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1 Assessment of the Economic Impacts of Heat Waves: A Case Study of Nanjing, China

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13 Abstract

14 The southeast region of China is frequently affected by summer heat waves. Nanjing, a metropolitan
15 city in Jiangsu Province, China, experienced an extreme 14-day heat wave in 2013. Extreme heat can
16 not only induce health outcomes in terms of excess mortality and morbidity (hospital admissions)
17 but can also cause productivity losses for self-paced indoor workers and capacity losses for outdoor
18 workers due to occupational safety requirements. All of these effects can be translated into
19 productive working time losses, thus creating a need to investigate the macroeconomic implications
20 of heat waves on production supply chains. Indeed, industrial interdependencies are important for
21 capturing the cascading effects of initial changes in factor inputs in a single sector on the remaining
22 sectors and the economy. To consider these effects, this paper develops an interdisciplinary
23 approach by combining meteorological, epidemiological and economic analyses to investigate the
24 macroeconomic impacts of heat waves on the economy of Nanjing in 2013. By adopting a supply-
25 driven input-output (IO) model, labour is perceived to be a key factor input, and any heat effect on
26 human beings can be viewed as a degradation of productive time and human capital. Using this
27 interdisciplinary tool, our study shows a total economic loss of 27.49 billion Yuan for Nanjing in 2013
28 due to the heat wave, which is equivalent to 3.43% of the city's gross value of production in 2013.
29 The manufacturing sector sustained 63.1% of the total economic loss at 17.34 billion Yuan. Indeed,
30 based on the ability of the IO model to capture indirect economic loss, our results further suggest
31 that although the productive time losses in the manufacturing and service sectors have lower
32 magnitudes than those in the agricultural and mining sectors, they can entail substantial indirect
33 losses because of industrial interdependencies. This important conclusion highlights the importance
34 of incorporating industrial interdependencies and indirect economic assessments in disaster risk
35 studies.

36 **Keywords:** Heat Wave, Health, Productivity, Capacity, Macroeconomic, Input-output Analysis,
37 Indirect Loss, Nanjing, China

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