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On the Redistributive Effect of the Erosion of the PIT Base: The Case of Italy

Ph.D. Candidate:
Stefano Boscolo

Tutor:
Professor Massimo Baldini

Coordinator of the Ph.D. Program:
Professor Tindara Addabbo

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Abstract

This thesis, which is made up of three chapters, deals with the erosion of the Italian personal income tax (PIT) base and its redistributive consequences, a highly debated phenomenon that is considered as the main responsible for the increased level of vertical and horizontal inequities of the present tax system.

The erosion of the PIT base consists of the gradual exclusion from progressive taxation of several income components and their subsequent subjection to proportional taxes or exemption from taxation. At the time of writing, the Italian tax system is characterised by the following exemptions from progressivity: i) rental income from residential properties and shops can be subject to a proportional tax which is known as the *cedolare secca*); ii) cadastral income from properties kept available and located in a different municipality from the one of the main residence is exempt from taxation; iii) self-employed workers can opt for a more favourable tax regime on income from self-employment which is known as the *regime forfetario*; iv) as for employment income, productivity bonuses paid to private-sector workers are taxed proportionally at a fixed rate, while goods and services provided by company welfare schemes are entirely tax-free; v) capital income and gains are subject to proportional withholding taxes since the introduction of the PIT (also known as the *Imposta sul reddito delle persone fisiche*) in 1974.

Despite being recognised as a crucial element that contributes to the weakening of the progressivity of the Italian tax system, the erosion of the PIT base is a subject that has been little explored in quantitative research. Its existence and relevance for the academic community has led some to advocate for a profound revision of the system of personal taxation. At the same time, the erosion of the PIT base can be framed in the broader context of the contribution of overall taxes and benefits in reducing inequality. The importance of a better understanding of the role played by each instrument in the redistribution of income acquires a renewed interest given the significant attention paid to flat-rate tax proposals with marked reduction in the redistributive effect during the first part of the eighteenth parliamentary term.

Regarding the methodology of analysis, this thesis makes extensive use of tax-benefit microsimulation techniques for the simulation of the existing legislation and alternative policy scenarios. Furthermore, several decomposition methodologies of the redistributive effect of a tax-benefit system are employed both for the study of classical horizontal inequity and for the analysis of the contribution of taxes and benefits to income redistribution.

A summary of the chapters' contents is provided in what follows. The first chapter offers evidence on the loss of progressivity and redistributive power entailed by the erosion of the PIT base, with specific emphasis on the distribution of fiscal benefits and burdens by income groups. The second chapter focuses on the contribution of tax-benefit instruments to redistribution at the national level and the macro-regional level. A specific focus is devoted to the extent to which proportional taxes, social insurance contributions, and tax-free cash benefits determine the redistribution of income. Finally, the third chapter tests whether the erosion of the PIT base has increased the level of horizontal inequity of the personal income tax system, as well as provide evidence on the extent of horizontal inequity if a flat-rate personal income tax were to be adopted in the Italian context.

Riassunto

La presente tesi, composta da tre capitoli, tratta dell'erosione della base imponibile dell'*Imposta sul reddito delle persone fisiche* (Irpef) e delle sue conseguenze redistributive, un fenomeno altamente dibattuto e considerato essere tra i principali responsabili dell'accresciuto livello di iniquità verticali e orizzontali del sistema fiscale corrente.

L'erosione della base imponibile dell'Irpef consiste nella graduale esclusione di diverse componenti di reddito dalla tassazione progressiva e il contestuale assoggettamento di queste fonti a tassazione proporzionale o la completa esenzione da imposizione. Al momento in cui si scrive, il sistema fiscale italiano è caratterizzato dalle seguenti esenzioni dalla progressività: i) gli affitti degli immobili locati ad uso abitativo e dei negozi e botteghe possono essere assoggettati ad un'imposta proporzionale – la c.d. *cedolare secca*; ii) il reddito catastale degli immobili tenuti a disposizione è esente da imposizione; iii) le persone fisiche esercenti attività d'impresa, arti e professioni possono optare per un regime di favore sui ricavi o compensi percepiti – il c.d. *regime forfetario*; iv) i premi di produttività sono tassati in misura proporzionale, mentre i beni e servizi offerti dagli schemi di welfare aziendale non prevedono il pagamento di imposte; v) i proventi dei redditi da capitale sono assoggettati ad un'imposta proporzionale con ritenuta alla fonte sin dall'introduzione dell'Irpef nel 1974.

Pur essendo riconosciuto come uno degli elementi cruciali che contribuiscono all'affievolimento della progressività del sistema fiscale, l'erosione della base imponibile dell'Irpef è un argomento che ha ricevuto scarsa attenzione nella ricerca quantitativa. La sua esistenza e rilevanza per la comunità accademica ha portato alcuni a sostenere la necessità di una profonda revisione del sistema di tassazione personale del reddito. Allo stesso tempo, l'erosione della base imponibile dell'Irpef può essere inquadrata nel più ampio contesto del contributo delle tasse e dei trasferimenti complessivi alla riduzione della disuguaglianza. L'importanza per una migliore comprensione del ruolo svolto da ciascun strumento fiscale nella redistribuzione del reddito acquisisce un interesse rilevante considerata la vasta attenzione che le proposte di *flat tax*, caratterizzate da una drastica riduzione dell'effetto redistributivo, hanno ricevuto nella prima metà della diciottesima legislatura.

Per quanto concerne la metodologia di analisi, la presente tesi si basa sull'utilizzo di tecniche di microsimulazione statica della legislazione vigente e di scenari di policy alternativi. Inoltre, diverse scomposizioni dell'effetto redistributivo di un sistema tax-benefit vengono impiegate sia per lo studio dell'iniquità orizzontale intesa in senso classico che per l'analisi del contributo delle tasse e dei trasferimenti alla redistribuzione del reddito.

Un breve sommario dei contenuti di ciascun capitolo è fornito nel seguito. Il primo capitolo offre delle evidenze sulla perdita di progressività e capacità redistributiva che l'erosione della base imponibile dell'Irpef ha comportato, con enfasi soprattutto sulla distribuzione dei benefici e oneri fiscali per gruppi di reddito. Il secondo capitolo si concentra sul contributo degli strumenti tax-benefit alla redistribuzione sia a livello nazionale che a livello macroregionale. Un focus specifico è dedicato alla misura in cui imposte proporzionali, contributi sociali e trasferimenti in denaro determinano la redistribuzione del reddito. Il terzo e ultimo capitolo esamina se l'erosione della base imponibile dell'Irpef ha accresciuto l'iniquità orizzontale del sistema di tassazione personale del reddito, oltre a fornire delle evidenze sul livello di iniquità orizzontale qualora un sistema di tassazione ad aliquota piatta fosse introdotto nel contesto italiano.

Quantifying the Redistributive Effect of the Erosion of the Italian Personal Income Tax Base: A Microsimulation Exercise*

Abstract
In recent years several sources of income have been excluded from the Italian Personal Income Tax (PIT) base and subject to alternative proportional systems or totally exempt from taxation. These changes have contributed to making PIT even more selective, accentuating vertical equity issues that have accompanied it since it was introduced in 1974. The aim of this paper is to calculate the redistributive effect following the erosion of the PIT base and the contribution of this phenomenon in determining the redistributive power of the Italian tax system, as well as the distribution of the fiscal benefits and burdens by deciles of income under the alternative tax rules considered. Using a static microsimulation model, the paper compares various versions of the tax system within a counterfactual logic: on the one hand, the existing legislation as of 2014 consisting of PIT and those incomes subject to substitute taxes or tax-free in this study; on the other hand, a hypothetical legislation which takes as a reference point the Comprehensive Income Tax (CIT) scheme and includes in its base all incomes replicated. The results demonstrate that the erosion of the PIT base has reduced the redistributive effect and the progressive nature of the Italian tax system.

Keywords: microsimulation; personal income tax; comprehensive income tax; redistributive effect; progressivity; decomposition approach
JEL: D31; H23; H24

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1. Introduction

In the last decade several types of income have been excluded from the Italian personal income tax (hereinafter PIT) and subject to alternative proportional systems or totally exempt from taxation. This process, still ongoing, has led to a weakening of the distributive characteristic of the main source of revenue, emphasizing vertical equity issues that have accompanied the PIT since its introduction. As highlighted by Bises and Scialà (2014) and Stevanato (2016), an income tax that is paid above all by employees and pensioners is even more selective on the same categories when elements of the tax base are removed from progressive taxation.

The aim of this paper is to calculate the redistributive effect associated with the exclusion from the PIT base of several types of income previously included in addition to capital income and gains. By means of an extension of MAPP© (Baldini, 2000; Baldini et al., 2011), a static microsimulation model used by the Research Center for the Analysis of Public Policies (CAPP) at the University of Modena and Reggio Emilia, we replicate and compare different fiscal legislations. First, we compare the existing legislation as of 2014 (hereinafter *EL*), reconstructing the PIT and several types of income subject to proportional taxation or exempt from taxation, with a theoretical legislation that includes in the PIT base those incomes excluded under EL (hereinafter *TL*). In another case, we focus only on the PIT (hereinafter *EL(PIT)*) without taking into account amounts exempt from taxation or proportionally taxed and comparing this snapshot to the TL. For each model of fiscal legislation, we include the surtaxes due at the regional and municipal level (hereinafter just surtaxes), assuming that tax rates do not vary depending on the fiscal legislation considered. The microsimulation exercise allows us to calculate the most used indices in measuring redistributive effects and tax progressivity under each fiscal legislation, as well as to compare the distribution of fiscal benefit and burdens by decile of income. Furthermore, this study aims to add to the existing literature by broadening our understanding of the extent to which income sources exempt from PIT affect the redistributive power of the Italian tax system. In light of the recent evidence on what explains the redistributive effect of PIT offered by Di Caro (2018) and Barbetta et al. (2018), we applied the generalization of the Pfähler-Lambert decomposition provided by Onrubia et al. (2014) for each model of fiscal legislation considered.

The counterfactual scenario represented thanks to the TL seems to come close to the Comprehensive Income Tax (CIT) scheme, although it does not follow the recommendations pointed out during the conference sponsored by the Brookings Institution in Washington in 1977 (Pechman, 1977), nor the rule of thumb put forward by Creedy (2010), who recommends lowering tax rates after broadening the tax base. However, the assumption of simply including in the PIT base certain incomes currently exempt from progressivity without changing any other significant aspect of the income tax structure does not jeopardize the results of our study, since the aim is to quantify the erosion of the PIT base and its consequences for the redistributive role played by fiscal policies rather than to determine the optimal CIT for the Italian fiscal system.

To the best of our knowledge, no research has been carried out to assess the redistributive effects resulting from the simultaneous exclusion of several types of

income from the PIT base. As recognized by the *Commissione Marè*, which quantified the loss of fiscal revenue attributable to tax expenditures, the evaluation of the financial effects of the single measure is reliable but not their sum, since the likely presence of interactions among tax expenditures could substantially reduce the total amount of tax revenue loss estimated by summing up the financial loss of each tax expenditures (MEF, 2017). In this latter report, the methodology applied to define the benchmark tax system refers to the legal approach (European Economy, 2014), assessing whether each tax expenditure granted represents a physiological characteristic of the tax involved or it constitutes a departure from its structure. Taking the 2018 tax year, the amount of tax revenue loss is quantified in 54.2 billion euros for a total number of 466 tax expenditures, of which 121 comes from PIT for a financial loss of 35.5 billion. Breaking down tax expenditures by classes of tax revenue loss, slightly more than half were estimated to be lower than one billion euros, while just fourteen involve a greater loss; 32.6% out of the total number of tax expenditures were defined as unquantifiable.

In recent years and in a European perspective, few studies have estimated the redistributive impact of a CIT scheme. Randjelovic and Zarkovic-Rakic (2011) and Randjelovic (2016) highlight what would happen in terms of poverty and personal savings if a CIT were to be introduced in Serbia. Randjelovic and Zarkovic-Rakic (2011) do this by implementing a tax-benefit model as outlined in the present paper, and Randjelovic (2016) by developing a macro-micro model. In contrast with reforms in other Central and Eastern European countries, Slovenia introduced a CIT scheme in 2007 and Majcen et al. (2009) focus on the macroeconomic and welfare aspects of this policy.

The paper is structured as follow. Section 2 aims to describe under a statutory framework (without claiming to be exhaustive) the income sources subject to alternative proportional taxation or exempt from taxation, presenting for each of them the resulting tax rates and those aspects useful to analytically replicate the scenarios. Section 3 focuses on the principal steps implemented in the reconstruction of the existing tax legislation, thus discussing the main features of MAPP©. Section 4 validates the model and shows the results of the comparative analysis, offering also useful insights on how tax evasion is likely to affect income inequality and the difference in revenue between the scenarios simulated. Finally, Section 5 concludes, summarizing the main results.

2. Statutory characteristics of incomes excluded from the PIT base

The construction of a microsimulation model requires an accurate analysis of the legal aspects of each source of income and legislation as a whole to verify which income can be realistically replicated and to obtain a simulation that is as reliable as possible. We therefore list the incomes that are excluded from progressive taxation taken into consideration in replicating the EL: *a*) capital income and gains, excluded from the PIT since its introduction in 1974; *b*) rental income from residential property subject to the proportional tax known as the *cedolare secca*; *c*) profits from business activities operating under a special tax regime, known as the *regime fiscale di vantaggio*; *d*) productivity bonuses granted to employees; *e*) goods and services provided by company welfare schemes; *f*) cadastral income of

dwellings kept available that are located in a different municipality from the one of the main residence; *g*) cadastral value of the main residence.

The taxation of financial income of individuals relies on a substitute regime based on two main withholding tax rates – except in cases of partial or total inclusion of capital income and gains in the PIT base – respectively equal to 26% for capital income, capital gains and returns from financial derivative products and 12.5% for financial income from government bonds. As regards business entities, financial income is conceived as a component of corporate income and thus it is subject to the PIT or to the Italian corporate income tax (*Imposta sul reddito delle società* - Ires) depending on the business form.

As regards rental income deriving from property rented for residential uses, taxpayers can choose whether to include this income in their PIT base or to take advantage of a substitute tax regime. In cases in which this rental income is included in the PIT base, rents are reduced by 5% to take into account maintenance and management fees. When taxpayers opt for a contract stipulated at a controlled rent, known as *canone convenzionato*, an additional deduction of 30% is allowed, resulting in a total reduction of 33.5%. In this case, the full value of the rents is subject to a withholding tax rate of 10% when rental agreements are of the *canone convenziato* type or 21% for all other agreements. Although not considered in the current study so as to ensure a full comparability between our results and the ones based on tax returns, the 2019 Finance Act broadens the scope of application of *cedolare secca* to crafts and trades workshop owners, who can choose to subject these immovable properties to the higher tax rate of 21% whether vacant or with a rental contract ending during the 2019 tax period. The number of properties potentially interested is estimated to be around 200,000 units (Lungarella, 2018).

With regard to the *regime fiscale di vantaggio*, replaced by the *regime forfetario* ever since the 2015 tax period (IRA, 2016), it allowed self-employed workers to opt for a proportional tax rate of 5%, substituting PIT (and the *Imposta regionale sulle attività produttive* – IRAP). This tax relief is subordinated to the fulfilment of several criteria with reference to the year before the one considered for tax purposes. Taxable income is determined by imputing costs and profits according to the *cash-basis accounting method* (IRA, 2012). It is worth mentioning that the special regime currently in force underwent substantial changes within the frame of the 2019 Finance Act, which may lead to an increase in the number of beneficiaries.

In the context of employment income, both public and private, *company-level welfare* provides goods and services to all employees or to specific categories, with particular regard to supplementary pensions, healthcare, work-life balance, vocational education and training. The attention to social risks helps us to identify a dividing line, even though it is not clearly defined, between *company-level welfare* and *fringe benefits*, with fringe benefits being offered to employees individually in relation to needs that differ from the social needs cited above (Mallone, 2015). The goods and services provided are tax exempt, although they constitute an alternative form of remuneration.

In contrast with *company-level welfare* schemes, productivity bonuses and corporate profits paid to employees concern only the private sector. In compliance with the 2013 Finance Act, productivity bonuses deriving from increases in productivity, profitability, quality, efficiency and innovation are subject to a proportional tax rate of 10% up to a limit of 3,000 euros before the application of

proportional taxes and after compulsory social security contributions. Tax relief is limited to employees in receipt of earned income of less than 40,000 euros in the previous year**,** a threshold doubled by the 2017 Finance Act. This threshold is calculated including every type of pension while excluding earned income subject to substitute taxes, goods and services provided as part of a company welfare scheme, and severance pay paid in advance. Furthermore, the 2017 Finance Act has broadened the pool of company welfare provisions that can be claimed in substitution of productivity bonuses, fostering the conversion of the latter with goods and services which may doubtfully defined as company-level welfare benefits (IRA, 2018). Finally, even if not simulated by our model, the 2016 Finance Act established that earned income distributed in the form of corporate profit-sharing is taxed at a rate of 10%.

A further source of income which deserves our full attention is the cadastral income of dwellings kept available, which is currently not included into the PIT base when properties are under the cadastral category A and located in a different municipality from the one of the main residence. In this particular case, we assumed that these dwellings are not situated in the same municipality of the main residence and so its cadastral value was excluded from PIT. In assessing the pertinence of the assumption made, it is well to bear in mind that there are no official data regarding the geographical distribution of the abovementioned properties respect to the location of the main residence, therefore it is not possible to establish whether their inclusion into the PIT base would have been a more representative scenario than their exclusion. According to administrative data on the Italian real estate stock for the 2014 tax period (IRA, 2017), the cadastral income of not rented dwellings is equal to 2.0 billion euros.

The last above listed income source excluded from progressive taxation is the cadastral value of the main residence, which has always been benefiting from a favourable treatment in the Italian tax system. Partially exempt from gross income subject to PIT up to a limit of 1,100,000 Italian lire in 1987, since 2002 its value is first included into the PIT base and then entirely subtracted by means of a deduction (MEF, 2008). Due to its early exemption, the counterfactual scenario as simulated in this study treats the cadastral value of main residence as given in the existing legislation.

3. The static microsimulation model: replication of incomes under the existing tax system

This section aims to highlight the process of analytical reconstruction implemented in the replication of the EL as of 2014 tax period. The analysis utilises data from the survey Statistics on Income and Living Conditions – UDB IT SILC 2015 (hereinafter IT-SILC), which income variables refer to the 2014 tax year, and the Survey of Italian Household Income and Wealth 2014 (hereinafter SHIW) released by the Bank of Italy as basis for imputing through statistical matching: i) the value of movable properties, whose simulation will be further discussed in Subsection 3.1 since its crucial relevance in determining the difference in revenue between the policy scenarios under study; ii) the value of immovable properties; iii) several tax credits, that is house refurbishments, life insurance premium and mortgage interest payments on main residence and other properties.

As mentioned earlier, this research has been possible through an extension of an existing static microsimulation model, called MAPP©, which construction dates back to 1998. Initially developed using SHIW, the model has been adapted to allow exploiting the broader variety of information offered by IT-SILC during the second half of the previous decade, broadening the spectrum of policies which can be realistically simulated. In taking account of all the changes intervened in the last twenty years in the Italian tax-benefit system, it has been constantly updated and refined to the current legislation. It mainly focuses on the impact of taxes and transfers on the level of poverty and inequality, but it also allows the evaluation of first-order effects of hypothetical policy changes. A reweighting procedure was applied at the individual level to adjust for the one-year gap between demographic characteristics and income variables, as well as to correct the number of PIT income earners per region exploiting the richness of information released by the Department of Finance – MEF (*Ministero dell'Economia e delle Finanze*) in the form of aggregate tax returns (Creedy and Tuckwell, 2004; Pacifico, 2014). In line with Albarea et al. (2015), household weights are given by averaging individual weights within the household; consequently, a further reweighting on household weights was ran to ensure representativeness by macroarea, region and number of household components.

Instead of using our own net-to-gross algorithm to obtain gross income variables, we opted for taking IT-SILC gross income variables as given, which are in fact the result of a mix procedure involving the usage of a net-to-gross algorithm combined with statistical matching techniques between sample variables and individual tax returns (ISTAT, 2011). After having reweighted the number of income earners, the main economic variables such as employment, self-employment, retirement and cadastral income were adjusted to the corresponding administrative data, that is the average weighted value was equalised to the corresponding administrative one per region except for self-employment income, where the adjustment was carried out equalising total income by region due to lack of data regarding the exact number of self-employed with or without VAT number.

Appendix A summarizes the steps implemented in replicating the EL and specifies the entire spectrum of income subcomponents included. All tax expenditures granted to taxpayers were totally simulated replicating their structure according to the existing rules, except for those labelled by (I) which were imputed through calibration with aggregate tax returns by income classes after having individuated their beneficiaries among the taxpayers with the highest probability of receiving tax expenditures (Albarea et al., 2015). Income earners and beneficiaries of tax expenditures whose individual weight was calibrated so as to obtain a more reliable representation of taxpayers are indicated by (R); monetary variables adjusted to administrative data are marked by (A); when statistical matching was employed, such values are identified by (M).

After calculating total revenue, when net PIT due before both surtaxes is lower than the so-called *Bonus 80 euro* (hereinafter B80), we added the excess difference to gross income subject to PIT. B80 is a tax credit paid to employees with income from employment ranging from 8,145 and 26,000 euros. The tax credit amounts to 80 euros per month for incomes up to 24,000 euros, and then it gradually decreases to zero for incomes of 26,000 euros (Baldini et al., 2015b). The 2018 Finance Act

increased the upper threshold to 24.600 euros, as well as the threshold beyond which the tax credit is zero to 26.600 euros.

3.1. Matching procedure of the value of movable properties

As well known by microsimulation modellers in the Italian context, matching procedures between data sets became a necessary mean to fully exploit the multiplicity of information collected by sample surveys (Ceriani et al., 2013). While most of the existing static microsimulation models currently in operation are based on IT-SILC (Azzolini et al., 2017), SHIW offers the opportunity to integrate the former with essential information on tax expenditures and immovable properties (Albarea et al., 2015), movable properties (Baldini et al., 2015a) and VAT liability (Baldini et al., 2015a; Maitino et al., 2017). In what follows we present the main features of the matching analysis implemented in simulating the value of movable properties, which was carried out using the Predictive Mean Matching method (hereinafter PMM) (Di Zio and Guarnera, 2009). In performing a PMM, the matching analysis was repeated five hundred times, having the number of nearest neighbours always set to $k = 5$ (Allison, 2015); when matching the value of movable properties, the distributions obtained were compared to the reference one by taking the average value of financial stock per decile of equivalent household disposable income; the distribution chosen is the one which minimises the sum of the squared difference between means.

The investigation of the effects of financial income on inequality has always been hindered by the remarkable underestimation of movable properties in terms of possession and volume (D'Aurizio et al., 2006), both using SHIW or IT-SILC. It has been shown that the aggregate value of SHIW movable properties is roughly one sixth than the administrative amount taken as reference (Brandolini et al., 2009), which is even lower in IT-SILC. Taking the 2014 year and excluding insurance schemes, the number of households who own at least one sort of financial instrument is equal to 82.6% according to SHIW, whilst in IT-SILC the ratio falls to 53.1%. In order to tackle these problems, we employed a semi-empirical method to correct both possession and volume of capital income and gains at the household level in SHIW before applying the imputation procedure. The financial stock finally obtained, being equal to 2,874 billion euros, is perfectly in line with the estimated value of 2,851 billion[1] of BI (2015).

As far as the possession is concerned, the procedure applied is divided in two main steps and reflects the one implemented by Brandolini et al. (2009 and 2014). First of all, for each SHIW biennial survey which goes between 2006 and 2016, we aggregated financial instruments in seven macro categories – namely: i) bank and postal deposits; ii) government securities; iii) bonds; iv) managed savings; v) funds; vi) shares; vii) supplementary pension plans and/or life insurances. We then ran a multinomial logit model with repeated cross-sectional data to estimate the probability to own a sophisticated financial portfolio, where the dependent variable takes on four modalities, ranging from 1 to 4, on the basis of the number of financial

[1] The amount reported was obtained subtracting 'Notes and coin', 'Insurance technical reserves' and 'Trade credits' from 'Total financial assets (b)' for the 2014 year. See Table 1A of BI (2015).

macro categories owned by each household (respectively: 1 instrument; 2 instruments; 3-5 instruments; 6-7 instruments). Explanatory variables included into the regression analysis capture those dimensions more likely to determine the degree of financial sophistication such as household socio-economic characteristics, allocation on the income and wealth distribution, risk aversion and financial market performances.

Once obtained the predicted probabilities from the first step, we ran a binomial logit model for the 2014 SHIW wave for each of the financial instruments initially defined excluding deposits, whose possession is likely to be not underestimated since the ratio of households declaring to own at least one deposit is 92.9%. As in the previous case, explanatory variables used for each of the five models control for the same dimensions taken into account in the multinomial model, including also the predicted probabilities to own a sophisticated financial portfolio. Still referring to the methodology applied by Brandolini et al. (2009 and 2014), we imputed the possession of financial instruments building a centered interval on the average predicted probability for each of the instruments considered, which is based on the standard deviation resulting from the regression analysis. Besides those households who spontaneously declared to own a certain instrument, we assigned the possession to those who did not declared it and whose predicted probability was higher than the upper threshold of the centered interval. The results of the correction procedure are given in percentage terms in Appendix B, where it can be seen that the imputation concerns above all households who live in the northern part of Italy, on the wealthiest quintile, whose reference person is a middle-aged adult, more educated and with an average risk aversion. We then imputed the value of the instruments assigned by running a propensity score matching among SHIW households per quintile of equivalent household disposable income for each of the abovementioned instruments using the Mahalanobis distance nearest-neighbour algorithm with replacement. The common variables employed cover various dimensions such as the number of income earners within the household, household size, ownership of the main residence, geographical area of residence, occupational status of the reference person, its sex, age and education divided by groups.

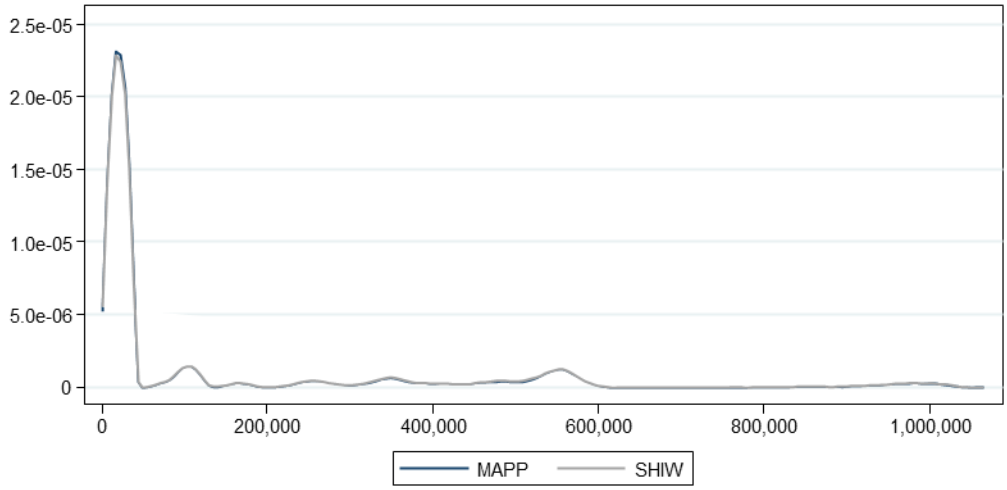
Moving on to the volume of financial instruments, its correction involves the employment of the percentage ratios between declared values and true ones as found in D'Aurizio et al. (2006). In this study, authors compared financial stock as gathered by a sample survey of customers of the UniCredit group to the corresponding administrative data in order to determine the extent of the under-reporting, assuming that UniCredit household behaviours can be generalised to the entire SHIW population. Since the socio-economic characteristics presented in Table B3 (D'Aurizio et al., 2006) are easily reproducible in SHIW for the 2014 year, we imputed underestimation rates to the latter data set for each financial instrument indicated in column and for each household according to its features.

Finally, once corrected possession and volume for SHIW households, we were therefore ready for running the PMM per decile of equivalent household disposable income for the whole financial stock so as to impute it in IT-SILC, using as common variables the same ones used in imputing the value of each financial instrument whose possession was assigned on the basis of the correction procedure. In doing so, since we need to differentiate government securities taxed at a lower rate of 12.5% from the remaining capital income and gains, the same SHIW unit who acted

as a donor in matching the financial stock was used to assign the value of government securities to IT-SILC perceivers.

As it can be seen in Figure 1, the kernel density distribution of the value of MAPP movable properties perfectly fits the SHIW reference distribution, as the two-sample Kolmogorov-Smirnov test for equality of distribution functions shows a non-statistically significant difference between the two distributions for an exact p-value of 0.483. A further evidence is given by the test implementable with the Stata command *distcomp* (Kaplan, 2018), where the equality of the two cumulative distribution functions is checked point by point. Setting the familywise error rate equals to 0.10 since the likely presence of ties between the distributions, this latter test confirms that there is no statistical difference.

Figure 1 – Kernel density distributions for the value of movable properties



Source: Own elaborations.

4. Data analysis results

Simulating a fiscal reform that entails the transition to the TL, we expect a reduction in inequality of disposable income accompanied by a generalised increase in average tax rates on gross income. In the forthcoming subsections several sample amounts which were obtained simulating the tax-benefit system will be presented and discussed. In order to validate the microsimulation model, the results will be compared to aggregate tax returns disclosed by the Department of Finance – MEF for the 2014 tax year, making it possible to assess the model accuracy.

Further analysis will concern the overall redistributive effect played by each model of fiscal legislation and the contribution of each income currently excluded from PIT in determining the redistributive power of the tax system. In drawing our conclusions, we are conscious of the fact that using the Gini coefficient as single-number summary index of inequality means accepting its implicit distributional weights and underlying social values (Atkinson, 2015). A detailed evaluation of the extent of average tax rates by income deciles will be provided, seeking to examine where benefits and losses may be concentrated once broadening the PIT base. In the last subsection the potential implications of tax evasion will be discussed by simulating all models of fiscal legislation without adjusting for those income

variables marked by (A) in Appendix A. All the figures presented in the following pages consider the equivalent household as the unit of analysis and thus adjusted using the OECD-modified equivalence scale, apart from the results on tax savings, expressed in non-equivalent terms, and those pertaining the validation of the model, which are presented at the individual level.

4.1. The main sample amounts

Table 1 and 2 show the sample amounts of gross income and revenue for each type of income subject to alternative proportional taxation or exempt from taxation and for the totality of incomes included in all the fiscal legislations replicated. The total amount of income under EL, which is the basis for calculating relative amounts in Table 1, is equal to 888.7 billion euros and the difference of nearly one billion between this sum and the corresponding one at TL is due to the eligible amount of the B80 and refundable tax credits under each fiscal legislation, which vary according to the respective tax-benefit system simulated. Gross income exempt from progressivity as defined in this study adds up 82.1 billion, that is around one eleventh of gross income at EL, whereas 806.5 billion are still taxed under progressive tax rates. Financial income and rental income subject to *cedolare secca* jointly represent 82.6% of the sum excluded from the PIT base, respectively equal to 58.6 and 9.3 billion.

Table 1 – Gross income subject to proportional taxes or exempt from taxation and gross income for fiscal legislation

Income	Absolute value	Relative value (%)
EL(PIT)	806,515	90.8
Capital income and gains	58,584	6.6
Rental income subject to cedolare secca	9,274	1.0
Self-employment income under regime forfetario	4,233	0.5
Productivity bonuses	4,086	0.5
Company welfare	3,941	0.4
Cadastral income from immovable properties kept available	2,029	0.2
Gross income exempt from PIT	82,147	9.2
EL	888,662	100.0
TL	888,597	100.0

Note: Values in million of euros. *Source*: Own elaborations.

Similarly as above, taking as denominator of the relative sums listed in the right-hand side of Table 2 the total amount of revenue as calculated under EL, which is equal to 181.4 billion euros, the transition from the EL to the TL would increase total revenue by 14.5 billion (8.0%), whereas by not considering proportional taxes the increase would be of 31.0 billion. In a context characterized by high fiscal pressure as in the Italian case, it is difficult to imagine a fiscal reform that involves an increase to this extent. The total sum of proportional taxes amounts to 16.5 billion, that is 9.1% of total revenue under EL, and 14.1 billion are solely referred to revenue from capital income and gains.

Table 2 – Revenue for income excluded from PIT under EL and total revenue per fiscal legislation

Revenue	Absolute value	Relative value (%)
EL(PIT)	164,831	90.9
EL(PIT) before surtaxes	148,684	82.0
Capital income and gains	14,148	7.8
Cedolare secca	1,759	1.0
Productivity bonuses	409	0.2
Regime forfetario	212	0.1
Total substitute taxes	16,527	9.1
EL	181,358	100.0
TL	195,812	108.0
TL – EL(PIT)	30,981	17.1
TL – EL	14,454	8.0

Note: Values in million of euros. *Source*: Own elaborations.

4.2. Model validation

With the purpose of validating the accuracy of the microsimulation model in reconstructing the tax-benefit system, in Table 3 individual taxpayers and income variables are validated through comparison with available administrative data. The values obtained under EL are highly consistent with the corresponding external sources, whose ratio ranges in an interval from 0.95 to 1.06. The same can be said looking at the number of taxpayers simulated: the reweighting procedure made it possible to perfectly align MAPP taxpayers to aggregate frequencies of real-world taxpayers. Although a margin of error is common to every microsimulation exercise carried out so far, the underestimation of PIT revenue by nearly 2.5 billion euros is partly due to the initial underestimation of 1.5 billion in gross income subject to PIT and to the overestimation of 1 billion in tax credits. The income sources excluded from the PIT base are among the best well-replicated in terms of validation to external official sources. Unfortunately, the sample amounts relative to company welfare provisions, which in fact contribute to lowering the redistributive power of the tax system under EL as it will be shown later on, cannot be validated due to the lack of administrative data and they may therefore be conceived as a first quantification attempt.

Further evidence of the reliability of our study is presented in Figures 2 and 3. As common in the literature (Albarea et al., 2015; Di Nicola et al., 2015; Maitino et al., 2017), we compared the distributions of individual taxpayers with positive gross income subject to PIT and with positive net PIT to the corresponding administrative data distributions by groups of non-decreasing gross income values. The comparison in terms of positive gross income values shows a strong similarity between the two distributions. On the contrary, once replicated the tax-benefit system, the MAPP distribution of taxpayers with positive net PIT slightly differs in its left tail from the one taken as benchmark in the validation process. As it can be seen in Figure 3, the number of taxpayers which fall into the first two income groups is higher, as the third and forth group show a reduced frequency compared to MEF taxpayers. Even if these differences may partially offset each other, the lack of precision in the lower tail of the distribution should not have any substantial effect on the Gini index, given its characteristic of being more sensitive to changes in the

middle of the distribution (Atkinson, 1970). Furthermore, this issue was found also by the most recent microsimulation study on the Italian tax-benefit system which uses sample surveys instead of administrative data (Maitino et al., 2017).

Table 3 – Validation of the main sample amounts under EL

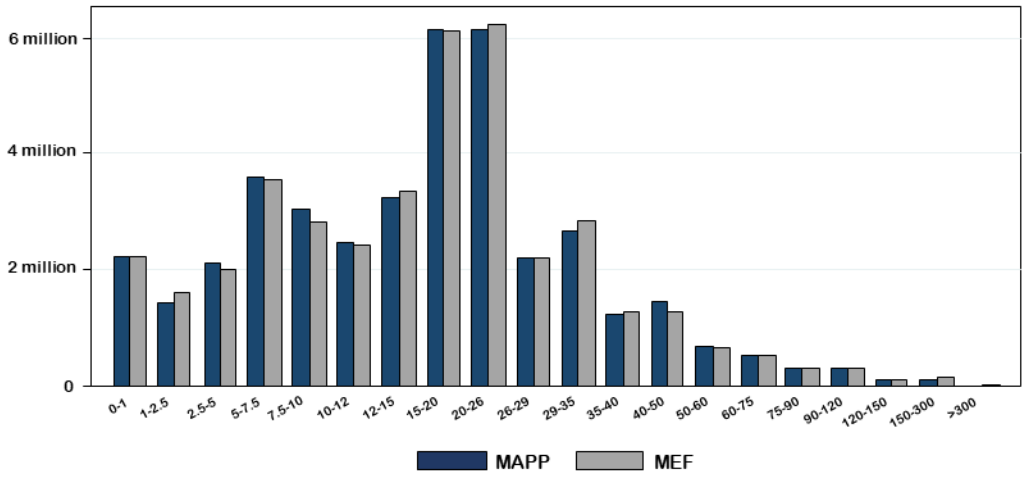
Variable	Number of taxpayers			Value		
	MAPP	MEF	Ratio	MAPP	MEF	Ratio
Gross income excluded from PIT	26,181	-	-	82,147	-	-
Capital income and gains	23,290*	-	-	58,584	58,449**	1.00
Rental income subject to cedolare secca	1,496	1,426	1.00	9,274	9.274	1.00
Self-employment income under regime fiscal di vantaggio	463	447	1.04	4,233	4,233	1.00
Productivity bonuses	3,164	3,164	1.00	4,086	3,848	1.06
Company welfare	3,838	-	-	3,941	-	-
Cadastral income from immovable properties kept available	5,715	5,715	1.00	2,029	2,029	1.00
Total substitute taxes	24,906	-	-	16,527	-	-
Capital gains tax	23,290*	-	-	14,148	14,436	0.98
Cedolare secca	1,496	1,426	1.05	1,759	1,759	1.00
Productivity bonuses	3,164	-	-	409	-	-
Regime fiscale di vantaggio	465	445	1.04	212	212	1.00
Gross income subject to PIT	39,979	40,183	0.99	806,515	807,994	1.00
Employment income	20,459	20,459	1.00	423,026	423,028	1.00
Retirement income	14,780	14,780	1.00	247,211	247,212	1.00
Self-employment income subject to PIT	6,000	-	-	101,148	101,140	1.00
Cadastral income except main residence	5,340	-	-	21,304	-	-
Deductions	21,262	-	-	33,107	33,407	0.99
Social insurance contributions paid by self-employed workers	4,517	4,517	1,00	19,087	19,087	1,00
Cadastral income of main residence	17,384	17,384	1,00	8,612	8,612	1.00
Taxable income	39,670	39,430	1.01	773,910	777,512	1.00
Gross PIT	39,670	38,541	1.03	209,422	210,142	1.00
Tax credits	37,675	38,428	0.98	67,241	66,151	1.02
Income source tax credits	34,668	35,836	0.96	42,987	42,048	1,02
Bonus 80 euro	9,994	9,842	1.02	5,562	5,756	0.97
Net PIT	30,262	30,729	0.98	148,684	151,185	0.98
Regional surtax	29,966	29,806	1.01	11,877	11,384	1.04
Municipal surtax	25,706	25,432	1.01	4,270	4,483	0.95

* Capital income and gains were simulated at the household level, therefore the number showed stands for households who have a positive financial income.
** This amount is equal to the sum of the following chapters of MEF (2014): 1026; 1027; 1028; 1031; 1034.
Note: Values in millions of euros and number of taxpayers in thousands. *Source*: Own elaborations.

When comparing distributions of total gross income and total net PIT by groups of gross income as shown in Figure 4 and 5 respectively, it can be noted that both aggregates tend to be underestimated for the richest income group reflecting a typical

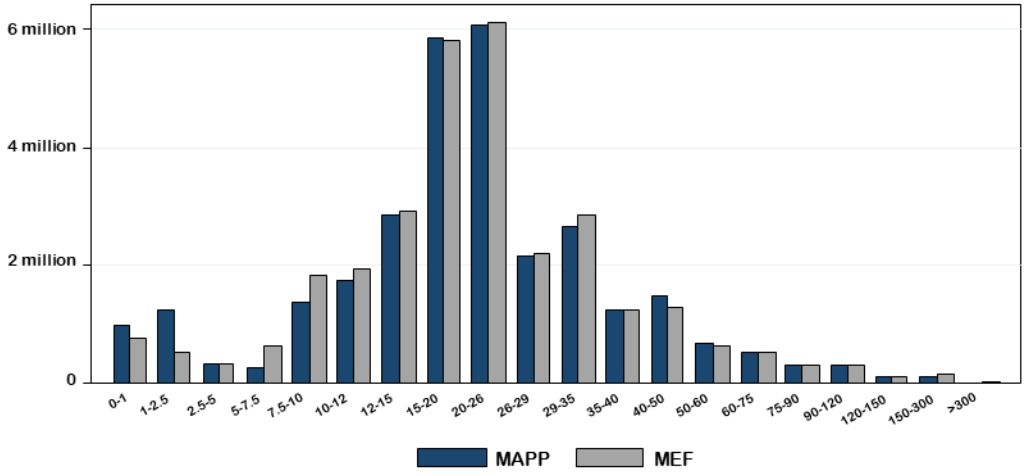
issue of underreporting. Moreover, still looking at Figure 5, the overestimations observed in correspondence to the income groups whose values ranges from 40 to 120 thousand euros jointly considered with the just mentioned underestimation of the far-right tail may have a small equalising effect on the post-tax income distribution, partially counterbalanced by the underestimation of the three income groups between 12 and 26 thousand euros.

