



A Grey Hybrid Multi-Criteria Decision-Making Framework for Assessing Tax Performance in G7 Economies

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ABSTRACT

In spite of the fact that tax performance constitutes a central dimension of fiscal governance, its comparative measurement across countries has received limited attention within the multi-criteria decision-making literature. Addressing this gap, the present manuscript proposes an integrated hybrid decision-making methodology, combining the Grey Symmetry Point of Criterion (Grey SPC) and Grey Simple Ranking Process (Grey SRP) methods, for the systematic and comparative assessment of tax performance. The introduced model derives objective criterion weights through the Grey SPC approach and generates country rankings through the Grey SRP technique, ensuring full methodological consistency between the two stages while preserving uncertainty throughout the analytical process via grey interval numbers. The developed approach is empirically applied to the G7 economies using ten-year average data for the period 2013–2022 across four tax performance indicators: total tax revenue, income and profits tax, corporate tax, and goods and services tax. The empirical findings reveal goods and services tax as the most influential criterion, while France attains the highest overall tax performance score among the G7 economies. The robustness of the rankings is confirmed through systematic weight sensitivity analyses and comparisons with five widely adopted grey multi-criteria decision making (MCDM) methods. Overall, the findings provide useful policy insights for improving fiscal performance through structural reforms in tax composition rather than through a sole emphasis on aggregate revenue levels.

1. Introduction

Taxation constitutes one of the most fundamental institutional mechanisms through which modern states mobilize resources, sustain public expenditure, and preserve macroeconomic stability. Rooted in Musgrave and Musgrave's [1] tripartite framework of resource allocation, income redistribution, and economic stabilization, the core functions of public finance are largely determined by the capacity and effectiveness of the tax system. Beyond its conventional role as a source of public revenue, the tax system reflects the fiscal capacity, administrative capability, and broader governance quality of a country. A well-functioning tax structure enables governments to sustain essential public services and social protection programs, expand policy space, and respond more

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effectively to economic and social shocks [2]. By contrast, weak tax performance constrains fiscal flexibility, deepens budgetary fragility, and undermines the long-term sustainability of development strategies [3]. In this respect, the tax system is recognized as a strategic public institution that not only finances a country's current welfare but also shapes its future development capacity, a point that is particularly salient for advanced economies in which the fiscal contract between the state and its citizens underpins the legitimacy of redistributive governance [4].

Yet a country's possession of a legally functioning tax system and the effective, equitable, and sustainable performance of that system represent fundamentally distinct conditions. Systematic measurement and evaluation of tax performance therefore responds not merely to an academic concern but to an analytical imperative that is essential for concrete policy design. Without measurement, meaningful comparison across countries becomes impossible; without comparison, it is equally impossible to identify which countries have developed more effective tax capacity under which conditions, or whether such achievements are transferable [5]. For policymakers, measuring tax performance provides an indispensable knowledge base for identifying reform priorities, allocating resources efficiently, and strengthening accountability mechanisms. International organizations such as the IMF and OECD regularly monitor the tax capacity of member countries through comparative indicators and ground their technical assistance and policy recommendations in these measurement findings [3-6]. For academic scholarship, measuring tax performance constitutes a prerequisite for understanding how tax structure shapes outcomes such as economic growth, income distribution, and institutional quality, a relationship that Acosta-Ormaechea *et al.* [7] document systematically across a broad cross-section of countries. Across all these dimensions, the measurement of tax performance serves as an indirect indicator of a country's governance capacity and institutional maturity, with strong tax performance reflecting the credibility and sustainability of the fiscal contract between the state and its citizens [4].

Notwithstanding its importance, tax performance is still frequently assessed through highly aggregated measures, most notably the total tax-to-GDP ratio. While such measures offer a useful macro-level overview of revenue generation capacity, they remain inadequate for capturing the internal structure of national tax systems [8]. Countries that share similar overall tax burdens may differ substantially in the composition of tax revenues, the relative weight of direct and indirect taxation, and the contribution of corporate tax to the overall fiscal structure. These structural differences cannot be adequately revealed through comparisons based on a single fiscal indicator. Tax performance should therefore not be reduced to a single financial ratio; rather, it should be conceptualized as a multidimensional phenomenon that is jointly shaped by the level and composition of tax revenue generation [2], [5]. Furthermore, the weighting of each criterion varies according to the priorities of decision-makers and the objectives of the analysis, giving rise to the risk of bias associated with subjective weighting. It is precisely at this juncture that multi-criteria decision-making approaches emerge as a critical methodological necessity. Multi-Criteria Decision-Making (MCDM) approaches offer four key advantages: the capacity to process multiple conflicting criteria simultaneously; the possibility of objective weighting derived from the internal structure of the data; a transparent comparative framework that renders visible from which criteria performance differences originate; and a traceable ranking logic that translates analysis into actionable policy recommendations [9-11].

Although a substantial body of literature has assessed countries' performance from various perspectives, tax performance has received remarkably limited attention within the MCDM literature. To the best of our knowledge, only Çiçek [8] has directly addressed this issue by applying an Entropy–MULTIMOORA framework to 18 OECD economies using biennial cross-sectional data.

This clear gap provides the main motivation for the present study. Accordingly, this manuscript proposes an integrated MCDM framework for the systematic and comparative assessment of countries' tax performance. The proposed methodology combines the SPC and SRP methods within a grey environment, which is particularly suitable for handling incomplete information, limited data, and weak discrimination among alternatives without requiring probability distribution or membership function assumptions [12-13].

In this framework, the existing manuscript introduces an integrated hybrid grey decision-making model that combines the Grey SPC and Grey SRP approaches. The criterion weights are identified objectively through the Grey SPC technique, introduced by Gligorić *et al.* [14] and extended within the grey system theory framework by Işık *et al.* [15], which derives criterion importance from deviations of alternatives from the symmetry point of each criterion without relying on any normalization procedure. The final country rankings are obtained through the Grey SRP method, originally proposed by Zakeri *et al.* [16] and similarly extended to its grey counterpart by Işık *et al.* [15], operating in direct alignment with the grey weights derived from the Grey SPC stage. The integrated structure of these two approaches preserves uncertainty coherently throughout the entire solution process, represents performance values through grey interval numbers rather than point estimates, and structurally departs from both classical MCDM and fuzzy set-based approaches in that it requires neither probability distribution nor membership function assumptions.

The proposed Grey SPC–SRP framework offers methodological advantages over alternative MCDM approaches along three principal axes. First, in handling uncertainty, crisp MCDM techniques (e.g., TOPSIS, VIKOR, MULTIMOORA, Entropy-based weighting) compress temporal variability into point estimates, while fuzzy and neutrosophic extensions require a priori membership functions or indeterminacy degrees that introduce subjective judgment. The grey set-based architecture circumvents both limitations by representing each performance value as a closed interval derived directly from the data, without any distributional assumption [12], [13]. Second, in ensuring methodological consistency, many hybrid frameworks combine weighting and ranking techniques originating from heterogeneous mathematical foundations, requiring intermediate normalization steps that may distort the propagation of uncertainty across stages. By contrast, Grey SPC and Grey SRP share a coherent grey-arithmetic logic in which interval-valued weights flow directly into the ranking stage without re-normalization, ensuring uncertainty is preserved throughout the entire analytical pipeline [15]. Third, in improving decision robustness, the absence of normalization in Grey SPC eliminates a well-documented source of rank reversal in classical MCDM applications, and the framework's stability is further validated empirically in Section 5 through both a systematic weight sensitivity analysis and a cross-method comparison against five widely employed grey MCDM techniques. Taken together, these properties render the framework particularly well-suited to comparative fiscal performance assessment under conditions of measurement heterogeneity, periodic methodological revisions in source data, and inter-temporal volatility, precisely the conditions characterizing internationally comparable tax revenue statistics.

