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THERMO-MODERNISATION RELIEF AS AN INSTRUMENT OF ECOLOGICALLY ORIENTED TAX SYSTEM

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ABSTRACT: The article discusses the problem of ecological tax solutions. The content of the article is part of the discussion on environmental protection through environmental taxes. The Polish ecological tax system does not sufficiently meet ecological functions. Therefore, it is advisable to use tax solutions to a greater extent in this area, e.g. in the form of thermo-modernisation tax relief. The aim of the article is to indicate the shortcomings of the structure of this relief and to present proposals for changes in this area. Legal and empirical analysis were used for this purpose.

KEYWORDS: environmental taxes, environmental protection, thermo-modernisation tax relief

Introduction

An environmentally oriented tax system aims to protect the natural environment. Such solutions should trigger adjustment reactions on the part of market participants (e.g. producers and consumers) – the so-called allocation effects. The concept of environmental taxes is related to the theoretical concept of the Pigou tax. The use of the Pigou tax to protect the environment is a complex process as it requires knowledge of the marginal external costs and adoption of assumptions concerning the effective level of pollution.

Environmental taxes primarily have a stimulating function (implementation of ecological goals). They can be implemented through the introduction of a specific tax or environmental fee or specific structural elements of levies (differentiation of tax rates, application of tax preferences). Therefore, economic instruments should be used in the state pro-environmental policy. In Poland, the system of solutions related to environmental protection is characterised by great dispersion. One example is the thermo-modernisation tax relief, which has been effective since 2019. The subject of the study is therefore to exhibit this tax preference as a manifestation of the greening of the Polish tax system.

The article adopts the hypothesis that the effectiveness of the thermo-modernisation tax relief as an instrument of tax policy in the field of environmental protection is limited by its structure and by distribution of the tax wedge.

In general, policy success can be measured either as (policy) effectiveness and/or efficiency. In the first context, it aims to assess the impact on market growth of a specific policy, while in the second, as the associated cost of supporting the policy (OECD/IEA, 2008). In addition to costs, other factors may be taken into account when evaluating a policy, such as benefits, environmental outcomes, etc. However, these two concepts are confused in many studies. In particular, cost efficiency is used as an equivalent of cost effectiveness without distinction and explanation. Baveye and Valenduc (2011) assume that cost effectiveness enables the achievement of policy objectives at minimum cost. Some authors analyse cost effectiveness in terms of CO_2 emission abatement (Alberini & Bigano, 2015; Arigoni Ortiz et al., 2009). By effectiveness, we mean the cogency of the design, implementation and targeting of tax policies. In particular, we focus on tax relief in this article. Therefore, we perceive the effectiveness of a tax relief as an appropriate level of targeted preferences, which becomes an incentive for taxpayers to make pro-ecological decisions. Consumer adjustments (allocation effects) should therefore be consistent with the needs of environmental protection. The purpose of such a tax solution will therefore be the implementation of ecological plans. When considering environmental taxes as an efficient tool for solving environmental problems, environmental factors such as internalisation of environmental costs, green investments, pro-environmental behaviour of consumers and businesses, and pro-environmental costs of taxes should be taken into account (Cieślukowski, 2016).

The aim of the article is to outline the necessary changes in the structure of the thermo-modernisation tax relief so that it can be an effective instrument of ecological state policy.

The article has been written on the basis of extensive data received from the Ministry of Finance and supplemented by the current literature in the field of environmental policy. The study consists of three parts. The first, theoretical part presents the idea of an ecological tax and introduces the structure of tax tools used in environmental policy. The second part discusses the thermo-modernisation tax relief currently functioning in Poland, exposing its advantages and disadvantages. The third empirical part conducts quantitative analyses demonstrating the ineffectiveness of the thermo-modernisation relief in its current form. Validation was performed based on the number of people, total deduction amounts, and the average deduction amount. The comparison included groups of taxpayers designated by income deciles to obtain a complete picture. Trend analysis allowed the identification of patterns in taxpayers' behaviour, the breaking of which is correlated with changes in legal conditions related to the increase in the personal allowance. Study exposes the relationship between tax expenditures and the tax wedge. The article concludes with recommendations for the thermo-modernisation relief design amendments that may improve its effectiveness.

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An overview of the literature

The activity of state authorities in supporting environmental objectives is multidimensional: it includes both the creation of an institutional and legal framework in this area, as well as – through the use of fiscal policy instruments and policies – influencing the decisions of market entities (Zioło, 2020). Policies can be developed in different thematic areas such as sustainable consumption (Kletzan et al., 2002) or energy conservation (Parczewski & Krawczynski, 2001). Various policy instruments can be used to support ecological activities (Helm, 2005; Endres, 2011), the most basic of which is taxation on activities and consumption that damage the environment. Taxation is most prevalent in EU countries and there are several hundred types of them (Famielec, 2003). Among them appear environmental taxes, also known as environmentally related taxes, which currently play a leading role.