Figure 2 – Distribution of individual taxpayers with positive gross income subject to PIT by groups of gross income



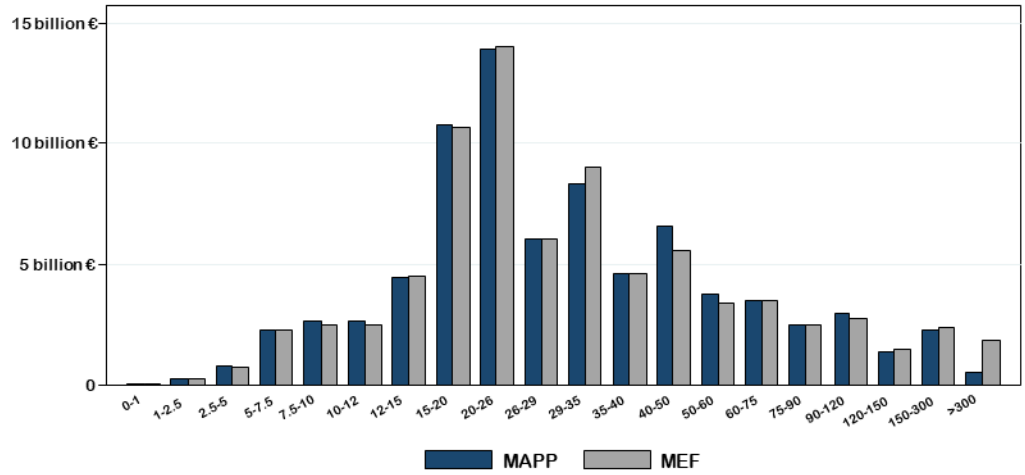
Note: Values in thousands of euros on the horizontal axis. The total number of individual taxpayers with positive gross income subject to PIT is 39,979,324. *Source*: Own elaborations.

Figure 3 – Distribution of individual taxpayers with positive net PIT by groups of gross income



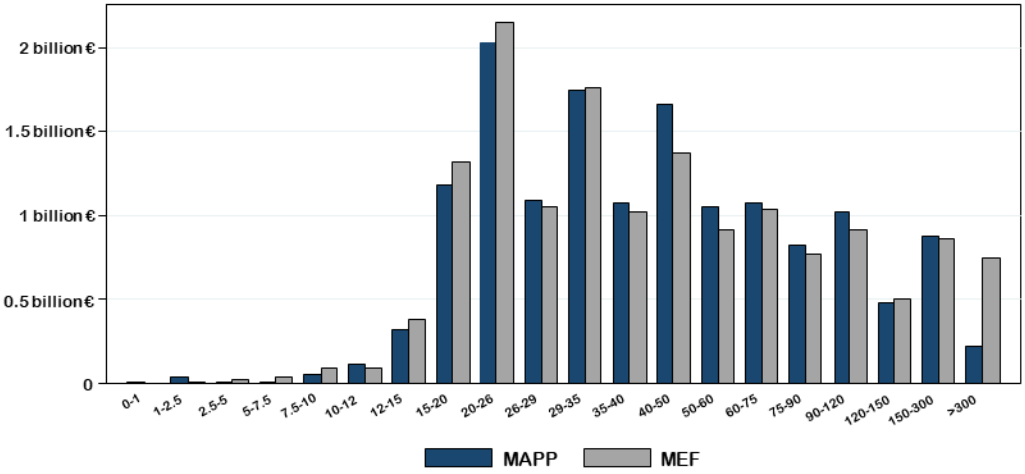
Note: Values in thousands of euros on the horizontal axis. The total number of individual taxpayers with positive net PIT is 30,261,853. *Source*: Own elaborations.

Figure 4 – Distributions of total gross income subject to PIT by groups of gross income



Note: Values in thousands of euros on the horizontal axis. *Source*: Own elaborations.

Figure 5 – Distributions of total net PIT by groups of gross income



Note: Values in thousands of euros on the horizontal axis. *Source*: Own elaborations.

A last source of validation of our results is discussed in Table 4. Although the indices are not fully comparable seen the differences in the incomes taken as basis for their calculation, it is worth to underline how the redistributive effect of PIT as computed here may differ from the one based on tax returns. First at all, a substantial gap exists between the two starting points: the distribution of the gross income subject to PIT tends to underestimate the level of income inequality by 0.0253 points, as it is defined by the pre-tax Gini index. The right-hand column of Table 4 refers to the results obtained by the static microsimulation model of the Italian Department of Finance (Di Nicola et al., 2015), which was constructed by matching personal tax returns for the 2009 tax period with IT-SILC, whereas our research is based on IT-SILC for the 2014 tax period. Given that there is no

substantial difference in the official value taken as benchmark[2] and seen the results obtained in terms of pre-tax Gini index by BETAMOD (Albarea et al., 2015) at the household level (0.3885) and by MicroReg at the individual level (0.4234), which is lower than the administrative one of 0.0361 (Di Nicola, 2015), it is likely to assume that there is a physiological gap in the pre-tax Gini index whether computed using sample data instead of tax returns and this is reflected also on the inequality level of the post-tax income distribution.

Table 4 – Validation of the indices under EL(PIT): indices multiplied by 100

Index	MAPP 2014	MEF 2009
Pre-tax Gini index (G_Y)	40.35	42.88
Post-tax Gini index (G_{Y-T})	35.23	38.06
Reynolds-Smolensky net redis. effect (RS)	5.12	4.82
Kakwani index (K)	20.39	18.40
Average tax rate (t)	20.41	21.07
Concentration index of taxes ($C_{T,Y}$)	60.74	61.28
Concentration index of income after taxes ($C_{Y-T,Y}$)	35.13	37.97

Note: Indices were multiplied by 100, while the equivalent household is the unit of analysis.
Source: Own elaborations and Di Nicola et al. (2015) for the column headed 'MEF 2009'

Still looking at Table 4, the Reynolds-Smolensky index of the net redistributive effect is slightly lower than the administrative one in absolute terms, which is equal to 0.0482, while the departure from proportionality as measured by the Kakwani index in our study plays a greater role in determining the redistributive effect than the one used for comparison and vice versa with regard to the average tax rate. Both concentration indices seem to be in line with the administrative ones, even if the post-tax income distribution resulting from our estimates is marginally less concentrated on its upper part.

4.3. Analysis of the redistributive effect of fiscal legislation

Starting from Table 5 (see Appendix C for a definition of the indices discussed), the Reynolds-Smolensky index (hereinafter RS index) for the EL is equal to 0.0469, while for the TL it is 0.0548, for a difference of 0.0079: this means that the fiscal system for the EL decreases the redistributive effect that would be reached for the TL of 14.4%. The Kakwani index (hereinafter K index) for the EL, equal to 0.1869, would rise to 0.1965 for the TL: the exclusion from the PIT base of incomes subject to proportional taxation or exempt from taxation under EL reduces the progressivity index by 4.9%. The reduction of the K index is lower than that of the redistributive effect due to the reduction at the same time of the average tax rate.

The post-tax Gini index (hereinafter G_{Y-T} index) under EL, is equal to 0.3693, 2.2% lower than the counterfactual index under TL, while the average tax rate increases from 20.4 to 22.1% confirming the relevance of the efficiency-equity trade-off: on the one hand, the EL leaves households with a larger amount of

[2] See Di Nicola et al. (2015) and Di Caro (2018). In the former case, the pre-tax Gini index computed at the individual level for the 2009 tax period is equal to 0.4595, while in the latter case this is 0.4606 for the 2014. No substantial changes in the composition of households occurred in the five-year period.

disposable income at the cost of a greater income inequality, whereas the TL would lead to lower income inequality and might negatively affect individual labour supply.

The comparison between the EL(PIT) and the TL reinforces the previously discussed results. The RS index at EL(PIT), equal to 0.0512, is 7.0% lower than that at the TL. The broadening of the PIT base would decrease the K index by 3.8%.

Table 5 – Redistributive effect of fiscal legislation

Index	EL	EL(PIT)	TL
Pre-tax Gini index (G_Y)	41.62	40.35	41.60
Post-tax Gini index (G_{Y-T})	36.93	35.23	36.12
Reynolds-Smolensky net redis. effect (*RS*)	4.69	5.12	5.48
Kakwani index (*K*)	18.69	20.39	19.65
Average tax rate (*t*)	20.39	20.41	22.09
Concentration index of taxes ($C_{T,Y}$)	60.32	60.74	61.25
Concentration index of income after taxes ($C_{Y-T,Y}$)	36.84	35.13	36.03

Note: Indices were multiplied by 100. *Source*: Own elaborations.

4.4. Analysis of the contribution to the redistributive effect of income sources exempt from PIT

In the Italian context, plenty evidence have been provided on the role played by each tax instrument in determining the redistributive effect of PIT. Using administrative data, Di Caro (2018) quantified the contribution given by tax credits and tax schedules for the 2014 tax period in 61.2 and 40.3% of the redistributive capacity of PIT respectively, while deductions play a much smaller positive effect of 1.3%. Similar results were obtained by Barbetta et al. (2018) analysing a sample of taxpayers for the 2011 tax period; both at the individual and household level, Di Nicola et al. (2015) found a negative effect of deductions for the 2009 year in contrast with the previous studies. Moving to evidence based on sample survey results, the contribution of tax credits, tax schedules and deductions was found to be equal to 58.2, 39.5 and 2.4% respectively by Barbetta et al. (2018) taking the equivalent household as the unit of analysis and employing SHIW for the 2012 year; finally, Avram (2017) quantified a negative effect of deductions at the individual level using EU-SILC 2010.

In what follows we present the results of the decomposition of the RS index for each fiscal legislation applying the generalised Pfähler-Lambert decomposition method proposed by Onrubia et al. (2015) and the geometric decomposition approach for the reranking term as defined in Duclos (1993) (see Appendix C for a brief description of both methods). Differently from the approach discussed by Kristjánsson (2013), which allows to disaggregate the contribution to redistribution of income sources subject to different tax regimes respect to their own tax bases, the revised decomposition formula introduced by Onrubia et al. (2015) seems to be particularly useful for its capacity of breaking down the redistributive effect on the whole amount of taxable income for a given tax system, as well as for not requiring a sequential order to measure the contribution of tax expenditures.

As it can be seen in Table 6, the results under EL(PIT) are in line with the most recent literature (Di Caro, 2018; Barbetta et al., 2018), suggesting that 98.7% of the redistributive capacity of PIT and income surtaxes is given by tax

credits and tax schedules jointly considered. The role played by tax credits is confirmed to be predominant for a contribution of 56.9%, almost entirely determined by tax credits for income source (C_1: 38.4%) and for dependent family members (C_2: 13.3%). As far as deductions are concerned, their effect is found to be positive (D: 3.3%) and still irrelevant when compared to other tax instruments. The reranking term completes the picture being almost equally distributed between its two components, which are the contribution due to gross tax liabilities (R^S: -1.1%) and the one due to tax credits (R^C: -1.0%).

Table 6 – RS index decomposition applying Onrubia et al. (2014) for the vertical effect and Duclos (1993) for the horizontal effect

Component	EL		EL(PIT)		TL	
	RS value	**%**	**RS value**	**%**	**RS value**	**%**
Tax schedules (S)	*1.851*	*39.5*	*2.141*	*41.8*	*2.454*	*44.8*
Capital gains tax (S_1)	0.574	12.2	-	-	-	-
Cedolare secca (S_2)	0.041	0.9	-	-	-	-
Productivity bonuses (S_3)	0.000	0.0	-	-	-	-
Regime fiscale di vantaggio (S_4)	-0.020	-0.4	-	-	-	-
PIT (S_5)	1.144	24.4	1.962	38.3	2.292	41.8
Surtaxes (S_6)	0.112	2.4	0.180	3.5	0.162	3.0
Tax credits (C)	*2.792*	*59.5*	*2.915*	*56.9*	*2.923*	*53.3*
Income source (C_1)	1.890	40.3	1.970	38.4	1.943	35.5
Dependent family members (C_2)	0.666	14.2	0.712	13.3	0.710	13.0
Other tax credits (C_3)	0.236	5.0	0.234	4.6	0.271	4.9
Deductions and exemptions (D)	*0.145*	*3.1*	*0.170*	*3.3*	*0.194*	*3.5*
Company welfare (D_1)	-0.018	-0.4	-	-	-	-
Cadastral income (D_2)	0.009	0.2	-	-	-	-
Sum of deductions (D_3)	0.154	3.3	0.170	3.3	0.194	3.5
Reranking (R)	*-0.097*	*-2.1*	*-0.103*	*-2.0*	*-0.092*	*-1.7*
Tax schedules (R^S)	-0.053	-1.1	-0.054	-1.1	-0.049	-0.9
Tax credits (R^C)	-0.044	-0.9	-0.049	-1.0	-0.043	-0.8
RS index	4.692	100.0	5.124	100.0	5.479	100.0

Note: RS values were multiplied by 100. *Source*: Own elaborations.

Moving to the tax system under EL, the redistributive effect of income sources subject to substitute taxes or exempt from taxation is twofold: in broad terms, the role played by tax schedules is reduced in favour of tax credits; focusing merely on tax progressive schedules, their contribution is substantially lower than that at EL(PIT), being equal to 26.8%. As firstly proved by Onrubia et al. (2015) for the Spanish tax system, our estimates found a positive effect associated with capital income (S_1: 12.2%), since its distribution is highly concentrated on the wealthiest income groups as showed by its concentration index in Table 7 ($C_{X_1,Y}$: 67.07); at the same way, rental income subject to cedolare secca positively affects redistribution (S_2: 0.9%) being mainly owned by equivalent households on the right tail of the gross income distribution under EL ($C_{X_2,Y}$: 58.36%). While productivity bonuses are found to have neutral effect, both self-employment income subject to the *regime fiscale di vantaggio* and company welfare provisions have a regressive impact on redistribution. In the first case, even if its distribution is skewed to the

right ($C_{X_4,Y}$: -24.38%), the tax relief granted to better-off taxpayers is such to lead to a negative contribution (S_4: -0.4%); in the latter case, despite its small incidence on gross income (% X_5/X_9: 0.4%), company welfare provisions contribute to lower redistribution as much as rental income subject to *regime fiscale di vantaggio* (D_1: -0.4%). Finally, cadastral income of dwellings kept available appears to have a small positive effect (D_2: 0.2%). Furthermore, it is worth noting that shifting to TL would have a rebalancing effect in the role played by tax credits and tax schedules, which would be equal to 53.3 and 44.8% respectively. The increase in the contribution given by tax schedules would be driven entirely by the greater effect of the PIT (S_5).

Table 7 – Indices for income sources exempt from PIT under EL

Income source	G_{X_i}	$C_{X_i,Y}$	% $X_i > 0$	% X_i/X_9
Capital income (X_1)	83.42	67.07	92.2	6.5
Rental income subject to cedolare secca (X_2)	96.71	58.36	5.7	0.8
Productivity bonuses (X_3)	93.81	41.35	11.4	0.4
Self-employment income subject to regime fiscale di vantaggio (X_4)	98.68	-24.38	1.9	1.0
Company welfare (X_5)	96.09	51.60	13.4	0.4
Cadastral income of dwellings kept available (X_6)	84.21	33.37	28.2	0.5
Gross income excluded from PIT (X_7)	77.71	59.11	94.0	9.5
Gross income subject to PIT (X_8)	40.53	39.78	98.0	90.0
Gross income (X_9)	41.62	41.62	99.5	99.5

Note: Indices were multiplied by 100. The column headed '% $X_i > 0$' stands for the percentage of households with positive values of the variable considered, while the column '% X_i/X_9' gathers the average ratio of the variable X_i on gross income at EL, X_9. *Source*: Own elaborations.

4.5. Analysis of the average tax rate per decile of income

Table 8 shows the average tax rate for each model of fiscal legislation by decile of equivalent household gross income. Sample units were ranked by increasing levels of income and divided by deciles. The first decile stands for the group of equivalent households with the lowest income within the population, while the tenth decile is the wealthiest one. As noted above, what we call tax takes on a different meaning depending on the fiscal legislation: PIT, surtaxes and proportional taxes at EL; PIT and surtaxes at EL(PIT); PIT and surtaxes at TL, having broadened the PIT base.

First of all, it is worth noting that the first decile bears a higher burden than the second one regardless the fiscal legislation considered. In fact, moving to the TL would reduce the distance in the average tax rate between them, showing an equalising effect on the left tail of the income distribution since the reduction of the average tax rate would be much higher for the first decile when shifting from EL to TL. The V-shaped tax incidence curve for the three poorest deciles at the household level is further confirmed by looking at the average tax rate per ventile of gross income at the individual level. As it can be seen in Table 9, the tax incidence curve computed by using aggregate tax returns takes on the same V-shaped form in the lower part of the distribution. In addition, the sum of PIT and income surtaxes due on average increases with rising income up to the forth ventile and then drops once reached the fifth ventile, suggesting that tax burden borne by worse-off income

groups does not strictly follow a monotonically increasing distribution even when comparing amounts actually paid by taxpayers.

Table 8 – Average tax rate per decile of equivalent household gross income

Decile	EL	EL(PIT)	TL
1°	5.41	3.47	3.78
2°	2.78	1.55	2.68
3°	6.78	6.01	7.06
4°	10.58	10.08	11.07
5°	13.60	13.23	14.36
6°	15.87	15.74	16.58
7°	17.63	17.37	18.63
8°	19.94	19.79	21.26
9°	22.84	22.87	24.93
10°	29.61	31.14	32.78
Total	20.39	20.41	22.09

Source: Own elaborations.

Table 9 – Average tax rate and average tax due per ventile of individual gross income: MEF data

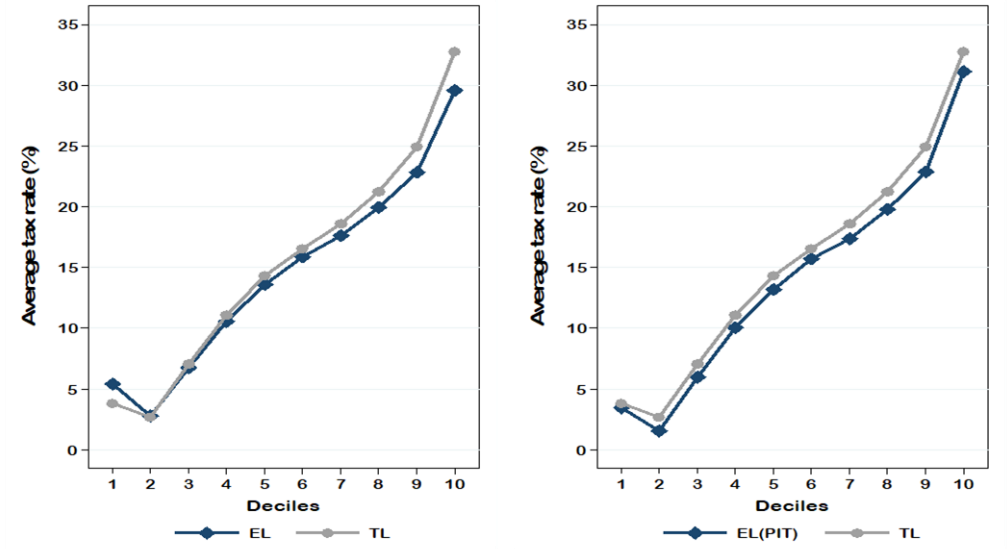
Decile	Average gross income	Average tax rate	Average tax due
1°	-1,094	-0.8	9
2°	1,146	5.0	57
3°	3,145	3.8	119
4°	5,691	2.4	136
5°	6,858	1.3	90
6°	8,435	4.0	340
7°	10,216	6.5	666
8°	11,916	8.4	999
9°	13,763	10.5	1,444
10°	15,542	12.3	1,909
11°	17,299	13.8	2,386
12°	18,997	15.2	2,891
13°	20,487	16.0	3,276
14°	22,237	16.9	3,748
15°	24,259	17.9	4,337
16°	26,648	19.0	5,059
17°	29,573	20.4	6,039
18°	33,763	22.5	7,608
19°	42,160	25.6	10,787
20°	90,130	33.5	30,158
Total	20,321	20.4	4,154

Note: Individual taxpayers were ordered and grouped by values of gross income before rental income subject to *cedolare secca*. Both average tax rate and average tax due refer to the sum of PIT and income surtaxes (what we call EL(PIT)). It is worth specifying that the first ventile, differently from all the other ones, has a lower number of taxpayers of 500,000 units. *Source*: Own elaborations.

The comparison between the models of fiscal legislation in Figure 5 makes it possible to identify from which decile of the population the average tax rate at TL would overtake the rate at EL and thus from which income groups it is more likely to expect a negative effect on labour supply. The average tax rate of the first and second decile at EL is lower than those at TL, while the average tax rate is constantly higher at TL from the third decile of equivalent household gross income.

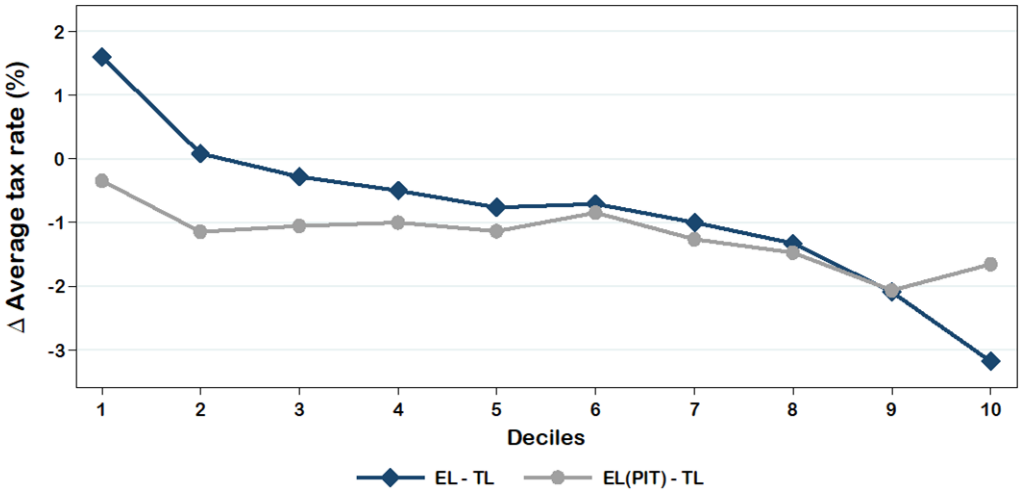
These results are attributable to the structure of the fiscal system: the broadening of the PIT base would increase the amount of income taxed at progressive rates but to an insufficient extent to increase the average tax rate, since taxpayers can deduct a larger portion of the tax credits granted and not fully exploited from their gross tax liability. Instead, in the comparison between EL(PIT) and TL in Figure 6, the average tax rates under TL are always higher than under EL(PIT).

Figure 5 (left-hand side) and Figure 6 (right-hand side) – Average tax rate per decile of equivalent gross income: comparison between models of fiscal legislation



Source: Own elaborations.

Figure 7 – Difference in the average tax rate per decile of equivalent household gross income: comparison between models of fiscal legislation



Source: Own elaborations.

Figure 7 shows the difference in the average tax rate between the two models of fiscal legislation per decile of income. The comparison between EL and TL, presented by the blue line, shows a decreasing trend with increasing income. The average tax rate of the poorest decile at EL is higher than the corresponding one

at TL: this means that taxpayers in the first decile at EL pay on average 1.63% of their gross income more than what they would pay at TL. As noted above, starting from the third decile the average tax rate at TL overtakes the one at EL, reaching the highest deviation in the richest decile: these taxpayers would pay 3.17% of their total income more than what they actually pay at EL. Supposing a homogeneous distribution of the labour supply consequences along the population due to a switch to TL, the impact is likely to be higher with increasing income deciles since the employment rate also increases with increasing levels of income according to IT-SILC.

4.6. Analysis of the average tax rate and distribution of the fiscal burden of PIT and proportional taxes at EL per decile of income

Focusing our attention merely on EL, it is worth calculating the average tax rate and the distribution of tax burden of the PIT and proportional taxes per decile of equivalent household gross income (see Table 10). Gross income subject to the PIT is equal to 806.5 billion euros corresponding to an amount of total revenue comprehensive of both surtaxes of 164.8 billion, while gross income subject to substitute schemes or exempt from taxation is equal to 82.1 billion and the relative total revenue is 16.5 billion (see Table 1 and 2).

Table 10 – Average tax rate and tax burden of PIT and proportional taxes per decile of equivalent household gross income

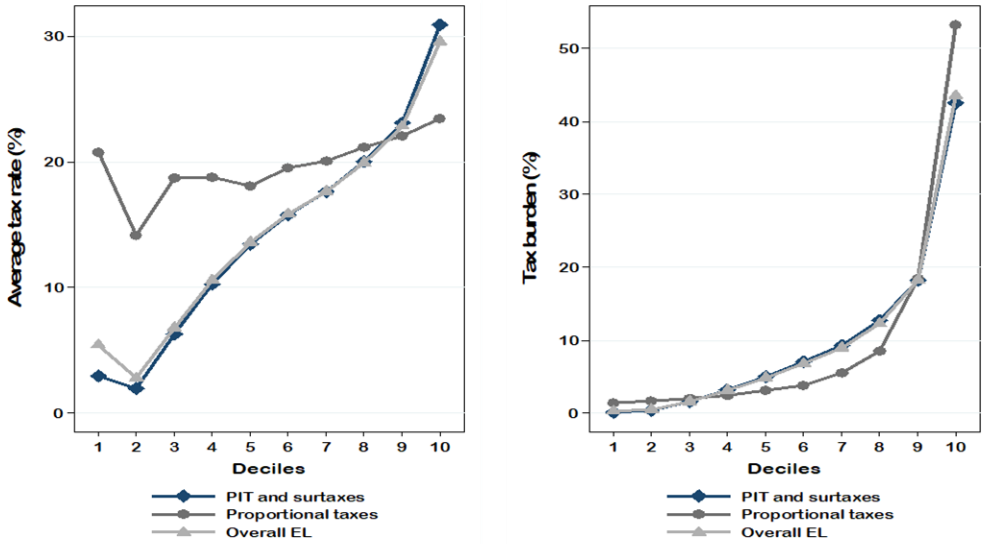
Decile	Atr – PIT	Tb – PIT	Atr - Flat	Tb – Flat	Atr – EL	Tb – EL
1°	2.95	0.12	20.80	1.34	5.41	0.24
2°	1.95	0.32	14.14	1.64	2.78	0.44
3°	6.26	1.53	18.74	2.02	6.78	1.57
4°	10.29	3.18	18.78	2.37	10.58	3.10
5°	13.47	5.03	18.09	3.11	13.60	4.84
6°	15.80	7.06	19.52	3.80	15.87	6.75
7°	17.65	9.31	20.10	5.47	17.63	8.94
8°	20.03	12.71	21.17	8.48	19.94	12.31
9°	23.13	18.18	22.09	18.46	22.84	18.21
10°	30.94	42.57	23.46	53.30	29.61	43.58
Total	20.41	100.00	21.92	100.00	20.39	100.00

Note: Households were ordered and grouped by non-decreasing values of equivalent gross income, whereas average tax rates of the PIT and substitute taxes (indicated with 'Flat' in table) were computed on their corresponding values of gross income. This is way there is no correspondence between the results presented below the column 'Atr – PIT' and those in Table 8. *Source*: Own elaborations.

In addition to the typical progressive structure of the PIT as shown in Figure 8, whose average tax rate per decile of income increases with rising income from the third decile onwards, it is worth highlighting the fact that substitute taxes, whose average tax rate on gross income subject to proportional taxes is equal to 21.92%, present substantially homogeneous levels of average tax rate per decile of income except for the second decile, whose average tax rate is lower than the one computed on the entire population of nearly 8%. The average tax rate of PIT and surtaxes on gross income is 20.41%, while considering total liability at EL do not lead to any substantial change on the average tax rate being equal to 20.39%.

Except for the first three deciles, Figure 9 shows that the share of PIT and surtaxes paid by each decile is always higher than that paid for proportional taxes up to the eighth decile, while the overall tax burden being particularly substantial in relation to the wealthiest decile, amounting to 43.58%. Still looking at the tenth income group, its share of substitute taxes borne is ten percentage points higher than the corresponding PIT burden and this can be explained by the prevalence of capital income and gains in absolute terms on the other income sources excluded from progressive taxation. In fact, more than half of the total amount of 58.6 billion euros pertains to the better-off decile.

Figure 8 (left-hand side) and Figure 9 (right-hand side) – Average tax rate and tax burden of PIT and proportional taxes per decile of equivalent household gross income



Source: Own elaborations.

4.7. Analysis of tax saving per decile of income

On the basis of the discussion so far, a fiscal reform that broadens the PIT base as replicated by the TL would increase the burden on taxpayers of all deciles except for the lowest two. These can be thought of to be tax savings since taxpayers continue paying the tax burden calculated at EL. It is therefore worth considering the distribution of the tax savings dividing the population by decile of household gross income. The figures presented in the following pages were not adjusted using an equivalence scale in order to show how much households pay at EL and how much they would pay at TL, in this way ignoring economies of scale.

Table 11 shows the amount and deviation of the average tax paid by decile of non-equivalent household gross income, as well as the distribution of the tax savings. To determine the deciles for which fiscal benefits are broader in relative terms, we subtract the average tax that would be paid at TL from the tax actually paid at EL, with the difference divided by the average tax at TL and then multiplied by 100 (the amount of average tax for each model of fiscal legislation is represented by the columns EL, EL(PIT) and TL of Table 10, while the columns Δ%, Δ€ and % stand for the tax saving in relative terms, the tax saving in absolute terms, and the

distribution of tax saving respectively). In this way we are able to establish which households receive the greatest benefit by comparing the EL to TL. For example, on average a taxpayer in the fifth decile pays at EL 158 euros less that the amount he or she would pay at TL, that is 2.63% in relative terms.

Fiscal benefits at EL increase with increasing levels of income, and as a result the richest deciles obtain higher tax savings both in relative and absolute terms than the poorest ones. This is the case starting from the second decile: the poorest 10% pays an amount of taxes at EL that is broader than what they would pay at TL. As far as the EL(PIT) is concerned, each decile obtains fiscal benefits, but the amount decreases with rising income in relative terms, while increases with rising income in absolute terms. Furthermore, it may be observed that 71.4% of the difference in total revenue between EL and TL, equal to 14.5 billion euros, pertains to the two better-off deciles, while from the comparison between EL(PIT) and TL the share of the same deciles is 68.2%.

Table 11 – Amount and deviation of average tax paid and distribution of tax saving per decile of non-equivalent household gross income

	Comparison EL – TL				Comparison EL(PIT) – TL				
Decile	**EL**	**Δ%**	**Δ€**	**%**	**EL(PIT)**	**Δ%**	**Δ€**	**%**	**TL**
1°	143	-47.42	46	0.00	58	40.21	-39	0.31	97
2°	465	1.27	-6	0.10	318	32.48	-153	1.23	471
3°	1,347	3.65	-51	0.85	1,202	14.02	-196	1.57	1,398
4°	2,250	4.01	-94	1.57	2,047	12.67	-297	2.38	2,344
5°	3,298	4.57	-158	2.63	3,055	11.60	-401	3.21	3,456
6°	4,625	5.63	-276	4.60	4,350	11.24	-551	4.42	4,901
7°	6,276	6.76	-455	7.58	5,796	13.89	-935	7.49	6,731
8°	8,709	7.22	-678	11.30	7,995	14.83	-1,392	11.15	9,387
9°	13,064	8.35	-1,191	19.85	11,652	18.26	-2,603	20.86	14,255
10°	31,200	9.02	-3,092	51.52	28,380	17.24	-5,912	47.38	34,292
Total	7,120	7.58	-584	100.00	6,472	15.99	-1,232	100.00	7,704

Source: Own elaborations.

4.8. Tax evasion and tax avoidance: potential implications

As it has been explained in Section 3, income variables were calibrated to aggregate tax returns provided by the Department of Finance – MEF in order to obtain consistency between our estimates and reported income. In what follows we discuss the potential consequences of tax evasion on the hypothetical shift from EL to TL by not adjusting employment and self-employment income, which were found to be evaded to a different extent by previous studies (Fiorio and D'Amuri, 2006; Albarea et al., 2015). Assuming that individuals may be more willing to declare a close-to-true income in anonymous interviews, we simulated the Italian tax-benefit system taking as true work income values their corresponding original IT-SILC distributions. We believe that such simulation could offer useful insights for understanding how tax evasion might be affecting the difference in revenue between the models of fiscal legislation compared.

As shown in Table 12, the amount of gross income in absence of tax evasion at EL would be equal to 943.6 billion euros for a difference of 55.2 billion respect to the status quo scenario. Looking at the difference in revenue between fiscal legislations, the increase would be of 3.4 billion euros for a total difference of 18.0

billion in absence of tax evasion. These results are consistent with those found by Albarea et al. (2015), where income evaded was quantified in 61 billion for an amount of tax revenue loss of 16 billion. The redistributive effect of the tax system as defined under both models of fiscal legislation would be higher in the full compliance scenario (see Table 13), but this comes at the cost of a greater pre- and post-tax income inequality as measured by the Gini index.

Table 12 – Gross income and revenue for fiscal legislation in absence and presence of tax evasion

Variable	Absence of tax evasion	Presence of tax evasion
Gross income at EL	943,855	888,662
Gross income at TL	943,790	888,597
Revenue at EL	198,618	181,358
Revenue at TL	216,606	195,812
Revenue: TL – EL	17,988	14,454

Source: Own elaborations.

Table 13 – Redistributive effect of fiscal legislation in absence and presence of tax evasion

Index	Absence of tax evasion		Presence of tax evasion	
	EL	TL	EL	TL
Pre-tax Gini index (G_Y)	42.20	42.18	41.62	41.60
Post-tax Gini index (G_{Y-T})	37.46	36.60	36.93	36.12
Reynolds-Smolensky net redis. effect (RS)	4.74	5.57	4.69	5.48
Kakwani index (K)	18.19	18.97	18.69	19.65
Average tax rate (t)	21.00	22.97	20.39	22.09
Concentration index of taxes $(C_{T,Y})$	60.39	61.14	60.32	61.25
Concentration index of income after taxes $(C_{Y-T,Y})$	37.37	36.52	36.84	36.03

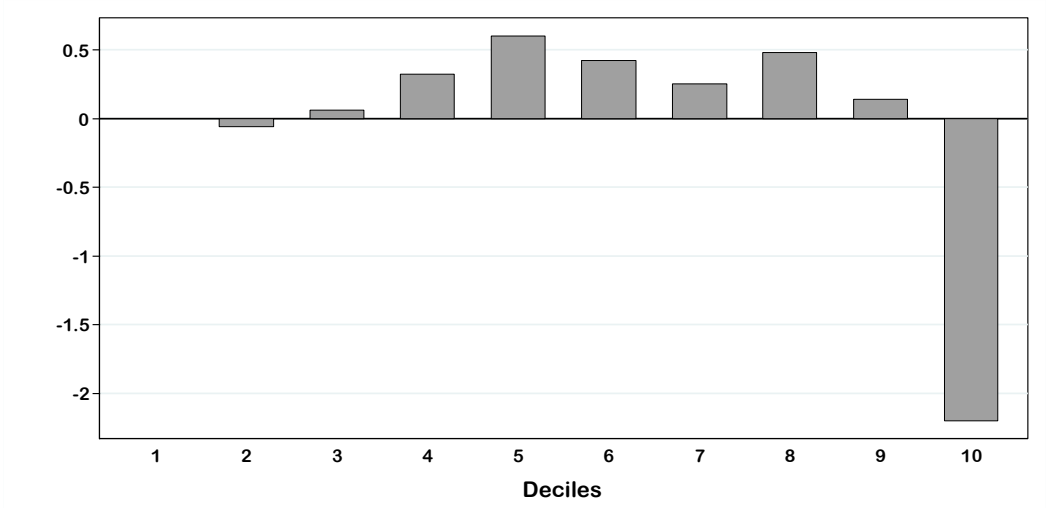
Note: Indices were multiplied by 100. *Source*: Own elaborations.

In Subsection 4.7 we saw that the overall amount of tax saving of 14.5 billion euros given by the difference between the two models of fiscal legislation is distributed mainly in favor of the wealthiest decile, which gains something like 7.4 billion. Since tax evasion may affect the distribution of tax savings, in Figure 10 we discuss how a full compliance scenario would redistribute this difference in revenue. Each bar were obtained subtracting per each decile the percentage of total tax saving for the status quo scenario from the corresponding percentage for the full compliance scenario. The first decile has no bar since the tax amount that would be paid under TL is higher than that at EL for both scenarios: in other words, the poorest decile would have a lower liability when shifting from EL to TL. From the comparison, it can be seen that households in the middle part of the income distribution would obtain a slightly higher share of total tax saving at the expenses of the better-off income group (-2.2%).

Not just tax evasion can have distributional consequences. We may be also interested in understanding how tax avoidance could affect the redistributive power of the tax system by means of its potential impact on those income sources excluded from PIT. While tax avoidance activities involving the movement of capital income towards tax heaven is a phenomenon likely to be correlated with the richest income percentiles, both productivity bonuses and company welfare provisions, even if

their distribution across income groups is less concentrated on the wealthiest ones when compared to the capital income distribution as showed in Table 7, they may further weaken the redistributive role of PIT playing a greater regressive effect in light of the recent legislative changes. In fact, since the 2017 Finance Act allowed the conversion of productivity bonuses into tax-free goods and services provided by company welfare schemes, tax avoidance strategies could be employed in order to obtain greater tax reliefs. As a result, this is likely to affect the redistributive capacity of the tax system as defined under EL. Even more controversial appears to be the case of self-employment income subject to the *regime dei contribuenti minimi*, the current tax regime which substituted the *regime fiscale di vantaggio*. The 2019 Finance Act increased the total amount of profits below which self-employed workers are entitled to the substitute tax regime, a change which may lead to greater tax avoidance and tax evasion above all from taxpayers in the middle of the income distribution in order to fall into the regime.

Figure 10 – Differences along the tax saving percentage distribution by decile of non-equivalent household gross income



Source: Own elaborations.

5. Conclusions

We now briefly review the main results obtained. In view of a total gross income of 888.7 billion euros under *existing legislation* as of 2014 (EL), 806.5 billion stand for the total gross income subject to PIT, while the remaining part of 82.1 billion is taxed at a proportional rate or exempt from taxation. The total revenue of PIT under EL is equal to 164.8 billion euros, including surtaxes, while substitute taxes amount to 16.5 billion euros. The broadening of the PIT base, what we called *theoretical legislation* (TL), that is the adoption of a CIT scheme (or at least the approach to a PIT scheme that resembles the CIT model more than under the existing income tax system), would lead to an increase in total revenue equal to 14.5 billion euros. Taking the equivalent household as the unit of analysis, the average tax rate under TL on total gross income would be 22.09%, while the PIT and surtaxes jointly considered present an average tax rate on total gross income subject to PIT of 20.41% to which it is necessary to add an average tax rate of total proportional taxes

on total gross income exempt from progressive taxation equal to 21.92%. This means that the average tax rate under EL is 20.39%, corresponding to the current tax liability on the 888.7 billion euros. Compared to the theoretical benchmark, on average taxpayers benefit from a tax saving equal to 1.6%, that is 14.5 billion euros.

Considering the EL, the net redistributive effect as identified by the Reynolds-Smolensky index is equal to 0.0469, while the progressive taxation measure represented by the Kakwani index is 0.1869. The inclusion in the PIT base of those incomes exempt from progressivity would increase the redistributive effect to 0.0548: this means that the exclusion from the PIT base of these income sources reduces the redistributive effect at TL of 14.4%. The Kakwani index is lower than the conterfactual one of 4.9%. A transition to the TL would therefore lead to a reduction of income inequality together with a likely disincentive effect on individual labour supply due to the increase of the average tax rate starting from the third income decile to the wealthiest one.

Decomposing the redistributive power of the tax system under EL, the greatest contribution is given by tax credits (59.5%), followed in order of magnitude by tax schedules (39.5%), deductions (3.1%) and the reranking term (-2.1%). As far as income sources excluded from PIT are concerned, capital income and gains have a positive effect (12.2%) as well as rental income subject to *cedolare secca* (0.9%) and cadastral income of dwellings kept available (0.2%), while both self-employment income subject to *regime fiscale di vantaggio* and company welfare provisions have a regressive effect on redistribution (-0.4%). Finally, productivity bonuses has a neutral effect.