The proposed framework is empirically applied to the G7 economies in order to assess their tax performance in a comparative setting. Building directly on the limitations identified above, namely, the predominance of single-indicator metrics, the absence of an objective weighting structure, the conceptual conflation of fiscal level and composition, and the scarcity of robustness-oriented MCDM applications in the tax performance domain, this manuscript addresses the following five interconnected research questions:

RQ1: Given the absence of an objective, data-driven weighting structure in the comparative tax performance literature, what are the relative weights of the principal tax performance indicators

across G7 economies, and which structural dimension exerts the strongest discriminative effect on cross-country differentiation?

RQ2: Beyond the single-indicator orientation that has dominated prior comparative assessments, how do G7 economies rank in terms of multidimensional tax performance once the structural composition of their revenue systems is jointly considered under conditions of measurement uncertainty and inter-temporal volatility?

RQ3: In light of the conceptual ambiguity surrounding the relative analytical importance of aggregate fiscal pressure versus structural revenue composition, which of these two characteristics constitutes the principal source of cross-country tax performance differentiation within the G7?

RQ4: Considering the well-documented sensitivity of MCDM rankings to the weight configuration adopted, to what extent does the obtained tax performance hierarchy remain robust to systematic perturbations in the relative importance of the most influential criterion?

RQ5: Given the methodological heterogeneity of grey MCDM ranking algorithms, do the country rankings produced by the proposed Grey SPC–SRP framework remain consistent when benchmarked against alternative widely employed grey MCDM techniques?

Beyond addressing these questions, the present manuscript advances the existing body of literature along three clearly differentiated dimensions, each filling a specific gap that has hitherto remained unaddressed. From a conceptual standpoint, while previous tax performance studies have predominantly relied on single-indicator metrics, especially the tax-to-GDP ratio, this manuscript reconceptualizes tax performance as a multidimensional construct in which the composition of taxation, rather than its aggregate level, constitutes the analytical primitive. This conceptual reformulation also differs from the closest prior MCDM application, Çiçek [8], in that it explicitly disentangles structural revenue composition from aggregate fiscal pressure and treats the two as analytically distinct objects of evaluation, rather than aggregating them within a single performance index. From a methodological standpoint, the manuscript introduces the first integrated application of the Grey SPC–SRP framework to fiscal performance measurement. Whereas prior grey MCDM applications in the fiscal and economic domain (e.g., [21], [25–28]) typically rely on hybrid configurations whose weighting and ranking stages combine heterogeneous mathematical logics, thereby introducing inconsistencies in the propagation of grey uncertainty between stages, the proposed Grey SPC–SRP integration adopts a fully grey-coherent architecture in which both stages operate directly on grey interval numbers, dispense with normalization, and remain free of probability or membership function assumptions. From an empirical standpoint, the paper provides the first systematic, ten-year comparative documentation of structural tax performance across the G7 economies under uncertainty, thereby filling a notable gap in the comparative fiscal literature, where attention has predominantly been directed toward developing economies and toward the level rather than the composition of taxation [2], [5], [7]. The resulting performance hierarchy offers an externally validated diagnostic benchmark that can inform both national fiscal reform deliberations and multilateral tax policy coordination.

The remainder of the paper is organized as follows: the methodological framework is presented in Section 2; the case study, including the tax performance indicators and decision alternatives, is described in Section 3; the empirical application of the introduced grey hybrid model is reported in Section 4; sensitivity and robustness analyses are conducted in Section 5; the findings are discussed and their policy implications are elaborated in Section 6; and concluding remarks are offered in Section 7.

2. Methodology

In this study, a two-stage hybrid decision-making framework grounded in grey system theory is developed to objectively assess the tax performance of the G7 countries over the 2013–2022 period under conditions of uncertainty. In the first stage, the G-SPC method is employed to derive the objective weights of the four tax performance indicators; in the second stage, these weights are transferred to the G-SRP method to rank the alternative countries. As outlined in Figure 1, the proposed framework delivers a systematic analysis built upon a set of mutually reinforcing methodological stages.

The combination of Grey SPC and Grey SRP within a single hybrid framework reflects a deliberate complementarity rather than an arbitrary pairing. Grey SPC addresses the weighting stage by deriving criterion importance from the deviation of alternatives from the symmetry point of each criterion, without normalization or distributional assumptions, while Grey SRP addresses the ranking stage through a transparent rank-based aggregation that operates on the same grey-arithmetic foundation. This pairing offers three advantages over standalone applications and alternative hybrid configurations. First, it enhances reliability: conventional hybrids combining grey weighting (e.g., Grey Entropy, Grey CRITIC) with normalization-dependent ranking algorithms (e.g., Grey TOPSIS, Grey COPRAS) require intermediate normalization steps that may compress the interval information generated at the weighting stage, whereas the Grey SPC–SRP integration transmits the grey weights to the ranking stage in their original interval form. Second, it improves interpretability: both methods share a comparative-deviation logic that renders the final scores directly traceable to the underlying performance differentials, a property particularly valuable for policy-oriented users. Third, it strengthens robustness: the absence of normalization in both stages eliminates a well-documented source of rank reversal in classical MCDM applications, a property empirically corroborated by the sensitivity and cross-method analyses reported in Section 5. The theoretical foundations of the framework are elaborated in the subsequent subsections.

