Technical Description of Eur3: A Prototype European Tax-Benefit Model[1]

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Section 1. Introduction

This research note describes the three national modules used in Eur3[2], a prototype three country microsimulation model covering France, Italy and the United Kingdom. This prototype was part of a preliminary study to investigate the feasibility of constructing a large scale 15 country model for the whole European Union. The prototype model has been used in Bourguignon et al. (1997) to carry out a number of European wide reforms, including European wide Child Benefits and Basic Incomes and reforms to social insurance contributions.

Until now, cross country comparisons of tax-benefit systems and the simulation of common policy reforms using microsimulation has taken place using existing national microsimulation models. For example Atkinson, Bourguignon and Chiappori (1988) and De Lathouwer (1996) carried out experiments running a national tax-benefit system on another country's population. Simulating the UK system on the French population and the Dutch system on the Belgian population respectively. Callan, O'Donoghue, Sutherland and Wilson, (1996) modelled a common Basic Income reform in Ireland and the UK, while Callan and Sutherland, (1997) tried to expand this to cover five European countries. Evans and O'Donoghue, (1998) have examined the impact of making common changes to social assistance schemes in Germany, Ireland and the UK. The OECD (1996) using seven EU national models carried out an international comparison of replacement rates.

There are however a number of problems with this approach. National models have been built for particular purposes and have tended not to have had international comparisons in mind. As a result comparability problems arise. Comparability problems relate both to the way in which national models are constructed and to the structure of national tax-benefit systems. In order to make comparisons, the inputs, the intermediate processes and the outputs need to be comparable.

The inputs of a microsimulation model are the household survey datasets. Microsimulation models are intensive users of this data, requiring great detail to model the complex procedures involved in assessing tax liabilities and social policy entitlements. Cross-national modelling need to ensure that the underlying *economic variables* are the same. Income variables need to encompass the same income sources in each of the countries. For example initially each of three datasets in Eur3 used different definitions of wages from employment. Ideally also, income data should refer to the same accounting period such as current income, monthly income or annual income. The definitions of other variables are also important; it needs to be possible to define children, employment status, unemployed and pensioners etc. in a similar manner.

Other issues include the representativeness of the sample and the stage of the economic cycle. National model builders aim to have their national models as representative as possible and so often have to make adjustments to account for under or over reporting of incomes such as those from self-employment and investments etc. In carrying out cross-national studies, it is necessary for the household surveys in as

[2] The modules simulate systems applying in 1994.

far as possible to be equally representative of national household income. A more difficult problem, generally ignored is the stage in the economic cycle at which the survey was collected, which can have significant bearings on the outcomes of analyses.

The model related issues (intermediate processes and outputs) are the issues which have most severely limited cross country analyses. Intermediate processes which are important for comparisons include the set of policy instruments simulated and take-up. In order to compare *like with like*, it is necessary to model the same set of policy instruments. Callan et al. (1996) had to employ very complicated mechanisms to ensure that both the Irish and the UK models simulated common instruments. In moving to a five country analysis, Callan and Sutherland (1997) found that as a result of differences in sets of instruments modelled by the national models, it was impossible to model a common a basic income reform in all of the five countries. For example a full basic income could not be modelled because the Italian model did not simulate all means tested and non-means tested benefits. In addition a partial basic income could not be analysed because the Belgian model incompletely modelled the means test benefits. Take-up refers to the fact that many people although entitled to benefits, do not claim for reasons such as lack of information, stigma etc. Deciding to account for take-up or not can have a significant effect in analysing the results of a simulation.

Output definitions also hamper comparisons when variable definitions and units of analysis differ. As in the definition of inputs, output definitions must be the same. Decisions need to be made as to what comprises disposable income for example. Does this variable include housing costs or not? Does primary income contain social insurance contributions? What definition of equivalence scale is to be used. In addition definitions of children and adult dependants etc. are necessary for calculating the equivalence scales. As national models are concerned only with national norms, matching up results can be a problem. Another issue is the unit of analysis, the level at which incomes are reported. Examples include household, nuclear family or individual. Evans and O'Donoghue (1998) experienced difficulty in adapting the models to use a common unit of analysis. In the end after a number of creative manipulations, the household was the unit of analysis used.

Although, a number of comparisons have been possible using national models, their lack of flexibility has often meant that less than optimal definitions have been adopted. As an integrated model and constructed from the outset for comparative purposes, Eur3 has avoided many of these pitfalls and allows for flexibility in specifying the optimal data and modelling definitions. Intensive effort has been made to ensure that input and output definitions are comparable. As outlined in the next three sections, common policy instruments have been modelled in each of the countries. The model has been constructed to allow for analyses at the household unit of analysis, but it is planned to enable the family and possibly the individual to be used also. Take-up of benefits have been assumed to be 100 per cent in each of the countries. Harmonisation of under-reporting factors have however been ignored for now.

Structure of Paper
This research note has been divided into a number of sections. Section 2, 3 and 4 describe the tax-benefit systems simulated for France, Italy and the United Kingdom respectively. Section 5 addresses a particular problem facing Italy tax evasion, and describes some potential adjustments. Section 6 describes the computing environment of the model. There are also a set of large appendices. The first outlines the national databases used. The second part defines the variables used and recodings necessary. An additional objective of this paper is to advise future country module builders of the level of detail required. The third part therefore describes in detail, the tax-benefit algorithm used for the UK. Although quite longwinded, it is clearer and less ambiguous than the written description in section 4.

Section 2. The French Tax-Benefit System

The section will describe the main aspects of the French tax-benefit system and how it was modelled in the prototype.

Table 2.1 Summary of the French Tax-benefit System

Social Contributions

Total Cost of Labour - Employers Social Contributions = **Gross Wages**

Gross wages - Employees Social Contributions = **Gross income from Wages**

Self- Employment Income - Social Contributions =**Gross Income from Self-employment**
Gross income from wages + Gross income from self-employment + Pensions + Capital Income = **Gross Income**

Tax and Benefits

Gross Income - Deductions = **Taxable Income** *(The basis for Quotient Familial and Income Taxation)*

Gross Income Tax- Credits = **Net Income Tax (IRPP)**

Gross Income - Net Income Tax = **Income after tax** *(The basis for Family Benefits)*

Income after tax +Family Benefits = **Income Base for Social Assistance**

Income after Tax + Family Benefits + Social Assistance = **Disposable Income**

1. Social contributions

Social contributions on earned income of employees (the only contributions included in our model) vary according to work status; the main distinction is the different treatment

of qualified clerks and supervisors on one side and other workers on the other (executives are not considered as employees). The regime varies according to the kind of contribution and the level of gross wage : some contributions (e.g. illness and pregnancy) are proportional to gross wage and take the whole wage as the basis of calculation; other contributions (retirement, unemployment) are progressive up to a certain level (fixed every year by fiscal authorities) and are regressive (at a rate of zero) from then on. The following tables (2.3 and 2.4) show in detail social contributions paid by employees (table 2.2), and those paid by employers (table 2.3) as of 1995 (reference year for social contributions in our model). In these tables rates apply to brackets that are function of a fixed amount P determined every year by the Government (in 1995, P was equal to 155940 Fr) :

Table 2.2 Social contributions paid by employees (Bracket of Gross wage)

Contribution	0-P	P-3P	3P-4P	4P-8P	>8P
Illness, pregnancy	.068	.068	.068	.068	.068
Retirement	.0655	.0655	.0655	.0655	.0655
ASSEDIC	.0242	.0297	.0297	.0	.0
ASF	.008	.0089	.0089	.0	.0
Pensions					
Non qualified clerks	.02	.02	.0	.0	.0
Qualified clerks					
Arco	.02	.0	.0	.0	.0
Agirc	.0	.05	.05	.15	.0
Apec	.0	.00024	.00024	.0	.0

Table 2.3 Social contributions paid by employers (Bracket of Gross wage)

Contribution	0-P	P-3P	3P-4P	4P-8P	>8P
Illness, pregnancy	.128	.128	.128	.128	.128
Retirement	.016	.016	.016	.016	.016
Retirement (compl.)	.082	.0	.0	.0	.0
Fam. Allowances	.054	.054	.054	.054	.054
ASSEDIC	.0418	.0	.0	.0	.0
ASF	.0116	.0129	.0129	.0	.0
FNGS	.0035	.0035	.0035	.0	.0
Pensions					
Non qualified clerks	.03	.03	.0	.0	.0
Qualified clerks					
Arco	.03	.0	.0	.0	.0
Agirc	.0	.1	.1	.0	.0
Apec	.0	.00036	.00036	.0	.0
Life	.015	.0	.0	.0	.0

Pensions are subject to a social contribution of 1.4 per cent on gross pensions received. Unemployment compensations (allocation chomage) are subject to the same contribution of 1.4 per cent, plus another 1.2 per cent as retirement contribution.

On February 1st 1991 a new contribution began to be collected : CSG (Contribution Sociale Generalisee), at the rate of 2.4 per cent on all gross incomes (including unemployment and pensions)[3]

Contributions on earned income are collected at the source while no income tax advances are collected (this is different to what is currently in use in Italy and UK). CSG on earned income is also collected at the source.

2. Personal Income Tax

The structure of French Income Tax (Impôt sur le Revenu des Personnes Physiques IRPF) is progressive. Two main characteristics of this tax are a set of deductions on some incomes and the utilization of Family Ratio (Quotient Familial) when submitting taxable income to tax income brackets

Income base is the total amount of income of previous year. Incomes included in this base are : rent of land ownership, incomes from capital and stock ownership, savings (except some popular savings account like PEP and CODEVI), income from dependent work (including unemployment compensations), retirement pensions, income from self-employment and income from the ownership of a firm.

The main deductions are social security contributions paid by employee and profesional expenses deduced either at a universal rate of 10 per cent of net wage (with a minimum of 2190 Fr and a maximum of 73270 Fr) or at real value (it is then necessary to justify this expenses). Other deductions are :

- 8000 Fr (if single) or 16000 Fr (if couple) on capital profits
- 10 per cent on pensions plus income (with a minimum of 1930 Fr per person and a maximum of 31300 Fr for the whole household)
- 20 per cent of wages plus pensions plus income after previous reductions have been applied (up to a maximum of 133400 Fr per person)
- 9440 Fr per old or handicapped dependent (this figure applies when family income after deductions is not bigger than 58400 Fr, otherwise, when family income is between 58400 Fr and 94400 Fr the deduction per person is 4720 Fr. (All these deductions are doubled if the dependent person is married to the head of household)

The taxable income (obtained after reducing deductions from base income) is then submitted to the Family ratio mechanism. The first step consists in giving a weight to each person in the household according to the following table:

[3] Let's recall that at the beginning of 1997 a new contribution has been introduced : RDS (Remboursement de la Dette Sociale), with the same basis as the CSG.

Table 2.4 Weight of each individual in the household

Number of Child Dependants:	0	1	2	3	4[4]
Type of Household					
Single	1	1	.5	1	1
Couple	2	.5	.5	1	1

The total weight of the household is obtained as the addition of individual weights. Family ratio is then computed as the result of dividing the total amount of taxable incomes (after deductions) by the total weight of the household. For example, for a couple with 3 child dependants and a taxable income (after deductions) of 150000 Fr, the Family ratio will be:

QF = 150000 / total weight = 150000 / (2+0.5+0.5+1) = 37500 Fr

This Family ratio is then submitted to tax rates according to the income brackets given in the following table :

Table 2.5 Income Tax Brackets (1994)

Income bracket (ff per annum)	Marginal Tax rate
0-22210	0 %
22210-48571	12 %
48571-85481	25 %
85481-138411	35 %
138411-225211	45 %
225211-277731	50 %
over 277731	56.8 %

With the figures of our example, Income Tax would then be

IRPP = .12*(37500-22210) + 0*22210 = 1834.8 Fr

This tax reduction due to the Family Quotient is subject to a maximum. The total income tax reduction resulting from the child dependent part of the quotient cannot be more than 15620 Fr per annum for each 0.5 child weight. In our example, there are 0.5+0.5+1 (=2) child weights. Therefore the maximum tax reduction possible for this family as a result of the child part of the Family Quotient is 4 * 15620 Fr. In other words the difference between what a couple would pay without children and with children is at most 62480 Fr.[5]

When income tax IRPP is below 4240 Fr another deduction (called decote) applies: income tax becomes then equal to IRPP minus (4240 Fr minus IRPP).

