

Assessing tax expenditures: a composite measure for sustainability, fairness and territorial equity in Italy

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Abstract

Over the last 30 years, the number of studies on tax expenditures has gradually increased in most OECD countries: given their importance for tax systems, most countries have decided to estimate revenue issues on a regular basis. Most of these studies have looked at issues such as the loss of tax revenue due to tax expenditures and their distributional effects across income groups. No specific studies have been carried out on the rationale to attribute a composite criterion of fiscal sustainability and inter-territorial equity, in order to monitor over the years the performance of each item in relation to the public budget. In this paper a first empirical attempt is proposed in the Italian context. For each tax deduction, a composite indicator is calculated for the dimensions of progressivity, relevance and territorial equity, in order to highlight an objective criterion useful for rationalising tax expenditure. Our analysis shows that there is room for rationalisation in the number and size of tax expenditures facing a clear correlation between the geographical distribution of some tax expenditures.

Keywords: Tax expenditures, Composite indicator, Financial sustainability, Tax system evaluation

JEL: H24, C43, C21

1. Introduction

Tax expenditures (TEs) are often used by policymakers to achieve a variety of policy objectives, such as encouraging investment, stimulating economic growth, or providing assistance to low-income individuals and families, but they can also be viewed as revenue losses resulting from the preferential

treatment of certain activities or groups ([Burman and Phaup, 2012](#); [Mare' and Porcelli, 2020](#)).

The use of tax expenditures has increased significantly over time in recent years, partly because in many countries most tax expenditures are not subject to the same controls/requirements in the budget process as direct government spending, and are more communicable when the government acts on the expenditure control side not by increasing taxes, but by reducing tax expenditures. Over a long period (1990-2020), governments allocated about 3.7 per cent of their GDP and 23.5 per cent of their tax revenue to tax expenditure ([Aliu et al., 2022](#)), or more precisely, 4.7 per cent of GDP and 27.9 per cent of tax revenue for OECD member states. Italy in this context seems to be an outlier, since show the highest number of tax expenditures (622) and a size slightly higher than 6.3 per cent of GDP (year 2022).

Tax expenditures constitute a substantial component of public budgets, often implicitly, to reward various interest groups closely associated with governments, with the aim of securing political consensus. The growth of the tax expenditure, as a result, has raised concerns about the sustainability, fairness and efficiency of the tax system ([Tyson, 2014](#)).

In addition to their increasing impact on public budgets, tax expenditures are often regressive, meaning that they benefit high-income taxpayers more than low-income taxpayers. The primary reason for this is the presence of tax-free areas, which primarily benefit individuals with extremely low income levels, while those at higher income levels generally receive greater benefits. For instance, the deduction for mortgage interest is solely accessible to taxpayers who itemise their deductions, and the child tax credit gradually diminishes for taxpayers with higher incomes.

Tax expenditures can also distort economic behaviour. This is because they create incentives for taxpayers to engage in certain activities, even if these activities are not socially desirable.

Despite these concerns, tax expenditures remain an important part of the tax system. They can be an effective way of achieving a variety of policy objectives and can be used to target support to specific groups of taxpayers. However, it is important to carefully consider the costs and benefits of tax expenditures, monitor the sustainability of different categories, and eliminate/reduce those that are no longer sustainable or desirable.

Our empirical analysis is based on Italian data. Italy is a good laboratory for two main reasons: first offers detailed information on the structure and nature of tax expenditure thanks to a detailed annual report issued by

the Italian Ministry of Finance (see [Ministero dell'Economia e delle Finanze \(2016-2022\)](#) for more details); moreover, the heterogeneous distribution of socioeconomic factors among regions provides interesting variation to study the territorial distribution keeping constant the institutional setting. Therefore we think that the use of Italian data is not a limitation but, on the contrary, offers an ideal setup to interpret our results in a more general way.

Our contribution to the existing literature is twofold: *(i)* proposing an assessment with a composite indicator for each tax expenditures, that may be useful in the revision of the current system, with a view to rationalisation or in the overall evaluation of a tax system; *(ii)* showing that this evaluation apart from budget purpose, must necessarily be carried out also at a very fine level of geographical detail, in order to reveal how some policies are not territorially neutral.

Our main empirical findings show that there is room for, at least, a numerical simplification of tax expenditures, which would allow both a recovery of tax revenue and, above all, the possibility of implementing a truly independent monitoring system in this area at a later stage. Furthermore, in order to be useful at the policy level, a micro approach at the country level is needed, as the number and amount, but above all the heterogeneity within each country, are different; in other terms, international comparisons are useful, but they refer to tax designs and compliance levels that are not always easily comparable.

The rest of the paper is structured as follows. Section 2 introduces our research into the existing literature on tax expenditure and into the more technical areas of measuring composite indicators. Section 3 define tax expenditures and the empirical setting, while section 4 describes the data and the empirical strategy. The empirical results are presented in section 5. Section 6 discusses the main findings and concludes.

2. Literature

Over the last decade, there has been an increasing number of studies on different types of tax expenditures, in particular on revenue foregone and possible distributional effects across different income groups.

[Buckley \(2011\)](#) *e.g.* analyse the distributional impact and the collateral consequences of tax expenditures showing that "*the interactions of tax expenditures will be one of the most difficult aspects of any reform effort*". [Burman and Phaup \(2012\)](#) points out how classifying tax expenditures as tax cuts

rather than spending has led over time to higher taxes, bigger government, and an inefficient spending mix due to too much tax spending; [Barbetta et al. \(2018\)](#) analyzing the Italian personal income tax shows that it is only a few major tax expenditures (the tax credit for employment and retirement income) that determine the total redistributive effect, while on the contrary most minor expenditures have no significant impact on redistribution.

In recent years, some countries have taken an additional step by including official estimates of their magnitude and reporting their key attributes as an integral part of their regular budget processes (for Italy, please see [Ministero dell'Economia e delle Finanze, 2016-2022](#)). These publications have tended to focus on the study of the overall system rather than the specific aspects of individual tax expenditures and their impact on citizens; this led to a lack of proposals for an overall, objective and robust assessment of trends in tax expenditures over time and space in a single country, mainly due to a lack of disaggregated data.