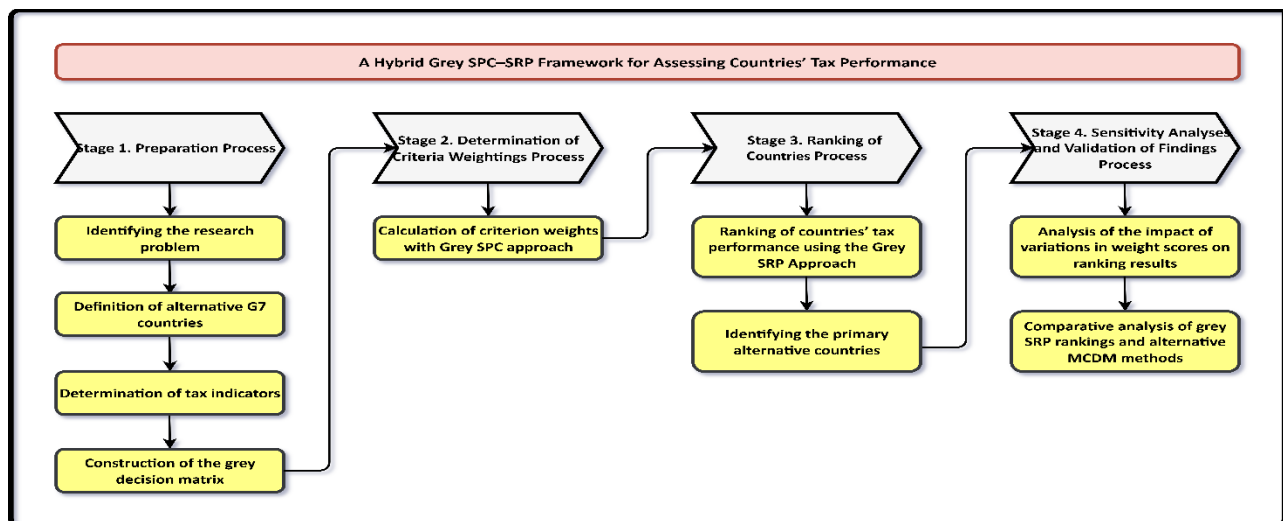


Fig. 1. Methodological framework

2.1 Grey SPC Approach

The SPC approach was introduced to the literature by Gligorić *et al.* [14] (2023) as a decision-making technique designed to objectively determine the relative importance of criteria. In its original formulation, the method takes as its reference the midpoint (i.e., the symmetry point) positioned between the extreme values of each criterion and quantifies the informational content of the criteria based on the deviations of alternatives from this reference point [11]. Three distinctive features set the classical SPC apart from other objective weighting techniques: its independence from any normalization procedure, its balanced treatment of the influence each criterion exerts on the decision problem, and the mathematical parsimony of its underlying algorithm [17]. Nevertheless, since the classical SPC operates on crisp numbers, its capacity to accommodate the uncertainty, information incompleteness, and measurement imprecision frequently encountered in real-world decision environments remains rather limited. To overcome this limitation, Işık *et al.* [15] extended the SPC method within the framework of Deng’s [18] grey system theory by reformulating it to operate with grey interval numbers, thereby proposing the extension referred to as G-SPC. While preserving the inherent strengths of the classical approach, this grey extension offers a structure that (i) allows performance values to be expressed as intervals rather than point estimates, (ii) yields reliable outcomes in decision problems characterized by sparse or incomplete data, and (iii) requires neither membership functions nor probability distribution assumptions, thus differing fundamentally from fuzzy set and neutrosophic set-based approaches. The implementation procedure of this weighting approach comprises the following six steps.

Step 1. The grey performance matrix, consisting of alternatives and assessment criteria, is created via Equation (1).

$$\otimes Z = [\otimes z_{ij}]_{m \times n} = \begin{bmatrix} [z_{11}^l, z_{11}^u] & [z_{12}^l, z_{12}^u] & \cdots & [z_{1n}^l, z_{1n}^u] \\ [z_{21}^l, z_{21}^u] & [z_{22}^l, z_{22}^u] & \cdots & [z_{2n}^l, z_{2n}^u] \\ \vdots & \vdots & \ddots & \vdots \\ [z_{m1}^l, z_{m1}^u] & [z_{m2}^l, z_{m2}^u] & \cdots & [z_{mn}^l, z_{mn}^u] \end{bmatrix}_{m \times n} \quad (1)$$

The matrix denoted $\otimes z_{ij}$ is composed of z_{ij}^l and z_{ij}^u values, which represent the lower and upper bounds associated with the evaluation criteria, respectively.

Step 2. The grey form of the symmetry point for each criterion is determined through Equation (2). The symmetry point of a given criterion is defined as the arithmetic mean of the minimum and maximum grey numbers located at the lower and upper bounds of the performance values pertaining to that criterion.

$$\otimes f_j = [f_j^l, f_j^u] = \frac{\max\{\otimes z_{ij} | 1 \leq i \leq m\} + \min\{\otimes z_{ij} | 1 \leq i \leq m\}}{2} = \left[\frac{\max\{z_{ij}^l | 1 \leq i \leq m\} + \min\{z_{ij}^l | 1 \leq i \leq m\}}{2}, \frac{\max\{z_{ij}^u | 1 \leq i \leq m\} + \min\{z_{ij}^u | 1 \leq i \leq m\}}{2} \right] \quad (2)$$

Step 3. The grey absolute distance matrix, which captures the deviation of each alternative from the symmetry point of the corresponding criterion, is derived by means of Equation (3).

$$\otimes d_{ij} = [d_{ij}^l, d_{ij}^u] = |\otimes z_{ij} - \otimes f_j| = [\min(|z_{ij}^l - f_j^l|, |z_{ij}^u - f_j^u|), \max(|z_{ij}^l - f_j^l|, |z_{ij}^u - f_j^u|)] \quad (3)$$

Step 4. The symmetry modulus matrix, expressed in Equation (4), is obtained by scaling the grey absolute distances against the mean of the grey performance values associated with each criterion.

$$\otimes s_{ij} = [s_{ij}^l, s_{ij}^u] = \left[\frac{\sum_{i=1}^m \otimes d_{ij}}{\otimes z_{ij}} \right] = \left[\min \left(\frac{\sum_{i=1}^m d_{ij}^l}{z_{ij}^l}, \frac{\sum_{i=1}^m d_{ij}^u}{z_{ij}^u} \right), \max \left(\frac{\sum_{i=1}^m d_{ij}^l}{z_{ij}^l}, \frac{\sum_{i=1}^m d_{ij}^u}{z_{ij}^u} \right) \right] \quad (4)$$

Step 5. For each performance indicator, the grey symmetric modulus vector is subsequently computed via Equation (5).

$$\otimes c_j = [c_j^l, c_j^u] = \left[\frac{\sum_{j=1}^n \otimes s_{ij}}{m} \right] = \left[\frac{\sum_{j=1}^n d_{ij}^l}{m}, \frac{\sum_{j=1}^n d_{ij}^u}{m} \right] \quad (5)$$

Step 6. In the final step, the grey objective weight scores of the performance indicators are calculated through Equation (6).

$$\otimes w_{j,spc} = [w_{j,spc}^l, w_{j,spc}^u] = \left[\frac{\otimes c_j}{\sum_{j=1}^n \otimes c_j} \right] = \left[\min \left(\frac{c_j^l}{\sum_{j=1}^n (c_j^l)}, \frac{c_j^u}{\sum_{j=1}^n (c_j^u)} \right), \max \left(\frac{c_j^l}{\sum_{j=1}^n (c_j^l)}, \frac{c_j^u}{\sum_{j=1}^n (c_j^u)} \right) \right] \quad (6)$$

2.2 Grey SRP Approach

The SRP is an innovative decision-making technique proposed by Zakeri *et al.* [16] for addressing complex decision problems that involve a large number of alternatives and criteria. The classical SRP approach handles both the ranking values of alternatives and the weights of criteria as crisp numbers, which restricts the representational capacity of the method in decision environments characterized by uncertainty. To overcome this limitation, Işık *et al.* [15] extended SRP within the framework of grey system theory and introduced its grey counterpart, referred to as G-SRP. The proposed grey extension departs from its classical predecessor in three fundamental respects. First, the ranking values of alternatives together with the criterion weights are processed in the form of grey interval numbers, thereby being represented through intervals bounded by lower and upper limits rather than point estimates. Second, uncertainty is coherently preserved throughout the entire solution process—from the weighting stage to the final ranking—thus allowing the outcomes to be interpreted in terms of confidence intervals. Third, the method offers an integrated structure that operates in direct alignment with the grey weights derived from the G-SPC stage, ensuring methodological consistency between the weighting and ranking procedures. Owing to these characteristics, G-SRP provides a suitable framework for international comparative studies in which data are more appropriately expressed as variable intervals due to measurement error, methodological revisions, and temporal fluctuations. The implementation process of this ranking approach is organized into the following six steps.

Step 1. The grey decision matrix is constructed in line with Equation (1).