According to Regulation (2011), "environmentally related tax' means a tax whose tax base is a physical unit (or a proxy of a physical unit) of something that has a proven, specific negative impact on the environment, and which is identified in ESA 95 as a tax". It was concluded that the tax base could be seen as the only objective basis for identifying environmental taxes for international comparisons. Other criteria, such as the purpose specified in the tax legislation, the name of the tax or the allocation of revenues to environmental purposes, were considered less appropriate and more difficult to apply in practice (European Commission, 2024). For analytical purposes, environmental related taxes are classified into four categories: 1) energy taxes (including transport fuel), 2) transport taxes (excluding fuel for transport), 3) pollution taxes, and 4) resource taxes. In addition, the European Commission formulates its policy decisions on climate change, energy or air pollution using a number of criteria to achieve the intended objectives (Delbeke et al., 2010).

Environmentally related taxes can motivate consumers and producers to change their behaviour, thus helping to achieve environmental goals. Compared to non-tax measures, such taxes are cost--effective due to their lower administrative costs, relative ease of management, and strong price signals sent to consumers and businesses (European Commission, 2022).

Environmental taxes are often referred to as the concept of the Pigouvian tax (Pigou, 1920), i.e. one that is imposed on a good generating a negative externality, with a rate equal to the marginal external cost. However, as Williams (2016) emphasises, this is difficult to apply in practice. Problems are related to estimating marginal damage, which refers in particular to situations when such damage occurs in the future or is differently distributed in time and space.

In addition to taxes and environmental fees, instruments supporting pro-ecological projects are also used. The goals defined by environmental protection policy can be implemented with financial resources transferred directly, in particular under various government programs, or indirectly, in particular through the tax system (Eurostat, 2015). In the latter case, it refers to environmental tax expenditures, which are revenue losses arising from special provisions in the tax law, such as exemptions, deductions, credits, and preferential tax rates, that are used as tools to promote environmental goals (World Bank, 2024). The thermo-modernisation relief is the most expensive environmental tax expenditure in Poland in the income tax.

The functions of ecological taxes differ from the functions of other taxes. Unlike other taxes, ecological taxes do not perform a regulatory (redistributive) function, while the stimulating function is dominant (Małecki, 2012). The fiscal function is not as important as in the case of other taxes, moreover, contrary to a common understanding, revenues from environmental taxes do not have to be allocated for environmental purposes (Williams, 2016). However, it should be remembered that linking the tax to the purpose of financing environmental objectives may also be one of the criteria used for defining environmental taxes.

In the literature, there is ongoing debate on the configuration of the policy mix, concerning the use of ecological taxes, increasing the price of undertaking activities harmful to the environment and tax preferences, reducing the price of undertaking environmentally friendly activities. It is indicated that the combined use of both ecological taxes and pro-ecological tax preferences allows for achieving policy goals at a lower cost (Köppl & Schratzenstaller, 2021). Political decisions to introduce environmental taxes are strongly influenced by the acceptability of such instruments by society. As the tax burden may be regressive, having a greater impact on lower-income households (e.g. in the case of energy taxes), accepting these taxes may require the introduction of compensatory measures to

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reduce their regressiveness (European Commission, 2022). The challenge for policymakers in designing and implementing effective policies is to target and measure the economic value of environmental resources (Pearce & Warford, 1993; Sterner, 2003; De Mooij et al., 2012). Policies may be in the form of taxes on measured emissions, a market good designed to be related to emissions or as a multi-part instrument (Fullerton et al., 2008). In particular, governments may use taxation on fuels and energy, CO_2 emissions, contamination or extraction of natural resources (these categories are used by the OECD, EU or IEA). Environmental and other policies should be analysed and assessed with respect to their effectiveness (Gayer & Viscusi, 2016).

In essence, many countries have implemented environmental taxes based on the polluter-pays principle which has reoriented their tax systems. Even if this reorientation was revenue neutral, it allowed to improve both environment and economic efficiency (double dividend). In the latter, employment policies have proven particularly effective and have produced positive economic results in many European countries when switching from taxing labour to carbon/energy.

Another issue in approaching environmental taxes is its efficiency. The efficiency of environmental fees and taxes is influenced by: (1) setting unit rates at a level higher than the marginal costs of reducing pollution, (2) making the rates of fees and taxes dependent on the price elasticity of demand for a specific environmental use, (3) introducing a system of refundable fees that encourage the reduction of pollutant emissions to a greater extent than traditional fees and taxes, support technological innovation and constitute a lower net burden for enterprises, which has an impact on their competitiveness, (4) reducing the amount of environmental fees paid by enterprises by linking them to the implementation of protective investments that will contribute to a significant reduction in emitted pollutants, (5) differentiating the rates of fees and taxes to promote those forms of environmental use that will primarily take into account the principle of prevention (Kasztelan, 2009).