[4] Additional dependent persons are given a weight of 1 in any kind of family

[5] See "Memento Fiscal 1995" editions Lefebvre, Paris, for a more detailed description of these mechanisms

Tax resulting from the above calculations is then reduced by the amount of other tax deductions (some professional and trade unions contributions, expenses for old relatives, day care), (lack of data prevent us from including these deductions in our model) and we then get the final amount of due income tax. In addition, if the income tax liability is below 400 Fr per year, then income taxation is set to zero. In our example, income tax becomes

IRPP = 1834.8 - (4240 - 1834.8) = -570.4

which means that tax due is zero

In addition, local taxation (land and residential taxes) can vary quite significantly from one area to another. These taxes are not included in this version of our model

3. Family Benefits

The most important element of the Family Benefit system in France is the Family Allowance (Allocations Familiales AF), that are allocated to households with 2 or more dependent children[6] and are not means tested.[7] The amount of the monthly allowance is proportional to a fixed monthly base determined by the Government (Base Mensuelle d'Allocations Familiales (BMAF) 2078.57 Fr in 1995) and to the number of dependent children. Table 8 contains the description of the Family Allowances

Table 2.6 Family Allowances

	Monthly amount	% of BMAF
2 dependent children	665.27	.32
each child after the second	852.37	.41
increase for child over 10	187.1	.09
increase for child over 16	332.63	.16

Families with one or more children under 3 can also receive the Young Children Allowance (Allocation pour Jeune Enfant APJE) if the taxable income of the household is not bigger than a certain ceiling. The monthly allowance (for each eligible child) is proportional to the BMAF (45.95 per cent in 1995). Similar to the APJE, the Family Allowances Institution (Caisse d'Allocations Familiales CAF) provides another allowance for families with 3 or more children of more than 3 years old : the Family complement (Complement Familial CF), which is means tested and given for third and following children (rate in 1995 is 41.65 per cent of BMAF). Table 9 gives the maximum income at which APJE and CF can be received.

[6] We must notice that the concept of dependent child is not defined as in the Family ratio: for social assistance, dependent child is under 19 while for income tax dependent children are under 17 or under 26 if they are student.

[7] Allocation Familiales are now means tested

Table 2.7 APJE and CF

Number of dependent children	maximum income (couple[8])
1	82706
2	103382
3	124059
4[9]	148870

Table 2.8 Family Allowances in France in 1995

Allowance	Present in the model
Allocation Familiale	Yes
Complement Familial	Yes
Aide à la Rentrée Scolaire	Yes
Aide à la Scolarité	Yes
Allocation pour Jeune Enfant	Yes
Allocation Parentale d'Education	No
Allocation de Garde d'Enfant à domicile	No
Aide Emploi Assistance Maternelle	No
Prime de Protection à la Maternité	No
Allocation de Parent Isolé	Yes
Allocation de Soutien Familial	No
Prestation hors Métropole	No
Allocation Différentielle	No
Frais de Tutelle	No

Single parents with children are eligible for Single Parent Allowance (Allocation de Parent Isole API) whose amount is calculated as the difference between family means (defined as the sum of net incomes plus AF plus CF plus APJE) and a guaranteed fixed amount equal to (in 1995):

1.5 * BMAF + number of dependent children * .5 * BMAF

A person with 3 dependent children and an income (net income plus AF plus CF plus APJE) of 50000 Fr would get an API of

API = (1.5 * 2078.57 + 3 * .5 * 2078.57)*12 - 50000 = 24828.52 Fr

There are other two allowances related to the presence of children in the family : Schooling Aid (Aide a la Scolarite AS) and School Entrance Aid (Allocation de Rentrée Scolaire ARS) : the first one is allowed to families with dependants between 11 and 16 and whose total income is less than 43393 Fr (plus 10014 Fr for each but the first dependent person) and amounts to 16.4 per cent of BMAF per month per eligible

[8] A deduction of 33242 Fr applies if there are more than one income earner in the household or in case of lone parent

[9] Maximum increases by 24812 Fr per each additional child after the fourth

dependent; the second is given once per year and its amount is 1500 Fr per each student between 6 and 18 as compensation for buying school materials (the ARS is means tested : annual family income must not be higher than 74188 Fr plus 30 per cent per dependent)

AF, CF, APJE, AS and ARS are the family allowances that have been included in our model; we could not obtain the data needed to compute other allowances. The table 2.8 summarises the whole set of French Family Allowances in 1995. The part of non modelled family allowances can be estimated to 12.2 per cent (140 billion Fr, according to CAF) of total distributed by Caisse d'Allocations Familiales in 1995.

4. Social Assistance

Social Assistance subsidies are the following:

a) Unemployment compensation is paid to unemployed people after entitlement to unemployment insurance (unemployment allowance financed by social security contributions paid by employed people in activity) runs out and who have been employed during 5 of the 10 years before the end of their last employment period. The amount of the compensation depends on the last earned wage and the number of years worked. This is however not modelled in the French module.

b) Minimum Income for preventing Social Exclusion (Revenu Minimum d'Insertion RMI) : it was created in 1989 in order to help workers to reenter the labour market. Persons between 25 and 65 (except those with dependent children or pregnant women) with total monthly family income (Net Income + Family Allowances + Social Assistance) below brackets given in table 2.9 can receive the benefit. RMI is given for a period of three months, renewable. No taxes apply to RMI. The amount of RMI is the difference between the amount indicated in the table and the monthly family income.

Table 2.9 Revenu Minimum d'Insertion

Size of household	Monthly Income
1	2325.66
2	3488.49
3	4186.19
4	4883.89
5	5814.15
6[10]	6744.41

c) Handicapped Adult Compensation (Allocation pour Adultes Handicapés AHH) : all persons with physical or mental handicap are eligible. The monthly amount and the conditions are similar to those of RMI.

d) Old Workers compensation (Allocation aux Vieux Travailleurs Salariés AVTS) : for people over 65 who had been wage earners, whose total annual income is less than 69576 Fr (couple) or less than 39721 Fr (single). The amount of this compensation is

[10] For each dependent person after the sixth the monthly amount is increased by 40% of 2325.66

38783 Fr per annum and per person (including the part that is financed by Fonds National de Solidarite). When income is over these limits, the compensation is reduced proportionally to the difference between income and limit.

e) Housing benefit (Allocation Logement AL) : there are three kinds of housing benefits:

i) Family housing benefit (Allocation à caractère Familial ALF),
ii) Social housing benefit (Allocation à caractère Social ALS)
iii) Individualised housing benefit (Aide Personnalisé au Logement APL)

Entitlement conditions are described in table 11. All housing benefits are computed in the same way (no differences are modelled). The amount depends on the type of family, the amount of rent paid, the total income of the family and the area of residence. Housing benefits are not subject to any kind of tax. The formula to compute AL (paid monthly) is

$$AL = K * (L + C - Lm)$$

where K is a coefficient defined by

$$K = .9 * (\text{Total Income} / (M * n))$$

Total Income is taxable income after deductions. M is a coefficient fixed every year by the Administration (in 1995 it was equal to 102702). n is the total weight (as defined for Family ratio used for Income Tax calculations). L is monthly rent paid (net of expenses such as cleaning, guard, etc.). C is an increase for extraordinary expenses fixed by the Administration (457 Fr in 1995). Lm is the minimum rent due by the household and is function of income, family size and area of residence[11]. The income is taxable income after deductions minus

a) 500 Fr if head of household and spouse are active
b) 4507 Fr if head of household has 1 or 2 dependants
c) 6758 Fr if head of household has 3 or more dependants

Table 2.10 Conditions for ALF, ALS and APL

Benefit	Conditions
AFL	Families eligible for family allowances, dependants aged less than 25 or more than 65, couples married less than 5 years if both of them were less than 40 when getting married.
ALS	Persons aged more than 60, young wage earners aged less than 25, persons eligible for RMI or Allocation de Solidarite
APL	Depends on the actual housing conditions : persons paying mortgage loans, persons paying rent

[11] For more details see "Memento Social 1995", editions Lefebvre, Paris.

Section 3. The Italian Tax-Benefit System

The model simulates the calculation of social security contributions, personal income tax, and family benefits.

Table 3.1. Summary of Italian Tax-benefit System (*)

Social Contributions

Total Cost of Labour - Employers Social Security Contributions = **Gross Wages**

Gross wages - Employees Social Security Contributions = **Net Wages**

Self- Employment Income - Social Security Contributions =**Net Income from Self-employment**

Tax and Benefits

Net Wages + Net Income from Self-employment + Pensions + Income from real capital = **Taxable Income** (*Family Benefits)*

Taxable Income - Deductions = **Net Taxable Income** *(Personal Income Tax (Irpef),)*

Gross Income Tax- Credits = **Net Income Tax**

Gross Investment Income - Withdrawal Tax on Investment Income = **Net Investment Income**

Taxable Income - Net Income Tax + Net Investment Income = **Net Income**

Net Income + Family Benefits = **Disposable Income**

(*) In brackets is the policy instrument for which the specific definition of Income is relevant.

1. Personal Income Tax

(Irpef :Imposta sul Reddito delle Persone Fisiche)

Taxable Unit

In the Italian fiscal system, taxation is levied at an individual level or at the level of the nuclear family, including the head of household and all the dependent members. The household unit collected by the Bank of Italy follows a broad definition that can easily include more than one tax unit. A distinction is made in the model among the following units:

- *Nuclear family* including the head of household and all the dependent persons
- *Individuals* who are part of the family but declare their income separately
- *Households* including all family members according to the definition adopted in the survey.

The income tax system in Italy is individual based, but elements such as tax credits and family allowances are based on the nuclear family which includes all dependent members.[12] For those individuals who are members of the household but who are not dependent, deductions and benefits apply separately. Multiple nuclear families are not modelled.

Taxable Income
Total gross income (*Reddito complessivo lordo YL*) relative to each individual includes the following types of income :

YL =Net wages +Self-employment income + Pensions + Other transfers + Capital Income.

All capital variables are collected at the level of the household and not at the individual level. Therefore capital income is always included in the income of the head of household. Income from non-financial capital is considered in the model as a component of the taxable income of the head of household (even if it belongs to different members of the household that are taxed separately). Investment Income however is subject to a withdrawal tax and therefore taxed independently.

Taxable Income = YL- Investment Income

Deductions
Net taxable income is obtained by subtracting from taxable income some deductible expenses (*oneri deducibili*): social and health contributions due by self-employed individuals; some medical expenses; alimony; donations to religious institutions; etc.. There is no information in the Survey on these deductible expenses that vary from household to household according to preferences and medical conditions. Nevertheless they significantly affect the fiscal revenue since they represent almost 4 per cent of declared taxable income. A possible solution would have been an imputation of a 4 per cent deduction to all taxable incomes. However the availability of the breakdown of these deductions made available by the Ministry of Finance[13] shows that they vary significantly according to the level of income and the occupational status of the head of the nuclear family. This information highlights the point that a proportionate imputation on all taxable incomes would have biased the distribution. However it also suggested an alternative method of imputation (the estimation of different parameters according to the level of income). The deductions are therefore approximated by a series of parameters representing their incidence at

[12] Officially members of the household are dependent when their income does not exceed a certain threshold equal in 1994 to L5,4 millions. Children are dependent when they are below 18 years of age or 26 if they are students. Dependent members of the household among the first four persons beside the head of household are identified building a dummy variable that specifies not only whether they are dependent or not, but also the type of relationship they have with the head of household

[13] See Ministero delle Finanze (1996)

various levels of income which obtained from national accounts data. These parameters which vary from 1 to 10 per cent are provisional; they only account for variation by total income and not by income source which is an important source of variation.