Step 2. A grey ranking matrix is formed to compare each alternative with respect to every criterion. When constructing the ranking matrix, if the criterion under consideration is of benefit-type, the alternative exhibiting the highest performance value is ranked as the best; conversely, if the criterion

is of cost-type, the alternative with the lowest performance value is assigned the top rank. The grey ranking matrix in question is presented in Equation (7).

$$\otimes R = [\otimes r_{ij}]_{m \times n} \quad (7)$$

Step 3. Drawing upon the weight scores associated with the evaluation criteria, the grey weighted ranking matrix is derived within the framework of Equation (8).

$$\otimes h_{ij} = [h_{ij}^l, h_{ij}^u] = [\otimes r_{ij} \times \otimes w_j] = [(r_{ij}^l \times w_j^l), [r_{ij}^u \times w_j^u]] \quad (8)$$

Step 4. The total ranking score of each alternative is determined through Equation (9).

$$\otimes t_i = [t_i^l, t_i^u] = \sum_{j=1}^n \otimes h_{ij} = [\sum_{j=1}^n h_{ij}^l, \sum_{j=1}^n h_{ij}^u] \quad (9)$$

Step 5. The priority score of each alternative is obtained by means of Equation (10).

$$\otimes p_i = [m - \otimes t_i] = [m - t_i^u, m - t_i^l] \quad (10)$$

Step 6. In the final computational stage of the grey SRP approach, the net performance score of each alternative G7 country is calculated using Equation (11). The decision alternative attaining the highest performance score is interpreted as the most successful.

$$Q_i = 0.5 \times \otimes p_i = 0.5 \times [p_i^l + p_i^u] \quad (11)$$

3. Case Study: A Comparative Assessment of Tax Performance across G7 Economies

This section introduces the case study through which the recommended Grey SPC–SRP hybrid methodology is applied to the comparative assessment of tax performance across G7 economies. The empirical setting is established on the basis of tax performance indicators forming the decision criteria and the G7 economies representing the decision alternatives. Accordingly, the following subsections briefly present the indicators employed in the analysis and the economies included in the empirical assessment.

3.1 Tax Performance Indicators

Four tax performance indicators are employed as evaluation criteria in this study: total tax revenue (C_1), income and profits tax (C_2), corporate tax (C_3), and goods and services tax (C_4). Each indicator is expressed as a percentage of GDP and sourced from the OECD Data Explorer [19]. Their formal definitions, OECD classification references, and directional orientations are provided in Table 1. Given that higher values across all four dimensions reflect greater fiscal mobilization capacity, each criterion is assigned a benefit-type (Max) orientation in the analysis.

Table 1
 Tax Performance Indicators

Symbol	Criterion	Definition	Direction
C_1	Total Tax Revenue	Aggregate compulsory and unrequited payments to general government encompassing OECD Headings 1000 through 6000, expressed as a percentage of GDP	Max
C_2	Income and Profits Tax	Revenues from taxes levied on the income, profits, and capital gains of individuals and corporations (OECD Heading 1000), expressed as a percentage of GDP	Max
C_3	Corporate Tax	Fiscal receipts derived from taxes imposed on the profits of incorporated enterprises and institutional entities (OECD Heading 1200), expressed as a percentage of GDP	Max
C_4	Goods and Services Tax	Revenues from value-added taxes, sales taxes, and excises levied on the consumption of goods and services (OECD Heading 5000), expressed as a percentage of GDP	Max

3.2 Decision alternatives: The G7 countries

The decision alternatives considered in this paper comprise the seven member states of the Group of Seven (G7), Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States. The principal fiscal characteristics of each member state are summarized in Table 2.

Table 2
 Decision Alternatives

Symbol	Country	Tax System Characteristics
A_1	Canada	Canada maintains a balanced revenue mix combining direct and indirect taxation, with a broadly applied goods and services tax and a stable personal income tax base. The federal tax structure involves revenue sharing across central and subnational government levels.
A_2	France	France consistently records one of the highest tax-to-GDP ratios within the OECD, underpinned by an expansive welfare state, a broad value-added tax base, and substantial corporate tax revenues. Its fiscal architecture reflects a strong preference for both direct and indirect revenue instruments.
A_3	Germany	Germany operates a federal tax system characterized by extensive revenue sharing among federal, state, and municipal levels. Social security contributions constitute a dominant component of the overall fiscal structure, while corporate tax revenues remain moderate relative to GDP.
A_4	Italy	Italy exhibits high overall fiscal pressure and a broad value-added tax base, positioning it among the higher-revenue G7 economies. Persistent structural challenges in tax compliance and administrative efficiency have nonetheless limited the full realization of its revenue potential.
A_5	Japan	Japan is distinguished among G7 members by a historically lower total tax-to-GDP ratio and a comparatively narrow goods and services tax base. Rising fiscal consolidation pressures and demographic challenges have intensified the need for revenue mobilization reforms over the study period.
A_6	United Kingdom	The United Kingdom operates a tax system combining personal income taxation, value-added taxation, and national insurance contributions as its principal revenue pillars. Corporate tax revenues remained moderate as a share of GDP over the 2013–2022 period.
A_7	United States	The United States is the only G7 member without a federal value-added tax, relying instead on state-level retail sales taxes. This structural absence, combined with a comparatively low total tax burden relative to other advanced economies, renders the United States a fiscal outlier within the group.

These economies collectively account for approximately forty percent of global gross domestic product and a substantial share of OECD tax revenues, and they share a set of common structural features, including advanced market institutions, mature financial systems, and well-established fiscal frameworks, that render them a methodologically coherent reference group for comparative tax performance analysis.

4. Application of the Introduced Hybrid Model

This section presents the empirical application of the introduced grey-based decision methodology to the assessment of tax performance in the G7 economies.

4.1 Findings Concerning the G-SPC Approach

In the first stage of the assessment procedure, the G-SPC approach was utilized to derive the objective weights of the selected tax performance indicators on the basis of the grey decision matrix constructed in accordance with Equation (1). Prior to presenting the resulting weights, however, two methodological choices underlying the construction of this matrix warrant explicit justification: the specification of the analysis horizon and the adoption of decade-aggregated grey intervals in lieu of an annual panel structure. The 2013–2022 horizon is selected as the most recent decade for which fully harmonized OECD Revenue Statistics are consistently reported across all G7 economies, and it commences after the macro-fiscal disturbances of the 2008–2012 global financial and European sovereign debt crises had substantially dissipated, thereby insulating the analysis from structural breaks that would otherwise confound the underlying tax-structure signal. Decade-aggregated grey intervals, in turn, follow from the analytical intent of characterizing the structural, rather than the dynamic, properties of G7 tax systems: this aggregation attenuates transitory cyclical fluctuations and yields stable reference values for cross-country benchmarking, in alignment with the comparative-static logic of the MCDM framework. While intra-period dynamics are not explicitly captured, this limitation is partially mitigated by representing each country's performance as a grey interval bounded by its observed minimum and maximum over the analysis horizon, thereby preserving the dispersion of country-level performance that would otherwise be discarded under a point-estimate specification; time-disaggregated and dynamic extensions are identified as an avenue for future research in the concluding section.

Accordingly, the grey decision matrix was constructed by defining, for each indicator, the minimum and maximum values attained throughout the 2013–2022 period as the lower and upper bounds of the corresponding grey interval number, respectively. The resulting initial grey decision matrix is reported in Table 3.

