribution of a given instrument to inequality and poverty; (iv) analysis of the incentive potential of a system (financial gains to work, effective marginal tax rates) or the contribution of a given instrument (e.g. an in-work transfer); (v) analysis of the incidence of a given instrument or reform (gainers/losers, etc.). These features allow consistent analyses for all 15 countries included and some of them can be applied on a hypothetical "EU-15-land".

Beyond this, as an integrated multi country model, EUROMOD offers specific possibilities like: (i) cross-country comparisons of certain instruments (e.g. the progressivity / equalizing role of income tax throughout EU-15); (ii) policy swapping (i.e. exporting one instrument from country A to country B and maybe vice versa) and system swapping (e.g. Spadaro, 2004); (iii) analysis of the impact of common changes across countries; (iv) analysis of the impact of country-specific changes at the European level with common objectives.

In fact, as several applications have shown, EUROMOD is flexible and adaptable enough to have uses far beyond its builders' original plans. Therefore, to give a complete list of all potential applications of the model is an impossible task. Instead, in the following we intend to provide some insight into research areas that EUROMOD is most suited to address and in the techniques that it offers to answer specific questions. This will draw to a large extent on research already carried out with EUROMOD, as examples show best how the model's capabilities can be used. Moreover it allows us to report some indicative findings.

3.1 Inequality, Poverty and Redistribution

A noticeable feature of EUROMOD is its standardized calculation of household disposable income and its components (original income[23], benefits, taxes and social insurance contributions[24]) for all countries included. This allows doing a range of calculation in a consistent way, amongst others it provides a common base for computing measures of income distribution, redistribution and poverty.

A basic but most indicative output of EUROMOD is the provision of an articulated picture of the effects of actual European tax benefit systems. Many EUROMOD applications are based on this feature.

A standard set of statistics on taxes, benefits and income distribution in the 15 member states has been produced.[25] They show income components and household characteristics by decile group for each country and for EU-15 as a whole. Figure 1, which is derived from these statistics, is an illustration on how this EUROMOD output can be used to derive interesting findings.[26] It shows the incidence of benefits and taxes (including social insurance contributions) on disposable income of poor households. Benefits are, in turn, defined as "gross" and "net" benefits, where net benefits are gross benefits minus taxes. The picture drawn by using the concept of net benefits is rather different from that obtained by using gross benefits alone. In several countries the poor pay a significant amount in taxes (and/or contributions). These taxes may be levied on other sources of income but in some cases on the benefits themselves. This illustrates that to establish the impact of social transfers on the poor across countries, account needs to be taken of the effect of taxes and contributions as well as cash transfers. It also shows that higher poverty rates are to be found mostly in Southern countries (Portugal, Italy, Greece, Spain) where family and social benefit schemes are not as developed as in the rest of Europe.

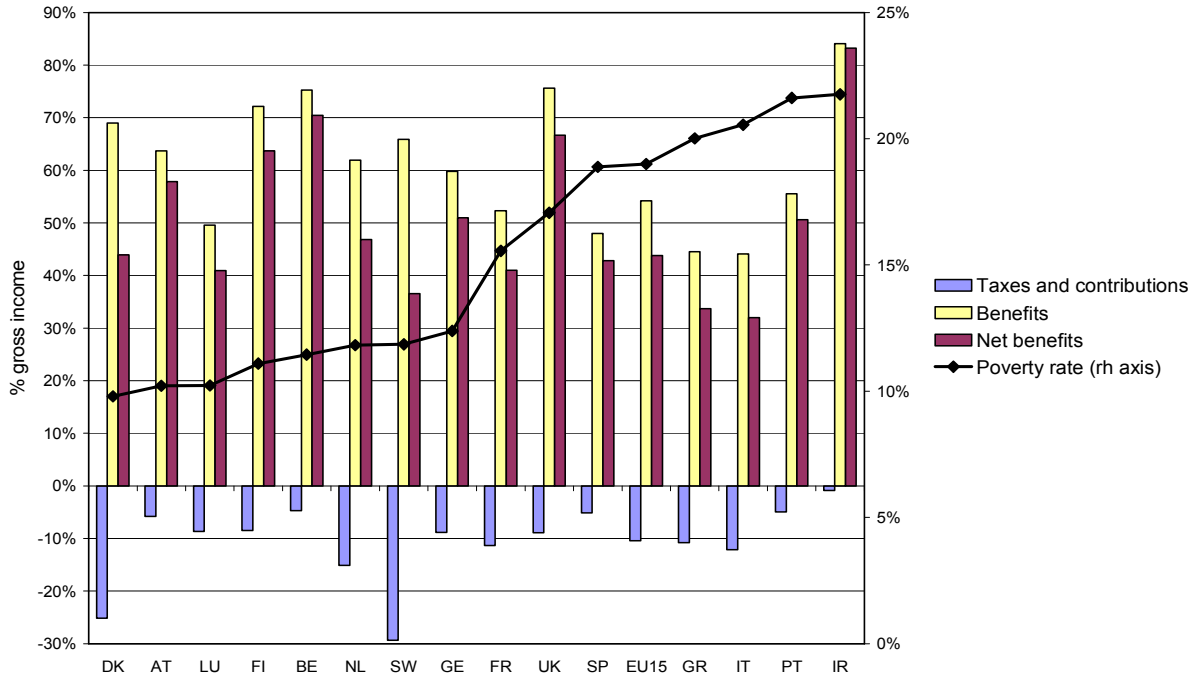
[23] Market income including private pensions

