Modelling Social Security, Direct Taxes and Cash Benefits [1]

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Abstract

The FaMiMod microsimulation model uses data gathered under the EU-SILC (European Union Statistics on Income and living conditions) framework, including both survey and administrative data, to assess the distributive effects of existing or hypothetical fiscal policies by computing taxes, social security contributions and some cash benefits at the micro level. The model estimates the main parameters of the distribution of individual and household incomes as well as aggregate welfare, equity and poverty indexes. Information on income referred to the year covered by EU-SILC is updated to current year by two procedures: (i) applying the National Accounts average growth rates of personal incomes, broken down whenever possible by source, geographical area and economic sector of activity; (ii) adapting the weights to account for changes in the demographic structure and in the employment status of the resident population occurred after the survey year. Social security contributions paid by both employees and employers are modelled, leading to an estimation of the current "tax wedge" on labour cost, as are the personal income tax, with special attention to the details of tax credits, and local taxes (regional and municipal) which have increased their weight in recent years. The main programme of family allowances is also modelled, in order to simulate redistributive policies that act simultaneously on the tax and on the benefit side.

Keywords: microsimulation, calibration, tax wedge, personal income tax, family allowances. JEL: C54 Quantitative Policy Modeling; D31Personal Income, Wealth, and Their Distributions; H71State and Local Taxation, Subsidies, and Revenue; I38 Government Policy Provision and Effects of Welfare Programs

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[1] The opinions expressed in this paper are those of the authors and do not entail the responsibility of their Institution. Although the article is the result of the joint work of the group of researchers, paragraphs 2 and 5.2 have been drafted by Gaetano Proto; paragraph 3 has been prepared by Fabrizio Solari; paragraph 4.1 by Maria Cozzolino and Paola Tanda, paragraphs 4.2 and 5.3 by Paola Tanda; paragraph 5.1 by Marco Di Marco; paragraph 6 by Carlo Declich. The authors are grateful to Corrado Pollastri and Floriana D'Elia for their valuable cooperation and to an anonymous referee who contributed with useful suggestions.

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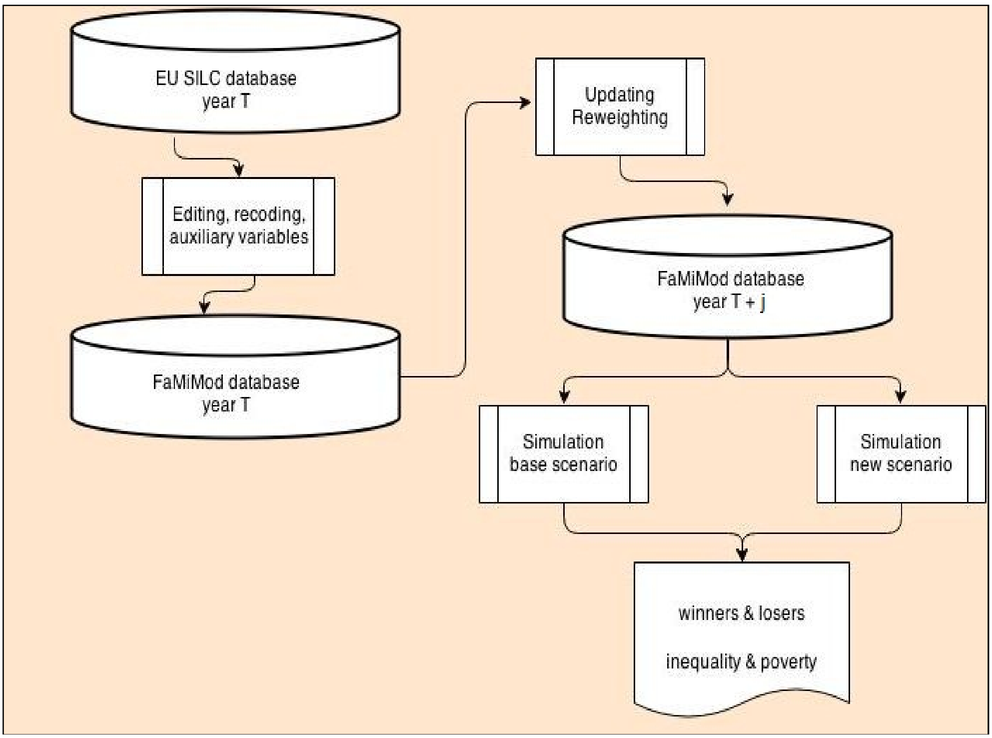
1. Introduction

FaMiMod, the microsimulation model of household taxes and benefits developed at Istat is a non-behavioral tax-benefit microsimulation model, as it does not account for the behavioral reactions of the individuals to the changes in the tax-benefit policies. Therefore, it is suited to assess the impact of the tax-benefit system and its changes on the distribution of personal and household incomes, focusing on short-term policy measures characterized by variations in policy parameters that are not too large. *Ex ante*, in the definition phase of the policy, the microsimulation model is a useful tool to assess the impact of the intended measures and to identify potential beneficiaries. The model is also useful for *ex post* evaluations of the effects of policies that have been undertaken, in order to assess the opportunity of corrective measures.

The structure of FaMiMod is based on a set of subsequent and interconnected modules, summed up in Figure 1. The first module, containing the selection of relevant variables from the data sources to be included in the database for the reference year and the creation of a set of new variables useful for the functioning of the model, is summarized in the following section, while the module describing the process of updating and reweighting to the current year is presented in section 3.

Figure 1 - Flow chart of the FaMiMod model



After these steps that lead to the updated database of the model, the modeling of the tax-benefit system takes control. The modules dealing with social security contributions and the subsequent calculation of the tax wedge are described in section 4. The personal income tax modules follow in section 5, including specific modules for the calculation of tax credits and of regional and municipal additional income taxes. Finally, the module describing family allowances is presented in section 6 while section 7 draws some conclusions and further developments.

2. Building the dataset for the FaMiMod microsimulation model

The database for the first release of the FaMiMod model builds on the 2010 edition of the Istat survey "European Statistics on Income and Living Conditions" (EU-SILC, income reference year 2009) [8]. This is a major innovation with respect to the previous microsimulation models based on the Bank of Italy survey on Income and Wealth (SHIW) such as MASTRICT and ITAXMOD (Di Biase et al. 1995, Proto 1999). In this section, the main steps of the building of the dataset will be recalled, pointing out when the new database has allowed to improve or at least to maintain the state of the art achieved by previous microsimulation models.

First of all, some basic preliminary choices had to be made regarding the unit of analysis, the definition of income and its disaggregation. The appropriate use of the available administrative information was also addressed in the planning phase.

Primarily, the main unit of analysis of FaMiMod is the individual. This is consistent with the individualistic nature of the Italian personal income tax, the most important component of the microsimulation model. This choice entails the reconstruction of some variables, as the survey total income is exhaustive only at the household level. Compared to the SHIW, where some income components are attributed to the head of the household, EU-SILC requires supplementary attention, because at the individual level misalignments may arise for some income components between net and gross variables that need to be detected and corrected. For capital incomes, the tax due on some components of income may have been attributed to a different member of the household than the one who actually perceives the corresponding net income, usually the one with the highest income, as the corresponding gross target variable is requested only at the household level. In the case of incomes from financial assets, the reallocation of taxes available at the household level in proportion to the reported net financial income of each member overrides these potential inconsistencies, and it will be a future refinement of the model to rely on more complex hypotheses, in order to account for individual portfolio structures and differences in the statutory rates applied to particular financial incomes.

Whilst the choice of the individual as the unit of analysis already was the standard of previous microsimulation models based on the Bank of Italy SHIW, in FaMiMod the choice regarding reference income has been an innovation. In fact, the SHIW only supplies information about the incomes net of taxes and social security contributions, while since the

[8] Other recent Italian tax-benefit microsimulation models based on EU-SILC are: ITaxSIM at the Department of Treasury, MAPP at the University of Modena and Reggio Emilia-CAPP (Baldini et al., 2011), MICROREG at the Tuscany Region-IRPET (Maitino et al., 2013). The Italian section of EUROMOD, a cross-national microsimulation model that produces comparable results for 27 EU countries, is also based on the same data source (Sutherland and Figari, 2013).

2007 edition the Italian EU-SILC includes gross incomes and therefore permits to take the *before tax and social contributions* income as the starting point of the updating and estimation procedures.

Besides, the Italian version of the EU-SILC survey is based on the integration of the survey data with administrative archives, the general principle being the building of gross incomes target variables on the basis of the net values reported to the interviewers, which may in turn be replaced by administrative data when these appear to be more complete, plus the taxes recorded in the tax files. Therefore, the logical structure of the new microsimulation model is simpler and more efficient with respect to pre-existing models, as the initial stage where net incomes are "grossed up" is no more necessary[9].

Another choice that is common to FaMiMod and to other models concerns the detailed level of disaggregation of income. In the context of a microsimulation model, indeed, total income cannot be treated as a single summary variable but must be processed as a collection of different components, each of them carefully checked for consistency and completeness.

A preliminary check has to be made on the consistency between survey variables and their definition in the tax code. First of all, net value and gross value must be identical for tax exempt incomes, such as the allowance for the attendance of disabled persons ("*Indennità di accompagnamento*"). In the 2010 edition of EU-SILC, taken as the basic source for the first release of FaMiMod, inconsistencies in this respect have a low incidence and the few observed cases could easily be corrected aligning gross to net values. On the other hand, the check of survey data against the maximum statutory values that had to be performed on the SHIW for some public transfers, like the welfare pensions to the elderly (*"Assegno sociale"* and *"Pensione sociale"*) and the consequent re-classification of the self-reported amounts exceeding the maximum statutory values are no longer necessary, thanks to the integration of the EU-SILC survey with the social security files.

As regards completeness, some variables missing or incomplete in the survey may turn out to be instrumental in the simulation of relevant details of the Italian tax law. For instance, information about the months worked by contract workers (termed Co.co.co or Co.co.pro, that is *Collaboratori coordinati e continuativi* or *a progetto*) is necessary to estimate the employment tax credit they are entitled to, which is approximately proportional to the number of days worked, since they are treated like employees for personal income tax purposes. Yet the months worked are not directly asked in the EU-SILC questionnaire (unlike the SHIW) as contract workers appear in the self-employed section, and they cannot always be retrieved from the answer to the question about month-by-month main activity in the income period, especially when they correspond to secondary activities. Thus, for the self-employed the missing values of the number of months worked have been estimated on the basis of gross income, assuming an average monthly reference income.

Disaggregation of income also permits the accurate modelling of differential tax regimes ('separate' taxation), of the exemption of specific income components as well as specific tax rules, such as the mentioned treatment of self-employment incomes of contract workers alike employment income. Along with the choice of gross incomes as initial inputs

[9] For a comparison of EU-SILC gross income data with the corresponding variables, simulated by subjecting EU-SILC net data to the net-to-gross module of a microsimulation model, see Ceriani, Fiorio and Gigliarano (2013).

of the model, the detailed disaggregation of incomes requires a supplementary effort in the proper treatment of the many variables used in the microsimulations, as the EU-SILC survey supplies more information on the components of net, rather than gross, incomes.

To this end, different procedures were followed. The simplest is to apply to the aggregate gross variable the ratio of the component, computed with reference to the aggregate net variable, in order to derive missing components of individual gross income starting from existing components of net, as in the cases of income from contract work with respect to total gross self-employment income and of arrears with respect to total gross labour income of employees. For severance pay, which is subject to separate taxation, the creation of a gross variable matching the net one asked for in the interview involves a plurality of income components, since severance pay can be allocated to unemployment benefits or to pensions (both old age and survivors) target variables in EU-SILC, depending on which social protection function it can be attributed to. Eventually, gross severance pay is the sum of three addends separately derived applying the specific ratio-of-net to the respective aggregate gross variable[10].

More complex hypotheses may be involved in the derivation of missing individual components of gross income from household components of gross income, as in the case of rental income: if co-owners are present, taxes paid on rental income available at the household level have been allocated to individuals as a proportion of their estimated average tax rates, since rents are included in taxable income.

Finally, a further innovative choice made possible by the use of EU-SILC as basic source is the exploitation of individual (anonymous) information stemming from tax records as a supplement to sample data. Whenever possible, tax records are linked to sample units by EU-SILC in the process of derivation of gross income target variables: some pieces of information have been made available for use to the team building FaMiMod, in order to fill in the gaps that sample surveys on incomes usually lack in the overall tax position of taxpayers.

This applies to expenses entitled to tax credits. In pre-existing models, health and other deductible expenses were imputed at their mean cell values based on occupation and income class, derived from semi-aggregated tax record data of previous years. This entailed a loss of individual variability that actual tax micro-data incorporated in the database of the FaMiMod model have allowed to avoid.

EU-SILC provides little information on real estate apart from owner-occupied housing, unlike the Bank of Italy SHIW which has wealth among its main objects of inquiry. Land and buildings other than home are lumped together in a single question, as are any rental incomes derived from them. Comparing sample data with information on income from land and buildings stemming from tax records, the latter showed a much broader coverage. Administrative data have therefore been used as a substitute, leaving to the future the possibility to complement them with sample information that would represent undeclared incomes.

Still regarding income from real estate, a further value added of tax records is to incorporate information concerning cadastral values, which otherwise could only be

[10] In fact, both arrears and severance pay are usually subject to separate taxation, providing for the application of an average estimated tax rate rather than the marginal rate: in this case, our simplified procedure of reconstruction entails some overestimation of their gross value.

approximately estimated on the basis of the respondents' self-assessed imputed rents of owner-occupied dwellings, as was usual with pre-existing microsimulation models. Nevertheless, information stemming from tax records may not always be exhaustive on its turn: this is the case of cadastral rent of owner-occupied housing, a part of the so-called "overall income" ("*reddito complessivo*") for income tax purposes until 2011. The value of this rent cannot be obtained from tax records if the individual is not obliged to file a tax return, either because he has no other income from real estate exceeding a low no-tax threshold, or because he has nothing to add to the record filled by his withholding agent. In these cases, it is still necessary to resort to imputations.