Dividing households by deciles of equivalent gross income, the difference between the amount of taxes that would be paid at TL and the amount actually paid at EL, which can be more simply thought of as tax saving, is higher above all for the wealthiest deciles. In fact, 51.5% of the total amount of tax saving goes to the richest income group, a share that would be reduced of 2.2% in absence of tax evasion. According to our estimates, the total amount of income evaded is 55.2 billion euros for a tax revenue loss of 17.3 billion under EL.

The erosion of the PIT base has clearly reduced the progressive nature of the tax system as a whole. This system seems to have deviated from the CIT model from the very beginning, when the PIT was introduced and capital income and gains were excluded from the PIT base. A progressive loss of rationality of the tax system has accompanied the gradual introduction of the exemptions examined in this research. The taxation of various income sources by means of alternative proportional systems or their exemption from taxation has been pursued to favour particular business activities or as the result of strategic political choices. This ongoing process seems to have moved the tax system toward a Dual Income Tax (DIT) scheme, although incongruities are evident in a comparison with the existing tax structure.

Appendix A

Existing legislation as of 2014
Gross income
Gross income subject to proportional tax rates or exempt from taxation
Gross income subject to PIT
Gross income subject to proportional tax rates or exempt from taxation
Capital income and gains (M) (A)
Rental income subject to cedolare secca (R) (A)
Self-employment income under regime fiscale di vantaggio (R) (A)
Productivity bonuses (R)
Company welfare
Cadastral income from immovable properties kept available (M) (R) (A)
→ Application of proportional tax rates
= Total proportional taxes
Total income subject to PIT
Employment income (R) (A)
Retirement income (R) (A)
Self-employment income for individuals with VAT number (R) (A)
Self-employment income for individuals without VAT number (R) (A)
Cadastral income of main residence and other immovable properties (M) (R) (A)
Capital income and gains subject to PIT (I)
→ Tax deductions
Cadastral income of main residence (M) (A)
Social insurance contributions paid by self-employed workers (R) (A)
Contributions to private pension plans (R)
Legally alimony payments (R)
Social insurance contributions paid for domestic help (R)
Healthcare expenditures for people with disabilities (R)
Other deductions (I)
= Taxable income
→ Application of progressive tax rates
= Gross PIT
→ Tax credits
Income source
Dependent family members
Housing refurbishments (M)
Tenants
Health expenditures (R) (A)
Mortgage interest payments on main residence (R) (M)
Life insurance premium (M)
Higher education and university tuition fees (R) (A)
Annual enrollment to sports facilities (R)
Bonus 80 euro
Other tax credits (I)
= Net PIT
b) Taxable income (just for taxpayers whose net PIT is positive)
→ Regional surtax
→ Municipal surtax
= Total surtaxes

Note: (I): calibration with aggregate fiscal declarations by income classes; (R): reweighted taxpayers; (A): monetary variables adjusted to administrative data; (M): statistical matching procedure applied.

Appendix B

Category	Original values	Revised values	Difference
Financial instrument			
Bank and postal deposits	92.9	92.9	0.0
Government securities	8.8	21.6	12.8
Bonds	8.2	21.1	12.9
Managed savings	1.0	4.0	3.0
Funds	6.0	15.6	9.6
Shares	6.4	14.2	7.8
Supplementary pension plans and/or life insurances	16.6	21.3	4.7
Degree of financial sophistication			
0 instrument	6.9	6.8	-0.1
1 instrument	61.6	54.5	-7.1
2 instrument	21.3	16.7	-4.6
3-5 instruments	9.9	14.9	5.0
6-7 instruments	0.3	7.1	6.8
At least one financial instrument excluding deposit: by geographical area			
North-West	38.9	47.6	8.7
North-East	47.7	58.0	10.3
Middle	33.5	42.2	8.7
South	14.7	18.8	4.1
Islands	18.2	20.5	2.3
: by quintiles of equivalent household disposable income			
1°	5.5	5.9	0.4
2°	15.5	18.0	2.5
3°	29.0	36.1	7.1
4°	43.7	54.2	10.5
5°	64.7	80.4	15.7
: by age groups of the reference person			
≤ 30	18.6	20.5	1.9
31-40	30.5	35.6	5.1
41-50	38.8	47.3	8.5
50-65	38.9	46.4	7.5
≥ 66	24.4	31.6	7.2
: by degree of the reference person			
Without a degree	28.2	34.9	6.7
With a degree	57.1	68.7	11.6
: by degree of risk adversity of the reference person			
High	23.5	29.2	5.7
Medium-high	46.0	55.6	9.6
Medium-low	35.9	45.2	9.3
Low	56.9	64.7	7.8

Source: Own elaborations.

Appendix C

One of the many ways the Gini index can be computed is the following one:

$$[1] \qquad G_i = \frac{2\mathrm{Cov}[i, F(i)]}{\mu_i}$$

where i is the *i-th* income variable, $\mathrm{Cov}[i, F(i)]$ is the covariance between i and the cumulative distribution fuction of individuals (households) sorted by non-decreasing values of i, $F(i)$, and μ_i is the average value of i. It ranges from zero to 1. Its maximum value stands for the highest inequality level reacheable, while the minimun one represents a situation of perfect equality.

Similarly, the Concentration index can be defined as follows:

$$[2] \qquad C_{i,j} = \frac{2\mathrm{Cov}[i, F(j)]}{\mu_i}$$

where i is the *i-th* income variable, j is the *j-th* income variable, $\mathrm{Cov}[i, F(j)]$ is the covariance between i and the cumulative distribution function of individuals (households) sorted by non-decreasing values of the j, $F(j)$, and μ_i is the average value of i. It ranges from -1, when the total value of i is owned just by the poorest individual (household), to 1, when the total amount of i is entirely concentrated on the wealthiest individual (household).

As far as the Reynolds-Smolensky index of the net redistributive effect is concerned, it can be calculated by subtracting the post-tax Gini index from the pre-tax Gini index (Reynolds and Smolensky, 1977; Baldini and Toso, 2009), where the *i-th* income variable as defined in [1] is respectively income after taxes and income before taxes according to the fiscal legislation considered. It measures the overall redistributive effect of tax-benefit systems and it can be broken down in three components:

$$[3] \qquad RS = G_Y - G_{Y-T} = \frac{t}{1-t}K - R$$
$$= \frac{t}{1-t}\left(C_{T,Y} - G_Y\right) - \left(G_{Y-T} - C_{Y-T,Y}\right)$$

$$[4] \qquad t = \frac{T}{Y} = \frac{\sum_{i=1}^{N} t(y_i)}{\sum_{i=1}^{N} y_i}$$

where $t/(1-t)$ is the factor related to the average tax rate, t, which is the ratio between the total amount of taxes (T) paid by individuals (households) and the corresponding total amount of income before taxes (Y); K is the Kakwani index, which measures the progressivity of a tax system in terms of departure from proportionality and it is given by the difference between the Concentration index of taxes, $C_{T,Y}$, where the *j-th* income variable as defined in [2] is income before taxes, and the pre-tax Gini index, G_Y; finally, R captures the reranking effect and it can be computed subtracting the Concetration index of income before taxes, $C_{Y-T,Y}$, where

the *j-th* income variable as defined in [2] is income before taxes, from the post-tax Gini index, G_{Y-T}.

Moving to the decomposition method of the Reynolds-Smolensky index of the net redistributive effect proposed by Onrubia et al. (2014), it allows to compute the contribution to the overall redistributive effect of each component of the tax system. Following the order of the terms of the right-hand side in [5], the RS index can be broken down into three main aggregates plus the reranking effect, namely: i) the sum of tax schedules; ii) the sum of tax credits; iii) the sum of exemptions, allowances and deductions. Each aggregate is given by the sum of its subcomponents, while the single subcomponent is given by the product of the group weight, constant for all its subcomponents, the individual weight and the Kakwani index. Suppose that the below decomposition is applied to the tax system under EL; *Y* is the gross income, that is the sum of all incomes either included into and excluded from the PIT base; *B* is the total taxable income, given by the sum of taxable income subject to PIT or proportional taxes; *S* stands for the overall gross liability, which is in our case the sum of PIT, income surtaxes and proportional taxes; *T* is the net liability; S_i indicates the *i-th* tax schedule; C_i is the *i-th* tax credit; finally, D_i represents the *i-th* exemption, allowance or deduction of the tax system. The upper bar means that the variable is at its average value. To simplify matters, taking only the first term of the right-hand side, the group weight is given by the $\bar{B}/(\bar{Y}-\bar{S})$; the individual weight is the proportion between *i-th* tax schedule and the total taxable income; $K^{Y}_{B,B-S_i}$ is the Kakwani index between the variables *B* and $B-S_i$ both sorted by non-decreasing values of gross income, *Y*, which measures the progressivity effect of changing from variable *B* to variable $B-S_i$. The same logic is then applied to the remaining terms in [5].

$$[5] \qquad RS = \frac{\bar{B}}{\bar{Y}-\bar{S}} \sum_{i=1}^{l} \frac{\bar{S}_i}{\bar{B}} K^{Y}_{B,B-S_i} - \frac{\bar{Y}}{\bar{Y}-\bar{T}} \sum_{i=1}^{m} \frac{\bar{C}_i}{\bar{Y}} K^{Y}_{Y-S,Y-S+C_i} - \frac{\bar{Y}\bar{S}}{\bar{B}(\bar{Y}-\bar{S})} \sum_{i=1}^{n} \frac{\bar{D}_i}{\bar{Y}} K^{Y}_{Y,Y-D_i} - R$$

In order to separate the part of the reranking effect due to gross tax liabilities, R^S, from that due to tax credits, R^C, we applied the decomposition proposed in Duclos (1993) as already employed by Di Caro (2018) for the Italian context, assuming that gross tax liabilities come first than tax credits.

$$[6] \qquad R = R^S + R^C = \left(C_{Y-T,Y-T-C} - C_{Y-T,Y}\right) + \left(G_{Y-T} - C_{Y-T,Y-T-C}\right)$$

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The Contribution of Tax-Benefit Instruments to Income Redistribution in Italy*

Abstract
Over the last two decades, interest in understanding what determines the redistributive role of tax-benefit systems has burgeoned worldwide. In the case of Italy, previous analyses tended to focus on quantifying the contribution of marginal tax rates, deductions and tax credits to the redistributive capacity of the personal income tax (PIT), while neglecting the effect of proportional taxes, SICs and tax-free cash benefits on income redistribution. This paper aims to address this gap by applying Gini-based decomposition methodologies (Onrubia et al., 2014; Urban, 2014) to the vertical and horizontal effects of the Italian tax-benefit system for the 2018 year at the national level and the macro-regional level. The findings show that tax-benefit instruments different from progressive taxation can contribute up to more than 50% of the redistributive effect with marked spatial differences regarding social transfers and SICs.

Keywords: tax-benefit system; progressive taxation; decomposition approach; redistribution; EUROMOD
JEL: D31, H23**,** H24

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1. Introduction

In recent years, the study of tax redistribution has been revived due to the increasing availability of exhaustive and comparable datasets at the micro level. This wealth of information has led to remarkable advances in static microsimulation modelling (Orcutt, 1957; O'Donoughe, 2014). Besides the development of the state-of-the-art tax-benefit microsimulation model EUROMOD (Surtherland and Figari, 2013) which is a powerful tool in terms of cross-country comparability, a variety of national models have gained prominence in a number of European countries.[1] A wide range of questions concerning income inequality measurements can now be addressed by social scientists inquiring into these from spatial as well as temporal comparative perspectives. In this paper, microsimulation techniques provide the starting point for studying the effect of taxes and benefits on income redistribution.

Despite the lack of homogeneity in the methodological approaches deployed, the examination of the role played by specific tax-benefit instruments in determining redistribution has attracted growing attention across the world over the past two decades (Creedy and Van de Ven, 2002; Immervoll et al., 2005; Urban, 2008; Kristjánsson, 2011; Verbist and Figari, 2014; Hümbelin and Farys, 2018; Morger and Schaltegger, 2018; Guilland et al., 2019). In regard to the Italian tax-benefit system which is the object of this study, a wealth of evidence has been provided above all on the contribution of personal income tax (PIT) components. One of the earliest contributions to the field was made by Wagstaff and Van Doorslaer (2001), showing that progressivity of net PIT liabilities were mainly due to rate and tax credit effects at the tax unit level during the mid-late 1980s. Moving forward to more recent research and retaining the individual as the unit of analysis, the net contribution given by tax credits and marginal tax rates was estimated respectively to comprise 56.5% and 42.3% of the (national) redistributive effect of PIT using tax returns for the 2014 year, while tax rates (tax credits) were found to make up higher contributions in the northern and central (southern) regions (Di Caro, 2020). With reference to the national level, similar results to the ones discussed above were obtained by Barbetta et al. (2018) in their analysis of the tax returns for the 2011 year as well as by studies based on sample survey data at the individual and household levels (Boscolo, 2019).

[1] In the case of Italy, the most up-to-date non-behavioural models and their primary characteristics are as follows: SM2 (Betti et al., 2011), the peculiar trait of which is the employment of its net-to-gross algorithm in order to obtain IT-SILC's gross income variables (ISTAT, 2011); BETAMOD (Albarea et al., 2015) which is known for its accuracy in estimating individual tax evasion rates; Di Nicola et al. (2015), the static model of the Italian Department of Finance which is based on an exact match between sample survey data and individual tax returns; TREMOD (Azzolini et al., 2017), one of the few examples of regional microsimulation modelling in the Italian context; BIMic (Curci et al., 2017), the Bank of Italy's model whose estimations of immovable and movable property values are generally more precise than other models employing non-administrative data; MicroReg (Maitino et al., 2017) which is focused on indirect taxes and in-kind transfers; finally, MAPP© (Baldini et al., 2015a; Boscolo, 2019), whose strength relies above all on the simulation of in-cash and in-kind transfers as well as proportional taxes and income sources exempt from progressive taxation.

Adopting a wider perspective, Fuest et al. (2010) analysed the redistributive effect of tax-benefit systems in the enlarged EU by applying two decomposition approaches to the 2007 EU-SILC wave at the household level, namely the *sequential accounting approach* (SA) and the *factor source decomposition approach* (FSD) implemented alike on the basis of the generalised entropy class of inequality indices (Shorrocks, 1980). In particular, Fuest et al. showed how the application of each method gave rise to contradictory policy implications. In relation to the Italian tax-benefit system, the authors suggested a predominant effect of public pensions and PIT in determining redistribution (38.3% and 25.0% respectively) which was accompanied by a small equalising effect of cash benefits (4.3%) and negative impact of social insurance contributions (-3.0%) when using SA. With FSD, in contrast with the above mentioned evidence, the redistributive role played by public pensions was found to be negative (-15.3%) with the same holding true for cash benefits (-1.5%), while PIT and social insurance contributions showed an equalising effect on income inequality (46.8% and 16.9% respectively). Fuest et al., despite shedding light on the contribution of tax-benefit instruments, focused on aggregate income variables such as the total sum of cash benefits rather than on the total amount of state pensions paid out.

To the best of our knowledge, no research has yet explored the contribution of overall tax-benefit instruments to income redistribution in Italy. The aim of this paper is to address this gap by applying Gini-based decomposition methodologies (Onrubia et al., 2014; Urban, 2014) to the vertical and horizontal effects of the Italian tax-benefit system as simulated by the microsimulation model EUROMOD for the 2018 year at the national level and the macro-regional (NUTS 1) level. The calculation is repeated for different degrees of extension of the tax-benefit system under examination which are referred to as scenarios. A specific focus is directed to the role played by proportional taxes, social insurance contributions (hereinafter SICs) and tax-free cash benefits in shaping income redistribution.

The interest in the sub-national effect of taxes and benefits stems from the spatial income and wealth disparities that continue to characterise the Italian context (Cerqueti and Ausloos, 2015; Di Caro, 2017; Mussida and Parisi, 2019). The choice of the macro-regional dimension rather than further disaggregated data is due to the need for overcoming representativeness issues that may arise when dealing with complex household survey data (Piacentini, 2014; Hlasny and Verme, 2018).

The study of how tax-benefit systems redistribute resources appears to be crucial in the Italian context given the significant attention directed to the proposal of a flat-rate personal income tax scheme during the eighteenth parliamentary term. Such a reform in Italy would have a significant effect: an increase in income inequality associated with a decrease in both progressivity and average tax rate effect, due to revenue losses of up to 50 billion euros in the most radical proposal (Baldini and Rizzo, 2020). Since ‘the tax system shall be progressive’ as stated in Article 53 of the Italian Constitution, the need to understand the role played by income components exempt from progressivity in the redistribution of income is more significant in the light of a personal income tax reform characterised by regressive redistributive consequences, especially as the VAT still has regressive effects above all for the lower income groups (Gastaldi et al., 2017). At the same time, the ongoing process of gradual erosion of the PIT base due to the subjection of certain income components to proportional taxation (Boscolo, 2019), put forward

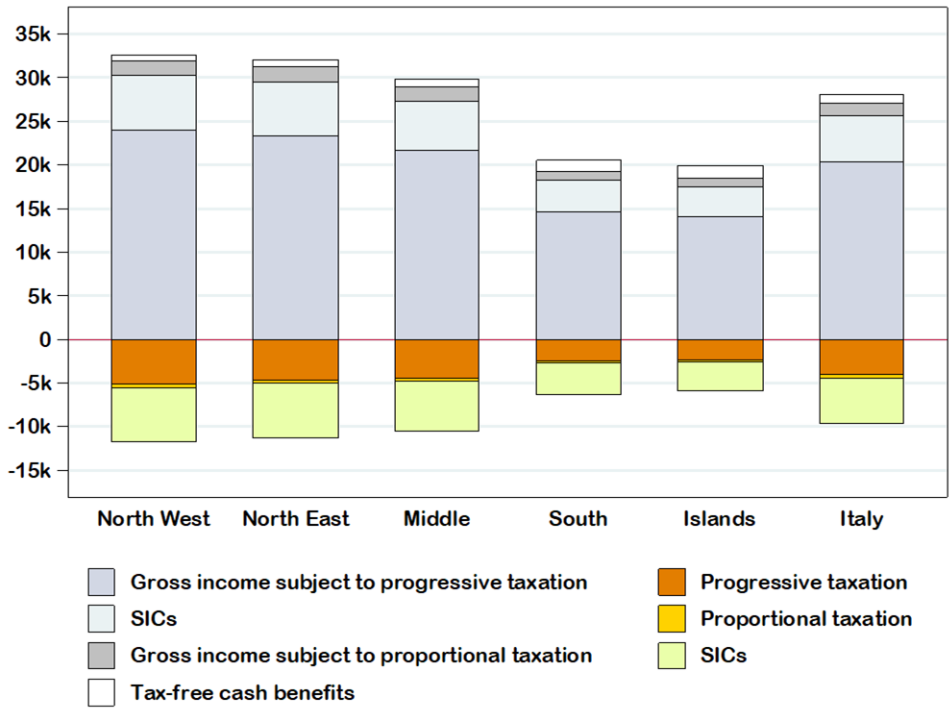
as one of the major causes of the loss of vertical and horizontal equity of the present system of personal taxation (Stevanato, 2016; 2017; Liberati, 2020), is important in this connection. Furthermore, the focus on the contribution of tax-free cash benefits allows for a comprehensive evaluation of the spacial redistributive impact of recent economic policies aimed at boosting private comsumption and tackling poverty (Bazzoli et al., 2017).

The remainder of the paper is structured as follows. Section 2 presents the data employed and simulated scenarios. Section 3 provides a brief description of the Italian tax-benefit system for the year 2018. Section 4 discusses the Gini-based decomposition formulas applied in this study. Section 5 presents the results of the analysis. Finally, Section 6 concludes the paper.

2. Data description and simulated scenarios

As noted above, the analysis was carried out using the microsimulation model EUROMOD for the simulation of the 2018 Italian tax-benefit system. The data employed are drawn from the 2016 IT-SILC dataset, the Italian component of the European Union Statistics on Income and Living Condition (EU-SILC) survey. All results discussed here and below were obtained by taking the household as the unit of analysis, made equivalent by means of the OECD modified scale.

Figure 1 – Income composition of equavalised disposable household income by macro-region



Note: Percentage values were obtained by dividing each income component by equivalised disposable household income. *Source*: Own elaborations.

Figure 1 shows some preliminary evidence on the composition of equivalised disposable household income by macro-region. First, it is worth noting that absolute income values differ noticeably across Italian macro-regions. Not surprisingly, sourthern macro-regions were found to have a lower disposable income of roughly one-third in comparison with northern and central areas of the country. On average, gross income subject to progressive taxation constitutes the highest share in terms of disposable income out of all positive income components regardless of the level of analysis. SICs follow closely, ranging between one-quarter and one-third of the disposable income. Northern and central macro-regions present a higher percentage of income components subject to proportional taxation over tax-free cash benefits, while the opposite stands for the South and main islands. This difference in the distribution of income components across macro-regions motivates the interest in studying the equalising role that can be played by proportional taxes and cash benefits regionally. Considered together, the two sources of income account for 13.3% of disposable income at the national level, while their incidence slightly increases up to a maximum of 17.6% in the southern areas of the country and decreases to a minimum of 11.4% in the northern areas. As for the negative income components that make up equivalised disposable household income, progressive and proportional taxes show a lower incidence in the southern areas in line with the distribution of positive income components. On average, they amount roughly to one-quarter of disposable income.

An overview of the scenarios involved is presented in Table 1. The focus on the redistributive effects of increasing degrees of extension of the tax-benefit system helps in understanding how inequality and progressivity vary when income components which are exempt from progressive taxation are considered. Starting from Scenario 1, in this case the definition of gross income is given by the sum of all gross income components subject to PIT and regional surtax. Results from this first scenario are of interest given the availability of fully comparable studies based on administrative data (Barbetta et al., 2018; Di Caro, 2020), thus facilitating the macroeconomic validation of the model in terms of redistributive indices. To the previous income definition, Scenario 2 adds all those income sources taxed at a proportional tax rate such as capital income and rental income from residential properties. The definition used in Scenario 3 adds to the sum of all income sources included in the previous two scenarios, including as it does income sources exempt from taxation which mainly consist of cash benefits, regardless of their non-means- or means-tested nature. Finally, Scenario 4 takes into account social insurance contributions from all sources (employee/self-employed as well as employer contributions).

Table 1 – Description of the simulated scenarios

VARIABLE	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Gross income subject to progressive taxation before SICs				✓
Gross income subject to progressive taxation after SICs	✓	✓	✓	
Gross income subject to proportional taxes		✓	✓	✓
Tax-free cash benefits			✓	✓

Source: Own elaborations.

Regardless of the level of analysis, income components exempt from progressive taxation increased in their incidence over time. Table 2 compares the share of income components that make up equivalised gross household income as simulated for the 2018 tax-benefit system with corresponding shares for the 2005 year, covering a fourteen-year period. As far as the national level is concerned (see the column headed 'IT'), income subject to proportional taxes presents a 1.9% increase in the share of gross income during the time span observed, followed by tax-free cash benefits (+1.1%) and SICs (+0.3%). As a result, the share of income subject to progressive taxation experienced a 3.3% decrease. While the northern and central areas (with the exception of SICs for the North East area showing a 1.2% increase) generally reflect the national trend, the South and main islands are characterised by a higher increase of cash benefits than income subject to proportional taxation and by a reduced share of SICs. These findings, despite their preliminary nature, underline the importance of better understanding the contribution of tax-benefit instruments different from progressive taxation to income redistribution.[2]

Table 2 – Income composition of equivalised gross household income by macro-regions over fourteen years in Scenario 4

VARIABLE	2005 tax-benefit system					
	NW	**NE**	**M**	**S**	**I**	**IT**
SICs	17.8	17.9	17.7	18.2	17.6	17.9
Income subject to progressive taxation	77.0	76.6	77.1	75.3	76.4	76.6
Income subject to proportional taxation	3.9	3.9	3.4	3.2	2.8	3.6
Tax-free cash benefits	1.3	1.6	1.7	3.4	3.1	1.9
VARIABLE	**2018 tax-benefit system**					
	NW	**NE**	**M**	**S**	**I**	**IT**
SICs	18.3	19.1	18.1	16.2	17.1	18.2
Income subject to progressive taxation	74.2	72.9	73.4	73.3	71.8	73.3
Income subject to proportional taxation	5.5	5.9	5.6	4.7	5.1	5.5
Tax-free cash benefits	2.2	2.1	2.9	5.8	6.0	3.0

Note: Values in percentage of total gross income. *Source*: Own elaborations.

3. The 2018 Italian tax-benefit system

This section is intended to provide a brief description of the Italian tax-benefit system as simulated by the microsimulation model EUROMOD for the 2018 year. Without claiming to be exhaustive, tax-benefit instruments are divided into four categories in line with the distinction made above between income components subject to different tax regimes.

3.1. Progressive taxation: personal income tax and surtaxes

The Italian personal income tax (*Imposta sul reddito delle persone fisiche*) was introduced in 1974 to replace a plethora of real taxes in force since Italy's

[2] The 2005 tax-benefit system is the first year of simulation available in EUROMOD with regard to Italy. The values in Table 2 are fully comparable to those reported for the 2018 tax-benefit system.

unification. The original provisions of the reform were intended to direct the personal taxation system toward a system of taxation characterised by a broad tax base comprehensive of all income components. However, capital income and gains were excluded and subject to proportional withholding taxes. Since then, several changes have followed regarding its structure and calculation (e.g. exclusion from the tax base of different sources of income and contextual subjection to substitute proportional tax regimes, changes in the number of tax brackets and tax rate levels, number and structure of tax credits and deductions).[3]

As for the 2018 year, the calculation of PIT is summarised in [1]. The taxable unit is the individual. Taxable income (Y_{G-D}) is obtained by subtracting deductions (D) from gross income (Y_G). Next, the determination of gross tax liability (T_G) is made by multiplying the set of tax rates (t) by taxable income. Finally, net tax liability (T_N) is given by subtracting tax credits (C) from gross PIT.

$$[1] \quad Y_G - D = Y_{G-D} \quad Y_{G-D} * t = T_G \quad T_G - C = T_N$$

$$where\ t\ = \begin{Bmatrix} 23\%: 0 < Y_{G-D} \leq 15{,}000 \\ 27\%: 15{,}001 \leq Y_{G-D} \leq 28{,}000 \\ 38\%: 28{,}001 \leq Y_{G-D} \leq 55{,}000 \\ 41\%: 55{,}001 \leq Y_{G-D} \leq 75{,}000 \\ 43\%: Y_{G-D} \geq 75{,}001 \end{Bmatrix}$$

Deductions and tax credits are crucial elements in the calculation of due liabilities. While the former stands for roughly 35.7 billion euros according to tax return data for 2018, most of which comes from self-employed SICs (19.4 billion) and main residences' cadastral value (9.0 billion), tax credits are almost twice as much (69.8 billion). Hovewer, despite the plethora of tax credits characterising the present system of personal taxation, only a few contribute significantly (on average) to reduce gross liabilities. On the one hand, tax credits for specific income sources such as labour or retirement income comprise the bulk of total tax credits for a value of 42.5 billion. The amount granted depends on the amount of income earned, number of days worked or days of retirement and contract duration, generally decreasing with increasing levels of income as in [2]:

$$[2] \quad C_{Y_1} = \begin{Bmatrix} 1{,}880\ (dw/365): with Y_{G*} \leq 8{,}000 \\ [978 + 902\ (28{,}000 - Y_{G*})/20{,}000]\ (dw/365): with\ 8{,}001 \leq Y_{G*} \leq 28{,}000 \\ [978\ (55{,}000 - Y_{G*})/27{,}000]\ (dw/365): with\ 28{,}001 \leq Y_{G*} < 55{,}000 \\ 0: with\ Y_{G*} \geq 55{,}000 \end{Bmatrix}$$

$$C_{Y_2} = \begin{Bmatrix} 1{,}104: with\ Y_{G*} \leq 4{,}800 \\ 1{,}104\ (55{,}000 - Y_{G*})/50{,}200: with\ 4{,}801 \leq Y_{G*} < 55{,}000 \\ 0: with\ Y_{G*} \geq 55{,}000 \end{Bmatrix}$$

$$C_{Y_3} = \begin{Bmatrix} 1{,}880\ (dr/365): with\ Y_{G*} \leq 8{,}000 \\ \{1{,}297 + [583\ (15{,}000 - Y_{G*})]/7{,}000\}\ (dr/365): with\ 8{,}001 \leq Y_{G*} \leq 15{,}000 \\ [1{,}297\ (55{,}000 - Y_{G*})/40{,}000]\ (dr/365): with\ 15{,}001 \leq Y_{G*} < 55{,}000 \\ 0: with\ Y_{G*} \geq 55{,}000 \end{Bmatrix}$$

[3] See Pellegrino and Panteghini (2020) for an exhaustive overview of the changes that have occurred in the last forty-five years.

where C_{Y_1}, C_{Y_2} and C_{Y_3} are the tax credit for employment, self-employment and retirement income, respectively; dw (dr) stands for the number of days worked (in retirement), scaled in such a way that one full month of work (retirement) correspond with the total number of days of the chosen month; finally, Y_{G*} is obtained by substracting the cadastral value of the main residence from the sum of gross income subject to PIT, Y_G, and rental income from residential properties subject to the *cedolare secca*. However, C_{Y_1} can not be lower than 690 euros if employment income arises from open-ended contracts or 1,380 euros in the case of fixed-term contracts or both. Similarly, C_{Y_2} must be at least equal to 713 euros. Taxpayers entitled to more than one tax credit for labour or retirement income are free to choose the most convenient scheme, but their sum is not allowed. On the other hand, tax credits for dependent family members also play a significant role in lowering the liabilities of specific groups of the population, amouting to 12.2 billion. With the aim of achieving greater horizontal equity, the present personal income tax system provides support to taxpayers by increasing household costs through three tax credits:

$$[3]\quad C_{FM_1} = \left\{ \begin{array}{c} 800 - 110 * Y_{G*}/15{,}000 \text{: } with\ Y_{G*} \leq 15{,}000 \\ 690 \text{: } with\ 15{,}001 \leq Y_{G*} \leq 29{,}000 \\ 700 \text{: } with\ 29{,}001 \leq Y_{G*} \leq 29{,}200 \\ 710 \text{: } with\ 29{,}201 \leq Y_{G*} \leq 34{,}700 \\ 720 \text{: } with\ 34{,}701 \leq Y_{G*} \leq 35{,}000 \\ 710 \text{: } with\ 35{,}001 \leq Y_{G*} \leq 35{,}100 \\ 700 \text{: } with\ 35{,}101 \leq Y_{G*} \leq 35{,}200 \\ 690 \text{: } with\ 35{,}201 \leq Y_{G*} \leq 40{,}000 \\ 690\ (80{,}000 - Y_{G*})/40{,}000 \text{: } with\ 40{,}001 \leq Y_{G*} < 80{,}000 \\ 0 \text{: } with\ Y_{G*} \geq 80{,}000 \end{array} \right\}$$

$$C_{FM_2} = \left\{ \begin{array}{c} b * 950\ \big((95{,}000 * nc) - Y_{G*}\big)/(95{,}000 * nc) \text{: } with\ nc \leq 3\ and\ Y_{G*} < 95{,}000 * nc \\ \big[b * 950\ \big((95{,}000 * nc) - Y_{G*}\big)/(95{,}000 * nc)\big] + 1{,}200 \text{: } with\ nc \leq 3\ and\ \big(C_{FM_2} - 1200\big) > 0 \\ 0 \text{: } with\ Y_{G*} \geq 95{,}000 * nc \end{array} \right\}$$

$$b = \left\{ \begin{array}{c} nc_{\leq 3}\ 1{,}220 + nc_{>3} * 950 + nc_{\leq 3,d} * 1{,}620 + nc_{>3,d} * 1{,}350 \text{: } with\ nc \leq 3 \\ nc * 200\ +\ nc_{\leq 3} * 1{,}220 + nc_{>3} * 950 + nc_{\leq 3,d} * 1{,}620 + nc_{>3,d} * 1{,}350 \text{: } with\ nc > 3 \end{array} \right\}$$

$$C_{FM_3} = \left\{ \begin{array}{c} nfm\_o * [750(80{,}000 - Y_{G*})/80{,}000] \text{: } with\ Y_{G*} < 80{,}000 \\ 0 \text{: } with\ Y_{G*} \geq 80{,}000 \end{array} \right\}$$

where C_{FM_1}, C_{FM_2} and C_{FM_3} are the tax credits for the dependent spouse, dependent children and other dependent family members, respectively; nc is the number of children, while $nc_{\leq 3}$ ($nc_{>3}$) is the number of non-disabled children with less (more) than three years of age; the subscript d in nc stands for disabled; finally, nfm_o represents the number of other dependent family members. C_{FM_2} can be equally divided among the parents if the spouse is not dependent, and the same stands for C_{FM_3} among non-dependent members.

Besides the PIT, the surtaxes at the regional and municipal level can also present a progressive structure.[4] Their payment is limited to taxpayers with positive PIT

[4] The municipal surtax is not simulated in the EUROMOD model, and therefore not included in the present study.

liabilities and PIT taxable income higher than exemption thresholds set at the regional level with the latter being the tax base for both surtaxes. The base tax rate of the regional surtax is set to 1.23% and can be increased up to 3.33%, while the tax rate of the municipal surtax can not exceed 0.8%. It is possible to differentiate tax rates in such a way that high-earning taxpayers pay a higher amount, but this must be done by setting tax rates according to the structure of the PIT brackets.

3.2. Proportional taxes

From 2011 onward, rental income from residential properties is excluded from the PIT base and taxed at a proportional tax rate of 10% when the underlying contract was stipulated at a controlled rent and 21% for all remaining cases.[5] This optional tax regime, introduced under the name of *cedolare secca*, is intended to recover tax revenue and to favour the emersion of undeclared properties. In the first year of its introduction, the revenue collected amounted to 0.9 billion euros for a total of nearly half a million taxpayers according to tax return statistics. The popularity of the substitute measure to progressive taxation increased rapidly in subsequent years, with revenues amounting to 2.6 billion paid by 2.8 million taxpayers according to tax return data in 2018.

Besides rental income, capital income and gains (defined in this study as the sum of arrears and severance pay, bonds, dividends, private pensions and deposits) are subject to withholding taxes at a rate of 26% with the exception of government bonds and private pensions which are respectively taxed at a rate of 12.5% and 20%.

3.3. Tax-free cash benefits

During the seventeenth parliamentary term, four measures were introduced in the broad context of redistributive policies amounting to 14.4 billion euros in total (equal to 0.8% of GDP at market prices in 2018):

i) the '80 euro' bonus[6], an in-work refundable tax credit of 80 euros per month granted to employees with income from employment ranging from 8,174 to 26,600 euros and positive net PIT, meant to stimulate private consumption of the working class and to boost economic growth (Baldini et al., 2015b; Bazzoli et al., 2017); the total amount was 9.9 billion euros for 12.1 million earners according to tax return data for 2018;

[5] Starting from the 2019 tax year, rental income from shops can be taxed at a rate of 21% rather than under the ordinary regime.

[6] Despite being commonly defined as a tax credit, this measure is not embedded within the structure of PIT. The contribution to the redistributive effect was computed considering the bonus as an income component exempt from taxation. Note that the measure has been replaced by a similar scheme as of July 2020. The new bonus amounts to 100 euros per month and it is granted to employees with income from employment up to 28,000 euros, while individuals with employment income ranging between 28,000 and 35,000 euros benefit from a tax credit of 80 euros per month. The tax credit is also granted to employees with employment income ranging from 35,000 to 40,000 euros, but its amount gradually decreases to zero.

ii) the newborn bonus, a means-tested benefit of 960 euros per year aiming to tackle child poverty and to increase the purchasing power of medium-low income groups, that can be claimed by households for each newborn or adopted child during the tax period in question if the corresponding ISEE (*Indicatore della Situazione Economica Equivalente*, a means-testing criterion also taking account of the overall wealth of the household) is less than 25,000 euros, while the amount of the bonus is doubled if the ISEE household income is less than 7,000 euros; EUROMOD calculations for the 2018 tax-benefit system indicate that roughly 911,000 households benefited from the bonus for a total amount of 1.1 billion euros;

iii) the Italian minimum income benefit for the year 2018, better known as REI (*Reddito di Inclusione*), comprises the first ever universal tool to fight absolute poverty introduced in the history of the Italian welfare state (Baldini et al., 2018), consisting of a cash benefit of a maximum of 6,408 euros per year conditional on the fulfilment of several economic criteria and the activation of a personalised path of social and labour re-inclusion of the family[7]; based on EUROMOD, its aggregate value amounted to 1.1 billion euros for a total of 813,000 households;

iv) the mother bonus, a lump sum benefit of 800 euros paid for the birth or adoption of a child regardless of the economic condition of the applicant; nearly half a million households received this benefit in 2018 for an aggregate value of 388 million euros according to EUROMOD calculations.

Along with the above list of cash benefits, the Italian tax-benefit system provides further income support through disability pensions[8], family allowance (known as the *Assegno al nucleo familiare*), social pension, child and housing benefits, maternity payments, scholarship and grants. See Ceriani et al. (2018) for a detailed description of each simulated transfer.

3.4. SICs

The calculation of SICs varies according to the source of earned income and for each source on the basis of several individual and organisational characteristics.

[7] At the time of its introduction, REI replaced a minimum insertion income scheme known as SIA (*Sostegno all'Inclusione Attiva*), with the simultaneous presence of both measures under certain circumstances only for the 2018 year, in turn to be replaced by RdC (*Reddito di Cittadinanza*), an enhanced minimum income scheme in effect since March 2019; the difference between the two benefits is in the form of a more generous sum granted by the new scheme in place, which is still conditional on the willingness of the individual to make the transition to employment, and in compliance with further patrimonial requirements. For a detailed examination of the measures, see Monticelli (2019).

[8] The following non-taxable income components are included within the category of disability pensions: Civil Infirmity Allowance (*Prestazione di invalidità civile*); Monthly Assistance Allowance (*Assegno mensile di assistenza*); Carer's Allowance (*Indennità di accompagnamento*); Frequency Benefit (*Indennità di frequenza*); Visual Impairment Pension (*Pensione di cecità);* Special Benefit (Indennità speciale); Deaf-Dumb Pension (*Pensione ai sordomuti*); Communication Benefit (*Indennità di comunicazione*); Personal Long-term Assistance Allowance (*Assegno per assistenza personale continuativa*).

Their detailed simulation is a challenging task considering the availability of needed information in survey data. The one presented here reflects the simplified version simulated in the EUROMOD model, wherein the rates are those which are applied to employees of industrial sector's companies with more than 50 employees, differentiating between blue and white collars, while self-employed workers are divided into craftsmen, retailers, and farmers.

As for employment income, roughly three-forths of the due amount is borne by employers (32.08% in the case of blue-collar workers and 29.86% for white-collar ones) and the remaining part by employees (9.49%, regardless their qualification). On the employer's side, the bulk of it goes to the payment of invalidity, old age and survivor retirement schemes (known as the *contributo IVS – Invalidità, Vecchiaia e Superstiti*), for a rate of 23.81%. Then follow, in order of increasing contribution, redundancy fund contributions (2.80%), sickness and maternity payments (2.68% for blue-collar workers, while the rate is 0.46% for white-collar ones), unemployment insurance contributions (1.91%), family allowances payments (0.68%), and severance contributions (0.20%). On the employee's side, the greatest contribution is made by retirement scheme payments (9.19%), while redundancy fund contributions account for whatever remains (0.30)%. The tax base on which SICs are calculated is made up of employment income components before taxes, but it can not be lower than a minimum threshold of 879.5 euros and higher than a maximum threshold of 8452.25 euros on a monthly basis.

In line with what has been described for employment income, the payment of SICs for self-employed workers is constrained within a specific self-employment income range and varies according to the age and category of the self-employed. As for craftsmen and retailers, the base rate for retirement scheme contributions is respectively set to 24.0% and 24.1% for those above the age of 21 years, while the rates are reduced by 3% otherwise. Farmers apply the same rates set for older craftsmen, regardless of their age. In addition to this, an annual payment of 7.44 euros is due for maternity contributions. The contributory base can not be lower than a minimum threshold of 15,710.04 euros and higher than a maximum threshold of 77,717.04 euros. The rate is further increased by 1% on taxable income higher than 46,630 euros for craftsmen and retailers.

