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Program Report

Environment and Energy Economics

Meredith Fowlie and Christopher R. Knittel*

Launched in 2007, the NBER's Environment and Energy Economics (EEE) Program brings together scholars working on environmental, energy, and natural resource economics. The EEE Program now has 126 affiliated researchers, 53 of whom share an appointment in another NBER program. EEE researchers have produced 740 working papers since the last program report in June of 2016.

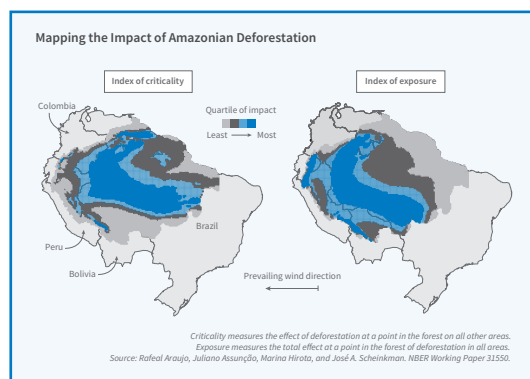
The EEE Program holds two regular annual meetings and several specialized meetings throughout the year. Recent specialized meetings have included workshops on the distributional impacts of climate change in the agricultural sector and of new energy policies, the economics of energy use in transportation, the economics of decarbonizing industrial production, and economic perspectives on water resources, climate change, and agricultural sustainability. Since 2019, the program has also hosted an annual conference in Washington, DC on "Environmental and Energy Policy and the Economy."

Our group is diverse in terms of the empirical methods we use, the theoretical foundations we build on, and the topics we study. Some primarily focus on issues and questions in energy economics, such as the design of wholesale electricity markets or the economics of oil and gas extraction. Others focus on purely environmental economics topics, such as the economics of biodiversity protection or the long-run effects of air pollution. Given the critical role that energy markets will play in any meaningful response to climate change and environmental degradation, a growing number of affiliates are conducting research at the intersection of energy and environmental economics.

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It is impossible to do justice to the breadth and depth of program affiliates' research in this short report. The last program report highlighted work on climate change impacts and policy design, on local air pollution, and on energy use in the developing world. We will use this opportunity to highlight some other flourishing lines of inquiry. As an organizing framework, we could not resist the temptation to draw inspiration from the 1970s band Earth, Wind, and Fire.

Earth

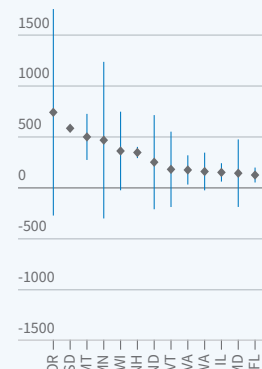
The EEE Program has an abiding interest in the economic costs and benefits of activities that affect the earth. This includes studies of how market-based approaches can advance conservation objectives, as well as the economic consequences of resource destruction.

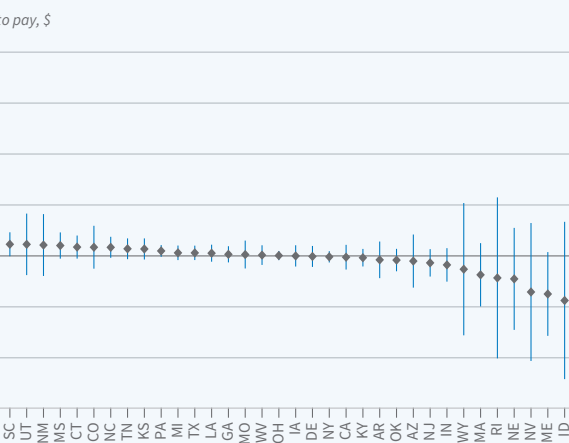
Environmental offsets are playing an increasingly central role in modern-day efforts to achieve environmental and conservation objectives more cost-effectively. For example, Daniel Aronoff and Will Rafey study offsets in the important context of wetlands conservation. In a recent working paper, they develop a structural model in which a regulator allows households and firms to generate offsets by investing in land restoration and selling those offsets to others who want to use land for real estate development.¹ They apply the model to study a market for wetlands offsets in Florida.

Section 404 of the Clean Water Act created a "No Net Loss" mandate for existing wetlands. In Florida, developers can repurpose a wetland area for other uses, provided the development is accompanied by approved actions that offset the wetland degradation. The Florida system allows developers to buy those offsets from others. Aronoff and Rafey use observed offset trades, prices, and production to measure the private gains from trade and to predict wetlands reallocation and environmental outcomes under alternative market designs. In addition, they combine their model of supply and demand for offsets with a hydrological model that allows them to estimate the expected flood damages from shifting wetlands from one area to another. They find that trade substantially increases private welfare but also increases total flood damages. However, combining the offset market with a Pigouvian tax proportional to local flood risk can

Willingness to Pay for Re

Black-White differential in willingness to pay for



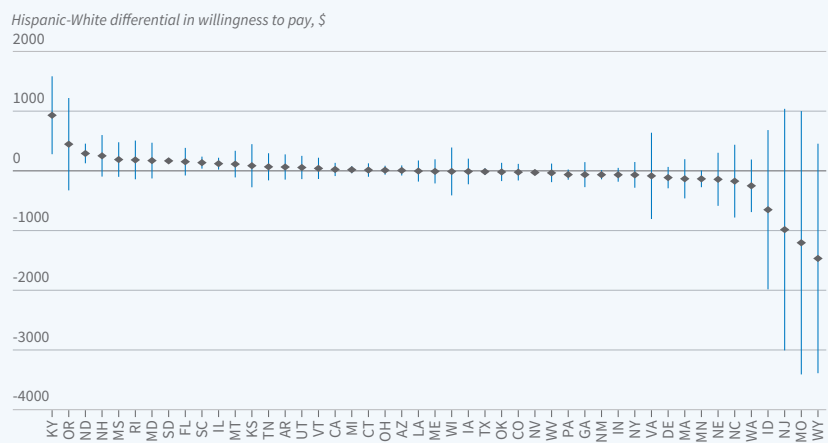


Source: Alecia W. Cassidy, Elaine L. Hill, and Lala Ma. NBER Working Paper 30661.

Figure 1

eliminate almost 90 percent of flood damages while preserving over two-thirds of the private benefits.

Land restoration also takes place after hazardous material leaks. Alecia Cassidy, Elaine Hill, and Lala Ma study the beneficiaries of hazardous waste cleanup.² Specifically, they estimate the housing price benefits at the census tract level of the cleanups performed under the Resource Conservation and Recovery Act (RCRA) Corrective Action Program and how these housing price effects correlate with sociodemographic variables. They leverage spatial variation in the distance between facilities and census tract boundaries and variation in the timing of cleanups to identify housing market impacts. They find that house price benefits are highly localized, and they find little heterogeneity in willingness to pay for cleanups across race. They find only weak evidence of sorting across sociodemographic variables in response to cleanups. Figures 1 and 2 plot the differences in willingness to pay between Blacks and Whites,



Source: Alecia W. Cassidy, Elaine L. Hill, and Lala Ma. NBER Working Paper 30661.

Figure 2

and Hispanics and Whites, across states. Taken together these results imply that the benefits from cleaning up hazardous waste under the RCRA accrue to those living closest to the facilities, who tend to be from relatively disadvantaged groups.

Forests play several crucial roles in the environment, including provision of natural habitats to support biodiversity, carbon sequestration, and water cycle main-

tenance. Rafael Araujo, Juliano Assunção, Marina Hirota, and José Scheinkman study the likelihood of local disturbances in the Amazon cascading to downwind locations due to the east-west atmospheric flow generated by trade winds.³ They estimate a model of spatial and temporal interactions that captures the cascading effects of local disturbances, such as deforestation of a local area or a localized drought. They gen-

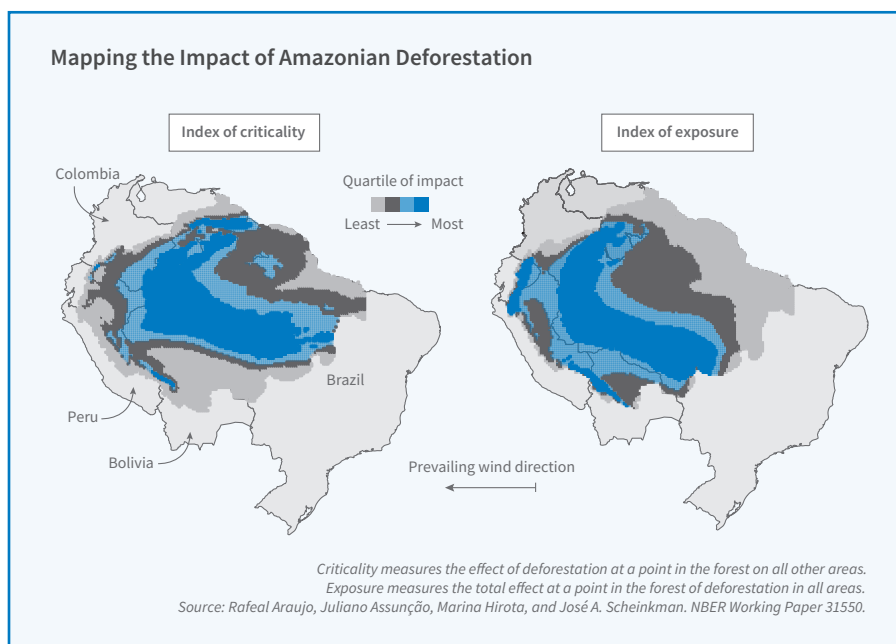


Figure 3

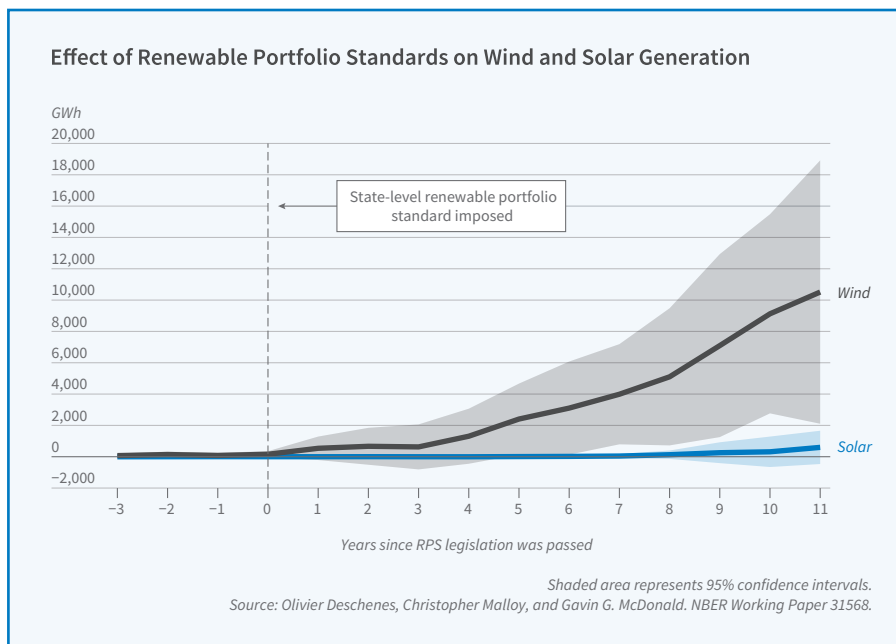


Figure 4

Wind

Because of both climate policy interventions and technological change, electricity markets throughout the world are decarbonizing. The bulk of the carbon-free investments have been in wind and solar. Research from the EEE group has been instrumental in analyzing the economics of the energy transition. One topic within this theme is the impact of policy on clean technology investment. Olivier Deschenes, Christopher Malloy, and Gavin McDonald provide causal estimates of how renewable portfolio standards (RPS) affect investment in and generation from wind and solar and the heterogeneity in these outcomes.⁴ They find that RPS increase wind capacity and generation; however, they do not find a statistically significant increase in solar capacity and generation, although with a lag. This is seen in Figure 4.