[24] EUROMOD is unique in allowing such a decomposition of disposable income, as it provides information on taxes and benefits for all 15 countries, while for some of them other micro data sources contain only disposable incomes.

[25] See http://www.iser.essex.ac.uk/msu/emod/emodstats/.

[26] The figure is taken from the MICRESA Final Report (Sutherland, 2005).

Figure 1: The Effect of Taxes and Benefits on Incomes in Poor Households, 2001



"poor" is defined as having equivalized household income below 60% of the national median household incomes are equivalized using the modified OECD equivalence scale (1/0.5/0.3)
Source: EUROMOD; MICRESA Final Report at http://www.iser.essex.ac.uk/msu/emod/micresa-final.php

A more sophisticated analysis of tax benefit systems - however still based on EUROMOD basic output (i.e. decomposed household disposable income) - was recently accomplished by Immervoll et al. (2005a). The authors investigate the direct effect of tax benefit systems on cross sectional inequality. Unlike many other international studies, the analysis encompasses both direct taxes and cash benefits. They find that non means tested benefits and taxes play an essential role in reducing inequality in countries with comparably more redistributive tax benefit systems, such as the Scandinavian and most of the countries in central Europe. UK and Ireland, where means-tested benefits are relatively more important, have an intermediate position concerning reduction of inequality. Finally, Southern European countries show the lowest degree of redistribution, with the exception of Spain if pensions are included in benefits.

Though EUROMOD basic output is already able to provide some interesting insights, the typical use of EUROMOD as a tax-benefit microsimulation model consists in analysing the effects of planned or illustrative reforms of tax-benefit policies. The standard definition of household disposable income is very useful for such analyses as well, as measurements of redistribution, changes in risk of poverty and budgetary effects can be computed on a comparable base. This is especially useful for studies which compare cross country effects of reforms implemented at European level. This is the reason why applications of this sort appear

as the earliest studies carried out with EUROMOD. Examples for such studies are Atkinson et al. (1999), which explores a universal minimum pension at European level and Atkinson (2000) which considers "poverty benchmarking" among countries and calculates a basic measure for the trade-off between poverty reduction and social spending. Two more recent examples of such methodology, referring to pensioners' well-being and tax-transfer policies, are presented in Mantovani et al. (2007) and Callan et al. (2007).