Gross income tax

The amount of gross income tax is determined applying marginal progressive rates to the increasing income brackets. (See Table 3.2)

Table 3.2 : Progressive Income Tax Rates

Income Bracket (1000 Lire per Annum)	Tax Rate
0	0.1
7200	0.22
14400	0.27
30000	0.34
60000	0.41
150000	0.46
300000	0.51

Employees and pensioners with incomes below L8.5 million are exempt from income tax since the amount of Tax Credit is equal or exceeds income tax liability.

Tax credits

Tax credits (*Detrazioni*) are subtracted from gross income tax to obtain the value of net income tax that has to be paid, with the limit that the minimum tax paid is zero (there is no negative income tax). Since the incidence of the credits on gross income tax decreases as gross income tax increases (often resulting in an exemption from income tax for low incomes and then rapidly diminishing), the whole amount of credits can be interpreted as a kind of low income support. There are three types of tax credits: Family Credits, Credits for Work-related Expenses and Credits for former Deductions.

Family credits

Tax credits for dependent relatives according to the standard fiscal definition including dependent husband or wife, dependent children and any other dependent members of the family are always allowed at any level of income. Family credits are also allowed separately to other members of the household that constitute an independent tax unit. The amount of credits for dependent children increase with the number of children and is higher in cases of lone parenthood according to the table 3.3. If the partner is dependent, the head of household is allowed a credit equal to L791,588. An additional non income-tested credit of L126,445 is allowed for each other dependent relative.

Work-related expenses

Credits for employees and pensioners, *Earned Income Credit* allow for a fixed amount equal to L759,715 and an additional income tested amount that decreases slightly at increasing levels of taxable income (See in Table 3.4). No additional credit is allowed

for income greater than the threshold L14.825 million. The overall amount of the credit is given by the sum of the fixed and Income tested amount. Tax credits for self-employed are completely income-tested, slightly decreasing according to increasing levels of income and allowed only for incomes below the threshold of L8.2 million (see Table 3.5).

Credits for former Deductions
A third kind of tax credit, introduced in recent years, is allowed as a percentage (22 per cent) of some expenses that used to be deductible: they include interest on mortgages for the first-owned house, medical expenses, school or education fees, insurance, etc. Like deductions, the incidence of these expenses on different levels of taxable income is estimated and the resulting parameters adopted in the simulation.

Table 3.3. Credits for Dependent Children (Lire per annum)

Number of children	Credit	With wife/husband	Without wife/husband
0	0	0	0
1	91438	182876	791588
2	182876	365752	980588
3	274314	548628	1169588
4	365725	731450	1358588
5	457190	914380	1547588

Table 3.4 Amount of income tested earned income credit (Lire per annum)

Income Brackets	Amount of Tax Credit
0	237215
14500	200725
14600	127715
14700	45590
14825	0

Table 3.5 Self-employment income credit (Lire per annum)

Income Brackets	Amount of Tax Credit
0	197505
7900	156750
8000	75240
8200	0

2. Family Benefits

They represent the only cash family benefit of the Italian system, but since eligibility is quite limited and payments of only a small amount, their incidence on overall social protection expenditure is very limited. The allowance (*assegno familiare)* is given to the head of the nuclear family provided they are an employee or pensioner and their wage or pension earnings be the main component (greater than 70 per cent) of total taxable income. The amount of the benefit varies according to the level of income and the number of household members with an increase for children under 18 and for lone parents. No family benefit is allowed beyond the threshold (See Table 3.6)

Table 3.6. Family Allowance according to levels of income *(L 1000 per annum)*

Income brackets		Number of family members							
	Lone parent	1	2	3	4	5	6	7	8
0	0	720	1080	1920	2760	3600	4440	5280	5280
17306	20190	240	840	1680	2400	3360	4320	5040	5040
21632	24517	0	600	1320	2040	3000	4200	4800	4800
25958	28840	0	240	960	1680	2640	3960	4560	4560
30282	33166	0	0	600	1320	2400	3840	4320	4320
34609	37493	0	0	240	960	2040	3600	4080	4080
38935	41818	0	0	0	600	1440	3240	3720	3720
43260	46144	0	0	0	240	840	2880	3360	3360
47585	50469	0	0	0	0	240	2520	3120	3120
51910	54794	0	0	0	0	0	1200	2760	2760
56236	59121	0	0	0	0	0	0	1200	1200
60562	63447	0	0	0	0	0	0	0	0
64888	67773	0	0	0	0	0	0	0	0
69214	72099	0	0	0	0	0	0	0	0

Table 3.7 Increases of family allowance for lone parents with minor dependent children *(L 1000 per annum)*

Number of minor dependent children	1	2	3	4	5	6	7
Amount of increase	0	240	1488	2736	3984	5232	6480

3. Taxation of Financial Capital

Tax on financial assets (*imposta sostitutiva*) is *a withdrawal tax* calculated with three different rates according to the type of the asset: Government bonds and other bonds are taxed with a rate of 12.5 per cent while short term bank deposits are taxed at a rate of 30 per cent. In the model the tax is subtracted from gross financial capital to determine the net amount of financial capital that is part of disposable income. Since financial capital is strongly underestimated in the survey data, simulated tax revenue is proportionally underestimated.

4. Social security contributions

Since the incidence of contributions on earned income is different according to the type of income (dependent, self-employment, pensions), the occupational status and the sector of activity, the model identifies these characteristics. In addition it is taken into account that individuals may perceive different types of income coming from different activities: for example an employee may occasionally receive an income from self-employment. Therefore for each individual there is the identification of incomes from the main and the secondary activity. The systems of social contributions include payments to the National Health Service (*SSN : Servizio Sanitario Nazionale*)

and a wide variety of contributions for situations of need such as family allowances, unemployment support, sickness, invalidity, maternity.

Employees

Social contributions based on employee income are levied against both employers and employees. In both cases the rates of contribution vary according to firm size, sector of activity and occupational status. In the model the three main work status are considered (blue collar, white collar and executives), but only eight sectors of activity could be taken into account following the level of detail allowed by survey data.

Employees contribution

Gross earnings are obtained grossing up net earnings from Survey data according to the specific rate of contribution as shown in Table 3.8. Incomes from secondary activity are grossed up with an average rate of 10 per cent. The difference between gross and net earnings gives the amount of contributions paid. Gross earnings and contributions on both types of income (on the main and the secondary activity) are summed to obtain the overall value of contributions by individual.

Employers contributions

Average rates are about 42 per cent for employers' contributions but they vary considerably according to the size of the firm, to the work status of the employee to the sector of activity and to the level income (above or below a ceiling of L40 Million of net earned income, see Tables 3.9, 3.10). However no contributions are paid above the ceiling of L150 Million.

Table 3.8 Contribution Rates for Employee Social Insurance Contributions

Economic sector		blue collars			white collars			executives		
		Social Security	Health	Total	Social Security	Health	Total	Social Security	Health	Total
1	Agriculture			7.75	8.34	1	9.34	8.34	1	9.34
2	Industry excluding. construction	8.84	1	9.84	8.84	1	9.84	9.5	1	10.5
3	Construction	8.84	1	9.84	8.84	1	9.84	9.5	1	10.5
4	Distributive trades, lodging, catering	8.84	1	9.84	8.84	1	9.84	9	1	10
5	Transport and communications	8.84	1	9.84	8.84	1	9.84	9	1	10
6	Banking and Insurance	8.84	1	9.84	8.7	1	9.7	9	1	10
7	Market services	8.84	1	9.84	8.84	1	9.84	9	1	10
8	General Government and non-market services	8.34	1	9.34	8.34	1	9.34	9.04	1	10.04

Source: Elaborations from *Prontuario Contributi* Various Years.

Table 3.9 Contribution Rates for Employee Social Insurance Contributions on Earnings below L40 million

Economic sector		blue collars			white collars			executives		
		Social Security	Health	Total	Social Security	Health	Total	Social Security	Health	Total
1	Agriculture			42	29.56	9.6	39.16	26.86	9.6	36.46
2	Industry excluding. construction	35.91	9.6	45.51	33.6	9.6	43.2	28.08	9.6	37.68
3	Construction	38.48	9.6	48.08	36.26	9.6	45.86	28.08	9.6	37.68
4	Distributive trades, lodging, catering	33.05	9.6	42.65	33.25	9.6	42.85	25.74	9.6	35.34
5	Transport and communications	33.05	9.6	42.65	33.25	9.6	42.85	25.74	9.6	35.34
6	Banking and Insurance	31.83	9.6	41.43	30.71	9.6	40.31	25.54	9.6	35.14
7	Market services	33.05	9.6	42.65	33.25	9.6	42.85	25.74	9.6	35.34
8	General Government and non-market services	24.46	9.6	34.06	24.46	9.6	34.06	24.46	9.6	34.06

Source: Elaborations from *Prontuario Contributi* Various Years.

Table 3.10 Contribution Rates for Employee Social Insurance Contributions on Earnings above L40 million

Economic sector		blue collars			white collars			executives		
		Social Security	Health	Total	Social Security	Health	Total	Social Security	Health	Total
1	Agriculture			42	29.56	3.8	33.36	26.86	3.8	30.66
2	Industry excluding. Construction	35.91	3.8	39.71	33.6	3.8	37.4	28.08	3.8	31.88
3	Construction	38.48	3.8	42.28	36.26	3.8	40.06	28.08	3.8	31.88
4	Distributive trades, lodging, catering	33.05	3.8	36.85	33.25	3.8	37.05	25.74	3.8	29.54
5	Transport and communications	33.05	3.8	36.85	33.25	3.8	37.05	25.74	3.8	29.54
6	Banking and Insurance	31.83	3.8	35.63	30.71	3.8	34.51	25.54	3.8	29.34
7	Market services	33.05	3.8	36.85	33.25	3.8	37.05	25.74	3.8	29.54
8	General Government and non-market services	24.46	3.8	28.26	24.46	3.8	28.26	24.46	3.8	28.26

Source: Elaborations from *Prontuario Contributi* Various Years.

Contribution rebates

Actual contribution rates are often smaller than those described above because of state intervention through contribution rebates, aimed mainly at reducing labour costs in low-income areas with poor quality of infrastructures (especially in the South). This intervention, takes the form of tax relief and contribution holidays, is progressively losing its importance following recent EC directives. Therefore, average percentages are used in the model in the attempt to take into account the gradual changes in the legal rates. Tax relief is given only on a fraction of the rate of contributions that varies according to occupational status (See Table 3.12). The percentage of the relief varies according to different geographical areas (see Table 3.11). In general it tends to be higher in the South than in the Centre.

Table 3.11 Relief Rate by Geographical Area

Geographical area	Rate of Relief
Abruzzo	12
Molise	12
Campania	15
Puglia	15
Basilicata	15
Calabria	15
Sicilia	15
Sardegna	15

Source: Elaborations from *Prontuario Contributi* Various Years.

Table 3.12 Percentage of contribution excluded from Relief

Type of worker	Rate
blue collars	13.72
white collars	11.5
executives	9.6

Source: Elaborations from *Prontuario Contributi* Various Years.

