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MODELING DIFFERENTIATED RATES OF THE SINGLE TAX IN UKRAINE BASED ON THE POLISH EXPERIENCE

Abstract

The study is devoted to the adaptation of the simplified taxation system for small businesses in Ukraine to European approaches in the context of the implementation of European integration commitments and the National Revenue Strategy until 2030. The purpose of the article is to develop and provide economic and mathematical justification for a model of differentiation of single tax rates by type of economic activity based on Polish experience, assessing its impact on equalizing the tax burden between sectors of the economy. Achieving this goal involved: (1) a comparative analysis of the Ukrainian and Polish simplified taxation models;

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(2) formalization of a multifactor model for setting rates, taking into account industry profitability indicators and value added structure; (3) calculation of changes in the tax burden coefficient by sector as a result of modeling. The research methodology combined a comparative analysis of the tax regimes of Ukraine and the Republic of Poland with economic and mathematical modeling based on official statistical data. The modeling results show that the proposed system of differentiated rates reduces inter-sectoral disparities in the tax burden, contributes to fiscal fairness, and increases the consistency of Ukraine's simplified taxation system with European principles of tax neutrality.

Key Words:

European principles of tax neutrality, fixed tax, Polish taxation system, simplified taxation system, single tax, small business, tax policy, tax rate differentiation.

JEL: H21, H25, H26, K34.

6 formulas, 7 tables, 36 references.

Problem Statement and Literature Review

In the context of Ukraine's integration into the European economic space and the fulfillment of obligations related to EU membership, the reform of the simplified taxation system (STS) for small businesses is becoming particularly relevant. Harmonizing national tax legislation with EU standards is not only a legal requirement of the integration process, but also an important factor in strengthening the fiscal stability of the state and increasing the transparency of budget revenues. One of the key strategic documents in this area is the National Revenue Strategy until 2030, approved by the Cabinet of Ministers of Ukraine at the end of 2023 with the participation of international partners, in particular the European Commission and the IMF. The document sets out a roadmap for the transformation of tax policy and provides for the adaptation of legislation to EU standards,

improving the efficiency of revenue administration, and fulfilling international obligations in the field of public finance.

In particular, the implementation of the National Revenue Strategy provides for a transition to an updated STS model that takes into account certain elements of the Polish small business taxation system, which was chosen as a benchmark for building an effective and transparent tax administration model (Cabinet of Ministers of Ukraine, 2023).

The simplified taxation system, introduced in Ukraine in 1998, has become an important tool for supporting small and medium-sized businesses, providing simplified accounting procedures and reducing the administrative burden. At the same time, its development has been accompanied by the accumulation of systemic problems, which has led to a gradual loss of fiscal efficiency and an increase in the scale of abuse.

The current STS model has a bunch of structural flaws that make it easy to dodge taxes and misuse the system. In practice, the STS is often used by medium and large businesses to minimize tax liabilities and conceal actual volumes of activity, particularly in transactions involving illegally imported or manufactured goods. A separate problem is the systematic use of single tax payer status to replace labor relations with civil law contracts, which complicates control over the labor market and reduces budget revenues.

Analytical assessments by Dubrovskyi et al. (2023) confirm the involvement of STS in schemes to understate tax liabilities, primarily through the registration of hired employees as individual entrepreneurs of the third group and the artificial structuring of economic activity. At the same time, the authors emphasize that in terms of the scale of fiscal losses, such abuses are inferior to other tax evasion tools, which indicates not the fiscal failure of the STS as such, but the imperfection of its institutional design and administration mechanisms. In this context, the priority area for reform is to strengthen tax analytics and introduce digital control tools that limit opportunistic behavior by taxpayers without losing the incentive role of the STS. The conditions of martial law and economic instability have only increased the relevance of such changes, creating a need for institutionally balanced reform capable of combining support for small businesses with the effective implementation of the state's fiscal function.

In view of these challenges, Ukraine has committed itself to a comprehensive transformation of the STS. The directions of the reform are defined in the National Revenue Strategy until 2030, which provides, in particular, for: gradual restriction of the application of the STS by legal entities, increase in single tax rates, merger of the 2nd and 3rd groups of individual entrepreneurs with differentiated rates, mandatory use of cash registers, introduction of inventory accounting, and unification of the VAT registration threshold (Cabinet of Ministers of Ukraine, 2023). Additional commitments to reform the STS and strengthen its fiscal discipline are enshrined in the Memorandum with the IMF, which also provides for nar-

rowing the scope of the STS and improving control mechanisms (National Bank of Ukraine, 2025).

Thus, the need to reform the STS is driven not only by European integration requirements, but also by the need to increase the transparency of economic processes, combat tax evasion, and ensure sustainable budget revenues in the context of post-war economic recovery.

One of the benchmarks for developing a new model of the STS was the Polish experience of taxation with a fixed tax on recorded income. The National Revenue Strategy provides that differentiated single tax rates ranging from 3% to 17% will be applied to the future unified second group, depending on the type of activity. Since the document does not contain specific details on rates and criteria for inclusion in the groups, it is advisable to take into account the Polish practice of setting rates according to the type of economic activity. This will allow for the formation of a more structured and fair model of taxation for small businesses in Ukraine.

