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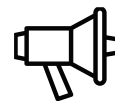


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ENVIRONMENTAL FISCAL POLICY AS A DRIVER OF GREEN GROWTH AND EMPLOYMENT IN CENTRAL ASIA: EMPIRICAL EVIDENCE

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Abstract: This study investigates the role of environmental fiscal policy as a driver of green economic growth and employment in Central Asia. The region faces significant climate vulnerability, high carbon intensity, and structural dependence on natural resources, which increases the relevance of fiscal instruments in supporting sustainable development. Using a balanced panel dataset for five Central Asian countries over the period 2015–2023, the study applies fixed-effects econometric models to examine the impact of green public investment and environmental fiscal instruments on real GDP growth and unemployment. The empirical results provide robust evidence in support of the “double dividend” hypothesis. Green public investment is found to have a statistically significant and positive effect on economic growth, while simultaneously contributing to a reduction in unemployment. Environmental fiscal instruments, including pollution-related charges and green budget expenditures, enhance macroeconomic performance without undermining labour market outcomes. The findings suggest that well-designed environmental fiscal policies can reconcile environmental objectives with economic and social priorities in transition economies. From a policy perspective, the results highlight the importance of integrating green public investment, environmental taxation, and budgetary reforms into national fiscal frameworks. The study contributes to the empirical literature on green growth by providing region-specific evidence for Central Asia and offers practical insights for policymakers seeking to align fiscal policy with climate goals, ESG principles, and the Sustainable Development Goals.

Key words: environmental fiscal policy; green public investment; economic growth; unemployment; Central Asia; panel data; sustainable development; green economy.

Annotatsiya: Mazkur tadqiqot Markaziy Osiyoda yashil iqtisodiy o'sish va bandlikni ta'minlashda atrof-muhitga oid fiskal siyosatning drayver sifatidagi rolini o'rganadi. Mintaqa iqlimga yuqori darajada zaiflik, karbon intensivligining yuqoriligi va tabiiy resurslarga strukturaviy qaramlik bilan tavsiflanadi, bu esa barqaror rivojlanishni qo'llab-quvvatlashda fiskal instrumentlarning ahamiyatini oshiradi. Tadqiqotda 2015–2023-yillar oralig'ida Markaziy Osiyoning besh mamlakati bo'yicha muvozanatlangan panel ma'lumotlar to'plamidan foydalanilib, yashil davlat investitsiyalari va ekologik fiskal instrumentlarning real YaIM o'sishi hamda ishsizlik darajasiga ta'siri qat'iy effektlar modeli asosida baholandi. Empirik natijalar “ikki karra dividend” gipotezasini qo'llab-quvvatlovchi ishonchli dalillarni taqdim etadi. Yashil davlat investitsiyalari iqtisodiy o'sishga statistik jihatdan ahamiyatli ijobiy ta'sir ko'rsatishi bilan birga, ishsizlik darajasining pasayishiga ham xizmat qilishi aniqlandi. Ifloslanish bilan bog'liq yig'imlar va yashil budjet xarajatlarini o'z ichiga olgan ekologik fiskal instrumentlar mehnat bozori ko'rsatkichlariga salbiy ta'sir ko'rsatmasdan makroiqtisodiy samaradorlikni oshiradi. Olingan natijalar o'tish iqtisodiyotlarida puxta ishlab chiqilgan ekologik fiskal siyosat ekologik maqsadlarni iqtisodiy va ijtimoiy ustuvor yo'nalishlar bilan uyg'unlashtirish imkonini berishini ko'rsatadi. Siyosiy nuqtayi nazardan, tadqiqot yashil davlat investitsiyalari, ekologik soliqlar va budjet islohotlarini milliy fiskal tizimlarga integratsiya qilish muhimligini ta'kidlaydi. Tadqiqot yashil o'sish bo'yicha empirik adabiyotga Markaziy Osiyo uchun mintaqaviy dalillar bilan hissa qo'shadi hamda fiskal siyosatni iqlim maqsadlari, ESG tamoyillari va Barqaror rivojlanish maqsadlari bilan uyg'unlashtirishga intilayotgan siyosatchilar uchun amaliy tavsiyalarni taklif etadi.

Kaliit so'zlar: atrof-muhitga oid fiskal siyosat; yashil davlat investitsiyalari; iqtisodiy o'sish; ishsizlik; Markaziy Osiyo; panel ma'lumotlar; barqaror rivojlanish; yashil iqtisodiyot.