Stephen Holland, Erin Mansur, and Andrew Yates develop a long-run model of entry and exit of generation assets in electricity markets.⁵ They calibrate it for 13 regions of the US and analyze how different policies affect investment in wind, solar, and other carbon-free resources. They find that a

carbon tax of \$150 per ton essentially eliminates carbon emissions, and that the attractiveness of renewable subsidies compared to subsidies for nuclear generation varies depending on the decarbonization goal.

More recently, John Bistline, Neil Mehrotra, and Catherine Wolfram simulate the economic impacts of the Inflation Reduction Act (IRA).⁶ They predict that annual investment in low-carbon-emitting technologies will nearly double as a result of the IRA compared to a business-as-usual case, increasing the amount of decarbonization in the electricity sector by roughly 15 percentage points in 2040. They also find that the IRA provisions are cost-effective using the EPA's proposed social cost of carbon of roughly \$190 per ton.

Another set of questions related to the energy transition centers around the distributional consequences of the transition. E. Mark Curtis and Ioana Marinescu document the growth in wind and solar jobs since 2010 and compare the wages of these jobs to average wage levels.⁷ Leveraging data from Burning Glass Technologies they find that both wind and solar jobs tripled from 2010 to 2019. They also find that these jobs tend to be located

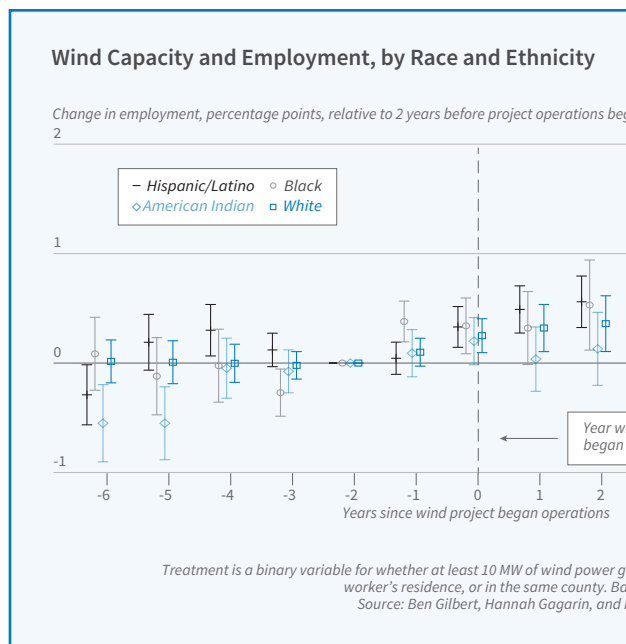


Figure 5

in regions of the country with a high share of fossil fuel employment. Jobs in the wind and solar sectors also pay a premium compared to the average job, and this premium is even higher when the job has a low education requirement. Ben Gilbert, Hannah Gagarin, and Ben Hoen estimate the impact of wind energy development on local earnings and employment and how these impacts vary across race, ethnicity, sex, and educational attainment.⁸ They find significant employment and wage impacts from utility-level wind developments, with the largest effects for Black and Native American workers, and those without a high school diploma.

Fire

With global temperatures on the rise, wildfires are becoming more frequent and more intense. The past several decades have also seen a large increase in the number of US homes located in the wildland urban interface (WUI), where housing is more affordable but wildfire risk is relatively high. The confluence of climate change, increasing fuel loads, and more people living in harm's way raises important questions about

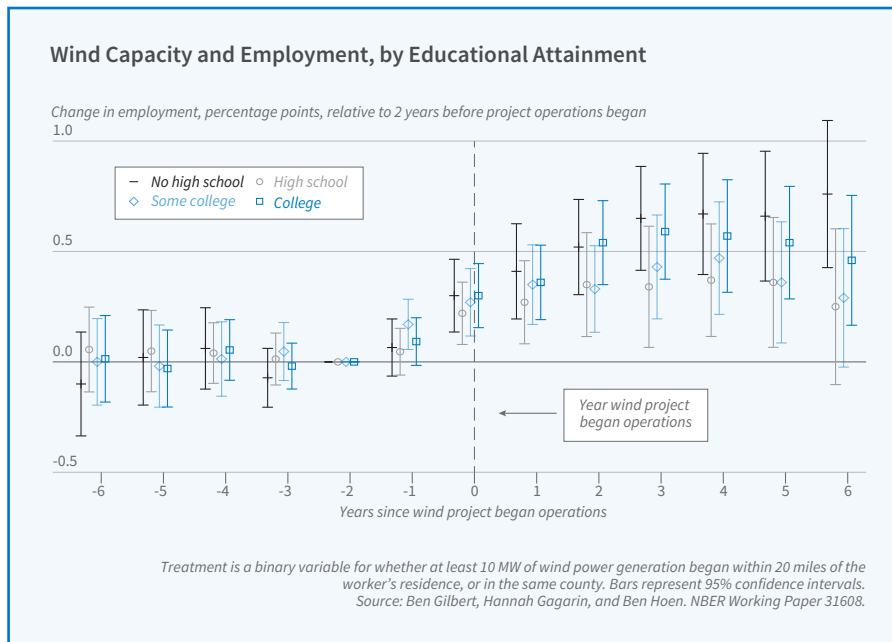
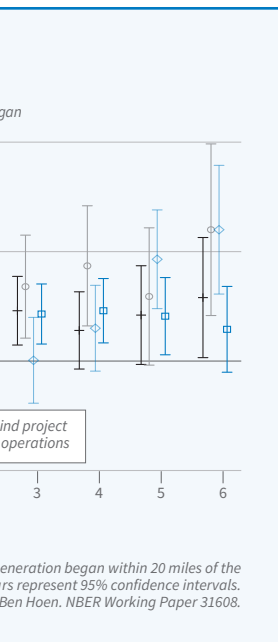


Figure 6

the scale and scope of wildfire damages, wildfire risk mitigation, and climate change adaptation. Several recent papers by EEE program members explore these important topics.

One important line of inquiry investigates the air pollution implications of increased wildfire activity. Past research has documented steady improvements in US air quality over time that can be traced to environmental policies. In recent years, however, these improvements have stagnated. Marshall Burke and coauthors quantify the contribution of wildfire smoke to these trends.⁹ They find that wildfire activity has slowed or reversed previous air quality improvements across two-thirds of US states. These wildfire-driven increases in air pollution concentrations are unregulated under current air quality laws. Absent policy intervention, as the climate continues to warm, the contribution

of wildfires to air quality trends is likely to grow.

Related work has studied the health and economic impacts of this increased wildfire smoke. Mark Borgschulte, David Molitor, and Eric Zou estimate that an additional day of wildfire smoke exposure reduced quarterly earnings by about 0.1 percent on average.¹⁰ Extensive margin responses, including employ-

ment reductions, explain 13 percent of the overall earnings losses. They find that the estimated welfare cost of lost earnings from wildfire smoke is on par with the fires' mortality impacts.

In addition to harmful effects on health and earnings, property damages from wildfires are on the rise. From 2013 to 2022, the share of global disaster losses caused by wildfires more than doubled compared with losses in previous decades. Investment in wildfire risk mitigation and adaptation will be

important in the face of this escalating risk. Cost-effective adoption of protective measures and behaviors appears to be limited by several factors including the misperception of disaster risk, public disaster spending programs that reduce private incentives for property protection, and spatial externalities across neighboring properties that create diverging private and social benefits of mitigation. One way to overcome these barriers involves mandating investments in wildfire risk mitigation and adaptation. Patrick Baylis and Judson Boomhower study the important case of wildfire building codes in California, a state that has suffered over \$40 billion in wildfire property damage in the past five years.¹¹ They estimate the effects of these codes on own-structure survival as well as neighbor spill-

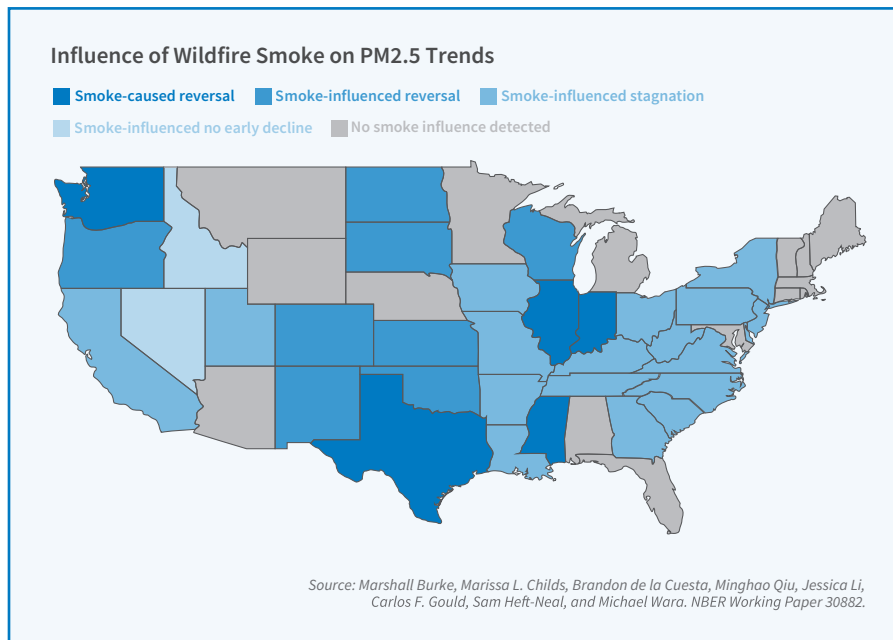


Figure 7

overs via structure-to-structure fire spread. Figure 8 shows that a home built after the building codes took effect was 40 percent less likely to be destroyed than a pre-code 1990 home experiencing an identical wildfire exposure. The authors also find code-induced mitigation of spread to neighboring homes.

An important implication of this research is that California's wildfire building codes have delivered unambiguously positive benefits in the most fire-prone areas of the state, especially where homes are clustered closely together and thus create a large risk of spillovers. The study also finds that given the costs of retrofitting existing homes to meet current wildfire building standards, retrofits are only economical in areas facing extreme wildfire hazards.

Conclusion

This is both a sobering and an exciting time to be an energy or environmental economist. The impacts of climate change and biodiversity loss have never been more salient. At the same time, many countries are making unprecedented commitments to conservation and investments in mitigating and adapting to climate change. Policymakers want to ensure that these efforts will deliver not only effective but also equitable outcomes. We hope and anticipate that EEE research will play a critical role in informing policy design going forward.