Special tax regimes for small businesses are an effective administrative tool in hard-to-tax sectors where the application of general taxation rules is economically inefficient (Thuronyi, 2004). Presumptive taxation reduces transaction and administrative costs by using indirect methods of assessing tax liabilities in conditions of limited control and incomplete accounting. At the same time, such regimes are associated with the risk of violating the principle of tax fairness and limitations in the accuracy of determining tax liabilities, which may reduce the effectiveness of fiscal control. The effectiveness of simplified regimes largely depends on the structure of rates, the choice of assessment methods, and the integration of presumptive taxation into the overall tax system, which requires a carefully thought-out design of the tax regime (Thuronyi, 2004).

A significant argument in favor of simplified regimes is the reduction of tax compliance costs, which are relatively higher for small businesses and create structural inequality compared to large businesses, justifying the need for differentiated approaches to taxation and reducing the administrative burden on small taxpayers (Eichfelder & Vaillancourt, 2014; VVA & KPMG, 2022; Wen, 2023).

The introduction of presumptive taxation based on indirect indicators (for example, turnover) can ensure a Pareto improvement in social welfare, as it minimizes the resources that businesses waste unproductively on hiding income (Balestrino & Galmarini, 2005). At the same time, the effectiveness of such a regime as an «entry point» to the legal economy critically depends on whether the tax burden corresponds to the real solvency of small taxpayers without creating excessive administrative pressure (Loeprick, 2009). This suggests that simplified regimes are not just a fiscal tool, but a complex mechanism for overcoming the «informality trap», requiring a careful balance between ease of administration and economic stimulation of business growth.

Based on a systematic review of empirical studies, Bucci (2020) argues that the positive effect of simplified regimes is only evident if they are correctly designed and take into account the balance between simplicity, neutrality, and fairness of taxation. In the absence of such conditions, simplified regimes can lead to a decrease in budget revenues without a significant improvement in the level of voluntary tax compliance. Analytical materials from the World Bank (Hoy et al., 2024) confirm the existence of typical trade-offs in the design of simplified regimes: minimizing the administrative burden can increase the risk of underreporting taxable income if there are no adequate mechanisms for data collection and analysis.

A review of international experience (Mas-Montserrat et al., 2023, 2024) shows that universal simplified taxation models with a single rate are ineffective due to the structural heterogeneity of small businesses. This strengthens the argument in favor of differentiated approaches, where the tax burden is adapted to the marginality of different types of activities.

At the same time, the overall complexity of reform is compounded by a critical challenge characteristic of simplified small business taxation regimes: excessively low rates create an incentive for tax status manipulation, whereby large companies artificially split up or masquerade as small businesses. Thus, the key compromise lies in setting system parameters that would encourage the legalization of real small businesses, but would not become a tool for abuse by large players (Wen, 2023).

Engelschalk & Loeprick (2015) draw attention to the risk of a «bunching effect» near the threshold values of simplified taxation regimes. This phenomenon manifests itself in the artificial restraint of enterprise income growth or the understatement of reporting data in order to preserve the right to tax preferences, which confirms the theory of taxpayers' behavioral response to tax thresholds as a tool for minimizing liabilities (Kleven, 2016).

This practice not only distorts economic behavior and violates the principles of fairness (Aditya, 2020), but also creates the risk of forming a segment of low-productivity enterprises that avoid scaling up due to a lack of incentives for growth resulting from a high administrative burden (Joshi et al., 2014). Ultimately, this leads to the emergence of a «small business trap», where fiscal incentives become a barrier to real economic development.

European experience shows that the complexity of tax administration is a barrier to the competitiveness of small and medium-sized businesses even in countries with developed institutions (VVA & KPMG, 2022). In this context, simplifying tax regimes and digitizing tax administration are seen as complementary areas of reform that can simultaneously reduce the administrative burden and encourage the legalization of entrepreneurial activity.

Contemporary research pays considerable attention to the technological transformation of simplified taxation and the use of digital tools to minimize the

risks of tax abuse. The works of Mbise & Baseka (2022) and Astuti et al. (2025) show that the introduction of digital tax administration systems increases compliance with tax legislation.

The effectiveness of technological and organizational modernization of simplified regimes in developing countries directly depends on the quality of the institutional environment. The introduction of innovative administration tools brings the expected results only if the management capacity of tax authorities is strengthened in parallel (Inter-American Development Bank, 2009; African Tax Administration Forum & International Centre for Tax and Development, 2024). Without systematic monitoring and verification of data, simplification of procedures risks becoming a tool for legalizing abuse rather than an incentive for businesses to actually come out of the shadows. Therefore, technological transformation must be based on building institutional trust and adapting control methods to the specifics of the informal sector, ensuring a balance between simplicity of accounting and fiscal transparency.

Comparative studies show that even with the widespread coverage of small businesses by simplified regimes, their fiscal contribution at the macro level remains insignificant (Yacoubian, 2025). This indicates that simplified and presumptive regimes primarily contribute to the legalization of activities and the reduction of administrative barriers, while their potential as a tool for significantly increasing budget revenues is limited.