3. Reweighting and updating to current year

Typically, microsimulation models use a set of individual and household micro-data collected over a period t to estimate distributional, budget (and possibly behavioural) effects of changes in the taxes and benefits system in a subsequent period $t + j$, comparing them with the effects of the existing system. This type of analysis requires techniques allowing to incorporate into microsimulations at least some of the characteristics of the population of period $t + j$, which may be different from those of the reference population of the available micro-data, normally referred to a previous year.

The details of the techniques used by different microsimulation models to update the database to the simulation year $t + j$ depend on the particular purpose of each model and, specifically, on the characteristics of the data base and the availability of additional information about the external characteristics of the population at time $t + j$. It is therefore not easy to provide a general theoretical framework of methodological aspects related to temporal data updating for microsimulation models, although some contributions for specific models illustrate systematic problems related to the different techniques used (see, e.g., Creedy, 2003, or Immervoll et al., 2005).

A first general distinction can be established between:

- static updating techniques, which basically consist in the recalculation of the individual and/or household weights, in order to replicate the known totals of some characteristics of the population at time $t + j$;
- dynamic updating techniques, typically based on micro-econometric models, which estimate the probability of transitions, i.e. changes in the individual life cycle (e.g., births, deaths, marriages/divorces, inputs/outputs from the labour market, etc.).

It is also useful to distinguish, conceptually, with respect to these two types of methods related to representation at time $t + j$, the values of the analysis variables (e.g. income). In fact, they are two separate issues: the demographic representativeness of a random sample of individuals after a certain period of time depends on the inputs/outputs from the labour market by layoffs and hiring, from births and deaths, as well as the processes of internal reorganization (for example, if managers have increased with respect to the employees, women with respect to men, changes in the economic activity sector, etc.).

These changes may work independently of the changes in the characteristics of individual occupations, i.e. wages, hours worked, etc., and it is therefore common practice in the construction of microsimulation models to update the database both for the individual characteristics and for changes in income (or other variables such as hours worked, taxes, etc.). In both cases, the distribution of analysis variables (such as income) is altered with respect to the base year. Ideally, to replicate the income distribution at year $t + j$ it would be desirable to have the highest level of detail on the variation of analysis variables, for example at the level of individual statistical unit, and the reference population distinguished by characteristics such as gender, age, employment status (particularly important are those related to changes in income). In practice, for the variation of analysis variables the most recent aggregate data (usually those from the National Accounts) actually allow to assign only mean changes to particular sub-groups (for instance the sub-groups of earners defined by different income sources) and therefore represent only one of the possible changes of the distribution occurred between time t and time $t + j$.

The year initially chosen for the representation of the system of taxes and benefits is 2012. The update from the base year is a basic feature of microsimulation models that allows to project the available information to a year for which final data from surveys or National Accounts are usually not yet available, especially when the model is used to evaluate current or planned policy measures. The update from 2009, the period for which we have information on incomes, to 2012 has been realized by applying the changes in the variables of interest using the various available sources, primarily the National Accounts. When aggregate data was not available, the macroeconomic forecasts provided by Istat macroeconomic models have been used. The projection was made considering the possible articulations by sector of activity and sources of income. Most pensions have been updated taking into account the normative concerning the adjustment to actual inflation.

Assuming that these average changes are sufficiently informative of the situation at time $t + j$ of individuals "represented" by the sample observed at the time t, the recalculation of the weights tries to make the sample units at time t consistent with the characteristics of the population available at time $t + j$. Calibration techniques (Deville and Särndal, 1992) may be used to adjust the sampling weights available for the sample data at time t. This is done by minimizing the differences between the weights at time t and the weights to be used for time $t + j$, and under the condition that the final weights computed for time $t + j$ must satisfy a set of constraints related to known characteristics of the population at time $t + j$.

Note that the new weights can in principle capture a part of those changes of the income distribution between time t and $t + j$ that cannot be represented through the average increase of analysis variables, replicating the composition effects. The most important of these effects are related to demographic changes, such as the distribution of the population by gender, age and employment status. The population counts of these variables are then considered for the adjustment of the weights available for time t. More controversial are the effects on the simulated distribution of any constraint corresponding to total amounts of some variables of investigation, such as income, which depends on a set of factors that are not perfectly kept under control by researchers, as for example the bias due to partial or total non-response.

As stated above, the data source used in the FaMiMod microsimulation model is the Italian EU-SILC survey. The survey is carried out yearly after the deadline to file tax returns in order to give to households and individuals the opportunity to use the information resulting from them. The survey provides both cross-sectional data on income, poverty and social exclusion and living conditions, and longitudinal data on income, employment and some non-monetary indicators of social exclusion.

The survey is based on four longitudinal samples. These samples are shifted in time so that in each wave take place the closure of the panel arriving to the fourth wave and the beginning of a new panel. Each longitudinal sample is the output of a two-stage stratified sampling design, with stratification of the primary sampling units, the municipalities, while the secondary sampling units are the households. The cross-sectional sample is composed by the union of four longitudinal samples, each for its specific wave.

The whole weighting procedure for the EU-SILC sampling design is extremely complex, since it covers both cross-sectional and longitudinal development. Therefore, the procedure can be divided in different sections according to their purpose.

Here we concentrate on the process to compute the cross-sectional weights since it is the phase connected with the microsimulation model. This calibration phase is a stepwise procedure and it is carried out separately for each of the four longitudinal samples. First design weights are adjusted in order to account for non-response. Different non-response mechanisms (basically current non-response and non-response due to attrition) are considered. Then the weights are calibrated to obtain coherence with some external sources. In detail, constraints are built so that the weights reproduce a set of population counts of the cross-classification by gender, age and geographical area available from population registers.

Unfortunately some discrepancies, although not too prominent, may be detected between the estimation of aggregates of interest and data from other sources. In particular, it may happen to observe inconsistency between the estimates and the distribution by professional status available from the continuous Labour Force Survey (RCFL). This phenomenon could lead to possible biases in the estimation of aggregates and distributions of interest. The solution adopted was to insert an additional correction for non-response before the calibration phase to the population registers, calibrating to the information from the RCFL.

Final weights used for the computation of cross-sectional estimates for EU-SILC 2010 survey need to be updated in order to be utilized by the microsimulation model. If they are not adjusted the microsimulation model will provide results for the population at 2010 rather than for the target population, i.e. the population at 2012. To this aim the EU-SILC 2010 sample weights are calibrated using Istat demographic statistics updated at 2012 for the age and gender composition and 2012 RCFL data for the occupational status population distribution. The reason why this calibration step is chosen as adjusting step is for the minimum deviation from original weights property. In fact, original weights usually contain much valuable information on the relationship between sample and population. They are calibrated weights related to time *t* and, therefore, they reproduce the population characteristics used in the calibration process. In addition, original weights contain correction factors that take into account non-response.

In particular, less detailed constraints are defined with respect to the original set of constraints used in EU-SILC. In fact, a large number of constraints would lead to extreme variability of the weights and, consequently, not allow complete control on errors related to one or more key variables considered in the microsimulation model. Furthermore, an interesting problem is the double source of information on income (tax returns and sample, the latter derived from the responses of respondents). And it is reasonable to minimize the number of constraints related to demographic characteristics and employment status of the population, for example by giving up an excessive territorial disaggregation, to eventually extend the calibration also to known totals reported to the characteristics of the individuals presenting tax returns in all their possible forms (730 form, *Unico Persone Fisiche* form, 770 form for withholding agents).

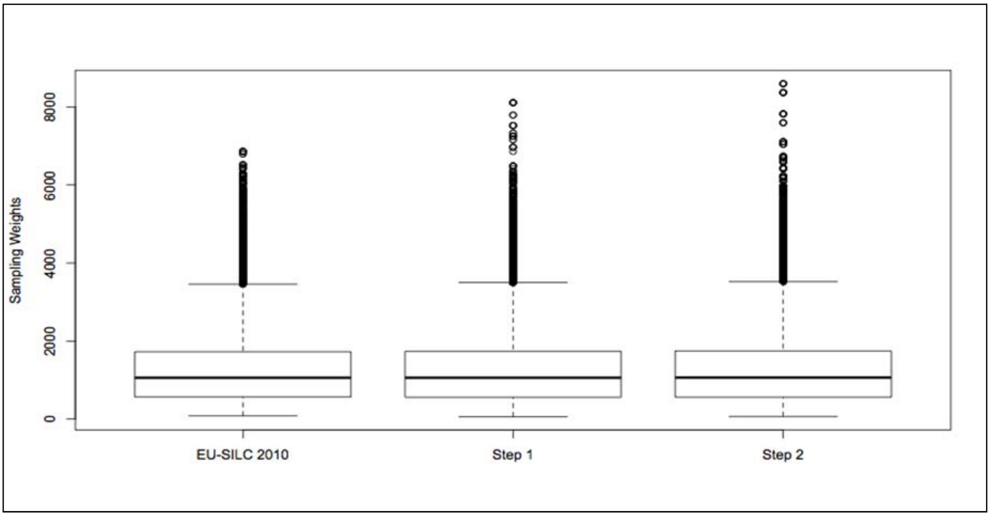
Therefore, to update EU-SILC 2010 sampling weights to the 2012 population distribution we proceeded in the following way:

- step 1: use the RCFL 2012 data to perform a phase analogous to the intermediate calibration stage in the original EU-SILC procedure;
- step 2: calibrate to the 2012 demographical information.

An important aspect to be analyzed when performing calibration is that the coefficient of variation (CV) of the final weights, i.e. the calibrated weights, should be comparable with the CV of the initial weights. In our case this is satisfied since the CVs for the original EU-SILC, step 1 and step 2 weights are respectively equal to 0.723, 0.738 and 0.735.

The following plots display some features of the EU-SILC sampling weights at the end of the calibration process to the 2012 external sources explained above.

Figure 2 - Distribution of the sampling weights for the EU-SILC 2010 survey: step 1 (calibration to RCFL 2012 survey) and step 2 (calibration to 2012 population registers)



Source: Elaborations on EU-SILC data

Figure 2 shows that the distribution of sampling weights is not substantially modified in the steps 1 and 2. In fact the first quartile Q1, the median and Q3 remain unchanged in the three distributions. The only difference is that the distributions related to steps 1 and 2 show larger extreme values with respect to the original EU-SILC sampling weights. But this difference seems to be unremarkable since the number of observations in steps 1 and 2 exceeding the maximum value of EU-SILC sampling weights is only 22 and 26 respectively, which is negligible if compared to the overall sample size (about 47,500 sampling units). Therefore, we can be confident that using the final calibrated weights in the microsimulation model will not create any significant deviation from the target population.

4. Social security contributions on employees and employers

4.1 Legislation, rules and modeling

In shaping the legislation ruling social security contributions in Italy, we have improved the treatment of some aspects, while maintaining the state of the art achieved by previous microsimulation models (ITAXMOD and MASTRICT). In particular, in ITAXMOD only the social contributions of employees were modeled in strict accordance with the rules, whilst in the case of the self-employed the contributions were computed applying an average of the statutory contribution rates pertaining to the main private professional pension funds. In MASTRICT, on the other hand, only the social security contributions charged onto employees were modeled, ignoring those paid by the employers. In building the social contributions module of FaMiMod, we have taken into account both the contributions payable by employees and those paid by the employers, considering in detail the statutory contribution rates of the different categories of self-employed workers.

In particular, in the social contributions module of FaMiMod, legislation in force in 2012 has been modeled taking account of the differences in the contribution rates relating to the individual characteristics of the worker: status (employees, contract workers, self-employed and professionals), professional qualification (production workers, clerical workers, junior managers, senior managers, apprentices), sector of activity (agriculture, manufacturing, construction, trade, information and communication, finance and insurance, public) and, for employees and contract workers, firm size (up to 15 employees, 16-49 employees, more than 50 employees).

Table 1 - Statutory contribution rates by type of worker: some examples – 2012

EMPLOYEES			
	Employers and employees		
Rates by: sector, professional qualification, firm size, age and other characteristics			
APPRENTICES	employees	Employers	Employers
	rate if age is 15-29 years	rate	rate if firms has less than 9 employees
	5.84	10.0	0.0
SELF EMPLOYED			
	Workers		
	rate	rate if age < 21 years	extra rate if income > 44.204 Euros
ARTISANS	21.30	18.30	0.01
SALES WORKERS	21.39	18.39	0.01
FARMERS	21.60	19.40	-
PROFESSIONALS			
	rate	extra rate if income > than ceiling	
ENGINEERS AND ARCHITECTS	13.5	0.03	
LAWYERS AND ATTORNEYS	13.0	0.03	
NOTARIES	33.0	-	
	rate	rate if age < 35 years	
LABOR CONSULTANTS	12.0	0.06	
…			
CONTRACT WORKERS [(a)]	rate	rates for retirees	
	27.72	18.0	

Source: INPS (National Social Security Institute) for employees, contract workers and self-employed; Private professional providers for each group of professionals.

(a) atypical workers.

Self-employed workers insured with INPS Funds (sales workers, artisans, farmers, tenant farmers and sharecroppers) were considered separately from the professionals, who are insured with specific private professional pension funds (lawyers, notaries, accountants, etc.). In addition, the rules on upper ceilings and minimum statutory rates and – as far as possible – special rates applied to particular conditions (e.g., retirees) have been taken into account. Table 1 presents some examples of the main statutory rates applied to different types of workers. The identification of professional qualification, sector, firm size and profession has been carried out on the basis of the information available in the EU-SILC Survey.

Table 2 - Social contribution rates, revenue and tax base: comparison among EU-SILC Survey aggregates (2009), FaMiMod model estimates (updated to 2012), and National Accounts statistics (2009 and 2012) *(millions of euros)*

	EU-SILC - 2009	National Accounts - 2009	FaMiMod - 2012[(a)]	National Accounts - 2012
EMPLOYEES				
Employers [(b)]				
average aggregated rate (%)	25.24	24.87	26.20	24.90
revenue	160,000	161,971	173,700	167,459
income from employment	634,000	651,354	662,000	672,594
Workers				
average aggregated rate (%)	8.82	8.51	8.69	8.23
revenue	41,800	40,527	45,600	40,381
gross wages	474,000	476,179	523,000	490,827
CONTRACT WORKERS [(c)]				
Employers				
average aggregated rate (%)	8.14		11.64	
revenue	1,620		2,620	
income from employment	19,900		22,500	
Workers				
average aggregated rate (%)	4.64		6.36	
revenue	812		1,310	
gross wages	17,500		19,800	
SELF EMPLOYED				
Workers				
average aggregated rate (%)	14.84		19.69	
revenue	27,600		25,400	
income from employment	186,000		129,000	

Sources: National Accounts, Annual sector accounts, Sequence of accounts by institutional sector, Total economy, Resources, years 2009 and 2012, (Edition: October 2013; aggregates: compensation of employees, wages and salaries, employers' actual social contributions, employees' social contributions)

European Union Statistics on Income and Living Conditions (EU-SILC) 2010 for Italy, 2009 incomes

Istat: Microsimulation model of household taxes and benefits (FaMiMod), 2009 incomes updated to 2012

a) we used the survey weight for EU-SILC 2009 data while for the FaMiMod model we used the reweighting updated to 2012

b) the employers contributions for employees in FaMiMod 2012 include severance pay (TFR)

c) atypical workers.