The advantage of tax tools supporting environmental protection is that they contribute to the implementation of environmental projects, while the private benefits from the tax preference are lower than the costs of the entire project borne by the taxpayer (Sally, 2013). However, the question arises whether this is the optimal tool for achieving the intended goals. In general, the findings of research on the consequences of tax policies using general equilibrium and econometric models are usually positive and indicate an improvement in the environment, an increase in the employment (although lesser than expected), an increase in GDP (not unequivocally confirmed), and beneficial distributed effect for households consuming less energy and also an increase in prices (Stodulski, 2001).

Many countries are taking action to increase the role of environmentally related taxes. Environmental tax reform is being introduced, in which the burden of taxation is shifted from conventional taxes (e.g. on labour) to activities harmful to the environment (e.g. pollution) (European Environment Agency, 2005). In Denmark, Finland, Sweden, the Netherlands, Germany and Great Britain, such changes were implemented on a larger scale already in the 1990s (Dyduch & Stabryła-Chudzio, 2019).

This article focuses on energy instruments in particular. Preferences for boosting energy efficiency in income taxation have been studied by several authors in different tax jurisdictions. The assessment of their effectiveness is not unequivocal. The tax credit available for Belgian taxpayers using energy saving scheme did not prove to be efficient (Baveye & Valenduc, 2011). Similarly, the Italian tax credit encouraging heating system replacement was not cost effective (Alberini & Bigano, 2015). However, the opposite is argued by Arigoni Ortiz et al. (2009), who assessed the cost effectiveness of tax deductions available to taxpayers replacing heating sources in Italy and Denmark. There are no previous assessments known to the authors of the Polish thermo-modernisation relief based on the tax data.

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Research methods

We have carried out an analysis of the design of the thermo-modernisation relief to observe its scope and eligibility. Then, an empirical study was conducted based on data from the Ministry of Finance to verify the effectiveness of the thermo-modernisation relief. Data for the study covers the years 2019-2022 and was limited to the PIT-37 form (employment and pension income mainly), which significantly affects the overall use of the subsidy. To identify patterns of taxpayers' behaviour, an analysis was carried out concerning the amount of tax, gender, number of children, and age of the taxpayer. The analysis also took into account the division into voivodeships. Statistical measures and descriptive statistics were used to examine the relationships between groups of taxpayers with different characteristics and potential changes over time, mainly due to the increase in the tax-free amount.

Due to the different tax group sizes considered and the related total amount of deductions, the average amount of deductions per taxpayer was considered the basic measure of comparison. Dividing all taxpayers into deciles of tax allowed for capturing the impact of the change in the tax-free amount in 2022. The statistical summaries have been illustrated with graphs and maps that better visualise the inadequate effectiveness of this form of subsidy in relation to the goals assumed by decision-makers.

Results of the research

How is the thermo-modernisation relief designed?

The thermo-modernisation relief is a tax tool supporting thermo-modernisation projects carried out by individuals only. The thermo-modernisation relief cannot be used by taxpayers of corporate income tax, i.e., for example, corporations, foundations, associations, housing communities or cooperatives. The relief can be used by individuals who settle their taxes both according to general rules (tax scale or according to the flat 19% tax rate) and in the form of a flat-rate tax on gross revenues. The relief can be used by both Polish residents and foreign persons if they generate income in Poland.

As part of the relief, taxpayers can deduct from the tax base (or revenue in the case of flat-rate taxation on gross revenue) the amount of expenses incurred in exercising the thermo-modernisation project, but no more than PLN 53,000. The thermo-modernisation project has been defined in the separate Act on Supporting Thermo-modernisation and Renovations and on the Central Record of Building Emissions. A thermo-modernisation project is understood as:

- an improvement resulting in a reduction in the demand for energy supplied for heating, domestic water heating, and heating of residential buildings,
- an improvement resulting in a reduction in primary energy losses in local heating networks and local heat sources supplying them, if the residential buildings to which energy is supplied from these networks meet the requirements for energy savings specified in the provisions of the building law, or actions have been taken to reduce the consumption of energy supplied to these buildings,
- making a technical connection to a centralised heat source, in connection with the liquidation of a local heat source, as a result of which the costs of obtaining heat supplied to residential buildings are reduced,
- a complete or partial replacement of energy sources with renewable sources or the use of high-efficiency cogeneration.

Not all expenses that potentially meet the above definition will be included in eligible expenses under the thermo-modernisation relief. These are specified in detail in the relevant implementing regulation. Eligible expenses include expenses for construction materials and equipment, or services related to the thermo-modernisation project (see Table 1).