4. Gini-based decomposition formulas

The net redistributive effect of a tax-benefit system can be divided into three components as follows (Reynolds and Smolensky, 1977):

$$[4] \quad RE = RS - R = \left[\frac{t}{1-t}\left(C_{T,Y} - G_Y\right)\right] - \left(G_{Y-T} - C_{Y-T,Y}\right)$$

where the first term between square brackets, $t/1-t$, is the average tax rate effect, while the second term is the Kakwani index (hereinafter K index) and provides a measure of departure from proportionality of what is defined from time to time as total taxes according to the scenario under examination. The product of these two components gives the Reynolds-Smolensky index (hereinafter RS index), capturing the redistributive effect of a tax-benefit system without taking account of horizontal

adjustments along the income distribution (what we will refer to as vertical effect or gross redistributive effect).

As for the decomposition formulas of the net/gross redistributive effect applied in this study, the computation of the contribution given by each tax-benefit instrument is first carried out by applying the generalisation of the Pfähler–Lambert decomposition outlined by Onrubia et al. (2014) (hereinafter O14). This method makes it possible to associate each tool available to the government with a single effect on the gross redistributive capacity of the tax-benefit system, overcoming the need for a sequential order when measuring the contribution of tax expenditures.

Following the order of the terms of the right-hand side in [5], the RS index can be broken down into three main aggregates: i) the sum of tax schedules, ii) the sum of tax credits, and iii) the sum of exemptions, allowances and tax deductions. Each aggregate is given by the sum of its subcomponents, while each subcomponent is given by the product of the group weight, constant for all subcomponents of a specific aggregate, the individual weight and the K index. *Y* is the gross income, that is the sum of all income sources subject to (or exempt from) progressive taxation according to the scenario; *B* is the total taxable income, given by the sum of taxable income components subject to PIT or substitute taxes; *S* stands for total gross liability; *T* is total net liability; S_i indicates the *i-th* tax schedule; C_i is the *i-th* tax credit; finally, D_i represents the *i-th* exemption, allowance or deduction of the tax system. The upper bar means that the variable is at its average value.

It is evident that tax-free cash benefits can be thought of as exemptions, an interpretation which is strengthened by the fact that several non-means-tested benefits are currently subject to progressive marginal tax rates (e.g. unemployment benefits). To simplify matters, taking only the first term on the right-hand side, the group weight is given by the $\bar{B}/(\bar{Y}-\bar{S})$; the individual weight is the proportion between the *i-th* tax schedule and total taxable income; $C_{B,Y}-C_{B-S_i,Y}$ is the difference between the concentration indices of taxable income and taxable income minus the *i-th* tax schedule respectively, both sorted by non-decreasing values of gross income – which we earlier defined as the K index. The same logic is then applied to the remaining terms in [5].

$$[5]\quad RS=\frac{\bar{B}}{\bar{Y}-\bar{S}}\sum_{i=1}^{l}\frac{\bar{S}_i}{\bar{B}}\left(C_{B,Y}-C_{B-S_i,Y}\right)-\frac{\bar{Y}}{\bar{Y}-\bar{T}}\sum_{i=1}^{m}\frac{\bar{C}_i}{\bar{Y}}\left(C_{Y-S,Y}-C_{Y-S-C_i,Y}\right)-\frac{\bar{Y}\bar{S}}{\bar{B}(\bar{Y}-\bar{S})}\sum_{i=1}^{n}\frac{\bar{D}_i}{\bar{Y}}\left(G_Y-C_{Y-D_i,Y}\right)$$

The method proposed by O14 has recently received considerable attention in the Italian literature (Di Caro, 2017; 2020; Barbetta et al., 2018; Boscolo, 2019; Curci et al., 2020). The desirable characteristic of allowing the decomposition on the common tax base of overall gross income, namely the sum of all mutually exclusive tax bases of a tax system, is important due to the policy implications that can be derived from its application.[9]

[9] Unlike the approach just discussed, the so-called *natural* decomposition rule as defined in Kristjánsson (2013) computes the effect of each tax-benefit instrument on its

One requirement that needs to be met in order to obtain an unbiased decomposition of the vertical effect as described in [5] is to define total taxable income as the sum of mutually exclusive components in such a way that there is no overlapping between tax bases. In order to explain why this is needed, take the case of SICs. These are levied on gross income, whereas gross income after SICs is subject to PIT. When adopting the method in [5], a problem arises in defining the common tax base. In the Italian tax-benefit system, self-employed SICs are deducted from gross income after SICs subject to PIT to obtain taxable income. This would lead to an unjustified reduction of the common tax base since self-employed SICs are first included in taxable income and then deducted from it. In other words, the sum of the relative effects is equal to the redistributive effect of the corresponding tax system only if $Y = B + D$, according to the notation in [5]. In order to satisfy this condition, a lower value of total taxable income than the actual one would be needed. Consequently, the results of the decomposition are likely to be biased by the notable amount of self-employed SICs granted in the form of deduction, amounting to 19.6 billion euros for the 2017 tax year according to aggregate tax returns. The lack of mutual exclusion between income sources therefore tends to distort the contribution of the measures analysed. Furthermore, our interest is also extended to the contribution of tax-benefit instruments to the horizontal effect as identified by the reranking term, *R*, while the decomposition formula presented in [5] allows the breaking down of the vertical effect only.

To deal with these issues, the decomposition method proposed by Urban (2014) (hereinafter U14) seems to be particularly useful. Based on the earlier contributions of Kakwani (1984) and Lerman and Yitzhaki (1985), it offers a reliable approach for studying the contribution of taxes and benefits to marginal changes in the vertical and horizontal effect of a tax-benefit system. Its analytical power makes it a useful tool for policy and decision-making process as it provides an empirical framework to isolate the determinants of a marginal change in the net redistributive effect of a tax-benefit system conditional on the actual redistributive capacity of such a system. Unlike the previous method, it does not require compliance with the mutual exclusion property. Imposing proportional changes in pre-tax/benefit income ($Y - Ben$), total taxes (T) and total benefits (Ben) for all income units, a single figure is computed for each tax-benefit instrument for the change in both the vertical and horizontal effect. Based on the notation in [4]-[5], a concise formalisation of the method is given below:

$$[6] \quad \delta RE = \delta V - \delta H = \left(\sum_{i=1}^{l} \delta V_{T_i} + \sum_{i=1}^{m} \delta V_{Ben_i} \right) - \left(\sum_{i=1}^{l} \delta H_{T_i} + \sum_{i=1}^{m} \delta H_{Ben_i} \right)$$

where δ indicates that we are now focusing on instruments' contributions to marginal changes; Ben_i is the *i-th* income source exempt from progressive taxation;

corresponding tax bases. This opposite method has been introduced as a technique for analysing the redistributive effect of a dual income tax system, whereby labour income is subject to progressive marginal tax rates, and capital income to alternative proportional tax regimes.

while overall (absolute) contributions of taxes and benefits in [6] can be broken down as follows:

$$[7] \quad \sum_{i=1}^{l} \delta V_{T_i} = \sum_{i=1}^{l} \frac{\bar{T}_i}{\bar{Y} - \overline{Ben}} \frac{C_{T_i,Y-Ben} - C_{Y-T,Y-Ben}}{G_{Y-Ben} - C_{Y-T,Y-Ben}} \dot{V}$$

$$[8] \quad \sum_{i=1}^{m} \delta V_{Ben_i} = \sum_{i=1}^{m} \frac{\overline{Ben}_i}{\bar{Y} - \overline{Ben}} \frac{C_{Y-T,Y-Ben} - C_{Ben_i,Y-Ben}}{G_{Y-Ben} - C_{Y-T,Y-Ben}} \dot{V}$$

$$[9] \quad \sum_{i=1}^{l} \delta H_{T_i} = \sum_{i=1}^{l} \frac{\bar{T}_i}{\bar{Y} - \overline{Ben}} \frac{\left(C_{T_i,Y-Ben} - C_{T_i,Y-T}\right) + \left(G_{Y-T} - C_{Y-T,Y-Ben}\right)}{\left(G_{Y-Ben} - C_{Y-T,Y-Ben}\right) - \left(C_{Y-Ben,Y-T} - G_{Y-T}\right)} \dot{H}$$

$$[10] \quad \sum_{i=1}^{m} \delta H_{Ben_i} = \sum_{i=1}^{m} \frac{\overline{Ben}_i}{\bar{Y} - \overline{Ben}} \frac{\left(C_{Ben_i,Y-T} - C_{Ben_i,Y-Ben}\right) - \left(G_{Y-T} - C_{Y-T,Y-Ben}\right)}{\left(G_{Y-Ben} - C_{Y-T,Y-Ben}\right) - \left(C_{Y-Ben,Y-T} - G_{Y-T}\right)} \dot{H}$$

Note that proportional changes in total taxes and total benefits are embedded within the methodology when a dot lies above the right-hand terms V and H in [7]-[10], standing for the (total) marginal change in the vertical and horizontal effect respectively. Recalling that the sum of changes in post-tax/benefit Gini indices in response to proportional increases in pre-tax/benefit income, taxes and benefits, is equal to zero as in [11], $\dot{V}$ and $\dot{H}$ are obtained by applying the Lerman and Yitzhaki (1985)'s decomposition to each coefficient in Kakwani (1984) and rearranging as follows:

$$[11] \quad \left[G_{Y-T}^{(Y-Ben)(1+\beta)} - G_{Y-T}\right] + \left[G_{Y-T}^{T(1+\beta)} - G_{Y-T}\right] + \left[G_{Y-T}^{Ben(1+\beta)} - G_{Y-T}\right] = 0$$

$$[12] \quad \dot{V} = -\frac{(\bar{Y} - \overline{Ben})(1+\beta)}{\bar{Y} - \bar{T}}\left(G_{Y-Ben} - C_{Y-T,Y-Ben}\right) =$$

$$= \frac{-\bar{T}(1+\beta)}{\bar{Y} - \bar{T}}\left(C_{T,Y-Ben} - C_{Y-T,Y-Ben}\right)$$

$$+ \frac{\overline{Ben}(1+\beta)}{\bar{Y} - \bar{T}}\left(C_{Ben,Y-Ben} - C_{Y-T,Y-Ben}\right)$$

$$[13][10] \quad \dot{H} = \frac{(\bar{Y} - \overline{Ben})(1+\beta)}{\bar{Y} - \bar{T}}\left(C_{Y-Ben,Y-T} - G_{Y-T}\right) - \frac{(\bar{Y} - \overline{Ben})(1+\beta)}{\bar{Y} - \bar{T}}\left(G_{Y-Ben} - C_{Y-T,Y-Ben}\right) =$$

$$= \left[\frac{\bar{T}(1+\beta)}{\bar{Y} - \bar{T}}\left(C_{T,Y-Ben} - C_{Y-T,Y-Ben}\right) - \frac{-\bar{T}(1+\beta)}{\bar{Y} - \bar{T}}\left(C_{T,Y-T} - G_{Y-T}\right)\right]$$

$$+ \left[\frac{\overline{Ben}(1+\beta)}{\bar{Y} - \bar{T}}\left(C_{Ben,Y-Ben} - C_{Y-T,Y-Ben}\right) - \frac{\overline{Ben}(1+\beta)}{\bar{Y} - \bar{T}}\left(C_{Ben,Y-T} - G_{Y-T}\right)\right]$$

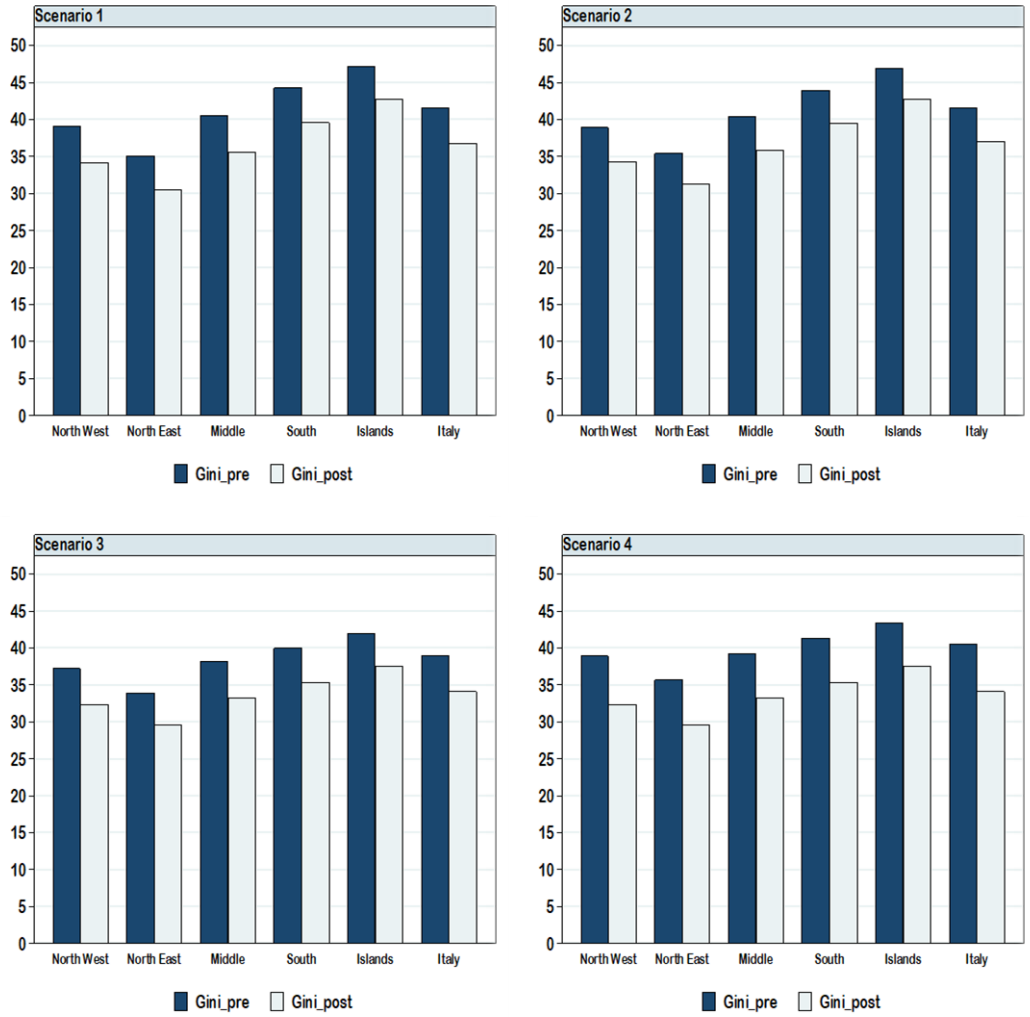
[10] Equations [12] and [13] are equivalent to $\dot{V}_K^{TB}$ and $\dot{R}_{APK}^{TB}$ in (22) of Urban (2014) respectively, while equations [6]-[10] are a different formalisation of (23)-(25). The only difference with U14 is that we directly include total marginal changes within [6]-[10] instead of using them in the computation of absolute contributions later on.

where β stands for the proportional change imposed. In line with O14, it should be noted that the decomposition formulas just presented rely on the prevalent normative view on vertical equity, requiring a non-decreasing level of taxes minus benefits for non-decreasing values of pre-fiscal income in relative rather than in absolute terms as assumed in the alternative view (Urban, 2014).

5. Data analysis

Before moving on to the discussion of the application of the Gini-based decomposition approaches, some general results may be presented concerning inequality and progressivity of the tax-benefit system under examination. This may be useful in order to better understand the context in which the analysis takes place.

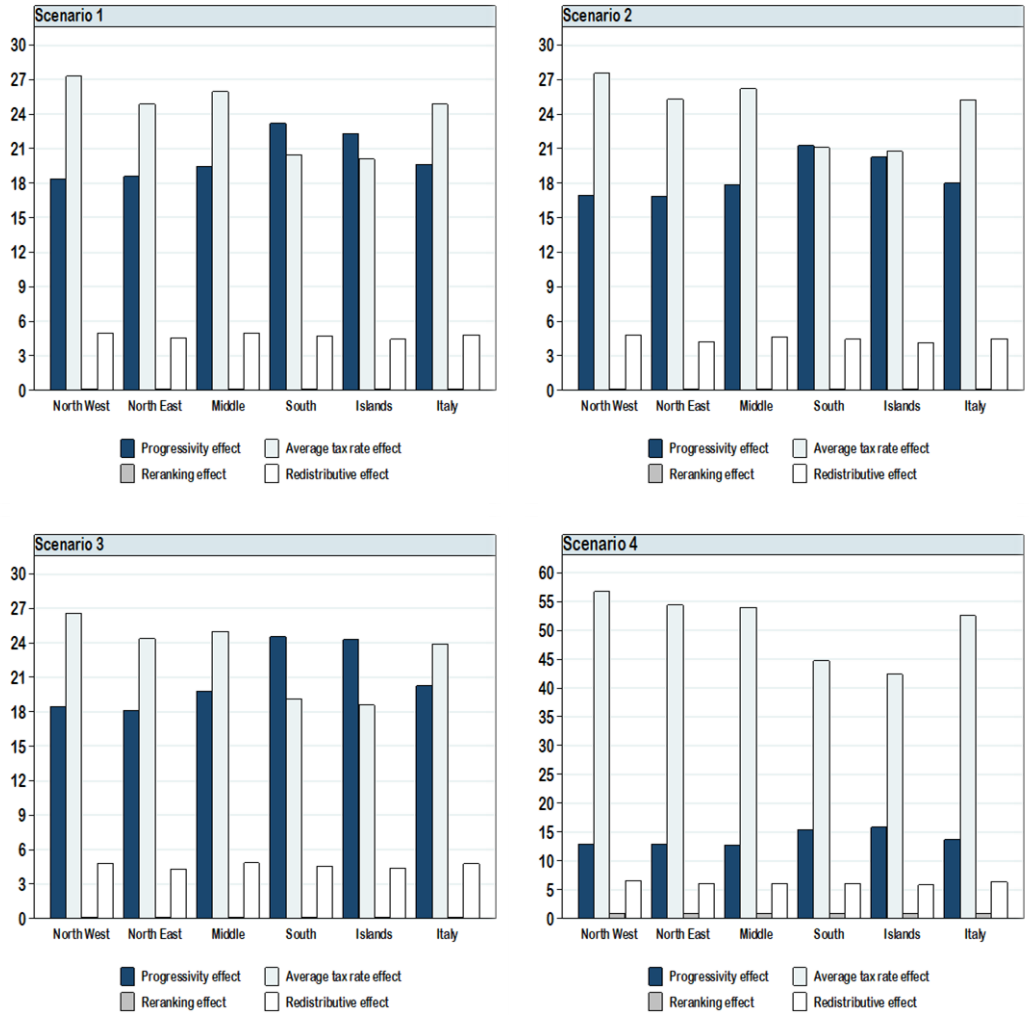
Figure 2 – Pre- and post-tax Gini index by macro-region: summary of results



Note: Indices were multiplied by 100. Full results are reported in Appendix A. *Source*: Own elaborations.

Figure 2 shows the pre- and post-tax Gini coefficients of income inequality for each simulated scenario and macro-region. On a general level, the focus on a more comprehensive definition of the Italian tax-benefit system is associated with lower levels of gross and net income inequality. The northern areas of the country are characterised by disparities in income substantially below the national level regardless of the scenario considered. As a result, southern macro-regions present inequality levels well above the national benchmark. This geographical divide is also confirmed when looking at the redistributive power of the tax-benefit system by dividing absolute redistributive effects by pre-tax Gini indices. What seems to be noticeable in Figure 2 is that geographical disparities are partly levelled when income components which are exempt from progressive taxation are taken into consideration. This suggests significant spatial differences in the equalising effect of related instruments.

Figure 3 – Progressivity, average tax rate and reranking effect applying [4] by macro-region: summary of results



Note: Indices were multiplied by 100. Full results are reported in Appendix A. *Source*: Own elaborations.

Figure 3 gathers the results of the decomposition in [4]. Not surprisingly, the average tax rate (progressivity) effect increases (decreases) with the inclusion of income components subject to proportional taxation (from Scenario 1 to Scenario 2), while the opposite holds true when broadening the analysis to tax-free cash benefits (from Scenario 2 to Scenario 3). Except for Scenario 4 where the tax incidence of SICs is such as to make the average tax rate effect highly predominant over the progressivity effect in each macro-region, the South and main islands are the only areas with prevailing progressivity effects. This is true above all when focusing on Scenario 3 and it reflects the greater proportion of benefits on total gross income.

5.1. The contribution of tax-benefit instruments applying Onrubia et al. (2014)

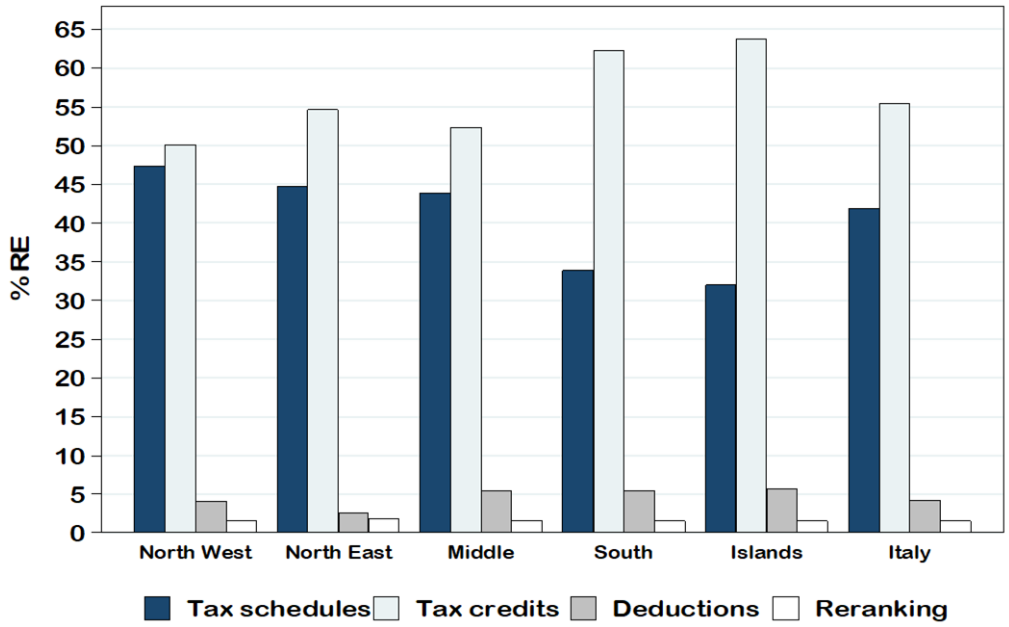
Despite progressive taxation underwent major changes over the years, what determines its redistributive capacity has remained rather similar up to the present time (Pellegrino and Panteghini, 2020). Figure 4 summarises the results of the application of O14 in Scenario 1 (see Appendix B for full results). At the national level, the most important role is played by tax credits with a contribution of 55.4% consisting of tax credits for labour and retirement income (C_1: 40.3%) and tax credits for dependent family members (C_2: 8.4%; C_3: 4.5%; C_6: 0.2%). PIT tax rates (S_1) and regional surtax (S_2) follow with a contribution of 38.8% and 3.1%, respectively. As for deductions, their effect is quantified as 4.2% of the redistributive effect, most of which arises from the deduction for the main residence (D_1: 4.0%). This distribution of contributions is in line with previous studies using administrative data (Barbetta et al., 2018; Di Caro, 2020). The only instruments with negligible regressive effects are deductible maintenance payments (-0.2%), health-related tax credits (-0.1%), insurance premiums (-0.1%), and other expenses related to tax credits (-0.1%) with the latter being a residual category gathering all remaining tax credits not analysed singularly.

The effect of progressive taxation instruments does not differ much at the macro-regional level. However, unlike northern and central areas, the South and main islands present a more predominant effect of tax credits over marginal tax rates. While tax credits for labour and retirement income and the regional surtax determine redistribution to a similar extent of what is achieved nationally, tax credits for dependent family members account to roughly 18.0% of the redistributive effect at the expense of a lower contribution of PIT tax rates.

As for the contribution of tax-benefit instruments different from progressive taxation, Figure 5 reports the aggregate results of the application of O14 in Scenario 3 (see Appendix B for full results). With regard to the national level, the vertical effect of proportional taxes and tax-free cash benefits is equal to 4.8% and 17.2% of RE respectively. Their joint contribution increases in the southern areas of the country (up to a maximum of 31.2% in the main islands) wherein the increase is almost exclusively driven by transfers' contribution, while the northern and central areas present aggregate results rather in line with the national benchmark except for the North West with a lower contribution of 16.3%. Still, it is worth noting that proportional taxation contributes to a greater extent to the redistribution of income in the North East for a contribution of 9.3%. Finally, the reranking effect does not

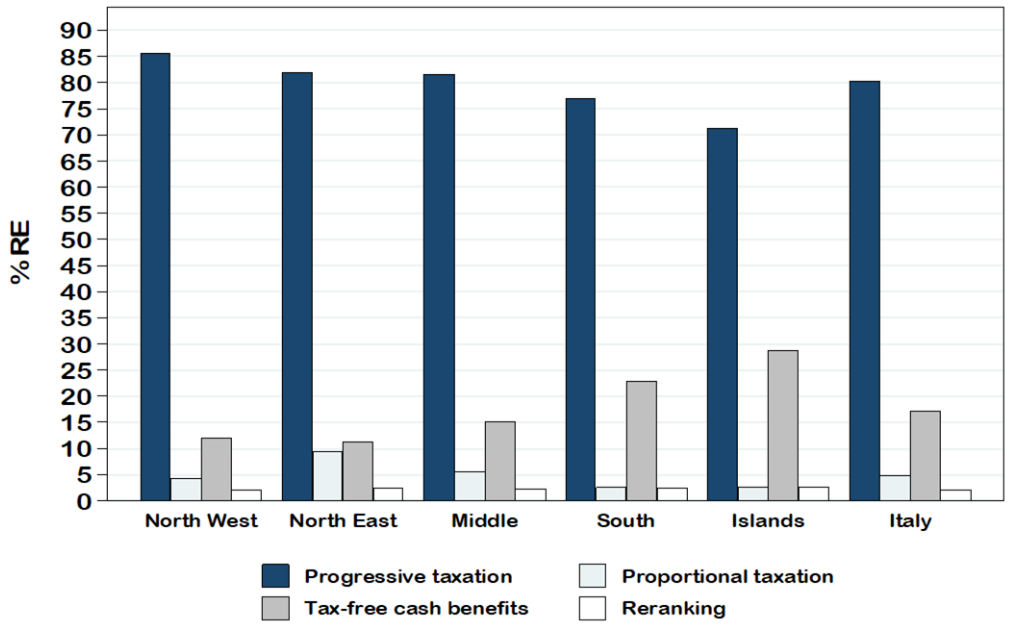
differ much across macro-regions, for a contribution that ranges within the interval [2.0%; 2.5%] of the redistributive effect.

Figure 4 – The contribution of PIT instruments by macro-region in Scenario 1: summary of results



Note: Full results are reported in Appendix B. *Source*: Own elaborations.

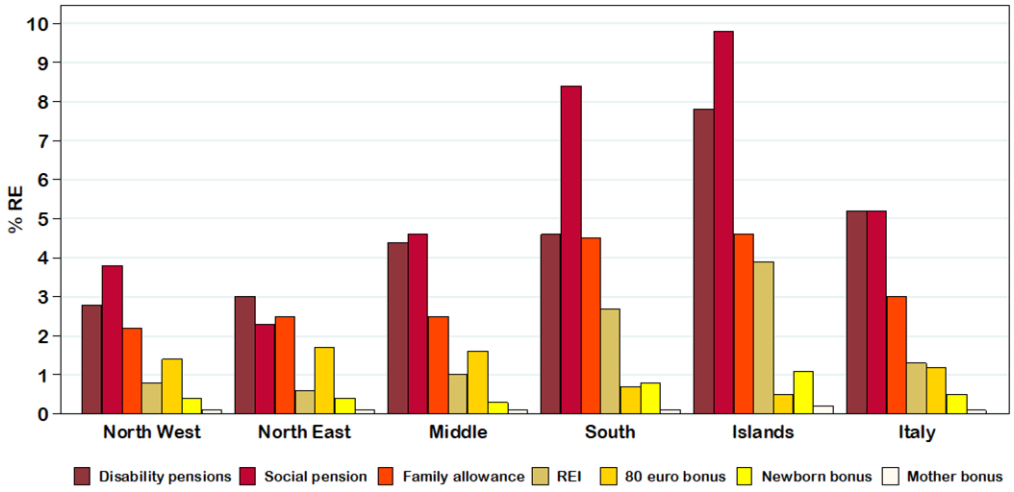
Figure 5 – The contribution of tax-benefit instruments by macro-region in Scenario 3: summary of results



Note: Full results are reported in Appendix B. *Source*: Own elaborations.

The greatest contribution among proportional tax instruments is provided by the tax on rental income from residential properties (S_3: 2.9%), followed by the withholding tax on arrears and severance pay (S_4: 2.1%). The levy on deposits is the only instrument contributing regressively to income redistribution (S_9: -0.3%). Such order of magnitude is also confirmed at the macro-regional level. The equalising effect of proportional taxes is unsurprising given that capital and rental income are heavily concentrated on the wealthiest income groups. At the same time, it is important to emphasise that their exclusion from progressive taxation is playing a role in sharpening the loss of vertical equity of the Italian tax-benefit system (Boscolo, 2019).

Figure 6 – The contribution of selected tax-free cash benefits by macro-region in Scenario 3: summary of results



Note: Full results are reported in Appendix B. *Source*: Own elaborations.

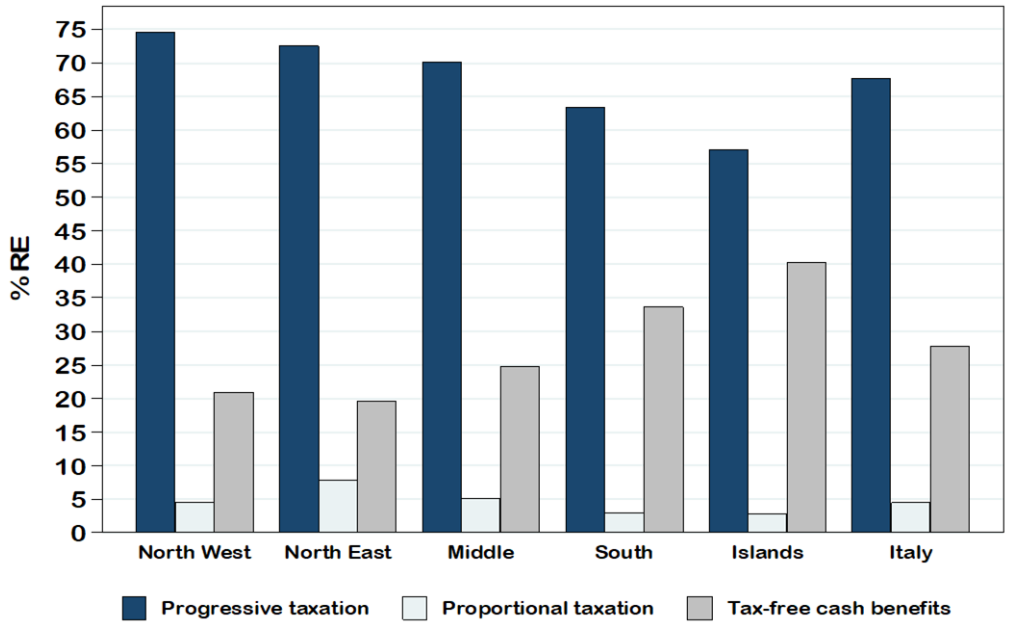
On the transfer side, Figure 6 presents the contribution of selected benefits to the vertical effect in Scenario 3 (see Appendix B for full results). Disability pensions, social pension, and the family allowance are tax-free cash benefits which contribute the most to determining redistribution regardless of the geographical area. Their overall contribution amounts to 13.4% of the national redistributive effect. At the macro-regional level, the social pension is the transfer that most contributes to the redistribution of income except for the North East, with a peak of 9.8% in the main islands. One particularly interesting case is that of the '80 euro' bonus once compared to REI: both measures positively affect income redistribution (roughly to the same extent) at the level of the whole country. Yet, one may argue that an 11.7-billion-euro transfer should lead to higher redistributive effects than an 1.1-billion-euro measure such as REI, even if the latter is intended for the poorest income groups. The difference in cost is remarkable, and the similar contribution of the two measures may be interpreted as the incapacity of the '80 euro' policy to achieve an adequate level of redistribution. However, at a more disaggregated level, there are some interesting differences in their contribution. On the one hand, the '80 euro' bonus prevails over REI in the northern and central macro-regions reflecting the higher employment rate characterising these areas. On the other hand, REI contributes to a greater extent than the '80 euro' bonus in the southern areas of the

country, where poverty and material deprivation levels are higher. The picture is then completed by the newborn bonus and the mother bonus, the overall redistributive effect of which ranges in the interval [0.5%; 1.3%].

5.2. The contribution of tax-benefit instruments applying Urban (2014)

To complete our investigation into the role of tax-benefit instruments in determining income redistribution, the results of the application of U14 will be discussed in this section (see Appendix C for full results). The peculiarity of this simulation is twofold. Firstly, the breakdown of RE was carried out taking accout of SICs (Scenario 4). Secondly, the decomposition approach employed differs from O14 by calculating contributions to marginal changes in RE through small proportional increases in the overall value of taxes, benefits and pre-tax/benefit income for all units, thus making it possible to isolate not just vertical but also horizontal effects of taxes and benefits.

Figure 7 – The contributions of tax-benefits instruments by macro-region in Scenario 3: summary of results



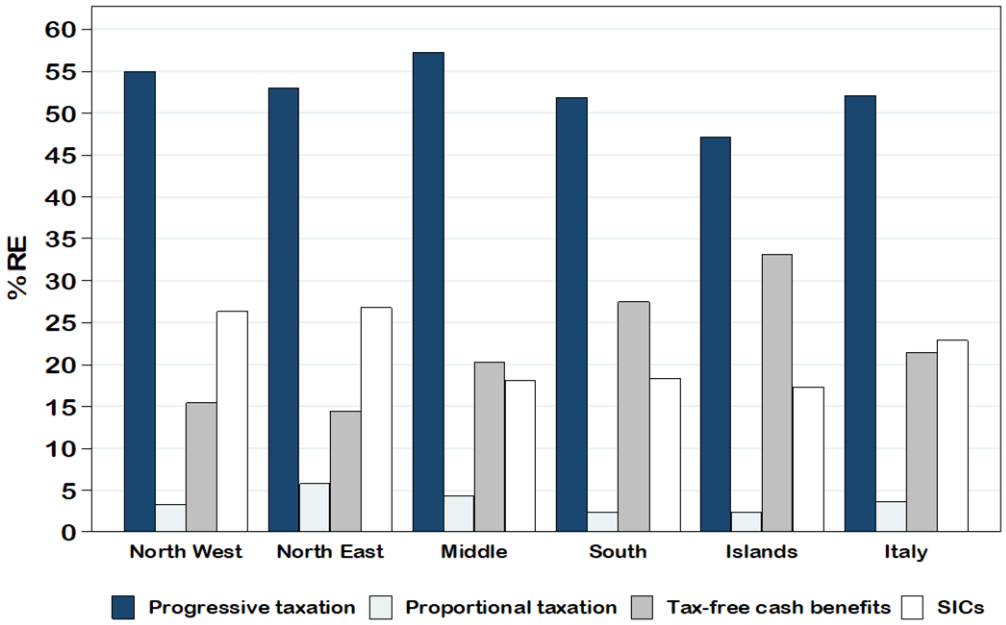
Note: Full results are reported in Appendix C. *Source*: Own elaborations.

Despite their different specificities, the method proposed by U14 leads to results in line with O14 in terms of sign and order of magnitude. Figure 7 reports aggregate contributions resulting from the application of U14 in Scenario 3. The contribution of progressive taxation decreases when moving from the northern to the southern areas of the country, while the opposite stands for cash transfers. With regard to proportional taxation, its contribution to income redistribution remains overall limited and more predominant in the northern macro-regions. These results, taken together with tax-benefit instruments' contributions presented in Figure 5, suggest that the two methods are consistent with each other. However, unlike cash benefits, progressive taxation would contribute to a marginal change in the redistributive

effect to a lower extent than its actual redistributive capacity as computed by using O14. As a result, further redistributive efforts may be more optimally achieved by enhancing the redistributive role of cash benefits rather than progressive taxation with the same resources being allocated. Not surprisingly, Italy is ranked among countries with the least effective targeting of cash benefits to low-income households, given that only 10% or less of total cash transfers goes to the poorest household quintile (Causa and Hermansen, 2019).

As for SICs' contribution, Figure 8 reports instruments' contributions to a marginal change in the redistributive effect in Scenario 4. SICs determine redistribution roughly as much as cash benefits do at the national level, for a contribution equal to 22.9%. If compared to other instruments, SICs' contribution is almost half that of progressive taxation. SICs' contribution lies slighlty above the national level in the northern macro-regions, while the opposite stands for the remaining areas. Progressive taxation remains the instrument with the highest contribution for a peak of 57.3% in the central area. Similarly to Scenario 3, cash benefits increase their contribution gradually from northern to southern areas. No particular differences are found in the contribution of proportional taxation with respect to previous results.

Figure 8 – The contribution of tax-benefit instruments by macro-region in Scenario 4: summary of results

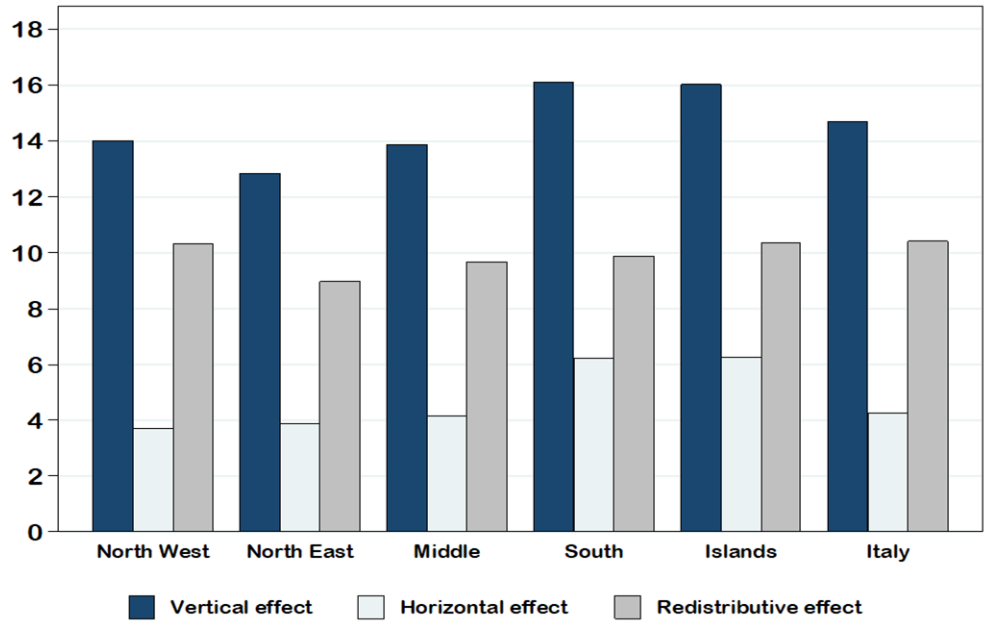


Note: Full results are reported in Appendix C. *Source*: Own elaborations.

At a higher level of disaggregation, it is first necessary to examine to which extent vertical and horizontal effects determine income redistribution. Figure 9 breaks down the redistributive effect in both the vertical and horizontal effect in Scenario 4. First, it should be noted that the order of magnitude of the redistributive effects is similar to that obtained by applying [4] as in Figure 3. This result further strengthens U14's overall validity. Second, and not surprisingly, vertical effects are by far greater than horizontal effects regardless of the level of analysis. Northern

and central areas present findings rather in line with national-level results, unlike southern macro-regions, which are characterised by substantially higher vertical and horizontal effects.