Domestic scientific research in recent years has focused on the peculiarities of the functioning of the STS in conditions of martial law and the vectors of its adaptation to European standards. When justifying the high adaptability of small businesses, Skrypnyk et al. (2023) note that it was the simplification of accounting procedures and administration that became a key factor in the survival of business entities, allowing them to adapt to changes in market conditions more flexibly than large businesses. At the same time, Ihnatenko (2023) emphasizes that tax breaks during the war period, despite their significant stabilizing role, have created potential threats to the stability of budget revenues. These risks are particularly acute at the local finance level, where the single tax is one of the main sources of income. This thesis is confirmed in the works of Dobrunik (2024) and Tuchak (2024), who justify the importance of STS for the formation of financial autonomy of territorial communities and warn about the vulnerability of local budgets in the event of uncoordinated administrative transformations or decentralization decisions.

Our previous research (Sidliar & Ivanova, 2025; Krysovatyy & Valihura, 2024) also demonstrates the important role of STS for the stability of local budgets. We emphasize the need for balanced reform that will preserve support for the business sector, aligning it with the fiscal goals of the National Revenue Strategy until 2030 and strategic European integration guidelines.

Methodology

The research methodology combines comparative analysis and economic-mathematical modeling. First, an analysis of Polish tax legislation and small business taxation practices was carried out, in particular the *Ryczałt* fixed tax regime, which contains differentiated rates for different types of activities. The Polish experience was used not as a direct model, but as an analytical basis for determining the logic of constructing a scale of rates – from highly profitable types of activity to low-margin ones. On this basis, a conceptual and economic-mathematical model for setting single tax rates was developed, which reproduces the differentiated approach of the Polish system, adapted to Ukrainian statistical data and the objectives of the National Revenue Strategy until 2030.

The modeling used official statistics on small enterprises (sales volumes and profits) for the base period preceding significant economic shocks to provide a representative assessment of sector profitability. The base period for modeling is 2019, which is considered in this study as the last relevant time interval with a completed statistical cycle and balanced macroeconomic proportions. The choice of this period is justified by the need to form a regulatory framework for the tax system that is free from exogenous distortions caused by the COVID-19 pandemic and large-scale military shocks in subsequent years. Although the full-scale war after 2022 led to profound structural transformations in the Ukrainian economy, including the mass relocation of enterprises, the destruction of logistics chains, and sectoral shifts in profitability, the use of 2019 data allows us to design the fundamental architecture of tax rate differentiation, abstracting from the transitory anomalies of martial law. This ensures the strategic stability of the model, the results of which are considered as an analytical basis for the implementation of the National Revenue Strategy measures until 2030.

The key indicator of the model was the tax burden on profits (λ_i), which reflects the share of profits subject to a single tax. The calculation of λ_i for each sector at the current flat rate of 5% revealed significant asymmetry: in highly profitable industries, the tax burden is relatively low, while in low-profit industries, it is excessive (the tax may exceed profits). Therefore, the objective function of the model is to equalize this burden by maximizing λ_i for profitable sectors (approaching the conditions of the general taxation system) and minimizing it for low-margin sectors (mitigating fiscal distortions). Based on a multifactor analysis (taking into account profitability R_i, the share of added value, and other industry characteristics) and optimization, differentiated rates T_i were determined for each group of activities. The model takes into account the principle of fiscal fairness (the rate is proportional to the solvency of the business) and strategic priorities (structural efficiency and social significance of industries), implemented through adjustment coefficients β_i. This approach provided justification for a single tax rate scale in the range of 3% to 17%, as defined by the National Revenue Strategy, while maintaining a balance between fiscal efficiency and support for small businesses.

Research Results

Taxation of entrepreneurial activity in Poland is carried out both on general grounds and in accordance with simplified approaches. In addition to the fact that Polish legislation defines the criteria for micro, small, and medium-sized enterprises (Republic of Poland, 2018), tax legislation also includes the concept of a «small taxpayer» *(mały podatnik)*, whose status entitles them to certain tax preferences. This concept appears in at least three normative acts (Republic of Poland, 1991, 1992, 2004):

- the Personal Income Tax Act (PIT) (Article 5a, point 20);
- the Corporate Income Tax Act (CIT) (Article 4a, point 10);
- the Goods and Services Tax Act (VAT) (Article 2, point 25).

In all of the above-mentioned regulations, the criterion for a «small taxpayer» is the same and is set at an income of EUR 2,000,000, expressed in zlotys as of the first working day of October of the previous tax year, rounded to the nearest PLN 1,000. However, for the purposes of levying value added tax on certain types of activities (management of a brokerage firm, management of investment funds, management of alternative investment funds, activities as an agent, contractor or other person providing services of a similar nature, except for commissions, etc.), a «small taxpayer» is a person whose remuneration for services rendered (including tax) did not exceed the amount expressed in PLN, corresponding to the equivalent of EUR 45,000, in the previous tax year.

The advantages of «small taxpayer» status include:

- the possibility of applying a reduced income tax rate;
- the possibility of making quarterly advance payments of income tax (instead of monthly);
- a reduction in the administrative burden: for example, simpler methods of calculating VAT, the possibility of applying *cash accounting* (VAT accounting using the cash method);
- depreciation benefits in the form of *one-off depreciation* of certain fixed assets.