Indeed, objective methods for evaluating public economic policy choices are important because they increase transparency, enable evidence-based decision making, facilitate comparative analysis, promote efficiency and effectiveness, build stakeholder confidence and foster continuous learning and improvement.

A notable approach that has gained considerable attention in recent years to measure and compare the national systems across different countries or regions in a objective and robust way is the Benefit of the Doubt approach (BoD) method ([Nardo et al., 2008](#)). BoD is a non-parametric weighting method (or better this family of methods) that aims to maximize the relative composite indicator value of each decision-making unit (DMU) integrating multiple dimensions into a single metric.

BoD frontier composite indicators are derived from the concept of frontier analysis, which originates from the field of production economics. In this case, the frontier represents the best observed performance allowing for the identification of the most efficient unit, serving as benchmarks against which other systems can be compared.

Starting with the seminal papers of [Cherchye et al. \(2005, 2007b\); Zhou et al. \(2010\)](#) the baseline BoD method served as a basis for theoretical improvements regarding the aggregation criterion ([Karagiannis, 2017; Rogge, 2018b,a; Verbunt and Rogge, 2018; Van Puyenbroeck and Rogge, 2017](#)) and the orientation ([Van Puyenbroeck, 2018](#)); such methods have been used empirically to evaluate production units (banks, hospitals, private companies),

but – to our knowledge – this is the first application of this method in the fiscal area and for the evaluation of individual expenditure items.

3. Defining tax expenditures and the empirical setting

[OECD \(2010\)](#) defines the tax expenditures as these measure that "reduces or postpone the revenue for a specific group of taxpayers or an economic activity with respect to a reference rule that represents the benchmark: A tax expenditure can be seen as a public expenditure implemented through the tax system by way of a special tax concession that results in reduced tax liability for certain subsets of taxpayers. In practice, tax expenditures are defined as deviations from a tax norm or a benchmark that result in a reduced tax liability for the beneficiaries, who are generally a particular group of taxpayers or an economic activity. The main challenge in any analysis of tax expenditures is to identify this reference point or benchmark tax system against which to establish the nature and extent of any tax concession. In general, the benchmark tax system is set as the regular tax arrangements that apply to similar classes of taxpayers or types of activity".

Defining a benchmark involves making determinations regarding the tax base, rate structure, and tax unit, which often require judgment regarding the prevailing tax arrangements (see *e.g.* [Altshuler and Dietz, 2008](#) and [Edgar, 2008](#) on classification problems and for related suggestions). As a result, benchmarks can vary not only across countries, but also within countries over time. Many OECD countries, such as Australia, Belgium, Canada, Finland, Ireland, Portugal, and Spain, adhere to some form of conceptual baseline. On the other hand, several other countries, including Austria, France, Korea, the Netherlands, and Italy, employ a reference law approach. Germany follows an expenditure subsidy approach, while the United Kingdom combines a conceptual and expenditure subsidy approach. The United States employs both a conceptual and reference law approach, whereas Sweden follows a conceptual approach for income taxes and a reference approach for consumption taxes (see [OECD, 2010](#)).

A legal benchmark entails identifying the reference tax system based on the current tax law. It involves determining, on a case-by-case basis, whether a provision is a fundamental characteristic of the tax system, inherent in its normal arrangement, or if it deviates from the norm. Only in the latter case would the provision be classified as a tax expenditure. This practice is widely adopted internationally, particularly by certain OECD countries.

The predominant criterion used in this study is the current tax law. This involves assessing whether each concessional provision represents a structural element, aligned with the fundamental tax setup, or constitutes a departure from it. The assessment is based on a systematic examination of the tax, starting from its foundational rules and their justification as outlined by the legislator (including accompanying reports and other official documents). Additionally, the analysis considers the extent of the provision's impact in terms of revenue implications and the number of beneficiaries it affects¹.

The evolution of the number and total amount of less revenue due to tax expenditures in Italy in the years 2016-2022 represents the empirical starting point of the research, because of the clear tendency to use increasingly tax detractions, often as an inappropriate instrument of political economy; the clear increase, both in number and in amount (Figure 1), representing 6.3% of less revenue to GDP (of the year $t + 1$, 2023), is a hidden issue for public finances soundness - because essentially its effects are not explicitly declared - which, therefore, needs to be analysed, evaluated and, if necessary, reduced.

¹Please see [Ministero dell'Economia e delle Finanze \(2016-2022\)](#) for a discussion of possible approaches and methods to estimate and assess tax expenditures.

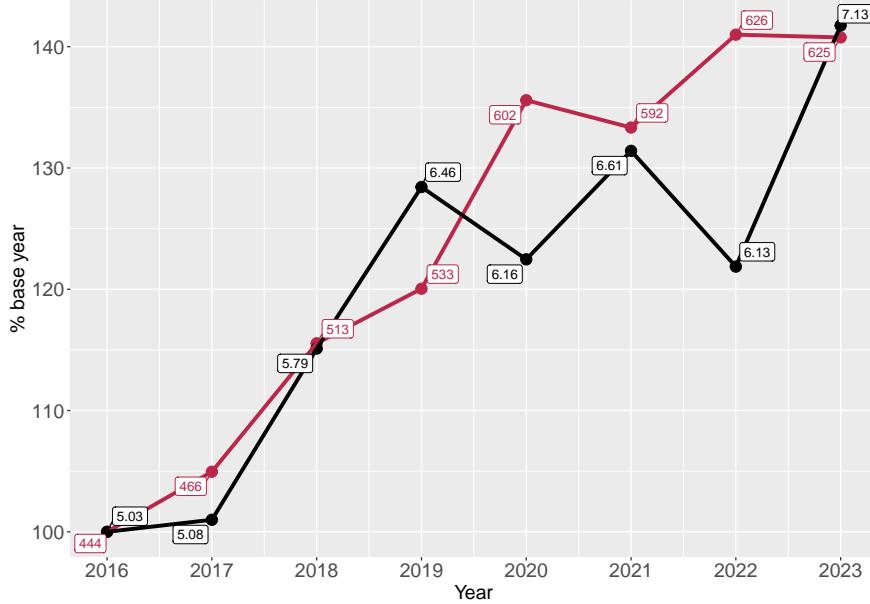


Figure 1: Italian tax expenditures, number (red line) and the % of less revenue to GDP (year t+1) (black line), Fiscal year 2016-2023 (base year 2016), % and absolute values in points label.