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Table 1. Eligible expenses related to the thermo-modernisation project

Specification	Eligible expenses for building materials and equipment related to the thermo-modernisation project	Eligible expenses for services related to the thermo-modernisation project
Expenditures related to the preparation of a thermo-modernisation project:	n/a	• performing an energy audit of the building before implementing a thermo-modernisation project; • performing thermographic analysis of the building; • preparation of design documentation related to thermo- modernization works; • performing ornithological and chiropterological expertise.
Expenditures related to improving the energy efficiency of the building:	• building materials used to insulate building partitions, balcony slabs and foundations, included in insulation systems or used to protect against moisture; • window and door joinery, including windows, roof windows with mounting systems, balcony doors, garage gates, transparent non-opening surfaces.	• insulation of building partitions or balcony slabs or foundations; • replacement of external joinery, e.g. windows, roof windows, balcony doors, external doors, garage gates, transparent non-opening surfaces.
Expenditures related to the replacement of heating sources:	• heating node with temperature programmer; • condensing gas boiler with control, safety and regulating fittings, and air supply and exhaust gas discharge system; • condensing oil boiler with control, safety and regulating fittings, and air supply and exhaust system; • gas tank or oil tank; • a boiler intended exclusively for burning biomass, provided that certain conditions are met; • connection to the heating or gas network; • building materials included in the heating installation; • building materials included in the domestic hot water preparation installation; • building materials included in the electric heating system.	• dismantling a solid fuel heat source • replacement of elements of the existing heating installation or domestic hot water preparation installation or construction of a new internal heating installation or domestic hot water preparation installation; • installation of a condensing gas boiler; • installation of an oil condensing boiler; • hydraulic regulation and balancing of installations; • commissioning and regulation of the heat source and flue gas analysis.
Expenditures related to renewable energy sources:	• heat pump with accessories; • solar collector with accessories; • photovoltaic cell with accessories;	• heat pump installation; • installation of a solar collector; • installation of a photovoltaic installation.
Ventilation related expenses:	• building materials constituting a mechanical ventilation system with heat recovery or heat and cold recovery.	• installation of a mechanical ventilation system with heat recovery from exhaust air.

Source: authors' work based on Regulation (2018).

The eligible expense must be documented with an invoice issued by an active VAT payer. This rule discriminates against the purchase of goods or services from other entities, including taxpayers exempt from VAT and natural persons not conducting business activity (e.g. resale of used materials).

A thermo-modernisation project can only be implemented in a single-family residential building, defined in accordance with the provisions of the construction law. A single-family residential building is a detached building or a semi-detached, terraced or group building that serves to meet housing needs, constituting a structurally independent whole, in which it is allowed to separate no more than two residential premises or one residential premises and a commercial premises with a total area not exceeding 30% of the total building area. It is also possible to locate various installations as part of a thermo-modernisation project outside the building itself. The thermo-modernisation project concerns an existing building, which means that the relief will not apply to the construction of a new building. However, if the existing building is expanded or added, the thermo-modernisation relief may also cover expenses related to the new part of the existing building (Ministry of Finance, 2023). The taxpayer must be the owner or co-owner of the building in which the thermo-modernisation project is carried out as at the date of submitting the tax return. It is possible for a taxpayer to run a business in a building that has undergone thermo-modernisation, and the building or part of it may be rented (Ministry of Finance, 2023).

In order to apply the relief, it is not necessary to perform other activities, often necessary in the case of obtaining financing from other sources, including the need to conduct an energy audit before

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starting thermo-modernisation. However, the thermo-modernisation project must be completed within three years, counting from the end of the tax year in which the first eligible expenditure was incurred.

Thermo-modernisation relief will not be available to a taxpayer who has already deducted the full amount of the relief. In the case of spouses, the spending limit of PLN 53,000 is determined for each of them. It is therefore possible that two or more thermo-modernisation projects will be implemented in one building by many taxpayers, including spouses, for a total amount exceeding PLN 53,000. The source of financing for eligible expenses can only be the taxpayer's funds, so expenses that have been financed or co-financed, e.g. under government programs, or returned to the taxpayer in any form will not be eligible expenses. The subsidy is a partial refund of previously incurred expenses. Expenses that have been included in tax-deductible costs or have already been deducted in another form cannot be deducted under the thermo-modernisation relief.

If in the year in which the taxpayer incurred eligible expenses related to the thermo-modernisation project, the taxpayer did not achieve sufficient income or revenue to deduct the amount of thermo-modernisation relief, he or she may deduct these expenses in the following 6 tax years.

Who really benefits from the thermo-modernisation relief – an empirical look

The scale of tax expenditures on the thermo-modernisation relief is one of the largest in personal income taxation (55-62% of other relief from income value in years 2020-2022). The general data for granted thermo-modernisation relief is shown in Table 2.

Table 2. Data of taxpayers taxing income using the tax scale, excluding data on taxpayers who are inherited enterprises for the years 2019-2022

Expenditures on the implementation of the thermo-modernisation project (Article 26h of the Act)				
YEAR	2019	2020	2021	2022
a/ Number of taxpayers	195,928	430,782	595,396	440,549
b/ Amount of deductions (PLN million)	2,827.97	6,976.463	10,414.41	8,232.199
c/ Average amount deducted by the taxpayer (PLN)	14,434	16,195	17,492	18,686

Source: authors' work based on Ministry of Finance (2024).