¹ “Conservation Priorities and Environmental Offsets: Markets for Florida Wetlands,” Aronoff D, Rafey W. NBER

Working Paper 31495, July 2023.
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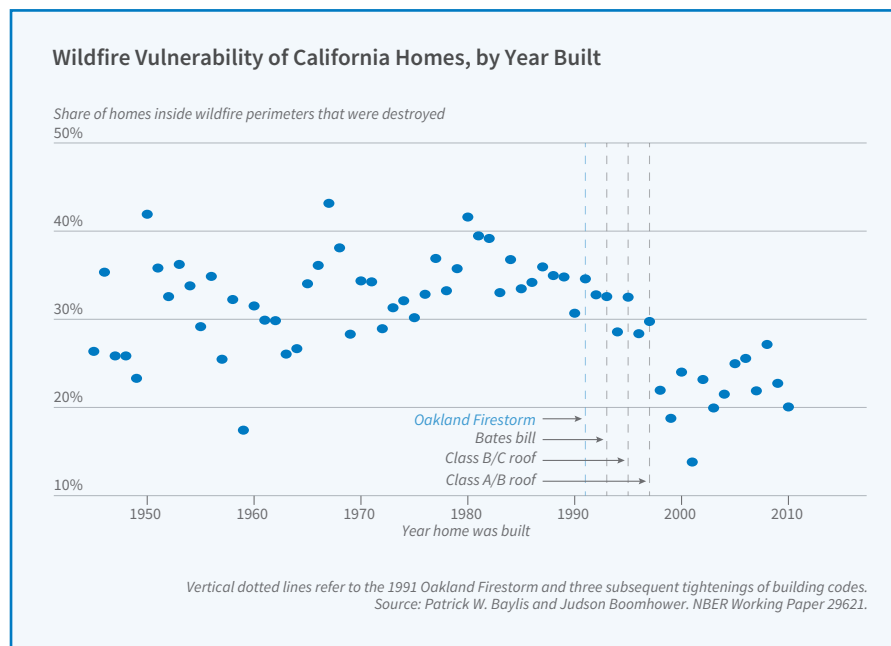


Figure 8

² “Who Benefits from Hazardous Waste Cleanups? Evidence from the Housing Market,” Cassidy AW, Hill EL, Ma L. NBER Working Paper 30661, November 2022.

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³ “Estimating the Spatial Amplification of Damage Caused by Degradation in the Amazon,” Araujo R, Assunção J, Hirota M, Scheinkman JA. NBER Working Paper 31550, August 2023.

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⁴ “Causal Effects of Renewable Portfolio Standards on Renewable Investments and Generation: The Role of Heterogeneity and Dynamics,” Deschenes O, Malloy C, McDonald GG. NBER Working Paper 31568, August 2023.

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⁵ “Decarbonization and Electrification in the Long Run,” Holland SP, Mansur ET, Yates AJ. NBER Working Paper 30082, May 2022.

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⁶ “Economic Implications of the Climate Provisions of the Inflation Reduction Act,” Bistline J, Mehrotra N, Wolfram C. NBER Working Paper 31267, May 2023.

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⁷ “Green Energy Jobs in the US: What Are They, and Where Are They?” Curtis EM, Marinescu I. NBER Working Paper 30332, August 2022.

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⁸ “Distributional Equity in the

Employment and Wage Impacts of Energy Transitions,” Gilbert B, Gagarin H, Hoen B. NBER Working Paper 31608, August 2023.

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⁹ “Wildfire Influence on Recent US Pollution Trends,” Burke M, Childs ML, de la Cuesta B, Qiu M, Li J, Gould CF, Heft-Neal S, Wara M. NBER Working Paper 30882, January 2023.

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¹⁰ “Air Pollution and the Labor Market: Evidence from Wildfire Smoke,” Borgschulte M, Molitor D, Zou E. NBER Working Paper 29952, April 2022.

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¹¹ “Mandated vs. Voluntary Adaptation to Natural Disasters: The Case of U.S. Wildfires,” Baylis PW, Boomhower J. NBER Working Paper 29621, December 2021.

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Research Summaries

Lasting Effects of Segregation on Political Behavior and Economic Opportunity

Eric Chyn and Kareem Haggag

Segregation based on race and income is a defining feature of cities and schools across the United States. While Black Americans make up less than 14 percent of the overall population, the typical Black child lives in a neighborhood where Black families make up the majority of residents and attends a school where at least half their peers are also Black.¹ These neighborhoods and schools also tend to have relatively high rates of poverty.

Theory posits that segregation in terms of neighborhoods and schools plays important roles in understanding poverty for disadvantaged Black communities.² This segregation may also shape the development of White

residents' attitudes, behaviors, and outcomes.

Although individual outcomes are notably correlated with exposure to segregation in neighborhoods and schools, it has proven difficult to assess whether these descriptive relationships reflect independent causal impacts. For example, descriptive work robustly documents that minorities who live in or attend schools in areas of concentrated poverty have worse economic outcomes than their counterparts who live outside these areas. It is well recognized that these patterns are difficult to interpret since differences in outcomes may reflect unmeasured differences in family background that may

drive residential selection or school choice.³

During the past decade, a large body of research has exploited natural experiments to provide new causal evidence on the effects of segregation in schooling and neighborhood contexts. In a recent set of papers, we have added to this literature by studying how segregation shapes civic participation and political identity, as well as broader social policy and economic opportunity. Our work relies on newly available data sources and demonstrates that segregation in cities and schools has wide-ranging impacts on both political and economic behavior. This piece summarizes our key findings.



Eric Chyn is an associate professor in the Department of Economics at the University of Texas-Austin and an NBER Research Associate in the Public Economics Program. He is an applied microeconomist whose research covers a range of topics in labor and public economics. Much of his research is focused on understanding the effects of government programs on the long-run outcomes of children.

Prior to joining the UT-Austin faculty, Chyn was an assistant professor at Dartmouth College and the University of Virginia. He received a PhD in economics from the University of Michigan.

studies topics at the intersections of economics, political science, and psychology.

Prior to joining the UCLA faculty, Haggag was an assistant professor at Carnegie Mellon University. He received a PhD in economics from the University of Chicago's Booth School of Business.

Kareem Haggag is an assistant professor at UCLA's Anderson School of Management and an NBER Faculty Research Fellow in the Political Economy Program. He



Can Moving to Higher-Opportunity Neighborhoods in Childhood Increase Civic Engagement?

An important body of research shows that childhood neighborhoods exert powerful influences on later-life economic outcomes,⁴ but there has been relatively less evidence on the links between childhood residence and social outcomes. Political engagement is an important outcome for which existing theory suggests neighborhoods play a critical role. For example, growing up in a disadvantaged community may reduce an individual's access to the types of institutions, civic norms, or social networks that foster engagement with the political process and voting.

We provide new quasi-experimental evidence on the link between childhood neighborhoods and later-life political behavior.⁵ Our analysis is based on a natural experiment created by public housing demolitions.⁶ During the 1990s, the Chicago Housing Authority (CHA) began a process of destroying high-rise public housing, prioritizing closing buildings that had histories of poor maintenance. Households living in buildings selected for demolition received housing vouchers and relocated to lower crime, higher income neighborhoods. We compare the long-run voting behavior of people who as children were displaced by public housing demolition to that of their peers who lived in nearby public housing buildings that were not destroyed.

We find that relocating to lower-poverty areas due to public housing demolition has large impacts on measures of political participation. Our analysis is based on linking administrative records

of displaced and nondisplaced children to statewide voter registration records from Illinois. As shown in Figure 1, displaced children were 2.3 to 2.8 percentage points—13 to 16 percent—more likely to vote in the presidential elections of 2008, 2012, and 2016. Overall, we find that displaced children were 3.3 percentage points—12 percent—more likely to vote in any general election up to 2018. We also find that registration increased by 2 percentage points—5 percent—for displaced children, demonstrating that part of the overall effects were due to new

run involvement in the political process, which may further feed back into political and economic outcomes.

Does Intergroup Contact in Schools Matter?

Prominent theories across the social sciences posit that racial attitudes are importantly shaped by exposure to racial out-groups. According to contact theory, meaningful interactions with racial minorities can reduce bias among majority group members.⁸ On the other hand,

the “racial threat” hypothesis posits that Whites’ proximity to minorities can trigger hostile attitudes as Whites perceive their status as threatened.⁹ While there has been a flurry of tests of real-world intergroup contact in recent years, understanding the long-run effects of sustained intergroup contact in early life—the period before preferences and beliefs can be calcified—has been a challenge.¹⁰

In work with Stephen Billings, we provide novel evidence on the long-run effects

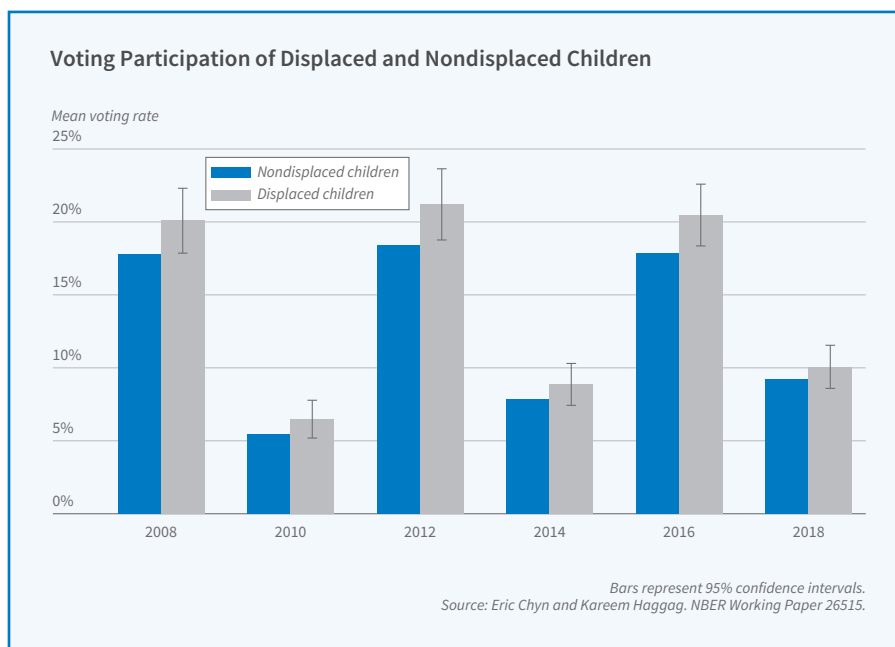


Figure 1

voters. These results suggest that childhood neighborhood inequality casts a long shadow over access to the political process.⁷

What are the implications of these findings? Recently, housing authorities and policymakers have introduced new housing counseling programs, such as the Creating Moves to Opportunity program in Seattle and King County, and have reformed housing voucher payment caps to encourage moves to more-advantaged neighborhoods. While such policies are primarily motivated by a desire to improve the economic circumstances of poor families, our results suggest these policies may have the added benefit of increasing long-

of changes in intergroup contact due to reforms that reshaped schooling environments in a large urban school district.¹¹ In 2002, Charlotte-Mecklenburg Schools (CMS) ended race-based busing and redrew existing school district boundaries. As a result of these reforms, some White students attended schools with varying percentages of Black students. In our work we ask whether the racial composition of schools attended during childhood affects one's political behavior more than a decade later. To answer this question, we assembled data linking administrative schooling records from CMS and voting registration records from North Carolina.