Based on an analysis of Polish tax legislation, taking into account the rules relating to «small taxpayers», we have developed options for the taxation of individual entrepreneurs (Table 1).

Table 1

Taxation options for individual entrepreneurs in Poland

Name	Who can choose / conditions	Rate / features
General rules	For individual entrepreneurs or partnerships when no other regime has been chosen. A flexible option where expenses can be taken into account	Progressive personal income tax rate: up to PLN 120,000 of income – 12%, above that – 32%
Flat tax	For entrepreneurs who expect fairly stable profits, or when it is easier to avoid complex deductions – but with limited access to the benefits that are usually available under the general rules	19% of net income (profit), taking into account expenses, usually under general accounting
Lump-sum tax on recorded revenues / ryczałt od przychodów ewidencjonowanych (fixed tax on recorded income)	For individual entrepreneurs or partnerships with only individuals, if income does not exceed €2,000,000. Expenses cannot be taken into account.	Rates depend on the type of activity and are 2%; 3%; 5.5%; 8.5%; 10%; 12%; 14%; 15%, 17%
Tax card / karta podatkowa (tax card)	A very simplified regime, but it is not always available; for certain small businesses with very simple activities	A fixed amount of tax, depending on the type of activity, the number of residents in the settlement, the number of employees, etc.; does not depend on actual income or expenses, but the choice is limited
Cash PIT scheme / PIT kasowy (personal income tax scheme based on the cash method)	For entrepreneurs with income not exceeding PLN 1,000,000 in the previous year and those who are just starting their business. Applicable voluntarily from January 1, 2025.	Income is recognized as taxable only after payment has been received for goods sold or services provided, while expenses incurred to earn income will be deductible only after payment has been made for goods or services purchased.

Source: compiled by the authors based on the legislation of the Republic of Poland (1991, 1998).

The Polish tax system provides for several taxation regimes for the income of individual entrepreneurs who conduct business activities in the form of individual entrepreneurship or as members of partnerships. This system is flexible, as it allows entrepreneurs to independently choose the form of taxation that best suits the scale and specifics of their business.

The basic rules are general taxation rules (*zasady ogólne / general rules*) and they apply automatically if the entrepreneur has not chosen another form. Taxation is carried out according to a progressive personal income tax scale:

- income up to PLN 120,000 per year is taxed at a rate of 12%;
- amounts above this threshold are taxed at a rate of 32%.

The advantage is the ability to deduct documented expenses, take advantage of numerous tax breaks (for children, medical expenses, insurance premiums, etc.) and apply joint taxation with your spouse. This option is often chosen by entrepreneurs with small or variable incomes, for whom flexibility and the ability to optimize the tax base are important.

A flat tax (podatek liniowy) is a form of taxation at a fixed rate of 19% of net profit, regardless of its size. An entrepreneur can deduct actual expenses, but is not entitled to most of the tax benefits available under the general rules. A flat tax is beneficial for entrepreneurs with high incomes (over PLN 120,000) when the progressive scale results in an excessive tax burden. It is mainly chosen by consultants, IT specialists, doctors, and lawyers who have high incomes and a stable client base.

A fixed tax on recorded income (*lump-sum tax / ryczałt od przychodów ewidencjonowanych*) is a simplified form where gross income is taxed instead of profit. The entrepreneur does not take expenses into account but benefits from reduced tax rates – from 2% to 17%, depending on the type of activity (Table 2).

This regime is only available to entrepreneurs whose annual income does not exceed €2,000,000. The main advantages are minimal reporting and simple administration. It is most often chosen by small entrepreneurs, freelancers, and individuals who do not incur large expenses in the course of their activities.

A tax card (karta podatkowa) is the simplest form of taxation, whereby the entrepreneur pays a fixed amount of tax set by the tax authority depending on:

- the type of activity;
- the place where it is carried out;
- the number of employees and the population in the area.

Table 2

Characteristics of fixed tax rates on recorded income in Poland

Rate (%)	Type of activity	Examples of activities
2	Sale of goods	Retail and wholesale trade in goods, food, clothing, appliances, fuel, etc.
3	Intermediary and support services, small retail trade, non-alcoholic catering services	Small shops, non-alcoholic cafes, sale of ready-made food, vending machines
5.5	Construction, repair, and manufacturing services	Repair and construction companies, workshops, furniture manufacturing, installation work
8.5	Other services (general) not classified in other groups	Rental, cosmetic, translation, consulting (except professional), graphic design, IT support services
10	Income from copyrights and rights to inventions, patents	Writers, inventors, software developers (if not working under license)
12	Services for providing qualified advice in the field of IT, accounting, law	Programmers, auditors, tax consultants, lawyers (except attorneys or notaries)
14	Professional medical services	Doctors, veterinarians, psychologists, physiotherapists
15	Services in the field of finance, insurance, accounting, auditing, advertising, marketing	Accountants, financial advisors, insurance agents, marketers, management consultants
17	IT consulting, legal, and high-level engineering services	Data analysts, ERP system consultants, corporate lawyers, risk management specialists

Source: compiled by the authors based on the legislation of the Republic of Poland (1998).

