



Review

Tax Instruments as a Key Driver of the Green Transition: The Role of Fiscal Policy in Sustainable Development

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Abstract: Fiscal instruments are pivotal in the green transition, shaping economic incentives for sustainable development. This paper examines carbon taxes, environmental levies, green investment tax credits, renewable energy incentives, and energy subsidies, assessing their effectiveness in reducing emissions, enhancing energy efficiency, and driving ecological innovation. Well-designed tax policies, supported by a stable regulatory framework and equitable revenue redistribution, can align environmental goals with economic competitiveness. However, challenges such as carbon leakage, compliance costs for industries, and public resistance continue to hinder their implementation. Strengthening tax enforcement, improving the collection of environmental levies, and integrating green investment tax credits into broader macroeconomic strategies are essential for ensuring stable funding for environmental programs. This study evaluates the role of fiscal instruments in the green transition, identifying key challenges and opportunities for optimizing tax policies to reduce emissions, stimulate ecological innovation, and maintain economic stability through coordinated tax reforms and international cooperation.

Keywords: *Fiscal policy; sustainable development; environmental taxation; market mechanisms; ecological sustainability.*

1. Introduction

The green transition has become a key priority of economic policy, aiming to reduce environmental externalities and promote sustainable development. Fiscal instruments play a central role in shaping economic incentives, directing economic activities toward more environmentally friendly models. Carbon taxes, environmental levies, and green investment tax credits have been implemented across various economies to mitigate the negative environmental impact of economic activities [1]. However, despite different mechanisms of environmental taxation, greenhouse gas emissions remain high in many economies, highlighting the need for stronger fiscal measures [2]. The effectiveness of these instruments depends on the level of economic development, institutional capacity, and the stability of the regulatory framework [3]. Fiscal policy can accelerate the green transition not only through tax instruments but also through energy subsidies and renewable energy incentives, as demonstrated by research on digitalization in agriculture, where technological advancements enable more efficient resource use and a reduction in environmental burdens [4]. One of the key challenges in implementing fiscal instruments is the risk of carbon leakage, where industrial capacities relocate to countries with more lenient environmental regulations, potentially undermining the effects of green tax measures [5]. Therefore, international coordination of tax

policies is essential for maintaining economic stability and ensuring the effective implementation of fiscal instruments for sustainable development [6].

Building upon these considerations, this paper explores the effectiveness of tax instruments in facilitating the green transition, addressing key challenges and identifying opportunities for advancing fiscal policy in support of sustainable development. The analysis begins with a presentation of the theoretical framework and a comprehensive literature review, emphasizing the role of fiscal policy in fostering a sustainable economy. It then examines tax mechanisms, their practical applications, and socio-economic impacts, highlighting successful policies and potential pathways for optimizing fiscal instruments to advance environmentally sustainable economic models.

2. Theoretical framework and literature review

The green transition involves redirecting the economy toward sustainable growth models by employing tax instruments designed to reduce carbon emissions, foster innovation, and improve energy efficiency [1]. This process aligns with the goals of sustainable development, which emphasize efficient resource management, reducing dependence on fossil fuels, and optimizing the use of by-products through the principles of the circular economy [7,8]. Research identifies fiscal policy as a key mechanism for accelerating the green transition by shaping economic incentives and directing investments into sustainable technologies [2].

The concept of environmental taxation is rooted in the economic theory of internalizing negative externalities [9]. Additionally, the double dividend hypothesis suggests that revenues generated from environmental taxes can simultaneously reduce fiscal burdens and incentivize environmental regulation [10]. However, empirical evidence indicates that the effectiveness of environmental taxes depends on a country's economic and institutional capacity [11].

Technological innovations and the digitalization of high-carbon-emission sectors, alongside fiscal instruments, play a critical role in the sustainable transformation of the economy. Digital strategies, such as smart technologies and the integration of sustainable urban solutions, significantly enhance the effectiveness of ecological fiscal policies by optimizing resource utilization, reducing operational costs, and improving systems for monitoring and collecting environmental taxes [12]. In the context of the green transition, intellectual capital and environmentally responsive business strategies are emerging as key drivers of sustainable competitiveness [13]. Fiscal reforms that incorporate tax incentives for innovation and renewable energy sources have demonstrated their effectiveness in reducing emissions and strengthening energy independence [14]. However, elevated carbon tax rates may threaten economic competitiveness unless harmonized at the international level [15]. Studies suggest that the success of fiscal instruments depends on their alignment with sector-specific requirements and regional economic dynamics [16].