Reducing the number of existing tax expenditures or deciding how to manage their growth is clearly difficult for electoral reasons, since even small interests groups of multiple stakeholders, of the lack of an implicit rationale for each individual detraction that has been introduced in the past, or for the lack of explicit attributes to help classify the "importance" of each individual item.

So what could be a discriminative criterion to govern this domain? From a technical point of view, the evaluation of tax expenditures is a multi-criteria problem (Thakkar, 2021), where several potentially conflicting criteria (economic and equity between taxpayers and between territories) have to be evaluated and weighted simultaneously.

Multiple perspectives and multiple indicators lead to the problem of subjectivity of weights; so how to objectively create an indicator that has to balance multiple utility functions? each taxpayer or group of taxpayers has in fact its own utility function and thus its own set of weights. BoD and the extended methods allow the choice of weights to be endogenous, determined by the observed performance and where the benchmark isn't based on

theoretical bounds, but is a linear combination of the best of the observed best performances. In addition, the rationale for the BoD methods is easy to communicate: since we are not sure about the right weights, we look for "*benefit of the doubt*" weights such that your overall relative performance index is as high as possible. In other terms, the set of weights for each unit is maximum, and no other combination of weights - all other units being equal - could provide a better composite indicator.

4. Data and empirical strategy

In order to empirically estimate the approach outlined in Section 3, an original database has been constructed at an unprecedented level of municipal detail.

More specifically, information on the different categories of tax detractions² (please see Appendix A) concerning Personal Income Tax has been requested for the years 2018-2021³ from the Dipartimento delle Finanze (DF, "Finances Department"), of the Ministry of Economy and Finance, that monitor the overall national tax system. It is evident that a complete analysis would have required the full set of detractions, especially in order to highlight those detractions that were most unequal across the territory, small or that involved a small number of taxpayers. Despite, as we have mentioned, the unpublished provision of 20 of the main detractions, the full provision was not possible due to privacy issues. In our opinion, the analysis exercise remains equally valid both as a methodological path and as an empirical application since it involves the main detractions categories. Structural information at municipal level, conversely, is from ISTAT and Italian Revenue Agency.

Table 1 reports the descriptive statistics of the average values for the years 2018-2021: in addition to the detractions reported in per capita terms at municipal level, other information has been also collected to explain the spatial non-stationarity of detractions in a second-stage analysis (Section 5.3). Please note that the OMI prices of rents for civilian housing (euro/sqm

²The number associated with each tax deduction analysed is consistent with the Commission's annual report for the Tax Expenditure (Table 1), https://www.mef.gov.it/ministero/commissioni/red_spe_fis/index.html; tax deduction #999 is the sum of #293 and #287.

³In order to have more robustness especially for small municipalities, the average of municipal data for the years 2018-2021 has been calculated.

per month) is used as a proxy for local prices.

Variable	N	Mean	St. Dev.	Min	Max
Interest on agrarian loans or mortgages #008	694	1,331.39	1,393.32	22.50	14,664.50
Public transport costs #188	7,228	191.18	25.68	37.00	250.00
Cadastral rent of main residence #214	7,839	392.66	124.12	50.04	2,002.31
Mortgage loans #215	7,590	1,020.37	186.24	32.50	2,186.33
Real estate brokerage fees #216	3,803	803.01	83.77	400.00	1,000.00
Disaster risk insurance #217	5,385	124.91	88.05	4.64	1,937.25
Expenditure on assets subject to regulation #218	149	7,175.92	10,063.88	21.00	50,116.75
Furniture and household appliances #244	7,440	608.54	100.36	132.00	1,217.44
Health expenditure #268	7,838	894.52	169.37	466.17	2,691.29
State liberal donations - culture #286	955	795.71	2,226.93	25.83	35,507.69
University education courses #314	7,789	782.08	176.54	134.50	4,497.18
University student rents #316	6,073	1,659.80	235.03	469.00	2,633.00
Periodical allowances paid to spouse #336	4,760	5,400.57	2,591.29	1,242.50	47,411.95
Veterinary expenditure #346	7,240	168.40	24.62	11.25	393.50
Funeral costs #347	7,499	1,483.58	67.75	619.75	1,937.50
Liberal donations #380	5,921	266.80	201.97	15.00	7,706.33
Nurseries #381	4,872	517.29	74.49	57.50	1,096.50
Donations to political parties #384	410	2,066.20	2,182.08	63.33	12,058.00
Sports associations, gyms #608	7,404	201.35	24.32	58.40	404.00
Music + performing arts organisations #999	242	356.27	215.67	16.25	1,536.25
Per capita income	7,839	18,450.57	3,898.91	6,490.74	46,802.01
Population 0-14 year	7,839	1,037.74	5,767.05	0	385,056
Population 15-64 year	7,839	4,930.70	27,786.08	19	1,857,834
Population more 65 year	7,839	1,715.42	9,721.91	5	630,604
OMI price (Euro/mq)	7,839	3.35	1.55	0.98	21.12

Table 1: Descriptive statistics, average values years 2018-2021

Against this background, what strategy should be used to construct a composite indicator of the value of individual detractions? As we have said, it is necessary to construct objective measures for each criterion chosen, criterion that should be as statistically discriminating as possible and at the same time linked to the requirements of equity and tax progressivity.

Table 2 reports three indicators chosen to highlight the progressivity with respect to income of individual detractions, the relative importance in terms of total tax expenditure, and finally, the territorial equity. The polarity of the indicator and the chosen statistical measure are also reported.