The accuracy in modeling the legislation allows greater precision in calculating the effects of hypothetical changes of the rules of social contributions, through a more detailed design of the simulation exercises. Table 2 shows the average aggregated rates, the average of individual rates, the total revenue and the tax base of the social security contributions, providing a comparison between the results of the EU-SILC Survey, estimates of the FaMiMod model and related National Accounts statistics[11]. As can be seen from Table 2, the model estimates for contribution rates, revenue, and tax base for the employees are in line with those provided by the National Accounts. For the self-employed the comparison is only between the results of the EU-SILC Survey and the estimates of the FaMiMod model. There are many differences in the definitions of the aggregates and asymmetries between the composition of the aggregates of the survey and those of the model if compared to those of National Accounts (for example, contract workers are considered together with the self-employed and are not easily separable from the latter).

4.2 Labour cost, wages and tax wedge

Using the FaMiMod model, the effects of economic and fiscal policy measures on the tax wedge can be calculated. The tax wedge equals the difference between the labour cost sustained by the employer and the net wage received by the employee. The tax wedge corresponds to the levy, in terms of taxation on income and of social contributions made by the State. One can distinguish between the direct tax part of the tax wedge on labour income and that which relates to social security paid by employers and workers. The whole burden of the levy on labour is paid by different subjects, the employer and the employee and, as we saw in the previous section, the contribution rates are very different, even if considering only employees, depending on the type of work, qualification, sector, firm size.

As a consequence, changes in the components of contributions may, for example, have different effects on labour costs of employees who work in different areas or have different qualifications. The components of labour costs have been estimated with FaMiMod, using the EU-SILC Survey data of 2009, updated to 2012. The calculation of the components of the tax wedge was made separately for the income of employees and contract workers and, in the part relating to the social contributions, both those paid by workers and those paid by the employers were estimated[12].

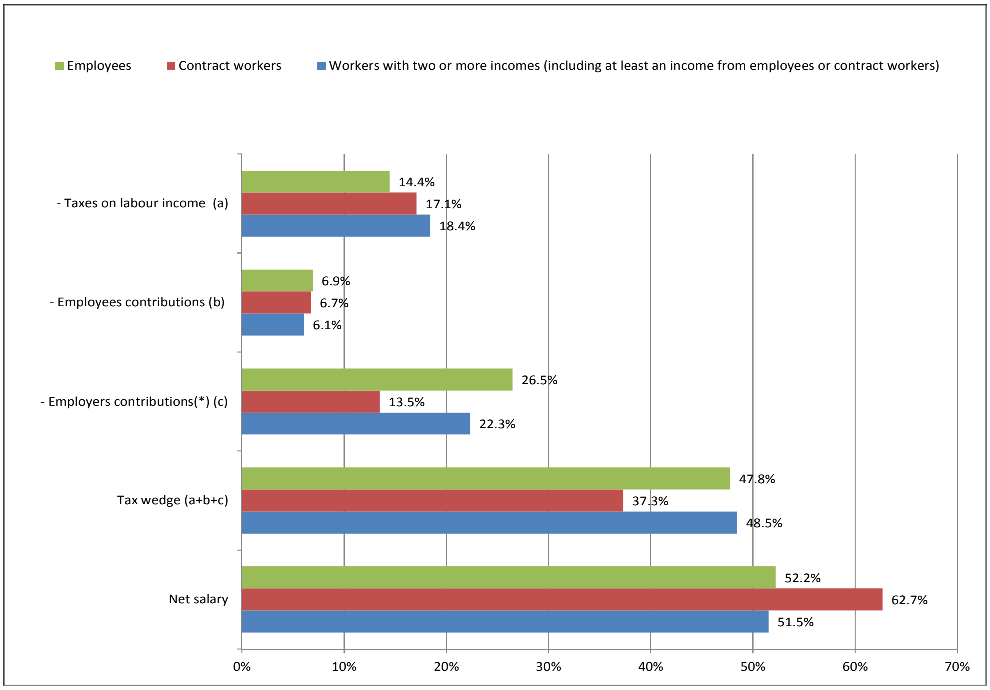
In the graphs below, workers are distinguished depending on whether they receive only one income (employees or contract workers) or two or more incomes (including at least one as employees or contract workers). In the case of two or more incomes, generally, the tax wedge on labour income and employees or contract workers also depends on the presence of self-employment income[13].

[11] The National accounts data are referred to 2009 for comparison with EU-SILC Survey data and to 2012 for comparison with FaMiMod model estimates updated to 2012.

[12] The tax wedge presented in this section has been calculated as the ratio between the total revenue from taxes and contributions on labour income and the total labour cost. The incidence of the tax wedge and its various components is calculated as the ratio between the revenue and the total labour cost. For algebraic reasons, this estimate does not necessarily coincide with the average of the individual effects, which is very much influenced by extreme values. In the case of more than one income, the tax wedge on employees and contract workers may also depend on the simultaneous presence of other income from self-employment. The income of self-employment is not considered in the calculation of the wedge. However, the amount contributes to determining the effective tax rate paid on the total labour income, the model then applies it 'pro-rata' to the incomes of employees and contract workers.

[13] It is considered that you might have a self-employment income even if it is not included in the calculation of the wedge. In the case of more than one income, the tax wedge on employees and contract workers may also depend on the simultaneous presence of other income from self-employment. The income of self-employment is not considered in the

Figure 3 - Wages, tax wedge and its components *(in % of labour cost)*



Source: Istat, Microsimulation model of household taxes and benefits (FaMiMod): 2009 incomes updated to 2012
(*) The employers contributions for employees in FaMiMod includes severance pay (TFR).

Wages, the tax wedge and its components in relation to total labour cost are presented in Figure 3, depending on whether workers receive one or two or more incomes. In 2012, the recipients of an employee income receive, on average, a net wage which is slightly more than half of the average labour costs (52.2%). The average value of the total tax wedge for employees amounted to 47.8% of the labour cost from which one can distinguish the component of social contributions (33.4%) and that of taxes on labour (14.4%). Social security contributions are, in general, the highest tax wedge component and are made of a more significant share charged to the employer (26.5%), and a less costly share paid by the worker (6.9%). However, as workers are affording taxes on labour income along with social contributions, together they account for 21.4% of labour cost. The recipients of a contract worker income, compared to that of pure employees, have an average net wage which represents over 60% of the average labour cost. The tax wedge is approximately 37.3% of the labour cost, of which 20.2% is attributable to contributions and 17.1% to taxes on labour income[14]. Moreover, contributions payable by the employer are 13.5% and those

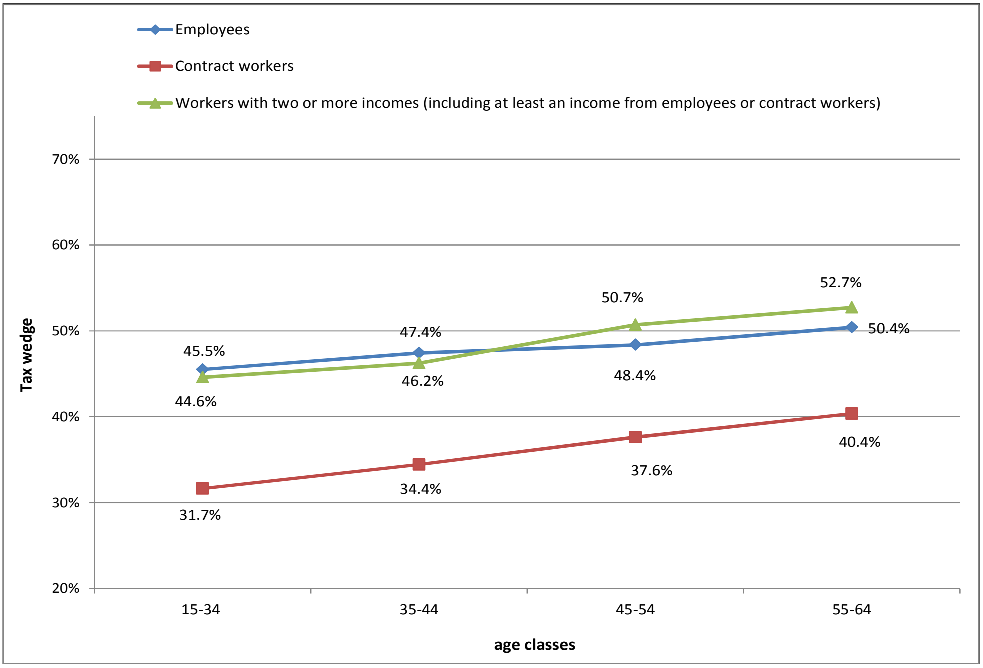
calculation of the wedge. However, the amount contributes to determining the effective tax rate paid on the total labour income, the model then divides them 'pro-rata' on the incomes of employees and contract workers.

[14] Contract workers have a lower statutory contribution rates than employees (the statutory contribution rate is 27,7 versus 33% in 2012) and also they do not have the severance pay (TFR) that is instead included in the employers contributions of the employees.

paid by workers are 6.7%. The earners of two or more income have a net wage that is approximately 51.5% of the labour cost. The tax wedge is 48.5% of the labour costs, with social contributions accounting for 28.4% while taxes total 18.4%. The share of social contributions paid by employers is 22.3%, and the workers charges are 6.1%.

Among the factors influencing contributions and the taxation of labour income there are, in particular, the age and gender structure of the population. These two demographic characteristics affect the level of employment, the rules of retirement and, in general, the social protection system. Obviously, the higher the cost resulting from the system of social protection, the greater the social contributions charged to employers and employees.

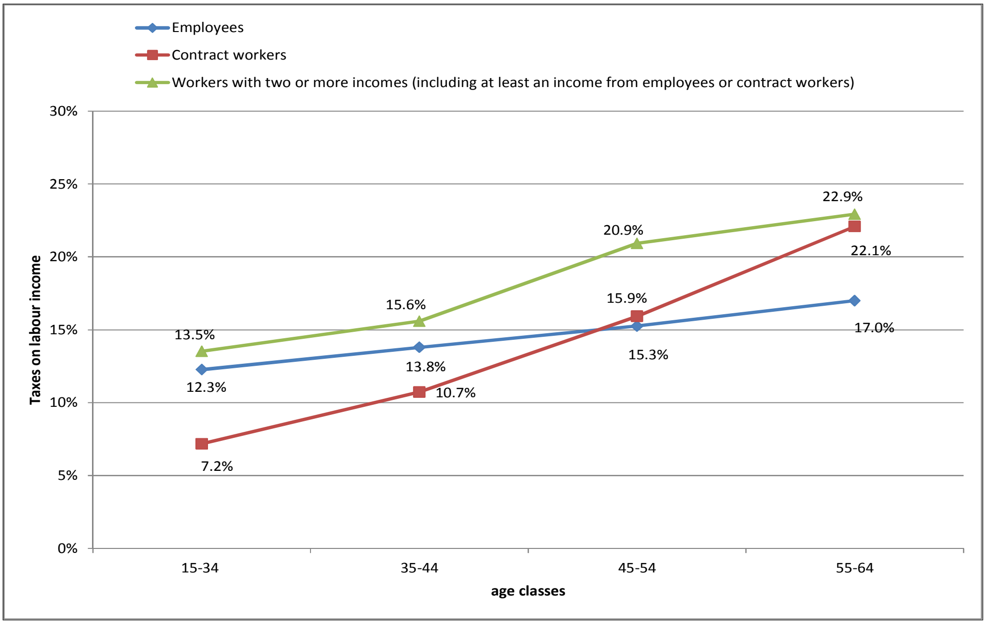
Figure 4 - Tax wedge by age *(in % of labour cost)*



Source: Istat, Microsimulation model of household taxes and benefits (FaMiMod): 2009 incomes updated to 2012

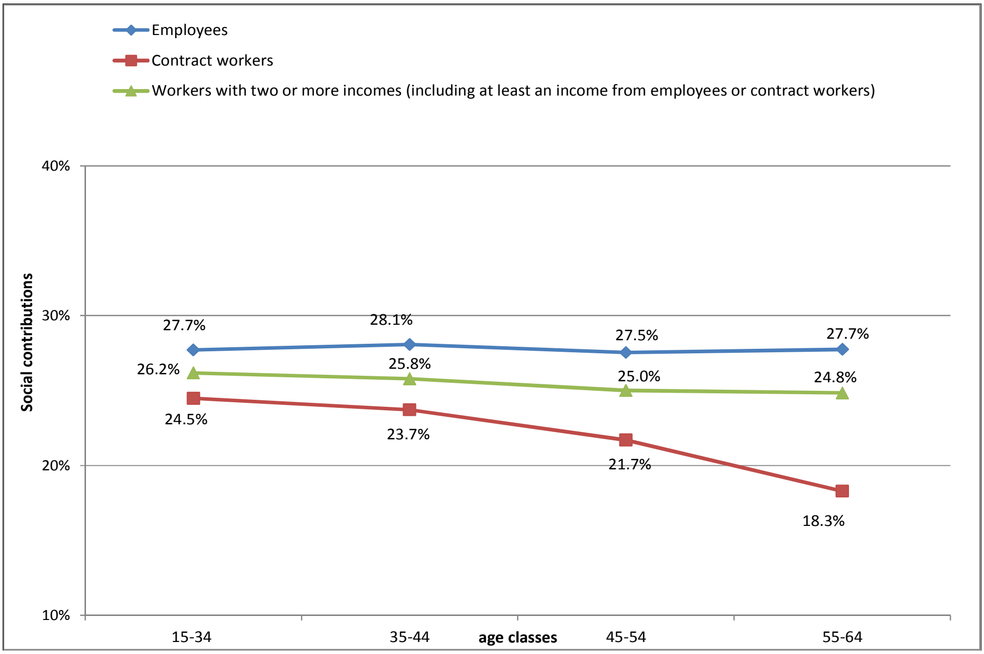
In Figure 4 the tax wedge for the earners of one or more income during the active life cycle is presented, distinguishing by age groups. The tax wedge and its component of labour taxes increase with age, as expected, following the upward trend of income during the active life (Figures 5 and 6). This trend is primarily due to the taxation of labour income, to a greater extent for the contract workers, where the figure grows from 7.2%, for workers less than 35 years old, to 22.1%, for those aged 55-64. The social contributions component, however, slightly decreases along the life cycle for all ages and for all categories of workers observed, to a greater extent for contract workers (see Figure 6).

