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Reforming Energy Excise Duties:

A Possible Balance Between Environmental and Redistributive Objectives

Federica Lanterna (*)

Abstract

The paper suggests a possible strategy to reform energy excise duties to address the issue of climate change, following the provisions of the proposed revision of the Energy Taxation Directive. The analysis focuses on three products: petrol, diesel, and electricity consumption. The logic of the environmental reform follows the double dividend theory. Indeed, using a micro-simulation model on data from the Household Budget Survey provided by the Italian National Statistics Institute, a first reform scenario is simulated for the values of the excise duties mentioned. The focus is on the additional revenue generated by the environmental reform, which will be used to intervene firstly on VAT, the main indirect tax in Italy, and secondly on excise duties themselves. The aim is to demonstrate that more robust redistributive effects can be achieved by using public expenditure to limit the regressive effect of the environmental reform, working with a comprehensive tax reform.

Keywords: *Tax Reform, Energy excise duties, VAT, Redistribution*
JEL Classification: H200, H230, H310

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1. Introduction

In the Italian tax system, the structure of excise duties on energy products plays a key role. It is a form of tax whose structure and method of application are closely linked to the configuration of the main indirect tax, i.e., value-added tax (VAT). The following analysis focuses on three products: petrol and diesel used as motor fuels and household electricity consumption. The current level of excise duties under Italian law are € 728.00/1,000 liters for petrol, € 617.40/1,000 liters for diesel, and € 22.7 per MWh for electricity consumption by non-business users.[1] A comparison with some European countries, such as Germany, France, Spain, Austria, and Greece, shows that Italy has higher excise tax values for 2021 for all three products considered (European Commission, 2021). Together with VAT, which is applied at the standard rate of 22% for the two fuels and 10% for electricity, excise duties constitute the tax component of the price. Therefore, excise duties have an impact on the price of the product and, consequently, could change consumer behaviour. In the form of a sales tax on electricity consumption and a production tax on mineral oils, these taxes were introduced, respectively, in 1895, and in 1939. Their introduction was encouraged by their ability to generate significant revenues at a time when Italian public finances were in difficulty. They continue to provide an important source of revenue. Indeed, according to the Tax Revenue Bulletin published for 2021 (*Ministero dell'Economia e delle Finanze*, 2022), excise duties on energy products, their derivatives, and similar products, excise duties on electricity and surtaxes, and excise duties on natural gas for combustion provided about 13% of total indirect taxes. Furthermore, according to data from the *Istituto Superiore per la Protezione e la Ricerca Ambientale* (ISPRA) for 2019, environmental taxes amounted to € 58.7 billion, about 7.8% of total revenues. The total revenue from energy taxes for 2019 amounts to about €47 million and has been growing steadily since 2008.[2]

They are also widespread in several European countries. This aspect, together with the interdependence with VAT, encouraged and favoured the creation of a community excise system in the 1990s (Zopolo, 1962; Majocchi, 1993). The Directive 2003/96/EC "restructuring the Community framework for the taxation of energy products and electricity" represents the main framework for these products, listing the minimum rates of excise duty for each product, differentiated according to use.

In addition to the revenue profile and the need for broad harmonisation at European level, a third important consideration is that, in the same years as the harmonisation process has been called for, international bodies have been paying increasing attention to the dynamics of climate change and the polluting effects of fossil fuels. Excise duties on energy products and electricity began to be seen as a possible key to limiting environmental damage (Perrone Capano, 2001; Allena, 2014). A first significant step towards the adoption of common and effective measures to address climate change was taken with the signing of the Kyoto Treaty in 1997. This was the first international agreement in which countries committed themselves to reducing greenhouse gas emissions. Since the early 2000s, therefore, excise duties on energy products have increasingly taken on the character of environmental taxes. The environmental tax character is based on the theory of market failure and therefore configures the environmental tax as a *Pigouvian tax* to absorb the negative externality (Pigou, 1920). Excise tax levels have been modulated to discourage the consumption and use of fossil fuels, while at the same time promoting the transition to "green resources". However, over the years, the critical issues related to the heterogeneity in the levels of application of the rates and their determination based on the volume rather than the energy content of the goods have raised the need for a comprehensive review of the energy

[1] The values reported, as well as the rest of the analysis do not consider the recent interventions on excise values due to the conjunctural situation resulting from the Ukrainian-Russian conflict and the energy crisis.

[2] The category of environmental taxes is broader than the assessment of excise duties on energy products. In fact, according to the Eurostat (2001) definition, environmental tax includes *"A tax whose tax base is a physical unit (or a proxy of it) of something that has a proven, specific negative impact on the environment."* In Italy, this set includes taxes on energy, taxes on transport and taxes on pollution.

taxation system. Today, this review is even more necessary in Europe because of the targets set by the Green Deal and Fit For 55.[3]

These three aspects of excise duties on energy products, i.e., their capacity to generate significant revenue, their interaction with VAT, and the role attributed to them as environmental taxes to limit climate change impacts, constitute the basis of the work. Equally relevant is the analysis of the proposed revision of the Energy Taxation Directive.

Indeed, in order to address climate change, a proposal to revise the Energy Taxation Directive has been presented in July 2021.[4] The revision of the Directive should lead to a taxation of energy products that complements the measures included in Fit For 55 by taxing products according to their environmental impact. The proposal is based on two main considerations. On the one hand, it emphasises that Directive 2003/96/EC is outdated and ineffective in ensuring the proper functioning of the internal market. There are now differences in the rates applied by Member States and the minimum levels of excise duty set when the Directive was adopted no longer seem appropriate. Moreover, no indexation mechanism has been provided for the latter concerning price changes, which confirms that the planned excise duties are outdated. On the other hand, the Energy Taxation Directive does not seem to be consistent with the achievement of the 2030 target first and the 2050 target later, i.e., it is not in line with the climate and energy objectives. An intervention is therefore needed to rationalise and modernise the structure of excise duties, their level in terms of rates, as well as the broad framework of exemptions and reductions provided for, to ensure a more efficient and integrated functioning of the internal market. At the same time, the new Directive should overcome many of the current limitations and move towards environmental taxation. As regards the latter, several weaknesses have been identified in the current system of taxation of energy products and electricity. It favours the use of fossil fuels through extensive tax exemptions and reductions. The proposal therefore included the prospect of replacing taxation based on the quantitative volume of products with taxation based on their energy content. The proposal sets out three possible reform options. Option 1, the so-called "minimalist option" would provide for an adjustment of the current minimum values to the inflation rate in 2018 and an annual revision according to the harmonised index of consumer prices. The second option, known as the "energy content option" is, in turn, split into three further proposals. Common to all sub-proposals is the intention to base excise duties on the energy content of products. Option 2 provides for a transitional period during which the value of the rates for certain products would be changed. It is designed to give a gradual and clear price signal to businesses with a view to investment and technology. The distinction between option 2(a) and option 2(b) is based on the different lengths of the transitional period: ten years in the first case and seven years in the second. Option 2(c), on the other hand, would provide that the excise duty would also consist of a tax component linked to air pollution.

Finally, in option 3, excise duties would still be determined by two components: one based on energy content, following the values set out in options 2(a) and 2(b), and one element considering carbon content. Under Option 3, three further proposals can also be identified: a) a 10-year transitional period; b) a 7-year transitional period; c) the introduction of a third tax element based on air pollution, like Option 2(c).

Following these suggestions, the aim of the work is to implement changes in the values of excise duties on petrol, diesel, and electricity in line with the EU's environmental objectives and, consequently, to use the additional revenue generated by this reform to achieve redistributive effects and limit existing distortions, not only in the context of excise taxation itself but also in the area of VAT. In this sense, it follows the logic of the double dividend theory (Pearce, 1991; Goulder, 1994, 1995). The reform strategy for excise duties on energy products will follow option 2(a) of the analysed Proposal Directive. There are several objectives behind these reform proposals: (i) the desire to implement a fiscal environmental reform; (ii) the idea of implementing forms of intervention that are not limited to a single tax but extend

[3] It is evident that the implementation of these climate targets is also driven by a growing concern about the acceleration of climate change.

[4] Proposal for a Council Directive restructuring the Union framework for the taxation of energy products and electricity (recast). COM (2021) 563 final, Bruxelles, 14.7.2021.

to the field of indirect taxation; (iii) to demonstrate that, to achieve redistributive effects, it is more effective to use public expenditure rather than taxation. I will show that this type of reform can lead to two important outcomes. Firstly, it considers the reform of excise duties to bring them into line with European climate objectives. Although the environmental analysis of this reform is not the focus of the analysis, it will be relevant in terms of the additional revenue it will generate. Indeed, it will be shown that reform with a single VAT rate combined with a cash transfer to the poorest families can achieve redistributive effects that are stronger than the current multiple tax-rate configuration. The redistributive robustness of the cash transfer is also demonstrated in the context of the same taxation of energy products. To carry out this analysis, a micro-simulation model on Household Budget Survey data is used, which simulates first changes in excise values and then changes in VAT and the implementation of the cash transfer.