Criteria	Indicator	Polarity	Measure
Progressivity	I1: Index of concentration on population quintiles	1: All income classes of taxpayers benefit proportionally, 0: Only some classes	Gini index
Relevance	I2: Importance on total expenditure	1: High, 0: Low	% of income
Territorial equity	I3: Territorial uniformity	1: All taxpayers benefit proportionally in individual provinces, 0: Only some territorial areas	Moran index I

Table 2: Simple indicators

Two caveats are required: (*i*) the choice of indicators is clearly subjective and linked to the more or less aggregated data held by researchers and (*ii*) results are obviously only valid within the chosen setting.

No ethical criteria/indicator have been adopted to limit the subjectivity of measures although it is clear that some support measures for poverty, disability, and social inclusion should be preserved more than other ones. However, the proposed method can easily be supplemented both in terms of more detractions (when possible) and by indicators linked to ethical criteria *e.g.* assessed by a panel of experts.

5. Main results

This section presents the results of the calculation of the individual indicators shown in Table 2 and the overall rating for each individual detraction. For the sake of simplicity, graphs and analysis are reported only for "*Detraction of the cadastral income of a property unit used as a principal residence*" (#214). Results for the other detractions are, as usual, available from the authors on request.

5.1. Progressivity

Progressivity of taxation is a key point in a tax system because it helps to reduce income inequality. In a progressive tax system, people with higher incomes pay a higher percentage of their income in taxes than people with

lower incomes. This helps to ensure that everyone contributes to the tax system according to their ability to pay.

Progressivity may be seen as the opposite of concentration: the more a detraction is claimed by a wealthy class of taxpayers, the more concentrated it is and the less progressive it is. For this reason, it has been possible to calculate the Gini index⁴ from the data of the taxpayers' deciles of Personal Income Tax for each tax expenditure. Table 3 reports the Gini concentration measure (which has a negative polarity with respect to the measure we want) and the related normalised progressivity measure (expressed in a positive direction and standardised between 0 and 1).

Detraction	Code	Concentration (NEG)	Progressivity (NORM)
Interest on agrarian loans or mortgages	d008	0.418	0.838
Public transport costs	d188	0.448	0.789
Cadastral rent of main residence	d214	0.319	1.000
Mortgage loans	d215	0.461	0.769
Real estate brokerage fees	d216	0.436	0.808
Disaster risk insurance	d217	0.611	0.524
Expenditure on assets subject to regulation	d218	0.909	0.040
Furniture and household appliances	d244	0.645	0.469
Health expenditure	d268	0.418	0.839
State liberal donations - culture	d286	0.776	0.257
University education courses	d314	0.510	0.689
University student rents	d316	0.582	0.572
Periodical allowances paid to spouse	d336	0.783	0.244
Veterinary expenditure	d346	0.428	0.822
Funeral costs	d347	0.369	0.918
Liberal donations	d380	0.755	0.289
Nurseries	d381	0.454	0.780
Donations to political parties	d384	0.933	0.000
Sports associations, gyms	d608	0.545	0.631
Music + performing arts organisations	d999	0.703	0.375

Table 3: Concentration (I1) by detraction

The Gini index is proportional to the Lorenz curve (Figure 2), which is a graph that shows the cumulative distribution of tax detraction. The Lorenz

⁴The Gini index ranges from 0 to 1. A Gini index of 0 represents perfect equality, while a Gini index of 1 represents perfect inequality.

curve plots the cumulative percentages of each detraction received against the cumulative number of taxpayers, starting with the poorest decile. The Gini index is calculated as the area between the Lorenz curve and the line of perfect equality, the line of perfect equality.

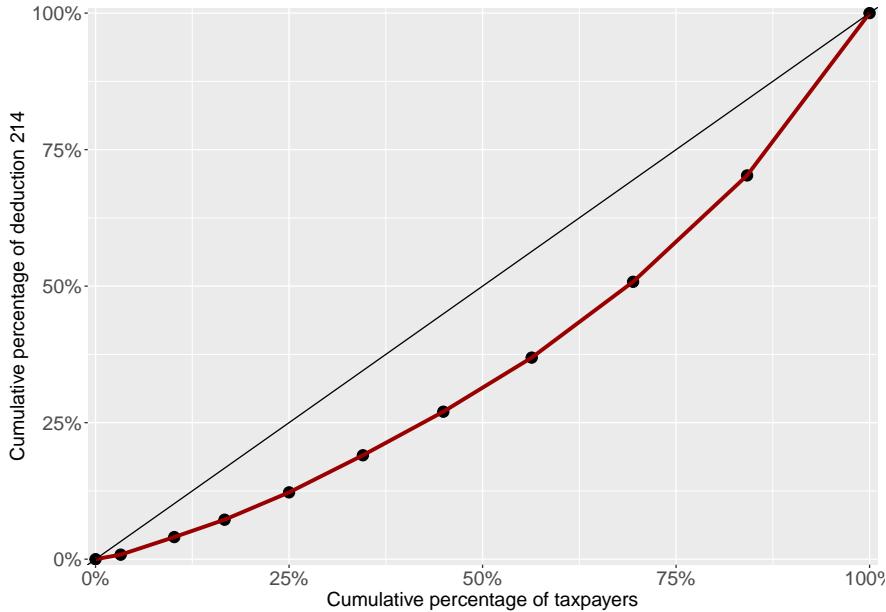


Figure 2: Lorenz curve, Detraction #214

5.2. Relevance

Relevance is the simplest measure, because it is expressed as the percentage ratio of the total detractions for all municipalities divided by the total of declared incomes (amounting to approximately EUR 862 billion). The idea is simple: the more relevant the detraction, the more difficult it will be politically to change or delete the detraction; the less relevant the detraction, the less impact it has on taxpayers on average.

Table 4 reports the results of the simple, normalised ratio between 0 and 1 of relevance showing that some tax expenditures - such as health expenditure (#268) or cadastral rent of main residence (#214) - are clearly more relevant than others such as liberal donations to third sector organisations (#380) or veterinary expenditures (#346).