The amount of tax does not depend on actual income or expenses. The entrepreneur does not file tax returns or keep accounting records. This regime is only available to taxpayers who carry out activities:

- in the field of services or production and services specified by law;
- in the provision of services in the field of retail trade in food, beverages, tobacco products, and flowers, with the exception of beverages containing more than 1.5% alcohol;

- in the retail trade of non-food goods, except for trade in motor vehicles, spare parts and accessories for vehicles, agricultural tractors and motorcycles, as well as trade in non-food goods subject to licensing;
- in the field of gastronomy, if beverages containing more than 1.5% alcohol are not sold;
- in the field of transport services provided using a single vehicle;
- in the field of entertainment services;
- in the field of selling home-cooked meals in residential premises, if beverages with an alcohol content of more than 1.5% are not sold;
- consisting of the provision of services in the field of human health care;
- consisting of the provision of veterinary services by veterinarians;
- in the field of home care for children and the sick;
- in the field of educational services consisting of providing lessons on an hourly basis;

Taxes in the form of a tax card can also be paid by individuals, including farmers who are engaged in agriculture. However, this regime is gradually becoming obsolete, and from 2022, new taxpayers will not be able to choose a tax card.

A new approach to taxation, introduced in Poland on January 1, 2025, is the so-called *cash PIT (PIT kasowy*) scheme. Its essence is that income is taxable not at the time of invoicing, but only after the actual receipt of payment. Similarly, expenses are recognized only after they are actually incurred (paid to the supplier). The relief is aimed at entrepreneurs whose income did not exceed PLN 1,000,000 in the previous year, as well as those who are just starting their business. This scheme aims to improve the liquidity of small businesses and reduce the tax burden during periods of delayed payments from customers.

Thus, the Polish model of personal taxation is flexible, adaptive, and focused on the development of small businesses. It allows entrepreneurs to optimize their tax burden by choosing the regime that best suits their financial capabilities and the nature of their activities. Such approaches ensure a balance between the interests of the state and entrepreneurs, promote the legalization of business, and create a competitive tax environment within the European Union.

An analysis of the legislative framework and regulations governing the taxation of entrepreneurial activity in Poland shows that the fixed tax regime on recorded income (*ryczałt od przychodów ewidencjonowanych*) is of considerable interest to Ukraine. The Polish model is particularly relevant to the Ukrainian context due to several key factors.

First, Poland is Ukraine's closest economic partner and competitor, and the taxation conditions for small businesses in both countries can influence the migration of entrepreneurial activity. In a situation of increasing business mobility and the spread of relocation practices, it is important to understand what taxation regimes are in place in the neighboring country and how they may affect Ukraine's competitiveness.

Secondly, the Polish system includes a legally established differentiation of rates for small businesses within the framework of a fixed tax on recorded income (*ryczałt od przychodów ewidencjonowanych*). Of particular interest is the methodology for setting rates, i.e., the mechanism for establishing rates according to types of activity based on specific criteria. This is relevant for Ukraine, given that the National Revenue Strategy until 2030 provides for the introduction of differentiated single tax rates in the range of 3–17%, but does not specify the methodology for their detailing. There are no criteria that would allow activities to be assigned to specific rates, nor is there a mechanism for taking into account the profitability, costliness of industries, or risks of tax evasion. Therefore, it is advisable to study the Polish approach from the perspective of the methodology for setting rates, taking into account the specifics of the national context.

Third, the Polish experience is valuable not as a model for direct replication, but as an analytical basis for tracing the logic behind the construction of the rate scale: from highly profitable activities to those characterized by lower margins or a significant share of costs.

The Polish experience can serve as a methodological basis, but its application requires adaptation to Ukrainian economic realities, the structure of entrepreneurship, and the conditions of post-war economic recovery. At the same time, the Polish system is characterized by its own institutional features and potential limitations, which necessitates its critical assessment and appropriate modification before use in Ukraine.

In view of the above, the next stage of scientific research is to model the mechanism for setting flat tax rates in Ukraine. This modeling is based on the principles of differentiation applied in the Polish *Ryczałt* system, but is formed taking into account Ukrainian statistical data, current regulatory requirements, and the goals of the simplified taxation system reform.

Taking these factors into account creates a basis for exploring the possibilities of adapting certain principles of the Polish system to national conditions. Within this stage, a conceptual and economic-mathematical model for setting single tax rates has been developed, which reproduces the differentiated approach inherent in *the* Polish *Ryczałt system*, but adapted to the Ukrainian statistical base and the objectives of the National Revenue Strategy.

Economic and Mathematical Modeling

As part of the next stage of the study, an economic and mathematical model was developed that replicates the mechanism for setting flat tax rates based on the principles of differentiation inherent in the Polish *Ryczałt od przychodów ewidencjonowanych* system and adapted to the Ukrainian statistical base and the objectives of the National Revenue Strategy (Republic of Poland, 1998; Cabinet of Ministers of Ukraine, 2023).

The key methodological challenge is to eliminate the asymmetry of the tax burden that arises when applying a flat single tax rate (5%), which ignores the real tax capacity of the business entity. Following the Polish model, rates are differentiated depending on the marginality and added value of the sector.

The methodological basis for modeling is based on the following principles:

1. Fiscal fairness – the rate T_i should be proportional to the tax capacity of the relevant sector.

2. Structural efficiency – the rate T_i should take into account the share of value added (*VA*) and material intensity (*MC*) of the sector.