To the best of our knowledge, there are no evaluations for Italy that include hypotheses of reform of excise duties on energy products and intervention in VAT at the same time, just as there are no proposals that combine an environmental reform with the distribution of a monetary transfer. Therefore, this analysis contributes relevant policy recommendations in equally important areas such as environmental policy issues and the restructuring of indirect taxation, which are currently being widely discussed in Italy and beyond.

The structure of the paper is as follows. Section 2 gives an account of the most prominent literature on some main topics: the role of excise duties as environmental taxes; the redistributive effect of excise duties and the use of revenues from environmental reforms for redistributive policies. Section 3 deals with the data and the methodology used to perform the analysis. Section 4 will show the redistributive outcome of different scenarios. First of all, I will analyse the current structure of excise duties on petrol, diesel, and electricity. This scenario will represent the *status quo* against which the reform of these excise duties following the proposals contained in Option 2(a) of the proposed revision of the Energy Taxation Directive will be compared. Finally, the increased revenue from this reform will also be used to simulate a VAT reform and an excise duty reform to assess the redistributive effects. Section 5 concludes.

2. Literature review

The role of energy excise duties has changed during the years. In the beginning, they were mainly employed to collect revenue. However, the increasing attention related to climate change has highlighted their potential in the form of environmental taxation. It is also emphasised that the ability to generate considerable revenues is closely linked to the environmental aspect. Indeed, these revenues could be used to implement environmental policies. At the same time, they could be dedicated to social and distributional policies to limit the regressive impact of excise duties on less well-off households.

The choice of instruments to achieve effective environmental protection is closely linked to "environmental damage" that is a classic example of a negative externality. The discussion of market failures and externalities in Pigou's 1920 work *"The Economics of Welfare"* and subsequent versions is considered a milestone in this regard.[5] The instruments to correct this market failure and thus overcome the divergence between social and private costs are generally distinguished between *"command and control regulation"* and *"market-oriented forms"* (Barthold, 1994; Bardazzi et al., 2004; Fullerton et al., 2010). The first category generally includes regulations that set specific limits on polluting activities or environmental quality standards, e.g., in terms of emissions. The second category includes

[5] The author emphasises the notions of private marginal net product and social marginal net product: the difference between the two values determines the origin of the externality. Specifically, in the case of a negative externality, a difference is found between the private and social costs, with the former being lower than the latter. The general conclusion is that the quantity produced in the presence of a negative externality will be greater than the socially optimal quantity.

instruments such as taxes and subsidies as well as the introduction of tradable emissions markets and auctions of emissions rights. Taxes are traditionally referred to as "Pigouvian taxes", and this concept is central to environmental policy. Since a negative externality leads to an inefficient allocation of resources and a failure to determine the optimal equilibrium price and quantity, as mentioned above, imposing a tax on the producer of the externality itself allows the damage caused to be internalised in its cost function. The tax is set equal to the marginal external cost at the optimal level of the externality. In this way, the externality would be fully reabsorbed by transforming the external cost into an internal cost for the producer causing the environmental damage. Moreover, these tax structures can raise large amounts in terms of tax revenue, which can be used for social and distributive policies.

The potential use of environmental taxes has given rise to a literature that has studied their advantages and disadvantages, comparing them with other available instruments, in particular with regard to instruments classified as "command and control" (Smith, 1992; Cropper and Oates, 1992; Barthold, 1994; Bovenberg and Cnossen, 1995; Smith, 1998; Fullerton et al., 2010; Mirrlees Review, 2011).[6]

Environmental taxation in the form of excise duties, which can be seen as an alternative to direct taxation of emissions (Smith, 1992), has played a central role in major political and economic debates since the first attempts to create a European Community. This is due to its possible flexibility in achieving extra-fiscal objectives. It has been emphasised that an environmental tax, by increasing the price faced by economic operators, encourages them towards less polluting products. Smith (1998) argue that "*These existing excises were created for purely fiscal reasons, but they offer scope for changes in the rates or structure of the excise to reflect current environmental concerns. Changes to the overall level of mineral oil excises will affect the incentives for fuel choice as between those fuels subject to the excise duties and those which are currently taxed. In addition, the relative tax rates applied to different taxed fuels may be altered to differentiated between those that are more and less environmentally damaging.*"[7]

It follows from the above considerations that excise duties on energy products influence the price of these goods, changing the behaviour of producers and consumers towards less polluting production and consumption, respectively. However, regarding the impact on consumers, it is generally recognised that "[…] *any policy to raise the price of energy will disproportionately impact poor households*" and, therefore, "*one of the major concerns that always arises when energy taxes are discussed is equity*" (Metcalf, 2009).[8] This observation has been analysed and supported by a large theoretical and empirical literature, including works by Fullerton *et al.* (2010), Rausch *et al.* (2011), Mirrlees Review (2011), Kosonen (2012), Williams *et al.* (2015), OECD (2017) and Pizer e Sexton (2020). The identification of energy taxes as regressive taxes stems from the consideration that "[…] *raising the cost of fuels and energy-intensive goods implies a larger percentage decline in overall consumption for poorer households because those goods often comprise relatively large shares of low-income household's budgets*" (Pizer and Sexton, 2020).[9] Thus, these goods that are today commonly accepted as essential necessities represent a significant expenditure in the budgets of poorer households compared to

[6] Among the forms of environmental taxes, the so-called carbon tax, which is generally considered to be a form of "direct" taxation of emissions and therefore aimed at tackling pollution, plays a key role (Elkins e Baker, 2001; Fullerton *et al.*, 2010). The issue of the carbon tax is rather controversial and still open: it has been proposed at various times in the past, both in Italy and in Europe, but it has never been definitively applied, except in some northern European countries. Moreover, at almost the same time as the possible introduction of a carbon tax was being discussed, the European Union was preparing to adopt the Emissions Trading System (ETS), another instrument that falls into the category of "market-based instruments" (European Directive 2003/87/CE). This is a form of incentive for companies to reduce polluting production, as the "cap and trade" mechanism set up under the ETS would require companies to buy permits to pollute at a market price.

[7] Smith, S. (1998). Environmental and public finance aspects of the taxation of energy. *Oxford review of economic policy*, *14*(4), p. 71.

[8] Metcalf, G. E. (2009). Designing a carbon tax to reduce US greenhouse gas emissions. *Review of Environmental Economics and Policy3: p. 63-64*.

[9] Pizer, W. A., e Sexton, S. (2020). The distributional impacts of energy taxes. *Review of Environmental Economics and Policy,* p. 106.

wealthier households. This results in a higher incidence of excise duties on these goods for the former group. The redistributive effect of excise duties depends on several factors: (i) how the incidence is assessed; (ii) which products are considered; (iii) how the tax revenue from the application of excise duties is employed.

The first aspect relates to the controversy still present in the literature and often discussed in the case of VAT, whether the incidence of such taxes should be measured against a measure of income or expenditure. Poterba studies (1989; 1991) are a milestone in arguing that the use of total expenditure as a proxy for lifetime income is a more appropriate way of assessing the fiscal impact of excise duties than annual household income, which is considered to be a rather volatile measure. Successive studies, such as Smith (1992), Barker and Köhler (1998), Symons et al. (2002), and Sterner (2012) follow the same considerations as Poterba, assessing the impact of excise duties both on the income of households and on their total expenditure. The general conclusion is that the regressivity of excise duties appears to be mitigated when assessed in relation to total household expenditure, ordered on the basis of the same dimension, than when assessed in relation to the income.

A second aspect stems from the consideration that these excise duties do not have the same distributive effect. It is noted that *"electricity consumption drives much of this regressivity"* (Pizer and Sexton, 2020). Indeed, the theoretical and empirical literature has found regressive effects in the analysis of taxes on electricity. On the contrary, in the case of taxes related to transport or excise duties on fuels, less regressive results have been found, and in some cases progressive results (Johnson *et al*., 1990; Barker and Köhler, 1998; European Environment Agency, 2011; Flues and Thomas, 2015; Pizer and Sexton, 2020). This is the result of a number of considerations. Firstly, all households need a certain amount of energy, and this is the part that cannot be saved. In addition, the poorest households may not have the resources to invest in energy efficiency products due to liquidity constraints. Finally, there are few substitutes for household energy, unlike the use of fuels that can be replaced by means of transport other than cars.