Detraction	Code	Relevance (POS)	Relevance Norm
Interest on agrarian loans or mortgages	d008	0.001	0.000
Public transport costs	d188	0.022	0.010
Cadastral rent of main residence	d214	1.049	0.478
Mortgage loans	d215	0.518	0.236
Real estate brokerage fees	d216	0.013	0.006
Disaster risk insurance	d217	0.003	0.001
Expenditure on assets subject to regulation	d218	0.002	0.001
Furniture and household appliances	d244	0.108	0.049
Health expenditure	d268	2.195	1.000
State liberal donations - culture	d286	0.001	0.000
University education courses	d314	0.337	0.154
University student rents	d316	0.051	0.023
Periodical allowances paid to spouse	d336	0.094	0.043
Veterinary expenditure	d346	0.024	0.011
Funeral costs	d347	0.086	0.039
Liberal donations	d380	0.010	0.005
Nurseries	d381	0.009	0.004
Donations to political parties	d384	0.001	0.001
Sports associations, gyms	d608	0.037	0.017
Music + performing arts organisations	d999	0.000	0.000

Table 4: Relevance (I2) by detraction

5.3. Territorial equity

A national tax system should be fair from a territorial point of view because it should not discriminate between taxpayers based on where they live or work. A territorial tax system taxes income where it is earned, not where the taxpayer lives or works. If it is unfair this may be due to different tax bases, different population structure or other local factors, but also to the fact that over time some specific detractions may have been introduced to favour some specific territories.

The purpose of the third indicator is, therefore, to ascertain how spatially concentrated a detraction is and secondly how much this concentration is not due to objective factors such as different income, different age structure of the population or local prices. The idea is that if - all things being equal - net territorial differences persist, this is a negative factor related to this detraction that systematically penalises one territory and favours another.

Figure 3 for example, shows the very unequal spatial distribution of the

detraction for the cadastral rent of the main residence; the original data were used to implement ordinary kriging, a geostatistical interpolation method that uses a weighted average of nearby data points to estimate the value of an unknown data point. In this way, a smoother estimate of the original data can be obtained. It is useful to note, for example, the difference between northern and southern regions, but also how there are evident and strong differences between mountainous areas and large cities (detailed results for each detraction are available on requests).

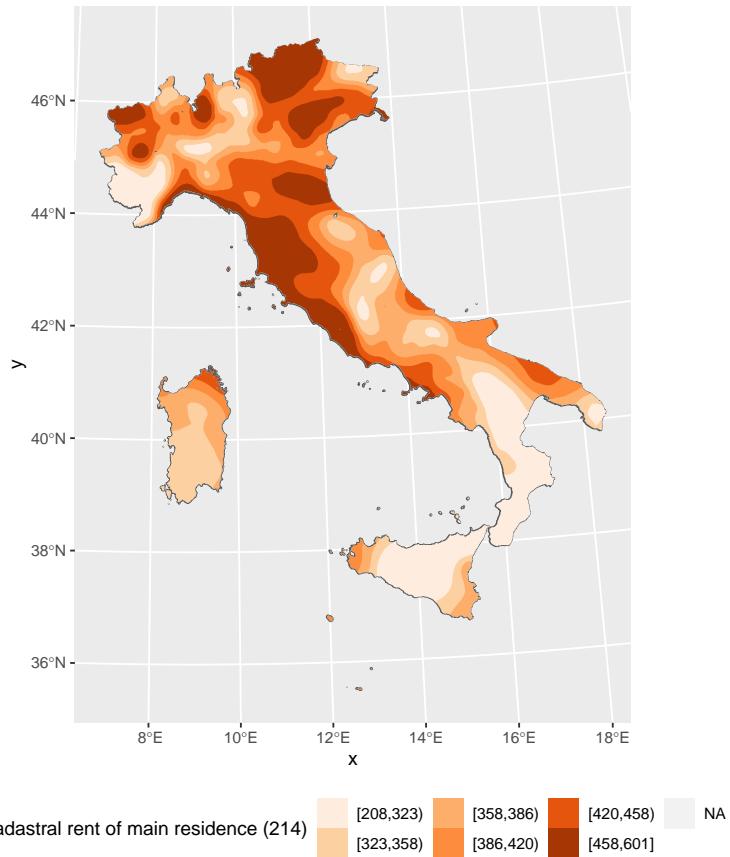


Figure 3: Kriging, Detraction #214

This evidence can be much more simply highlighted by means of the Moran plot that shows the relationship between a variable and its spatial lag, that is a measure of the average value of the variable at neighbouring

locations. For example, as in Figure 4, if the points in the Moran plot are clustered around the line $y = x$, then there is positive spatial autocorrelation. This means that high values of the detraction #214 tend to be found near other high values (in municipal terms) and low values of the variable tend to be found near other low values.