An additional exemption is calculated on the cost of labour net of tax relief with different percentages according to the regional areas. In the model some average rates are applied to take into account the differences both among areas and the evolution of the fiscal regime across the years. As well as other rebates, the incidence of *Contribution Holidays* tends to be higher in the South than in the North-Centre.

Severance pays

An annual amount, equal to 0.0714 per cent of gross earnings, is paid to a special fund that collects the money necessary for the payment of severance pays. In the model an average amount is imputed for all employees.

Pensioners

All pensioners with an annual income of more than 18 million pay a health contribution of 0.9 per cent of that income. The definition of income includes pension payments.

Self employed contributions

The self-employed pay a health contribution with rates varying according to the level of income (See Table 3.13) and a contribution for social security with rates varying according to the type of occupational status. The average rate is around 10 per cent but the regime is undergoing significant reforms in the latest years leading to a general increase of the rates of contributions. However, due also to the strong under-reporting of self-employment income, the amount of contribution is still very limited.

Table 3.13 Rates of Health Contribution

Income Brackets	Rate	Constant
0	5.6	0
40000	4.6	2240
150000	0	6900

5. Disposable Income

In the tax system disposable income is calculated by subtracting from gross income the amount of taxation due and adding family allowances. It is then necessary to add those income components that are not taxable but that are parts of disposable income i.e. imputed rents, and net financial capital. The model simulates the tax liability for each unit of analysis considered i.e. individuals, nuclear family, and household.

In order to adjust for problems associated with differential reporting of income in the survey relative to that reported to the tax authorities, a number of adjustments have been made. Table 3.14 outlines these changes. This table summarises the different definitions of income used throughout the modelling procedure, the modelling of the personal Income Tax and the procedure followed to take into account tax evasion.

Table 3.14. Summary of the transformation of the data from gross survey values to disposable income

Variables	Comments	Figures comparable with
Gross Survey Income (YL)	Net incomes from the Bank of Italy Survey have been grossed up with the TBM model. (TOTFAM)	Official National Accounts (ISTAT)
Tax evasion (EV) (-)	Amount of income declared to the Survey but hidden to the Fiscal Authorities (estimated by TBM)	
Gross Declared Income (YLD)	Income Declared to Fiscal Authorities	
Imputed rents (-) Financial capital (-)	These income components are not subject to income tax. Financial capital is subject to a separate taxation	
Taxable Income (-deductions)	Taxable Income net of deductions is the base for Personal Income tax.	Fiscal Authorities (Ministero delle Finanze)
Income tax (-) (-credits)	Personal Income tax ,net of credits	Fiscal Authorities (Ministero delle Finanze)
Family allowances (+)		RGSE
Imputed rents (+) Net financial capital (+)	These components were not taxable but they are part of disposable income Financial Capital net of Withdrawal Tax	
Net Declared Disposable Income (YND)	Official value of net income as results from declaration to Official Authorities	Fiscal Authorities (Ministero delle Finanze)
Tax evasion (EV) (+)	The part of income hidden to the revenue office but declared to the Survey is added since it is part of actual disposable income	
Net Survey Income (YN)	Effective disposable Income according to Survey data. This is the Output of the Model. (Disposable income after corrections)	Bank of Italy

Section 4. The UK Tax-Benefit System

This section describes how the UK tax benefit system is modelled in the prototype model. This is only a simple approximation to the actual UK tax-benefit system. Where possible therefore, we will outline what has been left out of the model. The policy instruments simulated in the model include, Income Tax, Social Insurance Contributions (both employer and employee), universal child benefits and means tested benefits. The contents of the section describe the tax and benefit rules. In addition the algorithm for the system is outlined in appendix 3. An outline of the tax-benefit system is described in table 4.1.

Income Tax

Most of the main features of the income tax code have been modelled; tax allowances, age related allowances, lone parent allowance, married couples allowance, the main tax rates and bands. Other tax credits such as life assurance premiums have not been simulated.

The tax base modelled consists of all income sources except for means tested benefits and child benefits., i.e. Gross wage (Labour Costs minus employer social insurance contributions), unemployment insurance benefits, state pension benefits, self employed income, other income, non means tested benefits (not including universal child and one parent benefits), property and investment income and occupational pensions less occupational pension contributions (superannuation).

Every individual gets a single person's allowance which varies by age. There are two age allowances; one for those aged 65 to 74 and one for those aged over 75. Individuals receive the full age allowance if their income is below the Age income limit. The allowance is reduced at the amount of the age allowance taper for each £1 received more than the income limit until the difference between the standard single tax allowance and the age allowance is zero. Any income received above this income tax allowance is charged according to an individual's marginal rate of tax. Income earned above the allowance but less than the lower rate limit is taxed at the lower rate income tax band. Income received in excess of the lower rate limit, but less than basic rate limit is taxed at the basic rate. Any remaining income is taxed at the higher rate.

Table 4.1 Overview of Tax/Transfer System

Calculation of National Insurance Contributions

Total Labour Costs

-Employer National Insurance Contributions

=Gross wage
(Income base for Employer and Employee National Insurance Contributions)

Self employment earnings
(Income base for Self-Employed National Insurance Contributions)

Calculation of Income Taxes

Gross wage + Self employment earnings + Social insurance benefits + Other income + Investment income - Occupational Pension contributions

= Taxbase
(Income base for Income Taxes)

Calculation of Means Tested Benefits

Taxbase - Income Taxes- National Insurance Contributions (Employee and Self employed)

=Net Income before Means tested benefits and Child Benefit
(Income base for Family Credit)

Net Income before Means tested benefits and Child Benefit + Child Benefits
(Income base for Income Support)

Net Income before Means tested benefits and Child Benefit + Family Credit + Child Benefits
(Income base for Housing Benefit)

Disposable Income = Gross wage + Self employment earnings + Social insurance benefits + Other income + Investment income + Untaxed income + Means Tested Benefits + Child Benefits - Income Tax - National Insurance Contributions (Employee and Self employed)

After income tax is modelled for single people, the value of the married couple's allowance (MCA) and the Lone parents allowance (APA) are simulated. Lone parents

are categorised as unmarried people with dependent children.[14] Relief is given at the 20 per cent rate in 1994 (reducing to 15 per cent in 1995) and varies by age. In the model the MCA relief is paid to the husbands rather than being transferable between the couple. The reason for this is that spouses in second couples in a household are not identified. The age related married couples allowance is calculated in the same way as the age related single persons allowance and relief is given at 20 per cent.

Table 4.2 Income Tax Parameter values (£'s per annum)

	1994
Allowance	
Single Personal Allowance	3445
Rates and Bands	
Lower Rate	20%
Lower Rate Band	3000
Basic Rate	25%
Basic Rate Band	20700
Higher Rate	40%
Age Allowances	
Single 65-74 Allowance	4200
Single Over 75 Allowance	4370
Married 65-74 Allowance	2665
Married 75 Allowance	2705
Income Limit	14200
Allowance taper	50%
Married and Lone Parent Allowance	
Married Couples Allowance (MCA)	1720
Lone Parent Allowance (APA)	1720
Relief rate of MCA and APA	20%
Mortgage Interest Relief	
Mortgage Interest Relief rate	20%
Mortgage Interest Max	30000

Another tax credit available to income tax payers is mortgage interest relief. Mortgage interest relief is also allowed in 1994 at the 20 per cent rate. The amount of mortgage interest which can be used for tax relief is limited by a limit on the size of the mortgage on which interest is payable. Any mortgage which is bigger than this limit gets relief at the relief rate times the interest on this upper limit. Total Income Tax

[14] The definition of a child used in the UK Tax-Benefit system is if they are under 16 or if under 19 and in education. Another point to note is that in this model, all children are assumed to be a child of the head of household. A lone parent income tax allowance is therefore only payable if the head of household is a lone parent.

paid is the sum of the taxes paid in each of the bands minus the value of the married couples allowance.

Social Insurance Contributions

Both employee and employer social insurance contributions are modelled. Three categories of employee national (social) insurance contribution are simulated; category 1 for employees, category 2 and 4 for the self employed. Social insurance contributions entitle individuals to contributory benefits such as the state pensions, unemployment and disability benefits. These however are not simulated in the model. Actual payments of these benefits are included in the survey income base however.

Employee national insurance contributions are paid if gross employee earnings are above the lower earnings limit. If so the amount paid is the lower earnings limit times the lower national insurance rate plus the upper national insurance rate times earnings between the upper lower earnings limits. (see Table 4.3) If employees contract out of the state earnings related pension, they are entitled to have lower national insurance. This is not modelled here. Reduced rate national insurance for women who opted for this before 1977 are not modelled. In addition all employee earnings are treated as if they had been earned in the same job.

Table 4.3 Parameter Values for Class 1 National Insurance Contributions (Employees) (£'s per week)

Class 1 NIC	
NIC1 Lower Earnings limit (pw)	57
NIC1 Upper Earnings limit (pw)	430
NIC1 Lower Rate	2%
NIC1 Upper Rate	10%

Table 4.4 Parameter Values for Employer's National Insurance Contributions (ERSIC) (£'s per week)

Employer NIC's	Value
ERSIC band1 (pw)	57
ERSIC band2 (pw)	100
ERSIC band3 (pw)	145
ERSIC band4 (pw)	200
ERSIC rate1	3.00%
ERSIC rate2	5.00%
ERSIC rate3	7.00%
ERSIC rate4	10.20%

Employer's national insurance contributions are also paid for employees who are below the pension age (65 for men and 60 for women). There are four different bands of employer social insurance. (see Table 4.4) Unlike the different bands of the income tax system, the average contribution is the contribution rate of that band. In other words, if an individual's earnings fall in band 4, then all their income faces a

contribution rate in the third band. Unlike the employee contribution, their is no upper earnings limit.

The self employed pay insurance contributions in two categories, 2 and 4 (see Table 4.5). Category 2 insurance is a flat rate payment and is payable if the individual earns more from self employment income than the NIC2 lower earnings limit. Category 4 national insurance contributions are paid in addition to category 2 insurance if an individual has self employment earnings greater than NIC4 lower earnings limit. The amount paid is the NIC 4 rate times the self employment income earned between the lower and upper earnings limits.

Table 4.5 Parameter Values for Class 2 and 4 National Insurance Contributions (Self-Employed) (£'s per annum)

Self Employed	Value
Class 2 NIC	
NIC2 rate	5.65
NIC2 Lower Earnings Limit (p.a.)	3200
Class 4 NIC	
NIC4 rate	7%
NIC4 Lower Earnings Limit (p.a.)	6490
NIC4 Upper Earnings Limit (p.a.)	22360

Child Benefit and One Parent Benefit

Child benefit and one parent benefits are universal payments paid to parents with children. Child Benefit is a payment made to all households with children and is paid for each child. A higher level of child benefit is paid to the first child. One parent benefit is paid only to lone parents and is paid only once irrespective of how many children the person has. One parent benefit is payable if the number of children is greater than 0 and if there are no other individuals aged over 18 in the household.

Table 4.6 Child Benefit Parameters (£'s per week)

Child benefit	Value in 1994
CB (first child)	10.2
CB (other children)	8.25
One Parent Benefit	6.15

Means Tested Benefits

A number of means tested benefits are modelled; income support, family credit and housing benefit. Council tax benefit is not modelled because council tax is not simulated.

Eligibility is first determined. The maximum amount of benefit is then determined. The actual amount of payment if any is then simulated after estimating the means of

an individual and household. Basic eligibility conditions are modelled, including the number of hours worked and whether the benefit unit has too much capital. Benefit unit characteristics are used to model the maximum payment, including age, number and ages of children and marital status.