Table 3
 Integrated Grey Decision Matrix

	C_1	C_2	C_3	C_4
A_1	[31.132, 34.700]	[11.253, 12.981]	[3.278, 4.573]	[7.170, 7.792]
A_2	[44.885, 46.076]	[8.425, 9.952]	[2.029, 2.924]	[11.658, 12.37]
A_3	[36.812, 39.316]	[9.610, 10.653]	[1.636, 2.423]	[9.742, 10.684]
A_4	[41.731, 43.828]	[10.721, 11.533]	[1.859, 2.872]	[11.475, 12.094]
A_5	[28.557, 34.075]	[5.491, 6.449]	[3.630, 4.570]	[5.021, 7.074]
A_6	[31.732, 35.299]	[8.384, 9.542]	[2.281, 3.105]	[10.262, 10.911]
A_7	[24.991, 27.656]	[9.070, 11.906]	[1.311, 2.257]	[4.310, 4.456]

Following the construction of the grey decision matrix, the grey symmetry points associated with each tax performance indicator were computed via Equation (2); subsequently, the absolute distance matrix was obtained through Equation (3) by calculating the absolute grey value of the difference between the performance of each G7 country on a given indicator and the corresponding symmetry point of that indicator. The results of these computations are jointly reported in Table 4.

Table 4
 Grey Symmetry Points and the Absolute Distance Matrix

	C_1	C_2	C_3	C_4
$\otimes f_j$	[34.938, 36.866]	[8.372, 9.715]	[2.471, 3.415]	[7.984, 8.413]
A_1	[2.166, 3.806]	[2.881, 3.266]	[0.808, 1.158]	[0.621, 0.814]
A_2	[9.210, 9.947]	[0.053, 0.237]	[0.442, 0.491]	[3.674, 3.957]
A_3	[1.874, 2.450]	[0.938, 1.238]	[0.835, 0.992]	[1.758, 2.271]
A_4	[6.793, 6.962]	[1.818, 2.349]	[0.543, 0.612]	[3.491, 3.681]
A_5	[2.791, 6.381]	[2.881, 3.266]	[1.155, 1.160]	[1.339, 2.963]
A_6	[1.567, 3.206]	[0.012, 0.173]	[0.190, 0.310]	[2.278, 2.498]
A_7	[9.210, 9.947]	[0.698, 2.191]	[1.158, 1.160]	[3.674, 3.957]

The symmetry modulus matrix defined in Equation (4) was obtained by scaling the absolute distances relative to the mean of the grey performance values associated with each criterion. This normalization brings the indicators, expressed in different units, onto a common comparative plane. The resulting values are presented in Table 5.

Table 5
 Grey Symmetry Modulus Matrix

	C_1	C_2	C_3	C_4
A_1	[0.154, 0.176]	[0.118, 0.140]	[0.184, 0.224]	[0.335, 0.369]
A_2	[0.107, 0.132]	[0.157, 0.183]	[0.287, 0.361]	[0.206, 0.233]
A_3	[0.130, 0.155]	[0.138, 0.171]	[0.347, 0.448]	[0.247, 0.269]
A_4	[0.115, 0.139]	[0.124, 0.158]	[0.293, 0.394]	[0.210, 0.238]
A_5	[0.168, 0.179]	[0.241, 0.282]	[0.184, 0.202]	[0.407, 0.479]
A_6	[0.151, 0.173]	[0.158, 0.190]	[0.271, 0.321]	[0.234, 0.264]
A_7	[0.192, 0.221]	[0.146, 0.153]	[0.372, 0.559]	[0.558, 0.646]

According to Table 6, goods and services tax (C_4) emerges as the most discriminating criterion in the comparative assessment of G7 tax performance, attaining the highest objective weight with a crisp value of 0.344, followed by corporate tax (C_3) with 0.324, income and profits tax (C_2) with 0.172, and total tax revenue (C_1) with 0.160.

Table 6
 Results of the G-SPC Approach

	C_1	C_2	C_3	C_4
$\otimes c_j$	[0.145, 0.168]	[0.155, 0.182]	[0.277, 0.358]	[0.314, 0.357]
$\otimes w_j$	[0.158, 0.163]	[0.171, 0.174]	[0.311, 0.336]	[0.335, 0.352]
Crisp w_j	0.160	0.172	0.324	0.344
Rank	4	3	2	1

4.2 Findings Related to the G-SRP Approach

In the second stage of the evaluation procedure, the grey objective weights obtained through the G-SPC approach were integrated into the G-SRP method to derive the ranking of the G7 countries in terms of their tax performance. Accordingly, the analysis first proceeded from the grey decision matrix constructed in accordance with Equation (1) and reported in Table 3; subsequently, the grey ranking matrix was established on the basis of Equation (7). The findings pertaining to the grey ranking matrix are presented in Table 7.

Table 7
 Grey Ranking Matrix

	C ₁	C ₂	C ₃	C ₄
A ₁	[5, 5]	[1, 1]	[2, 1]	[5, 5]
A ₂	[1, 1]	[5, 5]	[4, 4]	[1, 1]
A ₃	[3, 3]	[3, 4]	[6, 6]	[4, 4]
A ₄	[2, 2]	[2, 3]	[5, 5]	[2, 2]
A ₅	[6, 6]	[7, 7]	[1, 2]	[6, 6]
A ₆	[4, 4]	[6, 6]	[3, 3]	[3, 3]
A ₇	[7, 7]	[4, 2]	[7, 7]	[7, 7]

Following the construction of the grey ranking matrix, the weighted grey ranking matrix was derived through Equation (8) by multiplying each ranking value by the grey weight coefficients obtained at the G-SPC stage. The resulting values are reported in Table 8.

Table 8
 Grey Weighted Matrix

	C ₁	C ₂	C ₃	C ₄
A ₁	[0.788, 0.817]	[0.171, 0.174]	[0.336, 0.621]	[1.675, 1.762]
A ₂	[0.158, 0.163]	[0.855, 0.868]	[1.243, 1.346]	[0.335, 0.352]
A ₃	[0.473, 0.490]	[0.513, 0.695]	[1.864, 2.019]	[1.340, 1.410]
A ₄	[0.315, 0.327]	[0.342, 0.521]	[1.553, 1.682]	[0.670, 0.705]
A ₅	[0.945, 0.980]	[1.197, 1.215]	[0.311, 0.673]	[2.010, 2.114]
A ₆	[0.630, 0.653]	[1.042, 0.932]	[0.932, 1.009]	[1.005, 1.057]
A ₇	[1.103, 1.143]	[0.347, 0.684]	[2.175, 2.355]	[2.345, 2.467]

In the final stage, the ultimate performance scores of the G7 countries were derived through a three-step procedure. First, the total grey ranking score of each country was computed via Equation (9); subsequently, the grey priority scores were obtained through Equation (10). Finally, these scores were converted into crisp performance scores via the whitenization operator defined in Equation (11), and the G7 countries were ranked according to their tax performance. The resulting findings are provided in Table 9. According to Table 9, France attains the highest tax performance score among the G7 economies with a crisp value of 4.340, followed by Italy (3.943), Canada (3.828), the United Kingdom (3.323), Germany (2.599), Japan (2.277), and the United States (0.691), which records the lowest overall tax performance score in the comparative assessment.

Table 9
 Results of the G-SRP Approach

	Countries	$\otimes t_i$	$\otimes p_i$	Q_i	Rank
A_1	Canada	[2.970, 3.373]	[3.627, 4.030]	3.828	3
A_2	France	[2.591, 2.730]	[4.270, 4.409]	4.340	1
A_3	Germany	[4.190, 4.613]	[2.387, 2.810]	2.599	5
A_4	Italy	[2.880, 3.234]	[3.766, 4.120]	3.943	2
A_5	Japan	[4.463, 4.982]	[2.018, 2.537]	2.277	6
A_6	United Kingdom	[3.593, 3.761]	[3.239, 3.407]	3.323	4
A_7	United States	[5.969, 6.649]	[0.351, 1.031]	0.691	7

5. Sensitivity and Robustness Analyses

This section presents a series of sensitivity analyses designed to test the validity and reliability of the introduced grey hybrid decision-making model employed in assessing the tax performance of the G7 countries.