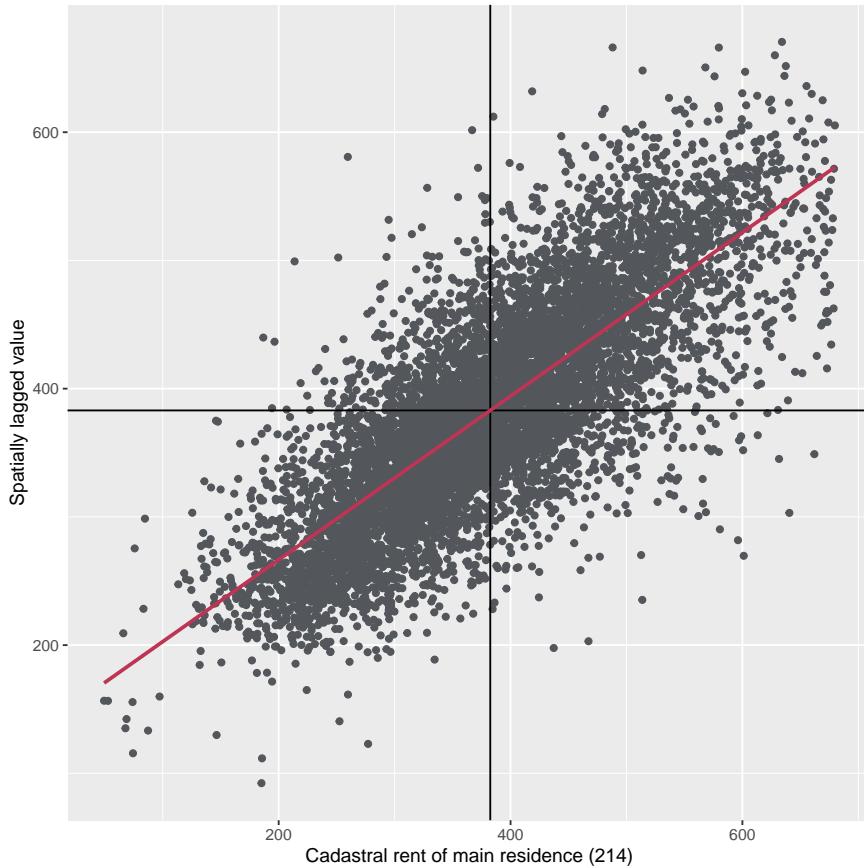


Figure 4: Moran plot, Detraction #214

The estimated spatial autocorrelation is an obvious result because it is linked to exogenous factors such as the different local income, the different age structure of the population and the property prices - which are highly spatially dispersed (see Figure 5) - that have a direct impact on the cadastral income and thus on the detractions.

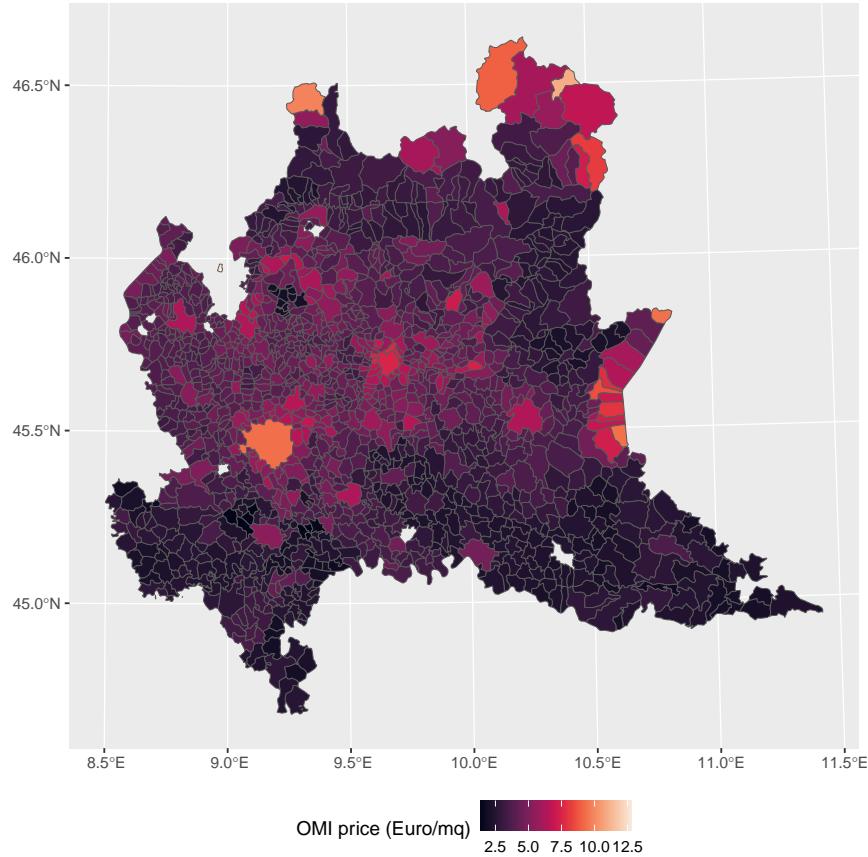


Figure 5: OMI price (Euro/mq), Lombardia

It is, therefore, necessary to compute a "conditional detraction", *i.e.* that is valid under the same exogenous conditions. For this purpose, an OLS estimate (Table 5 reports the results for the traction for the cadastral rent of the main residence; detailed results for each detraction are available on request) has been carried forward distinctly for each individual detraction on the basis of exogenous factors; the part of the detractions not affected by exogenous factors, *i.e.* the regression residuals for each municipality, have been finally used to calculate the Moran's index I on the estimation residuals.

Per capita income	0.008*** (0.0003)
Population 0-14 year	-0.003 (0.006)
Population 15-64 year	0.001 (0.002)
Population more 65 year	0.001 (0.002)
OMI price (Euro/mq)	35.911*** (0.804)
Constant	116.020*** (5.360)
Observations	7,839
R ²	0.395
Adjusted R ²	0.395
Residual Std. Error	96.556 (df = 7833)
F Statistic	1,023.756*** (df = 5; 7833)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 5: OLS estimates, Dependent variable: Detraction #214

Moran's index I is one of the most widely used measures in spatial statistics, a measure of spatial autocorrelation⁵ useful to identifying spatial patterns in data characterised by a spatial persistence of a variable among nearby locations. The measure of territorial equity is then calculated as the inverse of Moran's I; the higher Moran's I is, the more concentrated the detractions and the less territorially equitable this measure is.

Table 6 thus report the two Moran measures (unconditional and conditional) and the relative normalised rating between 0 and 1 (negative polarity).

⁵Moran's I equal to 0 indicates that there is no spatial autocorrelation while equal to 1 indicates that there is perfect positive spatial autocorrelation; if there is perfect negative spatial autocorrelation Moran's I is equal to -1.