There are two means tests used for each benefit, an income means test and an asset means test. As the survey does not contain asset values, total assets are determined on the basis of total investment income. Total assets are simulated by dividing annual investment income by the interest rate. The actual asset means test used is as follows. The first £3000 of capital is disregarded. Imputed income from capital is then assumed to £1 per week for every £250 of capital over this amount. This imputed income counts as means for each of the means tested benefits. There is an asset ceiling which varies across the benefits, above which no benefit is paid.

An issue which affects total expenditure on benefits is the take up of benefits. Research (Fry and Stark, 1989) has shown that not everyone entitled to a benefit actually takes up their entitlement and that this take up rate varies by benefit. Table 4.7 gives the estimates used in POLIMOD (Redmond and Wilson, 1995). In order to carry out cross-national analyses, we need to agree on a common basis for the incorporation of take-up estimates. Until further work is done however, we assume that take-up is 100 per cent. In other words we assume that everyone entitled to a benefit receives it.

Table 4.7 Take-up rates by means tested benefit.

Benefit	Take up rate
Income Support	0.8
Family Credit	0.62
Housing Benefit	0.91

Income Support

Income support is the main social assistance benefit of those who are out of work or those in part-time work. An individual is eligible if their total assets are less than the upper limit or if their or their spouses hours worked are under 16 hours per week. Income support is modelled on a Family Basis. In other words adults or couples plus their dependent children are treated as separate families for Income Support calculations. However as outlined above, children in this model are assumed to be dependent upon the head of household.

An individual is eligible for consideration for income support if their total assets are below a limit ,if their or their spouses hours worked per week are less than 16, if aged 18 or over and not a student.

If an individual is eligible for income support, then their maximum payment is simulated. This is the payment they would receive if they had no means. There a number of factors which determine the maximum level of payment. These are age, marital status and the presence of children. Quite a number of characteristics are not modelled. These include disability status, caring for someone and housing costs and other disregards.

If a family has a child then, a number of additional payments are possible. A Family Premium is paid if a an individual has at least one child. Only one payment is made per benefit unit. If an individual is a lone parent, then they are entitled to the lone parent premium. Finally for each child the benefit unit receives extra payments depend on the number and age of the children.

The maximum income support payment made is determined on a family basis. If a family consists of a couple, then maximum income support payments for both spouses are added to get a family total. Otherwise the individual components are added to get their maximum income support payment.

The means of an individual are now determined. The amount used is the after tax income before means tested benefits are calculated minus the Income Support Earnings Disregard plus Child Benefit plus One Parent Benefit plus Imputed income from Assets.

Also if the amount of income support paid is greater than zero, then mortgage interest is paid as part of the income support benefit.

Table 4.8 Parameters used in calculating Income Support in 1994. (£'s per week)

Income Support	
Personal Allowance 18-24	36.15
Personal Allowance Over24	45.7
coupleAllowance	71.7
Child Dependent Payment Under 11	15.65
Child Dependent Payment 11-15	23
Child Dependent Payment 16-17	27.5
Child Dependent Payment Over 18	36.15
Family Premium	10.05
Lone Parent Premium	5.1
Age Premium 60- 74 (Single)	18.25
Age Premium 60- 74 (Couple)	27.55
Age Premium 75- 79 (Single)	20.35
Age Premium 75- 79 (Couple)	30.4
Age Premium Over 80 (Single)	24.7
Age Premium Over 80(Couple)	35.3
Cap Lower Limit (per annum)	3000
Cap Higher Limit (per annum)	8000
Earnings Disregard	5

Family Credit

Family Credit is an in work social assistance benefit paid to families with children. The payment is open to both employees and the self employed. As is the case with other child payments, only the head of household is simulated as all children are assumed to be dependent on the head of household.

A family (single person or couple) is eligible for Family Credit if they have at least one child, one parent works at least 15 hours per week and have capital less than the upper limit for Family Credit.

Maximum Family Credit depends on the family composition and since 1995 on the number of hours worked. The maximum Family Credit is composed of the Adult Credit plus (since 1995) an additional amount if one parent works at least 30 hours per week plus amounts which vary with age for each dependent child.

The actual amount received depends on the total income of the family. The amount of by which the payment is reduced is Total income plus imputed value of income less the Family Credit Taper Threshold all times the Family Credit Taper .

Table 4.9 Parameters used in calculating Family Credit in 1994. (£'s per week)

Family Credit	
Adult Family Credit	44.3
Adult Family Credit30	0
Child Family Credit 1-11	11.2
Child Family Credit 11-15	18.55
Child Family Credit 16-17	23.05
Child Family Credit 18	32.2
Taper Threshold	71.7
Capital Higher Limit (per annum)	8000
Capital Disregard (per annum)	3000
Capital Child Limit (per annum)	3000
Taper	70%

Housing Benefit

Housing Benefit is a social assistance payment made to cover housing rental costs. Housing Benefit is modelled as total rent minus any income earned over an amount dependent on family circumstances.

A household is entitled to housing benefit, if they have assets less than the asset threshold. Neither the head of household or their spouse can be aged 18 or under or be students to be able to receive benefit.

An amount called an applicable amount is deducted from income which depends on a number of factors including marital status, number of children and age. The largest part of the applicable amount depends on marital status. There are three different rates depending on whether an individual is single, married or a lone parent. These rates vary by age (see Table 4.10).

Table 4.10 Parameters used in calculating Housing Benefit in 1994. (£'s per week)

Applicable Amount	
Single 18-24	36.15
Single Over 25	45.7
Lone Parent Under 18	36.15
Lone Parent Over 18	45.7
Couple Under l18	54.55
Couple Over 18	71.7
Family Premium	10.05
Lone Parent Prem	11.25
Age Premium 60- 74 (Single)	18.25
Age Premium 60- 74 (Couple)	27.55
Age Premium 75- 79 (Single)	20.35
Age Premium 75- 79 (Couple)	30.4
Age Premium Over 80 (Single)	24.7
Age Premium Over 80(Couple)	35.3
Child Dependent Payment u11	15.65
Child Dependent Payment 11 15	23
Child Dependent Payment 16 17	27.5
Child Dependent Payment 18	36.15
Non-Dependent Adults in Household	
Non-Dependent Adult band1	72
Non-Dependent Adult band2	108
Non-Dependent Adult band3	139
Non-Dependent Adult band1 Amount	5
Non-Dependent Adult band2 Amount	9
Non-Dependent Adult band3 Amount	13
Non-Dependent Adult band4 Amount	25
Earnings Disregards	
Earnings Disregard Single	5
Earnings Disregard Lone Parent	25
Earnings Disregard Couple	10
Withdrawal Rate	65 per cent

A household will receive the largest applicable amount they are entitled to. In addition to the basic marital status dependent applicable amount, extra amounts are added for each child and for pensioners. These calculations are similar to those made for income support. Child payments vary by the number of children and by their ages. Families with at least one child will also get an additional family premium added to their applicable amount. Lone parents in addition get another premium.

Total applicable amount is equal to the sum of the marital status applicable amount plus any premia entitled to. Family Excess income can now be calculated. This amount will be subtracted from rent. Family Excess income is total net income (excluding income support) minus the total applicable amount minus an earnings disregard (if an individual is in employment).

The income definitions used here is disposable income including family credit and child benefit, but not including income support plus an imputed income from capital. Individuals with earned income (i.e. employee or self employed income) are entitled to the earnings disregard. This depends on marital status.

Total Housing Benefit is therefore Total Rent minus a deduction made for non dependent adults in the household minus a withdrawal rate times Family Excess Income. The withdrawal rate used is 65 per cent. The deduction made for non dependent adults residing at the same address depends on their gross income

4.2 Validation

In this section we describe a simple validation experiment. Our objective here is to simulate taxes and benefits as closely as possible. One validation method would be to compare our forecasts with the actual situation in 1994. However as the data is old (1991), comparisons may be inaccurate. Instead we compare our forecasts with those of a model which uses similar methods and data. Here we compare our aggregate results with output from POLIMOD. POLIMOD has been extensively validated (see Redmond and Wilson, 1995). Both models also are based on the same dataset. Therefore a more appropriate validation procedure is to compare the output of both models. Table 4.2.1 outlines this comparison. The first column is the output from the UK prototype model, where full take-up of benefits is assumed. Column two contains POLIMOD output with full take-up of benefits. Aggregate totals of taxes and benefits simulated are given. As the income bases are slightly different, as the unit of analysis is different and as the Eur3 module has only 1000 households, compared with over 7000 in POLIMOD, one would expect differences. However the estimates are reassuringly close.

Table 4.11 Modelled Tax Benefit Aggregate Payments and Receipts (in £m)

	prototype 1996	POLIMOD
Means tested benefits	19213.9	18725.5
Child Benefit	6391.2	6459.8
Income taxation	70850.5	71662.1
Employee National Insurance Contributions	24436.3	22142.0

Source Eur3 and POLIMOD

Section 5. Tax Evasion in Italy: Grossing-up and Correction

The Bank of Italy's Survey collects data on income values net of taxes and including benefits. The grossing up procedure from the net values to the gross ones, needed as an input for the microsimulation model is not straightforward given the high rate of under-reporting of income that characterises declarations to the fiscal authorities. Comparisons with the aggregate values, indicate that survey data benefit from a more truthful declaration of effective income. The value of survey disposable income is therefore made of two components. The first one resulting from the amount of gross income that is declared to the Fiscal Authorities and on which taxes are paid (or benefits received). The second one which is the part of gross income hidden to the Fiscal Authorities but declared to the interviewers of the Bank of Italy[15]. When modelling the tax benefits system these behaviours are taken into account to avoid generating aggregate results of the fiscal revenue that reflect *potential* but not *effective* liabilities. One way of taking them into account is by the estimation of the evasive/elusive behaviour according to households' characteristics- mainly level and type of income- in order to correct the income figures declared to the survey interviewers.

The gross income data were provided by Dino Rizzi (University of Venice, Cà Foscari) as results of a simulation with the TBM static microsimulation model. The TBM model includes, along with personal income tax and capital taxation, rates of fiscal evasion which permit us to derive tax liabilities consistent with fiscal data according to the following steps :

1. Income from survey data (YN) is corrected with the estimate rates to obtain the values declared to the fiscal authorities (YND). (YN-YND) = EV is the amount of tax evasion estimated.
2. Since taxes and benefits are levied on the latter notion of income (YND) this value is grossed up to go from the net value to its gross one (YND + TAX)=YLD
3. The actual value of gross income (YL) is obtained by adding the estimated amount of tax evasion that was excluded from the declaration to the Fiscal Authorities.(YLD+EV=YL) .

The following table shows the difference among aggregate values of gross income before and after the correction for tax evasion according to the procedure described above.

[15] Part of the *non-declared* component, however, is probably due to elusion and tax-expenditure in general that are not easily detected within the microsimulation model.

Table 5.1. Comparison of Gross Survey Income and Estimated Gross Income declared to Fiscal Authorities.

Types of Income	Gross Income (YL) *(thousands billions)*	Gross *Declared* Income (YLD) *(thousands billions)*
Total	889	799
Earned Income	408	399
Self-employment Income	111	57
Pensions	185	181
Other Transfers	7,93	7,45
Capital Income	178	155

Source: Elaboration on 1000 Sub-sample of data from TBM and Bank of Italy

MODIT94 uses the values of YL as input. The procedure followed within the model to obtain net disposable income from gross income follows these steps:

1. YL- EV = YLD (Income declared to the fiscal authorities)
2. YLD-TAX = YND (Disposable income as resulting from the declaration to the fiscal authorities)
3. YND +EV=YN (Effective Disposable income)

However, aggregate figures from survey data (YL), even if higher than those declared to the Fiscal Authorities are much less than the figures of gross income given by the Official Statistics (ISTAT). There is a lot of evidence to believe that the survey data also understates the official value of variables with different magnitude according to different types of income. While dependent income is only slightly under-reported and transfers seem not to be declared for approx. one fourth, almost a half of self-employed income is not declared. The phenomenon is even clearer for income from financial assets of which less than one third appears to have been declared in the survey[16].