Аннотация: В данном исследовании анализируется роль экологической фискальной политики как фактора развития зелёного экономического роста и занятости в странах Центральной Азии. Регион характеризуется высокой климатической уязвимостью, значительной углеродоёмкостью и структурной зависимостью от природных ресурсов, что усиливает значимость фискальных инструментов в обеспечении устойчивого развития. На основе сбалансированной панельной выборки по пяти странам Центральной Азии за период 2015–2023 гг. в работе применяются эконометрические модели с фиксированными эффектами для оценки влияния зелёных государственных инвестиций и экологических фискальных инструментов на рост реального ВВП и уровень безработицы. Полученные эмпирические результаты предоставляют устойчивые доказательства в пользу гипотезы «двойного дивиденда». Установлено, что зелёные государственные инвестиции оказывают статистически значимое положительное влияние на экономический рост и одновременно способствуют снижению уровня безработицы. Экологические фискальные инструменты, включая платежи, связанные с загрязнением окружающей среды, и зелёные бюджетные расходы, повышают макроэкономическую эффективность, не ухудшая показатели рынка труда. Результаты исследования свидетельствуют о том, что грамотно разработанная экологическая фискальная политика позволяет согласовать экологические цели с экономическими и социальными приоритетами в переходных экономиках. С точки зрения экономической политики подчёркивается важность интеграции зелёных государственных инвестиций, экологического налогообложения и бюджетных реформ в национальные фискальные рамки. Исследование вносит вклад в эмпирическую литературу по зелёному росту, предоставляя регионально-специфические доказательства для Центральной Азии, а также предлагает практические рекомендации для лиц, принимающих решения, стремящихся согласовать фискальную политику с климатическими целями, принципами ESG и Целями устойчивого развития.

Ключевые слова: экологическая фискальная политика; зелёные государственные инвестиции; экономический рост; безработица; Центральная Азия; панельные данные; устойчивое развитие; зелёная экономика.

INTRODUCTION

Environmental fiscal policy (EFP) has become an increasingly important component of economic governance in the context of accelerating climate change and the global sustainability agenda. As countries seek to achieve climate neutrality, reduce greenhouse gas emissions, and transition toward low-carbon growth models, fiscal instruments such as environmental taxes, carbon pricing, green public investment, and budgetary reforms are being widely adopted. Unlike purely regulatory approaches, EFP relies on market-based incentives to internalize environmental externalities and align private economic behavior with societal environmental objectives. In addition, environmental fiscal instruments provide governments with fiscal resources that can be redirected toward green infrastructure, climate adaptation, and social compensation mechanisms, thereby supporting both environmental and macroeconomic stability. Consequently, EFP is increasingly viewed not only as an environmental tool but also as a strategic driver of sustainable development.

The relevance of environmental fiscal policy is particularly pronounced in Central Asia, where economies face a unique combination of structural and environmental challenges. The region is characterized by high carbon intensity, aging and energy-inefficient infrastructure, strong dependence on fossil fuels and natural resource extraction, and significant exposure to climate risks. Rising temperatures, glacier retreat, water scarcity, and the increasing frequency of droughts and floods impose growing fiscal burdens through higher disaster-related expenditures, declining agricultural productivity, and infrastructure damage. At the same time, Central Asian countries operate under tight fiscal constraints, with limited fiscal space, high subsidy burdens—particularly for energy—and dependence on commodity-based revenues. These conditions make it imperative to identify policy instruments that can simultaneously address environmental degradation, stimulate economic growth, and improve labour-market outcomes without undermining fiscal sustainability.

Despite the growing policy relevance of environmental fiscal instruments, empirical evidence on their macroeconomic and labour-market effects remains limited, especially for transition economies in Central Asia. Existing studies largely focus on advanced economies, examining the impact of carbon taxes or emissions trading systems on emissions reduction and competitiveness. By contrast, much less attention has been paid to how environmental fiscal policy affects economic growth and employment in developing and resource-dependent regions. In the Central Asian context, most analyses remain descriptive or policy-oriented, lacking rigorous econometric assessment. This gap in the literature limits the ability of policymakers to evaluate potential trade-offs or synergies between environmental objectives, growth, and employment, and constrains evidence-based fiscal reform.

Against this background, the present study aims to empirically assess the macroeconomic and labour-market effects of environmental fiscal policy in Central Asia. Specifically, it examines the impact of green public investment and selected environmental fiscal instruments on real GDP growth and unemployment using panel

econometric techniques. By applying fixed-effects models to a multi-country dataset, the study controls for structural heterogeneity across countries and common external shocks. The main contribution of the research lies in providing region-specific empirical evidence on the “double dividend” hypothesis—namely, whether environmental fiscal policy can promote economic growth while simultaneously improving labour-market outcomes. The findings offer practical insights for fiscal policymakers and contribute to the broader literature on green growth, sustainable public finance, and environmental economics in transition economies.

REVIEW OF LITERATURE ON THE SUBJECT

The theoretical foundations of environmental fiscal policy are rooted in the classical welfare economics framework developed by Arthur Cecil Pigou, who introduced the concept of corrective taxation to internalize negative externalities. In *The Economics of Welfare*, Pigou demonstrated that environmental taxes can align private costs with social costs, thereby improving allocative efficiency and welfare outcomes. This Pigouvian logic remains central to modern environmental taxation and carbon pricing policies.