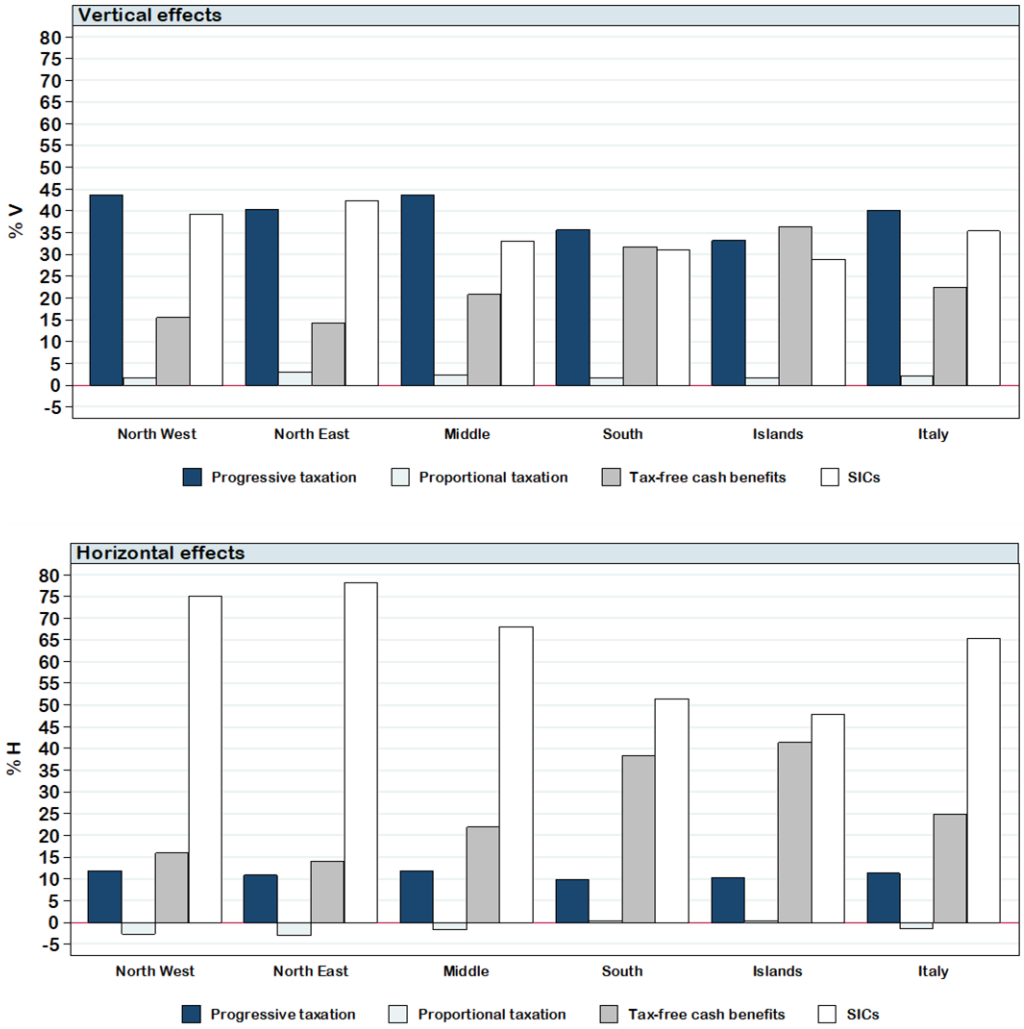
Figure 9 – Vertical, horizontal and redistributive effect applying U14 by macro-region in Scenario 4: summary of results



Note: Full results are reported in Appendix C. *Source*: Own elaborations.

Figure 10 presents instruments' contributions to a marginal change in the vertical and horizontal effects in Scenario 4. As for vertical effects, progressive taxation and SICs play the greatest role at the national level for a contribution of 40.3% and 35.3%, respectively. Cash benefits follow for a contribution of 22.4%. Progressive taxation and SICs determine redistribution to a similar extent in the northern areas at the expenses of a lower contribution of cash benefits. On the contrary, the southern macro-regions show overall lower variability in instruments' contributions. On the horizontal effects' side, SICs are the greatest contributors regardless of the level of analysis, up to a contribution of roughly 80.0% in the North West. This result is partly due to the increasing ratio of households where at least one member pays SICs by income group and to the average tax rate effects attributable to SICs. While the contribution of progressive taxation do not vary considerably across macro-regions, the incidence of cash benefits increases gradually when moving southwards. Furthermore, it is interesting to note that proportional taxation contributes positively at the margin not only via its contribution to the vertical effect but also via the horizontal effect. In fact, rental and capital income components are highly concentrated in the income groups with higher proportion of non-labour components on total income, i.e. the wealthiest groups, thus making more likely the presence of reranking. As a result, a marginal increase in the tax burden on these components mitigates the overall negative effects on horizontal equity related to proportional taxes, as found by Di Caro (2020) for the *cedolare secca*.

Figure 10 – Vertical and horizontal effects of tax-benefit instruments by macro-region in Scenario 4: summary of results

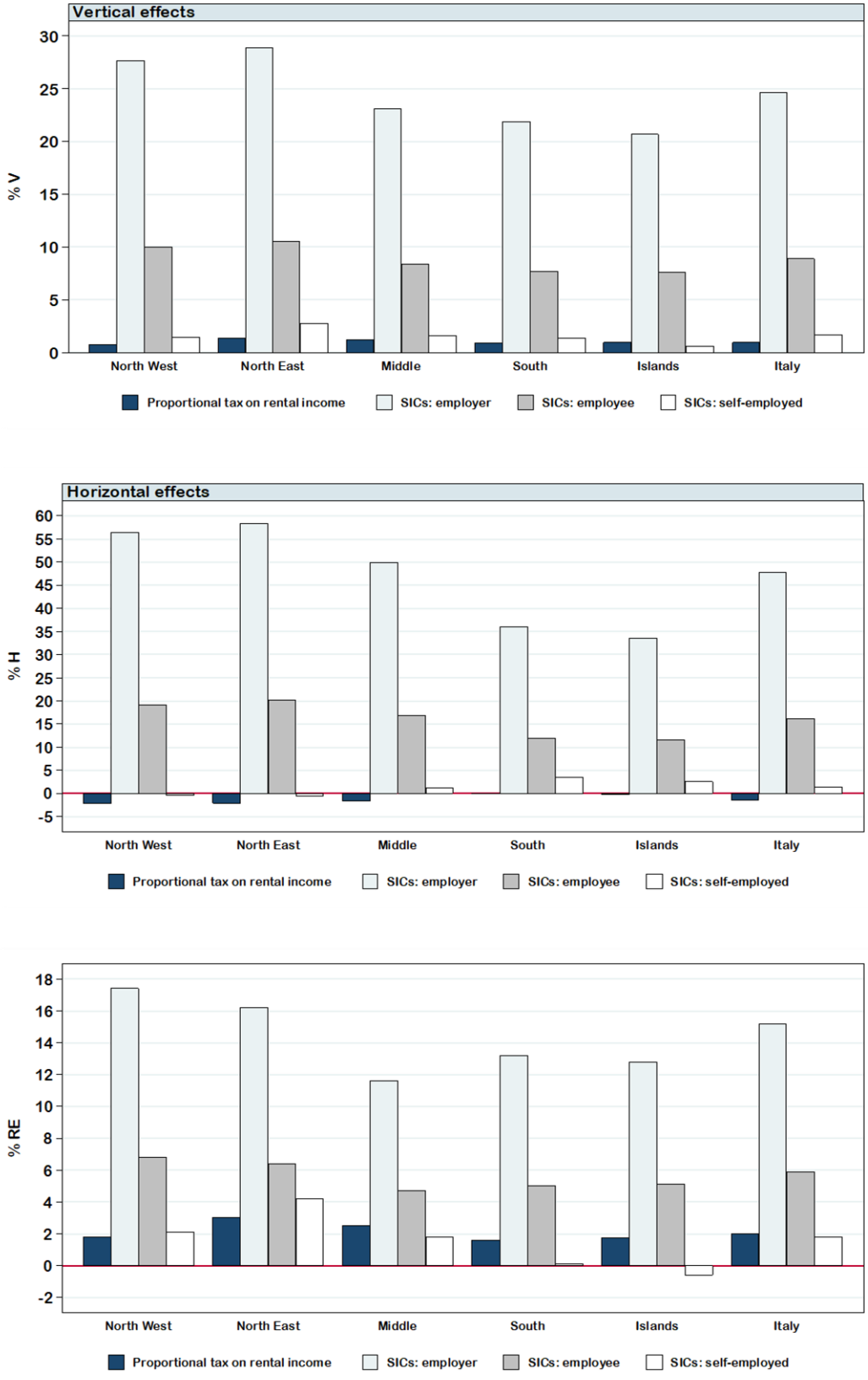


Note: Full results are reported in Appendix C. *Source*: Own elaborations.

Finally, Figures 11 and 12 report the contribution of selected tax-benefit instruments to a marginal change in the redistributive effect in Scenario 4 and its vertical and horizontal components. At the national level, much of the change in the redistributive effect related to SICs is achieved through employer contributions (S_{10}: 15.2%), followed in order of magnitude by employee (S_{11}: 5.9%) and self-employed contributions (S_{12}: 1.8%). This distribution of effects remains rather unchanged at the level of the macro-region (see Figure 11). The most remarkable difference concerns self-employed contributions in the South and main islands, where horizontal effects tend to offset vertical ones leading to a net contribution that is nil or even regressive. As for the selected cash benefits in Figure 12, the findings show strong similiarities to the contributions displayed in Figure 6. The social pension is the measure that most contributes to a marginal change in the redistributive effect both at the national and macro-regional level except for the North East. Disability pensions and the family allowance follow with similar contributions across the country apart from the South, where the family allowance

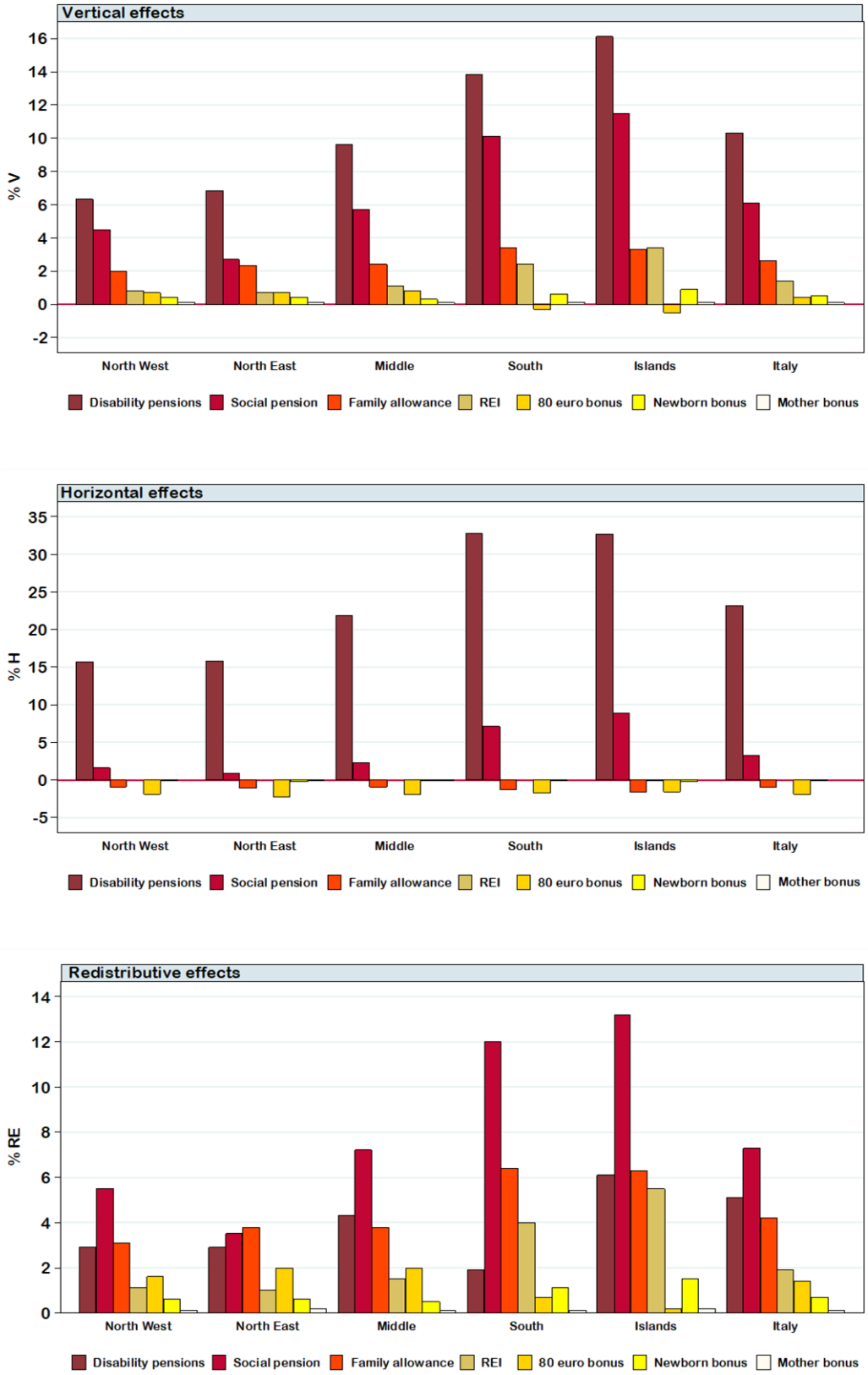
contributes to a far greater extent. In line with previous findings, REI determines redistribution at the margin to a greater extent than the '80 euro' bonus in the southern macro-regions, while the opposite stands for the northern and central areas. Breaking down the redistributive effect into its two factors, it is worth underlying that disability pensions, and not the social pension, contribute to the greatest extent among tax-free cash benefits, especially with regard to the horizontal effect (up to more than 30% of its marginal change in both the South and main islands). This is due partly to the high average tax rate effect proper of disability transfers in the Italian tax-benefit system, and partly to their equal concentration along the income distribution, which gives rise to higher chances of reranking among households. On the contrary, REI shows neutral horizontal effects. This can be explained by the way in which the benefit amount is calculated. In fact, keeping in mind that beneficiaries are mainly concentrated in the left-hand tail of the income distribution, the amount granted tends to decrease gradually as household income moves towards the eligibility income threshold, thus reducing to a minimum the reranking among units. As for the '80 euro' bonus, much of its contribution to a marginal change in the redistributive effect is achieved via its horizontal effects. This is true above all in the southern macro-regions, where the bonus contributes regressively to the vertical effect. Finally, the remaining cash benefits (i.e. social pension, family allowance, newborn bonus and mother bonus) determine redistribution at the margin mainly thanks to their effect on vertical equity.

Figure 11 – The contribution of selected taxes and SICs to vertical, horizontal and redistributive effects by macro-region in Scenario 4: summary of results



Note: Full results are reported in Appendix C. *Source*: Own elaborations.

Figure 12 – The contribution of selected tax-free cash benefits to vertical, horizontal and redistributive effects by macro-region in Scenario 4: summary of results



Note: Full results are reported in Appendix C. *Source*: Own elaborations.

6. Conclusions

This article provides preliminary evidence about the contribution of overall tax-benefit instruments to income redistribution in Italy for the 2018 year. In order to answer the questions posed above, two alternative methods for decomposing the redistributive effect of taxes and benefits were adopted (Onrubia et al., 2014; Urban, 2014). The calculation was repeated for various scenarios diverging from one another as they represent different degrees of extension of the tax-benefit system under examination. The analysis is performed both at the national level and macro-regional (NUTS 1) level.

As for the application of Onrubia et al. (2014)'s decomposition, we observe PIT instruments' contributions in line with the most recent studies on the topic (Barbetta et al., 2018; Di Caro, 2020). At the national level, a crucial role is played by tax credits with a contribution of 55.4%, followed by tax rates with a contribution of 38.8%. The macro-regional analysis overall confirms these findings, although tax credits are found to be even more predominant over tax rates in the southern macro-regions. In a more comprehensive scenario, including gross income subject to proportional taxes and tax-free cash benefits but excluding SICs, the contribution of instruments different from progressive taxation amounts to 22.0% of the redistributive effect at the level of the whole country. Much of this effect is related to cash benefits (17.2%), while proportional taxation has a rather limited effect (4.8%). At a more disaggregated level, the greatest contribution among proportional taxes is provided by the tax on rental income from residential properties (2.9%) and the withholding tax on arrears and severance pay (2.1%). On the transfers' side, disability pensions, social pension, and the family allowance are the tax-free cash benefits which contribute most to redistribution for a joint contribution of 13.4%. Interestingly, we found that the minimum income scheme into force in 2018, known as REI (*Reddito di Inclusione*), contributes to a similar extent to the '80 euro' bonus to the redistribution of income (roughly 1.2%-1.3%). At the macro-regional level, the contribution of instruments different from progressive taxation increases when moving from northern to southern macro-regions, and it is almost entirely due to cash benefits. The joint contribution of proportional taxes and cash benefits reaches a peak of 31.4% in the main islands. Unlike the national level, REI contributes to a significantly greater extent than the '80 euro' bonus in the southern areas of the country, while the opposite stands for the northern and central macro-regions. Particularly interesting is the case of the North East, where proportional taxes contribute up to roughly 10.0% of the redistributive effect.

Finally, to overcome the lack of compliance with the mutual exclusion property, and so to take account of SICs in the analysis, the empirical strategy proposed here is to turn our attention to the contribution of taxes and benefits to a marginal change in the redistributive effect, that is the application of the methodology proposed by Urban (2014). Unlike the previous decomposition, this method allows to isolate not just vertical but also horizontal effects of taxes and benefits. First, it is important to stress that the two methods provide results consistent with each other whether applied to a common scenario. Second, SICs determine redistribution at the margin as much as cash benefits do. At the national level, the contribution of SICs amounts to 22.9%, while cash benefits and proportional taxes contribute up to 21.4% and 3.5%, respectively. The sub-national analysis shows that SICs' and progressive

taxation's contribution decreases when moving southwards, and the opposite is true for cash benefits. At its peak, the overall contribution of instruments different from progressive taxation is equal to 52.9% in the main islands. SICs and progressive taxation are the main contributors to a marginal change in the vertical effect in the northern and central macro-regions, while each aggregate instrument except proportional taxation contributes to a similar extent in the South and main islands. On the horizontal effects' side, SICs are by far the greatest contributors with a peak of roughly 80% in the North East, followed by cash benefits, especially in the southern macro-regions. Disability pensions are the only instruments that are found to have relevant implications on horizontal equity.

Appendix A

Table 3 – Redistributive indices by macro-region

INDEX	Scenario 1						Scenario 2					
	NW	**NE**	**M**	**S**	**I**	**Italy**	**NW**	**NE**	**M**	**S**	**I**	**Italy**
G_Y: pre-tax Gini index	39.05	35.05	40.52	44.22	47.18	41.55	38.89	35.41	40.40	43.95	46.85	41.48
G_{Y-T}: post-tax Gini index	34.10	30.52	35.55	39.55	42.76	36.75	34.30	31.23	35.80	39.54	42.71	37.02
RE: net redistributive effect	4.96	4.54	4.97	4.68	4.42	4.81	4.59	4.18	4.60	4.41	4.14	4.47
$C_{T,Y}$: conc. index of taxes	57.44	53.61	59.98	67.39	69.45	61.18	55.80	52.24	58.25	65.21	67.09	59.48
K: Kakwani index	18.38	18.56	19.46	23.17	22.27	19.63	16.92	16.84	17.85	21.26	20.25	18.00
t: average tax rate	21.50	19.93	20.60	17.01	16.75	19.92	21.61	20.18	20.77	17.40	17.19	20.14
$t/(1-t)$: average tax rate effect	27.30	24.88	25.94	20.50	20.12	24.87	27.57	25.28	26.21	21.07	20.76	25.22
$C_{Y-T,Y}$: conc. index of net income	34.02	30.44	35.47	39.48	42.69	36.67	34.22	31.15	35.72	39.47	42.64	36.94
R: reranking effect	0.08	0.08	0.08	0.07	0.06	0.07	0.08	0.08	0.08	0.07	0.07	0.07
RS: vertical effect	5.03	4.62	5.05	4.75	4.48	4.88	4.66	4.26	4.68	4.48	4.20	4.54
$GPit$: Gross income subject to PIT (%)	100.0	100.0	100.0	100.0	100.0	100.0	93.5	92.8	92.9	93.6	93.4	93.2
INDEX	**Scenario 3**						**Scenario 4**					
	NW	**NE**	**M**	**S**	**I**	**Italy**	**NW**	**NE**	**M**	**S**	**I**	**Italy**
G_Y: pre-tax Gini index	37.18	33.88	38.11	39.92	41.91	38.86	38.89	35.61	39.24	41.30	43.35	40.44
G_{Y-T}: post-tax Gini index	32.38	29.56	33.26	35.34	37.51	34.12	32.38	29.56	33.26	35.34	37.51	34.12
RE: net redistributive effect	4.81	4.31	4.84	4.58	4.40	4.74	6.52	6.05	5.98	5.97	5.83	6.32
$C_{T,Y}$: conc. index of taxes	55.61	51.99	57.92	64.43	66.19	59.13	51.84	48.43	51.90	56.70	59.16	54.07
K: Kakwani index	18.43	18.12	19.81	24.51	24.28	20.27	12.95	12.82	12.66	15.40	15.82	13.63
t: average tax rate	21.00	19.60	20.00	16.07	15.67	19.29	36.18	35.22	35.07	30.89	29.78	34.42
$t/(1-t)$: average tax rate effect	26.59	24.37	25.00	19.15	18.58	23.89	56.69	54.38	54.02	44.69	42.40	52.49
$C_{Y-T,Y}$: conc. index of net income	32.28	29.46	33.16	35.23	37.40	34.02	31.55	28.64	32.41	34.42	36.64	33.28
R: reranking effect	0.09	0.10	0.11	0.11	0.11	0.10	0.83	0.92	0.86	0.92	0.87	0.84
RS: vertical effect	4.90	4.42	4.95	4.69	4.51	4.84	7.34	6.97	6.84	6.88	6.71	7.16
$GPit$: Gross income subject to PIT (%)	90.92	90.18	89.42	86.46	85.10	89.27	73.5	72.7	72.6	71.2	70.9	72.5

Note: Indices were multiplied by 100. *Source*: Own elaborations.

Appendix B

Table 4 – RE decomposition applying O14 and D93 in Scenarios 1 and 3: results for the North West area of Italy

TAX-BENEFIT INSTRUMENT	Scenario 1 RE	%	$C_{X,Y}$	Scenario 3 RE	%	$C_{X,Y}$
Tax schedules (*S*)	**2.3488**	***47.4***	**45.75**	**2.0447**	***42.5***	**44.88**
PIT (S_1)	2.2056	*44.5*	45.70	1.7298	*36.0*	44.57
Regional surtax (S_2)	.1433	*2.9*	46.72	.1120	*2.3*	45.44
Proportional tax on rental income (S_3)				.1225	*2.5*	53.16
Arrears and severance pay (S_4)				.1004	*2.1*	53.09
Private pensions (S_5)				-.0013	*0.0*	6.69
Government bonds (S_6)				-.0012	*0.0*	34.10
Dividends (S_7)				.0007	*0.0*	39.80
Other bonds (S_8)				.0013	*0.0*	42.09
Deposits (S_9)				-.0195	*-0.4*	28.48
Tax credits (*C*)	**2.4815**	***50.1***	**4.58**	**2.119**	***44.1***	**4.23**
Income source (C_1)	1.8526	*37.4*	-0.66	1.5836	*32.9*	-0.76
Dependent children (C_2)	.3199	*6.5*	-8.95	.2764	*5.8*	-9.06
Dependent spouse (C_3)	.1651	*3.3*	-30.88	.1464	*3.0*	-31.74
Rents (C_4)	.0878	*1.8*	-33.90	.0767	*1.6*	-33.65
Other expenses (C_5)	-.0031	*-0.1*	40.77	-.0034	*-0.1*	39.51
Dependent parents (C_6)	.0092	*0.2*	-54.30	.0080	*0.2*	-53.25
Mortgage interest payments (C_7)	.0194	*0.4*	25.73	.0167	*0.3*	24.09
Minimum limits for PIT (C_9)	.0001	*0.0*	-5.55	.0000	*0.0*	11.70
Education expenses (C_{10})	.0015	*0.0*	28.90	.0011	*0.0*	28.26
Insurance premiums (C_{11})	-.0035	*-0.1*	45.08	-.0035	*-0.1*	43.76
Building and refurbishing costs (C_{12})	.0339	*0.7*	32.88	.0206	*0.4*	31.97
Health-related expenses (C_{13})	-.0012	*0.0*	36.77	-.0038	*-0.1*	35.31
Deductions and exemptions (*D*)	**.2036**	***4.1***	**29.10**	**.7372**	***15.3***	**11.82**
PIT: main residence (D_1)	.1899	*3.8*	8.10	.1544	*3.2*	8.71
PIT: self-employed SICs (D_2)	.0195	*0.4*	37.31	.0102	*0.2*	36.15
PIT: other expenses (D_3)	.0009	*0.0*	37.98	.0003	*0.0*	36.81
PIT: maintenance payments (D_4)	.0009	*0.0*	37.43	.0013	*0.0*	34.56
PIT: private pension contributions (D_5)	-.0076	*-0.2*	43.08	-.0074	*-0.2*	41.9
Disability pensions (D_6)				.1351	*2.8*	1.04
Social pension (D_7)				.1840	*3.8*	-73.84
Family allowance (D_8)				.1041	*2.2*	-37.61
REI (D_9)				.0364	*0.8*	-92.43
80 euro bonus (D_{10})				.0686	*1.4*	9.44
Newborn bonus (D_{11})				.0210	*0.4*	-41.18
Child benefits (D_{12})				.0053	*0.1*	-59.01
Maternity payments (D_{13})				.0034	*0.1*	-13.43
Minimum Insertion Income (D_{14})				.0105	*0.2*	-37.84
Housing benefits (D_{15})				.0170	*0.4*	-36.09
Mother bonus (D_{16})				.0050	*0.1*	-3.76
Non-taxable rental income (D_{17})				.0002	*0.0*	15.57
Scholarships and grants (D_{18})				-.0120	*-0.2*	60.97
Reranking (*R*)	**.0779**	***1.6***		**.0946**	***2.0***	
Redistributive effect (*RE*)	**4.9560**	***100.0***		**4.8063**	***100.0***	

Note: Indices were multiplied by 100. *Source*: Own elaborations.

Table 5 – RE decomposition applying O14 and D93 in Scenarios 1 and 3: results for the North East area of Italy

TAX-BENEFIT INSTRUMENT	Scenario 1 RE	%	$C_{X,Y}$	Scenario 3 RE	%	$C_{X,Y}$
Tax schedules (*S*)	**2.0270**	***44.7***	**40.96**	**1.6979**	***39.4***	**40.48**
PIT (S_1)	1.9255	*42.4*	40.93	1.2329	*28.6*	39.55
Regional surtax (S_2)	.1015	*2.2*	41.55	.0671	*1.6*	40.15
Proportional tax on rental income (S_3)				.2109	*4.9*	58.69
Arrears and severance pay (S_4)				.1936	*4.5*	56.90
Private pensions (S_5)				-.0008	*0.0*	-17.66
Government bonds (S_6)				.0001	*0.0*	36.11
Dividends (S_7)				.0014	*0.0*	36.65
Other bonds (S_8)				.0027	*0.1*	41.13
Deposits (S_9)				-.0100	*-0.2*	29.78
Tax credits (*C*)	**2.4779**	***54.6***	**3.22**	**2.1412**	***49.6***	**3.03**
Income source (C_1)	1.8849	*41.5*	-1.56	1.6183	*37.5*	-1.35
Dependent children (C_2)	.3208	*7.1*	-8.77	.2773	*6.4*	-8.52
Dependent spouse (C_3)	.1624	*3.6*	-28.57	.1453	*3.4*	-29.65
Rents (C_4)	.0658	*1.5*	-32.29	.0594	*1.4*	-33.93
Other expenses (C_5)	-.0018	*0.0*	35.35	-.0015	*0.0*	33.89
Dependent parents (C_6)	.0110	*0.2*	-53.88	.0094	*0.2*	-51.59
Mortgage interest payments (C_7)	.0187	*0.4*	23.46	.0190	*0.4*	20.90
Minimum limits for PIT (C_9)	.0001	*0.0*	-15.44	.0001	*0.0*	-17.96
Education expenses (C_{10})	.0018	*0.0*	26.29	.0013	*0.0*	26.08
Insurance premiums (C_{11})	-.0025	*-0.1*	39.45	-.0022	*-0.1*	38.11
Building and refurbishing costs (C_{12})	.0202	*0.4*	30.77	.0180	*0.4*	29.47
Health-related expenses (C_{13})	-.0035	*-0.1*	33.68	-.0033	*-0.1*	32.41
Deductions and exemptions (*D*)	**.1145**	***2.5***	**29.69**	**.5765**	***13.4***	**14.15**
PIT: main residence (D_1)	.1840	*4.1*	6.02	.1537	*3.6*	6.28
PIT: self-employed SICs (D_2)	-.0577	*-1.3*	40.20	-.0453	*-1.0*	38.47
PIT: other expenses (D_3)	.0005	*0.0*	34.42	.0004	*0.0*	33.26
PIT: maintenance payments (D_4)	-.0118	*-0.3*	55.43	-.0120	*-0.3*	57.50
PIT: private pension contributions (D_5)	-.0005	*0.0*	35.98	-.0006	*0.0*	34.18
Disability pensions (D_6)				.1311	*3.0*	-0.08
Social pension (D_7)				.0981	*2.3*	-64.4
Family allowance (D_8)				.1080	*2.5*	-38.42
REI (D_9)				.0268	*0.6*	-94.39
80 euro bonus (D_{10})				.0717	*1.7*	9.02
Newborn bonus (D_{11})				.0182	*0.4*	-37.12
Child benefits (D_{12})				.0036	*0.1*	-47.49
Maternity payments (D_{13})				.0069	*0.2*	-19.97
Minimum Insertion Income (D_{14})				.0068	*0.2*	-59.69
Housing benefits (D_{15})				.0090	*0.2*	-13.38
Mother bonus (D_{16})				.0052	*0.1*	-5.45
Non-taxable rental income (D_{17})				-.0002	*0.0*	53.00
Scholarships and grants (D_{18})				-.0049	*-0.1*	44.84
Reranking (*R*)	**.0828**	***1.8***		**.1017**	***2.4***	
Redistributive effect (*RE*)	**4.5365**	***100.0***		**4.3138**	***100.0***	

Note: Indices were multiplied by 100. *Source*: Own elaborations.

Table 6 – RE decomposition applying O14 and D93 in Scenarios 1 and 3: results for the Middle area of Italy

TAX-BENEFIT INSTRUMENT	Scenario 1 RE	%	$C_{X,Y}$	Scenario 3 RE	%	$C_{X,Y}$
Tax schedules (*S*)	**2.1835**	***43.9***	**47.05**	**1.8513**	***38.2***	**46.07**
PIT (S_1)	1.9679	*39.6*	46.80	1.4207	*29.3*	45.37
Regional surtax (S_2)	.2157	*4.3*	51.09	.1673	*3.5*	49.50
Proportional tax on rental income (S_9)				.1598	*3.3*	55.07
Arrears and severance pay (S_3)				.1088	*2.2*	55.55
Private pensions (S_7)				.0038	*0.1*	69.37
Government bonds (S_6)				-.0001	*0.0*	40.29
Dividends (S_5)				-.0002	*0.0*	40.56
Other bonds (S_4)				.0028	*0.1*	52.41
Deposits (S_8)				-.0116	*-0.2*	33.00
Tax credits (*C*)	**2.5998**	***52.3***	**7.04**	**2.1622**	***44.6***	**6.24**
Income source (C_1)	1.9466	*39.2*	1.80	1.6158	*33.4*	1.40
Dependent children (C_2)	.3592	*7.2*	-6.02	.3040	*6.3*	-6.72
Dependent spouse (C_3)	.1851	*3.7*	-20.42	.1636	*3.4*	-22.96
Rents (C_4)	.0887	*1.8*	-34.47	.0791	*1.6*	-37.56
Other expenses (C_5)	-.0029	*-0.1*	42.13	-.0032	*-0.1*	40.36
Dependent parents (C_6)	.0079	*0.2*	-35.91	.0062	*0.1*	-30.28
Mortgage interest payments (C_7)	.0171	*0.3*	29.65	.0138	*0.3*	27.66
Minimum limits for PIT (C_9)	.0003	*0.0*	-43.83	.0003	*0.0*	-49.63
Education expenses (C_{10})	.0047	*0.1*	22.59	.0038	*0.1*	21.14
Insurance premiums (C_{11})	-.0027	*-0.1*	44.72	-.0028	*-0.1*	43.18
Building and refurbishing costs (C_{12})	.0048	*0.1*	37.57	-.0065	*-0.1*	36.09
Health-related expenses (C_{13})	-.0089	*-0.2*	40.04	-.0119	*-0.2*	38.29
Deductions and exemptions (*D*)	**.2699**	***5.4***	**28.83**	**.9387**	***19.4***	**10.33**
PIT: main residence (D_1)	.2399	*4.8*	8.69	.1860	*3.8*	9.58
PIT: self-employed SICs (D_2)	.0221	*0.4*	38.63	.0180	*0.4*	36.34
PIT: other expenses (D_3)	.0001	*0.0*	40.43	-.0006	*0.0*	38.94
PIT: maintenance payments (D_4)	.0050	*0.1*	33.51	.0026	*0.1*	33.86
PIT: private pension contributions (D_5)	.0028	*0.1*	41.71	-.0023	*0.0*	39.55
Disability pensions (D_6)				.2134	*4.4*	4.18
Social pension (D_7)				.2247	*4.6*	-68.07
Family allowance (D_8)				.1226	*2.5*	-33.39
REI (D_9)				.0465	*1.0*	-90.91
80 euro bonus (D_{10})				.0776	*1.6*	9.10
Newborn bonus (D_{11})				.0166	*0.3*	-30.12
Child benefits (D_{12})				.0061	*0.1*	-36.78
Maternity payments (D_{13})				.0044	*0.1*	-14.59
Minimum Insertion Income (D_{14})				.0029	*0.1*	-27.30
Housing benefits (D_{15})				.0121	*0.3*	-37.41
Mother bonus (D_{16})				.0039	*0.1*	4.09
Non-taxable rental income (D_{17})				-.0002	*0.0*	46.01
Scholarships and grants (D_{18})				.0043	*0.1*	22.52
Reranking (*R*)	**.0811**	***1.6***		**.1077**	***2.2***	
Redistributive effect (*RE*)	**4.9721**	***100.0***		**4.8445**	***100.0***	

Note: Indices were multiplied by 100. *Source*: Own elaborations.

Table 7 – RE decomposition applying O14 and D93 in Scenarios 1 and 3: results for the South area of Italy

TAX-BENEFIT INSTRUMENT	Scenario 1 RE	%	$C_{X,Y}$	Scenario 3 RE	%	$C_{X,Y}$
Tax schedules (*S*)	**1.5895**	***33.9***	**49.43**	**1.3100**	***28.6***	**47.99**
PIT (S_1)	1.4135	*30.2*	49.17	1.0514	*22.9*	47.58
Regional surtax (S_2)	.1760	*3.8*	53.85	.1370	*3.0*	52.09
Proportional tax on rental income (S_3)				.0978	*2.1*	55.04
Arrears and severance pay (S_4)				.0518	*1.1*	51.22
Private pensions (S_5)				-.0096	*-0.2*	-27.98
Government bonds (S_6)				.0006	*0.0*	50.58
Dividends (S_7)				-.0007	*0.0*	42.55
Other bonds (S_8)				-.0008	*0.0*	37.77
Deposits (S_9)				-.0174	*-0.4*	30.96
Tax credits (*C*)	**2.9152**	***62.2***	**15.67**	**2.1585**	***47.1***	**14.24**
Income source (C_1)	1.9846	*42.4*	14.09	1.4484	*31.6*	13.23
Dependent children (C_2)	.5536	*11.8*	3.39	.4370	*9.5*	1.38
Dependent spouse (C_3)	.2913	*6.2*	-3.79	.2436	*5.3*	-7.78
Rents (C_4)	.1083	*2.3*	-16.42	.0913	*2.0*	-20.6
Other expenses (C_5)	-.0033	*-0.1*	47.21	-.0047	*-0.1*	45.54
Dependent parents (C_6)	.0173	*0.4*	-33.60	.0121	*0.3*	-24.9
Mortgage interest payments (C_7)	.0089	*0.2*	34.51	.0054	*0.1*	31.76
Lone parents (C_8)	.0002	*0.0*	-14.37	.0002	*0.0*	-30.51
Minimum limits for PIT (C_9)	.0002	*0.0*	15.78	.0001	*0.0*	23.72
Education expenses (C_{10})	.0032	*0.1*	35.21	.0016	*0.0*	33.04
Insurance premiums (C_{11})	-.0039	*-0.1*	52.74	-.0041	*-0.1*	50.19
Building and refurbishing costs (C_{12})	-.0297	*-0.6*	45.53	-.0506	*-1.1*	43.66
Health-related expenses (C_{13})	-.0154	*-0.3*	45.96	-.0218	*-0.5*	43.27
Deductions and exemptions (*D*)	**.2518**	***5.4***	**31.64**	**1.2248**	***26.7***	**11.74**
PIT: main residence (D_1)	.1908	*4.1*	13.15	.1374	*3.0*	13.00
PIT: self-employed SICs (D_2)	.0564	*1.2*	39.07	.0486	*1.1*	34.57
PIT: other expenses (D_3)	.0003	*0.0*	43.87	-.0023	*0.0*	43.54
PIT: maintenance payments (D_4)	-.0009	*0.0*	48.16	-.0011	*0.0*	45.24
PIT: private pension contributions (D_5)	.0053	*0.1*	45.82	-.0046	*-0.1*	44.04
Disability pensions (D_6)				.2106	*4.6*	24.68
Social pension (D_7)				.3870	*8.4*	-41.86
Family allowance (D_8)				.2060	*4.5*	-22.46
REI (D_9)				.1215	*2.7*	-89.08
80 euro bonus (D_{10})				.0327	*0.7*	27.24
Newborn bonus (D_{11})				.0351	*0.8*	-24.31
Child benefits (D_{12})				.0221	*0.5*	-48.04
Maternity payments (D_{13})				.0133	*0.3*	-22.10
Minimum Insertion Income (D_{14})				.0052	*0.1*	-50.93
Housing benefits (D_{15})				.0045	*0.1*	-38.64
Mother bonus (D_{16})				.0040	*0.1*	7.36
Non-taxable rental income (D_{17})				-.0001	*0.0*	53.89
Scholarships and grants (D_{18})				.0048	*0.1*	32.89
Reranking (*R*)	.0720	*1.5*		**.1104**	***2.4***	
Redistributive effect (*RE*)	**4.6845**	***100.0***		**4.5829**	***100.0***	

Note: Indices were multiplied by 100. *Source*: Own elaborations.

Table 8 – RE decomposition applying O14 and D93 in Scenarios 1 and 3: results for the main islands of Italy (Sicily and Sardinia)

TAX-BENEFIT INSTRUMENT	Scenario 1 RE	Scenario 1 %	Scenario 1 $C_{X,Y}$	Scenario 3 RE	Scenario 3 %	Scenario 3 $C_{X,Y}$
Tax schedules (*S*)	**1.4168**	***32.0***	**51.97**	**1.1313**	***25.7***	**50.33**
PIT (S_1)	1.2688	*28.7*	51.71	.9032	*20.5*	49.92
Regional surtax (S_2)	.1480	*3.3*	57.69	.1098	*2.5*	55.44
Proportional tax on rental income (S_3)				.1186	*2.7*	61.04
Private pensions (S_5)				.0250	*0.6*	49.67
Government bonds (S_6)				.0003	*0.0*	51.54
Dividends (S_7)				-.0075	*-0.2*	29.58
Other bonds (S_8)				-.0001	*0.0*	45.80
Deposits (S_9)				-.0180	*-0.4*	33.20
Tax credits (*C*)	**2.8191**	***63.7***	**19.41**	**1.9496**	***44.3***	**17.86**
Income source (C_1)	1.9990	*45.2*	16.83	1.3559	*30.8*	16.19
Dependent children (C_2)	.4934	*11.2*	8.12	.3888	*8.8*	4.28
Dependent spouse (C_3)	.2969	*6.7*	-0.42	.2368	*5.4*	-4.27
Rents (C_4)	.0720	*1.6*	-10.89	.0573	*1.3*	-14.07
Other expenses (C_5)	-.0036	*-0.1*	51.13	-.0048	*-0.1*	48.26
Dependent parents (C_6)	.0169	*0.4*	-24.23	.0104	*0.2*	-11.87
Mortgage interest payments (C_7)	.0033	*0.1*	43.46	-.0005	*0.0*	39.72
Minimum limits for PIT (C_9)	.0001	*0.0*	-38.17	.0001	*0.0*	-53.12
Education expenses (C_{10})	.0046	*0.1*	32.79	.0028	*0.1*	30.14
Insurance premiums (C_{11})	-.0027	*-0.1*	53.09	-.0034	*-0.1*	50.87
Building and refurbishing costs (C_{12})	-.0274	*-0.6*	48.31	-.0537	*-1.2*	45.89
Health-related expenses (C_{13})	-.0334	*-0.8*	53.16	-.0400	*-0.9*	50.25
Deductions and exemptions (*D*)	**.2535**	***5.7***	**33.56**	**1.4293**	***32.5***	**10.71**
PIT: main residence (D_1)	.2025	*4.6*	11.51	.1411	*3.2*	11.47
PIT: self-employed SICs (D_2)	.0778	*1.8*	38.44	.0596	*1.4*	33.72
PIT: other expenses (D_3)	-.0015	*0.0*	49.18	-.0041	*-0.1*	48.44
PIT: maintenance payments (D_4)	-.0143	*-0.3*	67.17	-.0104	*-0.2*	59.69
PIT: private pension contributions (D_5)	-.0110	*-0.2*	56.51	-.0184	*-0.4*	53.24
Disability pensions (D_6)				.3434	*7.8*	18.82
Social pension (D_7)				.4330	*9.8*	-35.68
Family allowance (D_8)				.2040	*4.6*	-22.57
REI (D_9)				.1727	*3.9*	-87.59
80 euro bonus (D_{10})				.0210	*0.5*	34.15
Newborn bonus (D_{11})				.0492	*1.1*	-35.52
Child benefits (D_{12})				.0125	*0.3*	-40.80
Maternity payments (D_{13})				.0254	*0.6*	-60.76
Minimum Insertion Income (D_{14})				.0075	*0.2*	15.86
Housing benefits (D_{15})				.0199	*0.5*	1.39
Mother bonus (D_{16})				.0082	*0.2*	-13.57
Non-taxable rental income (D_{17})				.0000	*0.0*	32.93
Scholarships and grants (D_{18})				-.0354	*-0.8*	66.40
Reranking (*R*)	**.0647**	***1.5***		**.1107**	***2.5***	
Redistributive effect (*RE*)	**4.4246**	***100.0***		**4.3995**	***100.0***	

Note: Indices were multiplied by 100. *Source*: Own elaborations.

