

Research Statement
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October 2026

I am an applied microeconomist working in energy and environmental economics. My research addresses two broad questions: (1) how adverse shocks to electricity markets affect firms and households and (2) how environmental externalities and policies addressing them affect the welfare of producers, consumers, and residents. I study policies with substantial economic consequences in Japan, China, and the United States, offering broader lessons for energy and environmental policy worldwide. I draw on confidential administrative records and detailed data on production, energy use, health, and environmental quality. I use quasi-experimental designs to identify causal effects and structural models, including a production-function model, to examine mechanisms and evaluate policy alternatives.

My work has received more than 2,100 citations on Google Scholar as of September 2026. My research has been published in *American Economic Journal: Applied Economics*, *Nature Sustainability*, *Nature Human Behaviour*, and *Journal of Environmental Economics and Management*. Beyond academia, it has been covered by *Reuters*, *Bloomberg*, and *The Guardian* and cited in OECD policy reports.

1. Electricity supply shocks, firms, and households

Modern economies run on electricity, but its supply cannot be taken for granted, even in advanced economies. Russia’s war in Ukraine and decades of conflict in the Middle East highlight “significant fragilities in today’s global energy system” (IEA, 2024). Natural disasters pose additional risks to electricity supply. As societies replace fossil fuels with clean electricity, the stakes rise: the more they depend on electricity, the more they stand to lose when supply is disrupted. My first strand of research examines how adverse shocks to electricity supply affect manufacturing and household health.

Japan’s prolonged nuclear shutdowns after the 2011 Fukushima accident—often described as “the worst civil nuclear disaster since the one at Chernobyl in 1986” (UNSCEAR, 2021)—provide a setting for studying these questions. Nuclear power had supplied roughly 30% of Japan’s electricity, but its share fell to almost zero within a few years. These shutdowns raised electricity prices and prompted government conservation campaigns.

In **Kawaguchi and Tanaka (2026, *Job Market Paper*)**, we provide the first micro-level evidence on how large and persistent electricity supply shocks affect manufacturing output. Existing studies primarily examine changes in electricity taxes or pricing plans. Using confidential establishment-level data, we instrument for regional exposure to the shock with pre-accident nuclear reliance and reserve margins. We combine these estimates with a production function model to explain firms’ responses and evaluate counterfactual electricity-market reforms.

We find substantial output losses attributable to electricity supply shocks and little evidence of recovery, even seven years after the accident. Electricity supply shocks reduce manufacturing

electricity use by 6.7%, labor and material inputs by 1.3% each, and output by 1.7%—an annual manufacturing output loss of approximately US\$50 billion. These losses are striking because electricity accounts for only 2% of revenue. Establishments make limited adjustments through product switching, outsourcing, fuel substitution, or shifting production within firms. Instead, establishments respond by reducing operating hours, directly curtailing output.

Our production function model explains why an input with a small expenditure share can have large consequences for output. Electricity is difficult to replace with other inputs, and reductions in electricity use leave machinery idle. For instance, a firm cannot operate an electric furnace without electricity. Incorporating these mechanisms allows the production model to closely match the reduced-form estimates of output losses; conventional benchmark models substantially underpredict these losses. Our counterfactual analysis shows that higher electricity prices, rather than moral suasion, explain most of the output losses. We also find that reforms such as regional market integration can lower electricity prices and substantially reduce these losses.

My MPhil thesis at HKUST (**He and Tanaka, 2023, *American Economic Journal: Applied Economics***) examines how electricity conservation campaigns affect households' ability to cope with extreme heat. We find that government appeals to reduce electricity use discouraged air-conditioning use and increased mortality, with the effects concentrated among older adults. Our estimates imply approximately 7,700 additional premature deaths annually. The study advances the temperature–health literature by providing some of the first quasi-experimental evidence on electricity's protective role, addressing the endogeneity of households' adaptation choices. These findings underscore the importance of accounting for health consequences when designing electricity conservation policies. The findings were highlighted by *Bloomberg*, the *Thomson Reuters Foundation*, and *Nikkei*, a leading Japanese newspaper.

2. Environmental pollution, regulations, and welfare

Since the enactment of the U.S. Clean Air Act in 1970, concentrations of major air pollutants have declined by about 90%. China also experienced a sharp decline in particulate pollution around the launch of its “war on pollution” in 2014, with PM_{2.5} concentrations falling by about 40% between 2013 and 2018. My second strand of research examines how environmental externalities and policies addressing them affect the welfare of producers, consumers, and residents. This agenda extends to noise pollution, an externality that has received far less attention in economics. Countries face different environmental challenges and adopt different policy approaches. My research, therefore, draws lessons from these varied experiences around the world to inform environmental policy elsewhere.