Thus, a general regressive effect of excise duties on energy products and electricity, is observed. However, these taxes should not be observed in the light of distributive instruments. Indeed, on the one hand, they are indirect taxes and, on the other hand, as the very logic and concept of "environmental taxes" makes clear, the objective of these taxes at most is environmental protection. The importance should be reflected in the tax revenues they generate and the way in which they could be used. They can be used to consolidate public accounts; on the other hand, they can be employed to implement policies to mitigate the negative redistributive effects of environmental taxes. In the latter case, benefits and positive redistributive effects can arise depending on how the policy maker uses the revenue. For example, the revenue may be used to reduce the burden of existing taxes in the system, or it may be distributed as a transfer to poorer households. This approach is known in the literature as *"double dividend theory."* Indeed, operating in this way would produce two "dividends": the first is closely linked to the environmental tax, i.e., to reduce the level of pollution; the second takes the form of an increase in the welfare and efficiency of the system by reducing pre-existing distortions. The earliest formulations of the theory can be found in the late 1960s in Tullock (1967). The author does not explicitly mention the notion of "dividend" but points out how *"if some activity imposes an external cost, then a properly calculated tax on it will reduce the total output of the private sector by less than the revenue received by the government."*[10] However, it was not until the early 1990s that the double dividend theory gained wider acceptance and recognition, coinciding with the increasing focus on climate change concerns.[11] The works that revived the debate are generally identified in the studies by Pearce (1991) and Goulder (1994, 1995). In the first work, the author discusses the possible introduction of a carbon tax in the United States, following the indications provided by the IPCC (Intergovernmental Panel on Climate Change) in 1990, pointing out that the introduction of such a tax would have the double positive effect of correcting the negative externality associated with the use of fossil fuels and of

[10] Tullock, G. (1967). Excess benefit. *Water Resources Research*, *3*(2), p. 643.

[11] Note that the First Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) was published in 1990.

generating tax revenues that could be used to correct distortions associated with income or corporate taxes. This argument has often been used to support the introduction of a carbon tax, which is generally strongly opposed in the political debate. This vision also began to be promoted in international organisations (European Commission, 1994; Environmental Agency, 2011) and national governments in connection with the proposal of environmental tax reforms, where the introduction of a carbon tax or an increase in excise duties on energy products and electricity was advanced. Specifically for Italy, Law No. 448 of 23 December 1998 provided for the introduction of a carbon tax, explicitly stating that the increased revenue would be used to reduce the burden of labour costs. This type of literature and the potential distributional impacts that could result from the use of resources in social and economic policy have been empirically analysed (Groothius, 2016; Hogg *et al.*, 2016; Sasmaz, 2016).

Forms of the double dividend hypothesis were indeed implemented in the 1990s in some European countries, such as Germany, Sweden, Denmark, the Netherlands, and Finland. The issue has been raised several times in Italy, where environmental tax revenues are particularly important, as mentioned above. In turn, most theoretical and empirical assessments concern the role of the carbon tax (Bardazzi et al., 2004; Tiezzi, 2005; Villani, 2006; Faiella and Cingano, 2015). It should also be noted that the European Commission, through its country-specific recommendations, has invited Italy to shift the tax burden from production factors to environmental taxes (in addition to consumption and property taxes). This specific recommendation to reduce the tax wedge on labour has been made several times: first in 2012, again in 2013, and again in 2014. Subsequent recommendations on the environment, first in the 2019 European Semester and more recently in 2022, urge Italy to align itself with European climate goals and to carry out a thorough rationalisation of the numerous tax expenditures and subsidies in the environmental field.

Finally, when discussing the redistributive effects of energy taxation, it is worth mentioning the aspects related to energy poverty. It has received great attention in economic literature and public policy since the pioneering work of Boardman (2013) and nowadays plays a prominent role in legislative and non-legislative discussions in the European context as well. Indeed, the issue has recently been seen as particularly important because of the energy crisis resulting from the Russian-Ukrainian conflict. However, energy poverty issues also feature in the European climate change strategies mentioned above. Indeed, the need to address this form of poverty is explicitly mentioned in both the European Green Deal and the proposed revision of the Energy Taxation Directive. In these contexts, it is still emphasised that an environmental tax reform must then take due account of the consequent effects at the social level, as has been shown above.[12] Although recognised as a major challenge in European policy, there is still little agreement on the definition and measurement of energy poverty. According to the guidelines of the European Parliament, a condition of energy poverty can be defined as "a situation where a household cannot meet its domestic energy needs" (European Commission, 2022). Energy needs, generally, include the need for heating, cooling, lighting, and other energy-essential services. The difficulty in defining and measuring it stems from the fact that it is influenced by so many factors (among many, see Reddy, 2000; Bouzarovski and Petrova, 2015; González-Eguino, 2015; Siksnelyte-Butkiene *et al.*, 2021; Aristondo and Onaindia, 2023; Hasheminasab *et al.*, 2023). Among the various factors affecting energy poverty, the most commonly recognised are a low level of income, the aspects related to the energy supply-side, like the unavailability of certain forms of energy, the inefficiency of social and energy policies addressing the issue, and demographic and climatic conditions. This multidimensional aspect of energy poverty causes a problem in its measurement, as it cannot be measured by a single indicator.[13] With a view to tackling energy poverty, therefore, the efficient use of resources obtained from environmental reform becomes even more important.

[12] The proposal for a revised Energy Taxation Directive refers to the possibility of targeted tax reductions to address the social impact of energy taxes, and exemptions from taxation to protect the most vulnerable households.
[13] Regarding measurement issues, see, among many, two recent contributions: Menyhert (2022), Koukoufikis and Uihlein (2022).

3. Methodology and data

In order to analyse the distributive power and the effect of alternative fiscal reform on energy excises duties, we use a static microsimulation model built on the Household Budget Survey (HBS) data provided by the Italian National Institute of Statics (ISTAT) for 2019.[14] These models are used in the distributional assessment of tax-benefit systems, in their legislative configuration, and in the implementation of policy scenarios. It has been noted that they are also used to assess the impact of excise duties on energy products and, more generally, of environmental taxes, at least as far as the impact on consumers is concerned (Smith, 1996). Examples include the OECD report by Flues and Thomas for the 27 European countries (2015), the study by Symons et al. (1994) for the United Kingdom, the work by O'Donoghue et al. (2004) and Amores et al. (2022), both of which use the EUROMOD model, but in the second study it is integrated with the new Indirect Taxation Tool (ITT); for a specific Italian case, see the work by Brunetti and Calza (2015).[15]

For 2019, the HBS includes 501 expenditure items and a sample of almost 19 thousand households, corresponding to around 26 million households. The analysis focuses on specific energy products, looking in detail at household expenditure on petrol, diesel, and electricity.

To define and specify the microsimulation model, the strategy of O'Donoghue et al. (2004) and Flues and Thomas (2015) was followed. Unlike VAT, which applies to expenditure net of VAT, excise duties apply to physical quantities for which no information is available in the national consumption surveys. Quantities are therefore determined based on the unit prices of the products concerned. In detail, following the terminology of O'Donoghue et al. (2004), the expected excise revenue (ED) is obtained by formula (1).

(1) $ED = C_{pt} * edr = \frac{E_{retail}}{unit\ price} * edr$

where, C_{pt} indicates the quantity consumed by the goods subject to excise duty, edr the value of the excise duty, and E_{retail} the price after tax. This approach has been applied to petrol, diesel, and electricity. Therefore, for each product considered the value of the excise duty applied according to the 2019 legislation, the unit price for 2019 and the net expenditure have been identified. As regards fuels, price information was obtained from the annual average price publications of the Ministry of Ecological Transition. Specifically, the annual average price excluding VAT was used. For electricity, on the other hand, the price was derived from the Eurostat database, with reference to household consumption; again, the price excluding VAT was used. In detail, the prices and excise duties applied to each product are shown in Table 1.

[14] Micro-data on the HBS are also available for 2020 and 2021. However, they are expected to be affected by the shock of the Covid-19 pandemic; the survey for 2019 was therefore considered preferable.

[15] It should be noted that computable general equilibrium (CGE) models are also widely used and applied to analyse the effects of environmental taxes. Their widespread use is due to their ability to assess the long-term effects of environmental tax reform on the prices and quantities of goods consumed. On the use of a CGE model, see, among others, Rausch et al. (2011); Fullerton et al. (2011); Antimiani et al. (2022).

Table 1 - Price values per product and excise duties.

	Price net of VAT	Excise duties
Petrol	1.290,37 € / 1.000 litres	€ 728,40 / 1.000 litres
Diesel	1.212,72 € / 1.000 litres	€ 617,40/ 1.000 litres
Elecricity	0,2090 € / kWh	€ 22,7 per MWh

Note: Electricity price refers to the first half of 2019.

Source: Fuel prices are derived from the Ministry of Ecological Transition: https://dgsaie.mise.gov.it/prezzi-annuali-carburanti; electricity price from Eurostat: https://ec.europa.eu/eurostat/databrowser/view/nrg_pc_204/default/table?lang=en.

The main assumption of the model is the full pass-through of changes in excise values to the final consumer. This is a strong assumption that is, however, particularly common in the study of consumption taxes. It should be noted that the two aforementioned studies used to determine the model, namely O'Donoghue et al. (2004) and Flues and Thomas (2015), both adopt this assumption.[16]

According to the *Relazione del Libro Blu* for 2019, provided by *Agenzia Dogane Monopoli* (ADM), the amount of revenue from excise taxes on energy products is about € 25 billion, while about € 2.7 billion is derived from excise taxes on electricity. The total amount of excise duties on the above products estimated in the model is around € 16.5 billion. It should be noted, however, that the category of energy products as reported in the ADM estimates includes, in addition to petrol and diesel, other products such as heating oil and paraffin, which are not included in this analysis. The estimate obtained is, therefore, considered to be sufficiently close to the value provided in the report to validate the model.