3.2 Example: Child Poverty

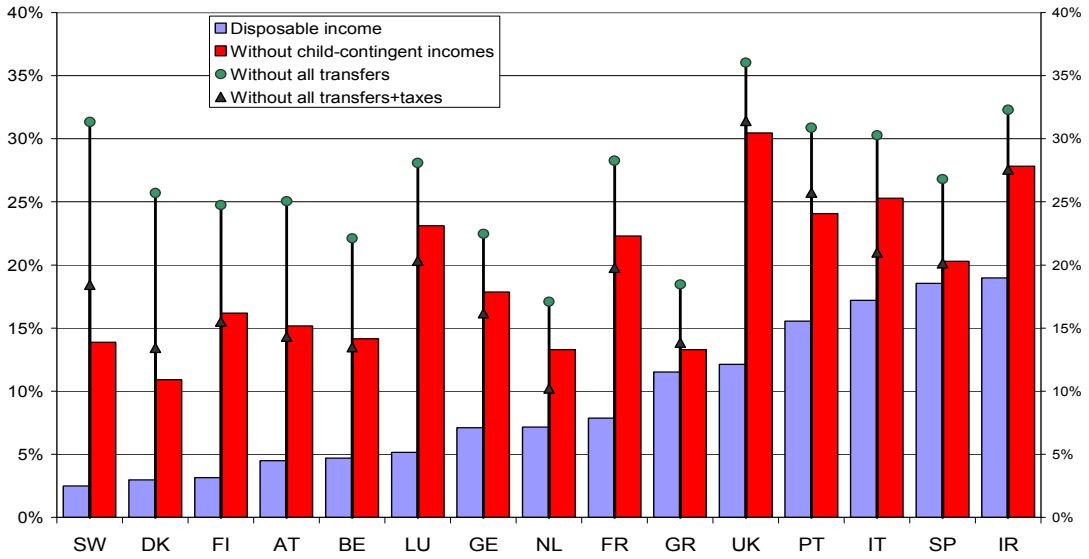
One key common social objective within the European Union is the reduction of poverty and social exclusion concerning children and many Member States are paying particular attention to the position of children living in households at risk of poverty. EUROMOD has the potential for enriching the knowledge about how to protect children from social exclusion by allowing the assessment and comparison of the impact of different European tax-benefit systems on child poverty.

A recent study by Corak et al. (2005) analyses the impact of fiscal policy on the economic resources available to children, and on the child poverty rate. The study is not only interesting because of its significant findings, but also because it applies a novel technique to measure those resources available to children. As the study illustrates and is briefly summarised below, the way in which "child benefits" are defined is important in assessing the impact of public policy. The definition used in the study and referred to as child-contingent incomes corresponds to the extra income the household receives from the state because of the presence of children and is assessed by the re-calculation of taxes and transfers as though there were no children. The difference between taxes and transfers in this "no children" scenario and the original taxes and transfers form the child-contingent incomes. This calculation is not the same as simply counting up the value of child and family benefits. Social assistance benefits may "fill the gap" left by family benefits; alternative housing benefit schemes may exist for parents and non-parents; some child-related components may be taxable and in this case their absence would result in a reduction in tax liability (though in general the removal of tax concessions for children will result in taxes rising). EUROMOD re-calculates liabilities and entitlements and thus measures the net effect of child-contingent tax-benefit components.

Figure 2 illustrates that the definition of resources available to households with children is of significant importance, by showing child poverty measured with different income bases: (1) household disposable income, (2) household income without child-contingent incomes; (3) household income without all transfers, and (4) household income without all transfers and before taxes. The contrast between the darkly shaded bars and the height of the circle-topped lines illustrates that child poverty rates are strongly affected by public resources not specifically addressed to children. The contrast is largest in the Scandinavian countries, because of public support to working parents. It is also important in the Southern countries, but in this case because of the relatively more important role of intra-household transfers from other co-resident adults. It also has proved instructive to compare the "before transfers" child poverty rates (a measure often used to assess the effect of government policies on poverty) with those that would apply before both transfers and taxes. As the figure illustrates, taking

away the transfers without giving back the taxes paid on them over-estimates the impact of the transfer system on poverty reduction, the effect being very significant in some countries. Of course some of the taxes correspond to taxes and contributions on original income, not on transfers. The point, in this context, is to demonstrate the relevance of taxes.

Figure 2: The Child Poverty Rate in EU-15 in 2001, with and without Child-contingent Incomes, all Transfers, and all Transfers and Taxes



Child poverty is defined as the proportion of households with children below the national poverty line (50% of the national median of equivalized household incomes, using the square root equivalence scale). Source: EUROMOD; Corak at al (2005)

Another fruitful source of investigation is the comparisons of countries' various family policies and their success in combating child poverty. In particular, EUROMOD's standardized structure facilitates a special approach: to transfer family benefits between countries, by implementing one country's benefits in another and vice versa. This kind of application fully exploits the most distinctive characteristics of EUROMOD: comparability and homogeneity. Examples of such "benefit swapping" exercises are Immervoll et al. (2000), Sutherland (2001b), Levy (2003) and Levy et al. (2005). Matsaganis et al.(2007) also analyse the impact of importing Northern child benefit policies to Southern Europe in order to alleviate child poverty. All these studies find that there is clearly some scope for improvements in looking beyond national borders.

3.3 Example: Links Between Macro and Micro-economic Variables

Research carried out with tax-benefit microsimulation models is usually not expected to deal with macro economic issues, such as growth, inflation and unemployment. However, this has been precisely the subject of a number of studies using EUROMOD.