3. Social function – the rate T_i should take into account the labor intensity (*L*) and social importance of the sector.

The objective function of the model is to set the rate T_i so that the value of the tax burden coefficient on profit λ_i for highly profitable sectors increases to a level commensurate with the general taxation system, while for low-profit sectors it is minimized, which is in line with the principle of minimizing tax distortions. The differentiation of single tax rates within the simplified taxation system is conceptualized as a constrained nonlinear optimization problem aimed at minimizing intersectoral fiscal asymmetry. The objective function takes the following form (Equation 1):

$$min \sum_{i=1}^{n} \left(\lambda_i - \lambda_i^{target} \right)^2, \quad (1)$$

where λ_i denotes the effective profit tax burden coefficient in sector *i*, defined as the ratio of tax liabilities to profit before taxation; λ_i^{target} represents the normative benchmark of tax burden reflecting the desired fiscal position of the sector, taking into account its profitability and structural role in the economy.

The use of a quadratic loss function is methodologically justified, as it symmetrically penalizes both excessive and insufficient deviations while ensuring the stability of the iterative optimization process.

The optimization is performed subject to the following constraints:

- $T_i \in$ [3%; 17%] – in accordance with the parameters defined in the National Revenue Strategy until 2030 (Cabinet of Ministers of Ukraine, 2023);
- preservation of a monotonic relationship between sectoral profitability and the tax rate;
- prevention of incentive inversion (i.e., a less profitable sector cannot be taxed at a higher rate than a more profitable one).

The coefficient λ_i we use as an indicator of fiscal equity, as it reflects the effective share of profit (profit before taxation) withdrawn in the form of the single tax calculated on turnover (sales revenue) (Equation 2):

$$\lambda_i = \frac{Tax_i}{P_i} = \frac{TR_i \times T_i}{P_i}, \quad (2)$$

where T_i is the single tax rate for industry i; Tax_i is the calculated amount of single tax; TR_i *(Total Revenue)* is sales volume (income); P_i *(Profit)* is the financial result (profit) before tax.

Considering that profitability (R_i) is determined by (Equation 3):

$$R_i = \frac{P_i}{TR_i} \times 100\%, \quad (3)$$

the final formula for the tax burden ratio on profit takes a simplified form (Equation 4):

$$\lambda_i = \frac{I_i}{R_i}, \quad (4)$$

where R_i *(Rentability)* is profitability.

Statistical data on the volume of sales (TR_i) and financial results (P_i) of small enterprises are for 2019, as this is the last full year before the start of the COVID-19 pandemic, as well as the period for which all the necessary indicators are available before the start of large-scale territorial and economic changes in 2022. This provides the most representative picture of the structure of the economy under conditions of relative macroeconomic stability (Table 3).

Table 3

Performance of small enterprises in terms of profitability in 2019

KVED Section	Activity	Financial Result (P), million UAH	Total Revenue (TR), million UAH	Profitability (R), %
A	Agriculture, forestry, and fisheries	6012	58718.2	10.2
C	Manufacturing	10659.1	338021.2	3.15
D	Electricity, gas, and steam supply	169.2	4756.9	3.56
F	Construction	557.6	44269.0	1.26
G	Wholesale and retail trade; repair	29285.6	1031356.0	2.84
H	Transport and warehousing	1120.7	35156.4	3.19
J	Information and telecommunications	6500	41500.0	15.66
M	Professional, scientific, and technical activities	5800	38000	15.26

Source: compiled by the authors based on data from the State Statistics Service of Ukraine (n.d.-b, n.d.-c).

A comprehensive set of analytical tools was used to ensure the accuracy of calculations and verification of the proposed model. The collection and consolidation of the initial financial and economic indicators of small businesses by section of the Classification of Economic Activities (KVED, Ukrainian national classification aligned with NACE Rev. 2; sections A, C, D, F, G, H, J, and M) was carried out based on data from the State Statistics Service of Ukraine (n.d.-a, n.d.-b, n.d.-c).

To estimate the tax burden ratio on profits under the current taxation system (λ_{base}), Equation 3 was used, assuming T_{base}=5% (Table 4).

The data in Table 5 show that, with a flat tax rate (5%), highly profitable industries (J, M) had a tax burden ratio on profit λ_{base} of 32%, which means that only about one-third of profits were taxed. In contrast, low-profitability industries (F) had a λ_{base}value of 400%, indicating significant fiscal imbalances in the taxation system for small businesses.

Table 4

Calculation of the base tax burden on income (λ_{base})

KVED section	Profitability (R_i), %	T_{base} (5%)	λ_{base} (at T=5%), %
M	15.26	5	32.7
J	15.66	5	31.9
A	10.24	5	48.8
C, D, H	≈ 3.3	5	≈151.5
G	2.84	5	176.1
F	1.26	5	396.8

Source: calculated by the authors.