To analyse the redistributive effect of excise duties, and of the fiscal reforms implemented I will make use of tools that are common in this literature: the Gini index, the Reynolds-Smolensky (RS) index, and the Suits index (S).

The Gini index (Gini, 1912; 1914) is an indicator of the degree of inequality in the distribution. It takes values between 0, perfect equidistribution, and 1, maximum inequality. The Reynolds-Smolensky index measures the net redistributive effect. It is obtained as the difference between the Gini before tax index (G_Y) and the Gini after tax index (G_{Y-T}), as in formula (2).

(2) $RS = G_Y - G_{Y-T}$

It can be rewritten, as in formula (3), by splitting it into three components: i) the Kakwani index (K), a measure of the degree of progressivity, i.e., how much the effect of a progressive tax differs from what would be obtained with a proportional tax, reached as the difference between the tax concentration index ($C_{Y,T}$) and the pre-tax Gini index (G_Y); ii) the average tax rate $\left(\frac{t}{1-t}\right)$; iii) the re-ranking effect (R),

[16] Note that the assumption of full pass-through to the final consumer is also adopted by Decoster *et al*. (2010); Smith (1992); Peter et al. (2007); CPB (2010); Leahy *et al*. (2011); Brunetti and Calza (2015), among others. For an overview of the price and income elasticities of demand for petrol and diesel, see Sterner (2012). The author, besides presenting some studies on the topic, also points out that "*While a range of estimates is found, the consensus is that the long-run price elasticity is around 0.8, while the corresponding income elasticity is around unity. Short-term elasticities tend to be about less than a third of the long-term ones.*" Similar estimates are reported in Flues and Thomas (2015), where the authors again refer to the work of Espey (1998) and Espey and Espey (2004), where they also trace the estimated elasticity of demand for electricity with respect to income, which is found to be 0.92. The elasticity of demand for electricity with respect to price, on the other hand, is essentially zero because, as it turns out, there are no substitutes to which consumption can be shifted in the face of a change in the price of the good in question (Rajah, 1996). Furthermore, it has been mentioned that the model is non-behavioural, i.e., it does not consider how consumers might change their spending habits as a result of changes in excise duties. It is not easy to take account of behavioural effects in microsimulation models; to do so would require the introduction of a system of additional assumptions and more detailed data. For this reason, non-behavioural models are generally used (Pizer and Sexton, 2020).

i.e., the re-arrangement that might take place in the shift from the distribution of gross income to net income, among taxpayers.

(3) $RS = K\,\frac{1}{1-t} + R = (C_{Y,T} - G_Y)\left(\frac{t}{1-t}\right) + \mathrm{R}$

The higher RS is, the greater the redistributive capacity of the system will be. Finally, the Suits index (Suits, 1977) is a measure based on the relation between the cumulative share of pre-tax income and the cumulative share of the tax burden. The Suits index is given by 1 minus the ratio between the value of the area below the Lorenz curve (L) and the value of the area below the equidistribution line (K), as reported in formula (4).

(4) $P^s = 1 - \frac{L}{K}$

The index would be zero under a proportional tax; it would be positive with a progressive tax; and negative with a regressive tax.

4. Empirical Analysis

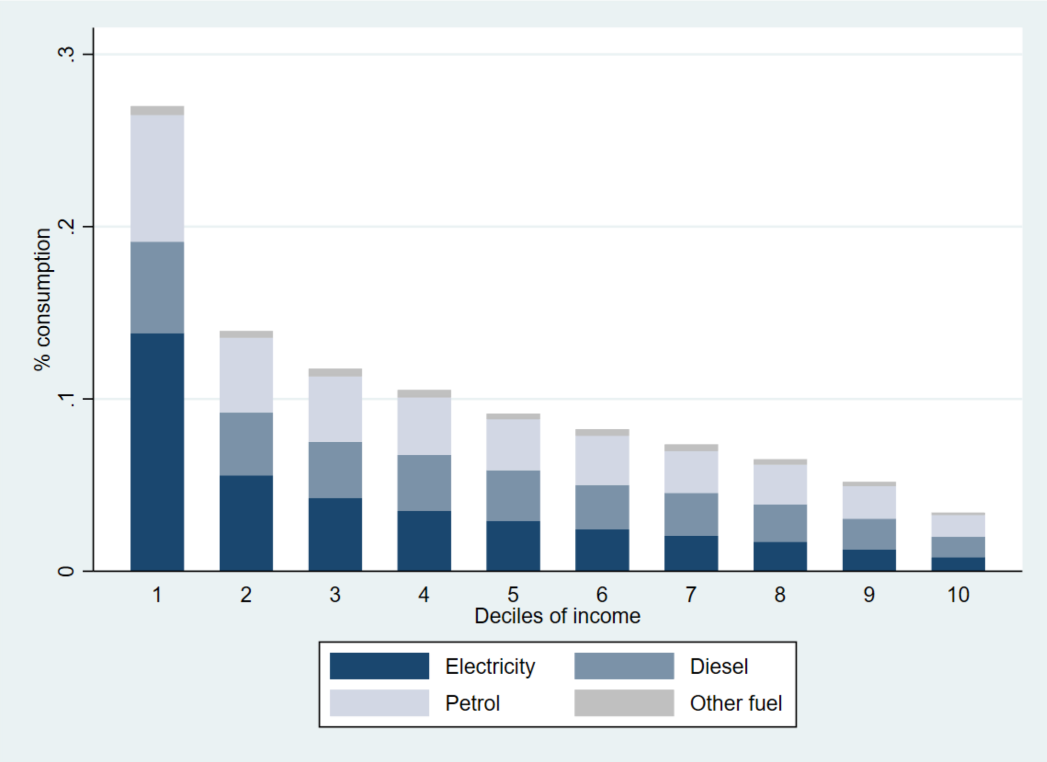
The first part of the analysis presents a distributive assessment of the excise duties on energy products. This assessment will involve at first the configuration of excise duties in Italy under the 2019 legislation, for an analysis in line with the adopted ISTAT data. Subsequently, a reform scenario on excise duties on energy products will be presented, in line with the proposals contained in the Proposed Revision of the Energy Taxation Directive. The second part, instead, focuses on the possible re-use of the additional revenue from the environmental reform. In a double dividend perspective, we will act autonomously by simulating first a VAT reform and second an excise tax reform.

4.1 Energy excise duties: status quo scenario

The legislative configuration of excise duties for 2019 represents the *status quo* scenario against which alternative scenarios are compared. First, the distribution of consumption among households can be observed. Figure 1 shows the percentage of household expenditure on the goods under consideration, (electricity, petrol, diesel, and other fuels) by decile of total income.[17]

[17] However, the focus will not be on "other fuels" as it is not possible to determine the composition of this category.

Figure 1 - Consumption of electricity, diesel, petrol, and other fuels by households.



Source: Author elaboration on ISTAT data, 2019.

The graph shows that poorer households tend to spend a higher proportion of their income on electricity than richer households, leading to a degree of regressivity in consumption. This observation is consistent with the findings in Section 2, where it was noted that electricity is considered a necessity good and that, unlike products used as fuels, it has a relatively narrow range of substitutes (Johnson et al., 1990; Flues and Thomas, 2015; Pizer and Sexton, 2020; Amores et al., 2022). In contrast, the regressivity of fuels relative to income appears to be more modest.

This aspect can be examined using two distributional indicators: the distributional characteristics of goods (DC) and the Gini elasticity (K_J). The former provides a measure of how the consumption of each good is distributed along the income distribution. It can be assessed through formula (5).

(5) $DC_i = \frac{\sum_{h=1}^{H} \beta^h x_i^h}{\bar{\beta} X_i}$

In the formula, x_i^h represents the consumption of each good *i* by individual *h*, where H denotes the total number of individuals; X_i denotes total consumption; $\beta^h = \frac{1}{(x^h)^e}$ is a social weight for each individual *h* that depends on an inequality aversion parameter *e*, while $\bar{\beta}$ represents the average social weight. It follows from the formulation that the higher the value of the DC index, the more the consumption of the good will be concentrated among poorer households.

Gini elasticity, on the other hand, is obtained through formula (6).

(6) $K_J = \frac{C_j^y}{G^y}$

The index is determined by the ratio of the expenditure concentration coefficient of good *j*, considering households ranked according to the level of total expenditure (income) (C_j^y) to the Gini index of total expenditure (income) (G^y). A value of K_J greater than 1 indicates goods whose expenditure is more concentrated among the richest households than total expenditure; conversely, if K_J takes values less than zero, it signals the presence of inferior goods, and therefore goods whose expenditure is proportionally more concentrated among the poorest households; finally, for values between 0 and 1, the measure signals expenditure on good j that is more evenly distributed than total expenditure. The two measures, distributional characteristics, and Gini elasticity have been assessed for the goods considered: petrol, diesel, and electricity. The results are presented in Table 2.

Table 2 - Distributional Characteristics and Gini elasticity.