Immervoll (2007) provides an important example of this kind of application. The author analyses the stabilization effect of fiscal drag in presence of inflation. One other example of research on fiscal stabilizers in Europe is presented by Mabbett (2004). Using EUROMOD, the author produces estimates of the automatic stabilisers, which focus on the stabilization of household income rather than the budgetary effects of cyclical changes in taxes and benefits. Mabbett's work confirms previous results that suggested that stabilization and redistribution are not separate functions, because welfare states provide insurance against excessive fluctuations of households' income due to the economic cycle.

Another study (Immervoll et al., 2005b) explores the sensitivity of (micro-based) indicators for social inclusion on "macro" changes for EU-15. Late in 2001 the European Union adopted a set of commonly agreed indicators for social inclusion (see Atkinson, 2005). These so-called Laeken indicators – among them some income based poverty measures – are meant to be part of a toolbox to assess Member States' success in reducing poverty and social exclusion. However, the positive effects of policy initiatives may be mitigated by other, independent changes in the economy or society. The study uses EUROMOD's capability to emulate such "macro" changes. Poverty measures can be computed based on original household disposable income before and after the simulated change. This allows an exploration of the sensitivity of indicators to such changes, i.e. if they are affected by the change, and if so, whether in the way that might be expected. The changes considered are (a) an increase in unemployment, (b) real income growth and (c) an increase in earnings inequality. The results suggest that indicators *are* sensitive to such types of macro changes and that the extent of sensitivity does differ across countries.

The most important result consists of demonstrating the dangers of relying on single indicators instead of maintaining a portfolio. In fact, unemployment, as simulated has an ambiguous effect on the poverty rate. Also the simulation of an increase in earnings inequality – an example of increasing the income of the rich at the expense of the poor – results in some countries in a *decrease* in measured poverty heads count, as the poverty line moves down.

3.4 Example: Work Incentives and Behavioral Responses

The basic version of EUROMOD is a static model, designed to calculate the immediate, "morning after" effect of policy changes. As such, it does not take into account the effects of behavioral changes nor the long-term effect of change. However, great effort has been put in making EUROMOD a suitable tool for research assessing the impact of tax-benefit policies on work incentives and labor supply. The starting point was the observation that EUROMOD is an ideal tool to compute the different budget constraints faced by workers under different tax-benefit systems.

A next step was the implementation of facilities to calculate *implicit tax rates* (often referred to as Effective Marginal Tax Rates, EMTR) to give an insight of the potential effect of a given tax-benefit system or reform on labor supply behaviors at the intensive margin (i.e., in terms of the number of working hours). This was motivated by the fact that macro-based effective tax rates do not capture differences among population sub-groups nor do they provide distribution of EMTRs by income levels. In this respect, EUROMOD not only allows the comparison of effective tax burdens over EU-15 in a consistent way, but can also show how many and which types of individuals face different EMTR levels. Moreover, results can also be broken down to isolate the influence of income taxes, social contributions and various types of social benefits. Immervoll (2004) recently covered the broad analysis of average and marginal tax rates for 14 of the EU countries.

In addition, EUROMOD allows the computation of *replacement rates*, namely the theoretical variation in household incomes due to a change in employment status of one or more of its members. An application of this feature is found in Immervoll and O'Donoghue (2004b). Bargain and Orsini (2007) also illustrate how to characterize the (dis)incentive potential of a given tax-benefit system or a reform (the UK Working Family Tax Credit in their case). In particular, financial gains to work (or replacement rates computed when switching from inactivity to employment) give a clear idea of the potential effects of reforms on labor market participation of different sub-groups of the population.

Finally, computations of EMTRs or budget constraints at the individual level can feed in labor supply models for richer comparative analyses involving behavioral responses. Applications of EUROMOD in this promising direction are starting to develop (see Bourguignon and Spadaro, 2000b; Spadaro, 2004; Bargain and Orsini, 2004; Immervoll et al., 2004a).

4 Conclusion and Future Issues

The long process of building EUROMOD has resulted in a success to a large extent; EUROMOD has been used widely for comparative studies by academic researchers. It has been and is used for a number of high scale projects by international institutions as well. Some recent examples are the contribution to the UNICEF report on child poverty in rich countries (UNICEF, 2005), the OECD research using typical household calculations (Immervoll et al., 2004b) and the contribution to the Social Situation Report 2005 of the European Commission (DG-EMPL, 2006).