5.1 Effect of Variations in Criterion Weights on the Ranking

Within the MCDM literature, a variety of sensitivity analysis designs have been proposed to examine the influence of criterion importance weights on the resulting ranking [20-21]. Accordingly, the final weight of the C_4 indicator, identified at the G-SPC stage as the indicator with the highest relative importance for the tax performance of the G7 economies, was systematically reduced by 5 per cent in each scenario, and the resulting 5-percentage-point differential was proportionally redistributed across the remaining four indicators, thereby generating a total of fifty alternative weight vectors. For each of these weight sets, the G-SRP model was re-executed and any shifts in the final ranking of the G7 countries were systematically monitored. The ranking outcomes obtained under each scenario are visualized in Figure 2. An inspection of the figure clearly demonstrates that, despite the progressive reduction in the weight assigned to C_4 across the fifty scenarios, the final ranking of the G7 countries remains entirely unchanged throughout the entire set of perturbations. This finding provides conclusive evidence that the proposed grey hybrid model exhibits strong stability underweight perturbations, and that the resulting ranking is shaped not by the dominant influence of any single indicator but by the holistic contribution of the multidimensional structure formed by all four indicators.

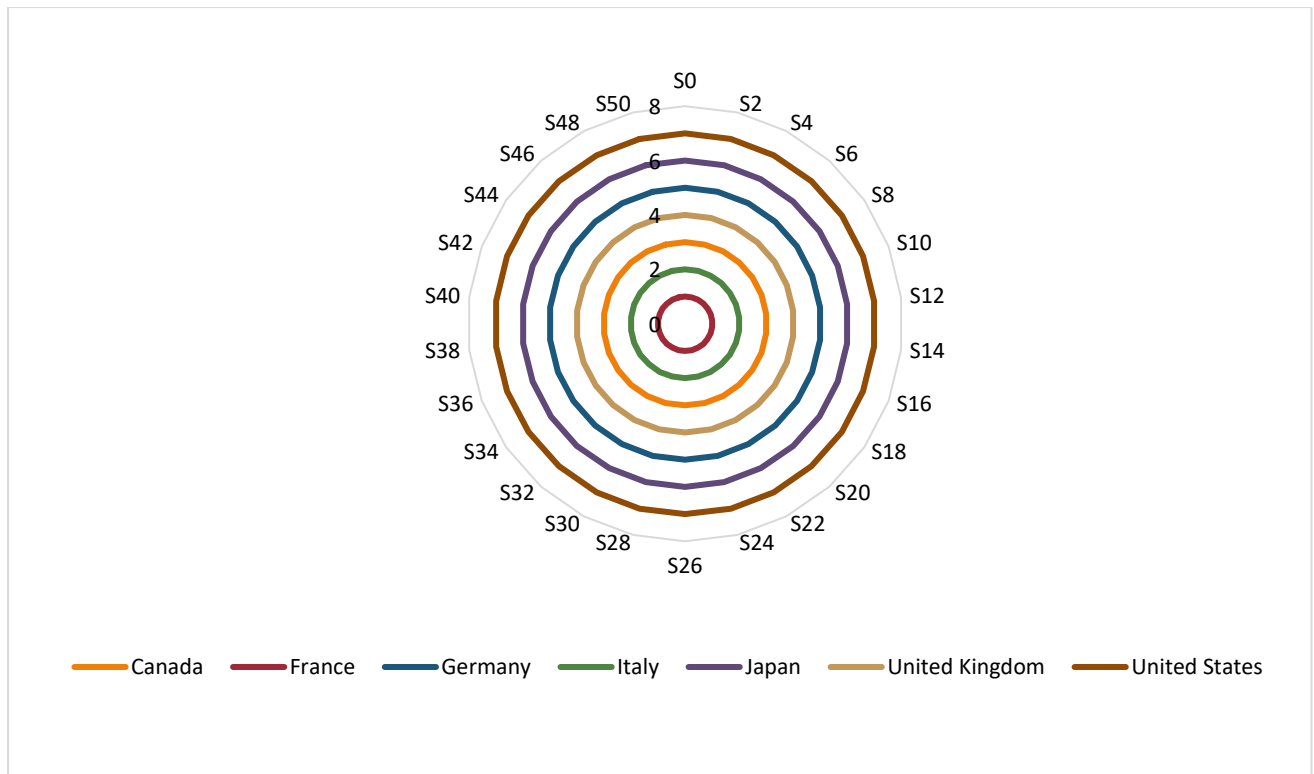


Fig. 2. Rankings Based on the New Weight Sets

5.2 Comparison of the Proposed Model with Alternative Ranking Approaches

At this stage, the reliability, robustness, and consistency of the ranking findings obtained from the proposed grey hybrid model are examined through alternative ranking techniques. Accordingly, the ranking produced by the G-SRP approach was compared against the outcomes generated by five grey MCDM techniques widely employed in the decision-making literature, Grey EDAS [22], Grey MAIRCA [23], Grey MARCOS [24-25], Grey PIV [26-27], and Grey SAW [28]. The results of this comparative analysis are presented in Figure 3. An examination of the figure clearly reveals that the final ranking of the G7 countries remains strictly identical across all five alternative grey ranking approaches, with no shift observed in the relative position of any country. This finding provides conclusive evidence that the weight structure derived at the G-SPC stage produces identical ranking outputs even when processed through different ranking algorithms, thereby demonstrating that the proposed model exhibits strong independence from the choice of ranking technique.