	Distributional Characteristics DC_i			Gini elasticity K_J
	e =0,5	e = 1	e =2	
Petrol	0.9160	0.8308	0.6511	0.6786
Diesel	0.9031	0.8029	0.5962	0.7653
Elecricity	0.9976	0.9958	0.9899	0.0514

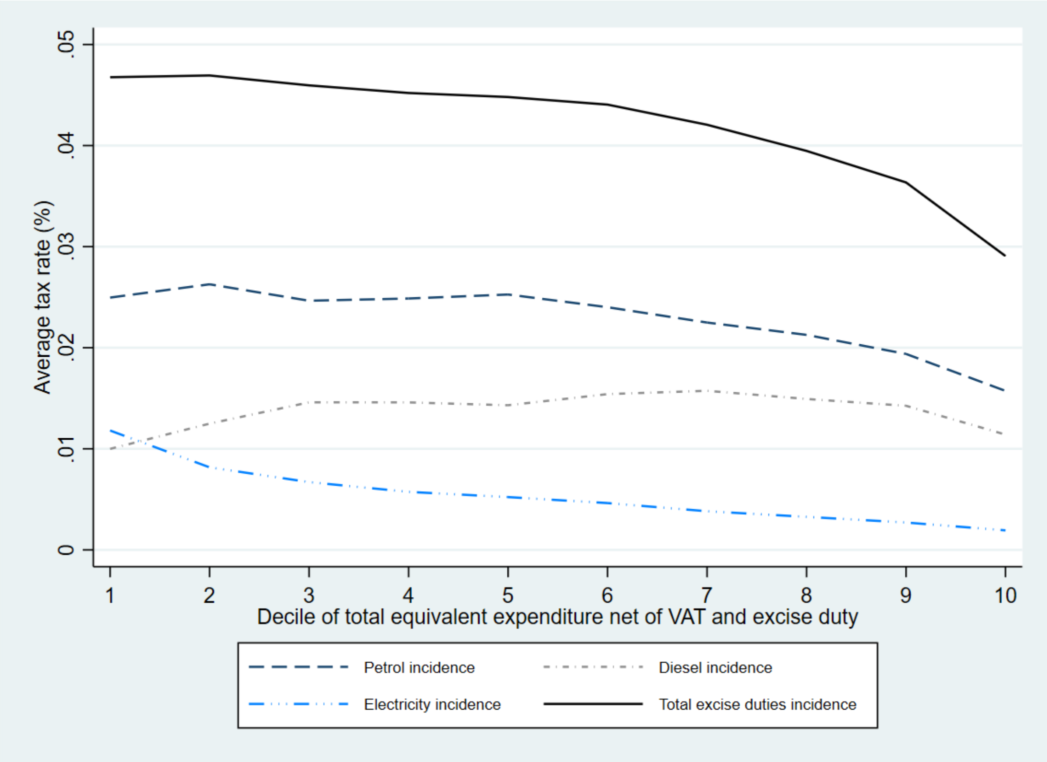
Source: Author elaboration on ISTAT data, 2019.

The distributional characteristics has been evaluated for three different values of e, the inequality aversion parameter: 0.5, 1 and 2. In all three cases, it can be observed that the DC value for electricity is always higher than for petrol and diesel. The high DC values for electricity, which are always close to 1, confirm the result already seen graphically in Figure 1, i.e., that electricity consumption appears to be more concentrated among poorer households than petrol and diesel. This result is also confirmed by the Gini elasticity values in the last column of Table 2. In fact, K_J for electricity takes a value close to zero (0.0514), indicating that it is a good whose consumption is that is more evenly distributed than total expenditure. The values for petrol (0.6786) and diesel (0.7653), on the other hand, are closer to unity but still lower, indicating a high concentration of the respective expenditures among the richest households.

In a second phase, the trend of the average rate has been assessed in order to obtain a measure of the incidence of excise duties. The average rate has been determined as the ratio of the amount of excise duty paid to taxable expenditure net of VAT and excise duty per decile of total equivalent expenditure net of VAT and excise duty.[18] The average rate has been calculated for each product separately and for the total. The trend is shown in Figure 2, while the values are shown in Table 3.

[18] An "equivalence scale" is used to take account of differences in household composition and size. Specifically, the OECD equivalence scale is used, which assigns a coefficient of 1 to the first member of the household, a coefficient of 0.7 to each additional adult member and a coefficient of 0.5 to members under the age of 14.

Figure 2 - Average rate of excise duty per decile of total expenditure net of VAT and excise duties.



Source: Author elaboration on ISTAT data, 2019.

Table 3 - Average excise rates per decile of equivalent expenditure net of VAT and excise duties.

Deciles	Average rate of excise duty on petrol (%)	Average rate of excise duty on diesel (%)	Average rate of excise duty on elecricity (%)	Average total excise rate (%)
1	0.030	0.012	0.011	0.053
2	0.029	0.015	0.008	0.052
3	0.026	0.016	0.006	0.049
4	0.026	0.017	0.005	0.048
5	0.025	0.016	0.005	0.045
6	0.024	0.017	0.004	0.046
7	0.022	0.016	0.004	0.042
8	0.020	0.016	0.003	0.039
9	0.019	0.014	0.003	0.035
10	0.015	0.011	0.002	0.028

Source: Author elaboration on ISTAT data, 2019.

The overall picture that emerges from both the graph and the analysis of the values is that excise duties tend to be regressive, even when measured in terms of expenditure. The independent analysis of the three products shows the highest incidence for petrol, with a difference between the first and the last decile of around 1.5 percentage points, to the disadvantage of the poorest households. The excise duty on diesel, on the other hand, appears to be at most proportional, although there is also a modest progressive effect in the first part of the distribution. The excise duty on electricity also shows a regressive trend, with a gap of about one percentage point between the first and the last decile of equivalent expenditure net of VAT and excise duty. The results obtained from the breakdown of the analysis for the three products are then confirmed by the analysis for total excise duties, where the regressivity of the tax is still evident and the gap between the rate of the first decile and the rate of the last decile is around 2.5 percentage points. Excise duties thus confirm their regressivity, albeit when measured against an expenditure measure. The results are consistent with the literature; in particular, we refer to the findings of Flues and Thomas (2015).[19]

The regressivity of excise duties is confirmed by the progressivity and redistribution indices, shown in Table 4.

Table 4 – Redistributive indices 2019.

	Petrol excise duty *status quo* (%)	Diesel excise duty *status quo* (%)	Energy excise duty *status quo* (%)	Total excise duties *status quo* (%)
Gini pre-tax	0.314	0.314	0.314	0.314
Gini post-tax	0.314	0.314	0.314	0.315
Reynolds – Smolensky index	-0.001	0.000	0.000	-0.001
Kakwani index	-0.062	-0.028	-0.227	-0.067
Suits index	-0.073	-0.042	-0.230	-0.078

Source: Author elaboration on ISTAT data, 2019.

Both the decomposition of the analysis by product and the consideration of the combined effect of the three excise taxes show complete equality between the pre-tax and post-tax Gini indices, indicating a zero redistributive effect. The same result is obtained when considering the Reynolds-Smolensky index, which is zero in the case of excise duties on diesel and electricity and slightly negative in the case of petrol. The progressivity index, measured by the Kakwani index, is always negative, indicating the regressivity of excise duties, especially in the case of electricity. This regressivity is also confirmed by the negative values of the Suits index.

4.2 Proposal for reform of excise duties on energy products

As mentioned above, the European Commission proposed a general review of the taxation of energy products and electricity in the final document COM (2021) 563 of July 2021. The document presents three general reform proposals, the last two of which provide for several possible scenarios, differentiated in terms of the timing related to the transitional period for the implementation of the reforms. In the present work, the strategy referred to as "Option 2" has been followed. It is based on the parameter "energy content", i.e., minimum rates should be set according to the energy content of each product, instead of the current volume-based determination. A second relevant indicator, closely related to the first, is then identified in the *"environmental performance"*, based on which energy products are classified into five categories, starting with the most polluting and therefore the products to which the highest rate should be applied, which would be gradually reduced: (i) traditional fossil fuels and non-sustainable biofuels; (ii) paraffin, within aviation fuels; (iii) LPG, natural gas and non-renewable hydrogen; (iv) sustainable but not advanced biofuels; (v) electricity, advanced and electronic fuels.

Option 2 consists of three sub-options. For the purposes of this work, option 2(a) will be followed. This choice is justified by the considerations set out in the Impact Assessment presented at the same

[19] Results were also obtained using an income measure. In this case, a more pronounced regressivity of excise duties is confirmed. The results are available upon request.

time as the proposal for the revision of the Directive. From the comparison of the different options and the analysis of the achievement of the objectives, the document concludes that options 2 and 3 appear to be the most suitable options for this purpose. It also adds that the longer transitional period of ten years is preferable to the more limited period in terms of social outcomes.

