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Young Scholars – Abstracts

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Climate Shocks, Cyclones, and Economic Growth: Bridging the Micro-Macro Gap

Abstract: Empirical analyses of climatic event impacts on growth, while critical for policy, have been slow to be incorporated into macroeconomic climate-economy models. This paper proposes a joint empirical-structural approach to bridge this gap for tropical cyclones. First, we review competing empirical approaches in a harmonized global dataset and through a theory lens. Second, we estimate cyclone impacts on structural determinants of growth (productivity, depreciation, fatalities) to quantify a stochastic growth model for 40 vulnerable countries and project welfare effects of climate-driven cyclone risk changes. Third, we compute cyclone impacts on the social cost of carbon in the seminal DICE model.

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Building Codes and Community Resilience to Natural Disasters

Abstract: Natural disaster losses can be mitigated through investments in structure hardening. When property owners do not correctly perceive risks or there are spatial externalities, it may be beneficial to mandate such investments through building codes. We provide the first comprehensive evaluation of the effect of California's wildfire building codes on structure survival. We combine administrative damage data from several states, representing almost all U.S. homes destroyed by wildfire since 2007. We merge this damage data to the universe of assessor data for destroyed and surviving homes inside wildfire perimeters. There are remarkable vintage effects in resilience for California homes built after 1995. Using differences in code requirements across jurisdictions, we show that these vintage effects are due to state and local building code changes prompted by the deadly 1991 Oakland Firestorm. Moreover, we find that these improvements increase the survival probability of neighboring homes due to reduced structure-to-structure spread. Our results imply that property losses during recent wildfire seasons would have been several billion dollars smaller if all older homes had been built to current standards.

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Soaking Up the Sun: Battery Investment, Renewable Energy, and Market Equilibrium

Abstract: Battery storage provides a potentially valuable complement to renewable energy. Thus, policymakers have recently incentivized and mandated storage as a means to integrate renewable energy and meet climate goals. This paper evaluates the equilibrium value and adoption trajectory of utility-scale batteries using California data, focusing on the impact of falling battery capital costs, complementarities with renewable energy, and market power. We add three key modeling features relative to the literature: (1) a modeling of equilibrium effects from large-scale batteries that includes ramping constraints, (2) a frontier time-series model of electricity load and marginal costs, and (3) linked competitive dynamic equilibrium models of battery adoption and operations. We find that: (1) the value of battery storage increased sharply between 2016-19 as solar generation increased, (2) battery investment exhibits decreasing returns-to-scale—the per-unit value of batteries drops significantly with total installed battery capacity, (3) battery operations increase California's 2018 expected discounted social surplus from the electricity market by $3.8 billion or $2.42 per MWh of solar energy generated, and (4) California's 1.3 GW storage mandate moves battery adoption forward by eight years compared to a counterfactual scenario without a mandate, and increases deadweight loss by $3.94 per California resident.

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Agriculture and Deforestation

Abstract: Although improving agricultural productivity is vital to anti-poverty and food security goals, its ecological effects are theoretically ambiguous. Increasing the relative value of agricultural land may spur deforestation, but factor market constraints paired with improvements in existing land productivity may reduce the demand for shifting cultivation. Leveraging the discontinuity in eligibility for a large agricultural extension program, we find that the program reduced deforestation by 13%. The program increased adoption of promoted practices such as manure-use and crop rotation resulting in higher productivity but no increase in cultivated area. Suitably designed programs improving agricultural productivity may also enable conservation.

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Collective Conservation Payments Promote Institutional Creation: An Experimental Analysis

Abstract: Local institutions are crucial to the solution of collective action problems. Yet we still have little knowledge of how to promote the creation of institutions where they have not already emerged endogenously. Can external policy interventions stimulate the creation of autonomously devised local institutions or is this a contradiction in terms? We argue that collective conservation payments can trigger the creation of local institutions. Conditional payments are a popular conservation policy, but critics of such programs suggest that they may alter the way that forest users perceive conservation –causing them to view it as a market-based activity rather than socially or environmentally motivated action – with worrisome implications for long-term conservation. However, such critiques rarely engage with the role of institutions as partly extrinsic motivators of behavior. We examine data from a lab-in-the-field conservation game played with real-life forest users in five developing countries. Groups were randomly assigned to a collective payment condition within the game, and communication was allowed between rounds. We ask whether institutional creation differed between groups, and whether these outcomes are associated with conservation. Results indicate that the payments groups are more likely to adopt institutions, which is also a statistically significant predictor of conservation behavior. We conclude that collective payments can promote institutional creation, and we discuss possible explanations for this finding.

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Lead Exposure Reduces Academic Performance: Intensity, Duration, and Nutrition Matter

Abstract: We leverage a natural experiment, where a large national automotive racing organization switched from leaded to unleaded fuel, to study how ambient lead exposure and nutrition impact learning in elementary school. The average race emitted more than 10 kilograms of lead — a quantity similar to the annual emissions of an airport or a median lead-emitting industrial facility in the United States. Increased levels and duration of exposure to lead negatively affect academic performance, shift the entire academic performance distribution, and negatively impact both younger and older children. We provide quasi-experimental evidence linking measured quantities of lead emissions to decreased test scores, information essential for policies addressing ambient lead and emission sources. Exposure to 10 additional kilograms of lead emissions reduces standardized test scores by 0.07 standard deviations. This corresponds to an average income reduction of $9,000 per treated student in present value terms, an effect of similar magnitude as improving teacher value added by one standard deviation, reducing class size by 10 students, or increasing school spending per pupil by $2,500. The marginal impacts of lead are larger in impoverished, non-white counties, and among students with greater duration of exposure, even after controlling for total exposure. Factors correlated with better nutrition — most notably consumption of calcium-rich foods like milk — help mitigate the link between lead exposure and reduced educational outcomes. These results show that improved child nutrition can help combat the negative effects of lead, addressing several prominent social issues including racial test gaps, human capital formation across income groups, and disparities in regional environmental justice.