Research on fiscal instruments in the green transition underscores their importance while also revealing significant implementation challenges. OECD analyses indicate that high carbon tax rates yield positive outcomes only when complemented by measures that preserve economic competitiveness and mitigate the risks of deindustrialization [17]. Flexible tax models that integrate environmental levies with innovation incentives have proven effective in maintaining economic stability, minimizing negative productivity impacts, and promoting more efficient resource utilization [18,19]. A comprehensive evaluation of fiscal instruments within the green transition highlights the necessity of aligning fiscal policies with the broader economic and regulatory frameworks of modern economies. Further research is essential to refining their effectiveness and adaptability to diverse economic conditions.

3. Tax instruments for sustainable development

Tax mechanisms play a pivotal role in shaping economic policy and fostering sustainable development. The primary fiscal instruments driving the green transition include carbon taxes,

energy subsidies, green investment tax credits, environmental levies, and renewable energy incentives (Figure 1). These instruments shape investment and consumption patterns, internalize the external costs of greenhouse gas emissions, and drive the development and adoption of clean technologies, fostering long-term economic and environmental sustainability.

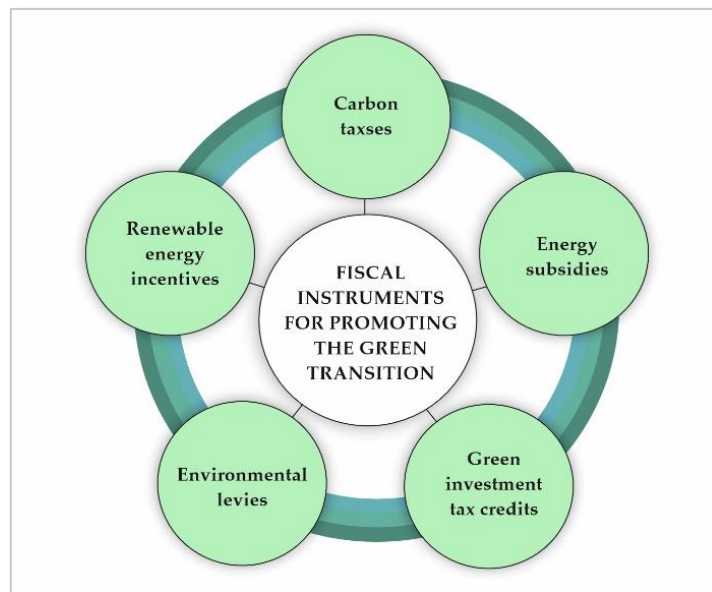


Figure 1. Fiscal instruments for promoting the green transition
(Author's illustration)

Carbon taxes are a key fiscal instrument for internalizing the external costs of emissions. According to the OECD [20], well-designed carbon tax rates accelerate the shift to sustainable technologies, with their effectiveness largely depending on adaptation to regional economic conditions [11]. However, unilateral implementation can increase energy costs and undermine the competitiveness of fossil fuel-dependent industries, increasing the risk of carbon leakage. This occurs when production relocates to jurisdictions with weaker environmental regulations, reducing the intended impact of fiscal policies. To mitigate these risks, targeted carbon tariffs have been proposed as a mechanism to maintain economic stability [21]. Additionally, redistributing tax revenues through reductions in other tax burdens or direct support for innovation can improve policy effectiveness and ensure a balance between environmental goals and economic resilience [22,23].

The availability and stability of energy resources are fundamental to economic and social development. Energy insecurity can hinder industrial growth, technological advancement, and improvements in living standards [24]. In developing countries, unreliable energy services pose a major barrier to economic progress, while energy instability in the African region reduces GDP by 2%–4% annually, with adverse effects on employment [25,26]. Energy subsidies have been widely used to enhance energy accessibility, but their effectiveness depends on the institutional framework and subsidy management [24]. While subsidies can lower living costs and improve energy security, their redistributive impact is often constrained by weak social protection systems [27]. Regional disparities in electrification further complicate energy policy implementation. Countries with low electrification rates face fiscal limitations in infrastructure investment, while approximately 85% of the population without electricity access resides in rural areas where infrastructure costs are significantly higher [28,29]. Achieving a sustainable energy system requires the integration of fiscal incentives for renewable energy sources with comprehensive energy policy reforms [30].

Green investment tax credits are a crucial fiscal instrument for stimulating investments in sustainable energy and reducing carbon emissions. These credits allow businesses and individuals to reduce their tax liabilities in exchange for investments in environmentally friendly technologies, energy-efficient infrastructure, and renewable energy sources [20]. Empirical studies indicate that such tax credits promote innovation and expand green technology markets; however, their

effectiveness depends on the regulatory framework and overall economic stability [19,31]. While tax incentives enhance the financial viability of sustainable investments, their impact on innovation may be limited if not properly integrated with complementary support mechanisms [32]. Ensuring the long-term sustainability of green investment tax credits requires their alignment with broader economic policies and a gradual phase-out as renewable technologies mature.