The proposed directive under option 2(a) sets minimum levels of excise duty on energy products and electricity for 2023 and 2033, which is the end of the transitional period.[20] The idea is that Member States with minimum rates below the levels set out in this option would adapt to them. The present work considers the values for the transitional period of ten years until 2033. Table 5, columns two and three, show the values of the current EU minimum excise duty and the proposed revision of the latter for 2033 for the products analysed in this work.

Table 5 - Current excise values, minimum levels proposed by option 2(a) and excise values applied in the reform.

	Current minimum tax rate	Minimum excise Proposal - 2033	Current excise duties Italy	Simulated excise duties - reform
Petrol (€/1.000 litres)	359.0	443.2	728.4	898.7
Diesel (€/1.000 litres)	330.0	481.8	617.4	900.8
Electricity (€/MWh)	1.00	0.67	22.7	15.2

Source: Author elaboration on ISTAT data, 2019.

For the sake of completeness, column 4 of Table 5 also shows the excise duty levels currently applied in Italy. It can be seen that these values are higher than the minimum values proposed in Option 2(a) for 2033. The work, therefore, proceeded to determine new values for excise duties by applying a growth rate between the current minimum excise duty and the minimum excise duty under Option 2(a) to the current level of excise duty applied in Italy. This procedure was carried out for the 2033 values and each product separately and resulted in the excise duties shown in the last column.[21]

The first outcome examined is the revenue achieved. The simulation shows an increase of about € 4.3 billion compared to the analysed *status quo* revenue. This is an important amount from the point of view of the recycling of tax revenue, i.e., from the point of view of the double dividend theory. The implemented model does not allow for an analysis of the environmental impact of the first dividend, i.e., how changes in the level of excise duties affect the environmental good: this analysis is not the focus of the work. Instead, the focus will be on the second dividend, i.e., how to redistribute this amount to achieve redistributive outcomes by working on the tax design of the tax system.

We are also aware that revenues from increased energy taxes are not constant over time but will decrease over the years. This decline is because there will be less and less dependence on the use of fossil fuels, both through energy-saving behaviour and through the use and consumption of sustainable alternative resources. This issue is also addressed in the impact assessment carried out for the proposal to revise the Energy Products Directive. Indeed, it is estimated that in the "baseline" scenario, i.e., the scenario representing the reference framework according to the climate legislation already agreed for the 2030 targets, a reduction in energy tax revenues of around 32% will be realised in the period between 2020 and 2035.[22]

[20] For details of the values, see Tables 2 and 3, pp. 32 and 33 in European Commission (2021b), Proposal for a Council Directive restructuring the Union framework for the taxation of energy products and electricity. COM (2021) 563 final, Brussels, 14.7.2021. It should be noted that the values in Table 2 are expressed in gigajoules, while those in Table 3 are expressed in current units. The latter measure is followed.

[21] It should be noted that the values for 2033 are discounted, i.e., they are not values to be applied as of 2033, but as of 2023.

[22] It should be stressed, however, that this analysis does not consider possible increases in excise duties by Member States to cope with falling revenues, as has often been the case over the years.

In addition, the evolution of revenue associated with the proposed reform options is estimated, assuming that Member States would only change their excise duty levels if they were below the new minimum levels proposed in the different options. In the case of option 2, which is the option followed in this analysis, it can be seen that the increase in excise duty levels and the broadening of the tax base through the abolition of some exemptions would lead to an estimated increase in revenue of 22% in 2035 compared to the baseline scenario. More specifically, for Italy the estimated revenue increase in 2035 from the application of Option 2(a) is just under 25%.[23] Compared to 2020, which is taken as the base year, the reduction in revenue in 2035 for Option 2(a) is estimated to be around 18%.[24] It can therefore be seen that the increase in revenue from changes in the level of energy taxation is not destined to be sustained over time, at least not to the same extent, but that it can nevertheless remain stable in the coming years, thus allowing it to be used - at least temporarily - for redistributive policies. This aspect is also supported by the consideration that the shift from the consumption of polluting products to the consumption of more sustainable products, and therefore the abandonment of fossil fuels in favour of green resources, will not be immediate and sudden, but gradual, depending on various factors. Among these, it is worth noting the role played by fossil fuel dependency and technological developments that encourage the adoption of sustainable technologies. For the first aspect, see Martins et al. (2019); for the second topic, instead, see Cingano and Faiella (2013) and the estimates of the Gestore dei Servizi Energetici (GSE), in the detailed note on energy in the transport of October 2022. The general conclusion, therefore, is that the consumption of fuels based on petroleum products will not disappear in the short term. Therefore, the revenues from their taxation, even if they may not appear stable in the long term, represent a tool for policymakers in the short term.

In addition, a robustness analysis was carried out on the revenue amount obtained. The direct price elasticity for the COICOP group (*Classification of Individual COnsumption by Purpose)* comprising fuel and electricity, as obtained by Regmi and Seale (2010), has been used to make a correction to the revenue estimate. It should be noted that the potential impact on revenue is estimated to be a reduction of around € 100 million, a value that is not considered to have a significant impact in the analysis.

The redistributive analysis of the reform scenario confirms a regressive effect of excise duties, which appears to be accentuated compared to the *status quo* due to the increase in excise duties on petrol and diesel. The results can be observed in the analysis of the evolution of the average rates shown in Table 6. The reduction in the value of the excise duty on electricity compared to the *status quo* leads to a consequent reduction in the incidence, which can also be observed in Table 6.

[23] See Figure 26, p. 55. COUNCIL DIRECTIVE restructuring the Union framework for the taxation of energy products and electricity (recast). COM (2021) 563 final.

[24] See Figure 23, p. 53. COUNCIL DIRECTIVE restructuring the Union framework for the taxation of energy products and electricity (recast). COM (2021) 563 final.

Table 6 - Average excise rates per decile of equivalent expenditure net of VAT and excise duties: *status quo*, and reform.

		Average tax rate	
	Deciles	*Status quo*	*Reform*
Petrol	1	0.030	0.037
	2	0.029	0.036
	3	0.026	0.032
	4	0.026	0.032
	5	0.025	0.031
	6	0.024	0.029
	7	0.022	0.028
	8	0.020	0.025
	9	0.019	0.024
	10	0.015	0.019
	Deciles	*Status quo*	*Reform*
Diesel	1	0.012	0.018
	2	0.015	0.021
	3	0.016	0.024
	4	0.017	0.024
	5	0.016	0.023
	6	0.017	0.025
	7	0.016	0.024
	8	0.016	0.023
	9	0.014	0.020
	10	0.011	0.016
	Deciles	*Status quo*	*Reform*
Electricity	1	0.011	0.007
	2	0.008	0.005
	3	0.006	0.004
	4	0.005	0.004
	5	0.005	0.003
	6	0.004	0.003
	7	0.004	0.002
	8	0.003	0.002
	9	0.003	0.002
	10	0.002	0.001

[continues]

	Deciles	*Status quo*	*Reform*
Total excise duties	1	0.053	0.062
	2	0.052	0.063
	3	0.049	0.060
	4	0.048	0.060
	5	0.045	0.057
	6	0.046	0.058
	7	0.042	0.054
	8	0.039	0.050
	9	0.035	0.045
	10	0.028	0.036

Source: Author elaboration on ISTAT data, 2019.

Finally, the redistribution indices have been evaluated, which are in Table 7.

Table 7 – Redistributive indices.

		Status quo	Reform
Petrol	Gini pre-tax	0.3136	0.3136
	Gini post-tax	0.3144	0.3144
	Reynolds – Smolensky index	-0.0008	-0.0009
	Average tax rate	0.0104	0.0127
	Kakwani index	-0.0622	-0.0574
	Suits index	-0.0734	-0.0686
		Status quo	*Reform*
Diesel	Gini pre-tax	0.3136	0.3136
	Gini post-tax	0.3139	0.3139
	Reynolds – Smolensky index	-0.0003	-0.0003
	Average tax rate	0.0066	0.0096
	Kakwani index	-0.0284	-0.0192
	Suits index	-0.0415	-0.0322
		Status quo	*Reform*
Elecricity	Gini pre-tax	0.3136	0.3136
	Gini post-tax	0.3141	0.3141
	Reynolds – Smolensky index	-0.0004	-0.0003
	Average tax rate	0.0019	0.0013
	Kakwani index	-0.2270	-0.2275
	Suits index	-0.2300	-0.2304
		Status quo	*Reform*
Total excise duties	Gini pre-tax	0.3136	0.3136
	Gini post-tax	0.3151	0.3151
	Reynolds – Smolensky index	-0.0014	-0.0015
	Average tax rate	0.0189	0.0236
	Kakwani index	-0.0672	-0.0526
	Suits index	-0.0782	-0.0641

Source: Author elaboration on ISTAT data, 2019.

For petrol, the Reynolds-Smolensky redistribution index is slightly more negative (-0.009) than in the *status quo* (-0.008), due to a higher average tax rate (0.0127), but there is also a slight reduction in the negative value of the Kakwani index (-0.0574), underlining an equally slight reduction in the regressive effect. In the case of diesel, the Reynolds-Smolensky index is the same as in the *status quo* (-0.003), but the size of the regressive effect, as measured by the negativity of the Kakwani index (-0.0192), tends to decrease. In terms of electricity, the redistributive results are essentially the same as those obtained under the *status quo*.