Figure 5 - Taxes on labour income by age classes *(in % of labour cost)*



Source: Istat, Microsimulation model of household taxes and benefits (FaMiMod): 2009 incomes updated to 2012

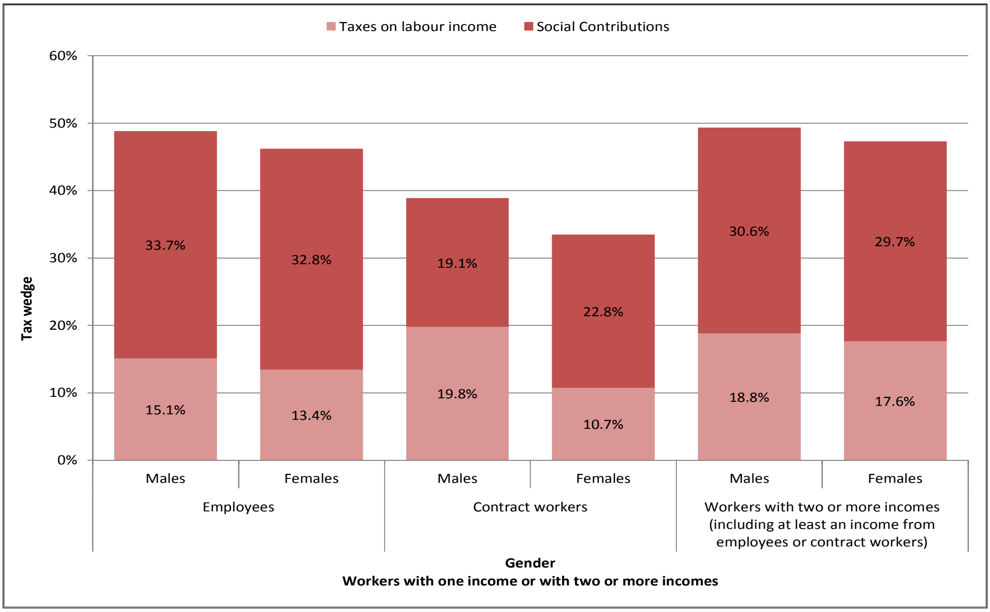
Figure 6- Social contributions by age classes *(in % of labour cost)*



Source: Istat, Microsimulation model of household taxes and benefits (FaMiMod): 2009 incomes updated to 2012

Figure 7 shows the gender breakdown of the tax wedge. Women have a lower overall tax burden than men (about 3 percentage points lower for employees, almost 5 for contract workers) and this trend is also observed in the tax on labour component of the tax wedge. The only exception is among contract workers, and it regards social contributions of women. Women showing an average rate higher than that of men also have an average value of labour cost much lower (about half) than that of men (50% of men have labour costs lower than 20,000 euros while 50% of women have labour costs under 10,000 euros). This is probably because women are more likely to be subject to the higher rates determined by the minimum rate of contribution specified by law.

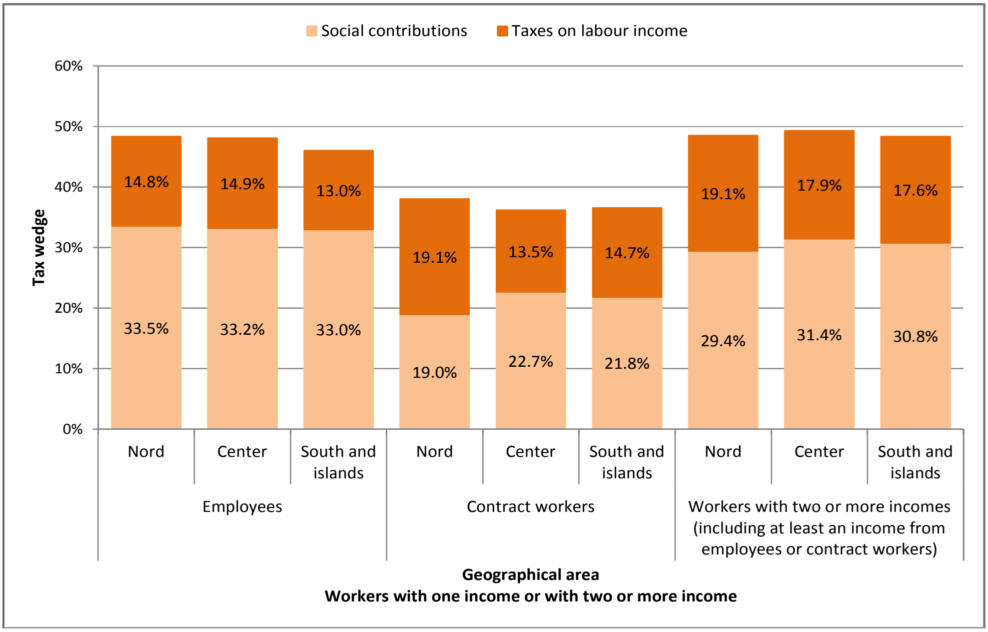
Figure 7 - Tax wedge by gender *(in % of labour cost)*



Source: Istat, Microsimulation model of household taxes and benefits (FaMiMod): 2009 incomes updated to 2012

The tax wedge is then disaggregated by geographical area (Figure 8). It is slightly higher in the Center and in the North than in the South and the Islands, for all the considered workers and for the two components of the wedge (taxes and contributions). The employees, along with workers with two or more incomes - including at least an income from working as an employee or as a contract worker - do not show significant differences among geographical areas. The variation in the tax wedge among areas range between 48.3% (in the North) and 46% (in the South and in the Islands) of the labour cost for employees and between 38% (North) and 36.2% (Center) for contract workers, settling, however, at around 49% for workers with two or more incomes in the three main areas. Some differences among the contract workers are found in the components of the tax wedge. On average, the lower values of the labour taxes are attributable to the workers who live in the South and the islands (13% of labour costs versus 14.8% in the North and 13.5% in the Center), while the lowest incidence of contributions is found among those living in the North (19% compared to 22.7% in the Center and 21.8% in the South and the islands).

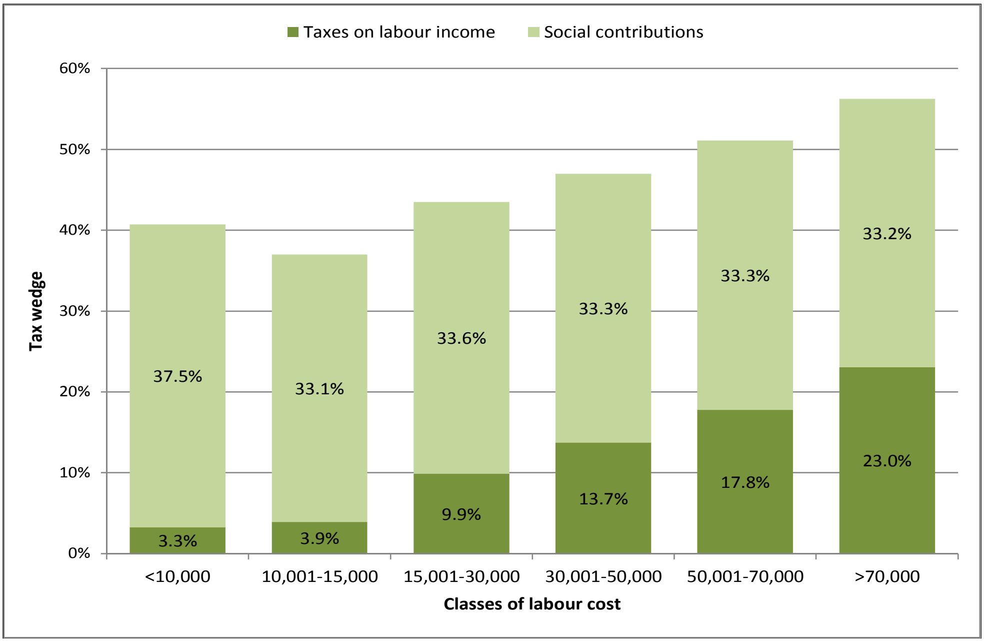
Figure 8 - Tax wedge by geographical area *(in % of labour cost)*



Source: Istat, Microsimulation model of household taxes and benefits (FaMiMod): 2009 incomes updated to 2012

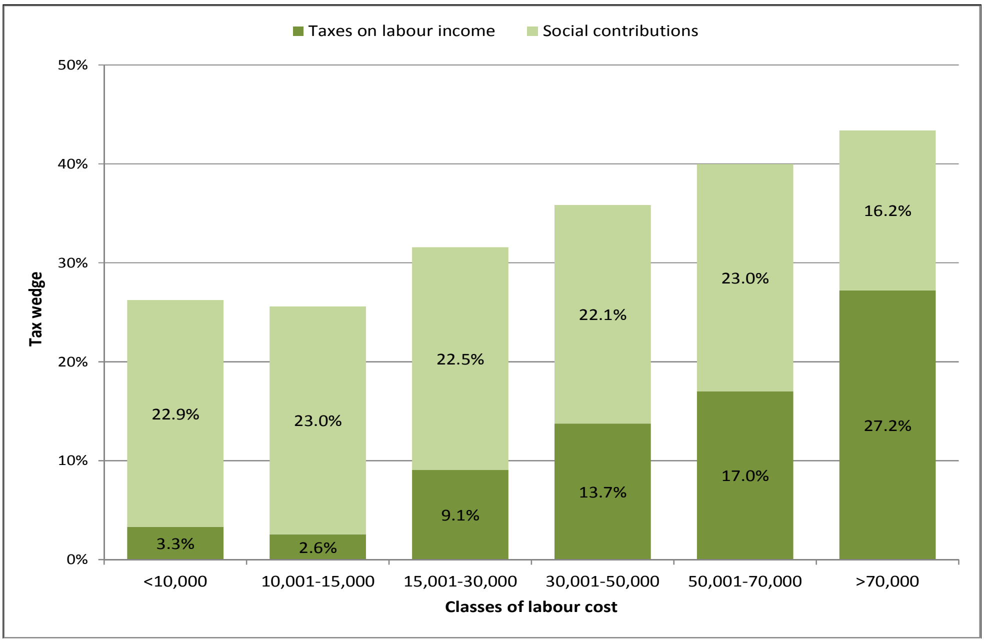
The distribution of taxes and contributions is observed looking to the tax wedge as a percentage of the labour cost. For all types of workers considered the wedge widens when labour costs increase, as expected, driven by the portion of the wedge represented by progressive taxes on labour income (Figures 9, 10 and 11). The exception to this trend is in the first class of labour cost where the wedge is higher than that of the next class. Due to the minimum rate of contribution specified by law, for an important part of workers whose labour cost is less than 10,000 euros, the tax wedge is 40.7%, higher than that of workers whose labour cost falls between 10,000 and 15,000 euros, that is 37%. In the next classes of labour costs, the wedge starts to increase slightly. The rising wedge is explained by the increase in labour taxes that increases the labour costs while contributions are reduced, decreasing from 37.5% of labour costs below 10,000 euros to 33.2% for those greater than 70,000 euros. In the class of higher labour cost, due to the effect of the ceilings, the contributions are slightly lower, whereas in the class under 10,000 euros, due to the minimum rate, they are higher. This trend can be seen for the other two categories of workers: the contributions component decreases with labour costs, while taxes on labour increase. The decline of the wedge in the transition from the class of labour costs lower than 10,000 euros to that between 10,000 and 15,000 euros also occurs for the other workers considered: for contract workers the wedge goes down slightly from 26.2% to 25.6%, while for workers with two or more incomes the wedge is reduced to an extent similar to that of employees, declining from 40.2% to 36%.