Researchers attribute much of the improvement in U.S. air quality to the Clean Air Act, but compliance can require costly investments in pollution-control equipment. A substantial literature documents adverse effects on firms' output, input use, and productivity. These outcomes, however, do not fully reveal the welfare effects of regulation or who ultimately bears its costs. Firms may pass compliance costs on to consumers through higher product prices. Fixed compliance costs can

also deter entry or induce exit, potentially reducing competition and increasing market power. If consumers bear regulatory costs through higher prices, overlooking this understudied channel may substantially bias our understanding of the welfare consequences of environmental regulation.

In my ongoing project, **“Environmental Regulation, Cost, Price and Welfare”** (*approved by the Census Bureau*), I examine how the U.S. Clean Air Act affects manufacturing costs, market power, and product prices. This project will use confidential records from the Census of Manufactures and the Annual Survey of Manufactures on product-level output prices and establishment-level inputs and outputs. My empirical approach will use production-function estimation to recover establishment-level markups. I will then estimate regulatory effects on markups and prices using difference-in-differences strategies that exploit variation in county-level attainment and nonattainment status. I will use these estimates to recover changes in producer and consumer welfare and assess incidence.

Developing countries face distinct challenges in combating air pollution, including continued reliance on highly polluting energy sources. China illustrates this challenge: despite substantial recent progress, air pollution remains severe. In **He, Pan, and Tanaka (2020, *Nature Sustainability*)**, we use evidence from the COVID-19 lockdowns to examine the obstacles to further improvements in China’s air quality. We find that formal lockdowns and other containment measures reduced PM_{2.5} concentrations by approximately 21 $\mu\text{g}/\text{m}^3$ in locked-down cities. Yet concentrations still averaged around 40 $\mu\text{g}/\text{m}^3$ —four times the WHO annual guideline in effect at the time—even as nonessential industrial activity and transportation largely ceased (WHO, 2006). We argue that residential emissions, particularly from outdated coal-fired heating, help explain why pollution remained high. These findings identify residential energy use as an important target for further pollution reductions, alongside industry and transportation.

My research also examines whether air pollution accelerates the spread of infectious diseases. In **He, Pan, and Tanaka (2025, *Journal of Environmental Economics and Management*)**, we combine epidemiological modeling with an instrumental-variables approach. We find that air pollution increased the daily growth rate of COVID-19 during the first wave in China, while its estimated effects on influenza-related healthcare visits in Japan were small and statistically insignificant. These findings suggest that cleaner air may help contain some infectious disease outbreaks, providing an additional health benefit to consider when evaluating pollution control policies.

Economists have extensively studied the welfare effects of air pollution and its regulation, but far less is known about noise pollution. Noise mitigation policies often remain fragmented despite the fact that noise pollution causes annoyance, disrupts sleep, and can impair cognition and health. In the United States, for example, funding for the EPA’s noise office ended in 1982, leaving responsibility primarily to state and local governments. Over nearly half a century, this has left many residents “without legal recourse to stop harmful noise exposures” (APHA, 2021).

In an ongoing project, **“Combating Noise Pollution: Policy, Exposure, and Welfare”** (*scheduled for presentation at ASSA 2027*), we provide the first evidence on how national efforts to combat noise pollution reduce traffic noise and how residents value these improvements.

We assemble two decades of largely untapped nationwide measurements of road-traffic noise from over 14,000 monitoring points in Japan and link them to detailed data on noise-mitigation policies obtained through freedom-of-information requests.

We find that traffic noise declined by approximately 3 dB from 2002 to 2022, a reduction equivalent to roughly halving sound energy and reducing perceived noise by about 20%. To investigate the sources of this decline, we develop a noise prediction model. The model attributes most of the decline to noise mitigation policies, particularly low-noise pavement and tighter vehicle noise-emission standards. Using a hedonic approach, we estimate that residents are willing to pay 1.14% of residential land value for a 1 dB reduction in road-traffic noise. We estimate that Japan’s efforts to combat noise pollution generated approximately 5 trillion yen (US\$38 billion) in capitalized benefits along the monitored road network. These findings highlight the economic value of sustained noise mitigation and suggest that countries with fragmented noise mitigation efforts, including the United States, may be leaving substantial benefits unrealized.

3. Public health during crises

Major policy shifts and societal disruptions create urgent demand for timely evidence. Alongside my core agenda, I seek to contribute to these debates by drawing on my expertise in data and empirical methods. During the COVID-19 pandemic, my experience with health data helped me recognize the value of Japan’s detailed and promptly released suicide statistics for studying the crisis’s emerging consequences. In **Tanaka and Okamoto (2021, *Nature Human Behaviour*)**, we document an increase in suicide, particularly among women, children, and adolescents. The findings were highlighted by *Reuters* and *The Guardian* and cited in OECD reports (2021, 2023). Complementary work examines the broader health consequences of pandemic restrictions. In **Qi et al. (2022, *Nature Human Behaviour*)**, we find that strict virus containment policies reduced non-COVID-19 mortality, with improved air quality among the plausible mechanisms.

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