Overall, in both the *status quo* and reform scenarios, the effect of excise duties on petrol, diesel, and electricity, whether considered separately or combined, is a negative redistributive effect. It has been analysed that this type of environmental reform can have negative redistributive effects on households. This was also verified in the implementation of the simulated reform: it is an expected result since the excise duties on petrol and diesel were increased. The importance of the simulation from a redistributive point of view lies in the increase in revenue compared to the *status quo*, which, according to the logic of the double dividend theory analysed in Section 2, can be used to limit the incidence of other taxes, such as VAT, or to provide a direct cash transfer to the most vulnerable households, thus achieving a redistributive effect.

The logic of the analysis follows a perspective of overall intervention in the tax-benefit system. In fact, given the hypotheses of reform in the context of environmental taxation, a measure is made in the field of VAT to reorganize the indirect tax system. In this way, a comprehensive approach is taken to different aspects of the tax system: reform measures are not isolated to individual instruments. Moreover, the revenue of € 4.3 billion from the second reform scenario was used to demonstrate the superiority of an instrument such as cash transfer for the most vulnerable households in terms of redistributive effects, both in the context of VAT and in the field of taxation of excise duties.

4.3 Use of additional resources for double dividend assumptions

As mentioned above, the additional revenue from the environmental reform on excise duties on energy products has been used to present reform hypotheses in light of the double dividend theory. In the first reform presented, the revenue of about € 4.3 billion is used to simulate a single-rate VAT reform, replacing the current multiple rate configuration, combined with a cash transfer to the poorest households to limit the regressivity of the single rate. In this case, therefore, the strategy follows an idea of rationalisation in the field of indirect taxation and thus of an overall tax design. In the second case, however, the amount has been used to distribute a cash transfer to the poorest households to limit the regressive effects of excise duties on energy products. In both contexts, a common result emerges: the achievement of redistributive effects seems to be more significant through public expenditure rather than through taxation.

It has been stated that the focus of the simulated reform is not on climate impacts. Rather, the focus is on the potential use of revenues from an environmental reform and on equity issues. Indeed, it has been noted that excise duties are a form of taxation that particularly affects the budgets of poorer households. At the same time, a reform that contributes to climate change objectives by increasing the value of excise taxes on some goods, and hence the price of those goods, could place an additional burden on poorer households compared to richer ones. This raises the question of how environmental reform can be linked to equity and redistribution issues (Pizer and Sexton, 2020). A trade-off between equity and efficiency is thus identified. As regards the importance of the distributional impact of environmental reform, it should be noted that the impact assessment accompanying the proposed revision of the Energy Taxation Directive includes a distributional analysis of each of the options presented.

4.3.1 Excise duties, uniform Vat-rate, and monetary transfer

The € 4.3 billion revenue increase from the excise tax reform has been used firstly to make VAT changes, the main indirect tax in Italy. It is currently levied through the adoption of three rates: the standard rate (22%), the reduced rate (10%), and the super-reduced rate (4%).[25] Three different reasons for introducing a system of multiple tax rates can be found in the literature: (i) equity objectives; (ii)

[25] There is actually a fourth rate equal to 5%, but as it is applied to a very limited basket of goods, it has not been included in the analysis.

efficiency aims; (iii) objectives to protect merit goods or sectors exposed to competition.[26] In this context, the aim is to demonstrate that the achievement of redistributive outcomes could be more robustly achieved through the use of instruments on the public expenditure side, rather than through the application of reduced rates within an indirect tax such as VAT.[27] Therefore, a single VAT rate system will be implemented, combined with a direct cash transfer to the poorest households.

The value of the single rate, which achieves revenue parity compared to the current configuration, is 15 per cent. As mentioned above, the single rate is combined with a monetary transfer, the value of which is determined on the basis of the ISTAT relative poverty thresholds and family size. It is a transfer whose value increases with family size and is determined on the basis of the amount available (4.3 billion euro) and an implicit equivalence scale derived from the above-mentioned poverty thresholds. The value of the transfer and relative poverty thresholds are shown in Table 8.

Table 8 – Monetary transfer values distributed according to household composition and relative poverty thresholds.

Household size	Poverty thresholds (Monthly amounts in euros)	Implicit equivalence scale	Cash transfers (monthly amounts in euros)
1	656.97	1.00	0
2	1,094.95	1.67	180
3	1,456.28	2.22	240
4	1,784.77	2.72	293
5	2,080.41	3.17	342
6	2,365.09	3.60	388

Source: Author elaboration on ISTAT data, 2019.

It is thus possible to compare the distributional outcome of a single rate VAT reform combined with a cash transfer with the current multiple rate tax configuration. In terms of the average rate, shown in Table 9, firstly it can be seen that in the first decile of equivalent expenditure net of VAT, the cash transfer acts as a subsidy for the poorest households. In the second decile, the average rate is also reduced. However, from the third decile on, there is a slight increase in the incidence for all deciles except the last two.

[26] The literature analysing the advantages and disadvantages of VAT differentiation is extensive. See, among others, Ebrill *et al.,* 2001; Copenhagen Economics, 2007; Crawford *et al.,* 2010; CPB, 2010; Mirrlees *et al.,* 2011; CPB, 2013; Abramovsky *et al*., 2017.

[27] This is in line with the literature which suggests that VAT rate differentiation should be used for redistributive purposes when alternative instruments such as income tax or cash transfers are not available and feasible (Atkinson and Stiglitz, 1980; Heady, 1993). This conclusion stems from the consideration that the application of reduced rates on essential goods is not an efficient instrument to achieve redistributive effects because richer households purchase larger quantities of all goods and services and, therefore, the subsidy implied by the application of reduced rates increases as income rises and is not limited to the poorest families.

Table 9 - Average tax rate: VAT current configuration vs reform.

Deciles of equivalent expenditure	Current Configuration VAT	VAT reform
	Average tax rate	
1	0.127	-0.065
2	0.133	0.113
3	0.136	0.150
4	0.139	0.150
5	0.142	0.150
6	0.144	0.150
7	0.146	0.150
8	0.149	0.150
9	0.152	0.150
10	0.158	0.150

Note: the current configuration represents the multiple tax-rate context (22%, 10%, 4%); the VAT reform is the scenario where we implement a single tax-rate (15%) combined with the cash-transfer.

Source: Author elaboration on ISTAT data, 2019.

In addition, concentration ratios and redistributive effects have been assessed and are presented in Table 10.

Table 10 – Concentration coefficients and redistributive indices: current configuration vs VAT reform.

	Current Configuration VAT	VAT reform
	Concentration coefficients	
Total expenditures net of VAT	0.246	0.246
VAT	0.278	0.334
Super-reduced tax rate	0.143	-
Reduced tax rate	0.208	-
Standard rate	0.312	-
	Redistributive indices	
Gini pre-tax	0.313	0.315
Gini post-tax	0.311	0.311
Reynolds-Smolensky index	0.003	0.005
Kakwani index	0.037	0.059
Suits index	0.041	0.049

Note: the current configuration represents the multiple tax-rate context (22%, 10%, 4%); the VAT reform is the scenario where we implement a single tax-rate (15%) combined with the cash-transfer. The household ranking for the determination of concentration coefficients follows the expenditure equivalent net of VAT.

Source: Author elaboration on ISTAT data, 2019.

It should be noted that a redistributive effect occurs when the tax concentration index is higher than the tax base concentration index. This means that the tax is distributed to a greater extent to the highest levels of expenditure. This occurs both in the *status quo* scenario, i.e., the current configuration of the tax, and in the reform scenario. However, it can be observed that the value of the concentration index is higher in the reform scenario (0.334) than in the current configuration (0.278), indicating a more significant redistributive effect. This result is also confirmed by the redistribution indices. The difference between the pre-tax and post-tax Gini indices is greater in the reform scenario, as is the value of the Reynolds-Smolensky index: 0.005 in the reform scenario versus 0.003 in the current system. In addition, the progressivity index, the Kakwani index, increased by around 2 percent. Finally, the Suits index is also higher: 0.049 in the reform scenario versus 0.041 in the *status quo.*

Essentially, therefore, the implementation of a reform in which a single VAT rate is adopted combined with a monetary transfer for the poorest households results in more significant and robust redistributive effects that the current configuration in which the application of reduced rates is designed to achieve this type of objective. Two important considerations therefore emerge. Firstly, it should be noted that the use of public expenditure, and hence of an instrument such as cash transfers, allows for more robust and direct redistributive effects than the application of reduced rates, which also benefit the richest families. In addition, this type of policy has been implemented without the need to identify additional financial resources compared to those obtained through environmental reform. Such an approach would therefore make it possible to focus attention on several objectives. On the one hand, the first measure has been taken on excise duties on energy products, which would make it possible to act on climate change. At the same time the increase in revenue generated by the environmental tax reform has made it possible to rationalise the indirect tax system and thus adopt a broader tax design. This has been shown to have a greater redistributive effect than using the tax system.

