Chapter 7
The Ripple and Spillover Effects of Environmental Policy Stringency on Environmental Degradation in EU–14 Countries

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ABSTRACT

This study examines the spatial spillover effects of environmental policy stringency, GDP per capita, and fossil energy consumption on the ecological footprint in EU–14 countries over the period 1990–2020 using spatial econometric techniques. The results reveal strong and positive spatial dependence in the ecological footprint, indicating significant cross-country spillovers. Environmental policy stringency is found to reduce the ecological footprint both directly and indirectly, while fossil energy consumption and GDP per capita increase environmental pressure through significant domestic and spillover effects. Notably, indirect effects dominate direct effects, highlighting the critical role of regional interdependence in shaping environmental outcomes. These findings demonstrate that environmental policies generate ripple effects beyond national borders and emphasize the necessity of coordinated environmental and energy policies, increased investment in renewable energy, and strategies to decouple economic growth from fossil fuel dependence across the EU–14 region.

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1. INTRODUCTION

Environmental pollution is among the most pressing and complex challenges facing countries worldwide. The accelerating pace of climate change has triggered profound and unprecedented environmental transformations. Greenhouse gas concentrations have reached historic highs, pushing global near-surface temperatures beyond pre-industrial levels. Simultaneously, ocean heat content has risen to record levels, sea levels have continued to increase, and glaciers have undergone rapid and widespread melting. These developments have intensified the frequency and severity of weather- and climate-related extreme events, generating severe consequences for ecosystems, human livelihoods, and economic systems across the globe (WMO, 2025).

Beyond their environmental implications, these adverse trends pose substantial risks to economic stability and sustainable development. Climate change and environmental degradation affect productivity, investment decisions, public finances, and long-term growth prospects, making them central concerns for economic analysis. Consequently, economists have increasingly sought to quantify the economic costs of climate change, as well as its broader macroeconomic implications (Stern, 2006). In addition to estimating these costs, environmental economists employ econometric methods to examine how environmental degradation is affected by key economic factors such as growth and energy consumption, with the aim of informing effective policy design.

Within the environmental economics literature, environmental degradation has traditionally been measured using proxies such as carbon dioxide (CO_2) emissions. Although these metrics capture important dimensions of environmental pressure, they offer a partial view by overlooking other critical aspects of ecological stress, including land use, resource extraction, and ecosystem capacity. This limitation has motivated the development of more comprehensive indicators, most notably the ecological footprint (EF) (Wackernagel & Rees, 1997). By accounting for both resource consumption and the regenerative capacity of ecosystems, it provides a more comprehensive assessment of humanity's environmental impact and offers a broader perspective on environmental sustainability.

Given the multidimensional nature of degradation, evaluating environmental outcomes also requires indicators that reflect the effectiveness of environmental policy interventions. In response to growing climate risks and the need to promote sustainability, governments have adopted a wide range of policy measures to mitigate climate-related challenges, most notably through international frameworks such as the Kyoto Protocol, and the Paris Agreement (UN, 2026). These initiatives underscore the growing recognition that effective climate action requires international cooperation and that sustainable development depends on integrated policy approaches linking economic, social, and environmental dimensions (Kozal, 2025). Alongside

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