An experiment was made to make the survey data consistent at national level with National Accounts using different rates according to the type of income. This procedure should have avoided the distortion coming from the adoption of a unique grossing-up factor, which implies the hypothesis of proportionality of non-declaration for any level and type of income. Deciles of household's disposable income and the effective tax rate before and after the corrections were compared. The distribution of income changed substantially and the progressivity features of the system appeared to be seriously weakened. (Income tax rate is even slightly regressive in the middle of the distribution). Income of the first decile rose considerably presumably according to very diffused areas self-employment income together with an enormous increase in the last decile of the distribution due to the concentration in that part of the distribution of income from financial assets.

[16]The presumed rates of underestimation are due to a variety of previous studies on the rate of tax evasion (See Bernasconi, Bernardi, Monacelli).

Since the precise quantification of this amount of underestimation is quite controversial[17] the assumption followed in the present model is that Survey data are an acceptable proxy of reality. The gap with National Accounts is taken into account in the calculation of the real Parity of Purchasing Power that brings all national survey figures to the standard coming from European economy/OECD statistics. This implies a bias since all monetary values are grossed up by the same ratio while the amount of underestimation differs significantly according to income sources.

Section 6. Computing Issues: Some Technical Considerations.

This section describes briefly the computing strategy taken in building the prototype model.

SPREADSHEETS

6.1. Our first decision was to use a spreadsheet as the computing environment for our modelling. The reason for this choice was not only that spreadsheet technology was the most universal tool we could find for calculation purposes but that it kept the model transparent and easy to modify by all members of the team. Modern spreadsheets include an important set of add-ons that increase productivity (sorting tools, graphs, synthetic tables, etc.), and keep good bridges to word processors and the Internet. From our point of view of modellers wishing to keep everything visible in spite of a certain slowness of simulations, spreadsheets provided a reasonable trade-off between comfort and efficiency

6.2. We introduced our model and data into spreadsheet files. We put data on a sheet and tax-benefit equations on another sheet. Since data came from external files we had to perform some import and check operations (missing data, blanks instead of zeros and other similar corrections).

On the other hand we wrote the equations representing the fiscal and social model: no special problems appeared at this stage since this operation consists simply in writing formulas in the formal language of the spreadsheet. It is important to keep equations clear and detailed enough to allow for future modifications and to give a certain structure to the sheet: one block for employee's contributions, another for employer's contributions, a third one for income tax, another block for family benefits (eventually split into several sub blocks if necessary).

Since spreadsheet optimal strategy is to compute all cells at once rather than call several times a function for every person in the household, we chose a structure where each person in a household was located in one column, and formulas written for first member in the household (in first column of the block) were copied for other members

[17] The precise estimation of the amount of non-declared income is object of continuous revisions since National Accounts estimations are based on assumptions that are not thoroughly accepted. See for example D.Rizzi et al. where indirect methods of evaluation of under-reporting of Survey data reduce this amount to only 10%.

(subsequent columns). The shape of our sheet was thus defined: vertically one column per each person in the household plus a column for the household collective results and, horizontally blocks of lines grouped per subject.

A macro organised the transfer of data towards the model sheet to compute tax and benefits for each of the individuals and to store the results after calculations (for a detailed description of the problem of submitting a set of individuals to the equations of a sheet, see section 5 below)

DATA

6.3. Harmonizing the structure of datasets for all countries was decided in order to keep the possibility of using data of one country with the model of another country. We were strict on that point and we defined a common list of variables as a pattern for all countries: several problems arose immediately such as differences in definitions (as, for instance, taxable income or how family composition is considered in fiscal calculations). We decided to keep a set of variables that were common to all tax-benefit systems, plus another set of country specific variables (less than 10 per cent of the variables were in the second set). Many efforts were necessary to harmonise the most important variables (gross income, net income, contributions, benefits)

NATIONAL MODULES

6.4. National modules were written separately by two different teams and, although some guidelines had been proposed, the structure and look were quite different. We planned then to rewrite models partially in order to make them more close, but the task appeared too long to be worth the effort. We proceeded then to define a table of results that should be common to all national modules. This table contains the set of most significant and more frequently used results.

We concluded that for national modules to come we will not try to impose a given structure but to use existing models as an example and a reference, and, to strongly recommend the usage of a common table of results

COMPUTATION PROBLEMS

6.5. An important problem appeared when simulating models for medium size samples (1,000 to 3,000 households): running time was quite significant (20 to 30 minutes on first generation Pentiums at 120 Mhz, with 8 Mb of RAM, running 16 bits applications). Trying to reduce simulation time took a lot of effort and needed a series of trials

6.5.a) Computing the equations written on a given sheet for each individual of a dataset located on another sheet was more difficult than we thought at first. The problem was not to find the fastest algorithm (irrelevant in the case of fiscal systems), but, to optimise the operations of bringing individual data to the model sheet and to save results in another sheet. We thought we could use three dimension references to point to cells in another sheet, or visual basic instructions to handle data to and from one or several

sheets, but we soon realised that three dimension references were not efficient for transferring data. Also basic, instructions were very slow when the sample was more than 100 individuals and very difficult to modify if new variables had to be introduced in the dataset.

6.5.b) Our first approach was a multiple step mechanism: at first, switch off automatic calculation, then copy all individuals from data sheet to model sheet and, then, for each individual:

a) copy its data to an exchange line on top of sheet,
b) copy the data from the exchange line to the block of input cells of the model,
c) activate calculation to get the results for the current individual,
d) transfer the results to the exchange line,
e) copy results from exchange line to the results area of model sheet.

After all individuals had been submitted, results of all individuals were stored again in the data sheet and all the temporary data stored in the model sheet was cleared.

This is a simple approach quite easy to implement but subject to several major defaults. First, space occupation is not optimal since data is duplicated before simulation; second, computation time appeared to be bigger than expected due to the number of elementary copy operations repeated for each individual; third, sheets for data, model and results had to be stored altogether in one workbook, whose size was consequently important, and fourth, the tool lacked flexibility, since altering the list of variables that are input (or output) of the model implied modifying the macros that exchanged data between the model and the sheets with data and results.

6.5.c) A second approach proved to be more efficient but without completely getting rid of some rigidities. We introduced named cells in the model and data sheets and we could then save an important number of operations: transfer from one sheet to another was now organised using named cells, since referring to a named cell in a formula automatically brings in the value in that cell. Input cells of model sheet refer to named cells of exchange line of data sheet, i.e., no more copying data from one sheet to another was required, (and, similarly, output cells of model sheet are named cells that are referred to by results cells of data sheet).

The process becomes now: at the beginning switch off automatic calculation and, then, for each individual in the sample

a) copy data to exchange line (now located in the sheet where data are stored),
b) transmission of data to input cells of model sheet is operated through names
c) activate calculation of model sheet to get results for current individual,
d) transmission of results to exchange line of data sheet takes place now through named cells,
e) copy results in exchange line of data sheet to the results area.

This approach has several advantages with regard to our previous approach (it is simpler in its mechanism, the macro becomes much shorter, it is faster when running, it involves less elementary operations and no additional space is required for simulation), but it keeps some of the disadvantages found in the previous approach : all sheets must be in the same file and any modification of the data set requires adapting the macro to the new location of data in the sheet.

EXCEL has a problem with references when a sheet is copied. References often link to the previous workbook and not the current. These links are in fact an important rigidity of these files, as any modification of a file requires, at least, one of the following actions: a) cutting the links, b) recreating the links, c) testing if the resulting links match the desired relations between sheets

6.5.d) A third approach reduced most of the previous problems and gave us more flexibility. The basic idea is to handle separately the files (or sheets) with data and equations and to link them only at the moment of running a simulation.

This temporary link can be operated by declaring object variables and assigning them to groups of cells (any element of a spreadsheet file can be referred to as an object, including the file itself): as the program can manipulate these object variables as standard variables, assigning data cells to a variable and input cells to another variable, data transfer becomes as easy as exchanging the contents of two variables, no matter where these contents are located. That is, object variables may be assigned to sheets (or blocks of cells) in different workbooks, without loss of performance. Hence, working simultaneously with sheets in several workbooks is now possible and gives much flexibility to simulations.

The mechanism is now the following:

a) assign input cells to an object variable (VINP) and output cells to another object variable (VOUTP)

b) run the simulation by

- i) putting input data in VINP into model sheet
- ii) computing results
- iii) storing results from model sheet to output variable VOUTP

c) erase object variables from memory.

There are several advantages in this method: each element is independent of the others and can be stored in a separate file and, as a consequence, files can be smaller than previously, no identical data is repeated in several files, and there is a dramatic reduction of simulation time (about 40 per cent). There are some minor disadvantages: it is necessary to keep track of the files intervening in a simulation, and before simulation starts the user has to give the name of all files for a simulation.

We have been using this method with success for our simulations, and have found that it works properly for samples of up to 6000 households with no more than 200 variables. Reduction of simulation time was the improvement we appreciated the more, as it gave way to simulations that were not conceivable before.

CONCLUSION

6.6. Spreadsheets, although useful have a number of important caveats when applications involve more than two or three users. First, the fact that all formulas in a sheet are always open for modification implies that, when an application is ready, it is quite difficult to keep all elements steady, as any change in a cell may alter many derived calculations. Second, and as a consequence of the previous remark, the authors of an

application distributed among users lose control of it and become thus unable to solve any problem that may then arise (unless using a very restrictive protection of the contents of the model that would reduce access far beyond reasonable level). Notice also that it becomes nearly impossible to provide any kind of distant assistance (hot line), as it is very difficult to know the actual state of the application when users call for help. Complete openness of spreadsheets, is their most attractive quality but happens to be their Achilles' heel, as they can move too easily.

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Appendix A.1 The Samples

1. French sample

The basic dataset is taken from the survey "Budget des Menages 1989" by the Institut National de Statistique et des Etudes Economiques (INSEE). The survey collects a representative sample of 9037 households representing 21.7 million of households. Before using the data, two main problem had to be dealt with :

a) some of the individuals of the sample could not or did not want to answer to some of the questions asked thus giving rise to the phenomenon known as Non-response item,
b) other individuals gave non consistent answers to questions, and as a result the observation cannot be used. This is the case, for example, for those people who declared themselves to be employees while they were providing no information on their salary.

Because of non-response items, a certain number of observations (25 representing 50 thousand families) had to be eliminated from the sample.

The second problem could be solved using a bottom coding procedure. The idea underlying this technique is to constrain one or more economic variables to a minimum value according to some criteria of consistency with the economic phenomenon being observed. In our case the hypothesis made was to assume that the head of household's work status could not coexist with a family income below a certain threshold. Therefore a threshold of 16 000 Fr of primary income (intended as the sum of all gross incomes net of social contributions before social assistance) was assumed to be the minimum

acceptable for households whose head work status was in one of the following positions : employees, independents and executives. This procedure ended out with the elimination of 590 observations (representing 1.42 million of households) who did not match the criteria.

All economic variables were grossed up (for inflation and growth) from 1989 to 1994 by 11.6 per cent. At this stage no changes in the social and demographic structure of the population were taken into account.