4.3.2 Excise duties, current Vat-rates, and monetary transfer

The additional revenue obtained from the simulation in the field of excise duties on energy products has been used to implement a cash transfer in the context of the same excise duties taxation. It should be noted that in the literature on double dividend theory and, more generally, in the analysis of the potential re-use of tax revenues from environmental tax reforms, the idea of using them in the form of lump-sum transfers to households is often advanced. The possibility of targeting and directing them to the most vulnerable members of the population, who are potentially most affected by the environmental reform, and thus mitigating the regressive effects of the reform itself, is emphasised (Speck, 1999). Some analyses have demonstrated the greater progressivity achieved by introducing a lump-sum cash transfer compared to measures to reduce pre-existing distortions in the tax system; however, if the results are better from a distributional point of view, some doubts have been raised about the economic efficiency (European Environmental Agency, 2011; Rausch et al., 2011; Kosonen, 2012; Caron et al., 2018; Pizer and Sexton, 2020).[28]

Since the values of the excise duties on petrol, diesel, and electricity have been adjusted according to the values shown in the last column of Table 5, and since an increase in revenue of 4.3 billion euros has been obtained compared to the *status quo*, this amount has been used to finance a cash transfer to the poorest families. This strategy is in line with that adopted for the VAT reform. In fact, the value of the transfer has been set based on the ISTAT relative poverty thresholds for 2019, considering the family dimension.[29] With the amount available, the transfer values are determined according to Table 11, which also shows the poverty thresholds.

[28] It should be noted, however, that in the studies cited, the transfer generally takes the form of a one-off and uniform transfer to all households and therefore has a different structure from the one presented in the paragraph.
[29] The design of a transfer based on poverty thresholds is in line with the objectives of reducing energy poverty, as it has been shown that the share of expenditure on electricity, in particular, which is a basic commodity, is

Table 11 - Monetary transfer values distributed according to household composition and relative poverty thresholds.

Household size	Poverty thresholds (monthly amounts in euros)	Implicit equivalence scale	Cash transfers (monthly amounts in euros)
1	656.97	1.00	0
2	1,094.95	1.67	130
3	1,456.28	2.22	172
4	1,784.77	2.72	211
5	2,080.41	3.17	247
6	2,365.09	3.60	280

Source: Author elaboration on ISTAT data, 2019.

The impact of the cash transfer on the total excise duty involved has been examined. Firstly, the effect has been assessed in terms of incidence, i.e., the average rate per decile of expenditure net of VAT and excise duties, the values of which are given in Table 12.

Table 12 - Average total excise rate per deciles of equivalent expenditure net of VAT and excise: status quo, reform, and reform with transfer.

	Status quo scenario	Reform scenario	Reform scenario + cash transfer
Deciles	Average tax rate (%)		
1	0.038	0.062	-0.122
2	0.023	0.063	-0.007
3	0.021	0.060	0.034
4	0.020	0.060	0.058
5	0.018	0.057	0.056
6	0.017	0.058	0.058
7	0.015	0.054	0.054
8	0.014	0.050	0.050
9	0.012	0.045	0.045
10	0.009	0.036	0.036

Source: Author elaboration on ISTAT data, 2019.

The effect of the transfer can be seen as a subsidy in the first two deciles. Moreover, compared with the simulation of the excise duty reform, there is also a reduction in the average tax rate up to the fifth decile of expenditure net of VAT and excise duties, and no deterioration from the sixth decile onwards, while the values remain the same as those obtained with the application of the new excise duty rates.

The concentration and redistributive indices, shown in Table 13, have then been evaluated.

higher for the poorest households than for the richest households (Flues and Thomas, 2015; Koukoufikis and Uihlein, 2022).

Table 13 – Concentration coefficients and redistributive indices.

	Status quo scenario	Reform scenario	Reform scenario + cash transfer
		Concentration coefficients	
Total expenditure net of VAT and excise duties	0.257	0.257	0.257
Total excise duties	0.157	0.164	0.433
		Redistributive indices	
Gini pre-tax	0.313	0.313	0.317
Gini post-tax	0.315	0.315	0.315
Reynolds-Smolensky index	-0.0014	-0.0015	0.0015
Kakwani index	-0.067	-0.052	0.054
Suits index	-0.078	-0.064	0.024

Source: Author elaboration on ISTAT data, 2019.

The concentration index of the tax, i.e., of the total excise duties considered, assumes the highest value in the context of the implementation of the monetary transfer (0.433), which is higher than both the *status quo* (0.157) and the only simulation on excise duties (0.164). This is the only case where it is higher than the concentration index of the total expenditure net of VAT and excise duties (0.257), which is the only case where a redistributive effect is obtained. This result is confirmed by the redistribution indices. The only case in which the Reynolds-Smolensky index takes a positive value, indicating a redistributive effect, albeit modest, is that of the distribution of cash transfers (0.0015). The effect can also be seen in the slightly positive value of the Suits index (0.024), as opposed to the negative values in the *status quo* (-0.078) and in the scenario where the transfer is not implemented (-0.064), indicating the regressivity of the tax. There is also a modest progressive effect, as indicated by the Kakwani index (0.05).

In conclusion, therefore, the introduction of a cash transfer targeted at the neediest families, as identified by the poverty thresholds and the family dimension, can determine redistributive effects, albeit limited, and mitigate and attenuate the regressivity of consumption taxes in general. The rationale behind the introduction of cash transfers, and thus the adoption of an instrument on the side of public expenditure, is to demonstrate that their use is capable of achieving results in terms of redistributive effects or reducing the regressivity of the tax system, whereas a tax is not as efficient. A programme such as cash transfer can meet the needs identified because it can be targeted directly and specifically at the poorest households, unlike a tax, in particular indirect taxes such as excise duties on energy products or value-added tax. Acting in this way as a whole, therefore, could have positive effects both in the environmental as well as in the social-redistributive sphere. In fact, the potentially regressive effect of environmental reform could be mitigated by using the additional revenues to support redistributive policies, which in turn would have to rely on the use of public expenditure.

5. Concluding remarks

Using a microsimulation model on the microdata of the HBS (ISTAT) for 2019, it has been possible to simulate hypotheses of reform on excise duties on petrol, diesel, and electricity. Changes in energy taxation are designed to discourage the consumption of the most polluting fossil fuels and to achieve the EU's common climate objectives. Thus, environmental tax reform on excise duties has been implemented. The simulations follow the proposal for the revision of energy taxation presented by the European Commission in July 2021; in particular, the indications of Proposal 2(a) are followed. According to this, the excise tax values on petrol and diesel are to be increased to discourage their consumption, and the excise tax on electricity is to be reduced to move towards climate neutrality, as envisaged by the European objectives.

The focus of the analysis is not on the environmental impact of these changes. Rather, the aim is to allocate the additional revenues generated by the reform scenario, which amount to about € 4.3 billion, to reduce distortions in other parts of the tax system and to achieve redistributive effects. These measures concern not only excise duties but also VAT. This approach has a logic in common with the double dividend theory. Before analysing the actual use of this amount, the redistributive effect was assessed.

The overall conclusion of the distributional analysis is that excise duties tend to be regressive, both in the *status quo* scenario and in the reform scenario. This result is in line with what has emerged from the literature analysis. In light of these unfavourable distributional results, the second part of the empirical analysis focused on the possibility of achieving redistributive effects. In order to carry out this analysis, the configuration of the main indirect tax, VAT, has been considered first and, in a second step, the configuration of excise duties themselves. The idea underlying both simulations is to show that more significant redistributive effects can be achieved by using public expenditure rather than the tax system. Thus, in the area of VAT, the current multiple rate configuration has been replaced by a single-rate of 15%, the level at which budget neutrality can be achieved. The uniformity of taxation is combined with a cash transfer to the poorest households. A cash transfer has also been introduced into the structure of excise duties. In both cases the transfer is targeted to the poorest households basing it on the ISTAT relative poverty thresholds and on family size. Both reforms achieve more robust redistributive effects than in their respective current configurations.

These results have important implications for possible policy actions. Firstly, the need to reform the excise duties on energy products and electricity to comply with European regulations and, in particular, to get on the road to achieving the objectives of the European Green Deal and Fit For 55. Secondly, the need to adopt a broad intervention perspective that does not act on the individual instrument without considering the "cascading effects" on the entire tax-benefit system. Energy tax revenues can be used for a variety of purposes, including environmental objectives or the reduction of pre-existing distortions in the tax system. This paper has followed the second route, by using the revenues to work on VAT, a tax closely related to excise duties. Indeed, it has been shown that it is possible to achieve distributional improvements in VAT. At the same time, the role of public expenditure in achieving redistributive effects, rather than using the tax system, was confirmed through the introduction of cash transfers. These are potentially important conclusions for policy makers. At the same time, two important aspects would be addressed. The first is the profile of the environmental protection good, where action no longer seems to be postponed. The second concerns the redistributive profile of the system, which is often the subject of debate and discussion in academic and political circles, a result that often does not seem to be achieved effectively with the instruments put in place by the policy-maker.

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