Figure 9 - Tax wedge by labour cost – Employees *(in % of labour cost)*



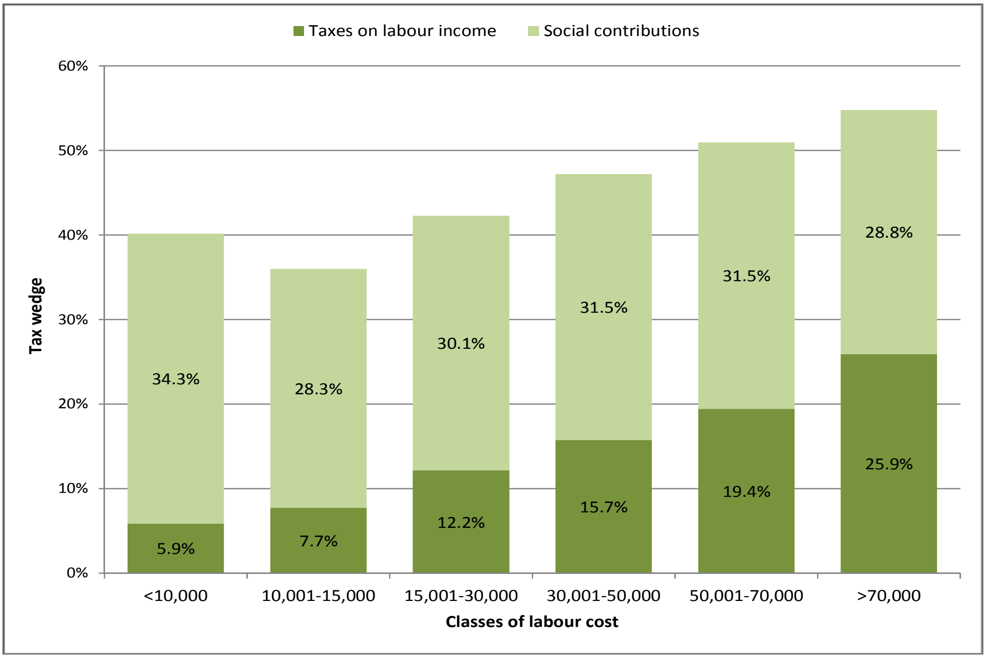
Source: Istat, Microsimulation model of household taxes and benefits (FaMiMod): 2009 incomes updated to 2012

Figure 10 - Tax wedge by labour cost – Contract workers *(in % of labour cost)*



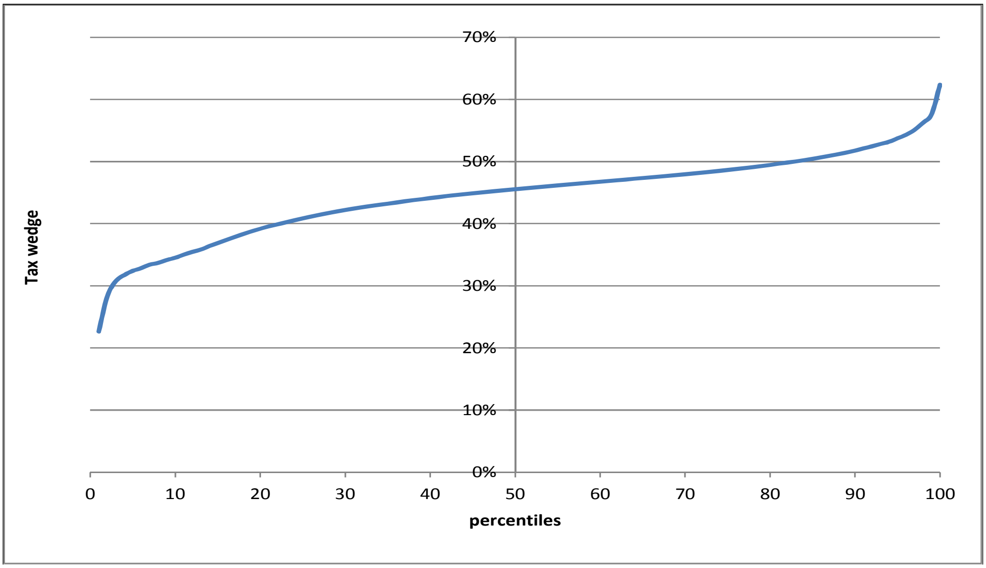
Source: Istat, Microsimulation model of household taxes and benefits (FaMiMod): 2009 incomes updated to 2012

Figure 11 - Tax wedge by labour cost – Two or more income earners *(in % of labour cost)*



Source: Istat, Microsimulation model of household taxes and benefits (FaMiMod): 2009 incomes updated to 2012

Figure 12 - Tax wedge – Employees *(average individual rate)*



Source: Istat, Microsimulation model of household taxes and benefits (FaMiMod): 2009 incomes updated to 2012
(a) The tax wedge is computed at the average individual level.

Finally, in Figure 12, the distribution of the tax wedge[15] shows that 50% of workers with one labour income as an employee has a tax wedge which accounts for slightly less than 47% of the total labour cost.

As we have seen the tax wedge in Italy is particularly high. In OECD (2013) it is shown that, in 2012, the percentage incidence of taxation on labour income and of social contributions on labour cost[16] in Italy amounted to 47.6%, placing Italy in the sixth position among the 34 OECD countries, after Belgium, Germany, France, Hungary and Austria (Table 3). However, the level of the tax wedge in each country reflects the system of taxation and redistribution that each country has adopted, which makes it difficult to evaluate the effects of measures to intervene on the tax wedge.

The reduction of the tax wedge is one of the objectives of the Budget law ("Legge di stabilità") for 2014[17] for two reasons related to the short-term crisis and the long-term lack of economic growth. The first reason is to help increase productivity through greater competitiveness of firms and thus a potential restart of the economic growth: for newly hired workers with permanent contracts made in 2014 to increase the employment base, there is a deduction from the Regional Tax on Productive Activities (Irap) up to 15,000 euros for a three-year period, resulting in a reduction of the tax due by the employer[18]. The second reason is to achieve the objectives of redistribution with respect to certain categories of workers by increasing tax credits for earned labour income, thus reducing the tax burden and therefore increasing the net wage of the employee.

[15] The distribution displays the dispersion of the tax wedge computed at the average individual level, whilst in the previous graphs the tax wedge was equal to the ratio between total revenue and total labour cost.

[16] The percentage of labour cost is taken with reference to a single individual without children who earns the income of the average production worker (see OECD, 2013).

[17] "Disposizioni per la formazione del bilancio annuale e pluriennale dello Stato", Law n. 147/2013, art. 1, paragraph 127.

[18] The calculation of the tax wedge based on FaMiMod model does not encompass the Irap component paid by the employer. However, the model provides an estimate of the Irap relating to the personal income of the sampled self-employed workers.

Table 3 - The components of the tax wedge as a percent of labour costs in 2012[a]

Country[b]	Income tax	Employee SSC	Employer SSC©	Total tax w edge[d]
Belgium	22.1	10.8	23.2	56.0
France	10.2	9.5	30.6	50.2
Germany	16.0	17.3	16.4	49.7
Hungary	12.8	14.4	22.2	49.4
Austria	12.3	14.0	22.6	48.9
Italy	16.1	7.2	24.3	47.6
Sw eden	13.6	5.3	23.9	42.8
Finland	17.7	6.2	18.6	42.5
Czech Republic	8.8	8.2	25.4	42.4
Slovenia	9.4	19.0	13.9	42.3
Greece	6.9	12.8	22.2	41.9
Spain	13.5	4.9	23.0	41.4
Estonia	12.7	2.1	25.6	40.4
Slovak Republic	7.4	10.5	21.8	39.6
Netherlands	14.9	13.9	9.7	38.6
Denmark	36.2	2.7	0.0	38.6
Turkey	11.1	12.9	14.2	38.2
Norw ay	19.1	6.9	11.6	37.6
Portugal	8.7	8.9	19.2	36.7
Luxembourg	13.8	11.0	11.0	35.8
OECD	13.1	8.2	14.4	35.6
Poland	5.8	15.3	14.4	35.5
Iceland	26.8	0.4	7.2	34.5
United Kingdom	14.0	8.5	9.8	32.3
Japan	6.6	12.0	12.6	31.2
Canada	13.6	6.6	10.6	30.8
United States	15.6	5.1	8.9	29.6
Australia	21.6	0.0	5.6	27.2
Ireland	13.4	2.9	9.7	25.9
Sw itzerland	9.7	5.9	5.9	21.5
Korea	4.4	7.4	9.2	21.0
Israel	7.5	7.3	4.4	19.2
Mexico	7.3	1.2	10.5	19.0
New Zealand	16.4	0.0	0.0	16.4
Chile	0.0	7.0	0.0	7.0

Sources: OECD (2013); country submissions, OECD (2012)
(a) Single individual without children at the income level of the average worker
(b) Countries ranked by decreasing labour costs
(c) Includes payroll taxes where applicable.
(d) Due to rounding, the total tax wedge may differ by one or more percentage points from the sum of the components. For Denmark, the Green Check (cash benefit) contributes to the difference as it is not included in the components.

5. The Personal Income Tax

5.1 Taxable incomes, gross and net tax liabilities

The Italian personal income tax (Irpef - *"Imposta sul reddito delle persone fisiche"*) applies increasing tax rates to the income, net of tax deductions:

$$T^G = \tau_i (Y^{TN} - L_i) + \Delta Y_i \qquad \text{if } L_i < Y^{TN} <= L_{i+1}$$

$$\text{where} \quad \Delta Y_i = \Delta Y_{i-1} + \tau_i (L_{i+1} - L_i) \quad \text{and} \quad \Delta Y_1 = 0$$

In the above formula, T^G is the gross tax liability for a taxable income Y^{TN} (net of tax deductions) and L_i its lower bound of the *i*-th income bracket (*i*= 1,…,5). The final tax liability is obtained by subtracting the tax credits from the gross tax.

Some incomes are totally tax exempt. The most important examples are the social security public transfers for low-income elderly (*"Assegno sociale"* and *"Pensione sociale"*), for children (*Family allowances*, *Maternity allowances*), for disabled persons.

Taxable income Y^{TN} is net of three main deductions:

- Mandatory social security contributions on primary (market) incomes
- Incomes taxed separately at source (*e.g.* interests on financial assets)
- Deductible expenses (*e.g.* voluntary contributions to private pensions plans)

Tax evasion is equivalent to another deduction from the tax base and must be estimated, even though approximately, to ensure consistency with the aggregate revenues recorded by the tax administration and encompassed in the National Accounts.

In pre-existing microsimulation models, correction coefficients were applied to components of total income showing a severe misalignment in their weighted sample total with respect to tax aggregates, in particular income from self-employment.

In the Italian edition of the EU-SILC project, when both the administrative files and the survey report it, income from self-employment is set equal to the maximum value between individual (anonymous) information on: (i) the net self-employment income resulting from the tax return and: (ii) the net self-employment income reported in the survey questionnaire.

This procedure is adopted to minimise either under-estimation due to tax evasion in the administrative data or under-reporting in the survey data, depending on which of the two is larger[19]. Among the individuals for which both sources contain self-employment incomes, the record linkage reveals that under-estimation is more frequently observed in the tax data than in the survey data. It turns out, moreover, that self-employment income in the integrated dataset is more unequally distributed than in the survey.

Tax exempt income of any kind, including tax avoidance, is encompassed in the

[19] The procedure requires the exact matching of survey with administrative data. With respect to the exclusive use of survey data, the record linkage increases substantially the number of percipients and the average self-employment income, resulting in aggregate estimates that are closer to the National Accounts figures.

disposable income of the individuals and their households and should be accounted for in the net income simulated by FaMiMod. In fact, when self-reported income is greater than the corresponding administrative value, the model uses such a difference at the micro level as a proxy for the amount of income that is not reported to the tax authorities. No correction is made when the administrative income is greater than that reported in the survey. The ratio of unreported to net income in the base year is then multiplied by the updated self-employment income in subsequent years to estimate the amount undeclared to the tax agency. As yet, the impact of the correction is relevant, as can be seen from Table 4.

Table 4 - Composition of overall income for tax purposes: FaMiMod versus tax returns *(thousands of euros)*

	Tax Returns 2012 (2011 incomes)	FaMiMod (2012 incomes) without corr_AUT	FaMiMod (2012 incomes) with corr_AUT
	(a)	(b)	(c)
Employee income	**422,904,039**	**467,462,666**	**467,462,666**
Pensions	**233,863,552**	**245,003,631**	**245,003,631**
Land	**1,335,021**	**2,081,063**	**2,081,063**
Buildings	**35,000,761**	**35,279,919**	**35,279,919**
Enterprise	***31,826,979***		
Self-employment	***33,906,366***		
Partnership	***35,892,693***		
Other income	***7,307,435***		
Total self-employment income	**108,933,473**	**205,980,020**	**128,267,218**
Optional separate taxation	517,190		
Maternity leave		383,018	383,018
Overall income	**800,293,855**	**956,190,317**	**878,477,515**

Source: (a) http://www.finanze.gov.it/stat_dbNew/index.php
(b) and (c): simulations with Istat Microsimulation model of household taxes and benefits (FaMiMod; corr_AUT: correction of self-employment income). To assure homogeneity with (a), Buildings and Overall income include imputed income of owner-occupied housing, following the tax law in force until 2011.

These data coming from different sources allow an analysis of the relationship between under-reporting and tax evasion (see Di Marco, 2007).

The model can also provide an estimate of the share of Irap (“*Imposta Regionale sulle Attività Produttive*”) relating to self-employment incomes. Depending on the scope of the analysis, this charge on companies can be optionally included in the total tax liabilities of the individuals. Indeed, Irap is not an income tax *per se*, the value added being its tax base. However, for the share of value added that consists of compensations for the work of the self-employed who own the business, Irap can be viewed as an additional tax on income. Moreover, this assures consistency with EU-SILC target variable for gross income from self-employment used as input, that includes a share of Irap estimated by applying the statutory tax rate to the share of self-employment in total taxable income

The sum of the tax credits determines algebraically the upper bound of the *no tax area*, below which no tax is due. If the sum of the tax credits exceeds gross tax liabilities, the difference is lost, since as a general rule there is no negative income tax[20]. A part of the fiscal benefits can thus be canceled for the taxpayers with the lowest incomes, namely those included in the *no tax area*.

5.2 The tax credit module

For the simulation of tax credits for employment, similar incomes and pensions the EU-SILC source supplies the basic information, with the exception of months worked by contract workers (a category of self-employed who are treated like employees under this respect). When missing, these had to be estimated as briefly sketched above (see section 2). On the other hand, unlike the Bank of Italy SHIW, months of income are present for various kind of unemployment benefits that are treated as employee income with respect to tax credits.

For the simulation of tax credits for dependent relatives (spouse, children, and other), pre-existing microsimulation models based on SHIW had to reconstruct the relevant tax unit as a preliminary, splitting multinuclear households when each nucleus included potential beneficiaries and/or restructuring the household in order to set a potential beneficiary rather than a dependant at the head of the unit. The EU-SILC source allows to skip this stage, since it includes information on nuclear families within the household (defined by parental and couple relations) that can be viewed as a suitable proxy for the tax units entitled to tax credits (as well as to family allowances, see section 6).

The modelling of tax credits takes into account all the important details of the tax law, already considered by the most advanced pre-existing models. In particular, the model considers the possible trade-offs in the choice of the most convenient tax credit for the first child of a lone parent and, moreover, in the attribution of the full tax credit for the dependent children to the highest income parent as an alternative to the fifty-fifty splitting between both parents when none of them is dependant. For lone parents, the tax credit for the first dependent child could equal, if more beneficial to the taxpayer, the tax credit for the spouse of an ordinary household. Actually, these tax credits share the same amount (in 2012) in correspondence of very low income levels. The first child tax credit, however, is constant for a broad income bracket, whilst the spouse tax credit is more strictly related to the taxpayer's income.