After the non-response and the bottom-coding elimination steps, we picked up a random subsample of 939 households for the simulations. This reduced sample was required since running simulations on the whole sample was taking too long a time

The structure of the sample was determined by the need to have the same structure for all countries in the Euromod project: some variables were included (or calculated) in order to compare them with Italian or English variables. Thus the final set of variables is the result of aggregating three sets of variables that are requested to run the simulations for France, Italy and UK

Records are composed by groups of variables that differ from each other in the level of disaggregation : the first group contains family variables (see table 1), the other five groups contain variables that refer to each of the potential income earners (people earning incomes and/or over 16). All potential earners (the first is by definition the head of household) are individually described while other members of the household (those under 16) are included only through some variables according to their demographic status (these variables are included in the group of family variables)

When the composition of the household is such that it could not be completely described (households with six or more potential earners), we have kept the economic information by summing the incomes of those not described in the five persons while we have dropped the demographic information.

In addition to the uprating of 11.6 per cent previously described for all economic variables, we have done a second correction of 2.32 per cent, corresponding to a 1994-95 shift, that applies to calculations of social contributions and family allowances (these corrections are not included in the database but appear in the corresponding equations)

We have not assumed any modification of the demographic structure of the population (i.e. we have not modified any of these variables) and we have not taken into account the problem of *Take up*, but we have assumed that a person gets always the allowances he is entitled for and pays the taxes he is subject to.

2. The Italian Sample

The dataset used for Italy is the 1994 Survey of the Bank of Italy on 1993 Household Income and Wealth (SHIW93) covering 8089 households representative of the whole Italian population. Municipalities are first divided into 51 strata (17 regions and three classes of population size) and then families are selected from the registry office records.

Families are interviewed at the beginning of the year about their income and personal characteristics of the previous year. Detailed information on income is available at an individual level while data on wealth are collected at the level of the household. Data on wealth are considered to be less reliable than data on income. In general the response rate tends to be inversely correlated with the level of income thus generating an underestimation of the mean and dispersion of income.

Some questionnaires, which contained data inconsistencies (e.g. those with savings greater than income and negative savings greater than consumption), were discarded if the inconsistency could not be found.

The definition of household adopted by the Bank of Italy includes "all persons living together because of family ties or affection and sharing part of their income". This definition, broader than the one adopted by the ISTAT leads to a higher average number of household members.

Survey data can be grossed up to aggregate values thanks to appropriate weights assigned to each household according to its probability to be included in the survey. The grossing up can be achieved at a household level -calculating the grossing up factor by dividing the total number of households (approx. 20 million) by the number of households present in the survey-or at an individual level-total population divided by total number of surveyed. The former method is the one adopted in the model.

The available data used by the prototype model come from the 1994 Survey conducted by the Bank of Italy on households' Income and Wealth of the previous year (SHIW93). Thus, in order to have comparable data from the different countries all monetary variables have been up-rated to the year 1994 with different parameters obtained from Official National Accountsˆ according to the type of income. The up-rating factor, including both growth and the rate of inflation is on average equal to approx. 5 per cent.

A sub-sample of 1000 household was extracted from the original sample to allow high manageability of the prototype model. The Italian sample was stratified with the employment status of head of household to ensure an acceptable partition of income among its different types.

3. The United Kingdom Sample

The base survey used by the UK model is the 1991 Family Expenditure Survey This dataset is described in detail in Kemsley, Redpath and Holmes, (1980) and CSO (1991). The FES is a household survey collected by the Office for National Statistics (ONS).

The survey is collected by means of interview and a two week expenditure diary. The survey collects detailed information at the individual level on both current weekly incomes and expenditures, as well as other socio-economic labour market and demographic variables. There are no data on wealth in the survey. However estimates can be imputed from questions on interest and dividends. Some data is also collected

at the household level; these include region, quarter of the year the household was interviewed and the value of their dwelling.

There are 7056 households, 8724 benefit units and 17,089 individuals in the sample. The definition of a household used is "one person living alone or a group of people living at the same address having meals prepared together and with common housekeeping". The sampling frame used is the postcode address file, which is the sampling frame used for other continuous surveys carried out by the ONS. The Northern Ireland sample was drawn as a random sample. The sample was stratified by regions, area type, the proportion of owner occupiers and the proportion of renters.

The response rate was 69 pre cent. Redpath (1986) found that there were lower response rates from households without children, where the head of household has ever been self-employed, older households, in multi-car households and in households living in dwellings with lower valuations.

Average income recorded in the FES has been found to be low relative to National Accounts, especially for self-employment and investment income. In the UK module, self employment and investment income are grossed up by a factor for use in ranking households and as part of the total disposable income. It is not included as part of the tax base, nor in included as means for means tested benefits. There is also an under-representation of female part-time earnings and the top 1 per cent of earners (CSO, 1991). Item non-response is imputed by the ONS.

Besides the transformation of variables, a number of other adjustments have been made to the data. The primary purpose of this is to allow analyses to be carried out for 1994 on 1991 data. The uprating procedures used in this model are similar to those used in the UK static model, POLIMOD and described in (Redmond and Wilson, 1995). Another adjustment is used to account for underreporting of investment and self-employment income. These incomes are increased by 19.5 per cent when ranking households to account for underreporting. However this increase is not included in the tax base.

Appendix A.2 Definition of the Variables

In this section, we describe the construction of the dataset used by the prototype model. We shall describe how the new dataset was constructed and the recoding of variables which was necessary.

A.2.1 Construction of the database

The prototype model is run using a random 1000 sample from each of the surveys. The data was first transformed from an individual level file to a household level file. Individuals were categorised as either adults or children (under 16). Table A.2.1 describes the variables contained in the dataset and their equivalent in each of the national datasets. A number of adjustments and assumptions have been made in creating this sample.

- Households are assumed to have at maximum 5 people over the age of 16.

- The unit of analysis modelled are only household and individual. Couples are only modelled for the head of household.
- All children are assumed to be dependent on the head of household.
- A number of variables have been aggregated together or recoded.

Recoding of variables

A number of variables had to be recategorised to produce common definitions across the countries modelled. These were

- Children's Age
- Employment Status
- Occupational Status
- Employment Sector
- Marital Status
- Relationship with Head of household
- Education Status
- Family Type

Children's Age
In the UK dataset, children's age has been recoded, so that all those aged zero years to have an age of 0.01. This was done in order to distinguish them from missing values in the flat file format (Missing values are coded as zero).

Employment Status
Employment Status has been recoded. The detail required by the other systems is not available in sufficient detail in the FES. Therefore only a subset of categories are used. These are outlined in Table A.2.2. For example an employee has been recategorised as category 6, blue collar workers. However being a blue collar worker as opposed to any other worker does not influence the UK simulation model. The two categories of unemployment status have been amalgamated. Sick and inactive have also been recoded into the same category.

Table A.2.1 Description of Household Level Variables used in the Eur3 Prototype

Variable Name	Definition	France: INSEE	Italian	UK: FES
Household Level				
idm	Household ID	idm		Hhid
Type	See table A.2.9	Type	PARENT(see code C5)	
Quarter	Quarter of the year household surveyed	Quarter		A099
HSGvint	Vintile (Gross income)	HSGvint		
HSGpcVint	Vintile (Gross income per capita)	HSGpcVint		
HSFSdec	Deciles of family size	HSFSdec		
DPT	Location	DPT	IREG	a098
Ponder	Population weights;	Ponder	PESOFL	wt91
Monloy	Gross rent	Monloy	TFITTO	RENT
Monloy2	Gross mortgage interest	Monloy2		GROSSMI
HousePrice	Price of house	HousePrice		
YCR	Interest of bank deposits	YCR	YCF1is (gross value of YCF1)	
YCF2is	Interest of Public Debt	YCF2is	YCF2is (gross value of YCF2)	
YCF3if	Interest of other financial products	YCF3if	YCF3is (gross value of YCF3)	
YCF4	Passive interests	YCF4	YCF4	
Revenu	Taxable household property income(from renting property and financial assets)	Revenu	*KYC-YCR3(imputed rents)	
KPITAL	Total investment income	KPITAL	*KYC (gross value of YC)	INV
NBPERS	Number of persons in household;	NBPERS	NCOMP	
cha1-cha8	Age of child 1-8	cha1-cha8	ANASC	a005

Table A.2.2 Description of Individual Level Variables used in the Eur3 Prototype

Variable Name	Definition	France: INSEE	Italian	UK: FES
Sex	Gender of first adult; 1 male; 2 female	Sex	SEX	a004
Age	Age	Age	ETA	A005
CSC	Employment Status (See table A.2.3)	CSC	APQUAL, APNONOC	A200
Statu	Occupational Status (See table A.2.4)	Statu	APSETT, ASNONOC	
Matri	Marital Status (see table A.2.6)	Matri	STACIV	based on A006
Ysal	Gross weekly wage	Ysal	*KYL(gross value of YL)	GWAGE
Cho	Unemployment Benefit	Cho	CIG	UB
Pen	Current State pension	Pen	*KYTP(gross value of YTP)	PEN
Inc	Self employment income	Inc	*KYM	SEINC
Otres	Other income	Otres	*(KYTA-CIG)	oynt+oyt+stgrant+ppen+cov+babysit+fosteral+maint+relly
Curred	Current Education level	Curred		AOO7
Hrs	Normal weekly hours of employment	Hrs		HRS
Nmtb	Non means tested benefits	Nmtb		b337+war+mobal+attal+smp+ssp+train+oben+indis+ica+sda+wid+mat+ivb+sick
PropInc	Individual investment income	PropInc		inv1a+inv1b+inv2+inv3
SUPER	Superannuation payments	SUPER		
Open	Occupational Pension	Open		
Lien	Relationship to Head of Household (see table A.2.7)	Lien		based on A002

*Gross values from TBM, see infra.

Table A.2.3 Recoding of Employment Status (CSC)

Eur3 code	Definition (Eur3 and France: INSEE)	UK: FES code(A200)	Italy: SHIW	Presence in Italian survey
0	missing value			
1	Farmer			
2	Employer or self-employed (non farmer)	2. Employer or Self employed	Occupato indipendente: APQUAL 6:libero professionista APQUAL 8 lavoratore autonomo APQUAL 9 titolare o coadiuvante di impresa familiare APQUAL 10 socio/gestore di società	7.86%
3	Business executive and assimilated		APQUAL 5 : dirigente, alto funzionario, preside, direttore didattico, docente universitario, magistrato	0.6%
4	Supervisor and intermediate decision positions		APQUAL 4: impiegato direttivo/quadro APQUAL 3: insegnante di qualsiasi tipo di scuola inclusi incaricati, contrattisti e simili	10.99%
5	White collars		APQUAL 2: impiegato	9.71%
6	Blue collars	1. Employee	APQUAL 1 : operaio e posizione similare (inclusi salariati e apprendisti, lavoranti a domicilio).	11.75%
7	Pensioners	6. Retired	APNONOC 5 : pensionato da lavoro APNONOC 6 :pensionato non da lavoro (invalidità/reversibilità sociale)	22.49%
8	Unemployed	3. and 4. Out of Work	APNONOC 1: in cerca di prima occupazione APNONOC 2 : disoccupato	7.19%
9	Education		APNONOC 7 : studente	18.86%
10	Inactive	5. Sick or injured; 7. Unoccupied	APNONOC 3: casalinga APNONOC 4: benestante APNONOC 8 : bambino età prescolare	17.45%
11	Other		APNONOC 9 : in altre condizioni	0.19%

Occupational status

Table A.2.4 Occupation Status

Eur3 code	Occupational Status and France (INSEE)code	Italy: SHIW classification
1	Civil servant or employed by the Government	1.Lavoratori dipendenti Pubblica Amministrazione
2	Employed by Local administration	(APQUAL <=5 & APSETT =9,10)
3	Employed by Public enterprise	
4	Other wage earner	2. Altri lavoratori dipendenti
5	Employer or self employed	3. Lavoratori indipendenti
6	Unpaid worker in family business	
7	Non declared	

Note This variable is not available for the UK.

