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Urban Growth and Climate Change

Matthew E. Kahn*

My recent research focuses on the implications of urban economic growth for greenhouse gas production. I also examine how the quality of life in different cities around the world may be affected by climate change.

Low Carbon Cities

Edward L. Glaeser and I ranked U.S. cities with respect to their household greenhouse gas emissions.¹ Using micro data on household consumption of transportation, electricity, and home heating, we document significant differences across major cities. For example, if the average household chose to live in Houston versus San Francisco, it would produce roughly 16 more tons of carbon dioxide each year. San Francisco is ranked as a “greener” city because of its temperate climate, which means that households there use less electricity, the region relies more on natural gas rather than coal for power generation, and this lowers the electric utility’s emissions factor. San Francisco is also more compact than Houston, with more of the metropolitan area’s total employment located downtown. The suburbanization of employment has contributed to a rising carbon footprint. When people work in the suburbs, they are likely to live in the suburbs, and to live in a larger home and rely on a private vehicle for transportation.² Policies such as declining center city crime and improved urban public schools help to shrink a city’s carbon foot-

print because they encourage densification and living closer to the city center.³

Today, households who live in Daqing—China’s “brownest city”—produce only one fifth of the emissions of households who live in San Diego, the U.S.’s “greenest city”. Building on my U.S. research, I recently ranked the household carbon footprint for 74 Chinese cities using high quality data from the 2006 Chinese Urban Household Survey.⁴ In the case of China, the dirtiest cities are to the North where coal is used for winter heating. These results are significant because Chinese regional economic development policy is encouraging growth in the Northern region to deflect growth away from the mega cities along the eastern coast. If Northern China’s cities continue to rely on coal for heat rather than substituting to natural gas, then this spatial trend could have significant aggregate carbon implications.

Durable Capital

Over time, new versions of products such as the Toyota Prius or Tesla electric car or Zero Net Energy homes will have much smaller carbon footprints than earlier makes of cars and homes. Such “green” products often represent a tiny share of the existing capital stock because cars and buildings are long lived capital. This means that it can take decades for average energy efficiency of homes or vehicles to improve.

I examine the consequences of durable capital for the greenhouse gas mitigation progress in one study with Lucas Davis. We collected detailed vehicle-level information on the scale and composition of used vehicles exported by the United

States to Mexico under NAFTA.⁵ As it turns out, NAFTA can be viewed as an early “cash for clunkers” program. While it provided cash for U.S. households, this type of trade can have detrimental environmental consequences. Even though Mexican households drive fewer miles per year than U.S. households, the exported vehicles would have been scrapped had they remained in the United States. Our best estimate is that U.S. vehicles that are imported into Mexico, and are 10 to 15 years old at the time, live on for another ten years. Thus free trade in used durables between richer and poorer nations slows down the overall vehicle scrappage rate.

In the case of residential homes, energy consumption varies across different birth cohorts. Using different datasets from California, Dora Costa and I document that homes built in the 1970s consume more electricity than observationally identical homes.⁶ Using panel data for the same home over time, we dismiss the hypothesis that this effect simply reflects aging. Instead, our preferred explanation is that during times when residential electricity prices are low, homes built under such incentive regimes are more likely to be energy inefficient, and this effect persists decades later.⁷ As the share of California homes that were built in the 1970s shrinks over time, overall California residential energy efficiency will rise.

The Political Economy of Carbon Legislation

In June 2009, the U.S. House of Representatives passed the American Clean Energy and Security Act (ACES). This complex carbon mitigation legisla-

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tion bundled together a wide range of policies all intended to increase energy efficiency and reduce greenhouse gas emissions. For example, the ACES included legislation to enact an electric utility cap-and-trade system for carbon emissions. In the summer of 2010, the Senate chose to not vote on this legislation. I examine the correlates of carbon voting on key pieces of legislation such as this one.⁸ Representatives from high carbon, poor, conservative areas have been the least likely to vote in favor of this legislation. Representatives in districts where industry is a large share of local emissions also were less likely to vote in favor.

During this slow recovery from the most recent recession, environmentalists are deeply concerned that climate change is not a policy priority. Indeed, President Obama did not mention the words “climate change” in his 2011 State of the Union address. In recent work Matthew Kotchen and I examine trends in Google searches to test for the relationship between business cycles and interest in the broad issue of climate change.⁹ Google Insights allows us to search at the state/year/week level and permits a peek into the “zeitgeist” at that moment. We match this data to state unemployment data by month and document that in those states in which the unemployment rate increases, searches for “global warming” decline and searches for “unemployment” increase. These findings support the claim that the recession has chilled interest in prioritizing climate change as a pressing policy issue. This finding is important because it challenges the conventional wisdom that recessions are good for the environment. The traditional view is that industry activity is dirty and procyclical. These facts imply that pollution improves during recessions. But, if we need to introduce a Pigouvian incentive to combat climate change, then my results suggest that the probability of this taking place will decline during recessions.