Comparing party affiliation in adulthood of students who lived in the same neighborhood but were assigned to schools with a different racial composition after the reforms, we find that a 10 percentage point increase in the share of minorities in a White student's assigned school decreased their likelihood of registering as a Republican by 2 percentage points (12 percent). Our results also provide suggestive evidence that White students are more likely to be registered as Democrats or unaffiliated voters. What is the link between exposure to minorities and party affiliation? Prior research has robustly documented a tight link between racial attitudes and Republican Party affiliation in the US.¹²

These results may have broader implications. Hundreds of school districts have been released from court-ordered desegregation during the past 30 years—a policy shift that has led to the gradual resegregation of schools within these districts.¹³ In addition to any negative effects of school segregation on economic outcomes, our estimates suggest that these policy changes could have led to important shifts in the partisan identities of Americans.¹⁴

Citywide Consequences of Residential Segregation

What impact does racial segregation have on the local political and policy environment? Residential segregation in cities implies segregation in schools, workplaces, and a range of avenues through which groups may have otherwise interacted. As we've noted above, a lack of intergroup contact can foster stereotyped and prejudicial views among majority group members. Given the documented link between racial attitudes and sup-

port for inequality-reducing programs, it is possible that segregation translates into impacts on redistributive social policies.¹⁵

In recent work with Bryan Stuart, we analyze the causal effects of citywide racial segregation with a focus on both political and economic outcomes,¹⁶ building on pioneering work by Elizabeth Ananat that introduced a novel instrument for racial segregation based on historical railroad placement.¹⁷ The strategy relies on the fact that cities that were subdivided to a larger extent by railroads during the nineteenth century became more segregated after the arrival of Black residents in the North and Midwest during the Great

ing minimum wage increases and social program spending. These survey-based findings appear to be matched by realized measures of government expenditures. We find that a 1 standard deviation increase in racial segregation results in a 39 percent decrease in total per capita government expenditures. This reduction is widespread, affecting vital areas such as education (38 percent of the total decrease), welfare and health, infrastructure, and public safety. Across all these measures of attitudes, we find that the results for Black residents move in the opposite direction.

Finally, our work also traces the effects of residential segregation on economic opportunity based on newly available data on upward mobility by race and parental income from the Opportunity Atlas.¹⁹ For a child whose parents are at the 1st percentile of the nationwide income distribution, we find that a 1 standard deviation increase in racial segregation leads to a 4.5 percentile decline in the child's long-run income rank, which amounts to 17 percent of the average mobility for this group.

Since Black children born to parents in the 1st percentile end up in the 27th percentile—\$17,500 in annual household income—on average, a drop to the 22nd percentile amounts to \$4,834 in lost income each year. The negative effects of segregation on mobility are also sizable and statistically significant for Black children whose parents have income at the 25th, 50th, and 75th percentiles of the distribution. For White children, we find evidence of heterogeneous impacts with segregation worsening outcomes for those from lower-income households and benefiting children from the very top of the distribution.

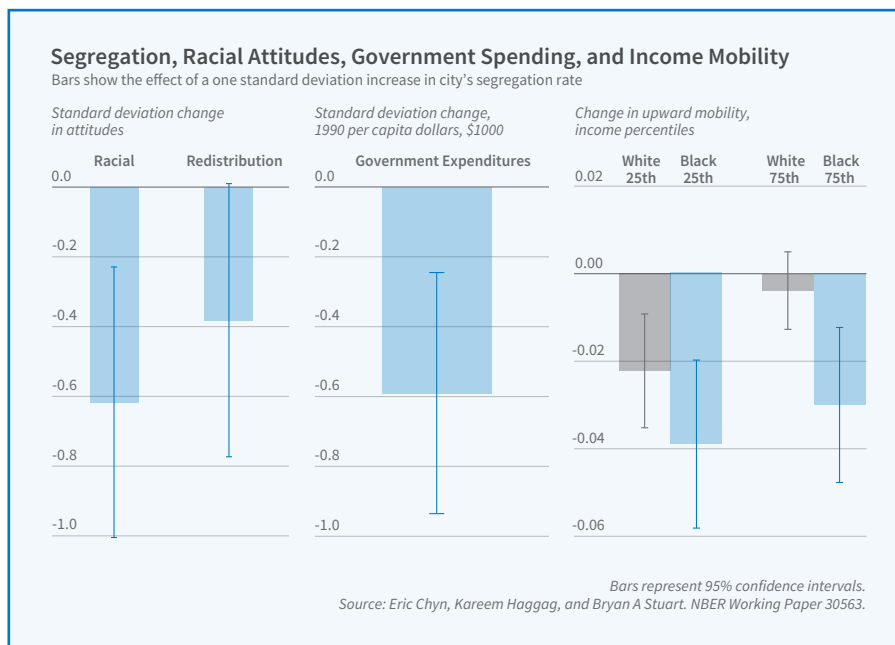


Figure 2

Migration. We apply this quasi-experimental research design to newly available large-scale surveys on political and racial attitudes as well as data on local government expenditures.

Figure 2 summarizes our key results on the effects of racial segregation across 121 cities. A 1 standard deviation increase in a city's segregation rate worsens an index measure of White residents' racial resentment by 0.69 standard deviation, echoing prior work that relies on related measures.¹⁸ Moreover, we find that these changes in attitudes are accompanied by lowered self-reported measures of sup-

¹ “Black-White Segregation Edges Downward since 2000, Census Shows,” Frey WH. Brookings Institution, December 17, 2018. “US Public School Students Often Go to Schools Where at Least Half of Their Peers Are the Same Race or Ethnicity,” Schaeffer K. Pew Research Center, December 15, 2021.

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² *The Truly Disadvantaged: The Inner City, the Underclass, and Public Policy*, 2nd ed., Wilson WJ, editor. Chicago: University of Chicago Press, 2012.

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³ “The Social Consequences of Growing Up in a Poor Neighborhood,” Jencks C, Mayer SE. In *Inner-City Poverty in the United States*, Lynn Jr. LE, McGeary MGH, editors, pp. 111–86. Washington, DC: National Academy Press, 1990.

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⁴ “Neighborhoods Matter: Assessing the Evidence for Place Effects,” Chyn E, Katz LF. NBER Working Paper 28953, June 2021, and *Journal of Economic Perspectives* 35(4), Fall 2021, pp. 197–222.

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⁵ “Moved to Vote: The Long-Run Effects of Neighborhoods on Political Participation,” Chyn E, Haggag K. NBER Working Paper 26515, November 2019.

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⁶ “Moved to opportunity: The long-run effects of public housing demolition on children,” Chyn E. *American Economic Review* 108(10), October 2018, pp. 3028–3056.

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⁷ These effects are in addition to the various other structural barriers faced by Black Americans in the political process, e.g., the much longer average voting wait times documented in “Racial Disparities

in Voting Wait Times: Evidence from Smartphone Data,” Chen MK, Haggag K, Pope DG, Rohla R. NBER Working Paper 26487, November 2020, and *The Review of Economics and Statistics* 104(6), November 2022, pp. 1341–1350.

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Disease and Economic Surveillance during the COVID-19 Pandemic

Anup Malani

Policymaking during a novel pandemic requires information about the spread and impact of infection or about the impact of nonpharmaceutical and pharmaceutical interventions. This is also critical for scientific understanding, whether one is developing models of the disease, the economy, or both. However, because the contagion is novel, we may not know what to measure before the event, and our existing data-gathering infrastructure may be lacking. We have to quickly adapt our surveillance, analysis, and models as we learn more about the threat.

This adaptation was on display during the COVID-19 pandemic. I illustrate this with a series of papers that responded to questions from policymakers and were written with coauthors who sacrificed their regular research to assist with pandemic response. These papers estimated several critical disease and economic parameters that could inform policymakers in India, a lower-income country. The initial papers focused on measuring the prevalence of infection by and immunity to the SARS-CoV-2 virus, the mortality burden of the pandemic, and the economic impact of the disease. Later papers used those estimates to tailor local nonpharmaceutical interventions and estimate the optimal amount of vaccines for governments to purchase. The research focused on India because it had far fewer researchers per capita than the US, Europe, and China. Many of these papers were prompted by requests from state governments in India or from the Asian Development Bank.

Disease Surveillance

The purpose of surveillance in a pandemic is to assess current exposure and future risk — the current prevalence of infection and immunity against future infection. These parameters change over time, so they must be measured continuously.

When the pandemic struck, around January 2020, public health authorities estimated the prevalence of SARS-CoV-2 using tests that searched for fragments of virus in biospecimens. They mainly tested people with respiratory symptoms visiting hospitals because tests were initially scarce. Authorities had planned for a flu pandemic and flu is spread by symptomatic persons, so testing patients might have guided quarantine or treatment decisions.¹ But SARS-CoV-2 was a coronavirus, and we did not know whether asymptomatic persons in the general population could spread a coronavirus.

To address this blind spot, my first paper took advantage of a massive flight of Indians out of cities when India lifted the lockdown that it, like many nations, initially imposed in an attempt to prevent the disease's spread. The lockdown interrupted a regular migration of workers from cities to villages to help with India's summer harvest, and when it was lifted workers rushed to rural areas. Working with the state of Bihar, my coauthors and I randomly tested migrant workers arriving on trains from other states and found that symptomatic testing revealed underestimation of the population-level

prevalence of the virus, which was 21 percent higher among asymptomatic migrants than among symptomatic patients in the states from which migrants came.² It was unlikely the migrants got infected on the one-day train ride because antigen tests can only detect infection several days after onset.

India's lockdown provided a second example of mistaken beliefs. The logic for lockdown was that individuals were less likely to spread infection if confined to their homes. This logic assumes people live in separate dwellings with private bathrooms. But roughly 20 percent of urban Indians live in slums with communal toilets.³ Confinement in slums might increase the number of contacts. I explored this in a paper estimating the prevalence of antibodies to SARS-CoV-2 in a random sample of Mumbai residents. By July 2020, while 16.1 percent of residents outside slums had been infected, 54.1 percent in slums had been.⁴

Several papers suggested that the prevalence was higher among the urban poor because they were essential workers who worked through the lockdown. We used location data from about 500,000 cell phones in Mumbai and found that slum residents traveled no more than other residents.⁵ It is likely that residential density explained higher infection rates in the slums.

The Mumbai seroprevalence study highlighted the value of testing for antibodies rather than for viral fragments. After an infection, a person's immune system generates antibodies to block viral reproduction and to help white blood cells locate and destroy copies of the virus. Once a virus is defeated, viral fragments are filtered from the bloodstream, while unique antibodies generated to neutralize the antigen at hand may remain longer. Testing for these antibodies helps in estimating cumulative infection rates, the success of past policies to prevent infection,

and the level of protection against re-infection.

We followed up on the Mumbai city study with population-level seroprevalence studies of whole states. We estimated that 46 percent of Karnataka state had been infected by August 2020, with urban areas having about 10 percentage point higher rates of immunity.⁶ In Tamil Nadu, we conducted a repeated cross-section, surveying about 25,000 persons four times over two COVID waves.⁷ We found that 90.6 percent of the population had humoral immunity by December 2021.

The Tamil Nadu study highlighted two limitations of antibody surveillance. First, unlike viral fragments, antibodies can be triggered either by infection or by vaccination, so one cannot identify the cause of humoral immunity without more information. In Tamil Nadu, we used self-reported vaccination to estimate that, while infection was responsible for 74 percent of the approximately 50 percentage point rise in seroprevalence after India's Delta wave in May 2021, vaccination was responsible for 78 percent of the approximately 20 percentage point increase in seroprevalence by December 2021. Second, although antibodies last longer than viral fragments, they too fade over time. Antibodies are costly for the body to produce and they are less useful after an infection is defeated, so they too are cleared from the bloodstream in time. In Tamil Nadu, seroprevalence declined more than 31.6 percent in roughly six months.

