A Regional Benefit-Cost Analysis of Heatwave Climate Resilience Technologies in South Korea

Donguk Bae[*], Hwuikwon Ahn[**], Soojeong kang[***], Donghwan An[****], Kwansoo Kim[*****]

Abstract

Climate resilience is crucial for reducing heatwave damages, leading the Korean government to deploy various response technologies such as rooftop/wall greening, cool roofs, cooling fogs, and pergolas. However, few studies have comprehensively evaluated the economic benefits and costs of these technologies. To fill this gap, this paper utilizes a panel dataset–including weather data (daily temperature, relative humidity), wages, industry-specific worker counts, and regional installations of heat mitigation technologies–to estimate labor productivity losses due to heatwaves. A two-step regression analysis is then implemented (i) to assess the impact of these technologies on the Heatwave Resilience Index (HWRI), and (ii) to examine how HWRI influences heatwave damages, measured as the sum of labor productivity losses and heat illness medical expenditures. Finally, a benefit-cost ratio (BCR) analysis evaluates the economic benefits. The estimation results show that the loss of labor productivity in South Korea due to heatwave from 2016 to 2022 is about KRW 265.1 billion, and it amounts to 0.18% of total wage payments. The BCR for cooling fogs is recovered to be 0.80, 1.66 for cool roofs, 2.60 for rooftop/wall greening, and 0.86 for pergolas. The contribution of this paper can be summarized as follows: (i) the originality of the panel dataset we constructed and (ii) a 2-step estimation strategy capable of incorporating both climate resilience index and adoption technologies when it comes to estimating the benefits of each technology in reducing damage costs related to heatwave. Our analysis is expected to provide a useful information to policymakers for a cost-effective way of introducing heatwave response technologies.

Keywords: Climate Resilience, Heatwave Damages, Labor Productivity Loss, Heatwave Response Technologies, Benefit-Cost Analysis

[*] M.A. Student at Department of Agricultural Economics and Rural Development, College of Agriculture and Life Sciences, Seoul National University, qoehddnr999@snu.ac.kr

[**] M.A. Student at Department of Agricultural Economics and Rural Development, College of Agriculture and Life Sciences, Seoul National University, iltoro@snu.ac.kr

[***] M.A. Student at Department of Agricultural Economics and Rural Development, College of Agriculture and Life Sciences, Seoul National University, tnwjd9428@snu.ac.kr

[****] Associate Professor, College of Agriculture and Life Sciences, Seoul National University, email: dha@snu.ac.kr

[*****]Corresponding Author, Professor, College of Agriculture and Life Sciences, Seoul National University, email: kimk@snu.ac.kr