Environmental levies encompass a diverse set of fiscal instruments, including taxes on pollution, waste management, and the use of natural resources. The OECD [20] highlights that these levies are most effective when embedded in integrated fiscal strategies that drive innovation and encourage sustainable resource utilization. The United Nations Environment Programme [33] notes that while the long-term benefits of low-carbon economies are often underestimated, short-term costs tend to be overstated. Targeted fiscal policies and advancements in green technologies can help minimize transition costs and enhance the impact of environmental levies. Empirical evidence suggests that a combination of environmental levies and green investment tax credits significantly reduces emissions while bolstering economic resilience to climate change [19,20,23,33,34,35].

Renewable energy incentives play a crucial role in expanding the share of renewables in total energy consumption. These instruments, including subsidies, preferential tax rates, feed-in tariffs, and auction systems, create stable conditions for investors and stimulate investments in the renewable energy sector [20]. Research confirms that these incentives have significantly contributed to the growth of solar and wind energy capacity while driving down production costs [33,37]. Qadir et al. [38] emphasize that these incentives facilitate energy mix diversification, reduce dependence on fossil fuels, and strengthen energy security. Macroeconomic analyses suggest that subsidizing labor costs in green industries may be a more effective driver of renewable energy sector growth than carbon taxes, as it reinforces supply-demand dynamics and accelerates the ecological transition [39].

However, the long-term effectiveness of these mechanisms depends on regulatory stability and the transition to market-driven support models [29]. The OECD [20] highlights that aligning incentive mechanisms with market conditions is essential for ensuring the sustainability of energy policies, as excessive subsidies may distort competition and create inefficiencies. Therefore, an optimal renewable energy incentive policy should be flexible, aligned with national economic conditions, and structured to gradually decrease reliance on state support as the market matures.

4. Effectiveness and optimization of fiscal instruments in the green transition

The effectiveness of fiscal instruments in the green transition is determined by their capacity to reduce greenhouse gas emissions, enhance resource efficiency, and support economic growth while maintaining environmental stability. The evaluation of tax policies relies on economic models and quantitative analyses that assess their impact on investment, labor markets, and energy efficiency [20]. Key performance indicators include reductions in carbon emissions and increased investment in renewable energy sources [34]. Empirical evidence suggests that the successful implementation of environmental taxes and incentives requires precise tax revenue modeling and projections to mitigate fiscal risks and ensure long-term policy sustainability [40]. Forecasting tax revenues through time series analysis and other quantitative methods enables more efficient fiscal planning and budget allocation.

Beyond fiscal instruments, energy transformation is a critical driver of the green transition. Research confirms that renewable energy consistently contributes to emission reductions, though the impact of green technology adoption varies depending on emission levels and the phase of transition to sustainable energy sources [41]. However, dynamic analyses indicate that the relationship between economic activity, energy consumption, and carbon emissions differs across countries, with some cases showing no long-term correlation between renewable energy expansion and emission reductions [42]. Evidence from countries that have implemented environmental taxes highlights that well-structured tax reforms, combined with strategic revenue redistribution, lead to sustained emission reductions and improved energy efficiency [20,23].

Sweden implemented high carbon taxes while simultaneously reducing labor taxation, fostering the transition to cleaner technologies while preserving economic competitiveness [11]. Germany promoted investments in renewable energy through energy subsidies, while Canada leveraged green investment tax credits to stimulate green innovation and lower industrial carbon emissions [19]. Despite these successes, the application of fiscal instruments in the green transition faces significant economic, political, and social challenges. Higher costs for energy-intensive industries may result in carbon leakage, shifting emissions to countries with weaker environmental regulations [21]. Additionally, political uncertainty and public resistance to rising energy prices further hinder the effective implementation of these measures [24].

The phased introduction of environmental taxes, transparent revenue redistribution, and alignment with complementary regulatory measures are essential for effective implementation [32]. Integrating tax policies with energy efficiency strategies and fostering innovation amplifies both economic and environmental benefits [29]. The OECD [20] highlights that reallocating tax revenues through reductions in other fiscal burdens can stimulate GDP growth, while combining tax incentives with investments in renewable energy reduces negative environmental externalities [37].

Global harmonization of tax policies can mitigate the risk of industrial relocation to countries with weaker environmental regulations while enhancing the effectiveness of fiscal instruments. The OECD and UNEP highlight the importance of international coordination in environmental taxation and emissions monitoring mechanisms [20;33], as standardized tax measures would foster economic stability and accelerate the green transition. However, research suggests that institutional inertia and regulatory constraints frequently hinder environmental reforms, resulting in an inefficient distribution of costs and benefits across different social groups [43]. These challenges further obstruct the alignment of fiscal policies with environmental goals, creating a gap between policy design and effective implementation.