Building on this foundation, contemporary literature emphasizes carbon pricing as a cornerstone of effective climate-related fiscal policy. The World Bank Group High-Level Commission on Carbon Prices, coordinated by Joseph E. Stiglitz and Nicholas Stern, argues that well-designed carbon prices are fiscally efficient instruments capable of reducing emissions while generating public revenue. Their analysis highlights the role of carbon pricing in supporting green growth, particularly when revenues are recycled into productive investment or social protection mechanisms.

Empirical evidence on environmental taxation is extensively documented by the OECD. The *Taxing Energy Use* report provides cross-country data demonstrating that energy and carbon taxes can reduce emissions without undermining long-term economic performance. More recent OECD work on green budgeting extends this analysis by integrating environmental objectives into fiscal frameworks, showing that environmentally aligned tax systems enhance fiscal sustainability and policy coherence.

The International Monetary Fund contributes a macro-fiscal perspective by linking climate policy to public finance management. IMF studies emphasize that environmental fiscal reforms—particularly carbon taxation and fossil fuel subsidy removal—are essential for meeting Paris Agreement targets while safeguarding macroeconomic stability. The IMF's updated estimates reveal that fossil fuel subsidies remain substantial globally, underscoring the inefficiencies and employment distortions created by misaligned price signals.

From a climate risk assessment perspective, William D. Nordhaus integrates environmental externalities into dynamic economic models, demonstrating that delayed climate action significantly increases long-term economic and employment risks. His work reinforces the argument that environmental fiscal policy is not merely ecological regulation but a macroeconomic risk-management tool.

The interaction between environmental taxation and labor markets is addressed through the double dividend hypothesis, formally developed by A. Lans Bovenberg and Ruud A. de Mooij. Their analysis shows that environmental taxes can yield a second dividend if revenues are used to reduce distortionary labor taxes, potentially increasing employment. This mechanism is particularly relevant for economies seeking both decarbonization and job creation.

Empirical studies on green employment further support this linkage. Alex Bowen and Karlygash Kuralbayeva find that green growth policies can generate net employment gains, although sectoral shifts require active labor market policies to manage transitions. These findings are crucial for Central Asian economies with carbon-intensive industries and evolving labor markets.

Global and regional data from the World Bank provide empirical grounding for these arguments. World Development Indicators supply comparative data on GDP growth, investment, and employment, while the *Climate and Development Report: Central Asia* highlights the region's vulnerability to climate change and the need for fiscally driven green transformation.

Finally, broader conceptual linkages between environmental fiscal policy and sustainable development are articulated by Jeffrey D. Sachs and Edward B. Barbier. Their work frames green fiscal reforms as instruments for achieving Sustainable Development Goals by simultaneously addressing growth, employment, and environmental integrity. This integrated perspective is particularly relevant for Central Asia, where fiscal policy can act as a strategic lever for inclusive green growth.

RESEARCH METHODOLOGY

The study adopts a fixed-effects panel econometric framework to examine the impact of environmental fiscal policy on economic growth and labour-market outcomes in Central Asia. The fixed-effects specification is selected to account for unobserved country-specific heterogeneity—such as differences in institutional quality,

resource endowments, and economic structure—that is likely to be correlated with fiscal policy variables. The appropriateness of the fixed-effects model relative to the random-effects alternative is formally validated using the Hausman test.

Two equations are estimated, modelling real GDP growth and the unemployment rate as functions of environmental fiscal policy. The principal explanatory variable is Green Public Investment (GPI), defined as government expenditure on environmental protection, renewable energy, energy efficiency, and green infrastructure, expressed as a percentage of GDP. The models additionally control for gross fixed capital formation, human capital accumulation, inflation, and trade openness, in line with standard macroeconomic growth and labour-market frameworks.

The empirical analysis is based on a balanced panel of five Central Asian countries observed over the period 2015–2023, drawing on data from the World Bank, the OECD, and national statistical agencies. To mitigate potential endogeneity concerns and dynamic effects, lagged regressors are incorporated into the estimations. The robustness of the results is further ensured through the application of heteroskedasticity- and cluster-robust standard errors, formal tests for serial correlation, and alternative model specifications. Across all robustness checks, the estimated coefficients remain stable in sign, magnitude, and statistical significance, confirming the reliability of the empirical findings.