For couples with children, the choice between a full tax credit to the highest income parent and a splitting of it in two halves only arises when the parent with the lowest income cannot benefit (totally or partially) of the tax credits he is entitled to (in Italian, "*incapiente*"). In fact, with few exceptions, the Italian tax schedule does not entail negative income taxes, so that in this case the highest income parent may be entitled to a greater effective benefit, even though his tax credit decreases as income grows.

Minimum values of tax credits provided for low income employees (including contract workers) and pensioners, aimed at limiting tax credit cuts due to a limited number of months of activity, have also been modelled. This detail proves particularly useful in order to check simulated values against individual (anonymous) tax record data associated with the sample, because in this case values are fixed rather than highly sensitive to small

[20] The special tax credit for households with three or more dependent children, however, is an exception, as are tax credits for rents (see below).

variation of income as is the rule, due to the linear decreasing mechanism introduced in 2002 when tax credits were turned into tax allowances and confirmed in 2007 when tax credits were restored.

When simulating tax credits, some items are particularly subject to overestimation, that is the tax credit for other dependent relatives and the (payable) tax credit for rents. In the first instance, entitled taxpayers do not always claim this benefit (that is, take-up is less than 100%); on the other hand, in some cases the model is not able to assure that the family relationship between potential claimant and dependant complies with the rules set by the tax law, aimed at excluding less close relationships. In the second instance, the main source of overestimation is the phenomenon of undeclared rents, since a registered rental agreement must be referred to when claiming for this tax credit.

Table 5 - From overall income for tax purposes to net tax: FaMiMod versus tax returns *(thousand of euros)*

	Tax Returns 2012	FaMiMod (2012 incomes)	
	(2011 incomes)	with sel_DETR	without sel_DETR
	(a)	(b)	(c)
Overall income	800,293,855	878,477,515	
Allowance for owner-occupied housing	8,510,433	8,599,632	
Tax allowances	22,400,416	36,454,276	
Taxable income	772,219,281	834,435,128	
Gross tax	208,215,753	223,712,968	
Tax credits for dependent relatives	11,289,654	12,237,558	
of which: other relatives	*230,862*	*285,670*	*438,703*
Tax credit for employment and pensions	41,467,876	42,185,390	
Tax credit for medical and other expenses	5,476,874	5,838,837	
Tax credit for home improv. & maintenance	2,457,789	2,175,808	
Tax credit for rents	146,926	187,935	*541,105*
Other tax credits	1,318,279	1,156,277	
Total tax credits	62,112,973	63,784,205	
Net tax	152,219,369	164,853,295	

Source: (a) http://www.finanze.gov.it/stat_dbNew/index.php (tax credit for other relatives: tax records associated with the sample)
(b) and (c): simulations with Istat Microsimulation model of household taxes and benefits (FaMiMod; sel_DETR: correction of selected tax credits). To assure homogeneity with (a), Overall income includes imputed income of owner-occupied housing and the corresponding allowance has been calculated, following the tax law in force until 2011.

In both cases, the chosen solution (already experimented with MASTRICT model) is the application of a random selector. This allows the exclusion of a number of beneficiaries, limiting the overestimation compared to aggregate tax record data (Table 5). The specific innovation in FaMiMod is to use the individual (anonymous) tax record data as an additional filter, in order to prevent real beneficiaries of this tax credit from having simulated values set to zero as a result of the random process.

As stated above (see section 2), tax credits based on deductible charges (health expenses etc.) which cannot be simulated on the basis of sample information are imputed using individual (anonymous) information stemming from tax records linked to sample units. For the residual fiscal item “other tax credits”, care is taken to minimise possible duplications with respect to simulated tax credits, in particular the tax credit for rents. Since statutory values show a limited differentiation, it is possible to detect cases where the “other tax credit” might correspond in fact to a tax credit for rents: in these cases, the value to be imputed from tax records is set to zero when simulated tax credit for rents exist.

In this first release of FaMiMod, the beneficiaries of alimony could not be included among those entitled to tax credits for employment, similar incomes and pensions, because information on alimony is missing from the 2010 release of EU-SILC taken as a source. In the next release the information should be restored, thus allowing to plug the gap.

In perspective, further developments of the tax credit module are possible by further exploiting the potential of the database. For instance, individual tax information linked to sample units allows to track individuals with dependent relatives living outside the household (for instance because they are divorced), up to now invisible to microsimulation models. The same source of data can help improving the correspondence between EU-SILC nuclei and tax units, particularly for components that are marked as “isolated” rather than children only because of their marital status (for instance, widows): these should be traced back to a nucleus when they can give rise to a tax credit.

As regards disability, a well-known gap in sample surveys on incomes, some information would be useful in order to include in the simulation the additional tax credit for disabled children. As a first approximation, proxies of this condition developed in other modules of the model (for instance, family allowances), however incomplete, could be exploited.

5.3 Regional and Municipal Income Taxes

The establishment of additional regional and municipal taxes comes as part of the process of fiscal decentralization of the state, in order to implement fiscal federalism[21].

The additional regional and municipal taxes are direct taxes that apply in addition to the personal income tax (Irpef) and are paid to regions and municipalities. The tax base on which both additional taxes are calculated is the same, and it consists in the sum of all personal incomes, net of deductible expenses. Nevertheless, a taxpayer is subject to additional taxes only if his personal income tax is due. The rates established by the region and the municipality of residence, within the limits of the maximum rate, must then be applied to the tax base. Additional regional and municipal tax rates are divided into two components: a partnership tax rate, which is compulsory and established by the central

[21] The regional additional tax was established by Legislative Decree n. 446/97 (art. 50) with effect from 1 January 1998. The municipal additional tax was established by Legislative Decree n. 360/1998 (Art. 1), and has been applied since 1999.

government[22] and an optional tax rate that can be introduced at the local level, within the limits of national law. The authorities of both regions and municipalities have legislative power over the determination of tax liability, as well as over any exemption based on taxpayers characteristics.

The additional municipal tax is ruled by the municipality[23] which may also introduce a threshold for exemption from tax for certain types of income (pension or employee or self-employed) and/or for the family composition, in relation to specific income thresholds. The system of local taxes that is currently in force has a wide heterogeneity in the application of different methods of tax levy, due to the decentralization at the regional and municipal level of the jurisdiction that defines the parameters relevant for this tax. In an attempt to simplify some local authorities adopt a single rate, while others have implemented a system of different rates. Municipalities may establish a variety of differential rates: however, they should articulate them according to the brackets of the personal income tax (*Irpef*) nationwide.

In the FaMiMod model there are two modules for additional taxes, one dedicated to the additional regional tax and the other to the municipal one. The module on the additional regional tax takes into account any tax exemptions or tax rates and increases for the entirety of the Italian regions.

As to the module on the municipal tax, information provided by individual municipalities has required a good deal of interpretation and systematization. All the information available in 2012 for the calculation of rates, exemptions and facilities has been taken into account to model the tax. The modeling, however, only concerns the municipalities represented in the EU-SILC survey (just over 10% of Italian municipalities), which are not necessarily representative of the distribution of the average rates of local taxes in Italian municipalities.

To assess the progressivity of additional regional tax structure, in Figures 13 a, b, c and d we consider the average rate[24] according to the different personal income tax brackets (Irpef) by region in 2012. Most regions (Valle d'Aosta, Trentino, Veneto, Friuli Venezia Giulia, Lazio, Molise, Campania, Basilicata, Calabria, Sicily, Sardinia) essentially have a proportional single tax rate, with the exception of the lowest income bracket (under 15,000 euros) where the incidence of low-income taxpayers located in the no-tax area results in a lower average tax rate. Other regions (Liguria, Emilia Romagna and Piedmont) have a lower tax rate in the two lowest income brackets (up to 28,000 euros), while two regions (Tuscany and Umbria) have a single tax rate in central income brackets, a lower tax rate for those on lower incomes (under 15,000 euros) and an higher one for higher incomes (over 75,000 euros).

[22] The basic rate for the additional regional tax is set by Central Government to 1.23%, while it was 0.9% previously. Regions can apply variations up to 0.5% on this rate in 2012, that is the limit established by national law (DL n. 138/2011 converted into Law no. 148/2011). In addition, regions with a budget deficit in health care have the option of applying the maximum rate of 2.03% (Legislative Decree n. 68/2011, implementing decree on fiscal federalism).

[23] The rate, which can vary between municipalities cannot exceed 0.80%, as expressly provided by law (Law no. 296/2006 art.1, paragraph 142). Previously, the optional additional tax rate could not exceed the maximum limit of 0.5%, with an annual increase of no more than 0.2%. The municipalities may decide to change the rate by 31 December of each year (Art. 28, Law no. 342/2000).

[24] The average tax rate is calculated as the ratio between the revenue from the additional regional tax and the corresponding tax base.

Finally, in some other regions (Marche, Lombardy, Alto Adige, Abruzzo and Puglia) there is a progressive tax rate that increases with income. In addition, the highest rates (at around 2%) are found in the South in the three regions (Molise, Campania and Calabria) subject to repayment plans for the deficit due to health care spending in 2012, while the lowest rates (at an average tax rate of around 1%) are observed in some northern regions where taxpayers in the lowest income bracket are either exempt or subjected to a reduced rate (Alto Adige and Friuli Venezia Giulia). The highest average tax rates are found in regions with higher incomes than the rest of the country and a progressive tax rate, as is the case of some northern regions (Emilia Romagna, Piedmont and Liguria) and one central region (Lazio).

Most of the regions with a prevailing single average rate settle at values around 1.23% and 1.73%, which are the basic statutory rates in 2012 established by the central government.

Figure 13 a - Additional regional tax by income tax bracket and geographical area *(average tax rate 2012[a])*

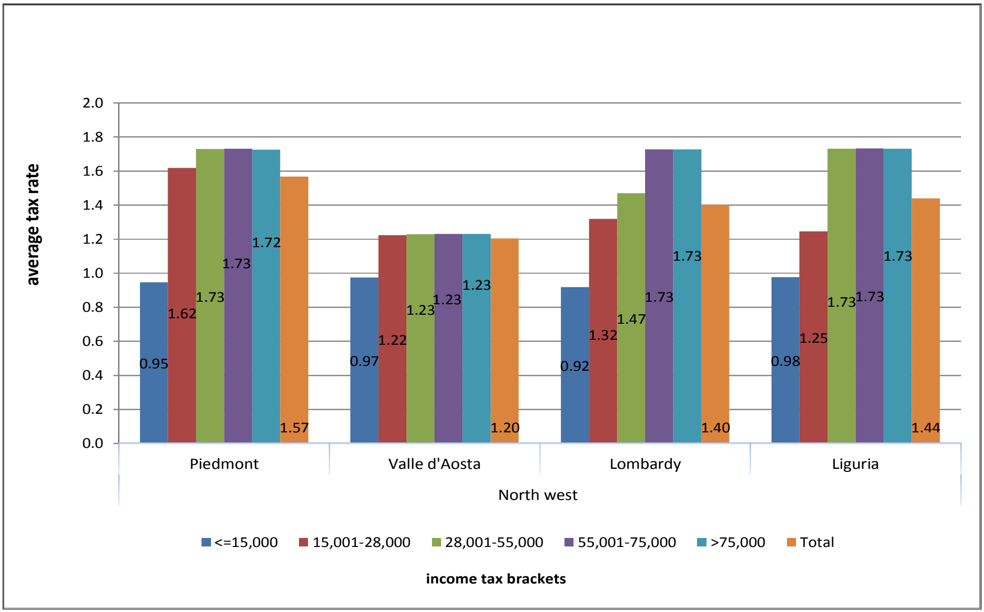


Figure 13 b - Additional regional tax by income tax bracket and geographical area *(average tax rate 2012[(a)])*

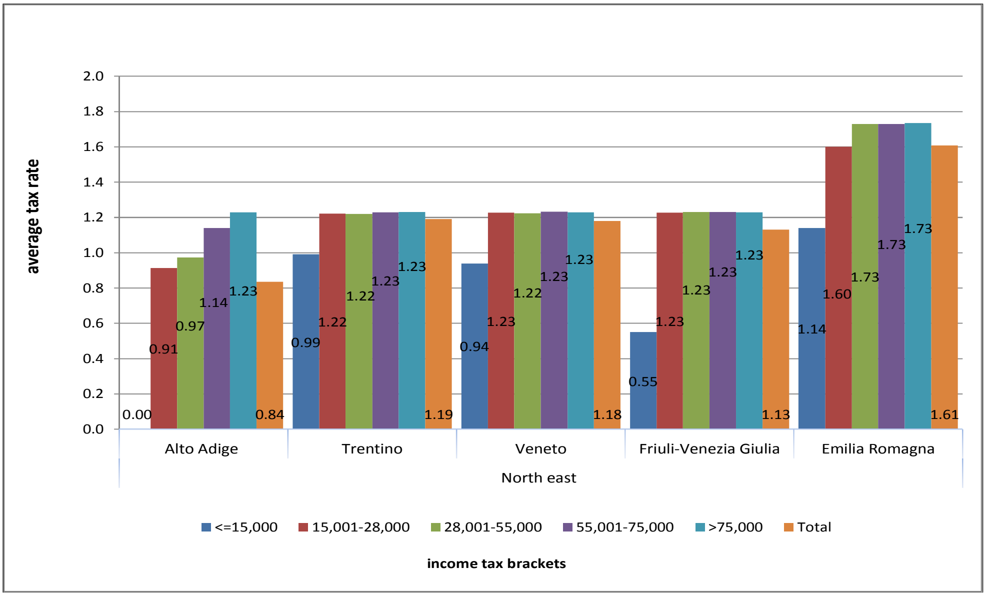


Figure 13 c - Additional regional tax by income tax bracket and geographical area *(average tax rate 2012[(a)])*