We observe that taxpayers increase deductions of the tax preference among subsequent years, with a clear drawback in 2022. We attempt to answer the question of what caused the drop and who benefits from the relief most now and then, and if it is the desired outcome. The analyses using data from the ministry are the best possible evidence of the need to properly adjust the rules to achieve high effectiveness in implementing ecological directives. The irregularity of interest in thermal relief can be seen based on significant differences in the number of municipalities and the average amounts of deductions. The visualisation of the state for 2022 is presented on maps (Fig. 1). In some municipalities, only one person took advantage of the thermo-modernisation relief. In one-quarter of municipalities, the number of taxpayers taking advantage of this relief did not exceed 24 individuals. On the other hand, the concentration of this tax relief is visible in the southern region of the country and large urban agglomerations. The largest number of deductions in PIT-37 on a municipality scale was 6,213 taxpayers. Moreover, the average deduction amount does not correlate with the number of taxpayers who took advantage of the thermo-modernisation relief. In half of the municipalities, the average amount of deductions did not exceed PLN 16,658; in one quarter, it exceeded PLN 18,671 per taxpayer. The disproportion between municipalities in terms of the average amount of deductions is almost eightfold, with the smallest amounts of deductions observed in the country's southeastern part.

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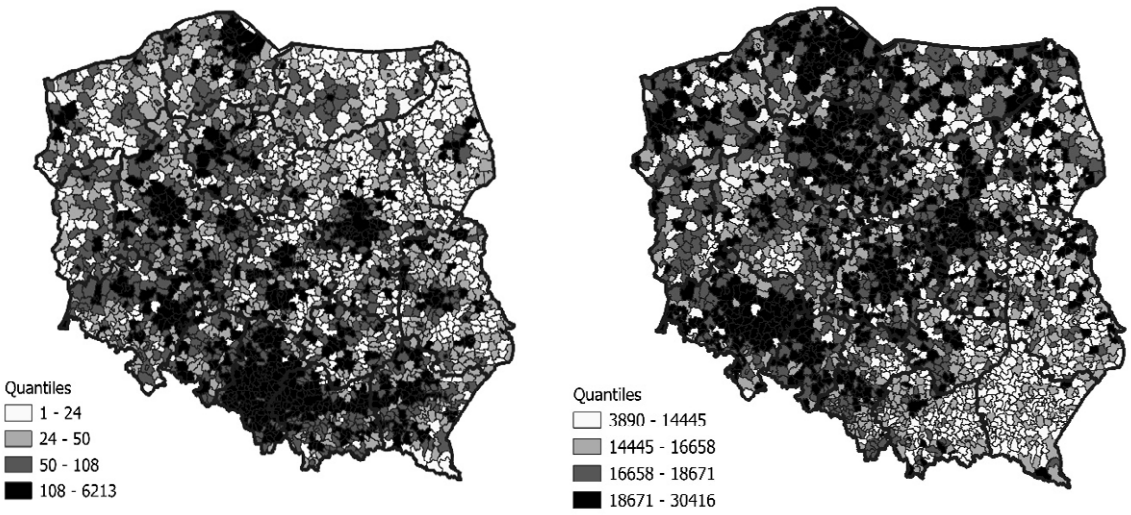

Figure 1. Number of taxpayers in the municipality using the thermo-modernisation relief in 2022 (map on the left) and the average amount of thermo-modernisation relief (map on the right)

Source: authors' work based on Ministry of Finance (2023).

The amount of thermo-modernisation relief depends on the expected amount of tax to be paid with no tax preferences used. If no or little tax is expected to be paid, there will be no interest of a taxpayer to use the thermo-modernisation relief. Hence, the comparative analysis of panel data covering changes broken down by years and income groups is fundamental. To prove comparability while maintaining the simplicity of the message, the study was limited to the division of taxpayers into deciles in terms of income in a given year. Figure 2 presents the distribution of the number of taxpayers and the amount of thermo-modernisation relief they used in particular years, broken down by income deciles.