After humoral immunity fades, the immune system retains a memory of the virus, and the specific antibodies suited to fight it, in T and B cells. Testing for such "cellular immunity" requires more blood and lab work than testing for antibodies, however. To demonstrate the feasibility of estimating population-level cellular immunity, we tested random samples of residents in Bangalore.⁸ This

is one of only two population-level cellular immunity surveys ever conducted, the other covering a population of young adults aged 24–27 in Sweden. By January 2021, we found that levels of humoral immunity substantially underestimated the levels of overall (humoral or cellular) immunity in the population: while 29.7 percent of our sample had antibodies, more than 55.7 percent had cellular immunity.

Although we made substantial progress in developing methods and infrastructure to conduct population-level disease surveillance, much work remains. SARS-CoV-2 is not a single virus. Variants evolve to escape immunity, which can be triggered by infection or vaccination. Immunity to one variant may provide imperfect protection against another variant. Forecasting future immunity requires population-level surveillance for infection by variant. Currently, this is done with nonrepresentative convenience samples rather than random samples.

We also need to track how vaccines affect viral evolution relative to infection. Before the pandemic, we conducted a simulation study to show that vaccines can slow the evolution of seasonal influenza if the scope of immunity from vaccines is not too small relative to that of infection.⁹ Similar work is required to understand how vaccines affect changes in SARS-CoV-2, which has a different pattern of evolution than flu.

Mortality Burden

The mortality rate from SARS-CoV-2 is an important measure of the health burden of the pandemic. Initial estimates generated a case fatality rate (CFR) — the probability of death conditional on *symptomatic* infection. This was because viral testing focused on symptomatic cases and deaths in hospitals were relatively well tracked, even

in lower-income countries. But a large percentage of SARS-CoV-2 infections are asymptomatic, so the infection fatality rate (IFR) — the probability of death conditional on infection — is lower than the CFR.¹⁰ Moreover, the IFR is more relevant for calculating the value of preventative measures as opposed to the value of treatment.

Because our population-level serological studies captured asymptomatic infection, they can be used to calculate the denominator of the IFR. Our initial estimates of the IFR, however, were very low, roughly 10 percent of the death rate in higher-income countries, due to underreporting of SARS-CoV-2 deaths.¹¹ This reflects problems with mortality data in lower-income countries like India. Death registries are incomplete. Of India's 28 states, only 14 have shared registry data with the public, and these registries capture perhaps three-quarters of deaths.¹² Registries also do not report the cause of death, and during the pandemic only a fraction of decedents in hospitals were tested for SARS-CoV-2 due to the scarcity of tests.

To address these limitations, we conducted three studies. The first used 174,003 household rosters from the Consumer Pyramids Household Survey (CPHS), a population-representative panel survey of Indian household income and consumption, to estimate the number of people who died from 2018 to 2021.¹³ We estimated about 4.2 million all-cause excess deaths across India during the pandemic. These estimates are very

sensitive to the calculation of how many would have died but for the pandemic and to the baseline period for the counterfactual.

The second study tackled cause of death. We visited all households that reported a decedent in the first study and conducted WHO-compliant verbal autopsies — interviews of the next of kin to determine symptoms of the decedent and map symptoms to the cause of death. Using data from 22,178 completed

Economic Impact

The pandemic did not merely affect health but also impacted income and consumption. Most countries experienced a sharp decline in economic activity in early 2020, typically followed by a V-shaped recovery. Two important questions were how households protected themselves against these economic consequences and the incidence of the consequences across the income distribution. We addressed these queries in India using the CPHS data. While some have criticized this survey as not entirely representative of poverty in rural India, those criticisms apply more to estimates of levels of poverty than changes in poverty conditional on levels.¹⁵ More importantly, there are few if any other high-frequency economic surveys, let alone panel surveys, conducted in low-income countries,

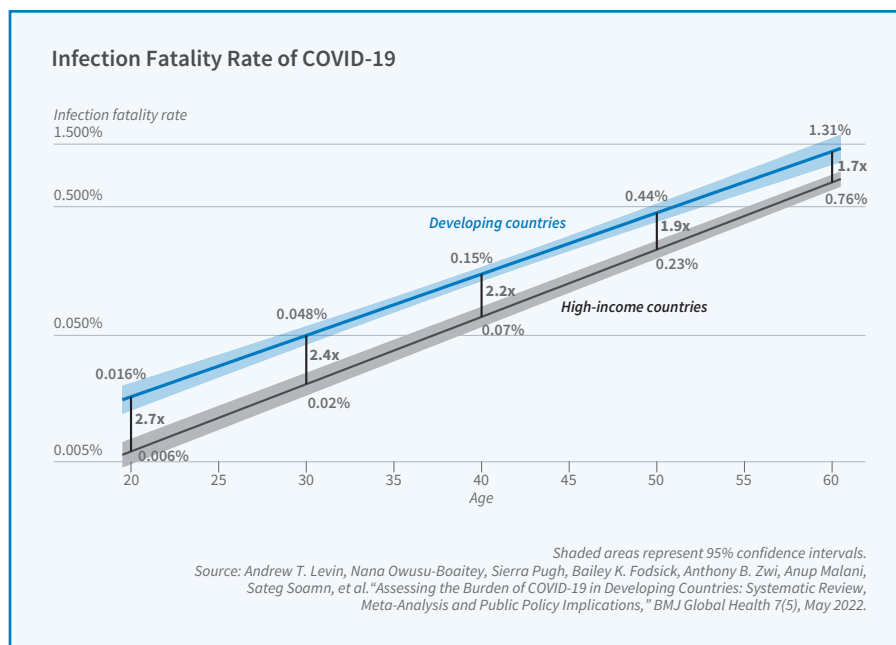


Figure 1

verbal autopsies, we estimated that 33 percent of excess deaths were attributable to the SARS-CoV-2 virus. The remaining excess deaths were indirectly attributable to the pandemic.

In the final paper, we conducted a meta-analysis of IFR estimates across a range of lower-income countries, giving greater weight to countries with higher-quality data on mortality.¹⁴ We estimated that age-specific IFRs were roughly double those in higher-income countries (Figure 1). However, the median IFR was roughly the same — 0.5 percent — because the IFR rises with age and lower-income countries have younger populations.

including India.

We found that households took action to protect both income and vital consumption during the pandemic.¹⁶ Workers switched occupations to buffer a decline in jobs, with net flows into agriculture, which was exempt from India's lockdown. We estimated a Roy model and found that reservation wages fell, suggesting the fall in jobs was driven by the demand for workers rather than the supply of labor. Households also sacrificed consumption of durables like clothing to protect consumption of food and fuel. A combination of social insurance and informal credit markets continued to insulate consumption through the crisis: the

marginal propensity to consume did not increase during the pandemic.

Many scholars expected and found that the pandemic increased poverty and inequality.¹⁷ Using CPHS panel data, we estimated that poverty spiked, especially during the lockdown, but income inequality fell, for two reasons. First, the capital income of top-quartile earners covaried more with aggregate income, consistent with data from the US.¹⁸ Second, demand for labor fell more for workers in higher quartiles of the income distribution. Indeed, we estimate that income losses during the pandemic increased almost monotonically with a household's income percentile before the pandemic. Moreover, the bottom 20 percent of rural households prior to pandemic saw no losses or gains during the pandemic (Figure 2).

Application to Policy Questions

Two policy issues headlined the government response to the pandemic: lockdowns and vaccines. Initial lockdowns were swift and covered wide areas because there was little information or time to tailor the lockdowns. But after the broad lockdowns were lifted, officials used local information to guide orders

restricting local activity. By contrast, vaccination did not begin until a year into the pandemic. This permitted data analysis that could guide purchase and allocation decisions from the start of the campaigns.

Our first paper addressed questions from Indian state governments about where to focus localized, short-term lockdowns and other nonpharmaceutical interventions,

the realism of standard modeling approaches, and simulated counterfactual reproductive rates under different policy responses.

In another paper, following requests from officials in Indonesia, we addressed the welfare effects of a government purchasing different numbers of vaccines, and allocating them in different ways.²² We did not have data from Indonesia, so we used

India as a case study. Our analysis combined epidemiological and economic models. We simulated how different vaccine allocations and rates would affect district-level prevalence and mortality, and then converted these simulations into social demand functions by aggregating two valuations. The first was (1) the private willingness to pay (WTP) for vaccination. We estimated the WTP to personally get vac-

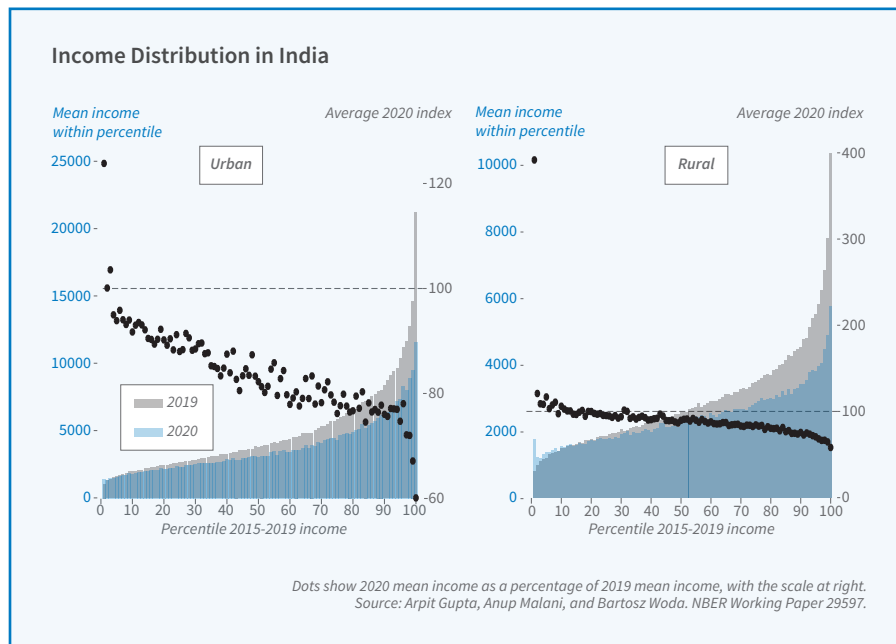


Figure 2

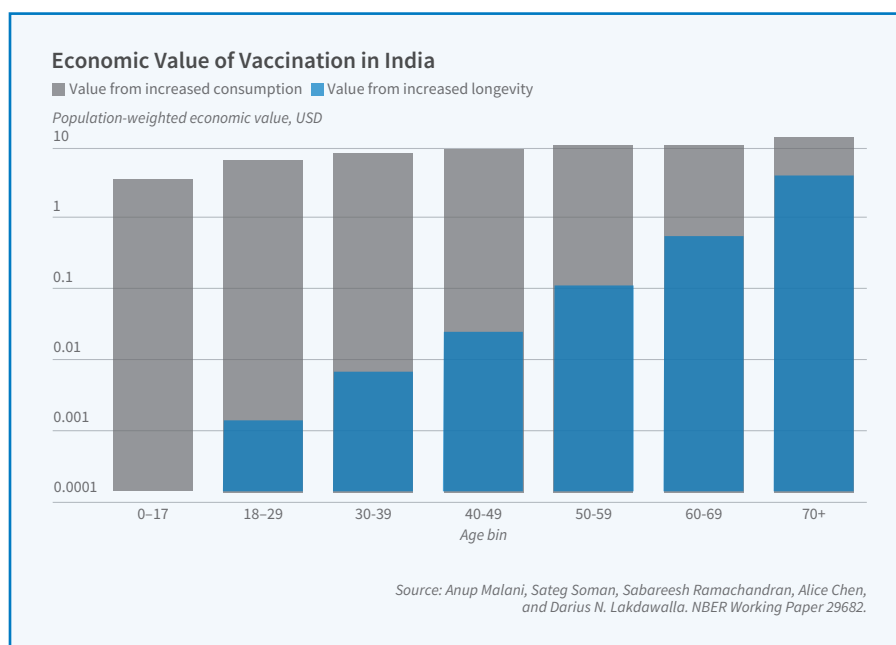


Figure 3

culated conditional on population-level vaccination rates crudely with the conditional probability of infection times the mortality rate times foregone consumption when dead. The second valuation was the private value obtained when others were vaccinated. This external effect has two parts. One is (2a) the value of lowering the risk of death conditional on not vaccinating, estimated via simulation of our epidemiological model. The other is (2b) increasing economic activity (income) for those who are not infected or killed, forecast using a regression of consumption on local infection levels using CPHS data during the pandemic.