Table 9 – RE decomposition applying O14 and D93 in Scenarios 1 and 3: national results

TAX-BENEFIT INSTRUMENT	Scenario 1 RE	%	$C_{X,Y}$	Scenario 3 RE	%	$C_{X,Y}$
Tax schedules (*S*)	**2.0169**	***41.9***	**47.56**	**1.7095**	***36.0***	**46.65**
PIT (S_1)	1.8661	*38.8*	47.43	1.3665	*28.8*	46.13
Regional surtax (S_2)	.1508	*3.1*	49.94	.1152	*2.4*	48.51
Proportional tax on rental income (S_3)				.1367	*2.9*	56.33
Arrears and severance pay (S_4)				.1012	*2.1*	54.80
Private pensions (S_5)				-.0015	*0.0*	19.55
Government bonds (S_6)				.0003	*0.0*	43.40
Dividends (S_7)				.0023	*0.0*	44.05
Other bonds (S_8)				.0024	*0.1*	48.79
Deposits (S_9)				-.0137	*-0.3*	33.19
Tax credits (*C*)	**2.6651**	***55.4***	**8.91**	**2.1695**	***45.7***	**8.23**
Income source (C_1)	1.9398	*40.3*	4.99	1.5751	*33.2*	4.70
Dependent children (C_2)	.4025	*8.4*	-5.25	.3380	*7.1*	-6.09
Dependent spouse (C_3)	.2146	*4.5*	-20.89	.1871	*3.9*	-23.08
Rents (C_4)	.0846	*1.8*	-26.49	.0737	*1.6*	-28.57
Other expenses (C_5)	-.0029	*-0.1*	43.39	-.0036	*-0.1*	41.85
Dependent parents (C_6)	.0114	*0.2*	-.42.80	.0091	*0.2*	-38.03
Mortgage interest payments (C_7)	.0118	*0.2*	32.66	.0091	*0.2*	30.40
Lone parents (C_8)	.0000	*0.0*	-44.78	.0000	*0.0*	-54.86
Minimum limits for PIT (C_9)	.0002	*0.0*	-16.44	.0001	*0.0*	-12.69
Education expenses (C_{10})	.0037	*0.1*	26.63	.0027	*0.1*	25.56
Insurance premiums (C_{11})	-.0030	*-0.1*	46.98	-.0032	*-0.1*	45.38
Building and refurbishing costs (C_{12})	.0112	*0.2*	38.15	-.0054	*-0.1*	36.83
Health-related expenses (C_{13})	-.0087	*-0.2*	41.28	-.0133	*-0.3*	39.54
Deductions and exemptions (*D*)	**.2044**	***4.2***	**31.95**	**.9641**	***20.3***	**10.45**
PIT: main residence (D_1)	.1924	*4.0*	11.73	.1496	*3.2*	12.04
PIT: self-employed SICs (D_2)	.0150	*0.3*	40.20	.0087	*0.2*	37.96
PIT: other expenses (D_3)	.0004	*0.0*	41.10	-.0008	*0.0*	40.06
PIT: maintenance payments (D_4)	-.0029	*-0.1*	46.87	-.0032	*-0.1*	45.53
PIT: private pension contributions (D_5)	-.0005	*0.0*	44.72	-.0067	*-0.1*	43.10
Disability pensions (D_6)				.2451	*5.2*	3.42
Social pension (D_7)				.2458	*5.2*	-61.61
Family allowance (D_8)				.1410	*3.0*	-33.45
REI (D_9)				.0624	*1.3*	-91.30
80 euro bonus (D_{10})				.0593	*1.2*	16.48
Newborn bonus (D_{11})				.0249	*0.5*	-35.10
Child benefits (D_{12})				.0091	*0.2*	-52.88
Maternity payments (D_{13})				.0081	*0.2*	-26.84
Minimum Insertion Income (D_{14})				.0069	*0.1*	-27.60
Housing benefits (D_{15})				.0123	*0.3*	-22.54
Mother bonus (D_{16})				.0048	*0.1*	0.86
Non-taxable rental income (D_{17})				-.0001	*0.0*	42.72
Scholarships and grants (D_{18})				-.0030	*-0.1*	44.33
Reranking (*R*)	**.0745**	***1.5***		**.1002**	***2.1***	
Redistributive effect (*RE*)	**4.8119**	***100.0***		**4.7428**	***100.0***	

Note: Indices were multiplied by 100. *Source*: Own elaborations.

Appendix C

Table 10 – The contribution of taxes and benefits applying U14 in Scenarios 3 and 4: results for the North West area of Italy

TAX-BENEFIT INSTRUMENT	Scenario 3						Scenario 4					
	H	**%H**	**V**	**%V**	**RE**	**%RE**	**H**	**%H**	**V**	**%V**	**RE**	**%RE**
Taxes	**.4138**	***38.1***	**6.4192**	***73.9***	**6.0053**	***79.1***	**3.1179**	***84.1***	**11.8318**	***84.4***	**8.7138**	***84.6***
PIT ($S_1 + C + D_{PIT}$)	.4007	*36.9*	5.8575	*67.5*	5.4568	*71.8*	.4100	*11.1*	5.8668	*41.9*	5.4568	*53.0*
Regional surtax (S_1)	.0226	*2.1*	.2314	*2.7*	.2088	*2.7*	.0260	*0.7*	.2348	*1.7*	.2088	*2.0*
Proportional tax on rental income (S_3)	-.0096	*-0.9*	.1792	*2.1*	.1889	*2.5*	-.0767	*-2.1*	.1121	*0.8*	.1889	*1.8*
Arrears and severance pay (S_4)	-.0024	*-0.2*	.1425	*1.6*	.1448	*1.9*	-.0082	*-0.2*	.1366	*1.0*	.1448	*1.4*
Private pensions (S_5)	.0002	*0.0*	-.0009	*0.0*	-.0011	*0.0*	-.0004	*0.0*	-.0015	*0.0*	-.0011	*0.0*
Government bonds (S_6)	-.0001	*0.0*	.0005	*0.0*	.0005	*0.0*	-.0012	*0.0*	-.0006	*0.0*	.0005	*0.0*
Dividends (S_7)	.0011	*0.1*	.0098	*0.1*	.0087	*0.1*	-.0043	*-0.1*	.0045	*0.0*	.0087	*0.1*
Other bonds (S_8)	.0000	*0.0*	.0044	*0.1*	.0044	*0.1*	-.0022	*-0.1*	.0022	*0.0*	.0044	*0.0*
Deposits (S_9)	.0013	*0.1*	-.0052	*-0.1*	-.0065	*-0.1*	-.0045	*-0.1*	-.0110	*-0.1*	-.0065	*-0.1*
SICs: employer (S_{10})							2.0891	*56.4*	3.8785	*27.7*	1.7894	*17.4*
SICs: employee (S_{11})							.7037	*19.0*	1.4045	*10.0*	.7009	*6.8*
SICs: self-employed (S_{12})							-.0134	*-0.4*	.2049	*1.5*	.2182	*2.1*
Benefits	**.6716**	***61.9***	**2.2626**	***26.1***	**1.5911**	***20.9***	**.5890**	***15.9***	**2.1798**	***15.6***	**1.5909**	***15.4***
Disability pensions (D_6)	.4929	*45.4*	.7896	*9.1*	.2967	*3.9*	.5829	*15.7*	.8797	*6.3*	.2967	*2.9*
Social pension (D_7)	.0572	*5.3*	.6286	*7.2*	.5714	*7.5*	.0580	*1.6*	.6295	*4.5*	.5714	*5.5*
Family allowance (D_8)	.0142	*1.3*	.3305	*3.8*	.3162	*4.2*	-.0341	*-0.9*	.2822	*2.0*	.3162	*3.1*
REI (D_9)	.0013	*0.1*	.1158	*1.3*	.1145	*1.5*	.0005	*0.0*	.1150	*0.8*	.1145	*1.1*
80 euro bonus (D_{10})	.0290	*2.7*	.1972	*2.3*	.1682	*2.2*	-.0721	*-1.9*	.0960	*0.7*	.1682	*1.6*
Newborn bonus (D_{11})	.0068	*0.6*	.0690	*0.8*	.0622	*0.8*	-.0030	*-0.1*	.0592	*0.4*	.0622	*0.6*
Child benefits (D_{12})	.0012	*0.1*	.0175	*0.2*	.0163	*0.2*	.0003	*0.0*	.0166	*0.1*	.0163	*0.2*
Maternity payments (D_{13})	.0022	*0.2*	.0115	*0.1*	.0093	*0.1*	-.0003	*0.0*	.0090	*0.1*	.0093	*0.1*
Minimum Insertion Income (D_{14})	.0146	*1.3*	.0428	*0.5*	.0282	*0.4*	.0138	*0.4*	.0419	*0.3*	.0282	*0.3*
Housing benefits (D_{15})	.0189	*1.7*	.0663	*0.8*	.0474	*0.6*	.0181	*0.5*	.0654	*0.5*	.0474	*0.5*
Mother bonus (D_{16})	.0032	*0.3*	.0163	*0.2*	.0131	*0.2*	-.0010	*0.0*	.0121	*0.1*	.0131	*0.1*
Non-taxable rental income (D_{17})	-.0001	*0.0*	.0006	*0.0*	.0007	*0.0*	.0001	*0.0*	.0007	*0.0*	.0007	*0.0*
Scholarships and grants (D_{18})	.0302	*2.8*	-.0231	*-0.3*	-.0531	*-0.7*	.0258	*0.7*	-.0275	*-0.2*	-.0533	*-0.5*
Total effect (*E*)	**1.0854**	***100.0***	**8.6818**	***100.0***	**7.5964**	***100.0***	**3.7068**	***100.0***	**14.0116**	***100.0***	**10.3049**	***100.0***

Note: Indices were multiplied by 100. *Source*: Own elaborations.

Table 11 – The contribution of taxes and benefits applying U14 in Scenarios 3 and 4: results for the North East area of Italy

TAX-BENEFIT INSTRUMENT	Scenario 3						Scenario 4					
	H	**%H**	**V**	**%V**	**RE**	**%RE**	**H**	**%H**	**V**	**%V**	**RE**	**%RE**
Taxes	**.4159**	***38.4***	**5.6876**	***74.4***	**5.2717**	***80.3***	**3.3293**	***85.9***	**11.0058**	***85.7***	**7.6766**	***85.6***
PIT ($S_1 + C + D_{PIT}$)	.4122	*38.0*	5.0341	*65.8*	4.6218	*70.4*	.4025	*10.4*	5.0243	*39.1*	4.6218	*51.5*
Regional surtax (S_2)	.0171	*1.6*	.1520	*2.0*	.1349	*2.1*	.0213	*0.5*	.1562	*1.2*	.1349	*1.5*
Proportional tax on rental income (S_3)	-.0078	*-0.7*	.2571	*3.4*	.2650	*4.0*	-.0833	*-2.1*	.1817	*1.4*	.2650	*3.0*
Arrears and severance pay (S_4)	-.0101	*-0.9*	.2267	*3.0*	.2369	*3.6*	-.0207	*-0.5*	.2162	*1.7*	.2369	*2.6*
Private pensions (S_5)	.0000	*0.0*	-.0006	*0.0*	-.0006	*0.0*	.0001	*0.0*	-.0006	*0.0*	-.0006	*0.0*
Government bonds (S_6)	.0003	*0.0*	.0016	*0.0*	.0012	*0.0*	-.0013	*0.0*	-.0001	*0.0*	.0012	*0.0*
Dividends (S_7)	.0020	*0.2*	.0100	*0.1*	.0080	*0.1*	-.0049	*-0.1*	.0031	*0.0*	.0080	*0.1*
Other bonds (S_8)	.0011	*0.1*	.0058	*0.1*	.0047	*0.1*	-.0022	*-0.1*	.0025	*0.0*	.0047	*0.1*
Deposits (S_9)	.0011	*0.1*	.0009	*0.0*	-.0002	*0.0*	-.0070	*-0.2*	-.0072	*-0.1*	-.0002	*0.0*
SICs: employer (S_{10})							2.2604	*58.3*	3.7114	*28.9*	1.451	*16.2*
SICs: employee (S_{11})							.7819	*20.2*	1.3599	*10.6*	.5780	*6.4*
SICs: self-employed (S_{12})							-.0175	*-0.5*	.3584	*2.8*	.3759	*4.2*
Benefits	**.6676**	***61.6***	**1.9603**	***25.6***	**1.2927**	***19.7***	**.5458**	***14.1***	**1.8386**	***14.3***	**1.2927**	***14.4***
Disability pensions (D_6)	.5104	*47.1*	.7738	*10.1*	.2634	*4.0*	.6130	*15.8*	.8764	*6.8*	.2634	*2.9*
Social pension (D_7)	.0367	*3.4*	.3480	*4.6*	.3113	*4.7*	.0330	*0.9*	.3443	*2.7*	.3113	*3.5*
Family allowance (D_8)	.0182	*1.7*	.3555	*4.6*	.3373	*5.1*	-.0411	*-1.1*	.2962	*2.3*	.3373	*3.8*
REI (D_9)	.0009	*0.1*	.0878	*1.1*	.0869	*1.3*	.0004	*0.0*	.0873	*0.7*	.0869	*1.0*
80 euro bonus (D_{10})	.0367	*3.4*	.2131	*2.8*	.1763	*2.7*	-.0879	*-2.3*	.0885	*0.7*	.1763	*2.0*
Newborn bonus (D_{11})	.0059	*0.5*	.0622	*0.8*	.0563	*0.9*	-.0071	*-0.2*	.0492	*0.4*	.0563	*0.6*
Child benefits (D_{12})	.0009	*0.1*	.0124	*0.2*	.0115	*0.2*	-.0006	*0.0*	.0109	*0.1*	.0115	*0.1*
Maternity payments (D_{13})	.0055	*0.5*	.0253	*0.3*	.0198	*0.3*	-.0007	*0.0*	.0191	*0.1*	.0198	*0.2*
Minimum Insertion Income (D_{14})	.0042	*0.4*	.0248	*0.3*	.0206	*0.3*	.0036	*0.1*	.0242	*0.2*	.0206	*0.2*
Housing benefits (D_{15})	.0085	*0.8*	.0339	*0.4*	.0255	*0.4*	.0037	*0.1*	.0292	*0.2*	.0255	*0.3*
Mother bonus (D_{16})	.0035	*0.3*	.0183	*0.2*	.0148	*0.2*	-.0029	*-0.1*	.0119	*0.1*	.0148	*0.2*
Non-taxable rental income (D_{17})	.0000	*0.0*	-.0008	*0.0*	-.0008	*0.0*	.0004	*0.0*	-.0004	*0.0*	-.0008	*0.0*
Scholarships and grants (D_{18})	.0362	*3.3*	.0060	*0.1*	-.0302	*-0.5*	.0320	*0.8*	.0018	*0.0*	-.0302	*-0.3*
Total effect (*E*)	**1.0835**	***100.0***	**7.6479**	***100.0***	**6.5644**	***100.0***	**3.8751**	***100.0***	**12.8444**	***100.0***	**8.9693**	***100.0***

Note: Indices were multiplied by 100. *Source*: Own elaborations.

Table 12 – The contribution of taxes and benefits applying U14 in Scenarios 3 and 4: results for the Middle area of Italy

TAX-BENEFIT INSTRUMENT	Scenario 3						Scenario 4					
	H	**%H**	**V**	**%V**	**RE**	**%RE**	**H**	**%H**	**V**	**%V**	**RE**	**%RE**
Taxes	**.4925**	***34.5***	**6.4508**	***68.9***	**5.9582**	***75.2***	**3.2544**	***78.0***	**10.968**	***79.2***	**7.7136**	***79.7***
PIT ($S_1 + C + D_{PIT}$)	.4493	*31.4*	5.7252	*61.2*	5.2759	*66.6*	.4540	*10.9*	5.7299	*41.4*	5.2759	*54.5*
Regional surtax (S_2)	.0315	*2.2*	.3059	*3.3*	.2744	*3.5*	.0374	*0.9*	.3119	*2.3*	.2744	*2.8*
Proportional tax on rental income (S_3)	.0053	*0.4*	.2428	*2.6*	.2374	*3.0*	-.0684	*-1.6*	.1690	*1.2*	.2374	*2.5*
Arrears and severance pay (S_4)	.0042	*0.3*	.1596	*1.7*	.1554	*2.0*	-.0002	*0.0*	.1552	*1.1*	.1554	*1.6*
Private pensions (S_5)	-.0001	*0.0*	.0046	*0.0*	.0047	*0.1*	-.0009	*0.0*	.0038	*0.0*	.0047	*0.0*
Government bonds (S_6)	.0001	*0.0*	.0009	*0.0*	.0008	*0.0*	-.0003	*0.0*	.0005	*0.0*	.0008	*0.0*
Dividends (S_7)	.0011	*0.1*	.0065	*0.1*	.0054	*0.1*	-.0007	*0.0*	.0047	*0.0*	.0054	*0.1*
Other bonds (S_8)	.0003	*0.0*	.0046	*0.0*	.0043	*0.1*	.0000	*0.0*	.0043	*0.0*	.0043	*0.0*
Deposits (S_9)	.0008	*0.1*	.0007	*0.0*	-.0001	*0.0*	-.0026	*-0.1*	-.0027	*0.0*	-.0001	*0.0*
SICs: employer (S_{10})							2.0825	*49.9*	3.2066	*23.1*	1.1241	*11.6*
SICs: employee (S_{11})							.7022	*16.8*	1.1588	*8.4*	.4567	*4.7*
SICs: self-employed (S_{12})							.0514	*1.2*	.2260	*1.6*	.1746	*1.8*
Benefits	**.9367**	***65.5***	**2.9058**	***31.1***	**1.969**	***24.8***	**.9170**	***22.0***	**2.8859**	***20.8***	**1.969**	***20.3***
Disability pensions (D_6)	.7459	*52.2*	1.1663	*12.5*	.4204	*5.3*	.9147	*21.9*	1.3351	*9.6*	.4204	*4.3*
Social pension (D_7)	.0998	*7.0*	.7974	*8.5*	.6976	*8.8*	.0964	*2.3*	.7940	*5.7*	.6976	*7.2*
Family allowance (D_8)	.0154	*1.1*	.3869	*4.1*	.3715	*4.7*	-.0374	*-0.9*	.3341	*2.4*	.3715	*3.8*
REI (D_9)	.0022	*0.2*	.1489	*1.6*	.1466	*1.8*	.0012	*0.0*	.1479	*1.1*	.1466	*1.5*
80 euro bonus (D_{10})	.0189	*1.3*	.2163	*2.3*	.1973	*2.5*	-.0797	*-1.9*	.1176	*0.8*	.1973	*2.0*
Newborn bonus (D_{11})	.0059	*0.4*	.0543	*0.6*	.0484	*0.6*	-.0042	*-0.1*	.0442	*0.3*	.0484	*0.5*
Child benefits (D_{12})	.0021	*0.1*	.0204	*0.2*	.0184	*0.2*	-.0001	*0.0*	.0182	*0.1*	.0184	*0.2*
Maternity payments (D_{13})	.0023	*0.2*	.0149	*0.2*	.0126	*0.2*	-.0014	*0.0*	.0112	*0.1*	.0126	*0.1*
Minimum Insertion Income (D_{14})	.0025	*0.2*	.0109	*0.1*	.0084	*0.1*	.0024	*0.1*	.0108	*0.1*	.0084	*0.1*
Housing benefits (D_{15})	.0069	*0.5*	.0428	*0.5*	.0359	*0.5*	.0046	*0.1*	.0405	*0.3*	.0359	*0.4*
Mother bonus (D_{16})	.0021	*0.1*	.0125	*0.1*	.0104	*0.1*	-.0024	*-0.1*	.0080	*0.1*	.0104	*0.1*
Non-taxable rental income (D_{17})	-.0002	*0.0*	-.0014	*0.0*	-.0012	*0.0*	.0003	*0.0*	-.0010	*0.0*	-.0012	*0.0*
Scholarships and grants (D_{18})	.0329	*2.3*	.0356	*0.4*	.0027	*0.0*	.0226	*0.5*	.0253	*0.2*	.0027	*0.0*
Total effect (*E*)	**1.4292**	***100.0***	**9.3566**	***100.0***	**7.9272**	***100.0***	**4.1714**	***100.0***	**13.8539**	***100.0***	**9.6826**	***100.0***

Note: Indices were multiplied by 100. *Source*: Own elaborations.

Table 13 – The contribution of taxes and benefits applying U14 in Scenarios 3 and 4: results for the South area of Italy

TAX-BENEFIT INSTRUMENT	Scenario 3						Scenario 4					
	H	**%H**	**V**	**%V**	**RE**	**%RE**	**H**	**%H**	**V**	**%V**	**RE**	**%RE**
Taxes	**.6644**	***22.8***	**6.0264**	***54.8***	**5.3621**	***66.4***	**3.8227**	***61.5***	**10.985**	***68.3***	**7.1622**	***72.5***
PIT ($S_1 + C + D_{PIT}$)	.5668	*19.4*	5.4489	*49.6*	4.8821	*60.4*	.5614	*9.0*	5.4436	*33.8*	4.8821	*49.4*
Regional surtax (S_2)	.0463	*1.6*	.2849	*2.6*	.2386	*3.0*	.0458	*0.7*	0.2845	*1.8*	0.2386	*2.4*
Proportional tax on rental income (S_3)	.0256	*0.9*	.1805	*1.6*	.1549	*1.9*	-.0081	*-0.1*	0.1468	*0.9*	0.1549	*1.6*
Arrears and severance pay (S_4)	.0192	*0.7*	.1152	*1.0*	.0960	*1.2*	.0266	*0.4*	0.1226	*0.8*	0.0960	*1.0*
Private pensions (S_5)	.0025	*0.1*	-.0064	*-0.1*	-.0089	*-0.1*	.0011	*0.0*	-0.0077	*0.0*	-0.0089	*-0.1*
Government bonds (S_6)	.0002	*0.0*	.0014	*0.0*	.0012	*0.0*	.0001	*0.0*	0.0012	*0.0*	0.0012	*0.0*
Dividends (S_7)	.0014	*0.0*	.0048	*0.0*	.0034	*0.0*	.0012	*0.0*	0.0046	*0.0*	0.0034	*0.0*
Other bonds (S_8)	.0000	*0.0*	.0003	*0.0*	.0003	*0.0*	-.0001	*0.0*	0.0002	*0.0*	0.0003	*0.0*
Deposits (S_9)	.0024	*0.1*	-.0032	*0.0*	-.0055	*-0.1*	.0000	*0.0*	-0.0055	*0.0*	-0.0055	*-0.1*
SICs: employer (S_{10})							2.2305	*35.9*	3.5315	*21.9*	1.3010	*13.2*
SICs: employee (S_{11})							.7449	*12.0*	1.2345	*7.7*	0.4897	*5.0*
SICs: self-employed (S_{12})							.2193	*3.5*	0.2287	*1.4*	0.0094	*0.1*
Benefits	**2.2516**	***77.2***	**4.9668**	***45.2***	**2.7151**	***33.6***	**2.3903**	***38.5***	**5.1052**	***31.7***	**2.7149**	***27.5***
Disability pensions (D_6)	1.659	*56.9*	1.8488	*16.8*	.1897	*2.3*	2.0354	*32.8*	2.2251	*13.8*	0.1897	*1.9*
Social pension (D_7)	.4362	*15.0*	1.6213	*14.7*	1.1851	*14.7*	.4390	*7.1*	1.6241	*10.1*	1.1851	*12.0*
Family allowance (D_8)	.0188	*0.6*	.6511	*5.9*	.6323	*7.8*	-.0811	*-1.3*	0.5512	*3.4*	0.6323	*6.4*
REI (D_9)	.0030	*0.1*	.3968	*3.6*	.3937	*4.9*	.0000	*0.0*	0.3937	*2.4*	0.3937	*4.0*
80 euro bonus (D_{10})	-.0113	*-0.4*	.0540	*0.5*	.0653	*0.8*	-.1111	*-1.8*	-0.0459	*-0.3*	0.0653	*0.7*
Newborn bonus (D_{11})	.0100	*0.3*	.1163	*1.1*	.1063	*1.3*	-.0065	*-0.1*	0.0998	*0.6*	0.1063	*1.1*
Child benefits (D_{12})	.0050	*0.2*	.0742	*0.7*	.0692	*0.9*	-.0016	*0.0*	0.0676	*0.4*	0.0692	*0.7*
Maternity payments (D_{13})	.0090	*0.3*	.0477	*0.4*	.0387	*0.5*	.0020	*0.0*	0.0407	*0.3*	0.0387	*0.4*
Minimum Insertion Income (D_{14})	.0005	*0.0*	.0172	*0.2*	.0167	*0.2*	.0002	*0.0*	0.0169	*0.1*	0.0167	*0.2*
Housing benefits (D_{15})	.0046	*0.2*	.0182	*0.2*	.0137	*0.2*	.0041	*0.1*	0.0178	*0.1*	0.0137	*0.1*
Mother bonus (D_{16})	.0024	*0.1*	.0131	*0.1*	.0106	*0.1*	-.0010	*0.0*	0.0096	*0.1*	0.0106	*0.1*
Non-taxable rental income (D_{17})	.0003	*0.0*	-.0001	*0.0*	-.0005	*0.0*	.0005	*0.0*	0.0001	*0.0*	-0.0005	*0.0*
Scholarships and grants (D_{18})	.1141	*3.9*	.1082	*1.0*	-.0057	*-0.1*	.1104	*1.8*	0.1045	*0.6*	-0.0059	*-0.1*
Total effect (*E*)	**2.916**	***100.0***	**10.9932**	***100.0***	**8.0772**	***100.0***	**6.2130**	***100.0***	**16.0902**	***100.0***	**9.8771**	***100.0***

Note: Indices were multiplied by 100. *Source*: Own elaborations.

Table 14 – The contribution of taxes and benefits applying U14 in Scenarios 3 and 4: results for the main islands of Italy (Sicily and Sardinia)

TAX-BENEFIT INSTRUMENT	Scenario 3						Scenario 4					
	H	**%H**	**V**	**%V**	**RE**	**%RE**	**H**	**%H**	**V**	**%V**	**RE**	**%RE**
Taxes	**.7077**	***21.9***	**5.8238**	***49.4***	**5.1161**	***59.8***	**3.6748**	***58.6***	**10.5806**	***63.7***	**6.9059**	***66.8***
PIT ($S_1 + C + D_{PIT}$)	.6055	*18.8*	5.2793	*44.8*	4.6738	*54.7*	.6043	*9.6*	5.2781	*31.8*	4.6738	*45.2*
Regional surtax (S_2)	.0406	*1.3*	.2345	*2.0*	.1939	*2.3*	.0416	*0.7*	.2355	*1.4*	.1939	*1.9*
Proportional tax on rental income (S_3)	.0239	*0.7*	.2007	*1.7*	.1768	*2.1*	-.0163	*-0.3*	.1605	*1.0*	.1768	*1.7*
Private pensions (S_5)	.0003	*0.0*	.0016	*0.0*	.0013	*0.0*	.0002	*0.0*	.0015	*0.0*	.0013	*0.0*
Government bonds (S_6)	.0002	*0.0*	-.0032	*0.0*	-.0034	*0.0*	-.0001	*0.0*	-.0036	*0.0*	-.0034	*0.0*
Dividends (S_7)	.0381	*1.2*	.1171	*1.0*	.0790	*0.9*	.0446	*0.7*	.1236	*0.7*	.0790	*0.8*
Other bonds (S_8)	-.0001	*0.0*	.0006	*0.0*	.0007	*0.0*	-.0002	*0.0*	.0005	*0.0*	.0007	*0.0*
Deposits (S_9)	-.0008	*0.0*	-.0068	*-0.1*	-.0060	*-0.1*	-.0038	*-0.1*	-.0098	*-0.1*	-.0060	*-0.1*
SICs: employer (S_{10})							2.1087	*33.6*	3.4308	*20.7*	1.3221	*12.8*
SICs: employee (S_{11})							.7303	*11.6*	1.2623	*7.6*	.5320	*5.1*
SICs: self-employed (S_{12})							.1655	*2.6*	.1012	*0.6*	-.0643	*-0.6*
Benefits	**2.5187**	***78.1***	**5.9545**	***50.6***	**3.436**	***40.2***	**2.5975**	***41.4***	**6.0333**	***36.3***	**3.436**	***33.2***
Disability pensions (D_6)	1.7487	*54.2*	2.3761	*20.2*	.6274	*7.3*	2.053	*32.7*	2.6804	*16.1*	.6274	*6.1*
Social pension (D_7)	.5148	*16.0*	1.879	*16.0*	1.3642	*16.0*	.5511	*8.8*	1.9153	*11.5*	1.3642	*13.2*
Family allowance (D_8)	-.0084	*-0.3*	.6393	*5.4*	.6477	*7.6*	-.0999	*-1.6*	.5478	*3.3*	.6477	*6.3*
REI (D_9)	-.0031	*-0.1*	.5673	*4.8*	.5704	*6.7*	-.0059	*-0.1*	.5645	*3.4*	.5704	*5.5*
80 euro bonus (D_{10})	-.0133	*-0.4*	.0112	*0.1*	.0245	*0.3*	-.1004	*-1.6*	-.0759	*-0.5*	.0245	*0.2*
Newborn bonus (D_{11})	.0022	*0.1*	.1593	*1.4*	.1571	*1.8*	-.0135	*-0.2*	.1436	*0.9*	.1571	*1.5*
Child benefits (D_{12})	.0054	*0.2*	.0448	*0.4*	.0394	*0.5*	.0013	*0.0*	.0407	*0.2*	.0394	*0.4*
Maternity payments (D_{13})	.0076	*0.2*	.0903	*0.8*	.0827	*1.0*	.0031	*0.0*	.0858	*0.5*	.0827	*0.8*
Minimum Insertion Income (D_{14})	.0333	*1.0*	.0495	*0.4*	.0163	*0.2*	.0269	*0.4*	.0432	*0.3*	.0163	*0.2*
Housing benefits (D_{15})	.0814	*2.5*	.1274	*1.1*	.0460	*0.5*	.0714	*1.1*	.1174	*0.7*	.0460	*0.4*
Mother bonus (D_{16})	.0019	*0.1*	.0273	*0.2*	.0254	*0.3*	-.0022	*0.0*	.0231	*0.1*	.0254	*0.2*
Non-taxable rental income (D_{17})	.0003	*0.0*	.0003	*0.0*	.0000	*0.0*	.0005	*0.0*	.0004	*0.0*	.0000	*0.0*
Scholarships and grants (D_{18})	.1479	*4.6*	-.0173	*-0.1*	-.1651	*-1.9*	.1121	*1.8*	-0.053	*-0.3*	-.1651	*-1.6*
Total effect (*E*)	**3.2264**	***100.0***	**11.7783**	***100.0***	**8.5521**	***100.0***	**6.2723**	***100.0***	**16.6139**	***100.0***	**10.3419**	***100.0***

Note: Indices were multiplied by 100. *Source*: Own elaborations.

Table 15 – The contribution of tax-benefit instruments applying U14 in Scenarios 3 and 4: national results

TAX-BENEFIT INSTRUMENT	Scenario 3						Scenario 4					
	H	**%H**	**V**	**%V**	**RE**	**%RE**	**H**	**%H**	**V**	**%V**	**RE**	**%RE**
Taxes	**.4876**	***30.8***	**6.2777**	***65.4***	**5.7901**	***72.2***	**3.2111**	***75.1***	**11.3939**	***77.6***	**8.1829**	***78.6***
PIT ($S_1 + C + D_{PIT}$)	.4512	*28.5*	5.6632	*59*	5.2121	*65.0*	.4507	*10.5*	5.6627	*38.6*	5.2121	*50.1*
Regional surtax (S_2)	.0276	*1.7*	.2405	*2.5*	.2129	*2.7*	.0309	*0.7*	.2438	*1.7*	.2129	*2.0*
Proportional tax on rental income (S_3)	.0012	*0.1*	.2046	*2.1*	.2034	*2.5*	-.0579	*-1.4*	.1455	*1.0*	.2034	*2.0*
Arrears and severance pay (S_4)	.0037	*0.2*	.1530	*1.6*	.1492	*1.9*	.0005	*0.0*	.1497	*1.0*	.1492	*1.4*
Private pensions (S_5)	.0004	*0.0*	-.0006	*0.0*	-.0010	*0.0*	-.0002	*0.0*	-.0012	*0.0*	-.0010	*0.0*
Government bonds (S_6)	.0001	*0.0*	.0016	*0.0*	.0015	*0.0*	-.0006	*0.0*	.0009	*0.0*	.0015	*0.0*
Dividends (S_7)	.0015	*0.1*	.0104	*0.1*	.0089	*0.1*	-.0017	*0.0*	.0072	*0.0*	.0089	*0.1*
Other bonds (S_8)	.0005	*0.0*	.0051	*0.1*	.0046	*0.1*	-.0008	*0.0*	.0038	*0.0*	.0046	*0.0*
Deposits (S_9)	.0014	*0.1*	-.0001	*0.0*	-.0015	*0.0*	-.0032	*-0.1*	-.0047	*0.0*	-.0015	*0.0*
SICs: employer (S_{10})							2.0432	*47.8*	3.6301	*24.7*	1.5869	*15.2*
SICs: employee (S_{11})							.6932	*16.2*	1.3102	*8.9*	.6170	*5.9*
SICs: self-employed (S_{12})							.0570	*1.3*	.2459	*1.7*	.1889	*1.8*
Benefits	**1.0977**	***69.2***	**3.328**	***34.6***	**2.2304**	***27.8***	**1.0622**	***24.9***	**3.2927**	***22.4***	**2.2304**	***21.4***
Disability pensions (D_6)	.8253	*52.1*	1.3531	*14.1*	.5279	*6.6*	.9850	*23.1*	1.5129	*10.3*	.5279	*5.1*
Social pension (D_7)	.1367	*8.6*	.9019	*9.4*	.7652	*9.5*	.1377	*3.2*	.9029	*6.1*	.7652	*7.3*
Family allowance (D_8)	.0154	*1.0*	.4485	*4.7*	.4331	*5.4*	-.0446	*-1.0*	.3885	*2.6*	.4331	*4.2*
REI (D_9)	.0022	*0.1*	.2014	*2.1*	.1992	*2.5*	.0009	*0.0*	.2001	*1.4*	.1992	*1.9*
80 euro bonus (D_{10})	.0174	*1.1*	.1580	*1.6*	.1406	*1.8*	-.0825	*-1.9*	.0581	*0.4*	.1406	*1.4*
Newborn bonus (D_{11})	.0065	*0.4*	.0818	*0.9*	.0754	*0.9*	-.0054	*-0.1*	.0700	*0.5*	.0754	*0.7*
Child benefits (D_{12})	.0022	*0.1*	.0303	*0.3*	.0281	*0.4*	.0000	*0.0*	.0281	*0.2*	.0281	*0.3*
Maternity payments (D_{13})	.0039	*0.2*	.0279	*0.3*	.0240	*0.3*	-.0002	*0.0*	.0238	*0.2*	.0240	*0.2*
Minimum Insertion Income (D_{14})	.0089	*0.6*	.0282	*0.3*	.0193	*0.2*	.0082	*0.2*	.0275	*0.2*	.0193	*0.2*
Housing benefits (D_{15})	.0163	*1.0*	.0505	*0.5*	.0341	*0.4*	.0139	*0.3*	.0481	*0.3*	.0341	*0.3*
Mother bonus (D_{16})	.0026	*0.2*	.0156	*0.2*	.0130	*0.2*	-.0019	*0.0*	.0111	*0.1*	.0130	*0.1*
Non-taxable rental income (D_{17})	.0000	*0.0*	-.0004	*0.0*	-.0004	*0.0*	.0003	*0.0*	-.0001	*0.0*	-.0004	*0.0*
Scholarships and grants (D_{18})	.0603	*3.8*	.0312	*0.3*	-.0291	*-0.4*	.0508	*1.2*	.0217	*0.1*	-.0291	*-0.3*
Total effect (*E*)	**1.5853**	***100.0***	**9.6057**	***100.0***	**8.0205**	***100.0***	**4.2733**	***100.0***	**14.6866**	***100.0***	**10.4133**	***100.0***

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On the Horizontal Inequity Effect of the Erosion of the PIT Base: The Case of Italy*

Abstract
This paper deals with the erosion of the personal income tax (PIT) base, a well-known phenomenon that is undermining the redistributive features of the Italian tax system. Several sources of income previously subject to progressive marginal tax rates are now taxed under proportional tax regimes or are entirely exempt from taxation. The existing tax system as of the 2019 tax year is compared with three alternative policy scenarios. First, a comprehensive income tax scheme where all income components are included in the PIT base is examined. Second, a flat-rate personal income tax scheme with a drastic reduction in revenue is considered. Third, a further flat-rate tax scheme with a neutral effect on revenue is simulated. The focus of the comparison is on the unequal tax treatment of close equals. Decomposition approaches to the study of classical horizontal inequity are applied and discussed (van de Ven et al., 2001; Duclos et al., 2003; Urban and Lambert, 2008). The findings show that the erosion of the PIT base has increased the level of horizontal inequity of the tax system only negligibly, and that limited benefits would be obtained if a flat-rate personal income tax were to be adopted.

Keywords: classical horizontal inequity; comprehensive income tax; flat tax; redistribution; microsimulation; IT-EXEMPT
JEL code: D31, H23, H24

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1. Introduction

In the debate about the distinguishing characteristics of the Italian tax system, the erosion of the personal income tax (PIT) base has been widely examined (MEF, 2008; Bises and Scialà, 2014; Boscolo, 2019a). Among other reasons, the horizontal redistributive effects of this phenomenon have been used to justify the introduction of a flat-rate personal income tax scheme in the Italian system (Stevanato, 2016; 2017). At the same time, the erosion of the PIT base has been regarded as one of the major causes of the loss of horizontal equity (Liberati, 2020).

The gradual exclusion from progressive taxation of various sources of income can be traced back to the introduction of the Italian PIT, known as the *Imposta sul reddito delle persone fisiche*. The original provisions of the reform sought to create a PIT scheme with a broad comprehensive tax base (Paladini, 2014). However, once the reform became effective in 1974, it became clear that the scheme deviated from the theoretical framework intended. Capital income and gains, that were initially intended to be included in the PIT base and taxed at progressive marginal tax rates, were excluded and subject to proportional withholding taxes. This first exception may be seen what we could call the theoretical erosion of the PIT base.[1] A further exclusion was allowed in 1987, with the cadastral value of the main residence deemed to constitute taxable income only if its value was greater than an amount equivalent to 1,300 euros and the taxable amount was based on the value in excess of that limit.[2]

Over the last twenty years there has been a marked tendency to transfer specific sources of income previously subject to progressive taxation to more favourable tax regimes, thus reviving the interest in the erosion of the PIT base as a primary issue in the tax debate. Without claiming to be exhaustive and based on the order of the introduction of the various measures, the following is a list of sources of income that have been subject to this phenomenon, which we can define as actual erosion. The 2019 Italian tax system is characterised by the following features.

i) A substitute tax regime is applied to income from self-employment – known as the '*regime forfetario*' – conditional on certain income and organisational criteria that tend to restrict the potential beneficiaries to small firms (IRA, 2019). The maximum sales volume to be able to benefit from the regime is 65,000 euros, and taxable income is calculated by reducing earnings first using a cost coefficient, that differs by business sector, and then subtracting social security

[1] This view is in line with the work of the Italian Committee on tax expenditures (*Commissione sulle spese fiscali*), where proportional taxes on capital income and gains are not included among tax expenditures (MEF, 2020).