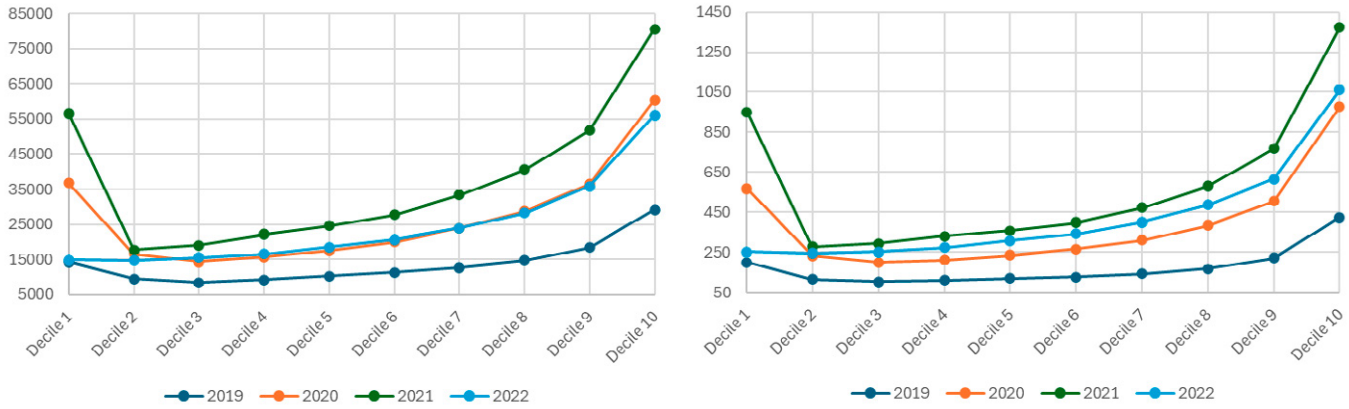

Figure 2. Number of taxpayers who took advantage of thermo-modernisation relief (left graph) and amount (in mln PLN) of thermo-modernisation relief (right graph) per year and income decile. The income means gross income reduced by tax deductible costs before any further deductions

Source: authors' work based on Ministry of Finance (2023).

A specific pattern of taxpayer behaviour was repeated in 2019-2021: many taxpayers used thermo-modernisation relief in the first income decile, and a growing trend from the second to the 10th decile is to be observed. Moreover, we can observe an increase in the number of taxpayers and the total amount of relief year-to-year. Meanwhile, in 2022, the pattern broke down. The number

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of taxpayers returned to the 2020 level, noting a decline from 17% to 31% compared to 2021 within income deciles 2nd to 10th. Considering amounts, it slightly exceeded the 2020 level, which means a 12% to 23% drop compared to 2021, excluding the first decile, where a 74% drop means a return to the 2019 level. There is an evident decline in interest in thermo-modernisation relief, especially for the poorest taxpayers (from the first income decile). The reason for the sudden change in the trend was the changes introduced by the "Polish Deal" reform, which influenced the tax wedge, resulting in a significant reduction in the tax burden among the lowest-earning taxpayers.

Based on taxpayer data from 2019-2022, the presented reasoning empirically confirms the hypothesis about the low effectiveness of thermo-modernisation relief. The literature on the subject reflects this and allows for the proposal of specific recommendations, described later in the article, that will allow for better use of taxpayers' money.

Is the thermo-modernisation relief an effective tool supporting the environment?

Environmental tax preference should be designed in a correct manner to avoid negative outcomes. Such outcomes may be due to the substitution effect – limited resources would be directed to the subsidised project rather than to another goal, which may be of higher priority. The good practice here is to provide for some performance standards that need to be met for the tax preference to be eligible (Greene & Braathen, 2014). Thus, there is an important flaw of the Polish thermo-modernisation relief, which does not require the taxpayer to present any outcome in terms of environmental protection to be entitled to the deduction. There are several other incentives in the Polish income tax that require certain outcomes and if not fulfilled, the tax benefit shall be returned (e.g. expansion relief, restoration relief). The minimal outcomes should be aligned with the environmental policy goals.

There may also be a rebounding effect in place. In the case of replacing energy sources or undertaking another thermo-modernisation project, energy expenditure falls. This may result in savings for the household and reduced energy consumption, but just as well the lower cost of obtaining energy may lead to increased energy consumption. In such a way the rebounding effect limits the positive results of the tax allowance. It might be the case of the Polish thermo-modernisation relief; however, the effect cannot be measured due to lack of tracking of the energy expenditures after the thermo-modernisation project completion. It is necessary to implement a tracking system by linking the tax data with the data collected on energy consumption.

Taxpayers using the thermo-modernisation relief are free to choose an investment and its parameters – a wide catalogue means that the allocation of funds spent under the relief is not controlled. At the same time, the inclusion of different categories of expenditure causes a substitution effect of one expense over another. In conditions of limited financial resources, spending funds on photovoltaics will exclude investments in other energy-saving projects, even if in the given circumstances, these other projects would be more effective. After all, no one evaluates the taxpayer's decision, which may be based on premises other than maximising the environmental effect. There might be two basic solutions for this shortfall: a year-to-year reassessment of the eligible expenditures in place that will take into account the current needs and the latest technologies, or the individual administrative decision approving the planned project and expenditures before the tax relief is used.

A very significant disadvantage of preferences for individuals in income tax is also the risk of free riding. Tax benefits may be granted to a person who would have carried out a given project anyway, even without the relevant tax relief. Tax expenditures in such a case do not result in a real incentive to behave in a preferred way but play the role of an expensive reward (Greene & Braathen, 2014). This risk increases the more the relief reaches higher earners. This is a very important aspect in the context of recent changes in the so-called tax and contribution wedge for individuals in Poland. Even before 2022, this wedge in Poland was slightly above the OECD average. Since 2022, it has been below the EU average. The main component of the wedge in Poland is social and health insurance contributions, which are not related to the thermo-modernisation relief in income tax.