We also use this accounting to determine how much social value from vaccination is due to increased longevity (1 plus 2a) and due to increased economic activity (2b). While mortality effects increase exponentially with age, economic value of vaccination increases more gradually with age. The reason is that younger populations disproportionately benefit from greater economic activity as vaccination slows the epidemic (Figure 3).

Our analysis yields social demand curves that change with policy choices and over time. For any given history of infections, vaccine policy, and price, our model can be used to estimate how many vaccine doses to purchase. In the model, the optimal number of doses increases with the number of people the government can vaccinate each day. The value of vaccines falls when vaccination rates slow because the virus continues to spread, and natural immunity is a substitute for vaccine-acquired immunity. The model also shows that although the social value of vaccination is greater when campaigns prioritize the elderly, if the valuation of vaccinations is based on WTP, it may be optimal to prioritize vaccinating working-age populations in higher-income regions before the elderly in lower-income regions.

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Generic Drugs: A Healthcare Market Trial

Amanda Starc

Can healthcare markets deliver access, affordability, and quality? While markets for hospital and physician services both have unique challenges, generic drug pricing is often seen as a success story for market forces. After patent-related exclusivity ends, prices fall dramatically. Consumers have access to a range of highly clinically valuable products at low prices. Is this success unique or can it be replicated in other parts of the healthcare sector?

As in other healthcare markets, insurers play a crucial role in determining both prices and utilization of prescription drugs. Patients purchase pharmaceuticals from a pharmacy, either in a physical location or by mail. Like many retailers of consumer goods, pharmaceutical retailers purchase products from wholesalers and manufacturers. A unique feature in the financing of drug purchases is that insurers negotiate reimbursements with pharmacies and set consumer out-of-pocket costs. Negotiated reimbursements tend to be composed of an ingredient cost, aimed at covering the wholesale cost of the product, as well as a dispensing cost, to allow pharmacies to earn a positive margin on their sales.

My research agenda is at the intersection of industrial organization and health economics. I use healthcare markets to understand general economic phenomena, including the role of information and market concentration in

shaping equilibrium outcomes. I also use economic concepts to evaluate the performance of healthcare markets and the potential benefits of government intervention. In this article, I describe a series of papers that highlight the value and shortcomings of healthcare markets, using generic drugs as an example.

and drugs. In those states, transitioning to private insurers lowers drug spending dramatically.

Lower prices per prescription — not a reduction in prescriptions — drive the savings. Figure 1 illustrates this effect. It plots lag and lead coefficients relative to privatization to illustrate the extent

of privatization over time and the resulting effect on the average point-of-sale price per prescription. This price variable is stable before privatization and falls immediately following privatization; our estimates suggest that full privatization of drug benefits would reduce the price per prescription by a staggering 28 percent. Further analysis shows that private insurers' ability to negotiate lower point-of-sale prices with pharmacies for identical

drugs accounts for one-third of the overall savings. The remaining two-thirds is driven by the greater use of lower-cost drugs, such as generics.

Ashley Swanson and I further measure the costs and benefits of saying “no” to high-price pharmacies in the Medicare Part D program.² In our setting, insurers negotiate aggressively with pharmacies. Plans form restrictive “preferred pharmacy networks” in which consumers face lower out-of-pocket costs at “preferred” pharmacies. Selective contracting can screen out unprofitable enrollees, steer enrollees to low-cost suppliers, or give insurers negotiating leverage. To understand

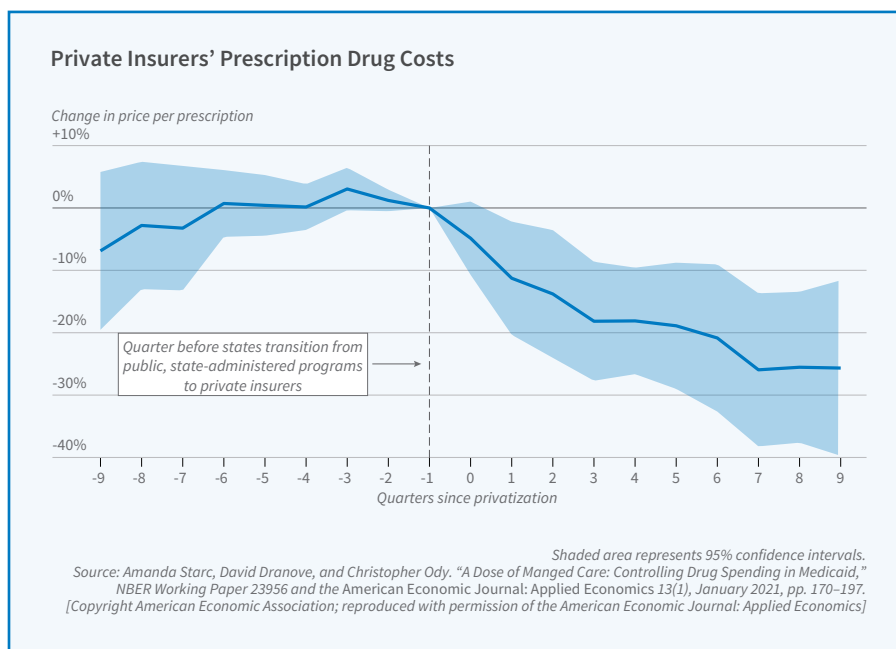


Figure 1

When negotiating reimbursement, it is critical that insurers be able to say “no” to expensive suppliers. In the context of drugs, this could mean not covering expensive branded drugs when generics are available. It could also mean steering consumers to lower-cost pharmacies. In healthcare markets more generally, saying “no” is critical for reducing spending.

David Dranove, Christopher Ody, and I compare the performance of public, state-administered pharmaceutical programs with that of programs administered by private insurers.¹ Some states give private insurers the flexibility to deny coverage of certain pharmacies

strategic incentives and develop evidence-based policy, we must measure trade-offs between cost and access empirically. This is not just an important setting, as prescription drug costs are rising, but also an ideal setting for analysis, because we can control for detailed national drug codes, leaving pharmacies as the only important differentiator. While only 13 percent of sample plans used preferred pharmacy networks in 2011, 70 percent did in 2014.

We expect restrictive preferred pharmacy networks to achieve lower drug prices. However, the effect is mitigated by price-insensitive enrollees, as the reduced ability to steer such enrollees limits any potential increase in steering or bargaining leverage. Figure 2 shows that broad network plans with a high percentage of pharmacies in the preferred network have higher point-of-sale prices than narrower network plans. The effect is largest for plans without “low-income subsidy” enrollees, who face limited cost sharing. A 1 standard deviation increase in the percentage of pharmacies preferred is associated with a 4.2 cent price increase

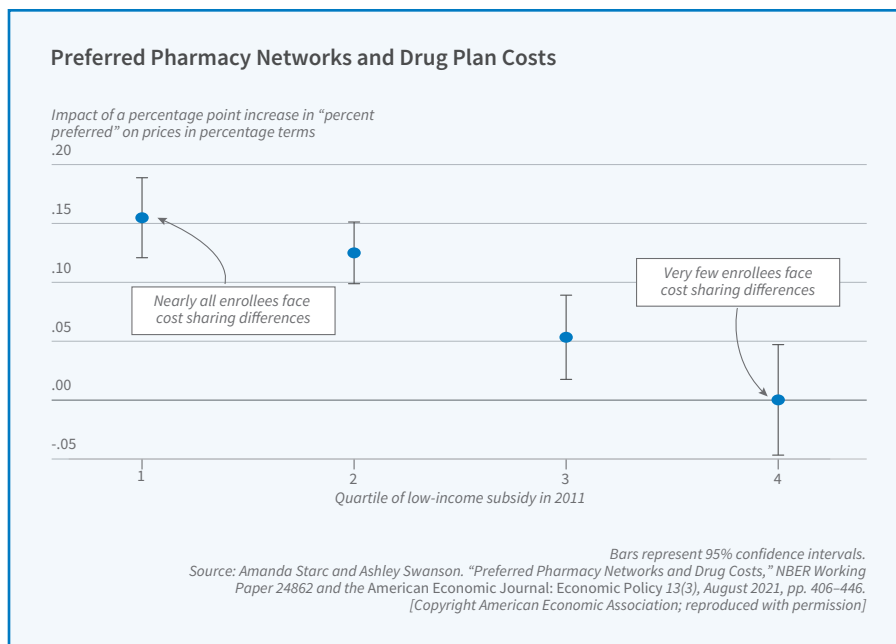


Figure 2

per day supplied if nearly all a plan’s enrollees face cost-sharing differences. By contrast, if very few enrollees face cost sharing differences (the top quartile), there is no relationship between preferred pharmacy network breadth and point-of-sale prices. Overall, the estimates indicate that preferred-network plans pay between 4.2 and 5.1 cents less per day supplied, a difference of between 1.9 and 2.3 percent, for drugs at the point of sale. We model demand to quantify the welfare impact of reduced access and find that the average enrollee benefits from preferred pharmacy contracting due to reduced out-of-pocket costs at preferred pharmacies.

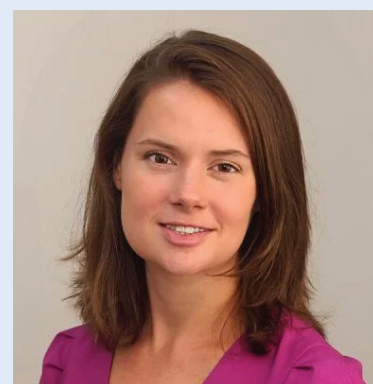
In many ways, the empirical findings summarized above describe the value of market institutions.

Despite this, prices of many generic drugs have risen substantially in the past decade. While many factors are responsible, collusion has contributed to large price hikes in a subset of markets. Anticompetitive behavior is a threat to market efficiency in all industries. Nowhere is this more true than in health-

care, and generic drugs in particular provide an instructive example. For several years beginning in 2013, generic manufacturers are alleged to have fixed, and thereby raised, prices of many drugs.

Thomas G. Wollmann and I explore strategic responses to cartel formation.³ We first document the impact of alleged price-fixing on prices, comparing generic drug prices for drugs that were allegedly part of the price-fixing scheme to prices for drugs that were not. The prices for both groups of drugs followed similar downward trends over the 2008–13 period, but their paths diverged after 2013. Prices that were allegedly controlled by the

Amanda Starc is an associate professor of strategy at the Kellogg School of Management and a Faculty Research Fellow at the NBER. She received her BA in Economics from Case Western Reserve University, and her PhD in Business Economics from Harvard University. Starc’s research agenda sits at the intersection of industrial organization and health economics. Her research spans three main themes. First, she studies the fundamental economic question of what health insurance covers and how it is priced. Second, she studies how information shapes consumer demand for both insurance and healthcare. Finally, she studies the efficacy of market mechanisms in allocating goods and services in healthcare markets.



price-fixing cartel rose by 50 percent.