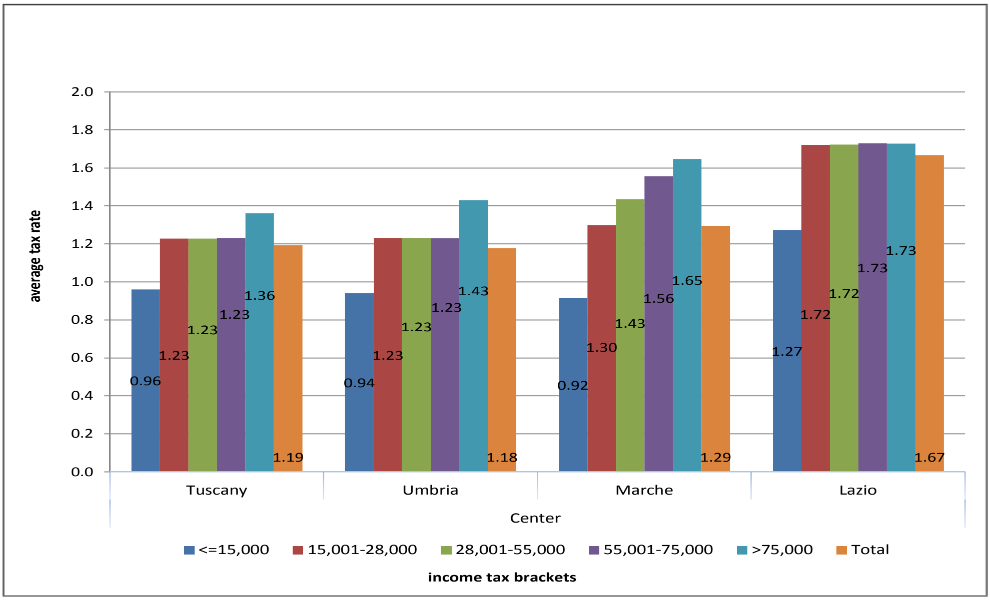
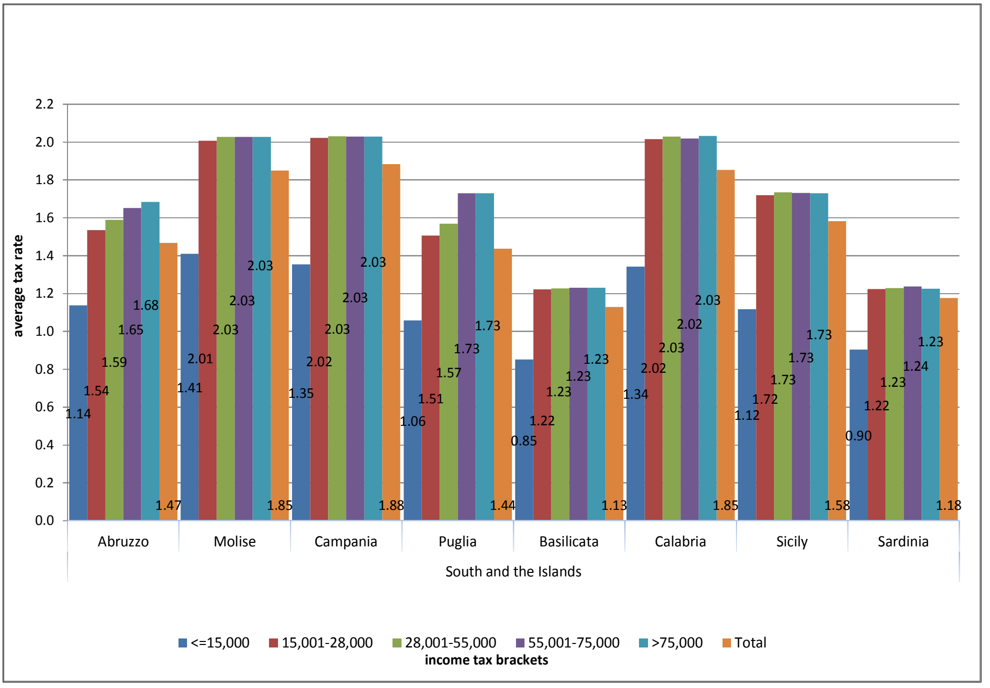


Figure 13 d - Additional regional tax by income tax bracket and geographical area *(average tax rate 2012[(a)])*



Source: Istat: Microsimulation model of household taxes and benefits (FaMiMod): 2009 incomes updated to 2012

(a) The average tax rate is calculated as the ratio between the revenue from the additional regional tax and the corresponding tax base.

Turning to the additional municipal tax, Figures 14 a and b show the average rate, that is the ratio between the revenue from the additional tax and the tax base according to the different personal income tax brackets (Irpef), by macro area in 2012. In all areas the additional municipal tax shows a proportional or mildly progressive structure, with a rate that increases marginally in all income brackets above the first (over 15,000 euros). There is a slightly greater increase in the rate in the last income bracket (over 75,000 euros) in the North-west, Center, South and the Islands. A mild case of regressive municipal tax is found in the South in the transition from the third to the fourth income bracket, in which the average tax rate is lower, although to a limited extent. Finally, it should be noted that the highest rates are found in the Center, probably due to the presence of the city of Rome[25], followed by the South, the Islands and the North-east.

[25] The city of Rome has many inhabitants almost half of the entire region and has also high additional tax rates.

Figure 14 a - Additional municipal tax by income tax bracket and geographical area *(average tax rate 2012[(a)])*

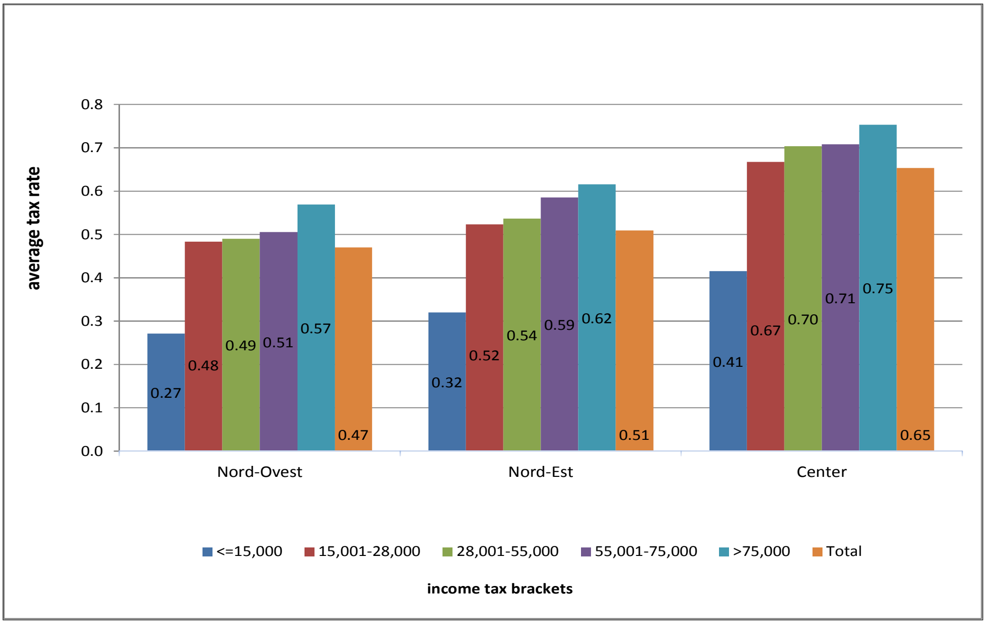
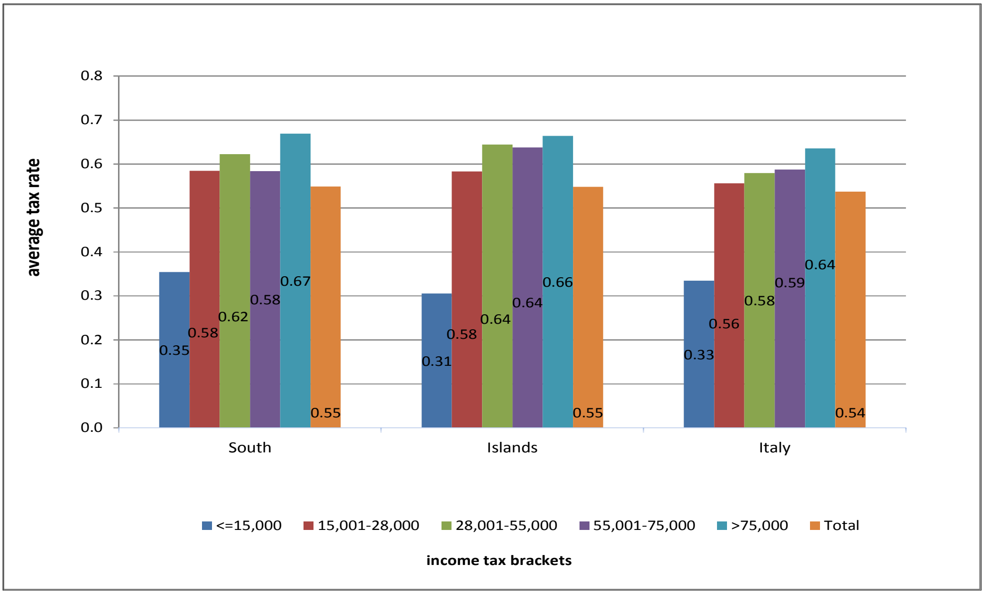


Figure 14 b - Additional municipal tax by income tax bracket and geographical area *(average tax rate 2012[(a)])*

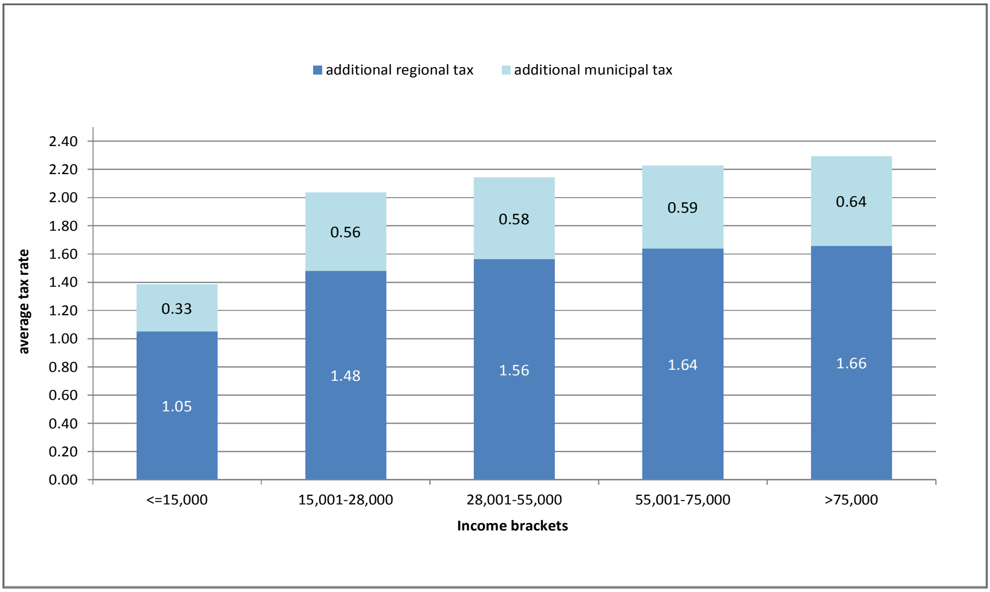


Source: Istat: Microsimulation model of household taxes and benefits (FaMiMod): 2009 incomes updated to 2012

(a) The average tax rate is calculated as the ratio between the revenue from the additional municipal tax and the corresponding tax base.

Finally, Figure 15 shows the average combined rate[26] of additional regional and municipal taxes in Italy, according to the different personal income tax brackets (Irpef) in 2012. The two taxes are moderately progressive: the most consistent rate increase, for both the regional and the municipal rate, occurs in the transition from the first to the second personal income tax bracket and, although to a lesser extent, in the transition from the second last to the last personal income tax bracket.

Figure 15 - Additional regional and municipal tax by income tax bracket – Italy - *(average tax rate 2012[(a)])*



Source: Istat: Microsimulation model of household taxes and benefits (FaMiMod): 2009 incomes updated to 2012
(a) The average tax rate is calculated as the ratio between the revenue from the additional regional and municipal tax and the corresponding tax base.

The result is a tax levy system that is complex and heterogeneous. The system has potentially distortionary effects due to the lack of coordination between the redistributive goals pursued at the central level and those introduced at the local level, as well as local differences between the various regions and municipalities, to the effect that taxpayers with the same income can be treated very differently depending on the region or the municipality in which they reside. Moreover, this system also increases the overall tax burden.

[26] The average tax rate is calculated as the ratio between the revenue respectively of the additional regional and of the additional municipal taxes and the corresponding tax base.

6. Family allowances

6.1 The Italian system

The current system of Family Allowances (*"Assegno per il nucleo familiare"*, hereafter ASF) can be viewed as the result of a troubled history, in which subsequent laws are stratified and overlap in time, without merging in a fully organic and coherent design.

The first economic support to family burden in Italy dates back to the mid-thirties[27]. Since then, a long sequence of interventions and micro-interventions have occurred over the decades: the 1955, 1988 and 2007 reforms attempted to rationalize and standardize this matter, not always fully achieving this goal. Just to sketch the long-term trends of this regulatory process, we can highlight some relevant aspects:

- the shift from a social security measure, categorical (i.e. related to the employment status of the recipient) and characterized by high funding rates, to a social assistance tool designed to support family income, financed by general taxation: recipients have been progressively extended – the measure remaining still categorical – including retirees (former employees), those receiving unemployment benefits and more recently (with 1998 Budget Law, no. 449/1997) the contract workers (termed Co.co.co or Co.co.pro,)
- the gradual merging of benefit structures, originally differentiated according to working sector[28];
- the introduction of selection rules (since 1988), varying allowance amounts on the basis of family income and excluding households beyond a maximum threshold[29];
- the introduction of benefit differentiation according to the number of family members, particularly children (making it more generous for larger families), and depending on the presence of disabled, single parents or orphans.

The 2007 Budget Law (no. 296/2006) outlined the current system: the most significant change, compared to before, is represented by the introduction of a "quasi-linear" decreasing rule in the amount of the allowances, in order to soften significantly the previous strong "poverty trap" effects (see Figure 16)[30]. The recipients were defined, according to Law no. 153/1988 (no amendments occurred subsequently on this respect), as families fulfilling certain requirements. These are briefly summarized below.

[27] We shortly report some focal point of the story, a fully discussion falling outside the scope of the present contribution. More insights can be found in Ricci (2008).