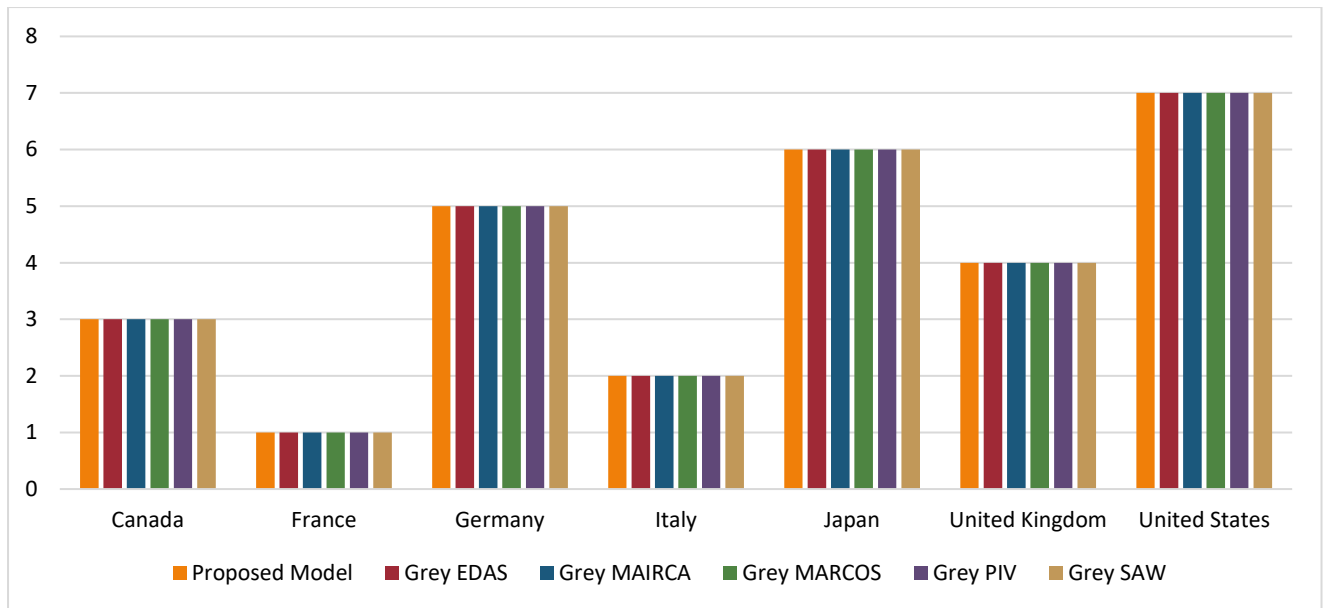


Fig. 3. Ranking Stability of the G7 Countries across Different Grey MCDM Tools

6. Discussion and Policy Implications

The grey objective weights derived through the Grey SPC approach reveal a clear hierarchical structure among the four tax performance criteria, the analytical content of which extends well beyond a numerical ranking. The two composition-based criteria, goods and services tax and corporate tax, jointly capture the majority of the total discriminating information, whereas the level-oriented indicator of total tax revenue absorbs the smallest share. This pronounced dominance of compositional over aggregate-level criteria is itself the central methodological finding of the weighting stage: it suggests that, in the high-income subset of the OECD, fiscal heterogeneity is generated primarily by the structure of revenue mobilization rather than by its aggregate intensity. This pattern resonates directly with the empirical literature on the differential growth and welfare implications of alternative tax mixes [7], which has consistently emphasized the analytical primacy of revenue composition over aggregate fiscal pressure in advanced economies. The high discriminative power of goods and services tax is, in turn, traceable to a well-defined institutional asymmetry: the United States is the only G7 jurisdiction operating without a federal consumption tax of value-added type, while the remaining six members rely on broadly applied VAT systems whose statutory rates and base coverage differ substantially [6]. Likewise, the prominence of corporate tax mirrors the well-documented cross-country dispersion in effective corporate taxation, jointly determined by statutory rate differentials, base-erosion exposure, and the sectoral profile of taxable profit [6]. By contrast, the low weight obtained for total tax revenue should not be read substantively as evidence of irrelevance; methodologically, it reflects the comparatively low informational content of an aggregate indicator within an institutionally homogeneous reference set, in which tax-to-GDP ratios cluster within a relatively narrow band. Taken jointly, these results constitute the empirical foundation for the central conceptual claim of the paper: among advanced economies, comparative tax performance is differentiated principally along the composition axis rather than the level axis (RQ3).

The Grey SRP results reveal a clear performance hierarchy across the G7 economies that acquires its analytical content only when read jointly with the criterion weights derived at the Grey SPC stage; under that lens, each country's position emerges as the joint outcome of two structurally distinct revenue dimensions, the breadth and depth of consumption taxation, and the effective taxation of corporate profit. The leading positions of France and Italy reflect the coincident operation of these two forces: both economies combine high aggregate fiscal pressure with structurally broad VAT systems [6], although the well-documented compliance and administrative-efficiency frictions of the Italian fiscal apparatus [3] suggest that its nominal score partly reflects revenue capacity rather than fully realized revenue performance. Canada's intermediate ranking is generated through a structurally different mechanism: rather than excelling along any single axis, its tax architecture exhibits a balanced revenue mix in which moderate values across all four indicators jointly produce a competitive composite score, an empirical illustration that, under a properly weighted MCDM aggregator, multidimensional fiscal performance does not require dominance along any single dimension. The mid-range positions of the United Kingdom and Germany reflect, respectively, broad alignment with the G7 median and a methodologically consequential boundary of the analytical framework: by adopting the OECD tax revenue classification [6], the present model excludes social security contributions, which constitute a structurally dominant component of German general-government revenue. This exclusion mechanically depresses Germany's score and should be read as an interpretive caveat regarding the scope of the indicator set rather than as evidence of an underlying performance deficit. Japan's sixth-place position is consistent with the comparative fiscal evidence documenting both a historically modest consumption tax base and below-average aggregate revenues, the adverse implications of which are amplified precisely because the Grey SPC procedure endogenously assigns the highest weight to consumption taxation. The United States' last-place outcome is not a marginal result but a structural one: the absence of a federal VAT eliminates the entirety of the most heavily weighted criterion, while corporate and aggregate revenues likewise rank at the bottom of the G7 distribution, a configuration whose distinctiveness within the OECD has long been documented in the comparative fiscal literature [2]. The persistence of this configuration across all five alternative grey MCDM techniques (Section 5.2) further indicates that the U.S. position reflects a robust structural feature of its tax architecture rather than an artifact of the specific aggregation rule adopted (RQ5).

The findings of this paper carry several policy-relevant implications for fiscal authorities within the G7. First, the dominant weight of goods and services tax in the comparative performance assessment points to the strategic centrality of consumption-based revenue instruments. For economies seeking to strengthen overall tax performance without intensifying the direct tax burden on labour and capital, broadening the indirect tax base, through the introduction of a federal VAT or the reduction of exemptions within existing systems, represents a structurally significant reform option. Second, the high discriminative weight of corporate tax performance underscores the importance of protecting and strengthening the corporate tax base in an era of increasing international tax competition; the international evidence suggests that aligning domestic corporate tax systems with the OECD/G20 global minimum tax framework constitutes a priority structural lever. Third, the low weight assigned to total tax revenue implies that raising overall tax levels without restructuring the revenue mix is unlikely to generate meaningful performance improvements: the composition of taxation matters more than its level, and targeted reforms that rebalance the tax mix toward the most discriminating dimensions are likely to yield greater fiscal performance gains than undifferentiated revenue increases.

Beyond these general implications, the disaggregated structure of the empirical findings supports a series of country-specific policy pathways for the three G7 economies whose performance scores fall below the group median. For the United States, the structural absence of a federal value-added tax represents both the most analytically discriminating feature of its tax architecture and the most consequential lever for closing the performance gap with the rest of the G7. While the political-economy obstacles to introducing a federal VAT are well-known, intermediate reform pathways, such as harmonizing state-level retail sales taxes into a more uniform consumption-based instrument, narrowing exemption regimes, or progressively coordinating sub-national consumption tax bases, could deliver structurally meaningful performance improvements without requiring full federal-level adoption. The international evidence further suggests that revenue-neutral shifts from labour and capital taxation toward consumption taxation can support long-run growth while preserving fiscal adequacy [7]. For Japan, the priority lever lies in the further broadening and strengthening of the consumption tax base, which has historically operated below the OECD average and which the present analysis identifies as the single most influential criterion in cross-country fiscal performance differentiation. Continuing to align the consumption tax rate and base with broader OECD norms, while concurrently expanding effective corporate tax revenues through the elimination of preferential regimes and the reinforcement of base-erosion safeguards, would jointly address Japan's two principal structural weaknesses identified in this study. For Germany, the policy implications are twofold. Substantively, the moderate corporate tax revenues as a share of GDP, despite the country's overall fiscal strength, indicate the analytical centrality of strengthening the effective taxation of corporate profit, particularly through full alignment with the OECD/G20 global minimum tax framework and the systematic closure of base-erosion channels. Methodologically, however, Germany's below-median position also reflects the exclusion of social security contributions, a structurally dominant component of its fiscal architecture, from the OECD tax revenue classification adopted here [6], suggesting that German fiscal authorities should interpret the present ranking jointly with broader general-government revenue indicators in order to derive a comprehensive performance assessment. Taken together, these country-specific pathways illustrate that the most consequential reform directions for below-median G7 economies do not lie in undifferentiated revenue increases but in structural rebalancing along the precise dimensions identified as analytically dominant by the proposed grey hybrid framework.