Environmental taxation in Serbia has the potential to significantly contribute to sustainable development, but its effective implementation requires regulatory adjustments, enhanced fiscal capacity, and stronger integration into broader economic policies. While the tax system generates revenues at a level that supports fiscal stability, strengthening tax discipline could improve the collection of environmental taxes and ensure the consistent application of the polluter pays principle [44]. Data from the Statistical Office of the Republic of Serbia [45] indicate that environmental protection expenditures reached 78,410.6 million RSD in 2023, marking a 13.9% increase compared to the previous year. Investments accounted for 40.4% of total expenditures, while current expenditures represented 59.6%. The largest share of investments was directed toward air protection (47.4%), while waste management absorbed the majority of current expenditures (73.7%). Despite increased environmental spending, further refinements in fiscal policy are necessary. Strengthening tax mechanisms and strategically allocating resources to sustainable projects will be essential for achieving long-term environmental and economic objectives.

Despite the increase in environmental expenditures, further enhancements in fiscal policy through more efficient tax mechanisms and targeted investments in sustainable projects remain essential for achieving long-term environmental and economic goals. The legal framework also incorporates environmental levies aimed at funding environmental protection, yet their effectiveness often depends on revenue collection efficiency and fiscal coordination. According to the Law on Environmental Protection [46], these levies apply to the use of natural resources, pollution control, and improvements in environmental conditions. The Ministry of Environmental Protection [47] outlines specific categories, including levies on electronic and electrical waste, vehicles, tires, batteries, oils, asbestos, plastic bags, packaging waste, and emissions of pollutants such as sulfur dioxide and nitrogen dioxide. However, optimizing their implementation requires improved collection mechanisms and stronger fiscal coordination.

In addition to environmental objectives, fiscal instruments can play a significant role in driving economic growth. Environmental taxes not only contribute to environmental protection but also help address both short-term and long-term economic challenges [48]. In the long run, they support resource conservation, while in the short term, they enhance budget stability and promote employment. When effectively designed, these taxes can alleviate other fiscal burdens, such as labor

taxation, thereby stimulating economic activity. However, rising energy and production costs may be transferred to end consumers through higher prices for goods and energy, underscoring the need for a carefully calibrated fiscal approach that balances environmental and economic priorities.

The further development of fiscal policy in environmental protection requires reforms that ensure a fairer distribution of the tax burden between businesses and households while increasing the share of taxes on pollution and resource use. Strengthening tax compliance could enhance fiscal revenues and provide more stable funding for environmental programs. Integrating tax instruments with macroeconomic strategies would contribute to long-term sustainable development, facilitating the effective implementation of environmental responsibility principles and fostering innovation across industries.

5. Conclusions

Fiscal instruments are not merely tools for economic adjustment – they are essential drivers of the green transition, shaping long-term environmental and economic trajectories. Their effectiveness, however, is highly contingent on economic conditions, institutional capacity, and the ability to balance fiscal sustainability with environmental responsibility. In developed economies such as Sweden, Germany, and Canada, a strategic combination of carbon taxes, tax incentives, and renewable energy subsidies has led to a measurable reduction in pollution while maintaining economic competitiveness. These mechanisms demonstrate that well-structured fiscal policies can accelerate the transition to sustainable economic models without compromising growth and employment.

In Serbia, the reliance on energy taxes while maintaining low revenues from pollution and natural resource taxes underscores the need for comprehensive fiscal reforms. Strengthening tax compliance, optimizing revenue collection, and expanding incentives for sustainable investments are critical steps toward enhancing environmental taxation and securing stable financing for green policies. However, experience from other nations indicates that fiscal instruments alone are insufficient. They must be embedded within broader economic strategies that foster technological innovation, infrastructure investments, and regulatory consistency to maximize their impact and ensure a just and efficient transition.

As the world faces intensifying climate and economic challenges, fiscal policy must evolve from a reactive tool into a proactive force that reshapes market dynamics in favor of sustainable development. Tax mechanisms should not only facilitate emission reductions but also strengthen macroeconomic stability, ensuring resilience against future economic and environmental disruptions. The successful implementation of green fiscal measures, aligned with global trends and international cooperation, will determine the pace and effectiveness of the green transition. A forward-looking, well-coordinated fiscal approach is no longer an option – it is an imperative for achieving a sustainable and competitive global economy.

Conflicts of Interest: The author declares no conflict of interest.

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