This episode raises the question of whether market forces can protect consumers. There are two potential market checks on harms from collusion: cheating and entry. In practice, the latter is quite important. Entry rose in response to price increases. The filing of abbreviated new drug applications (ANDAs) increased in cartelized markets. These

filings indicate an intent to enter. Yet while ANDAs increase almost immediately following cartelization, regulatory review delays entry, often by years. Two key questions are whether entrants can earn profits that exceed the sunk cost of entry, and whether they can exert downward pressure on prices in the meantime.

To explore these issues, we model price and entry. We find that pricing is consistent with collusion even after a price-fixing investigation is opened. We also find that the cartel is stable, and cartel members are unlikely to deviate. Yet entry can also be profitable for nonmembers. These nonmembers undercut the cartel and prices fall, albeit not to competitive levels. We estimate that cartel profits would have been 35 percent higher absent entry.

In addition to antitrust enforcement, there is an important policy

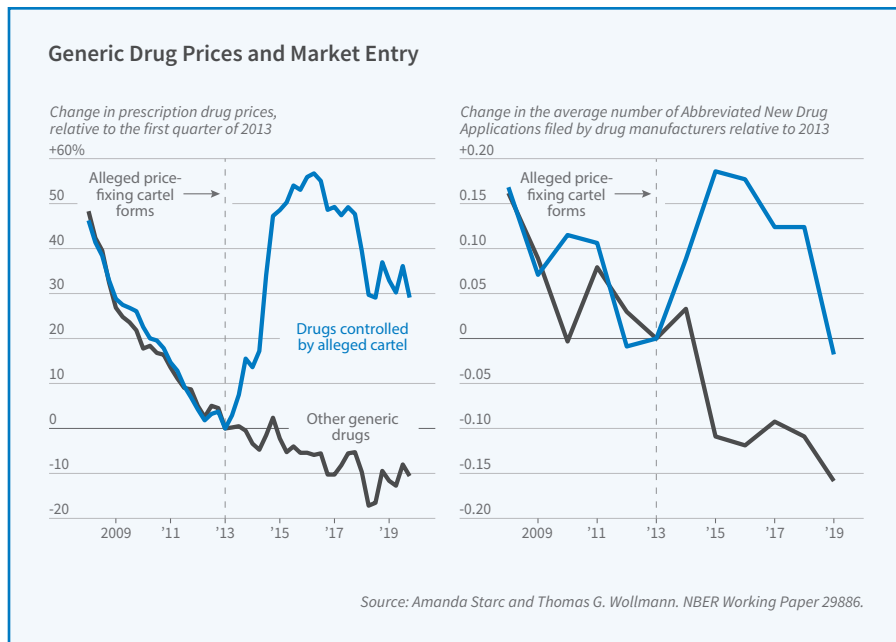


Figure 3

role for the FDA in our setting.

The cost of the research that is required to enter a drug market averages about \$3.2 million. This figure reflects both the costs of proving the generic is identical to the branded molecule and various government fees. Even more important, the approval process can take up to four years. Both lower entry costs and speedier approvals can reduce drug prices: a one-year reduction in time to approval would have led to average savings of \$596 million. Reducing regulatory delays generates a substantial increase in consumer welfare.

The historical success of generic drugs in reducing healthcare costs is a result of market forces. Yet whether markets can deliver more broadly on the promise of affordability and access is unclear. My research suggests two broad lessons. First, insur-

ers play a crucial role beyond providing risk protection. When serving as an appropriate counterpoint to providers, they can steer consumers in ways that lower healthcare costs. Second, when public policy entrenches incumbents in uncompetitive markets by preventing substitution or creating barriers to entry, higher prices are a likely result. These insights are likely to apply to healthcare markets other than pharmaceuticals.

¹ “A Dose of Managed Care: Controlling Drug Spending in Medicaid,” Dranove D, Ody C, Starc A. NBER Working Paper 23956, October 2017, and *American Economic Journal: Applied Economics* 13(1), January 2021, pp. 170–97.

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² “Preferred Pharmacy Networks and Drug Costs,” Starc A, Swanson A. NBER Working Paper 24862, July 2018, and *American Economic Journal: Economic Policy* 13(3), August 2021, pp. 406–46.

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³ “Does Entry Remedy Collusion? Evidence from the Generic Prescription Drug Cartel,” Starc A, Wollmann TG. NBER Working Paper 29886, April 2023.

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The East Asian Seminar on Economics, 1990–2023

Takatoshi Ito, Anne O. Krueger, and Andrew K. Rose

The East Asian Seminar on Economics (EASE) was launched in 1990 to promote academic exchange between North America–based economists, particularly those who are not experts on East Asia, and economists in East and Southeast Asia. The annual EASE conference has become a premier venue for analysis of economic issues that affect East Asia. The EASE is one of the NBER’s long-running international outreach activities, along with the International Seminar on Macroeconomics and the Trans-Atlantic Public Economics Seminar in Europe, and annual conferences in India, Japan, and China.

The EASE conferences were focused on topics in international trade and finance in the early years, but over time expanded to also include monetary and fiscal policy and financial crises. Growth also has been a recurring theme. Some structural issues, such as inequality, housing, and demography, have also been highlighted. Table 1, on pages 22–23, shows the complete list of meetings, topics, locations, and organizers for the full history of EASE meetings.

The first EASE conference was hosted by the Korea Development Institute in Seoul in June 1990. The topic was “The Political Economy of Tax Reform.” Takatoshi Ito of Columbia University (then Hitotsubashi University) and Anne O. Krueger of Johns Hopkins University (then Duke University) were co-organizers. They assembled a consortium of three research institutes in the East Asian region. Each institute took its turn hosting the conference, and all of the institutes sent researchers to present papers at the conference each year. In a typical year, the meeting attracted three or four NBER researchers, mostly as paper presenters. The second EASE meeting, on “Trade and Protectionism,” was hosted by



EASE organizers, past and future. Tokyo, June 2023.

Left to right: Hoshi, Rose, Krueger, Ito, and Faber.

the Chung-Hua Institution for Economic Research in Taipei. The third was in Sapporo, Japan, hosted by the Tokyo Center for Economic Research. The topic was “Macroeconomic Linkage: Savings, Exchange Rates, and Capital Flows.” The NBER hosted the fourth meeting in San Francisco on “Growth Theories in Light of the East Asian Experience.”

The San Francisco meeting concluded the first cycle. As the second cycle began, several additional research institutes, universities, and central banks joined the EASE rotation. Some stayed permanently, while others participated for a shorter period. The Australian National University, National University of Singapore, and Hong Kong University of Science and Technology became permanent members over the years. Two Chinese universities, Tsinghua University and Beijing University, participated at

various times. EASE has met in Bangkok, Manila, and Wellington, even though no institution from Thailand, the Philippines, or New Zealand is a formal EASE affiliate. The two EASE organizers and the local host choose the topic for each conference. The selection has been guided by current topics in which interest was high and research was ongoing in member countries and the global economics community.

EASE meetings have provided important opportunities for international scholarly exchange. Some NBER participants were visiting Asia for the first time when they attended a conference. Each conference participant from the NBER presents a paper, and discusses a paper. Beyond this formal structure, however, many of the gains to participating scholars have come from informal chats on recent developments in methods, theory, and data. These

benefits have been invaluable to the participants. This is a clear case of gains from trade: the NBER authors learn from their Asian colleagues, and vice versa.

We believe that the collaboration between NBER economists and economists from first-rate institutions in East Asia has raised the quality of empirical research in Asia. When EASE began, rigorous empirical work in the NBER tradition was rare in East Asia. Today, it is

much more of a standard.

EASE meetings 1 through 20 resulted in conference volumes published by the University of Chicago Press. Ito and Krueger co-edited EASE volumes 1 through 12. Andrew Rose of the University of California, Berkeley replaced Krueger when she became the First Deputy Managing Director of the IMF. Ito and Rose co-edited EASE volumes 13 through 20.

Beginning with the EASE 32 meeting, the organizers will be Benjamin Faber of the University of California, Berkeley, and Takeo Hoshi of the University of Tokyo. When EASE 31 met in Tokyo in June 2023, all five current, past, and future EASE organizers were present. They celebrated the success of this long-running meeting series, and looked forward to EASE 32, which will take place in Hong Kong and focus on “Global Shocks and Policy Responses.”

Takatoshi Ito currently holds multiple positions at Columbia University: he is the director of the Program on Public Pension and Sovereign Funds and associate director of research at the Center on Japanese Economy and Business, as well as a professor at the School of International and Public Affairs. Ito’s research focuses on Asian financial markets, the Japanese economy, international finance, monetary and fiscal policy, and public pension funds.

His academic journey, beginning with a PhD from Harvard University in 1979, includes a range of teaching roles in both the United States and Japan at esteemed institutions such as the University of Minnesota, Hitotsubashi University, and the University of Tokyo. Ito has held visiting professorships at various universities and has been recognized in the academic community through roles like the presidency of the Japanese Economic Association and a fellowship at the Econometric Society. His career also features unique appointments in the official sector, such as senior advisor at the International Monetary Fund and deputy vice minister for international affairs at Japan’s Ministry of Finance, highlighting his blend of academic and practical expertise.

In addition to his academic roles, Ito has been instrumental in shaping financial policy in Japan. He chaired a committee in 2013 to reform the asset management benchmark of the Government Pension Investment Fund (GPIF), valued at 130 trillion yen, and in 2021, he led a committee for the National University Fund’s asset management guidelines, overseeing 10 trillion yen. A prolific writer, Ito contributes to major publications like the *Financial Times* and has authored numerous books and over 130 academic articles, focusing on topics such as capital flows, currency crises, and inflation targeting. His work has earned him significant recognition, including the National Medal with Purple Ribbon in 2011 for his academic contributions.

Anne O. Krueger holds prominent positions as a Senior Fellow at the School of Advanced International Studies at Johns Hopkins University and as the Herald L. and Caroline Ritch Emeritus Professor in the Economics Department at Stanford University. In 2023, she expanded her academic involvement by joining the Ukraine Global Faculty as a global contributor.

Her professional background includes significant roles such as the First Deputy Managing Director of the International Monetary Fund from 2001 to 2006 and Vice President of Economics and

Research at the World Bank from 1982 to 1986. Prior to these roles, she was affiliated with Stanford and Duke Universities and was a professor of economics at the University of Minnesota.

Krueger’s academic career is marked by visiting professorships at various global institutions, including MIT, Northwestern University, and others in Turkey, India, Australia, and Sweden. She holds academic qualifications from Oberlin College (BA) and the University of Wisconsin (PhD). Her involvement in the economic community is further evidenced by her positions as a Distinguished Fellow and past President of the American Economic Association, a Research Associate at the National Bureau of Economic Research, and memberships in several prestigious academic societies. Her publications focus on economic development, international trade, and finance, as well as policy reform, with particular attention to India, South Korea, and Turkey.