[2] Since the 2002 tax year, the cadastral value of the main residence has been one of the income sources in PIT gross income, but its value is entirely subtracted by means of a deduction. Due to its early exemption and to the frequency of interested taxpayers (roughly half of all individuals filing tax returns declare its possession, for a number at least four times higher than the one of each current exemption from progressivity), the cadastral value of the main residence was not included in the definition of actual erosion that follows. In fact, its exclusion from the PIT base may be seen as a structural feature of the Italian tax system.

contributions; the tax liability is calculated by applying a proportional tax rate of 15%.[3]

ii) Productivity bonuses paid to private-sector employees up to a limit of 3,000 euros are taxed at a rate of 10%.

iii) Company welfare schemes are entirely tax-free, with a view to increasing employee well-being through the provision of goods and services.

iv) A proportional tax is applied to rental income from residential properties, known as the '*cedolare secca*', with two different tax rates depending on the type of rental agreement between the parties (10% for controlled rents or 21% otherwise). Starting from the 2019 tax year, a substitute (proportional) tax can also be applied to rental income from shops (at a rate of 21%).

v) Cadastral income from properties at the disposal of the owners and located in a different municipality from that of the main residence are excluded from the PIT base and not subject to taxation at all.

In the light of the above, it is easy to suspect that the gradual subjection to proportional taxation of income sources previously included in the PIT base (and thus taxed progressively) could have a significant impact on the *vertical* and *horizontal equity* principles (Kakwani and Lambert, 1998).

Take the case of two single persons, one of whom is an employee and the other is self-employed and so can opt for the more favourable tax regime on self-employment income. For the sake of simplicity, let us suppose that taxable income from employment after social insurance contributions is the only income for both these individuals and amounts to 50,000 euros a year. Suppose again that personal income tax is calculated by simply applying the marginal tax rates applicable in 2019,[4] excluding deductions and tax credits. In this simplified scenario, the employee would be liable to an effective tax rate (30.6%) that is twice that of the self-employed worker, whose marginal tax rate equals the effective tax rate (15%). This example shows the lack of horizontal equity when proportional regimes replace the application of the progressive principle to specific income sources. A lack of vertical equity would also be evident in the case of an employee earning 15,000 euros, leading to the absurd situation in which the tax system differentiates according to the taxpayers' ability to pay, but regressively: in this case the effective tax rate would be 23%.

Evidence of the magnitude of the horizontal effect in the Italian income tax system has previously been provided by Pellegrino and Vernizzi (2011). Their results were dependent on the decomposition methodology and on the choice of the optimal bandwidth in which comparable individuals are identified. For the 2006 (2007) tax year and taking the individual as the unit of analysis, the absolute

[3] In the case of taxpayers meeting certain requirements – that the business was not carried on during the previous three years or was not the continuation of an activity previously carried on in the form of salaried employment – the tax rate is reduced to 5% for the first five business years.

[4] The PIT brackets and relative tax rates are as follows (value in euros): 1) up to 15,000: 23%; 2) 15,001-28,000: 27%; 3) 28,001-55,000: 38%; 4) 55,001-75,000: 41%; 5) over 75,000: 43%.

horizontal effect of Urban and Lambert (2008) was estimated to be 0.05% (0.09%) of the PIT redistributive effect when the optimal bandwidth is chosen by maximising the ratio of the vertical effect to the redistributive effect – the criterion adopted by van de Ven et al. (2001). The magnitude of the horizontal effect was found to be slightly greater using alternative decomposition methodologies but never greater than 0.9% (1.2%) for the 2006 (2007) tax year.

This paper aims to shed light on the horizontal equity issues associated with the actual erosion of the PIT base in Italy. As a secondary aim, given the attention paid to flat tax proposals in connection to the gradual exclusion of certain income sources from progressive taxation, it investigates to what extent such a scheme would limit inequality between similar taxpayers. By means of microsimulation techniques, the existing tax system in the 2019 tax year (hereinafter EX) is compared with three alternative policy scenarios. First, income sources excluded from the PIT base are simulated and then reincluded, defining what for the sake of simplicity we can call the *comprehensive income tax* scheme (hereinafter CIT). Second, a flat-rate personal income tax scheme with a drastic reduction in revenue is simulated (hereinafter FLAT). Third, a further flat-rate tax scheme with a neutral effect on revenue is evaluated (hereinafter NFLAT). The comparison between the different tax systems makes use of four decomposition methodologies designed for the study of *classical horizontal inequity* (van de Ven et al., 2001; Duclos et al., 2003; Urban and Lambert, 2008), where close equal groups are taken as the basis for the measurement.

The remainder of the paper is structured as follows. Section 2 briefly outlines the IT-EXEMPT microsimulation model. Section 3 describes the decomposition approaches adopted to measure classical horizontal inequity. Section 4 presents the simulated policy scenarios. Section 5 discusses the redistributive features of the existing tax system as of 2019 and alternative policy scenarios. In addition to this, it provides an examination of the determinants of income redistribution under existing legislation. Section 6 presents the results of the horizontal inequity analysis. Section 7 focuses on the policy implications arising from the research findings and concludes the paper.

2. IT-EXEMPT: a static microsimulation model for the study of income sources exempt from progressive taxation

The substitution of progressive taxation with proportional tax regimes gives rise to a series of difficulties when it comes to their simulation. Tax exemptions are often granted to a small number of taxpayers, who may not be properly represented in survey data. As a result, their precise replication may require the adjustment of survey weights to aggregate administrative data. Furthermore, not all the information needed for the simulation is collected. In the following, the features of the IT-EXEMPT model are briefly presented.

The starting point of the analysis is the choice of the data source. The model was developed using the Survey on Household Income and Wealth (SHIW) released by the Bank of Italy for the 2016 tax year. Its structure and sequentiality largely draws on the MAPP© model developed and maintained at the Research Center for the

Analysis of Public Policies (CAPP) (Baldini et al., 2011), but it differs with regard to survey data employed and the implementation of grossing-up techniques.[5]

The procedure for the construction of the model is divided in six main steps: (1) identification of tax expenditures beneficiaries, (2) grossing-up procedure, (3) simulation of income sources not subject to PIT, (4) survey weight calibration, (5) model validation, and (6) income updating and simulation of the 2019 tax system.

First, in line with previous applications in the field of static microsimulation – see, among others, Albarea et al. (2015), from which what follows is derived – individual-level information in the SHIW survey were exploited to identify the beneficiaries of most PIT expenditures prior to the simulation of tax rules for the 2016 year. This evidence was then used to select the beneficiaries of deductions and tax credits that can not be fully simulated due to data availability constraints[6] among those taxpayers with greater probability of receiving PIT expenditures, while related expenditure amounts were imputed through calibration with statistics on tax returns by income groups.

The second steps deals with the conversion of income subject to PIT from net to gross amounts. This is needed because the SHIW survey does not contain information on gross income values, as well as to ensure consistency between gross and net income given the simulated structure of the tax system. A hypothetical value of gross income was assigned to each taxpayer, $Y_i^H = (Y-T)_i\, s$, that is the *i-th* net income before tax-free transfers as collected in SHIW, $(Y-T)_i$, multiplied by a factor s that equalises $\sum_{i=1}^{j} Y_i^H$ to gross income subject to PIT from aggregate tax returns, Y^A. The tax rules for the 2016 year were iteratively simulated in order to find the value of gross income that makes the simulated value of net income, $(Y-T)_i^S$, equal to that in SHIW, $(Y-T)_i$, by adding (subtracting) one income unit to (from) Y_i^H at the end of each round if $(Y-T)_i^S$ is higher (lower) than $(Y-T)_i$. Once one or more individuals satisfy the above condition, they are excluded from the iterative mechanism. The procedure stops when all taxpayers were expelled, or after a predefined number of rounds (Immervoll and O'Donoghue, 2001).

Subsequent to the application of the net-to-gross algorithm, proportional tax regimes and tax-free income sources were fully simulated. For the proportional tax on rental income and the substitute tax regime for income from self-employment, the group of potential taxpayers was first simulated exploiting the information available in SHIW and then restricted to match as far as possible the corresponding number of taxpayers in administrative data. A thousand random draws for each category of taxpayers divided by macro area were carried out in order to choose the best-fitting sub-sample population. The draw that minimises the gap between the (weighted) number of randomly chosen individuals and the external total was the one used to select the taxpayers. As a result, if individuals were found to have both income subject to progressive taxation and income taxed under a substitute regime,

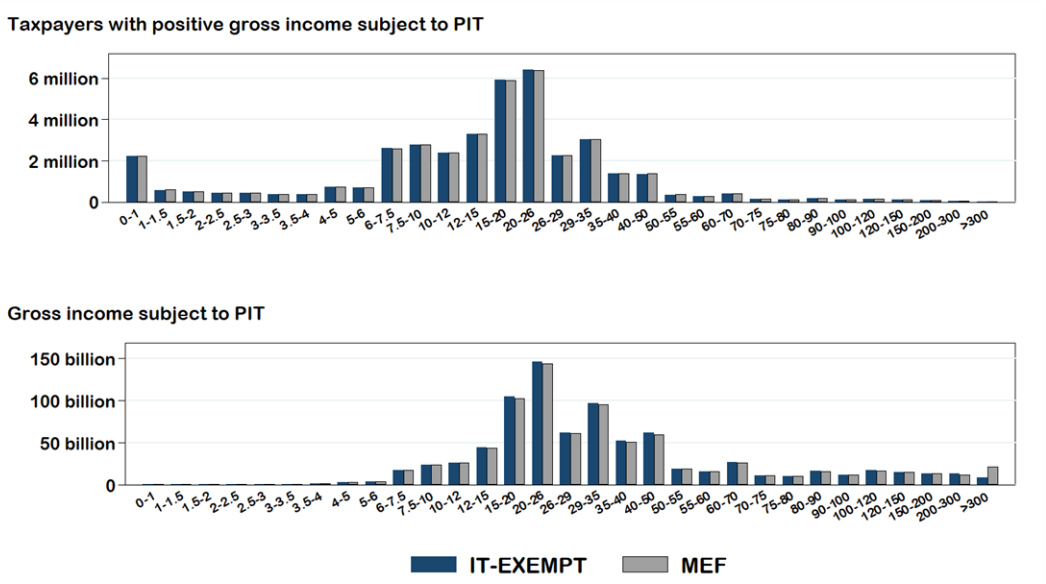
[5] In a previous but related work (Boscolo, 2019a), the author focused on the redistributive and progressivity effects associated with the erosion of the PIT base by means of an extension of the MAPP© model. Unlike the present study, the microsimulation exercise was based primarily on data from the Italian component of the European Union Statistics on Income and Living Conditions for the 2015 year.

[6] Such as funeral expenses, donations to charitable institutions and political parties, and other residual expenditures.

net income values that were previuosly employed as benchmark in the grossing-up procedure were adjusted by substracting net income components related to substitute tax regimes and new gross income values subject to PIT were calculated.

The use of survey reweighting techniques has become a rather common practice in microsimulation studies. Sample surveys are often hardly representative of all the dimensions needed for an accurate replication of complex tax-benefit systems (Creedy and Tuckwell, 2004). The SHIW weights were reweighted in order to better represent specific categories of taxpayers, such as those with income sources exempt from progressive taxation, those with tax-free income components, those with tax expenditures, and taxpayers ranked by non-decreasing groups of gross income subject to PIT, together with the initial dimensions for which the SHIW weights are calibrated (BI, 2018). The adjustment made use of the wealth of information at the individual level made publicly available by the Italian Ministry of the Economy and Finance (MEF) in the form of aggregate data from tax returns. With the external total of the exact number of taxpayers benefitting from proportional tax regimes and exemptions, it is possible to calibrate the corresponding sample groups such that their weighted value matches the exact proportions of the tax-paying population. The reweighting technique applied here is based on the Stata command *sreweight* (Pacifico, 2014), which implements Deville and Särndal (1992)'s generalised raking procedure and to which reference is made for an extensive formalization of the method.

Figure 1 – Taxpayers and gross income subject to PIT by income group for the 2016 tax year: values on the horizontal axis in thousands of euros

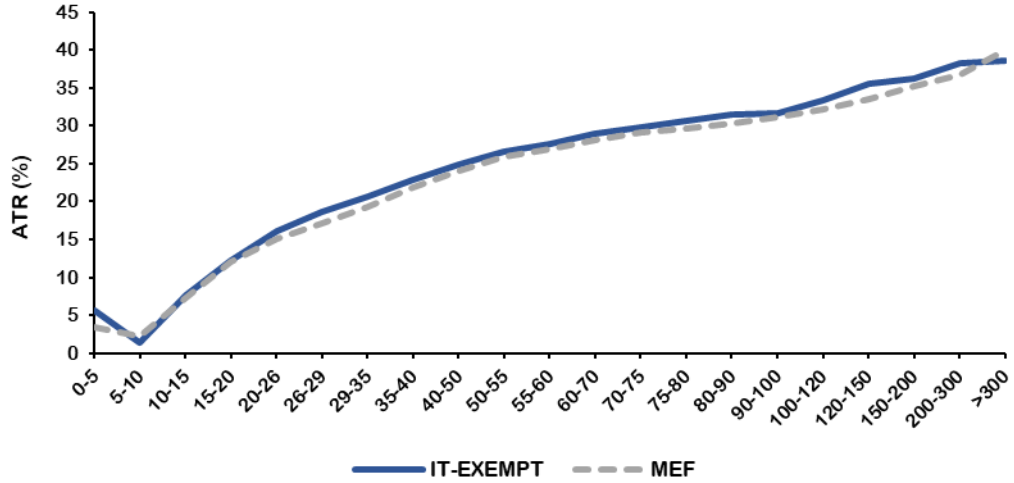


Source: Own elaborations.

A further step consists in the macroeconomic validation of the model. Total values of income components and taxes are compared with the equivalent administrative totals in order to estimate the extent to which the simulated tax system represents a good approximation of the actual system. For this purpose, taxpayers with positive income and total gross income by groups of gross income subject to PIT are shown in Figure 1. The simulated totals correspond almost

perfectly with the true totals except for the wealthiest income group (taxpayers who declared more than 300,000 euros), for which total gross income is substantially underestimated. This reflects the usual difficulties encountered in studies of top-income earners when employing survey data (Alvaredo and Pisano, 2010). The representativeness of the results is also confirmed by the adherence of the PIT incidence curve to tax return statistics (see Figure 2).

Figure 2 – Average PIT rate by income group for the 2016 tax year



Note: Values on the horizontal axis in thousands of euros. *Source*: Own elaborations.

Gross income values and imputed expenditure related to tax credits and deductions were then adjusted using the Consumer Price Index for the 2019 tax year. The replication of the existing tax system for the 2019 year and alternative scenarios represents the last step needed. Compared with the 2016 tax year, the simulated tax system is characterised by an extension of the *cedolare secca* to shops and a broadening of the substitute tax regime for income from self-employment. No less importantly, a further legislative change extended the retirement income tax credit granted to taxpayers over 75 years of age to all retired taxpayers.

3. The measurement of horizontal inequity[7]

For the classicist, in the sense intended by Dardadoni and Lambert (2001), to distinguish between practitioners and researchers making use of tools for the investigation of horizontal inequity other than copula functions, the two measurement concepts in the literature on the subject – the *reranking approach* on the one hand and the *classical horizontal inequity approach* on the other – are somehow bonded together. Let the pre-tax income vector be $x =$

[7] Several decomposition approaches for the study of horizontal inequity were applied in this study, although they do not represent the entire spectrum of methodologies proposed in the literature. In this connection, mention should be made of the use of copula function approaches based on the horizontal inequity concept of Dardanoni and Lambert (2001). Bø et al. (2012) and Díaz-Caro and Onrubia (2019) provided the first applications of this measurement framework.

$\{1, 2, 3, 6, 6, 8, 10, 10, 13\}$ and the resulting post-tax income vector be $y = \{1, 0, 2, 4, 7, 6, 9, 11, 12\}$. The first couple of exact equals, x_4 and x_5, ends up showing a different level of post-tax income, which as a result leads to the reordering of units, since x_5 has a higher disposable income than x_6. In this simple example, the existence of unequal treatment among equals signals the manifestation of reranking, a finding which is quite common in empirical studies with large samples. However, reranking can also be the sole result of unequal treatment among unequals (see the post-tax ordering of x_1 and x_2), as the unequal treatment among equals can lead to no reranking when those below and those above do not overlap with the pre-tax equal units (see the second couple of exact equals, x_7 and x_8). A further conceptual link between classical horizontal inequity and reranking might be revealed by breaking down the overall process of redistribution in each of the tax instruments contributing to it, when pre-tax unequal units become equal following the payment of an initial tax and then turn out to be treated unequally because of the application of another tax.

Horizontal inequity in taxation was first operationalised in the literature through *reranking* (Feldstein, 1976; Atkinson; 1979; Plotnick, 1981). Several authors have suggested such an approach partly because of the undermining role that horizontal inequity plays on the progressivity principle and partly because of the inherent difficulties in identifying exact equals in survey data (Duclos et al., 2003). According to this strand of literature, the net redistributive effect (RE) of a tax system can be defined as in [1] following Kakwani (1984):

$$[1] \quad RE = \left(G_Y - C_{Y-T,Y}\right) - \left(G_{Y-T} - C_{Y-T,Y}\right) = VE - R$$

where *VE* stands for the vertical effect (also referred to as the Reynolds-Smolensky index) and is given by the difference between the pre-tax Gini index (G_Y) and the concentration index of post-tax income ($C_{Y-T,Y}$), while the horizontal effect, expressed with the *R* of reranking, is equal to the difference between the post-tax Gini index (G_{Y-T}) and $C_{Y-T,Y}$.

This framework was extended in the work of Aronson et al. (1994) [hereinafter AJL] shedding light on the concept of classical horizontal inequity, where reranking and unequal treatment among equals are considered as separate contributions to RE. By dividing the population into *i* groups of exact equals – that is, individuals or households with an identical level of gross income – it is argued that RE can be broken down into three aggregates exploiting the lack of exact decomposability of the Gini index in between and within components:

$$\begin{aligned}[2] \quad RE &= G_Y - G_{Y-T} \\ &= G_Y - (G^B_{Y-T} + G^W_{Y-T} + R^{AP}_{Y-T}) \\ &= (G_Y - G^B_{Y-T}) - G^W_{Y-T} - R^{AP}_{Y-T} \\ &= VE^{AJL} - HE^{AJL} - R^{AJL}\end{aligned}$$

$$[3] \quad G^W_{Y-T} = \sum_{i=1}^{k} \left[\left(\alpha_i \beta_{i,Y-T}\right) G_{i,Y-T}\right]$$

where VE^{AJL} represents the vertical effect and is equal to the difference between the pre-tax Gini index and the between-group component of the post-tax Gini index (G^{B}_{Y-T}), the latter obtained by replacing post-tax income values in each group with the corresponding group mean value; VE^{AJL} measures the redistributive impact that would be achieved by a tax system free of horizontal inequity. Then HE^{AJL} captures within-group inequality (G^{W}_{Y-T}), which is understood for present purposes as unequal treatment among equals and is given by the sum of the product of the population share (α_i), the post-tax income share ($\beta_{i,Y-T}$) and the post-tax Gini index for each *i-th* group. Finally, R^{AJL}, the residual that one obtains by decomposing the Gini index (that is, in our case, the post-tax Gini index) if overlapping between units occurs, is identified with the Atkinson-Plotnik index (R^{AP}_{Y-T}). Following van de Ven et al. (2001) [hereinafter VCL], the decomposition in [2] can be adapted to close equal groups by breaking down both post- and pre-tax Gini indices in between and within components:

$$[4]\quad RE = (G^{B}_{Y} - G^{B}_{Y-T}) - (G^{W}_{Y-T} - G^{W}_{Y}) - (R^{AP}_{Y-T} - R^{AP}_{Y})$$
$$= VE^{VCL} - HE^{VCL} - R^{VCL}$$

$$[5]\quad G^{W}_{Y} = \sum_{i=1}^{k} (\alpha_i \, \beta_{i,Y}) \, G_{i,Y}$$

where G^{B}_{Y} is the pre-tax Gini index with gross income on average at each *i-th* group – the between-group component of the pre-tax Gini index; G^{W}_{Y} is the within-group components of the pre-tax Gini index; and R^{AP}_{Y} is the residual for pre-tax income. The decomposition in [4] supposes the absence of within- and entire-group reranking (defined later in this section), which implies that $R^{AP}_{Y} \cong 0$ and thus leads to $R^{VCL} = R^{AJL}$.

A further adaptation of [2] to close equal groups is offered by Urban and Lambert (2008) [hereinafter AJL-UL]. The decomposition that follows differs from [4] except for the reranking term ($R^{AJL-UL} = R^{VCL} = R^{AJL}$):

$$[6]\quad RE = (G_Y - G^{B}_{Y-T} - G^{W}_{Y-T_s}) - (G^{W}_{Y-T} - G^{W}_{Y-T_s}) - R^{AP}_{Y-T}$$
$$= VE^{AJL-UL} - HE^{AJL-UL} - R^{AJL-UL}$$

$$[7]\quad G^{W}_{Y-T_s} = \sum_{i=1}^{k} (\alpha_i \, \beta_{i,Y-T_s}) \, G_{i,Y-T_s}$$

where the vertical effect (VE^{AJL-UL}) is given by the difference between the pre-tax Gini index, the between-group component of the post-tax Gini index and the within-group component of the *smoothed* post-tax Gini index ($G^{W}_{Y-T_s}$). The term *smoothed* refers to a post-tax income distribution (indicated as $Y - T_s$) where liabilities are determined by multiplying pre-tax income values by the corresponding bandwidth's average tax rate. As a result, $G^{W}_{Y-T_s}$ diverges from G^{W}_{Y-T} given that no reranking arises within each group. As far as the horizontal effect is concerned (HE^{AJL-UL}), it can be obtained by subtracting $G^{W}_{Y-T_s}$ from the within-group

component of the post-tax Gini index. HE^{AJL-UL} differs from H^{VCL} for using the same weighting for each of its two within-group components ($\beta_{i,Y-T}$ is equal to $\beta_{i,Y-T_s}$ in [7], but this is not true for $\beta_{i,Y-T}$ and $\beta_{i,Y}$ in [5]).

Urban and Lambert (2008) go even further, suggesting a new decomposition approach for the study of classical horizontal inequity that takes account of all possible rerankings [hereinafter UL]. In fact, when dealing with close equal groups, there are three distinct reranking effects that might occur: the reranking among unequals (R^{AP}_{Y-T}), the within-group reranking (R_{WG}), which takes place when individuals are in a different after-tax position to the before-tax ordering in the specific group's income distribution, and the entire-group reranking (R_{EG}), which captures the reordering of post-tax means. Therefore:

$$
\begin{aligned}
[8]\quad RE = {} & \left(G_Y - C^B_{Y-T,Y} - G^W_{Y-T_s}\right) \\
& - \left(C^W_{Y-T,Y} - G^W_{Y-T_s}\right) \\
& - \left[\left(G_{Y-T} - G^B_{Y-T} - G^W_{Y-T}\right) + \left(G^W_{Y-T} - C^W_{Y-T,Y}\right) + \left(G^B_{Y-T} - C^B_{Y-T,Y}\right)\right] \\
& = VE^{UL} - HE^{UL} - \left(R^{AP}_{Y-T} + R_{WG} + R_{EG}\right) \\
& = VE^{UL} - HE^{UL} - R^{UL}
\end{aligned}
$$

where R^{UL} is equal to the reranking effect in [1]; while $C^W_{Y-T,Y}$ and $C^B_{Y-T,Y}$ are respectively the within-group and the between-group components of the concentration index of post-tax income. The differences between [6] and [8] can be better grasped by examining the formulas below:

$$[9]\quad VE^{UL} = VE^{AJL-UL} + R_{EG},\quad HE^{UL} = HE^{AJL-UL} - R_{WG}$$

Basically, the vertical effect as proposed in [8] is equal to the vertical effect in [6] with the addition of the entire-group reranking, while the horizontal effect in [8] can be obtained by subtracting the within-group reranking from the horizontal effect in [6]. It is worth mentioning that the horizontal effect in [8] has the drawback of often being negative even for small values of the bandwidth, reflecting the scarcity of exact equals in our sample. Urban and Lambert justify this by pointing out that the concentration curves of post-tax income and *smoothed* post-tax income may cancel each other out several times, thus leading to small and negative values of HE^{UL}. The solution they suggest is to break down HE^{UL} into two components, the first being the sum of all areas with positive values of HE^{UL} and the second the sum of all areas with negative values of HE^{UL}:

$$[10]\quad HE^{UL-T} = HE^{+} + abs\{HE^{-}\}$$

Thus, HE^{UL} can be turned into a measure of *absolute* classical horizontal inequity by taking the absolute value of negative areas. As Pellegrino and Vernizzi (2011) noted, this modified version of HE^{UL} does not verify the specification in [8].

The last of the decomposition approaches discussed here is the *change-in-inequality approach* as in Duclos et al. (2003) [hereinafter DJA]. Unlike the

previous ones, it constitutes a method that combines the Gini index and the Atkinson inequality measure. The advantage of this method lies also in the determination of close-equal groups by means of non-parametric statistical procedures. Despite being the most theory-grounded method for the study of classical horizontal inequity out of those considered, this approach has not yet found widespread application in practice and, to the best of our knowledge, has never been applied to the Italian context. The redistributive effect is decomposed into three components as seen above:

$$[11] \quad RE^{DJA} = (I_Y - I^e_{Y-T}) - \left(I^p_{Y-T} - I^e_{Y-T}\right) - \left(I_{Y-T} - I^p_{Y_T}\right)$$
$$= VE^{DJA} - HE^{DJA} - R^{DJA}$$

where the first bracket stands for the vertical redistributive effect of a tax system free of horizontal inequity (VE^{DJA}), with I_Y equal to pre-tax income inequality and I^e_{Y-T} capturing inequality in *expected post-tax income*, the latter referring to an income definition where pre-tax equals are treated equally; the horizontal effect (HE^{DJA}) is given by the difference between I^p_{Y-T}, a measure of post-tax income inequality when the pre-tax reranking is preserved, and I^e_{Y-T}; and the reranking effect, R^{DJA}, which can be computed by subtracting $I^p_{Y\_T}$ from I_{Y-T}, the post-tax income inequality index.

In more detail, these inequality measures are based on the use of social evaluation functions and rank-dependent weights. Take the case of I_Y in [12]. The utility of pre-tax income of the *i-th* individual takes the form of Atkinson's (1970) utility function in [13], where ε indicates the ethical parameter of relative risk aversion. As for the rank-dependent weights (w_i^Y) in [14], observations were sorted by pre-tax income levels, while v and $q_{Y,i}$ are respectively the ethical parameter of aversion to rank inequality and the sample estimate of the *i-th* quantile of the cumulative distribution function. fw_i stands for the survey frequency weight of the *i-th* individual. It should be noted that when $\varepsilon = 0$, then $HE^{DJA} = 0$ by definition. In the case where $\varepsilon = 0$ and $v = 2$, the decomposition in [11] becomes equal to [1]. Finally, considering the denominator in [12], $\hat{\mu}(Y)$ is pre-tax mean income. An analogous procedure was followed for I_{Y-T}, replacing pre-tax income with post-tax income and sorting observations by post-tax income levels in the weighting.

$$[12] \quad I_Y = 1 - \frac{\left[(1-\varepsilon)\left(\sum_{i=1}^{k} U(Y_i)\, fw_i\, w_i^Y\right)\right]^{\frac{1}{1-\varepsilon}}}{\hat{\mu}(Y)}$$

$$[13] \quad U(Y_i) = \frac{{Y_i}^{1-\varepsilon}}{1-\varepsilon}$$

$$[14] \quad w_i^Y = v\left(1 - q_{Y,i}\right)^{v-1}$$

$$[15] \quad q_{Y,i} = \left(\sum_{i=1}^{k} fw_i\right)^{-1} \sum_{i=1}^{m} (fw_i + fw_{i-1})$$

For the estimate of expected post-income levels, it is necessary to employ curve-fitting methods such as kernel-weighted local polynomial regression (Fan and Gijbels, 1996). Note that the computation of I^{e}_{Y-T} makes use of the rank-dependent weights in [14].

$$[16] \quad I^{e}_{Y-T} = 1 - \frac{\left[(1-\varepsilon)\left(\sum_{i=1}^{k} U(Y - T_i^e)\, fw_i\, w_i^Y\right)\right]^{\frac{1}{1-\varepsilon}}}{\hat{\mu}(Y - T_i^e)}$$

Finally, I^{p}_{Y-T} is computed by replacing pre-tax income with post-tax income in [12] but using a modified set of weights ($\overline{w}_i^Y$) as described by Urban (2013). The use of the original weights in [14] as initially proposed by Duclos et al. (2003) would lead to biased estimates of the inequality measure. In fact, equal individuals would be weighted differently, although these units have the same ranking if ordered by pre-tax income levels. As a result, the new weights are obtained by taking the average value of w_i^Y by group of equals.

4. Policy scenarios

The reference distribution common to all the simulated policy scenarios is gross income subject to PIT or substitute tax regimes with the addition of tax-free income sources previously subject to progressive marginal tax rates and the '80 euro' bonus.[8] It is worth bearing in mind that behavioural responses to policy changes, such as labour supply adjustments and tax evasion responses, were not considered in the simulation of counterfactual scenarios.

CIT includes in the PIT base the list of income components taxed at a proportional rate or entirely tax-free under EX (see the list in the introduction, which we referred to as actual erosion), while keeping constant the remaining features of the tax system. In contrast, in FLAT a tax rate of 15% is applied to gross household income subject to PIT jointly with a deduction granted at the level of the household,[9] while keeping the proportional taxes and tax-free income components as simulated under EX. Once PIT liabilities were computed, the average household tax rate was assigned to each family member with positive income to determine individual liabilities. The tax system represented in FLAT is the initial proposal made by the League party during its recent term of office (2018-2019), which is the most radical proposal on personal income taxation to be put forward in the Italian scenario. The aim of the simulation is not to legitimise the proposed reform, but simply to offer the chance to assess an alternative tax system intended to reduce horizontal inequity effects as much as possible. Among all flat tax proposals, the one simulated in FLAT is characterised by the lowest PIT tax rate, thus minimising the distance from tax rates applied in substitute tax regimes and tax-free sources of

[8] A sum of 80 euros per month granted to employees with income from employment ranging from 8,174 to 26,600 euros and positive net PIT.

[9] To determine the amount of the deduction, a value of 3,000 euros was assigned to all family members if gross household income is less than 35,000 euros; with household income ranging between 35,000 and 50,000 euros, a value of 3,000 euros was granted for each dependent member; for income higher than 50,000 euros, the deduction was set to zero.

income (which may be thought of as components with a zero tax rate). Finally, NFLAT maintains the same features as FLAT except for the tax rate applicable to income subject to the current PIT, set at 24.8% so as to ensure the same level of revenue simulated in EX.

5. Empirical description of the Italian tax system as of 2019 and alternative policy scenarios

In the following, income/revenue aggregates and common measures for the analysis of income redistribution and progressivity in each simulated scenario are compared and discussed. In addition to this, an in-depth examination is carried out with the aim of understanding the determinants of income redistribution under EX. The contribution of each tax instrument to redistribution is calculated employing the method used in Onrubia et al. (2014) [hereinafter O14], and then compared with contributions that are measured with the method in Kristjánsson (2013) [hereinafter K13]. The two decomposition approaches are extensively examined in Appendix A. This allows us to describe the redistributive features of the Italian tax system by showing what contributes most to the achievement of its actual redistributive effect. All the following figures were obtained taking the taxpayer as the unit of analysis.

Table 1 – Redistributive indices and total sample amounts for each scenario

INDEX	**EX**	**CIT**	**FLAT**	**NFLAT**
G_Y: pre-tax Gini index	0.4432	0.4431	0.4432	0.4432
G_{Y-T}: post-tax Gini index	0.3914	0.3871	0.4332	0.4263
RE: redistributive effect	0.0517	0.0560	0.0100	0.0168
RS: Reynolds-Smolensky index	0.0525	0.0567	0.0103	0.0179
R: reranking	0.0008	0.0007	0.0003	0.0011
K: Kakwani index (progressivity effect)	0.1988	0.2048	0.0695	0.0678
t: average tax rate	0.2089	0.2168	0.1291	0.2091
$t/(1-t)$: average tax rate effect	0.2641	0.2768	0.1482	0.2644
C_T: concentration index of taxes	0.6420	0.6480	0.5126	0.5110
C_{Y-T}: concentration index of disposable income	0.3907	0.3864	0.4329	0.4252
PIT gross income	844,590	889,265	844,590	844,590
PIT exemptions	44,675	-	44,675	44,675
'80 euro' bonus*	11,073	10,984	11,073	11,073
TOTAL GROSS INCOME	**900,338**	**900,249**	**900,338**	**900,338**
Progressive taxation (PIT + surtaxes)	182,048	195,158	110,197	182,191
Proportional taxation	6,059	-	6,059	6,059
TOTAL REVENUE	**188,107**	**195,158**	**116,256**	**188,250**
Observations	11,734	11,734	11,734	11,734
Taxpayers	**40,714,464**	**40,714,464**	**40,714,464**	**40,714,464**

* The bonus is kept constant in all scenarios except for CIT since gross income subject to PIT determines whether individuals receive the bonus and to what extent.

Note: Total sample amounts in millions of euros. *Source*: Own elaborations.

Considering first EX in Table 1, the redistributive effect of the tax system is equal to 0.0517, a result that is in line with studies making use of tax returns as the base data set (Di Nicola et al., 2015; Di Caro, 2020). Reincluding income components that are currently exempt from progressive taxation in the PIT base would lead to an increase in the redistributive effect to 0.0560 (8.3%). The

progressivity effect as measured by the Kakwani index and the average tax rate effect would increase by 3.0% and 4.8%, respectively. In contrast, the introduction of a flat-rate tax scheme with a marked reduction in revenue would drastically decrease the redistribution achieved to a value of RE equal to 0.0100 (-80.7%). As a result, the progressivity and average tax rate effects would show sharp decreases of -65.0% and -43.9%, respectively. These results do not vary significantly when revenue neutrality is imposed. Such a flat-rate tax scheme would reduce RE to 0.0168 (-67.5%). The greater redistributive capacity in NFLAT when compared with FLAT is mainly driven by an increase in the average tax rate effect (*t*: 12.91% → *t*: 20.91%) and only partially determined by a reduction in the progressivity effect of the tax system (*K*: 0.0695 → *K*: 0.0678).

Table 3 – RE decomposition using O14 for different degrees of extension of EX

VARIABLE	EX (S1) %RE	EX (S2) %RE	EX (S3) %RE	Value in billions
Tax schedules (*S*)	**48.1**	**46.9**	**45.5**	**244.6**
Gross PIT (S_1)	43.4	42.3	38.5	221.4
Regional surtax (S_2)	3.5	3.4	3.2	12.5
Municipal surtax (S_3)	1.3	1.3	1.2	4.6
Proportional tax on rental income from residential property (S_4)	-	-	1.8	1.8
Proportional tax on shops (S_5)	-	-	0.0	0.1
Proportional tax on productivity bonuses (S_6)	-	-	0.1	0.2
Proportional tax on income from self-employment (S_7)	-	-	0.6	4.0
Tax credits (*C*)	**54.7**	**52.4**	**54.7**	**56.4**
Dependent family members (C_1)	5.4	5.2	5.7	11.1
Income source (C_2)	46.3	44.3	46.0	39.9
Expenses for refurbishment of historic buildings (C_3)	0.0	0.0	0.0	0.2
Energy conservation projects (C_4)	-0.1	-0.1	-0.1	0.1
Rents (C_5)	0.3	0.3	0.3	0.3
Health-related expenses (C_6)	2.2	2.2	2.3	2.7
Mortgage interest payments (C_7)	0.2	0.2	0.2	0.8
Insurance premiums (C_8)	0.1	0.1	0.1	0.1
Non-tertiary education expenses (C_9)	0.0	0.0	0.0	0.1
Tertiary education expenses (C_{10})	0.0	0.0	0.0	0.3
Other tax credits (C_{11})	0.2	0.2	0.2	0.8
Deductions and exemptions (*D*)	**-1.6**	**2.0**	**1.3**	**49.8**
PIT: self-employed social insurance contributions (D_1)	-2.2	-2.2	-2.2	19.6
PIT: other deductions (D_2)	-0.5	-0.5	-0.5	1.8
PIT: maintenance payments (D_3)	0.0	0.0	0.0	0.5
PIT: private pension contributions (D_4)	-0.1	-0.1	-0.1	2.6
PIT: cadastral income from main residence (D_5)	1.2	1.2	1.2	8.9
80 euro bonus (D_6)	-	3.6	3.7	11.1
Cadastral income from properties left available (D_7)	-	-	0.0	2.1
Company welfare provisions (D_8)	-	-	-0.7	3.2
Reranking (*R*)	**1.2**	**1.3**	**1.5**	**-**

Source: Own elaborations.

The total value of exemptions from progressive taxation is close to 45 billion euros (5.0% of total gross income), that was earlier defined as the actual erosion of the PIT base. Table 2 in Appendix B provides detailed information on these income components and their distribution among income groups. On the revenue side, CIT would be expected to increase revenue by an amount of 7 billion without considering behavioural responses that might be induced by the new tax system. The loss in revenue that would occur if FLAT were applied is equal to almost 72

billion, a significant amount that underlines the lack of sustainability of such a reform in the Italian context (unless the role of the existing welfare state is questioned and severe cuts in public spending are proposed).

In Table 3, the contributions of tax schedules, tax credits, deductions and income components exempt from progressivity to income redistribution are computed using the method in Onrubia et al. (2014) for different degrees of extension of EX. Scenario 1 (S1) focuses merely on PIT components; Scenario 2 (S2) adds the '80 euro' bonus; finally, Scenario 3 (S3) brings together the PIT components and all the sources of income that are excluded from progressive taxation and taxed at a proportional tax rate or are entirely tax-free. S1 and S2 are particularly useful for validating our results. Despite the differences in the tax year simulated and the base data set employed, the distribution of contributions found in S1 is consistent with previous findings obtained using the same decomposition approach (Barbetta et al., 2018; Boscolo, 2019a; Boscolo, 2019b; Di Caro, 2020). Tax credits are the instrument that most determines PIT redistribution (C: 54.7%) followed by tax schedules (S: 48.1%), while deductions have a small regressive effect (D: -1.6%). Focusing on the various contributions, tax credits granted on the basis of an income from work typology determine almost half of the redistributive effect in S1 (C_3: 46.3%). The second highest contribution is given by the PIT tax schedule (S_1: 43.4%). Then come all the remaining tax instruments such as tax credits for dependent family members (C_1: 5.4%), the regional surtax (S_2: 3.5%), tax credits for health-related expenses (C_6: 2.2%) and so on. Self-employed social insurance contributions (D_1: -2.2%), private pension contributions (D_4: -0.1%) and a range of deductions such as social insurance contributions for domestic help, personal care services and support for people with disabilities, donations to religious institutions and other deductions (D_2: -0.5%) are the measures that contribute regressively in determining income redistribution by means of deductions, together with tax credits for energy conservation projects (C_4: -0.1%).

As for S2, the contribution to income redistribution of the '80 euro' bonus was found to be positive (D_6: 3.6%), with a sign and magnitude in line with previous evidence (Baldini et al., 2015; Boscolo, 2019a; Boscolo, 2019b; Di Caro, 2020).

The proportional taxes and income components excluded from progressive taxation in S3 all have non-regressive effects, except for company welfare provisions (D_8: -0.7%). The proportional tax on rental income from residential properties contributes positively (S_4: 1.8%) as highlighted in Boscolo (2019a; 2019b), where different static models and base data sets were employed, but it diverges from the negative effect found by Di Caro (2020) on a sample of tax returns. The positive effect found here can be better understood by looking at the distribution of income sources by non-decreasing income groups. Rental income is highly concentrated in the wealthiest groups: the richest fifth of taxpayers account for 84.7% of its aggregate value (see Appendix B, row 'I_1' and columns '9^{th}' and '10^{th}'). If the number of taxpayers paying proportional taxes rises with increasing income values, proportional taxes tend to have progressive effects on income inequality when employing O14.