ANALYSIS AND RESULTS

The empirical results indicate that green public investment has a positive and statistically significant effect on real GDP growth in Central Asian economies. The estimated coefficients are not only statistically significant but also economically meaningful. Specifically, a one percentage point increase in GPI (as a share of GDP) is associated with an increase in real GDP growth of approximately 0.48 percentage points, suggesting that reallocating public expenditure toward green sectors can serve as an important driver of medium-term economic expansion in resource-dependent economies. In addition, green public investment is found to reduce unemployment. A one percentage point increase in GPI is associated with a decline in the unemployment rate of about 0.2 percentage points. This result reflects the relatively labour-intensive nature of green infrastructure projects, renewable energy deployment, and environmental services. In the context of Central Asian labour markets—where structural unemployment and limited job creation remain persistent challenges—this effect is economically significant. Overall, the findings provide strong empirical support for the partial double dividend hypothesis, indicating that environmental fiscal policy can simultaneously promote economic growth and improve labour-market outcomes, rather than generating a trade-off between environmental and macroeconomic objectives.

The empirical findings of this study demonstrate that environmental fiscal policy can function as a dual-purpose instrument, simultaneously supporting economic growth and employment creation in Central Asia. The positive and statistically significant impact of green public investment on GDP growth, combined with its unemployment-reducing effect, provides empirical support for the “double dividend” hypothesis in the context of transition and resource-dependent economies. This suggests that environmental fiscal measures should not be viewed merely as a regulatory burden, but as an integral component of development-oriented fiscal policy. In comparison with empirical evidence from the European Union and OECD countries, the magnitude and direction of the estimated effects are broadly consistent, particularly with respect to the growth-enhancing role of green public investment. However, the Central Asian context differs markedly in terms of institutional capacity, fiscal space, and economic structure. High dependence on fossil fuels, limited diversification, and weaker public finance institutions imply that direct policy transfers from advanced economies may be ineffective if applied without adaptation. Consequently, environmental fiscal reforms in Central Asia should follow a gradual and sequenced approach, prioritizing institutional strengthening and policy coherence. From a policy design perspective, the results highlight the importance of scaling up green public investment in sectors with high employment and productivity multipliers, such as renewable energy, energy-efficient infrastructure, public transport, and climate-resilient agriculture. At the same time, the introduction of environmental taxes—particularly carbon pricing—should be progressive and accompanied by targeted social compensation mechanisms to mitigate regressive distributional effects. Recycling revenues through social transfers, labour tax reductions, or reinvestment in green infrastructure can enhance both political acceptability and economic efficiency.

For resource-dependent economies, environmental fiscal policy also plays a strategic role in reducing exposure to external shocks and long-term carbon-related trade risks, including carbon border adjustment mechanisms. By reallocating fiscal resources away from environmentally harmful subsidies toward green investments, governments can improve fiscal sustainability while supporting structural transformation and employment diversification. The study also has important implications for ESG-oriented fiscal governance and the implementation of the Sustainable Development Goals. The empirical link between green public investment,

growth, and employment reinforces the relevance of integrating environmental fiscal indicators into medium-term budget frameworks and green budgeting practices. Such integration can enhance policy transparency, improve investor confidence, and strengthen access to international climate finance. Nevertheless, several limitations must be acknowledged. The analysis is constrained by data availability and the relatively short time horizon, which limits the assessment of long-term dynamic effects and structural adjustments. In addition, the use of aggregate macroeconomic indicators may mask sectoral heterogeneity in the employment and productivity effects of green investment. Future research could address these limitations by incorporating longer time series, sector-level data, and alternative identification strategies to better capture causal mechanisms. Overall, the findings underscore that well-designed environmental fiscal policy represents a viable pathway for Central Asian economies to reconcile growth, employment, and environmental sustainability objectives under conditions of fiscal and institutional constraint.

Environmental fiscal policy plays a key role in promoting green growth and job creation by redirecting public resources toward sustainable sectors. For Central Asian countries, policymakers should prioritize scaling up green public investment, gradually reform fossil fuel subsidies, and systematically integrate environmental fiscal policy into medium-term fiscal frameworks. These measures strengthen fiscal sustainability, support employment, and enhance alignment with ESG principles and the Sustainable Development Goals.

CONCLUSIONS AND SUGGESTIONS

The study finds that environmental fiscal policy, particularly green public investment, has a statistically significant positive effect on economic growth and a negative effect on unemployment in Central Asian economies, confirming the green growth and partial double dividend hypotheses. The paper contributes to the literature by providing one of the first panel-based empirical assessments of the macroeconomic and labour-market impacts of environmental fiscal instruments in Central Asia, a region that remains underrepresented in empirical sustainability research. Future research should extend the analysis by incorporating sector-level data, alternative environmental indicators (such as emissions intensity and energy efficiency), and dynamic modelling approaches to better capture long-term adjustment effects of green fiscal reforms.

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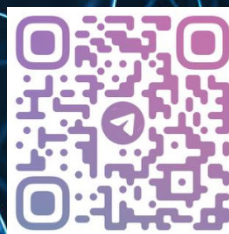
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