Nevertheless EUROMOD is now facing the challenge of keeping up with new knowledge needs of social scientists and policy makers due to the EU enlargement in 2004. Several new issues have to be addressed for the model to continue to be useful and to realize its full potential. Some developments seem of particular importance: (i) Ways to update EUROMOD, i.e. implement tax-benefit rules for further policy years and incorporate recent data, must be found. This involves further improvement and standardization of procedures to facilitate these tasks. (ii) The extension of EUROMOD to cover the ten New Member States of the EU seems to be another evident task. Considering the fact that this means extending EUROMOD for tax-benefit systems, which are likely to involve some features that are quite different form those already encountered in EU-15, this task is certainly not trivial and might also involve a

reassessment of the way EU-15 is treated. The EUROMOD team has recently started a new project that, amongst others, investigates the inclusion of the New Member States into EUROMOD.[27] (iii) The community of users needs to be expanded to fully exploit the research possibilities the model offers. It is important in this context to improve EUROMOD's user-friendliness to facilitate the application of the model.

[27] FP6 Research Infrastructures Design Study on "Improving the Capacity and Usability of EUROMOD" (I-CUE).

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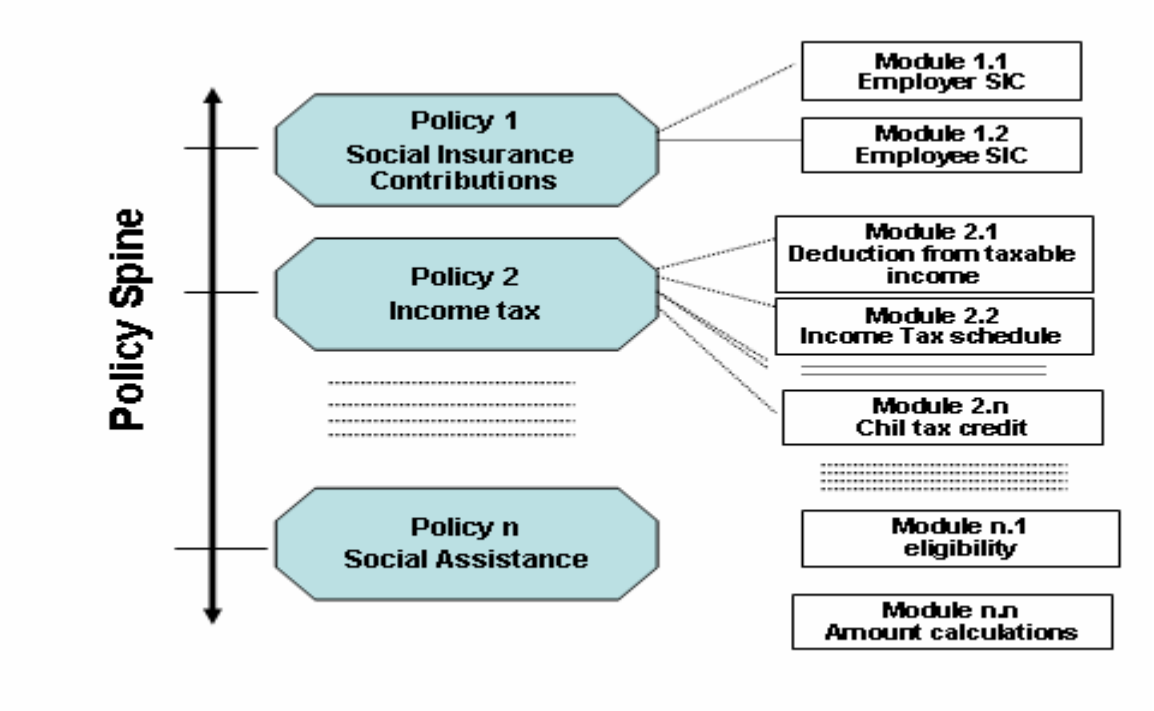
Appendix: Architecture of the Model

The programming language used for EUROMOD is C/C++, with input data stored in Microsoft Access databases and all other input parameters stored as spreadsheet tables that can be read and manipulated with any spreadsheet software.[28]

Any country's tax benefit system might be seen as a collection of complex policy instruments, such as income tax and social assistance. In turn, policy instruments are made up of more elementary blocks, e.g. application of rates to tax base brackets and tax credits. Figure A1 shows EUROMOD's hierarchical structure. The figure also introduces the terminology used by EUROMOD builders and users.