Changes in the tax and contribution wedge were introduced in 2022 on the basis of two acts – the so-called Polish Deal (Act, 2021) and the corrective Low Taxes (Act, 2022). The changes introduced as part of the Polish Deal pleaded in increasing the personal allowance, the threshold of the tax scale, eliminating the deductibility of the health insurance contribution from tax and making the level of the health insurance contribution dependent on the income of entrepreneurs, as well as introducing

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a number of reliefs – for the middle class, for families with 4+, for working seniors and for those returning. The balance of changes in the tax wedge was influenced by the opposite effects on the public finance sector of individual elements of the reform. Increasing the personal allowance to PLN 30,000 and raising the tax threshold to PLN 120,000 are changes beneficial to taxpayers, which, according to forecasts, were to cost the public finance sector as much as PLN 87.6 billion on their own. This effect was, however, balanced by the elimination of the possibility of deducting part of the paid health insurance contribution from tax, which was to bring an additional PLN 65.7 billion in revenues for the public finance sector. The correction of the Polish Deal (Low Taxes) had equally significant effects on the tax wedge as the first legislative action. As part of the correction of the Polish Deal, a reduction of the tax rate in the first tax bracket from 17% to 12% was adopted, a partial deduction of the paid health insurance contribution for entrepreneurs was introduced, the joint settlement of single parents with a child was restored, replacing the amount of relief introduced by the Polish Deal, and at the same time the so-called relief for the middle class was eliminated. These changes had a negative impact on PIT revenues, which were to decrease by another PLN 14.45 billion after the correction of the Polish Deal (Explanatory statement, 2022). As a result, the correction of the Polish Deal almost doubled the negative effect on the public finance sector.

The Polish Deal and its correction, by influencing the distribution of the tax and contribution wedge, completely changed the base system for determining the size of tax expenditures. The introduction of a high personal allowance and the shift of the tax threshold resulted in a lower income tax to be paid by approximately 18 million PIT taxpayers, of whom almost 9 million were not obliged to pay income tax at all, including the lowest earners and approximately $^2/_3$ of pensioners. Due to the increase in the tax threshold, the 32% tax was to be paid by half as many people as before the reform – the number of taxpayers in the second threshold of the tax scale was to decrease from approximately 1.24 million to 620 thousand (Explanatory statement, 2021). The lack of tax to be paid or its low amount means that all support instruments, both those already existing in the tax system and new solutions in the income tax, may become less effective and ill-fitting. As a result, by easing the repressiveness of the base system, the scale of tax expenditures and their nature are limited. The Ministry of Finance estimated the amount of tax expenditures in PIT in 2018 at PLN 26.249 million (Ministry of Finance, 2018). Although official statistics in this area are no longer kept, it can be predicted that this amount has relatively decreased from 2022. Tax preferences are being withdrawn or limited by reducing total tax liabilities; at the same time, substitute solutions have not been proposed, for example, if an employee with a minimum wage did not pay income tax as a result of applying the thermo-modernisation relief, after implementing the Polish Deal or he will still not pay tax, but due to the higher personal allowance. Relatively, however, compared to another taxpayer – an employee with the same income who did not use the thermo-modernisation relief – her or his situation worsened, a certain amount was taken away from him, which, from the perspective of the state budget, makes up the tax expenditures related to the thermo-modernisation relief. At the same time, as a result of this type of change, the group of taxpayers who can actually benefit from the support has changed significantly. These will primarily be people with higher earnings, who may have the funds to implement thermo-modernisation projects. Considering that the owners of single-family houses are mainly middle-aged and elderly people with children, they also benefit from the relief for children or families with 4+ children, which further reduces the potential for using the thermo-modernisation relief. In turn, retired people who are owners of single-family houses often do not have significant taxable income and can use other available reliefs, including the rehabilitation relief or the working senior relief. At the same time, the prohibition of combining direct support with the thermo-modernisation relief means that the thermo-modernisation relief will be used by people who undertake much larger investments. Hence, ultimately, after reducing the tax wedge, relief will be available to people earning significantly above average.

The risk of free riding can be limited again by periodically updating eligible expenses so that the catalogue is limited to more advanced projects in terms of availability and technology. This argument is of greater importance if the tax relief is used primarily by the top-income taxpayers. In such a case, granting tax relief to the wealthier citizens may be justified by technological advancement and positive spillovers. Only top earners may be able to invest in expensive innovations, which incentivises producers to carry on research and development in this area.

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Conclusions and recommendations

Utilising reliable tax data from the Ministry of Finance, it was possible to assess quantitatively the effectiveness of thermo-modernisation relief in relation to the increase in the personal allowance. The statistics calculated within the income deciles allowed for the identification of regularity in taxpayers' relief applications, visualised in charts and maps. The analysis results indicate that the growing trend was reversed due to increased personal allowance.

