



GRANTS Ryoichi Sasakawa Young Leaders Fellowship Fund (SYLFF) Research Award, 2021

AWARDS AND SYLFF Fellow, 2018–19, 2019–20  
HONORS Yale Graduate Fellowship, Yale University, 2015–2022  
Cowles Foundation Fellowship, Yale University, 2015–2019  
Wells Scholar (Full Scholarship), Indiana University Bloomington, 2011–2015

SKILLS Programming Languages: Proficient in Python, L<sup>A</sup>T<sub>E</sub>X. Experienced in R  
Languages: English (native), French (conversational)  
Special Sworn Status: U.S. Census Bureau, Federal Statistical Data Research Center

WORKING *The Price of Financial Inclusion: Equilibrium Effects of Rural Banking Policy in India*  
PAPERS (November 2021), **Job Market Paper**  
*Technology Lock-in and Optimal Carbon Pricing*, with Katherine Wagner (November 2021)

WORK IN *The Use and Misuse of Average and Marginal Energy Prices: Implications for Climate*  
PROGRESS *Policy*, with Katherine Wagner

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**The Price of Financial Inclusion: Equilibrium Effects of Rural Banking Policy in India** (November 2021), Job Market Paper

Governments often require private firms to provide unprofitable services. Such mandates can have large benefits for the targeted population, but by increasing provider costs they may reduce overall supply, with adverse impacts on others. I examine how mandates designed to increase access to commercial bank branches in low-income areas affect the size, geographic distribution, and profitability of the national branch network.

I use novel, comprehensive administrative records of branch licenses to construct an annual municipality-level panel of bank branch networks from 2006-2018 and link this to Census and geospatial data. I present new facts about a major reform to India's bank branching regulations. After July 2011, commercial banks were required to open 25% of their new branches in unbanked villages. At the time, over 600 million Indians lived in villages not served by bank branches, with little progress since the early 1990s. In the next five years, banks opened over 11,000 branches in unbanked villages, home to over 42 million people. I characterize changes in the types of villages entered and show that over 100 million people saw their distance to the nearest branch cut by at least 2 km.

I then use a model of branch entry to study the causal effects of the reform. I estimate banks' profits from entry in each market, using plausibly exogenous variation in historical branch networks to identify the effect of rivals' endogenous entry. I compute banks' regulatory compliance costs as a function of the mandatory unbanked share and banks' profits in available unbanked villages. I then simulate equilibrium branch networks to obtain bank profits and entry probabilities under counterfactual policies.

Compared to a free-entry counterfactual, the baseline policy increases entry in unbanked markets by a factor of seven, but reduces urban entry by 24% and profits from new branches by 26%. Smaller, lower-income banked markets face disproportionate reductions in entry. In equilibrium, marginal compliance costs vary by a factor of three between banks. A competitive market for tradable permits makes the policy 11% less costly for banks but does not result in additional branches. Private banks become less constrained and replace public sector branches less than one-for-one, resulting in higher private sector profits and increased geographic concentration of bank branch networks.

**Technology Lock-in and Optimal Carbon Pricing**, with Katherine Wagner (November 2021)

This paper studies the implications of low energy prices today for energy efficiency and climate policy in the future. If adjustment costs mediate manufacturing plants' responses to increases in energy prices, incumbents may be limited in their ability to reoptimize energy-inefficient production technologies chosen based on past market incentives. Using U.S. Census microdata and plausibly exogenous variation in state energy prices, we show that the electricity prices manufacturing plants pay in their first year of operations are important determinants of long-run energy intensity. Plants that open when the prices of electricity and fossil fuel inputs into electricity are low consume more energy throughout their lifetimes, regardless of current electricity prices. We measure the relative contributions of initial energy productivity and capital adjustment frictions to the overall lock-in effect by estimating a model of plant input choice. We find that observed lock-in is mostly explained by persistent differences in the relative productivity of energy inputs. We discuss how these long-run effects of low entry-year energy prices increase the emissions costs of delayed action on carbon policy.

## **The Use and Misuse of Average and Marginal Energy Prices: Implications for Climate Policy**, with Katherine Wagner

The goal of a carbon tax is to equate the marginal cost of reducing carbon emissions with the marginal social benefit of avoiding these emissions. However, the responses of firms and individuals to these taxes are often calculated using average costs commonly reported in economic data, rather than marginal costs. This paper quantifies the wedge between marginal and average electricity prices for industrial consumers and studies the implications for climate policy. First, we document that the marginal price of electricity paid by manufacturing plants is lower than the average price by constructing a panel of both average and marginal electricity prices using plant-level microdata from the U.S. Census and utility-level electricity rate schedules for over two hundred utilities over 20 years. Second, we provide guidance on when average costs are an appropriate proxy for marginal costs by identifying economic and geographic characteristics that predict variation in the wedge between marginal and average electricity prices. Overall, we find that the standard use of average energy prices to calculate responses to carbon taxes may underestimate the energy price increases needed to meet emissions targets.