Detraction	Code	Territ equity (NEG)	Territ equity Norm (POS)	R ²	Condit. Territ equity (NEG)	Condit. Territ equity Norm (POS)
Interest on agrarian loans or mortgages	d008	0.024	1.000	0.023	0.015	1.000
Public transport costs	d188	0.534	0.268	0.010	0.523	0.000
Cadastral rent of main residence	d214	0.534	0.268	0.395	0.486	0.072
Mortgage loans	d215	0.367	0.507	0.142	0.284	0.472
Real estate brokerage fees	d216	0.191	0.761	0.052	0.135	0.764
Disaster risk insurance	d217	0.263	0.658	0.028	0.224	0.589
Expenditure on assets subject to regulation	d218	0.069	0.937	0.154	0.055	0.922
Furniture and household appliances	d244	0.269	0.648	0.071	0.232	0.573
Health expenditure	d268	0.720	0.000	0.541	0.411	0.221
State liberal donations - culture	d286	0.028	0.995	0.006	0.028	0.975
University education courses	d314	0.342	0.544	0.019	0.356	0.328
University student rents	d316	0.149	0.820	0.018	0.140	0.755
Periodical allowances paid to spouse	d336	0.158	0.807	0.188	0.045	0.943
Veterinary expenditure	d346	0.276	0.638	0.136	0.147	0.741
Funeral costs	d347	0.156	0.811	0.022	0.140	0.754
Liberal donations	d380	0.057	0.953	0.037	0.032	0.967
Nurseries	d381	0.233	0.701	0.120	0.131	0.772
Donations to political parties	d384	0.100	0.892	0.031	0.073	0.886
Sports associations, gyms	d608	0.348	0.535	0.197	0.186	0.665
Music + performing arts organisations	d999	0.113	0.872	0.061	0.064	0.904

Table 6: Territorial equity (Moran's I index) by detraction

5.4. Composite indicator

As the last step of the analysis, a composite indicator from the three individual indicators has to be calculated. As pointed out in section 2, this step is not without assumptions, especially concerning the choice of weights to be adopted and the form of aggregation. As stated by Cherchye et al. (2007a), in fact, "*the disagreement among experts/stakeholders on the specific weighting scheme used to aggregate sub-indicators, are often invoked to undermine the credibility of composite indicators*". The BoD approach and the subsequent methods always based on linear optimisation methods, on the contrary, make this choice endogenous, and, therefore, more objective.

Table 7 shows two estimated BoD composite indicators⁶: the first (pink column) relates to the indicator of Progressivity, Relevance and unconditional Territorial equity, while the second one (green column) takes into account the indicator of conditional territorial equity. In addition to the scores of the composite indicators, the relative absolute ratings⁷ are shown. Therefore, in a rationale of selection of tax detractions that may be reduced, low values of the composite indicator (rating D or C) show detractions that may be easily removed, while high values (rating A or B) show detractions that for the examined characteristics are to be considered more fair, relevant and/or progressive.

⁶R Compind package (Vidoli and Fusco, 2023) has been used.

⁷Calculated as A: (0.9,1]; B: (0.8,0.9]; C: (0.7,0.8]; D: (0.5,0.7]; E: [0,0.5].

Detraction	Code	Rating	Comp. indicator	Condit. Rating	Condit. comp. indicator
Interest on agrarian loans or mortgages	d008	A	1.000	A	1.000
Public transport costs	d188	C	0.797	C	0.789
Cadastral rent of main residence	d214	A	1.000	A	1.000
Mortgage loans	d215	B	0.842	B	0.841
Real estate brokerage fees	d216	B	0.896	A	0.908
Disaster risk insurance	d217	D	0.659	D	0.615
Expenditure on assets subject to regulation	d218	A	0.937	A	0.922
Furniture and household appliances	d244	D	0.698	D	0.611
Health expenditure	d268	A	1.000	A	1.000
State liberal donations - culture	d286	A	0.996	A	0.975
University education courses	d314	C	0.768	C	0.722
University student rents	d316	B	0.843	C	0.773
Periodical allowances paid to spouse	d336	B	0.850	A	0.976
Veterinary expenditure	d346	B	0.883	A	0.914
Funeral costs	d347	A	1.000	A	1.000
Liberal donations	d380	A	0.957	A	0.970
Nurseries	d381	B	0.853	B	0.886
Donations to political parties	d384	B	0.892	B	0.886
Sports associations, gyms	d608	D	0.684	C	0.730
Music + performing arts organisations	d999	B	0.872	A	0.904

Table 7: Fiscal rating for each tax expenditure

6. Final remarks

In recent years, there has been a very extensive use of tax expenditures in the fiscal domain as part of economic policy in many OECD countries; in Italy, there has been an increasing dynamic especially in the number and atomisation of micro interventions on a small number of beneficiaries.

The paper, starting with geographically unpublished data, revealed an enormous potential of data to control dynamics in time and space; objective methods, such as the BoD used by the authors, makes it possible to outline preliminary tools useful to policy makers for rationalising tax expenditures on the one hand and for enhancing interventions that have the greatest impact in fighting inequalities between geographical areas, between income classes and between age groups on the other.

Three actions, finally, seem no longer postponable, in the opinion of the authors, to monitoring regularly the dynamics and effects of tax expenditures: (*i*) identify methods and criteria to revise the whole system and the single item in particular (as suggested in this paper); (*ii*) assess the fiscal sustainability conditions in medium and long term, moving from a static individual tax expenditures assessment (in the introduction year) to a dynamic year-by-year assessment and (*iii*) provide policy maker with a systematic revision and policy proposal to mitigate negative effect on efficiency and equity of tax expenditures.

References

- Aliu, F., Redonda, A., von Haldenwang, C., 2022. The Global Tax Expenditures Database (GTED) Progress Report. Deutsches Institut für Entwicklungspolitik gGmbH .
- Altshuler, R., Dietz, R.D., 2008. Tax expenditure estimation and reporting: A critical review. Technical Report. National Bureau of Economic Research.
- Barbetta, G.P., Pellegrino, S., Turati, G., 2018. What explains the redistribution achieved by the Italian personal income tax? evidence from administrative data. *Public Finance Review* 46, 7–28.
- Buckley, J.L., 2011. Tax expenditure reform: Some common misconceptions. *Tax Notes* 18.
- Burman, L.E., Phaup, M., 2012. Tax expenditures, the size and efficiency of government, and implications for budget reform. *Tax Policy and the Economy* 26, 93–124.
- Cherchye, L., Lovell, K., Moesen, W., Puyenbroeck, T.V., 2005. One market, one number? a composite indicator assessment of EU internal market dynamics. Technical Report. Working Paper Series ces0513, Katholieke Universiteit Leuven, Centrum voor Economische Studien.
- Cherchye, L., Moesen, W., Rogge, N., van Puyenbroeck, T., 2007a. An introduction to 'benefit of the doubt' composite indicators. *Social Indicators Research* 82, 111–145.
- Cherchye, L., Moesen, W., Rogge, N., Puyenbroeck, T., 2007b. An Introduction to 'Benefit of the Doubt' Composite Indicators. *Social Indicators Research* 82, 111–145.