Figure A1: EUROMOD Hierarchical Structure



Each national tax-benefit ***System*** is made up of individual ***Policies***. The order in which single policies are simulated is not "hard-wired" in the program, but might be chosen by editing an input file, called ***Policy Spine*****,** that controls the flow of the computational operations taking place within the model. In practice, the Policy Spine is a list of Policies indicating the sequence by which they are computed in the tax-benefit System. For example, if social

[28] A more detailed description of EUROMOD's programming can be found in Immervoll, O'Donoghue and Sutherland, 1999 and in Immervoll and O'Donoghue, 2001a.

insurance contributions are tax deductible, then the corresponding Policy would have to appear before the Policy that computes income tax because the model requires the amount of contributions as a prerequisite for calculating income tax; similarly, if social assistance depends on after tax income, then the social assistance Policy would have to appear after the income tax Policy.

For the implementation of a Policy elementary building blocks, called ***Modules***, are used. For instance, a child benefit policy may contain a module for means-testing, a module for general eligibility conditions (e.g. test on the age of children) and a last module for computation of the entitled amount. Technically a module is a piece of code (a C-function), but its behavior is not "hard-wired" as it requires parameters to specify what it does. If all inputs of a module are parameterized it is possible to implement changes without any reprogramming. The concept of Modules as distinct elementary building blocks has special advantages. If Modules are designed in a sufficiently general manner one can build up a large "library" of algorithms and can use these for different policies and different tax benefit systems. An example for such a ***Common Module*** is the so-called "benefit calculator", which allows the implementation of a wide range of different types of benefits. EUROMOD'S Common Modules provide a general structure, which can be seen as using a standardized language to describe policy instruments of their sub-components. Once EUROMOD users are accustomed to this language, their understanding of other (foreign) countries' benefits and taxes improves considerably. Moreover, the use of a common structure facilitates the detection of similarities and differences between (maybe only seemingly very different) tax and benefit instruments.

EUROMOD's Modules have three types of parameters. ***Tax-benefit parameters*** are those related to tax-benefit system amounts, such as rates, income brackets and means testing thresholds. ***Fiscal units***, define the group of person(s) on which the tax-benefit rules are to be performed; for example the persons over whom taxable incomes are to be aggregated in order to determine total taxable income for a joint tax system, or the definition of family relevant for a certain benefit. Users may not only choose among a standard set of already defined fiscal units, they are able to create their own new definitions as well. This is made possible by two EUROMOD's characteristics. First, sufficiently disaggregated and detailed micro-data (each individual is identified separately and some relationships, such as parent/child, partner or living in same household, between these individuals are recorded), second, there is an algorithm within the model that can aggregate individuals according to criteria specified by the user. Finally, another type of parameter refers to ***Income Concepts***, used as both, input to the tax-benefit algorithms (e.g., taxable income, "means", etc.) and as output of the model (e.g., disposable income). Income concepts can be defined in terms of all monetary variables (whether contained in the micro-data or simulated by the tax-benefit model) available in the model.

5.1.1.1.1 Table 1: Sources of Micro-data for EUROMOD

Country	**Base Dataset**	**Type**	**Year of collection (sample size: individuals)**
Austria	European Community Household Panel	ECHP	1998+1999 (7386)
Belgium	Panel Survey on Belgian Households (PSBH)	National Panel	1997(7057) 1999(9089)
Denmark	European Community Household Panel	ECHP	1995(7044)
Finland	Income distribution survey (IDS)	Register + Survey	1998(25010) 2001(28303)
France	Budget de Famille (BdF)	Household Budget Survey	1994/5(29158)
Germany	German Socio-Economic Panel (GSOEP)	National Panel	1998(18227) 2001(16874) 2002(26249)
Greece	European Community Household Panel	ECHP	1995(15062)
Ireland	Living in Ireland Survey (LIS)	National Panel	1994(14585)
Italy	Survey of Households Income and Wealth (SHIW)	Income Survey	1996(23924)
Luxembourg	PSELL-2	National Panel	1999(6566) 2001(6226)
Netherlands	Sociaal-economisch panelonderzoek (SEP)	National Panel	1996(11035) 2000(10344)
Portugal	European Community Household Panel	ECHP	1996(14468) 2001(13092)
Spain	European Community Household Panel	ECHP	1996(18991) 2000(14787)
Sweden	Income Distribution Survey (IDS)	Register + Survey	1997 (38756) 2001 (33223)
UK	Family Expenditure Survey (FES)	Household Budget Survey	1995/6(16586) 2000/1(15914)