Employment Sector

Table A.2.5 Employment Sector

code	definition
0	missing value
1	Agriculture
2	Industry (excluding building)
3	Building
4	Distribution.
5	Transport and Communication
6	Bank and Insurance
7	Services
8	Public Administration

Marital Status

Table A.2.6 Recoding of Marital Status

Eur3 code	Definition (Eur3 and France: INSEE)	Italy: SHIW	UK: FES code(A006)
		STACIV2 & ETA<16	
0	Child less than 16	STACIV2 & ETA >=16	
1	Single	STACIV1	1,Single
2	Married	STACIV4	1., 2. Married and 3. Cohabitee
3	Widowed	STACIV3	3.Widowed
4	Divorced or legally seperated		6. Divorced, 7. Seperated

Relationship with Head of household

Table A.2.7 Relationship with head of household

Eur3 code	Definition (Eur3) and France: (INSEE)	Italy: SHIW	UK: FES code(A002)
0	missing value		
1	Husband, wife	2. PARENT2 (coniuge/convivente del CapoFam.)	Wife or Husband
2	Son, daughter	3. PARENT3	Son or Daughter
3	Brother, sister		6. Brother or Sister
4	Father, mother	4. PARENT4	4. Father or Mother
5	Father in law, mother in law		5. Father in law or mother-in-law
6	Brother in law, sister in law		
7	Son in law, daughter in law		3. Son in-law or daughter in-law
8	Grandchildren		7. Grandson or granddaughter
9	Other relatives (2nd degree)	5. PARENT5 (altro parente/affine del capofamiglia)	8. Other Relative
10	Fostered children		
11	Servant		
12	Tenant		
13	Friend		
14	Other (out of family) relationship	6. PARENT6 (altro componente non legato da rapporto di parentela)	9. Non-relative

Education Status

Table A.2.8 Description of Variable CURRED (Current Educational Status)

Value	Description
0	Not in Education
1	In Education
2	Not Recoded

Family Type

Table A.2.9 Family Type

code	definition
1	S(ingle)
2	S + 1 dependent child
3	S + 2 dependent children
4	C(ouple)
5	C + 1 dependent child
6	C + 2 dependent children
7	C + 3 dependent children
8	C + 4 or more dependent children
9	C + 1 non dependent person
10	C + 1 non dependent person + 1 dependent child
11	C + 1 non dependent person + 2 dependent children
12	S + 1 non dependent person
13	Other (Single)
14	Other (Couple)

Appendix A.3 UK Tax-Benefit System Algorithm[18]

Income Tax System

Tax Base
Tax base =
Employee Income + Unemployment Benefit + State Pension + Self-employment income + Other income + Other non means tested benefits + Investment Income +Occupational Pension -Superannuation

Simulating Age Allowances
If (*aged 65- 74)* Then
Single Allowance. = MAX(0,Single 65 Allowance-MAX(0,IT base-income limit)* Age Allowance Taper)

If (*aged over 74)* Then
Single Allowance. = MAX(0,Single 75 Allowance-MAX(0,IT base-income limit)* Age Allowance Taper)

Lone Parent Allowance
IF(not *married* **AND** *number of children >0) Then*
Lone Parent Tax Credit = Lone parent Allowance * Lone Parent Relief Rate

Income Tax paid in the lower tax band:
If MAX(0, *Income Tax base - Single person allowance*) < Lower Rate Limit Then

[18] Note this is a description of the UK system implemented in Eur3, which is a simplified version of the actual system

MAX(0, *Income Tax base - Single person allowance*)* Income Tax Lower Rate,
Else Lower Rate Limit * Income Tax Lower Rate

Income Tax paid in the basic tax band:
If (MAX(0, *Income Tax base - Single person allowance* - Lower Rate limit)< Basic Rate Band Then
MAX(0, *Income Tax base - Single person allowance* - Lower Rate limit)*Basic Rate,
Else Basic Rate Band * Basic Rate

Income Tax paid in the higher tax band:
MAX(0, *Income Tax base - Single Person Allowance* - basic Rate Band - Lower Rate limit)* Higher Rate

Married Couples Allowance
If Sex = *Male* **AND (**Age of husband >=65 **OR** Age of Wife >=65) Then
MCA = MAX(0,Married 65 Allowance-MAX(0,IT base-income limit)* Age Allowance Taper)
Else MCA. = Married Couple's Allowance

If (Sex = *Male* **AND (**Age of husband >=75 **OR** Age of Wife >=75) Then
MCA.=MAX(0,Single 75 Allowance-MAX(0,IT base-income limit)* Age Allowance Taper)
Else MCA. = Married Couple's Allowance

Value of Married Couples Allowance = MCA relief rate * MCA
(Note Families can chose who gets the married couples allowance. We however assume it goes to the husband for simplification reasons.)

Mortgage Interest Relief
Mortgage Interest Relief Rate* (If (Total Mortgage < Upper limit, Interest Relief) Then Total Interest, Else Interest on mortgage upper limit)

Social Insurance Contributions

Employee Class 1
If Gross wage > lower limit Then
Social Insurance Contribution = NIC1 rate1 * lower limit + NIC1 Rate2 *
(If Gross wage <NIC1 higher limit Then
Gross wage- NIC1 lower limit
Else NIC1 higher Limit -NIC1 lower limit)
Else Social Insurance Contribution = 0

Self Employed Class 2
If Self Employment Income < NIC2 lower limit Then
Social Insurance Contribution = 0
Else Social Insurance Contribution = NIC2 Flat Rate

Self-Employed Class4
If Self Employment Income > NIC4 lower limit Then
Social Insurance Contribution = NIC4 rate *MIN(Self Employment Income- NIC4 lower Limit, NIC4 higher Limit- NIC4 lower Limit)

Else Social Insurance Contributions = 0

Employer Social Insurance Contributions

Employer Social Insurance Contribution (ERSIC) =
If Gross Wage

1. (>= ERSIC Band1 and < ERSIC band 2), Then Gross Wage * ERSIC rate 1
2. (>= ERSIC Band2 and < ERSIC band 3), Then Gross Wage * ERSIC rate 2
3. (>= ERSIC Band3 and < ERSIC band 4), Then Gross Wage * ERSIC rate 3
4. (>= ERSIC Band4), Then Gross Wage * ERSIC rate 4

Child Benefits

Child Benefit
Child Benefit = If *Number of children > 0 Then*
First Child, Child benefit + *number of children -1* * Other child, child benefit
Else 0

One Parent Benefit
One Parent Benefit = If *Number of children > 0* **AND** *No other individuals aged over 18* Then
One Parent Benefit
Else 0

Income Support

Asset Means Test
Total Assets = Investment and Property Income * 52/Capital Interest Rate

Total imputed income from assets =
If *Total Capital*<=3000 then
Imputed income =0
Else TRUNC((*Total Capital* - 3000.01)/250)+1)

Eligibility
If *Total Assets* > Income Support Upper Limit **OR** Age = 0 **OR** hours worked by individual or spouse > 15 **OR** Aged under 18 **OR** A Student Then
Eligibility =0
Else Eligibility =1

Maximum Payment
If individual is married Then
Max. Payment = Couple Allowance /2
Else

If aged 25 or over Then
Max. payment = personal allowance over 24
Else Max. payment = personal allowance 18 -24

If individual is married and either spouse is aged 60-74Then
Max. Payment = couple Allowance 60 74 /2
Else
If aged 60-74 or over and single Then
Max. payment = personal allowance 60-74

If individual married and either spouse is aged 75-79Then
Max. Payment = couple Allowance 75 79 /2
Else
If aged 75 79 or over and single Then
Max. payment = personal allowance 75 79

If individual married and either spouse is aged 80 or over Then
Max. Payment = couple Allowance 80 or over /2
Else
If aged 80 or over or over and single Then
Max. payment = personal allowance 80 or over

Family Premium
If Total number of children >0 Then
Family Premium = IS Fam. Premium
Else Family Premium = 0

Lone Parent Premium
If individual is unmarried and number of children >0 Then
Pay Lone Parent Premium

Child dependent premium
Number of children aged under 11 *Child Dependent Payment u11 rate + Number of children aged 11-15 *Child Dependent Payment 11-15 rate + Number of children aged 16-17*Child Dependent Payment 16-17 rate

Total Means
Means = MAX(0,Net Income before MTB CB-IS Earnings Disregard) +Child Benefit +OPB+ Imputed income from Assets.

Net Payment
Total Payment MAX(Max Income Support Payment - If Married Then Total of both spouses means, Else Individual's Means, 0)

Family Credit

Eligibility
If *number of children* > 0 **AND** hours worked of one parent is 16 or more **AND** Total Capital owned by the parents < Family Credit Capital upper limit Then

Eligible for Family Credit

Maximum Payment
Adult Family Credit + Adult Family Credit30hrs (if one parent works at least 30 hours per week) +Ch FCredit1 11 *nchFC1 11 + Ch FCredit11 15*nchFC11 15 + Ch FCredit16 17 *nchFC16 17 + Ch FCredit18*nchFC18,0)

Total Means
Total Income of HOH and Spouse = Net Income before Means tested benefits are calculated +Imputed value of Capital

Net Payment of Family Credit
Maximum value of Family Credit -Family Credit Taper * (Total Income of HOH and Spouse- Family Credit Taper Threshold)

Housing Benefit

Eligibility
IF(**Either** Household Assets exceed Capital higher limit **or** the HOH is a student **or** (the HOH **and** his/her spouse aged 18 or under) Then
Not eligible for Housing Benefit

Applicable Amount
If HOH married Then
If HOH aged <18 Then
Housing Benefit Married Applicable Amount (under 18)
Else
Housing Benefit Married Applicable Amount (over 18)
Else
If HOH Single Then
If HOH aged <18 Then
Housing Benefit Single Applicable Amount (under 18)
Else
Housing Benefit Single Applicable Amount (over 18)

Else
If HOH a lone parent Then
If HOH aged <18 Then
Housing Benefit Lone Parent Applicable Amount (under 18)
Else
Housing Benefit Lone Parent Applicable Amount (over 18)
End

Child premium:
number of children aged 0-11* Housing Benefit applicable child premium (0-11)+
number of children aged 12-15* Housing Benefit applicable child premium (12-15)+
number of children aged 16-17* Housing Benefit applicable child premium (16-17)

Family Premium:
If total Number of children >0 Then
    Family Premium

Lone Parent premium:
If Lone Parent then
    Lone Parent Premium

Age Premium
If individual married and either spouse is aged 60-74Then
    Housing Benefit premium = couple Allowance 60 74 /2
Else
    If aged 60-74 or over and single Then
        Housing Benefit premium = personal allowance 60-74

If individual married and either spouse is aged 75-79Then
    Housing Benefit premium = couple Allowance 75 79 /2
Else
    If aged 75 79 or over and single Then
        Housing Benefit premium = personal allowance 75 79

If individual married and either spouse is aged 80 or over Then
    Housing Benefit premium = couple Allowance 80 or over /2
Else
    If aged 80 or over or over and single Then
        Housing Benefit premium = personal allowance 80 or over

Earnings Disregard
If earned income >0 Then
 If HOH married Then
    Housing Benefit Married Earnings Disregard
 Else
 If HOH Single Then
    Housing Benefit Single Earnings disregard
 Else
 If HOH a lone parent Then
    Housing Benefit Lone Parent Earnings disregard
 End

Family Excess Income:
Total Net income minus Total Applicable Amount minus Earnings Disregard

Net Payment:
Total Rent - Non Dependent Adult Deduction - Withdrawal Rate * *Family Excess Income*