Proportional taxes on rental income from shops and productivity bonuses present a neutral effect on overall redistribution as defined in this study (S_5: 0.0%; S_6: 0.1%), as does cadastral income from properties left available (D_7: 0.0%). Finally, substitute tax regimes on income from self-employment as in the 2019 tax year have

a small progressive effect (S_7: 0.6%), with a contribution that seems to confirm the observations above for S_4. Access to these tax regimes has recently been granted to taxpayers with a maximum turnover of 65,000 euros, while the threshold was much lower under previous regimes, as it was equal to 30,000 euros up to the 2014 tax year (IRA, 2012) and ranged between 25,000 and 50,000 euros from 2015 to 2018 (IRA, 2016). In fact, their contribution in the 2014 tax year has been found to be small and negative (Boscolo, 2019a).

As often pointed out in the literature, a plethora of methods are available for the measurement of progressivity and redistribution (Urban, 2014). The choice of one method rather than another may lead to substantially different results. Among those meant for the study of specific contributions, an extensive comparison between O14 and the method put forward in Urban (2014) is described in Boscolo (2019b) dealing with the Italian tax-benefit system. The two methods were shown to provide similar results. However, the discussion can be further extended by applying K13, a method adopted for the study of dual income taxation systems (Kristjánsson, 2013). What makes the comparison between O14 and K13 particularly interesting is that the results of the latter method can be used to better interpret the positive redistributive effect found above for proportional taxes and income components excluded from progressive taxation. The main difference in their structure is to be found in the tax base on which contributions are computed. While O14 defines taxable income as the sum of the taxable share of each income source, K13 takes the same number of tax bases as the number of income components that make up gross income as the basis for the measurement. In fact, the employment of K13 allows for a more comprehensive understanding of the average tax rate effect of income components.[10] As explained in Appendix A, RS in K13 can be divided into two components: a direct effect capturing progressivity effects; and an indirect effect measuring differences in tax levels between income subject to progressive taxation and income taxed at a proportional tax rate or tax-free income.

The results of the application of K13 are presented in Table 4. First, it is worth stressing that each of the income components exempt from progressive taxation now shows a negative effect on income redistribution (see column '%RE') except for the neutral effect of the proportional tax on rental income from shops, perhaps due to its low aggregate value. Substitute tax regimes on income from self-employment are the tax instrument with the greatest negative contribution (S_7: -2.1%), followed by company welfare provisions (D_8: -1.3%), which were also found to be regressive using O14, and the proportional tax on rental income from residential properties (S_4: -0.8%). The remaining exemptions and proportional taxes complete the picture, presenting a smaller but still negative effect. As for progressive taxation, its overall effect is the only factor responsible for the reduction in income inequality (S_1-S_3-S_3: 106.8%), a reduction that would be even higher (+6.8%) in the case of the absence of regressive effects and reranking.

Direct effects should not be negative when a proportional tax rate is applied. S_4 and S_7 both present a small positive direct effect due to their tax schedule, where

[10] Correlating the values in billion euros presented in the last column of Table 3 with the contribution of proportional taxes and income components exempt from progressive taxation (S_4, S_5, S_6, S_7, D_6, D_7, D_8) to the redistributive effect, O14's contributions show a high and positive correlation (0.79), contrary to what is true for K13 (-0.07).

two tax rates are applied instead of one (10% and 21% in S_4; 5% and 15% in S_7). These positive effects are then nullified by the corresponding indirect effects. Only progressive taxation has an indirect effect that contributes positively to determining redistribution (S_1-S_3-S_3: 0.00302). Therefore, the negative contributions to overall redistribution found for all the other measures must be attributed to the prevalence of negative indirect effects. These results are in line with those reported by Kristjánsson (2013) on the tax system in Iceland, but no other evidence has yet been provided for Italy.

Table 4 – RE decomposition using K13 for EX (S3)

VARIABLE	**Effect**			
	Direct	**Indirect**	**RE**	**%RE**
Progressive taxation (S_1-S_2-S_3)	0.05224	0.00302	0.05526	106.8
Proportional tax on rental income from residential property (S_4)	0.00001	-0.00041	-0.00040	-0.8
Proportional tax on rental income from shops (S_5)	0	0	0	0
Proportional tax on productivity bonuses (S_6)	0	-0.00019	-0.00019	-0.4
Tax regimes on income from self-employment (S_7)	0.00003	-0.00110	-0.00107	-2.1
80 euro bonus (D_6)	0	-0.00016	-0.00016	-0.3
Cadastral income from properties left available (D_7)	0	-0.00028	-0.00028	-0.5
Company welfare provisions (D_8)	0	-0.00065	-0.00065	-1.3
Reranking (*R*)	-	-	**0.00077**	**1.5**
Redistributive effect (*RE*)	**0.05228**	**-0.00023**	**0.05173**	**100.0**

Source: Own elaborations.

As a result, the policy implications deriving from a comparison of the two decomposition approaches differ significantly. While the employment of K13 would suggest a reinclusion of certain income components exempt from progressive taxation in the PIT base due to their negative impact on income inequality reduction, which is true above all for income from self-employment subject to substitute tax regimes and rental income from residential properties, taking O14 for the study of specific tax-benefit contributions would perhaps imply simply reconsidering the role of these components. In this case, despite the consensus that redistribution would be better achieved by resubjecting all income components to progressive marginal tax rates, the different tax treatment might be justified more easily by the need to boost labour supply efforts or tax compliance, since their effect on redistribution is small but still positive.

6. Horizontal inequity analysis

In this section, the results of the unequal tax treatment of close equals are presented and discussed. For each simulated scenario, the decomposition approaches in [4], [6] and [8] were applied on simulations with bandwidth varying by one income unit within the range 1-3,000 euros (extremes included). Along with this, two criteria were employed for the choice of the optimal bandwidth. First, we defined the optimal bandwidth as the one with the highest contribution of the vertical effect on the redistributive effect following van de Ven et al. (2001):

$$[19] \quad OB^{VCL} = max\left\{\frac{VE_i}{RE}\right\}$$

Then, following Mazurek et al. (2013), the vertical effect in [8] can be written as follows:

$$[20]\quad V^{UL} = V^{VCL} + R_{EG} - P_{VW}$$

$$= \left(G_{Y_e} - G_{Y-T_e}\right) + \left(G_{Y-T_e} - C_{Y-T_e,Y}\right) - \sum_{i=1}^{k}\left(\alpha_{i,Y-T} - \alpha_{i,Y}\right) G_{Y_i}$$

$$[21]\quad OB^{MPV} = \left\{P_{VW_i} = R_{EG_i}\right\}$$

where P_{VW} is defined as the *vertical within group progressivity effect*. Mazurek et al. suggest determining the most convenient bandwidth by minimising the greater ratio between P_{VW_i}/V^{UL} and R_{EG}/V^{UL} or, equivalently, by choosing the narrowest bandwidth such that $P_{VW_i} = R_{EG_i}$ as in [21], since $P_{VW_i}(R_{EG_i})$ generally increases (decreases) with increasing values of the bandwidth. If taxation policy is implemented such that net income, $Y - T_j$, is the result of the application of the effective tax schedule, $v(Y)$, together with a random term (u_j) capturing the deviation from the actual tax schedule and the effective one for the *j-th* taxpayer as in Aronson et al. (1994) and van de Ven (2001), the optimal bandwidth is identified when within group deviation averages converge to zero, meaning that the rank of $\left[(1/N_k)\sum_{j\in k} Y - T_j\right]$ converges to that of $\left[(1/N_k)\sum_{j\in k} Y_j\right]$ for the *k-th* group of close equals, and so R_{EG} must tend to zero. It should be noted that this criterion can be applied solely when using [8]. In cases in which multiple optimal bandwidths exist for a specific scenario, the minimum one was selected in line with the interpretation that a low bandwidth value better approximates the implications stemming from the horizontal equity principle.

As for the decomposition approach in [11], we pointed out that the determination of close equal groups is statistically driven. However, this does not imply that the analyst has no control over the selection procedure. Urban (2013) puts forward some suggestions regarding the appropriate estimate of expected post-tax income levels. The optimal half-bandwidth of the kernel was determined in a manner consistent with Urban's application:

$$[22]\quad OB^{U} = \sum_{v=1}^{k} min\left|I^{p}_{Y-T,v,\varepsilon=0} - I^{e}_{Y-T,v,\varepsilon=0}\right|$$

where v, the parameter of aversion to rank inequality, ranges in the interval [1.0; 4.0] and increases by 0.1 units. Expected post-tax income levels were computed using the third-degree local polynomials and the Epanechnikov kernel function. Individuals falling in the extremes (the 1st and the 100th quantile) of the non-weighted reference distribution under EX were excluded from the analysis regardless of the scenario analysed, so as to preserve optimality in the computation.

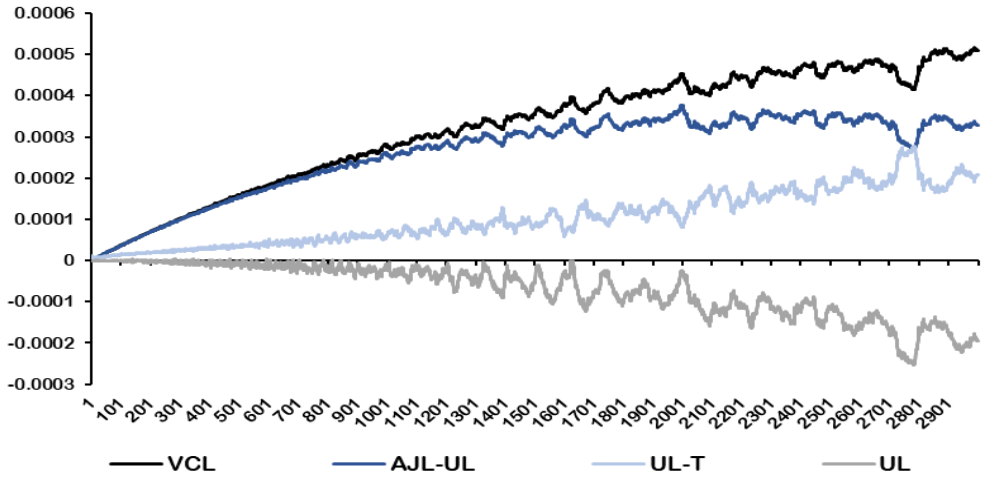
The comparison between scenarios was conducted by adopting the optimal bandwidth (or half-bandwidth) as in [19], [21] and [22] found for EX according to the decomposition approach applied. Since alternative specifications of the tax system can lead to different optimal bandwidths (or half-bandwidths), an assessment is provided of the criterion that minimises the difference between the

'true' value indices – those obtained by the application of each scenario-specific optimal bandwidth – and the 'approximate' ones – those resulting from the use of the optimal bandwidth for EX.

6.1. Results

First, it needs to be stressed out that classical horizontal effects play a minor role regardless of the decomposition approach employed. As shown in Figures 3 and 4, the sign and magnitude of the effect found for the present tax system is in line with previous evidence for the Italian context (Pellegrino and Vernizzi, 2011).

Figure 3 – Horizontal effects (HE^{VCL}, HE^{AJL-UL}, HE^{UL} and HE^{UL-T}) for EX

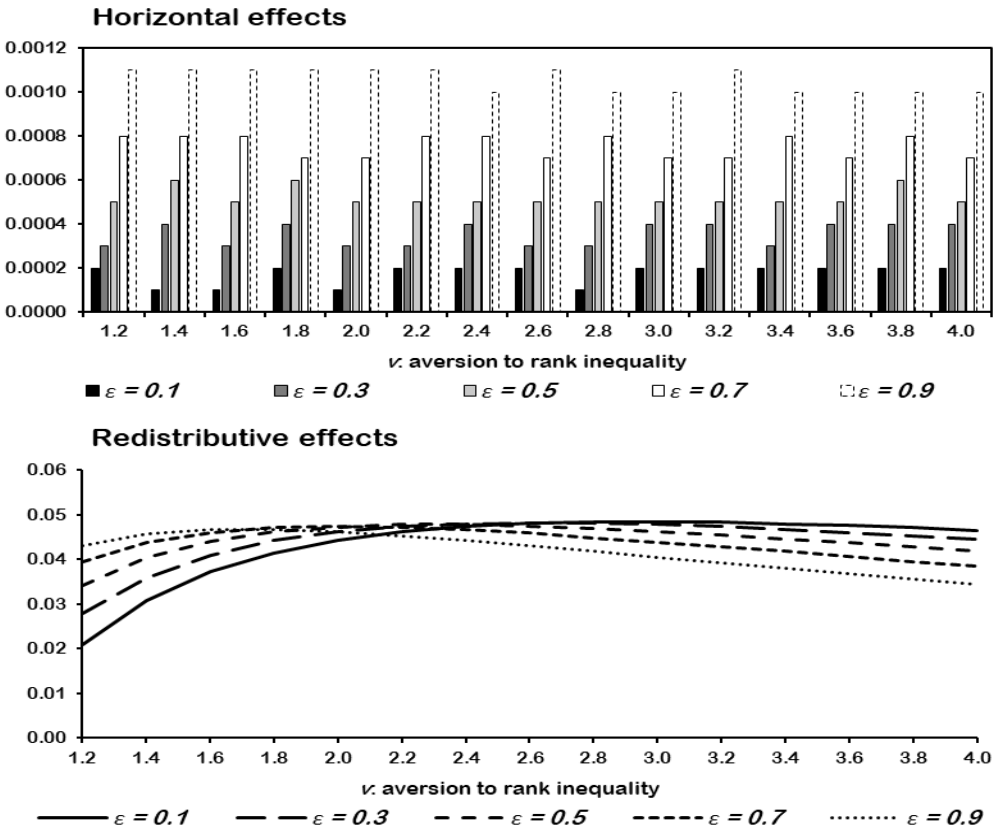


Source: Own elaborations.

Horizontal effects grow with increasing values of the bandwidth regardless of the decomposition approach employed except for HE^{UL}, which shows a negative decreasing trend over the bandwidth adopted confirming what Urban and Lambert (2008) pointed out. As for HE^{DJA}, the magnitude of the effect in absolute terms remains essentially unchanged over different values of *v*. On the other hand, when relating horizontal effects to overall redistributive effects of the current tax system (see Figure 4), a direct relationship emerges between relative risk aversion attitudes (ε) and classical horizontal inequality (HE^{DJA}) regardless of *v*, the parameter of aversion to rank inequality.

Table 5 shows the optimal bandwidth (or half-bandwidth of kernel) found for each of the simulated scenario according to the three criteria employed. The practice of imposing the bandwidth value that optimises the formation of close equal groups for a specific scenario – in our case the baseline scenario – to other simulated (counterfactual) scenarios was previously applied by Mazurek et al. (2013). But what seems relevant here is the application of this empirical strategy to half-bandwidths of kernel, in other words to the decomposition approach of Duclos et al. (2003). Despite the specificities of the criteria used in the assessment of the most suitable close equal groups, the concept of half-bandwidth of kernel does not differ significantly from that of bandwidth. The column headed 'Max/Min' presents the ratio between the maximum and the minimum bandwidth and serves as a proxy for

Figure 4 – Horizontal effects (HE^{DJA}) and redistributive effects (RE^{DJA}) for EX



Source: Own elaborations.

the bias introduced in the calculation of 'approximate' horizontal effects. Out of all criteria, OB^{VCL} is found to be the most accurate only when applied to the decomposition approach in [4]. The capability of the criterion to minimise the dispersion among optimal bandwidths of dissimilar scenarios is strictly related to the framework into which the criterion was first conceived. In fact, OB^{VCL} is rather inaccurate when applied to the specifications in [6] and [8]. As for OB^{MPV}, which can be applied solely to the decomposition approach in [8], it provides a greater level of accuracy (almost three times greater) than that achievable with OB^{VCL}.

Table 5 – The optimal bandwidth (half-bandwidth of kernel)

CRITERION	EX	CIT	FLAT	NFLAT	Max/Min
OB^{MPV}: UL	750	600	336	664	2.23
OB^{VCL}: VCL	1,997	2,013	2,012	2,013	1.01
OB^{VCL}: AJL-UL	280	704	1,347	1,623	5.80
OB^{VCL}: UL	280	336	1,347	1,623	5.80
OB^{U}: DJA	1,156	1,302	4,597	4,670	4.04

Source: Own elaborations.

Finally, OB^{U}, which is specific to the decomposition approach in [11], performs poorly when compared to the previous application with OB^{MPV}. However, it is necessary to bear in mind that the specification in [10] leads to an absolute measure of horizontal inequity that does not verify equation [8], and that the decomposition

approach in [4] comes with a number of methodological limitations that have been addressed by subsequent methods in the literature – the remaining decompositions employed in this study.

Tables 6 and 7 show the results of the decomposition methods. Several considerations follow from comparing simulated scenarios.

i) The erosion of the PIT base – the gradual exclusion from progressive taxation of income components previously included in the PIT base, for a value of roughly 45 billion euros in 2019 – shows practically no effect on the horizontal inequity features of the tax system. The difference in the level of horizontal inequity between EX and CIT – the latter being a counterfactual scenario that subjects to progressive taxation those income components currently excluded – is negligible regardless of the decomposition approach.

ii) On the other hand, the erosion of the PIT base has a substantial effect on the vertical redistributive features of the tax system. As far as the decompositions in [4], [6] and [8] are concerned, the loss of vertical equity attributable to current exemptions from progressivity ranges in the interval [-0.004212; -0.004187], roughly 8.1% of RE in EX (see approximate value indices in Table 6). This is true also when employing the specification in [11], for a loss that ranges in the interval [-9.1%; -6.1%] depending on the specific combination of v and ε (see approximate value indices in Table 7).

iii) Peculiar to the loss of vertical equity, the erosion of the PIT base has led to a rather modest increase in the reranking among unequals. The increase ranges in the interval [0.10%-0.11%] of RE in EX according to decompositions in [4], [6] and [8], while it is negligible and often nil for the selected combinations of v and ε in [11].

iv) In contrast with the previous comparisons, the introduction of a flat-rate personal income tax scheme with a drastic reduction in revenue would lead to a minimal gain in terms of horizontal inequity. Its absolute level would be half that of the present tax system but at the cost of a remarkable increase in income inequality by means of a four-fifth reduction in vertical equity. These findings are confirmed regardless of the decomposition approach.

v) Finally, the introduction of a flat-rate personal income tax scheme with a neutral effect on revenue would not just substantially increase income inequality but would also lead to no gain in terms of horizontal inequity. In fact, the absolute level of horizontal inequity would be equal to or greater than the present one regardless of the decomposition approach. Unlike the previous case, such a flat tax reform would come with greater reranking among unequals than the present level and a three-fifth loss in vertical equity.

7. Policy implications and concluding remarks

The erosion of the PIT base has increased the level of horizontal inequity of the tax system only negligibly. The evidence provided here suggests that the gradual departure from a comprehensive income tax scheme has had a rather limited impact when it comes to horizontal equity issues, and that tax evasion, especially on self-

employment income, may be regarded as the main responsible factor. Further research efforts should be directed to investigate to what extent tax evasion prevents compliance of the tax system with the horizontal equity principle.

As pointed out in the economic literature, progressivity in taxation can be achieved in different ways. The compliance of the tax system with the principle of progressive taxation could also be accomplished by introducing a flat-rate tax scheme. In fact, a proportional tax rate jointly combined with a significant *no tax area*, with further deductions where appropriate, would ensure the progressivity of the PIT and of the entire tax system in line with the principles of the Italian Constitution. Considering only the progressive nature of the PIT, even a small *no tax area* would ensure its accomplishment. Moving to a flat tax scheme with a drastic reduction in revenue would reduce horizontal inequity, while leading to a simplification of the tax system, as well as possibly having a positive impact on individual labour supply and tax compliance.

Despite the many issues that still need to be addressed in relation to the taxation of personal income (MEF, 2008), the argument that greater horizontal equity would result from such a revision of the tax system should be carefully considered in light of the marked reduction in the redistributive effect that would follow. This is not to say that the erosion of the PIT base is of negligible importance. The deviation from the theoretical framework that inspired the structure of the PIT does in fact affect the reduction of income inequality: the redistributive effect would increase by 8.3% in the case in which income components now subject to proportional taxation were reincluded in the PIT base, as this study points out. Furthermore, this increase would be 16.8% in the case in which capital income and gains were among the income components reincluded (Boscolo, 2019a). On the contrary, moving to a flat tax scheme such as those simulated here would dramatically decrease the redistributive effect in both cases. More importantly, no substantial gain would be achieved in terms of the treatment of close equals in the case in which the proportional tax rate was to be set at a low level. In the opinion of the author, this gain would not be enough to justify the disproportionate loss in vertical equity that would follow. This is partly due to the low existing level of horizontal inequity that characterises the Italian tax system. On the other hand, a reform with a neutral effect on revenue would lead to equal or greater horizontal inequity compared with the current system. However, the introduction of a flat tax that is intended to exploit all the benefits mentioned above would need to be carried out by setting the tax rate at such a level that would reduce revenue substantially and thus increase income inequality compared to the current situation. Even when designing a flat tax so as to limit as far as possible the drawbacks relating to greater income inequality, it remains to be seen whether it would be effective in terms of boosting individual labour supply, reducing tax evasion and achieving greater horizontal equity.

Table 6 – RE decomposition using [4], [6], [8] and [10]

INDEX	OB^{MPV} *for EX (approximate value indices except for EX)*								OB^{MPV} *for each scenario (true value indices)*							
	EX		**CIT**		**FLAT**		**NFLAT**		**EX**		**CIT**		**FLAT**		**NFLAT**	
	Effect	**%RE**	**Effect**	**%RE**	**Effect**	**%RE**	**Effect**	**%RE**	**Effect**	**%RE**	**Effect**	**%RE**	**Effect**	**%RE**	**Effect**	**%RE**
VE^{UL}	5.2478	**101.44**	5.6681	**101.20**	1.0302	**103.24**	1.7925	**106.53**	5.2478	**101.44**	5.6675	**101.19**	1.0299	**103.21**	1.7928	**106.54**
HE^{UL}	-0.0023	**-0.04**	-0.0015	**-0.03**	0.0006	**0.06**	-0.0004	**-0.02**	-0.0023	**-0.04**	-0.0021	**-0.04**	0.0003	**0.03**	0.0000	**0.00**
HE^{UL-T}	0.0049	**0.09**	0.0039	**0.07**	0.0021	**0.21**	0.0047	**0.28**	0.0049	**0.09**	0.0039	**0.07**	0.0017	**0.17**	0.0052	**0.31**
R^{AJL}	0.0528	**1.02**	0.0474	**0.85**	0.0178	**1.78**	0.0783	**4.65**	0.0528	**1.02**	0.0494	**0.88**	0.0236	**2.36**	0.0805	**4.78**
R_{WG}	0.0228	**0.44**	0.0208	**0.37**	0.0139	**1.39**	0.0317	**1.88**	0.0228	**0.44**	0.0185	**0.33**	0.0080	**0.80**	0.0292	**1.74**
R_{EG}	0.0012	**0.02**	0.0005	**0.01**	0	**0.00**	0.0002	**0.01**	0.0012	**0.02**	0.0008	**0.01**	0.0001	**0.01**	0.0004	**0.02**
RE	**5.1733**	**100.00**	**5.6009**	**100.00**	**0.9979**	**100.00**	**1.6827**	**100.00**	**5.1733**	**100.00**	**5.6009**	**100.00**	**0.9979**	**100.00**	**1.6827**	**100.00**
INDEX	OB^{VCL} *for EX (approximate value indices except for EX)*								OB^{VCL} *for each scenario (true value indices)*							
	EX		**CIT**		**FLAT**		**NFLAT**		**EX**		**CIT**		**FLAT**		**NFLAT**	
	Effect	**%RE**	**Effect**	**%RE**	**Effect**	**%RE**	**Effect**	**%RE**	**Effect**	**%RE**	**Effect**	**%RE**	**Effect**	**%RE**	**Effect**	**%RE**
VE^{VCL}	5.2554	**101.59**	5.6741	**101.31**	1.0320	**103.42**	1.7959	**106.73**	5.2554	**101.59**	5.6743	**101.31**	1.0327	**103.49**	1.8000	**106.97**
HE^{VCL}	0.0454	**0.88**	0.0423	**0.76**	0.0255	**2.56**	0.0518	**3.08**	0.0454	**0.88**	0.0411	**0.73**	0.0259	**2.60**	0.0532	**3.16**
R^{VCL}	0.0367	**0.71**	0.0309	**0.55**	0.0086	**0.86**	0.0614	**3.65**	0.0367	**0.71**	0.0323	**0.58**	0.0089	**0.89**	0.0641	**3.81**
VE^{AJL-UL}	5.2455	**101.40**	5.6667	**101.17**	1.0296	**103.18**	1.7901	**106.38**	5.2455	**101.40**	5.6693	**101.22**	1.0316	**103.38**	1.7969	**106.79**
HE^{AJL-UL}	0.0094	**0.18**	0.0089	**0.16**	0.0071	**0.71**	0.0140	**0.83**	0.0094	**0.18**	0.0189	**0.34**	0.0211	**2.11**	0.0548	**3.26**
R^{AJL-UL}	0.0628	**1.21**	0.0569	**1.02**	0.0246	**2.47**	0.0934	**5.55**	0.0628	**1.21**	0.0495	**0.88**	0.0126	**1.26**	0.0594	**3.53**
VE^{UL}	5.2506	**101.49**	5.6698	**101.23**	1.0300	**103.22**	1.7939	**106.61**	5.2506	**101.49**	5.6700	**101.23**	1.0316	**103.38**	1.7966	**106.77**
HE^{UL}	0.0004	**0.01**	0.0002	**0.00**	0.0003	**0.03**	0.0010	**0.06**	0.0004	**0.01**	0.0004	**0.01**	0.0020	**0.20**	0.0038	**0.23**
HE^{UL-T}	0.0025	**0.05**	0.0023	**0.04**	0.0015	**0.15**	0.0029	**0.17**	0.0025	**0.05**	0.0023	**0.04**	0.0037	**0.37**	0.0062	**0.37**
R^{AJL}	0.0628	**1.21**	0.0569	**1.02**	0.0247	**2.48**	0.0935	**5.56**	0.0628	**1.21**	0.0560	**1.00**	0.0126	**1.26**	0.0642	**3.82**
R_{WG}	0.0090	**0.17**	0.0087	**0.16**	0.0067	**0.67**	0.0129	**0.77**	0.0090	**0.17**	0.0101	**0.18**	0.0191	**1.91**	0.0458	**2.72**
R_{EG}	0.0051	**0.10**	0.0031	**0.06**	0.0004	**0.04**	0.0038	**0.23**	0.0051	**0.10**	0.0026	**0.05**	0	**0.00**	0.0001	**0.01**
RE	**5.1733**	**100.00**	**5.6009**	**100.00**	**0.9979**	**100.00**	**1.6827**	**100.00**	**5.1733**	**100.00**	**5.6009**	**100.00**	**0.9979**	**100.00**	**1.6827**	**100.00**

Note: Indices were multiplied by 100. *Source*: Own elaborations.

Table 7 – RE decomposition using [11] with different combinations of v and ε

INDEX	OB^U for EX (approximate value indices except for EX)								OB^U for each scenario (true value indices)							
	EX		CIT		FLAT		NFLAT		EX		CIT		FLAT		NFLAT	
	Effect	%RE	Effect	%RE	Effect	%RE	Effect	%RE	Effect	%RE	Effect	%RE	Effect	%RE	Effect	%RE
	v=1.1 and ε=0.1								***v=1.1 and ε=0.1***							
VE^{DJA}	0.0142	**102.16**	0.0152	**102.01**	0.0032	**103.23**	0.0055	**105.77**	0.0142	**102.16**	0.0152	**102.0**	0.0032	**103.2**	0.0055	**105.8**
HE^{DJA}	0.0001	**0.72**	0.0001	**0.67**	0.0001	**3.23**	0.0001	**1.92**	0.0001	**0.72**	0.0001	**0.7**	0.0001	**3.2**	0.0001	**1.9**
R^{DJA}	0.0002	**1.44**	0.0002	**1.34**	0	**0**	0.0002	**3.85**	0.0002	**1.44**	0.0002	**1.3**	0	**0.0**	0.0002	**3.8**
$\boldsymbol{RE^{DJA}}$	**0.0139**	**100.00**	**0.0149**	**100.00**	**0.0031**	**100.00**	**0.0052**	**100.00**	**0.0139**	**100.00**	**0.0149**	**100.0**	**0.0031**	**100.0**	**0.0052**	**100.0**
	v=4.0 and ε=0.1								***v=4.0 and ε=0.1***							
VE^{DJA}	0.0474	**101.94**	0.0505	**101.61**	0.0116	**104.50**	0.0202	**108.60**	0.0474	**101.94**	0.0505	**101.6**	0.0116	**104.5**	0.0202	**108.6**
HE^{DJA}	0.0002	**0.43**	0.0002	**0.40**	0	**0**	0.0001	**0.54**	0.0002	**0.43**	0.0002	**0.4**	0	**0.0**	0.0001	**0.5**
R^{DJA}	0.0007	**1.51**	0.0006	**1.21**	0.0005	**4.50**	0.0015	**8.06**	0.0007	**1.51**	0.0006	**1.2**	0.0005	**4.5**	0.0015	**8.1**
$\boldsymbol{RE^{DJA}}$	**0.0465**	**100.00**	**0.0497**	**100**	**0.0111**	**100.00**	**0.0186**	**100.00**	**0.0465**	**100.00**	**0.0497**	**100.0**	**0.0111**	**100.0**	**0.0186**	**100.0**
	v=2.0 and ε=0.5								***v=2.0 and ε=0.5***							
VE^{DJA}	0.0485	**102.54**	0.0518	**101.97**	0.0121	**104.31**	0.0210	**108.81**	0.0485	**102.54**	0.0517	**101.8**	0.012	**103.4**	0.0209	**108.3**
HE^{DJA}	0.0005	**1.06**	0.0005	**0.98**	0.0002	**1.72**	0.0008	**4.15**	0.0005	**1.06**	0.0004	**0.8**	0.0001	**0.9**	0.0007	**3.6**
R^{DJA}	0.0007	**1.48**	0.0005	**0.98**	0.0003	**2.59**	0.0009	**4.66**	0.0007	**1.48**	0.0005	**1.0**	0.0003	**2.6**	0.0009	**4.7**
$\boldsymbol{RE^{DJA}}$	**0.0473**	**100.00**	**0.0508**	**100.00**	**0.0116**	**100.00**	**0.0193**	**100.00**	**0.0473**	**100.00**	**0.0508**	**100.0**	**0.0116**	**100.0**	**0.0193**	**100.0**
	v=3.0 and ε=0.5								***v=3.0 and ε=0.5***							
VE^{DJA}	0.0474	**102.38**	0.0506	**102.22**	0.0122	**105.17**	0.0212	**109.28**	0.0474	**102.38**	0.0505	**102.0**	0.0121	**104.3**	0.0211	**108.8**
HE^{DJA}	0.0005	**1.08**	0.0005	**1.01**	0.0002	**1.72**	0.0006	**3.09**	0.0005	**1.08**	0.0004	**0.8**	0.0001	**0.9**	0.0005	**2.6**
R^{DJA}	0.0006	**1.30**	0.0006	**1.21**	0.0004	**3.45**	0.0012	**6.19**	0.0006	**1.30**	0.0006	**1.2**	0.0004	**3.4**	0.0012	**6.2**
$\boldsymbol{RE^{DJA}}$	**0.0463**	**100.00**	**0.0495**	**100.00**	**0.0116**	**100.00**	**0.0194**	**100.00**	**0.0463**	**100.00**	**0.0495**	**100.0**	**0.0116**	**100.0**	**0.0194**	**100.0**
	v=1.1 and ε=0.9								***v=1.1 and ε=0.9***							
VE^{DJA}	0.0423	**102.92**	0.0450	**102.74**	0.0117	**105.40**	0.0202	**108.6**	0.0423	**102.92**	0.0448	**102.3**	0.0115	**103.6**	0.0199	**107.0**
HE^{DJA}	0.0011	**2.68**	0.0011	**2.51**	0.0005	**4.50**	0.0015	**8.06**	0.0011	**2.68**	0.0009	**2.1**	0.0003	**2.7**	0.0012	**6.5**
R^{DJA}	0.0001	**0.24**	0.0001	**0.23**	0.0001	**0.90**	0.0001	**0.54**	0.0001	**0.24**	0.0001	**0.2**	0.0001	**0.9**	0.0001	**0.5**
$\boldsymbol{RE^{DJA}}$	**0.0411**	**100.00**	**0.0438**	**100.00**	**0.0111**	**100.00**	**0.0186**	**100.00**	**0.0411**	**100.00**	**0.0438**	**100.0**	**0.0111**	**100.0**	**0.0186**	**100.0**
	v=4.0 and ε=0.9								***v=4.0 and ε=0.9***							
VE^{DJA}	0.0358	**103.77**	0.0379	**103.55**	0.0108	**106.93**	0.0188	**110.59**	0.0358	**103.77**	0.0377	**103.0**	0.0105	**104.0**	0.0184	**108.2**
HE^{DJA}	0.0010	**2.90**	0.0010	**2.73**	0.0004	**3.96**	0.0011	**6.47**	0.0010	**2.90**	0.0008	**2.2**	0.0001	**1.0**	0.0007	**4.1**
R^{DJA}	0.0003	**0.87**	0.0003	**0.82**	0.0003	**2.97**	0.0007	**4.12**	0.0003	**0.87**	0.0003	**0.8**	0.0003	**3.0**	0.0007	**4.1**
$\boldsymbol{RE^{DJA}}$	**0.0345**	**100.00**	**0.0366**	**100.00**	**0.0101**	**100.00**	**0.017**	**100.00**	**0.0345**	**100.00**	**0.0366**	**100.0**	**0.0101**	**100.0**	**0.017**	**100.0**

Source: Own elaborations.

Appendix A

The decomposition formulas for the Reynolds-Smolensky index applied in Section 5 are discussed here. It is worth specifying that VE in [1] can be thought of as the sum of the vertical effect and the classical horizontal effect, as expressed in [8].

The computation of the contribution made by each instrument was first carried out by applying the generalisation of the Pfähler–Lambert decomposition provided by Onrubia et al. (2014). Following the order of the terms on the right-hand side of [17], the RS index can be broken down into three main aggregates, namely: i) the sum of tax schedules; ii) the sum of tax credits; iii) the sum of exemptions, allowances and deductions. Each aggregate is given by the sum of its subcomponents, while each subcomponent is given by the product of the group weight – which is constant for all the subcomponents of a specific aggregate – the individual weight and the Kakwani index (the terms within round brackets). *Y* is the gross income, which is the sum of all sources of income either subject to or exempt from progressive taxation; *B* is the total taxable income, given by the sum of the taxable income components subject to PIT or substitute taxes; *S* stands for the overall gross liability; *T* is the total net liability; S_i indicates the *i-th* tax schedule; C_i is the *i-th* tax credit; and D_i represents the *i-th* exemption, allowance or deduction in the tax system. An upper bar means that the variable is at its average value.

$$[17]\quad RS = \frac{\bar{B}}{\bar{Y}-\bar{S}}\sum_{i=1}^{k}\frac{\bar{S}_i}{\bar{B}}\left(C_{B,Y}-C_{B-S_i,Y}\right)-\frac{\bar{Y}}{\bar{Y}-\bar{T}}\sum_{i=1}^{m}\frac{\bar{C}_i}{\bar{Y}}\left(C_{Y-S,Y}-C_{Y-S-C_i,Y}\right)-\frac{\bar{Y}\bar{S}}{\bar{B}(\bar{Y}-\bar{S})}\sum_{i=1}^{n}\frac{\bar{D}_i}{\bar{Y}}\left(G_Y-C_{Y-D_i,Y}\right)$$

What if the analysis were conducted by isolating the contribution of each instrument on the basis of its own tax base? Would these findings provide a substantially different snapshot of what determines redistribution? These questions can be addressed by applying the so-called *natural* decomposition rule as defined in Kristjánsson (2013). In contrast to the approach just discussed, the effect of each instrument is computed on its corresponding tax base. The method has been adopted as a technique for analysing the redistributive effect of a dual income tax system, where labour income is subject to progressive marginal tax rates and capital income to alternative proportional tax regimes. Since our interest is in understanding the role played also by income components exempt from taxation, company welfare provisions, cadastral income from properties left available and the '80 euro' bonus can be thought of as income sources where a zero tax rate is applied. The decomposition formula allows us to separate the RS index into direct and indirect effects. As far as direct effects are concerned, the interpretation is straightforward as they are defined as the sum of the progressivity effects of all mutually exclusive income sources making up total gross income.

Turning to the indirect effects, they can be interpreted as the result of differences in the various tax schedules applied and how income distributions fit one another. Therefore:

$$[18]\quad RS = \sum_{i=1}^{k}(RS_i^D - RS_i^I)$$
$$= \sum_{i=1}^{k}\left[\frac{\bar{Y}_{C_i}}{\bar{Y}}\frac{t_{C_i}}{1 - t_{C_i}}\left(C_{T_{C_i},Y} - C_{Y_{C_i},Y}\right) - \frac{\bar{Y}_{C_i}}{\bar{Y}}\left(\frac{t - t_{C_i}}{1 - t}\right)C_{Y_{C_i}-T_{C_i},Y}\right]$$

where Y_{C_i} is the *i-th* gross income component; *Y* is the sum of all gross income components; T_{C_i} is the amount of net tax liability due on the *i-th* gross income component; t_{C_i} stands for the average tax rate of the net tax liability due on the *i-th* gross income component; *t* is the average tax rate in the tax system as a whole; $C_{T_{C_i},Y}$ is the concentration index of the net tax liability due on the *i-th* gross income component sorted by non-decreasing values of total gross income, and so on for the remaining concentration indices.

Appendix B

Legend: I_1, rental income from residential properties subject to proportional taxation; I_2, rental income from shops subject to proportional taxation; I_3, self-employment income subject to substitute tax regimes; I_4, productivity bonuses; I_5, cadastral income from properties left available; I_6, company welfare provisions; I_7, '80 euro' bonus; I_8, income subject to progressive taxation; I_9, total gross income; T_1, gross PIT; T_2, net PIT; T_3, regional surtax; T_4, municipal surtax; T_5, proportional taxes; T_6, total taxes.

Table 2 – Statistics on income and revenue: total values and distribution among income groups

Variable	Value	Taxpayers	G_Y	$C_{X,Y}$	Income group (%)									
					1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
I_1	10,585	2,038,198	0.9768	0.7824	0.1	0.2	0.8	1.0	3.2	2.0	3.4	4.5	20.5	64.2
I_2	276	481,214	0.9933	0.3951	0.7	1.3	0.9	6.3	10.7	3.8	12.2	16.8	7.1	34.0
I_3	26,609	1,198,008	0.9805	0.4932	0.1	2.4	1.8	4.4	3.1	4.5	16.1	21.6	19.3	26.6
I_4	1,983	1,858,384	0.9605	0.6421	0.1	0.0	0.2	0.5	2.5	4.6	9.8	19.5	26.2	36.6
I_5	2,064	5,641,556	0.9386	0.4629	6.1	7.4	3.1	2.6	2.8	3.1	3.6	10.8	20.5	40.1
I_6	3,158	1,802,074	0.9801	0.7027	0.0	0.2	0.1	1.2	0.6	4.5	14.5	11.9	11.4	55.7
I_7	11,073	12,758,267	0.7154	0.0505	0.8	0.6	4.3	13.3	21.3	25.2	27.0	7.5	0.0	0.0
I_8	844,590	39,637,648	0.4604	0.4410	0.6	2.5	4.1	5.8	7.6	9.3	10.3	12.3	15.4	32.0
I_9	900,338	40,714,464	0.4432	0.4432	0.6	2.5	4.0	5.8	7.5	9.2	10.6	12.4	15.4	31.9
T_1	221,363	39,093,922	0.5230	0.5041	0.4	2.1	3.5	5.0	6.6	8.3	9.4	11.2	15.0	38.5
T_2	164,948	32,077,675	0.6757	0.6553	0.3	0.1	0.4	2.2	4.4	6.6	8.5	11.5	17.0	49.1
T_3	12,477	31,458,331	0.5696	0.5311	0.3	0.2	0.2	4.9	7.2	8.9	10.5	12.5	16.3	37.2
T_4	4,623	25,838,559	0.5715	0.5334	0.0	0.0	0.0	4.3	8.4	10.6	11.7	13.9	16.9	34.3
T_5	9,196	35,355,034	0.8992	0.5341	1.4	2.7	2.6	3.6	3.9	4.6	10.0	14.6	20.0	36.6
T_6	188,107	33,253,367	0.6501	0.6420	0.3	0.2	0.6	2.4	4.6	6.8	8.9	11.7	17.0	47.6

Note: the values are in million euros; G_Y stands for the Gini index of the *x-th* variable; $C_{X,Y}$ is the concentration index of the *x-th* variable ranked by non-decreasing value of total gross income; the income groups are ordered by non-decreasing values of total gross income excluding individuals with zero income. *Source*: Own elaborations.

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