7. Conclusions

This manuscript introduced and empirically applied an integrated hybrid grey decision-making methodology for the comparative assessment of tax performance across G7 economies over the 2013–2022 period. The developed approach combines two recently introduced grey decision-making methods, Grey SPC and Grey SRP, into a unified analytical structure. Within this structure, the Grey SPC technique is utilized to derive objective criterion weights. The Grey SRP tool subsequently forms country rankings in terms of their tax performance.

The obtained findings yield clear and interpretable results across both analytical stages. At the weighting stage, “goods and services tax” emerges as the most influential criterion in shaping tax performance differentials among G7 economies. “Corporate tax” ranks second, capturing the considerable cross-country variation in the effective taxation of corporate profits driven by differences in statutory rates, base erosion dynamics, and the sectoral composition of taxable income. “Income and profits tax” occupies the third position, reflecting moderate variation in personal income tax revenues across the group, a dimension shaped by differences in progressivity

structures and the relative importance of labour versus capital income in each country's tax base. Finally, "total tax revenue" receives the lowest weight, indicating that aggregate fiscal pressure is relatively homogeneous within this group of advanced economies and thus contributes limited discriminative information to the analysis, a methodologically meaningful result suggesting that it is the composition rather than the level of taxation that fundamentally differentiates G7 fiscal performance.

At the ranking stage, France attains the highest overall tax performance score, followed by Italy, Canada, the United Kingdom, Germany, and Japan, with the United States recording the lowest score, a result primarily attributable to its structural absence of a federal value-added tax and comparatively low corporate tax revenues as a share of GDP over the study period.

The reliability and stability of the suggested framework were assessed via two complementary robustness procedures. First, a systematic weight sensitivity analysis, conducted by progressively reducing the weight of the highest-ranked criterion and redistributing the differential proportionally across the remaining indicators, demonstrated that the country rankings remain largely stable across alternative weight configurations, with France consistently occupying the top position and the United States the bottom position throughout all scenarios. Second, a comparative ranking analysis benchmarked the Grey SRP results against five widely employed grey MCDM techniques, Grey EDAS, Grey MAIRCA, Grey MARCOS, Grey PIV, and Grey SAW, and confirmed a high degree of rank concordance across approaches. Thus, these robustness assessments provide strong evidence that the rankings produced by the integrated Grey SPC–SRP approach are robust and trustworthy.

The existing manuscript advances the existing literature at three distinct levels. At the conceptual level, it reframes tax performance as a multidimensional evaluation problem, demonstrating that the structural composition of a country's revenue system, rather than its aggregate fiscal pressure, constitutes the primary analytical dimension along which advanced economies are meaningfully differentiated. At the methodological level, it introduces the first application of the integrated Grey SPC–SRP model to comparative tax performance measurement, providing a coherent, uncertainty-preserving, and normalization-free alternative to existing approaches. At the empirical level, the study provides a systematic comparative documentation of G7 structural tax performance over a ten-year horizon, offering a diagnostic benchmark that can inform national fiscal reform deliberations and multilateral tax policy coordination.

The findings reported in this manuscript should be interpreted in light of three categories of limitations that, while not undermining the validity of the proposed framework, define the analytical perimeter within which its conclusions hold. First, with respect to the scope of the selected indicators, the analysis relies on four revenue-based fiscal indicators drawn from the OECD tax revenue classification and therefore does not capture other analytically important dimensions of tax performance, including administrative efficiency, taxpayer compliance, distributional outcomes, and the qualitative responsiveness of tax systems to economic shocks. The exclusion of social security contributions from the OECD classification, in particular, mechanically depresses the comparative position of fiscal architectures in which such contributions constitute a structurally dominant revenue component. Second, with respect to data constraints, the empirical scope is restricted to the G7 economies and to the 2013–2022 horizon for which fully harmonized OECD Revenue Statistics are consistently available; the analytical reach of the framework toward more heterogeneous country groups is therefore not directly tested in the present study. Furthermore, the adoption of decade-long grey intervals, while necessary for characterizing the structural rather than dynamic properties of G7 tax systems, implies that the temporal evolution of country positions cannot be examined within the present design. Third, with respect to the methodological assumptions embedded in the

framework, the proposed Grey SPC–SRP architecture treats the selected criteria as analytically commensurable, abstracts from contextual covariates such as governance quality, institutional capacity, and fiscal-rules regimes, and assumes that the performance signal contained in the OECD revenue indicators is sufficient to characterize comparative tax performance. While the grey interval representation explicitly accommodates measurement uncertainty within each indicator, the framework does not endogenize the institutional and political determinants of tax performance, which remain exogenous to the present analysis. These limitations, taken jointly, do not compromise the methodological coherence or the robustness of the obtained rankings, but rather delineate the boundary conditions under which the framework operates and identify the directions along which its analytical reach can be productively extended.

The boundary conditions identified above translate into a structured research agenda articulated along four complementary trajectories. First, future studies could investigate whether the structural primacy of consumption and corporate taxation observed within the G7 generalizes to fiscally diverse environments by replicating the framework on OECD-wide samples, BRICS and G20 groupings, or regional clusters such as ASEAN and the Eurasian Economic Union; such applications would clarify whether alternative criterion weight hierarchies emerge under different institutional and developmental settings, and would enable the empirical mapping of fiscal performance archetypes across distinct economic regimes. Second, the analytical content of the framework could be substantially enriched by integrating qualitative and behavioural performance dimensions that complement the revenue-side analysis adopted here, such as governance-linked tax morale indices, behavioural compliance metrics derived from administrative micro-data, environmental and green-tax components, digital-service-tax revenues, and equity-based distributional incidence measures, thereby producing a multi-layered performance profile capable of capturing both the quantity and the quality of national tax systems. Third, comparative methodological investigations could systematically benchmark the proposed Grey SPC–SRP integration against fuzzy, neutrosophic, intuitionistic, and grey-rough hybrid MCDM architectures, as well as against emerging machine-learning-supported weighting schemes, in order to delineate the precise epistemic conditions under which grey-based decision frameworks deliver the strongest comparative advantages relative to other uncertainty-handling approaches. Fourth, the comparative-static logic of the present analysis can be extended along the temporal dimension through the development of dynamic grey MCDM specifications, such as panel-grey, interval-trajectory, and time-series-augmented hybrid models, capable of tracking the joint evolution of fiscal performance and policy regimes over time, accommodating regime shifts, and modelling the persistence and convergence properties of cross-country performance differentials, thereby offering a longitudinal complement to the cross-sectional architecture adopted in this study. Pursued in combination, these four research trajectories would extend the analytical reach of the proposed framework along its institutional, indicator-based, methodological, and temporal dimensions, and would consolidate the role of grey hybrid MCDM models as a robust decision-analytic infrastructure for comparative fiscal performance assessment. In addition, recent MCDM models and AI tools [29-33] can be adopted in future studies.

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Data Availability Statement

The study did not report any data.

Conflicts of Interest

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