Andrew K. Rose is professor emeritus at the Haas School of Business, University of California, Berkeley, and is the dean of NUS Business School in Singapore. He completed his academic training with a PhD from MIT, an M.Phil. from Nuffield College at the University of Oxford, and a BA from Trinity College at the University of Toronto. Rose’s scholarly output is extensive, with over 150 papers and 90 articles in notable economics journals, such as the *American Economic Review* and the *Journal of Finance*. His research, which has accrued over 40,000 citations, focuses on international trade, finance, and macroeconomics. In addition to his research, he has been recognized for his teaching in international macroeconomics, receiving two teaching awards.

In his administrative career, Rose served as associate dean for academic affairs and chair of the faculty at Berkeley Haas from 2010 to 2016. He was also the managing editor of the *Journal of International Economics* from 1995 to 2001. Rose founded the Clausen Center for International Business and Policy at Berkeley Haas and the Risk Management Institute at the National University of Singapore, contributing to the development of these institutions. His professional experience extends to working with various international economic agencies, including the International Monetary Fund, the World Bank, and the Asian Development Bank, as well as with national agencies like the US Department of the Treasury and the central banks of several countries.

Table 1

No.	Agenda/Title of Conference Volume	Organizers/Editors	Seminar held	Venue	Publication Date
31	Foreign exchange and capital flows	Ito and Rose	Jun-23	Tokyo, Japan	—
30	International Trade	Ito and Rose	Jun-19	Bangkok, Thailand	—
29	Political Economy	Ito and Rose	Jun-18	Seoul, Korea	—
28	Inequality	Ito and Rose	Jun-17	Manila, Philippines	—
27	Housing	Ito and Rose	Jun-16	Singapore	—
26	Financial Stability	Ito, Rose and Spiegel	Jun-15	San Francisco, US	—
25	Unconventional Monetary Policy	Aoki, Ito, Rose, and Watanabe	Jun-14	Tokyo, Japan	—
24	Crises in the Open Economy	Ito and Rose	Jun-13	Wellington, New Zealand	—
23	Employment and Growth	Ito and Rose	Jun-12	Taipei, Taiwan	—
22	The Role of Government	Ito and Rose	Jun-11	Beijing, China	—
21	A Pacific Rim Perspective on the Financial Crisis	Ito and Rose	Jun-10	Kirribilli, Australia	—
20	Commodity Prices & Markets	Ito and Rose	Jun-09	Hong Kong, SAR	2011
19	The Economic Consequences of Demographic Change in East Asia	Ito and Rose	Jun-08	Seoul, Korea	2010
18	Financial Sector Development in the Pacific Rim	Ito and Rose	Jun-07	Singapore	2009
17	International Financial Issues in the Pacific Rim	Ito and Rose	Jun-06	Hawaii, US	2008
16	Fiscal Policy and Management in East Asia	Ito and Rose	Jun-05	Manila, the Philippines	2007
15	Monetary Policy with Very Low Inflation in the Pacific Rim	Ito and Rose	Jun-04	Tokyo, Japan	2006
14	International Trade in East Asia	Ito and Rose	Sep-03	Taipei, Taiwan	2005
13	Growth and Productivity in East Asia	Ito and Rose	Jun-02	Melbourne, Australia	2004
12	Governance, Regulation, and Privatization in the Asia-Pacific Region	Ito and Rose	Jun-01	Hong Kong, SAR	2003
11	Trade in Services in the Asia-Pacific Region	Ito and Krueger	Jun-00	Seoul, Korea	2002
10	Regional and Global Capital Flows: Macroeconomic Causes and Consequences	Ito and Krueger	Jun-99	Kona, US	2001
9	The Role of Foreign Direct Investment in East Asian Economic Development	Ito and Krueger	Jun-98	Osaka, Japan	2000

8	Deregulation and Interdependence in the Asia-Pacific Region	Ito and Krueger	Jun-97	Taipei, Taiwan	1999
7	Changes in Exchange Rates in Rapidly Developing Countries: Theory, Practice, and Policy Issues	Ito and Krueger	Jun-96	Hong Kong, SAR	1998
6	Regionalism versus Multilateral Trade Arrangements	Ito and Krueger	Jun-95	Seoul, Korea	1997
5	Financial Deregulation and Integration in East Asia	Ito and Krueger	Jun-94	Singapore	1996
4	Growth Theories in Light of the East Asian Experience	Ito and Krueger	Jun-93	San Francisco, US	1995
3	Macroeconomic Linkage: Savings, Exchange Rates, and Capital Flows	Ito and Krueger	Jun-92	Sapporo, Japan	1994
2	Trade and Protectionism	Ito and Krueger	Jun-91	Taipei, Taiwan	1993
1	The Political Economy of Tax Reform	Ito and Krueger	Jun-90	Seoul, Korea	1992

Claudia Goldin Awarded 2023 Nobel Prize



Research associate **Claudia Goldin** has been awarded the 2023 Nobel Memorial Prize in Economic Sciences “for having advanced our understanding of women’s labor market outcomes.” The Royal Swedish Academy of Sciences explained that Goldin “provided the first comprehensive account of women’s earnings and labor market participation through the centuries. Her research reveals the causes of change, as well as the main sources of the remaining gender gap.”

Goldin is the Henry Lee Professor of Economics at Harvard University and an NBER research associate. She is affiliated with four NBER programs: **Development of the American Economy** (DAE), **Labor**

Studies, Economics of Education, and Children. She directed the DAE program for more than 25 years and she codirects the recently-launched NBER Working Group on Gender in the Economy.

Goldin presented the 2020 Martin Feldstein Lecture, “**Journey across a Century of Women**,” summarizing some of her research on the historical evolution of gender disparities in the labor market.

In announcing the prize, the Academy released both a **high-level summary of Goldin’s contributions** and a **longer account of her work**.

Goldin delivered her **prize lecture** on December 8, 2023.

Indian School of Business-NBER Research Conference, 2023

The Indian School of Business (ISB) in Hyderabad, India, hosted the second meeting in an annual joint NBER conference series on December 16–17, 2023. The meeting, on “Capital Markets, Technology, Financial Inclusion, and Economic

Growth,” was co-organized by **Shilpa Aggarwal** of ISB and **Amit Seru** of Stanford University and NBER. The **program included 10 papers** that study new developments in the financial sector, particularly the diffusion of new digital technologies in India and

other emerging markets, as well as the links between the financial sector and the real economy. The meeting also included a panel discussion on how the rise of digital payment systems in both the public and private sectors has affected financial inclusion.

New Project on Analysis of Systemic Financial Market Risk

The NBER has launched a new project on Financial Frictions and Systemic Risk to provide a venue for research on financial market institutions, including operational and financial linkages across markets, funding structures, trading costs, and other market frictions, and risks to the financial system.

The project, which is supported by the Office of Financial Research at the US Treasury Department via an interagency agreement with the National Science Foundation, will promote interaction between researchers, financial market participants, regulators, and policymakers, with the goal of identifying and

addressing research questions that bear on the determinants of, the detection of, and the remediation of systemic financial market risk. Research Associates Wenxin Du of Columbia University, Alp Simsek of Yale University, and Chester Spatt of Carnegie Mellon University will serve as the inaugural codirectors.

Conferences and Meetings

Conferences and Meetings, Fall 2023

Detailed programs for NBER conferences are available at nber.org/conferences

Behavioral Public Economics Bootcamp

Organizers: Hunt Allcott, B. Douglas Bernheim, and Dmitry Taubinsky
October 12–14, 2023

International Finance and Macroeconomics Program Meeting

Organizers: Wenxin Du and Kei-Mu Yi
October 13, 2023

Workshop on Methods and Applications for Dynamic Stochastic General Equilibrium Models

Organizers: Luigi Bocola, Christian K. Wolf, Frank Schorfheide, and Keith Sill
October 13–14, 2023

Public Economics Program Meeting

Organizers: Raj Chetty, Peter Ganong, and Kory Kroft
October 19–20, 2023

Political Economy Program Meeting

Organizers: Alessandra Casella, Federico Finan, and Brian G. Knight
October 20, 2023

Economics of Transportation in the 21st Century

Organizers: Edward L. Glaeser, James Poterba, and Stephen J. Redding
October 20, 2023

Economic Analysis of Business Taxation

Organizers: Joshua Rauh and Juan Carlos Suárez Serrato
October 20, 2023

Economic Fluctuations and Growth Program Meeting

Organizers: Janice C. Eberly and Guido Lorenzoni
October 27, 2023

Economics of Mobility

Organizers: Sandra E. Black and Jesse Rothstein
October 27, 2023

Market Design Working Group Meeting

Organizers: Nikhil Agarwal and Dirk Bergemann
October 27–28, 2023



Corporate Finance Program Meeting

Organizers: Peter M. DeMarzo and Nadya Malenko
November 3, 2023

Asset Pricing Program Meeting

Organizers: Tarek Alexander Hassan and Lars A. Lochstoer
November 3, 2023

The Work–From–Home Shock to Labor Markets

Organizers: Richard B. Freeman and Ina Ganguli
November 3–4, 2023

Monetary Economics Program Meeting

Organizers: Gauti B. Eggertsson and Carolin Pflueger
November 10, 2023

Labor Studies Program Meeting

Organizers: David Autor and Alexandre Mas
November 10, 2023

Behavioral Finance Working Group Meeting

Organizers: Nicholas C. Barberis
November 10, 2023

Organizational Economics

Organizers: Raffaella Sadun and Andrea Prat
November 16–17, 2023

Distributional Impacts of Climate Change in the Agricultural Sector

Organizers: Ellen M. Bruno, Meredith Fowlie, and Danae Hernandez-Cortes
November 17, 2023

American Agriculture, Water Resources, and Climate Change

Gary D. Libecap and Ariel Dinar, editors.

<https://www.nber.org/books-and-chapters/american-agriculture-water-resources-and-climate-change>

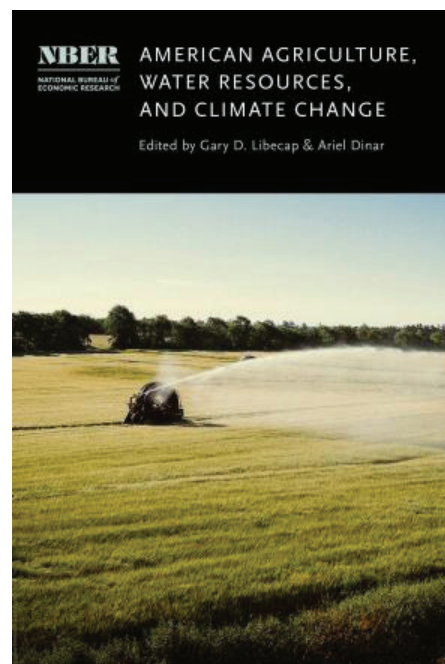
Agriculture has been critical in the development of the American economy. Except in parts of the western United States, water access has not been a critical constraint on agricultural productivity, but with climate change this may no longer be the case.

American Agriculture, Water Resources, and Climate Change highlights new research on the interconnections between American agriculture, water resources, and climate change. It examines climatic and geologic factors that affect the agricultural sector and highlights historical and contemporary farmer responses to varying conditions and water availability. It identifies poten-

tial effects of climate change on water supplies, access, agricultural practices, and profitability, and analyzes technological, agronomic, management, and institutional adjustments.

Adaptations such as new crops, production practices, irrigation technologies, water conveyance infrastructure, fertilizer application, and increased use of groundwater can generate both social benefits and social costs, which may be internalized with various institutional innovations.

Drawing on both historical and present experiences, this volume provides valuable insights into the economics of water supply in American agriculture as climate change unfolds.



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