Table 5

Performance of small enterprises by share of value added in 2019

KVED section	Activity	Total Revenue (TR), million UAH	Value Added (VA), million UAH	VA Share[1], %
A	Agriculture, forestry, and fisheries	58718	3600	High
C	Manufacturing	338021.2	115000	Medium
D	Electricity, gas, and steam supply	4756.9	–	Average
F	Construction	44269.0	33000	Average
G	Wholesale and retail trade; repair	1031356.0	31000	23.85
H	Transportation and warehousing	35156.4	3100	Average
J	Information and telecommunications	41500	27500	57
M	Professional, scientific, and technical activities	38000	24500	66

Source: compiled by the authors based on data from the State Statistics Service of Ukraine (n.d.-a, n.d.-b).

[1] Note: For sectors A (agriculture), C, D, H (production, energy supply, transport), and F (construction), the exact calculated values of value added (VA) are not published by state statistics agencies in the necessary detail for small businesses due to statistical confidentiality rules. In this regard, qualitative assessments (high/medium/low) are applied to these sectors, based on: analysis of the cost structure, using the material intensity (MI) indicator as a reverse proxy for VA (the higher the MI level, the lower the share of VA); consolidated statistical data by type of economic activity, namely estimates for the relevant sections of the Classification of Economic Activities in the total volume without dividing enterprises by size (small/large), which ensures the scientific accuracy of generalizations; comparative analysis, in particular a comparison with the structure of value added in the Polish taxation system, which uses a similar principle of tax rate differentiation.

The next important indicator for justifying rate differentiation is the value *added share (VA Share*). It is calculated using Equation 5 and reflects the share of value added created in the total turnover of enterprises in the relevant sector.

$$VAShare_i = \frac{VA_i}{TR_i} \times 100\%, \quad (5)$$

where VA_i *(Value Added)* is value added at factor costs; TR_i *(Total Revenue)* is the volume of sales (income).

The results of the calculations are presented in Table 5.

To achieve a higher level of scientific validity and harmonization with European standards of tax neutrality, additional structural and socio-labor indicators are introduced. This allows for a transition to a multifactor differentiation model, within which the rate T_i is considered as a function not only of the level of profitability, but also of the contribution to value added and the characteristics of the operational cost structure of enterprises in the relevant sectors (Table 6).

Table 6

Set of indicators used to justify differentiated rates

Group of indicators	Indicator	Purpose for T_i
Financial capacity	R_i (Profitability)	Basic criterion: determines tax capacity.
Fiscal fairness	λ_i (Profit burden ratio)	Key indicator: measures the effectiveness of the burden.
Structural efficiency	*VA* ratio *Share*	Measures value: the higher *the VA*, the higher the T_i should be
Operational structure	Material intensity ratio	Measures costs: the higher the material intensity, the lower T_i should be.
Social factor	Number of employees per unit of TR_i	Measures labor intensity: important for qualitative justification of preferential rates.

Source: compiled by the authors.

The rate differentiation model T_i is based on the assumption that the tax rate should be directly proportional to the level of profitability and determined taking into account socio-economic priorities. Such priorities are introduced into the model through qualitative adjustment factors in the form of a multiplier (β_i).

$$T_i = f(R_i) \times \beta_i, \quad (6)$$

where β_i is an adjustment multiplier, the value of which is determined by a set of structural and socio-economic characteristics of the sector and depends on the following conditions:

- $\beta_i > 1$ (increase) – applied to sectors with a high specific weight of value added (*VA*) and low material intensity (*MC*);
- $\beta_i < 1$ (decrease/support) – applied to sectors with high material intensity or low profitability (R_i), which is a direct economic justification for the application of preferential tax rates.

The adjustment coefficient β_i is defined as a function of the relative deviations of sectoral structural characteristics – namely, the share of value added, material intensity, and labor intensity – from their sample averages. A composite structural index is constructed using a uniform procedure applied to all sectors without individual expert adjustments. To ensure tax stability, the amplitude of the adjustment is restricted to a fixed range of ±10%. This approach minimizes subjectivity and guarantees the replicability of the results.

The proposed approach allows for the formation of fiscal policy targets for the tax burden on profits (λ_i) in accordance with the provisions of the National Revenue Strategy and the principle of fiscal fairness, namely:

(1) maximization of the tax burden – for sectors with the highest profitability R_i (J, M), for which the value *of* λ_i should be maximum and close to 100% (compliance with the general taxation system);

(2) minimization of tax distortions – for sectors with the lowest profitability R_i (F, G), for which λ_i should be as low as possible, even if it exceeds 100%, which is interpreted as a form of tax support;

(3) neutral tax burden – for manufacturing and strategically important sectors R_i (A, C, D, H), for which the value of λ_i should remain moderate.

The economic-mathematical modeling was carried out using *MS Excel* with the *Solver* add-in (*GRG Nonlinear algorithm*), which enabled the construction of an iterative model for estimating the effective profit tax burden coefficients (λ_i) and the share of value added (*VA*). The convergence criterion was defined as the stabilization of tax rate values with a precision of 0.01 percentage points and the attainment of a stable minimum of the objective function. The calculation of differentiated tax rates T_i was based on multifactor analysis and the optimization of the fiscal capacity objective function.

The results of economic and mathematical modeling are presented in Table 7.