[28] Allowances were different depending on whether the worker was an employee in industry, commerce, etc.; civil servants benefited of the so-called "family addition", differentiated on the basis of the size of the municipality. The unification of all treatments occurred with the 1988 reform (Law no. 153/1988) that defined the "*Assegno per il Nucleo Familiare*". At present, only allowances for farmers, tenant farmers and sharecroppers, together with pensioners formerly self-employed, are diversified.

[29] Actually, the first measures differentiating benefits with family income and establishing maximum threshold for access to the benefit refer to some years before (Law Decrees no. 17/1983 and no. 70/1984, Law no. 41/1986). However, the 1988 reform organically introduced ASF decreasing with income: mainly for this reason, the number of individuals living in beneficiary households showed a marked decrease during the eighties (from 24 to 14 million persons).

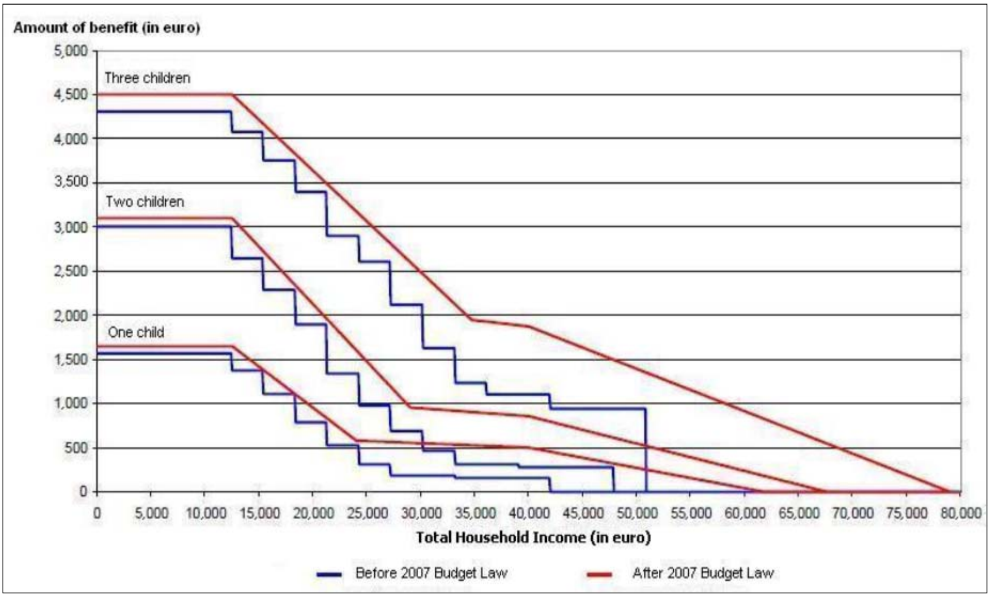
[30] As results from Figure 16, taken from Ricci (2008), in 2006 the annual benefit for a three children family was equal to 942 euros for incomes up to 49,968 euros and became zero beyond this level, while for five children the benefit below the maximum income threshold (55,776 euros) even reached 2,268 euros.

Demographic requirements: the family unit is composed of the applicant, his/her spouse, children of minor age and, if disabled, even older (provided that they are not married). If there are at least four children under 26 years, children aged 18 or more but less than 21 are also included, as long as they are students or in training. Finally, brothers, sisters and grandchildren of the applicant are included, as are minors or disabled adults if they have lost both parents, are unmarried and not entitled to survivor pension.

Job requirements: employees (including part-time), unemployed receiving unemployment benefits, retired former employees, contract workers, domestic workers and farm workers are eligible for the benefit. The amount is paid monthly and is immediately cut off when any requirement is lost.

Income requirement: the sum of all incomes subject to the income tax of the eligible family members is considered, including (if above 1,032.91 euros) tax-free incomes or those subjected to substitute tax[31]. However, at least 70% of household income must result from wages (or incomes from contract work), unemployment benefits and pensions. Yearly income of the family in year *t - 1* determines the amount of the benefit for the second half of year *t* and the first half of *t + 1*.

Figure 16 - Family allowances before and after 2007 Budget Law *(Household with both parents and no disabled)*



Source: Ricci (2008)

[31] Among the first, social pensions/allowances and disability pensions are to be included, whereas allowances for the attendance of disabled persons, war pensions and family allowances themselves are excluded. As for incomes subjected to substitute tax, the typical example is interest on financial assets.

6.2 Modelling allowances

Despite the considerable rationalization carried out by 2007 Budget Law, ASF scheme is still based on a complex mechanism of income thresholds, benefit values and decreasing paths, all depending on the number of eligible family members making up the family unit and some other household characteristics. One can briefly summarize the model using the following expressions and parameters:

- a first threshold *s_ass*$_0$ variable by family size and type, identifying the income level below which the benefit is maximum;
- a final threshold *s_ass*$_{NO}$ variable by family size and type, identifying the income level above which the benefit is null;
- intermediate thresholds, also variable by family size and type, identifying the income level at which the decreasing rule (i.e., the speed) changes;
- an additional allowance for single-parent households with 3 or more children, also defined according to thresholds and decreasing rules varying by family size and type.
- In short, allowances can be expressed by[32]

$$ASF = ASF_0^F \, , \qquad Y < s_{ass_0}^F$$

$$ASF = ASF_0^F - \left[\sum_{i=1}^{K-1} p_i^F \frac{\left(s_{ass_i}^F - s_{ass_{(i-1)}}^F\right)}{INT}\right] - p_K^F \frac{\left(Y - s_{ass_{(K-1)}}^F\right)}{INT}, \qquad s_{ass_{(K-1)}}^F \leq Y < s_{ass_K}^F$$

$$ASF = 0 \, , \qquad Y \geq s_{ass_{NO}}^F$$

where *s_ass* and *p* are depicted in Tables 6 and 7, *K* may vary between 1 and 5 (depending on family type), *F* indicates parameter variability according to household characteristics (i.e., number of children, parents, presence of disabled persons) and the income bracket *INT* was fixed by 2007 Budget Law equal to 100 euros and yearly increases along with thresholds according to price index (currently it is equal to 110.27 euros).

[32] As already mentioned, the expression represents a proxy of the quasi-linear decreasing rule. The resulting values are coherent with official ones at the top of each income class; on the contrary, for the bottom values of each class the discrepancy is maximum, the size depending on the decreasing rule in that income class.

Table 6 – Family allowance Income thresholds, by family type *(2012 July - 2013 June)*

Family type	s_ass_0	s_ass_1	s_ass_2	s_ass_3	s_ass_4	s_ass_{NO}
both parents, at least one minor, no disabled, 3 persons	13,784.93	26,467.05	44,111.75			68,042.37
both parents, at least one minor, no disabled, 4 persons	13,784.93	31,981.03	44,111.75			74,548.84
both parents, at least one minor, no disabled, 5 persons	13,784.93	38,266.94	44,111.75			87,120.71
both parents, at least one minor, no disabled, 6 persons	13,784.93	23,489.51	39,810.85	49,625.72		89,767.40
both parents, at least one minor, no disabled, 7 persons	13,784.93	23,489.51	39,810.85	43,008.96	49,625.72	95,171.09
single parent, at least one minor, no disabled, 2 persons	13,784.93	26,467.05	44,111.75			68,042.37
single parent, at least one minor, no disabled, 3 persons	13,784.93	31,981.03	44,111.75			74,548.84
single parent, at least one minor, no disabled, 4 persons	13,784.93	38,266.94	44,111.75			87,120.71
single parent, at least one minor, no disabled, 5 persons	13,784.93	23,489.51	39,810.85	49,625.72		89,767.40
single parent, at least one minor, no disabled, 6 persons	13,784.93	23,489.51	39,810.85	43,008.96	49,625.72	95,171.09
single parent, at least one minor, no disabled, 4 persons - additional allow ance	15,990.51					28,812.60
single parent, at least one minor, no disabled, 5 persons - additional allow ance	15,990.51	58,448.07				91,722.11
single parent, at least one minor, no disabled, 6 persons - additional allow ance	23,489.51	61,756.44				105,633.00
both parents, at least one disabled, 3 persons	24,592.30					68,097.26
both parents, at least one disabled, 4 persons	24,592.30					74,564.37
both parents, at least one disabled, 5 persons	24,592.30					87,159.99
both parents, at least one disabled, 6 persons	30,878.22					89,806.39
both parents, at least one disabled, 7 persons	33,083.81					95,198.73
single parent, at least one disabled, 2 persons	24,592.30					68,097.26
single parent, at least one disabled, 3 persons	24,592.30					74,564.37
single parent, at least one disabled, 4 persons	26,797.89					87,225.08
single parent, at least one disabled, 5 persons	30,878.22					91,659.79
single parent, at least one disabled, 6 persons	33,083.81					105,546.95
single parent, at least one disabled, 7 persons	36,392.19					109,636.05

Source: INPS

Table 7 – Family allowance parameters, by family type *(2012 July - 2013 June)*

Family type	ASF_0	p_1	p_2	p_3	p_4	p_5
both parents, at least one minor, no disabled, 3 persons	1,650	9.3	0.5	2.3		
both parents, at least one minor, no disabled, 4 persons	3,100	13.0	0.9	3.1		
both parents, at least one minor, no disabled, 5 persons	4,500	11.5	1.4	4.8		
both parents, at least one minor, no disabled, 6 persons	6,000	5.0	10.5	19.6	6.2	
both parents, at least one minor, no disabled, 7 persons	7,500	7.5	11.2	1.6	25.0	8.8
single parent, at least one minor, no disabled, 2 persons	1,650	9.3	0.5	2.3		
single parent, at least one minor, no disabled, 3 persons	3,100	13.0	0.9	3.1		
single parent, at least one minor, no disabled, 4 persons	4,500	11.5	1.4	4.8		
single parent, at least one minor, no disabled, 5 persons	6,000	5.0	10.5	19.6	6.2	
single parent, at least one minor, no disabled, 6 persons	7,500	7.5	11.2	1.6	25.0	8.8
single parent, at least one minor, no disabled, 4 persons - additional allowance	1,000	8.6				
single parent, at least one minor, no disabled, 5 persons - additional allowance	1,000	1.5	1.4			
single parent, at least one minor, no disabled, 6 persons - additional allowance	1,550	1.6	2.5			
both parents, at least one disabled, 3 persons	2,020	5.1				
both parents, at least one disabled, 4 persons	3,920	8.7				
both parents, at least one disabled, 5 persons	5,640	9.9				
both parents, at least one disabled, 6 persons	7,690	14.4				
both parents, at least one disabled, 7 persons	9,700	17.2				
single parent, at least one disabled, 2 persons	2,020	5.1				
single parent, at least one disabled, 3 persons	3,920	8.7				
single parent, at least one disabled, 4 persons	6,280	11.5				
single parent, at least one disabled, 5 persons	8,450	15.3				
single parent, at least one disabled, 6 persons	11,040	16.8				
single parent, at least one disabled, 7 persons	13,590	20.5				

Source: INPS

6.3 ASF: simulation issues

As is known, microsimulations generally need to be translated into working hypotheses, attempting to approximate current laws (or an alternative, hypothetical, scenario). In some cases, one can reach a good level of approximation of the “real world”, whereas in others some puzzles remain unsolved. Let us here review the problems that arose and the solutions given – when feasible – in the simulation.

A first issue concerns the definition of the family that is relevant for ASF: families in the model were derived from EU-SILC households, recoding kinships when appropriate to identify nuclear families within the households; therefore, in some household there can be two or more families that can apply for ASF.

A second issue relates to disability: to be eligible as a ASF recipient, a disabled person “has absolute and permanent inability to engage in work, for physical or mental dearth”. In the model, we count as disabled the pensioners and housewives who receive a disability pension (without labour income).

Using FaMiMod, the number of family allowances is estimated at 4.8 millions for

2012, with total expenditure equal to 5.2 billion euros (the resulting average allowance is 1,071 euros). Most benefits (96% of beneficiaries, 94% of expenditure) are paid to families with children and without disabled persons. Instead, recent National Accounts showed that family allowances in 2012 amounted to 6.4 billion euros[33]. The underestimation (over one billion euros) could be partly due, to the assumption that family income is entirely (i.e. honestly) reported when applying for ASF benefits, with the only exception of financial incomes.

Hence, an improvement in the treatment of tax avoidance is required fill the gap with National Accounts figures.

Further improvements may come from the simulation of family allowances for farmers, tenant farmers and sharecroppers as well as those directed to surviving spouses.

7. What is next?

An ambitious task of Istat is to jointly provide, for any given tax/policy, a representation of its redistributive effects and of the expected aggregate change in the public budget. The available data and the micro-simulation techniques, encompassed in FaMiMod, do not allow the simultaneous estimation of the redistributive effects and of total tax revenues. A second best *ad hoc* solution would be to setup an additional calibration of weights to compute the total amount of expenses and/or revenues. Such a calibration should correct the wide difference in the amount of under-reported income in administrative with respect to survey data. A more refined solution requires to find an appropriate mix of different analytical strategies:

- integration of FaMiMod with the macroeconomic forecasts provided by the Istat Me-mo model;
- in depth analysis of the whole information about the universe of taxpayers. On the one hand, it would be important to assess the statistical representativeness of the EU- SILC theoretical sample (*i.e.* including the non-respondents) when the reference population is the totality of Italian taxpayers. A first advantage would be the inclusion of the aggregate amounts from the tax files as constraints in the weighting procedure. On the other hand, the study of the differences between the incomes reported in the two sources of microdata would allow an improvement of the proxy measure of tax avoidance, which is now too simple;
- setup of a dynamic micromodel, including behavioural responses and demographic ageing, to obtain a better updating of both administrative and survey microdata from the base year to the desired date and to account for the expected individual reactions to policy changes.

[33] See dati.istat.it → National Accounts → Environmental and other satellite accounts → Social Protection Accounts. Actually, the 2012 value is slightly higher, amounting to 6.580 billion euros, since some items are delivered by INAIL (National Institute for Work Accidents Insurance). Since information on the total number of cheques paid is missing, we can consider data referring to year 2011 as a proxy (see 2011 General Report on Economic Situation in the Country): for that year, the number of beneficiaries in the private sector amounted to 3,961,000 (source: INPS), to which allowances provided to public workers must be added, which may be approximately estimated at about 400,000.

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