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The Determinants and Impacts of Historical Treaty-Making in Canada

Abstract: For nearly three centuries, Indigenous peoples within the borders of present-day Canada engaged in treaty-making with the British Crown and other European powers. These treaties regularly formed the colonial legal basis for access to Indigenous lands for settlement and use. However, the cession of land through treaties did not occur everywhere, including in regions subsequently settled by Europeans. As a consequence, there is substantial variation in the legal status of lands, jurisdiction over resources, and state commitments to Indigenous nations. We combine spatial, archival, anthropological and census data to understand the determinants of when and where treaties were signed, their provisions, and how they have shaped the long-run path of economic development in Indigenous communities. We find that treaties were most likely to be signed by nations that experienced deterioration in their bargaining power through resource depletion and where transaction costs were lowest. Using restricted access census data, we show that historical treaties are associated with statistically and economically lower income in Indigenous communities today. We argue that this is likely the result of differences in the value of property rights relative to the treaty commitments delivered upon by the Crown.

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Heterogeneity and Market Adaptation to Climate Change in Dynamic Spatial Equilibrium

Abstract: The impacts of climate change are heterogeneous across space, industries, and time. In this paper we develop a dynamic spatial general equilibrium model where changes in local temperature distributions affects productivity growth and local amenities. Our model captures different novel forms of heterogeneity in climate change and allows us to estimate temperature impacts on productivity and amenities while accounting for dynamic and spatial behavior. We use our model to quantitatively evaluate the consequences of adapting to climate change through migration across regions, job switching, and trade. We find that allowing for within-country market adaptation can mitigate and even reverse the large negative effects of climate change in the US. Adaptation through trade and job switching are the most important mechanisms and are improve welfare by 5% in consumption equivalent terms. Moreover, heterogeneity in economic exposure and changes in the local climate play a critical role in the value of adaptation. Heterogeneous impacts of climate change on industries magnifies the benefits of trade and job switching, while muting the benefits of migration. Models that abstract away from the variation of climate change across space, industries, and time significantly understate the value of market-based adaptation.

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The Effects of Individualized Water Rates

Abstract: Utility rate structures make tradeoffs between multiple objectives including cost recover, conservation, equity, and affordability. Two-part tariffs are commonly deployed with the volumetric portion often using increasing block tiers. This serves to provide “essential” water at a lower marginal rate while encouraging conservation of resources at higher use. Setting the size of the tiers is a challenge given heterogeneous household needs and a uniform size may inadvertently put more burden on lower-income groups that may have less efficient homes and more people per household. This paper is the first to analyze the effects of using average winter consumption (AWC) to create individualized rate structures tailored to revealed essential use. I use over seven million monthly household water bills from before and after the implementation of AWC pricing to explore three related questions. First, do consumers respond strategically to the implicit discount for winter use embedded in AWC pricing? Second, how does AWC, by charging different households different amounts for the same amount of water, alter equity and affordability? Finally, how does the new rate structure affect water use and to what price are consumers responding to? Findings show that: on average, strategic behavior is not present, although a subset of consumers respond to the (unintended) incentive; AWC does increase the size of the tier for larger households and results in a progressive structure holding water use constant, but a regressive structure when including the fixed fee, which is now higher, and the water use decision; and consumers do reduce use in response to the higher prices and it is the total average price that drives the changes, not the marginal, volumetric average, or total bill. On net, the evidence is favorable that AWC pricing can be an economical method to create individual water rate structures with limited strategic activity, but given the prominent

role of the fixed fee in affecting affordability and use decisions, more consideration of this aspect is warranted in the literature and by utilities.

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What's Missing in Environmental (Self-)Monitoring: Evidence from Strategic Shutdowns of Pollution Monitors

Abstract: Regulators often rely on self-reported data to determine compliance. Tolerance for missingness in self-monitoring data may create incentives for local agents to strategically decide when (not) to monitor regulated activities. This paper builds a framework to detect whether local governments skip air pollution monitoring when they expect air quality to deteriorate. We infer this expectation from air quality alerts – public advisories based on local governments' own pollution forecasts – and test whether monitors' sampling rates fall when these alerts occur. We first use this method to test an individual pollution monitor in Jersey City, NJ, suspected of a deliberate shutdown during the 2013 "Bridgegate" traffic jam. Consistent with strategic shutdowns, this monitor's sampling rate drops by 33% on days that Jersey City issues pollution alerts. Building on large-scale inference tools, we then apply the method to test over 1,300 monitors across the U.S., finding at least 14 metro areas with clusters of monitors showing similar strategic behavior. We discuss imputation methods and policy responses that may help deter future strategic monitoring.