- Edgar, T., 2008. A reconsideration of tax expenditure analysis. *Canadian Tax Journal* 56, 1038–1040.
- Karagiannis, G., 2017. On aggregate composite indicators. *Journal of the Operational Research Society* 68, 741–746.
- Mare', M., Porcelli, F., 2020. A political economy model of tax expenditures: Evidence from a cross-section of countries, in: Proceedings of the National Tax Association's 113th Annual Conference on Taxation, November 16th 2020, Denver, USA.
- Ministero dell'Economia e delle Finanze, 2016-2022. Rapporto annuale sulle spese fiscali. Technical Report. Ministry of Economy and Finance, Italy. Rome, Italy.
- Nardo, M., Saisana, M., Saltelli, A., Tarantola, S., Hoffman, A., Giovannini, E., 2008. Handbook on constructing composite indicators: Methodology and user guide. OECD Publishing .
- OECD, 2010. Tax Expenditures in OECD Countries. OECD publishing.
- Rogge, N., 2018a. Composite indicators as generalized benefit-of-the-doubt weighted averages. *European Journal Of Operational Research* 267, 381–392.
- Rogge, N., 2018b. On aggregating benefit of the doubt composite indicators. *European Journal Of Operational Research* 264, 364–369.
- Thakkar, J.J., 2021. Multi-criteria decision making. volume 336. Springer.
- Tyson, J., 2014. Reforming tax expenditures in Italy: What, why, and how? International Monetary Fund.
- Van Puyenbroeck, T., 2018. On the output orientation of the benefit-of-the-doubt model. *Social Indicators Research* 139, 415–431.
- Van Puyenbroeck, T., Rogge, N., 2017. Geometric mean quantity index numbers with benefit-of-the-doubt weights. *European Journal of Operational Research* 256, 1004–1014.
- Verbunt, P., Rogge, N., 2018. Geometric composite indicators with compromise benefit-of-the-doubt weights. *European Journal of Operational Research* 264, 388–401.
- Vidoli, F., Fusco, E., 2023. Compind: Composite Indicators Functions. URL: <https://cran.r-project.org/web/packages/Compind/index.html>. r package version 2.7.1.

Zhou, P., Ang, B.W., Zhou, D.Q., 2010. Weighting and aggregation in composite indicator construction: A multiplicative optimization approach. *Social indicators research* 96, 169–181.

Appendix A. List of tax expenditures

1. (#008) An amount equal to 19 per cent of interest payable and related charges paid in respect of agricultural loans and mortgages;
2. (#188) Purchase of season tickets for local, regional and inter-regional local, regional and inter-regional public transport services or for national rail transport services;
3. (#214) Detraction of the cadastral income of a property unit used as a principal residence;
4. (#215) Detraction, to the extent of 19%, of interest payable and related ancillary charges, to an amount not exceeding €4,000, incurred in respect of mortgage loans for the purchase or construction of the principal residence;
5. (#216) Detraction of fees paid to intermediaries for the purchase of the main residence for an amount not exceeding euro 1,000 per annum;
6. (#217) Detraction of insurance rates for disaster risk insurance provided in respect of residential property units;
7. (#218) Detraction for maintenance, protection and restoration expenses of property protected under Law no. 1089 of 1939 and Presidential Decree no. 1409 of 1963;
8. (#244) Detraction, to the extent of 50%, for the purchase of furniture and large household appliances of not less than class A for ovens, class E for washing machines, washer-dryers and dishwashers, class F for fridges and freezers, for appliances for which the energy label is provided, aimed at furnishing properties undergoing renovation;
9. (#268) Detraction, to the extent of 19%, for the part exceeding €129.11, of medical expenses, medical and specific assistance expenses;
10. (#286) Detraction, at the rate of 19%, for liberal donations in cash and in kind in favour of the State, the regions, local authorities, public bodies or institutions, organising committees, foundations and legally recognised associations;
11. (#314) Detraction, at the rate of 19%, of expenses for attendance of university education courses, first-cycle pre-schools and secondary schools;

12. (**#316**) Detraction, at the rate of 19%, for rental fees (contracts pursuant to Law no. 431 of 1998) stipulated by university students. The detraction is also available if the expenses were incurred in the interest of tax dependants;
13. (**#336**) Detraction of periodical allowances paid to a spouse, excluding those for child support, as a result of legal and actual separation, dissolution or annulment of marriage;
14. (**#346**) Detraction of veterinary expenses up to € 550, limited to the part exceeding € 129.11;
15. (**#347**) Detraction, at the rate of 19%, of funeral expenses not exceeding € 1,550 for each person;
16. (**#380**) Detraction of donations in cash and in kind in favour of the so-called third sector entities (Onlus, NGOs, voluntary bodies, etc.) up to 10 per cent of the total income and in any case up to a maximum amount of €70,000 per year;
17. (**#381**) Detraction of 19 per cent for nursery school attendance expenses;
18. (**#384**) Detraction for donations to political parties;
19. (**#608**) Detraction for annual membership/subscription for children between 5 and 18 years of age to sports associations, gyms, swimming pools, etc. identified by specific decree;
20. (**#999**) Detraction for donations to bodies active in the field of music, theatre and dance (#293) + Public bodies or institutions, foundations and legally recognised associations active in the field of the performing arts (#287).