Table 7

Multifactor justification for the differentiation of single tax rates (2019)

KVED section	R_i, %	*VA Share,* %	*MC*	λ_{base} (at T = 5%), %	Proposed rate T_i, %	Burden coefficient (λ_i), %	Qualitative justification (β_i)
M	15.26	6	Low	32	15	98.3	$\beta_i >> 1$. Highest VA. $\lambda_i \rightarrow 100\%$; approximation to the general taxation system.
J	15.66	57	Low	31	12	76.6	$\beta_i > 1$. High R_i; consistent with the practice of taxation of services in Poland.
A	10.2	High	Average	48	8	78.1	Moderate λ_i; balanced increase.
C, D, H	≈3	Average	High	151	6	≈181.8	$\beta_i \approx 1$. High *MC* restrains the growth of T_i, supporting production.
G	2.84	23.85	High	176.1	4	140.9	$\beta_i < 1$. Lowest *VA*; minimization of λ_i to support trade.
F	1.26	Average	Highest	396.8	4	317.5	$\beta_i << 1$. Extremely low R_i; minimization of distortions.

Source: calculated by the authors.

Tax rate differentiation reduces fiscal asymmetry by increasing T_i for highly profitable sectors (where λ_i increases to 76–98%) and reducing T_i for low-profit sectors (where λ_i remains relatively high, but significantly reduced).

Particular attention should be given to cases where λ_i >100%, meaning that the calculated tax liability exceeds the average financial result of the sector. Such a situation does not imply actual taxation beyond profit at the level of individual firms; rather, it reflects a structural mismatch between a turnover-based tax and low average sectoral profitability.

From an economic perspective, these outcomes may indicate:

- limited suitability of the simplified taxation regime for low-margin or highly volatile industries;
- the need for alternative government support instruments (such as subsidies, tax credits, or direct transfers);
- substantial intra-sectoral heterogeneity concealed by aggregated statistical indicators.

The proposed rates T_i strictly adhere to the profitability hierarchy: $T_{F,G}$ (4%) < $T_{C,D,H}$ (6%) < T_A (8%) < T_J (12%) < T_M (15%). This confirms the mathematical consistency of the model and the absence of incentives for taxpayers to artificially move to lower tax categories.

Accordingly, the proposed rate adjustments should be interpreted as an instrument for minimizing tax distortions within the existing regime rather than as a universal mechanism of sectoral support. This highlights the trade-off between horizontal neutrality and intersectoral equity considerations, which constitutes a central issue in optimal taxation theory.

Implementation of Research Results

Based on the results of economic and mathematical modeling, a set of institutional measures has been proposed for the implementation of a differentiated model of a simplified taxation system, in particular:

(1) legislative introduction of differentiated rates – amendments to the Tax Code of Ukraine establishing single tax rates of 4%, 6%, 8%, 12% and 15% with a clear link to the KVED-2010 codes (Table 3) as a key tool for implementing the National Revenue Strategy;

(2) introduction of a fiscal restriction based on the tax burden coefficient (λ_i) – legislative consolidation of the application of the minimum rate (4%) to sec-

tors in which the value of λ_i exceeds 200% at a base rate of 5%, ensuring the transparency of fiscal support mechanisms;

(3) institutionalisation of the value added (*VA*) indicator – inclusion of the *VA/TR* indicator in the official statistical methodology as a mandatory indicator for the STS sectors for the purpose of periodic (once every 3–5 years) monitoring of the validity of rates;

(4) encouraging the legalization of employment – introducing an additional condition for applying the 6% rate for manufacturing sectors (C, D, H) related to the level of official employment, in particular the number of employees (*L*) per unit of income.

(5) taking into account potential behavioral responses of taxpayers, it is advisable to introduce a pilot phase (sectoral or regional) lasting 1–2 fiscal years, followed by a decision on nationwide implementation based on predefined quantitative criteria. These may include the absence of significant deviations of actual tax revenues from projected values, no statistically significant increase in the number of entities in the lowest tax brackets (as a potential indicator of business fragmentation), and the stability of λ_i coefficients within target intervals. Such an approach is consistent with the principle of gradual fiscal reform and reduces the risk of systemic distortions during the implementation of the proposed model.

Conclusions

The results of multifactorial economic and mathematical modeling confirmed the main hypothesis of the study, according to which the differentiation of single tax rates by type of economic activity is the only scientifically sound mechanism for restoring fiscal justice within the simplified taxation system, in particular by:

- Elimination of fiscal asymmetry – the proposed system of rates T_i in the range of 4–15% eliminates critical imbalances in the tax burden ratio on profit λ_i that existed under a single rate of 5%. It has been established that highly profitable sectors with low material intensity (J, M) have sufficient tax capacity to allow rates to be raised to 12–15% while maintaining an acceptable effective tax burden (λ_i< 100%).
- Empirical confirmation of the Polish approach – the model mathematically substantiates the direct dependence of rates T_i on the specific weight of value added (*VA*). Sectors with high *VA* (in particular IT and consulting services) are logically taxed at the highest rates, which is consistent with the fiscal logic of the Polish *Ryczałt* system.

- Socio-economic protection of vulnerable sectors – for low-profit and high-material-intensive sectors (F, G), the 4% rate is not a tax break, but a critically necessary tool for minimizing tax distortions. In this case, the rate reduction serves as a form of state support aimed at preserving employment and ensuring the operational viability of enterprises.

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