We show that thermo-modernisation relief is not well targeted solution, which becomes rather a budgetary burden than an incentive for taxpayers to make pro-ecological decisions. Consumer adjustments appear not to be consistent with the needs of environmental protection. The results of empirical studies exhibit that with the current distribution of the tax wedge, taxpayer's earnings and the structure of the thermo-modernisation relief, support through the tax system is discriminatory and inadequate. Many low-income households, which are most in need of public support to carry out the thermo-modernisation projects, are excluded from the tax relief and on the other hand, the widest group of beneficiaries of the tax relief are the highest income investors who grasp most of the tax expenditures accounted for the thermo-modernisation relief. Taking into account the indicated research results and the current design of the thermo-modernisation relief, recommendations can be made regarding the need to expand the circle of beneficiaries of the relief, as well as the parameters of the relief.

The thermo-modernisation relief can be directed to a more tailored group of beneficiaries by using the relief refund tool, in cases when the taxpayer's income is not sufficient to use it. However, a tax expenditure with a refund tool imitates the direct subsidy. Therefore, there would be a further question whether there is a need to replicate subsidies on the same area. There are many direct tools in Poland supporting thermo-modernisation projects, besides the thermo-modernisation tax relief. These tools may be used as an alternative to the thermo-modernisation relief or, additionally, as part of an investment project whose value exceeds the amount of the thermo-modernisation relief (PLN 53,000). Depending on the financial situation of the family, there is even up to PLN 135,000 subsidy available for thermo-modernisation project under "Czyste Powietrze" programme, and more under other programmes like "Mój prąd" subsidising ecological sources of electricity or "Stop smog" again subsidising thermo-modernisation projects of the lowest-income households. Compared to the taxpayer savings on the thermo-modernisation relief, which are at most PLN 16,960 (32% × PLN 53 000), the tax tool is of the latter financial importance. Direct subsidies have their limitations; however, they solve the same problem in a more transparent manner, as each financing should be assessed before being transmitted to the beneficiary. If the thermo-modernisation tax relief should be kept in the tax system with the refund mechanism, there should be some amendments carried out as well.

Firstly, the purpose of funds settled under the relief should be modified to limit the observed negative effects of the relief. In particular, it is necessary to focus on the most important investments in terms of environmental needs or technology development. This can be done either at the general level, through a periodic change in the tax law regulating the relief, or at the individual level (e.g. through an audit or administrative decision). Nowadays, the thermo-modernisation relief seems to be no longer a suitable solution to address environmental protection issues, but rather a substantial loss of budgetary income. Even if the proposed refund mechanism opens the relief to more low-income beneficiaries, still the highest tax savings will be received by the wealthiest taxpayers. Thus, the tax relief should be an incentive to carry out especially the most innovative projects.

Secondly, the thermo-modernisation relief should not enhance the use of energy or environmental pollution. However, the use of the relief is not coordinated in any way. The relief mechanism should be rather correlated with the limitation of negative externalities than with the spending on the areas that are not scrutinised by authorities. Consequently, there should be an audit carried out for certain project benefiting from a tax savings.

Thirdly, the scope of the thermo-modernisation relief should be rather subsidiary than conquering direct subsidies. At the moment, the investor may choose which way of public support he chooses for the thermo-modernisation project, while tax and non-tax instruments may vary not in terms of the investment scope, but rather the formalities, scrutiny, as well as the moment and form of the funding. The public support for thermo-modernisation projects, taking into account direct and tax

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expenditures, is now chaotic and incoherent. Taking into account previous recommendations, the tax relief should be designed to promote more innovative projects, while direct support should cover simpler investments. Thus, the scope of tax relief and direct subsidies for thermo-modernisation should be aligned in such a way that they complement each other rather than compete, taking into account primarily the distinction based on the innovativeness of the project.

Taking into account recent changes in the tax wedge in Poland, thermo-modernisation relief has changed the scope of its beneficiaries and is no longer a well-functioning mechanism. To be continued in the tax system, the tax relief should be made independent from the tax due. Then, the indicated changes in the relief design should be implemented.

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ULGA TERMOMODERNIZACYJNA JAKO INSTRUMENT SYSTEMU PODATKOWEGO ZORIENTOWANEGO EKOLOGICZNIE

STRESZCZENIE: W artykule podjęto problem ekologicznych rozwiązań podatkowych. Treść artykułu wpisuje się w dyskusję na temat ochrony środowiska poprzez podatki ekologiczne. Polski ekologiczny system podatkowy nie spełnia w wystarczającym stopniu funkcji ekologicznych. Dlatego też celowe jest szersze wykorzystanie rozwiązań podatkowych w tym obszarze, np. w formie ulgi termomodernizacyjnej. Celem artykułu jest wskazanie mankamentów konstrukcji tej ulgi oraz przedstawienie propozycji zmian w tym zakresie. W tym celu wykorzystano analizę prawną i empiryczną.

SŁOWA KLUCZOWE: podatki ekologiczne, ochrona środowiska, ulga termoizolacyjna

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