States that rely on coal fired power plants, such as Indiana, have worried that if carbon emissions are priced through a carbon tax or cap-and-trade regulation, then their local electricity prices will soar

because of pass through. The conventional wisdom is that such states will lose manufacturing jobs because those jobs seek out cheaper places to do business. Erin Mansur and I investigate this claim¹⁰ by comparing employment counts by manufacturing industry in adjacent counties. Adjacent counties share many common factors such as amenities and a common local labor market and similar access to final consumers. But two adjacent counties can differ along key dimensions such as energy prices and exposure to government labor and environmental policy. We exploit this variation in energy prices and labor and environmental regulation within county-pairs to provide new estimates of their effects on the locational pattern of manufacturing. We conclude that employment in only a handful of energy intensive manufacturing industries, such as primary metals (NAICS 331), paper manufacturing (NAICS 322) and textile mills (NAICS 313), is responsive to electricity prices.

Environmental Ideology and Living the “Green” Life

In the absence of formal Pigouvian carbon pricing, households have no financial incentive to economize on their production of greenhouse gas emissions, yet at any point in time we observe many households living the “green life.” In Berkeley, California, I see people driving Prius vehicles, biking to work, having solar panels installed, and even having the grass ripped out of their lawns. Each of these actions contributes to the public good. In a series of papers, I seek to describe who lives the “green life.”¹¹ Controlling for standard demographic variables such as age, education, income and ethnicity, I focus strictly on the role of political ideology. It seems that people who are registered members of liberal political parties (Democrats, Green Party) literally “walk the walk.” They are more likely to own a Prius, use public transit, and consume less electricity, and to respond to conservation “nudges” than observationally identical non-liberal households.¹² Of course, I

do not literally believe that registering for the Democratic Party causes you to buy a Prius and to live a green lifestyle. Instead, such political party registration data provides a signal of one’s otherwise difficult to observe “ideology.”

This research contributes to a growing economics literature on the role of ideology in determining economic outcomes. There are several open research questions here. First, how does a person “acquire” an environmentalist ideology? What role do peers play in how this ideology evolves over time? The economics of identity literature offers some fruitful pathways for exploring this issue.¹³

Documenting the role of ideology in explaining population heterogeneity would be less important if we collectively taxed negative externalities. But, in the absence of formal carbon pricing, society as a whole benefits when a subgroup of citizens volunteers to be “guinea pigs” by purchasing the first generation of new green products and enacting novel new legislation such as California’s AB32.

Urban Adaption to Climate Change

My book titled *Climatopolis: How Our Cities Will Thrive in the Hotter Future* was published in fall 2010.¹⁴ In it, I examine how urban quality of life will be affected by climate change. Assuming free market capitalist growth and the fundamental worldwide free rider problem, global greenhouse gas emissions will continue to rise. Facing this reality, what will climate change do to our urban economy?

Although I cannot predict what will happen to a city such as Moscow in the year 2050, I am confident that the insights generated by NBER research have direct implications for the complex challenge of climate change adaptation. Microeconomics provides a powerful tool for thinking about how we will cope with this emerging ambiguous threat. The book’s core thesis is that urban capitalism will play a crucial role in helping us to adapt to the challenge

posed by climate change.

For example, climate change is likely to raise the average temperature in certain cities. Because of that, cities such as Detroit and Buffalo will have an easier time competing against Sun Belt cities whose warm winter temperatures have acted as a magnet, attracting population migration.¹⁵

In *Climatopolis*, I argue that households will learn from climate scientists about the new challenges that different cities will face. If specific cities do experience a decline in their quality of life, then their real estate prices will decline, and they will suffer a net outflow of people. Households will “vote with their feet” and this nimbleness will help them to cope with the evolving challenge of climate change. Cities compete to attract and retain the skilled. If a city’s quality of life declines because of climate change, then the skilled will leave and economic growth will slow.

My book emphasizes the potential for endogenous technological advance to play a key role in helping us to adapt. The billions of people who will be affected by climate change create a large market opportunity for entrepreneurs who can serve this market.¹⁶ In the presence of fixed costs to develop new products, the scale of the market is a key determinant. If billions of people seek an energy efficient air conditioner to offset hot summers, then there will be sharp incentives to invest in developing such products. Some of these producers will succeed. In a globalized world market, the pay-off to the successful entrepreneur will be huge. In new research, I will continue to explore microeconomic issues related to climate change mitigation and adaptation.

¹ E. Glaeser and M. Kahn, “The Greenness of Cities: Carbon Dioxide Emissions and Urban Development,” NBER Working Paper No. 14238, August 2008.

² E. Glaeser and M. Kahn, “Decentralized Employment and the Transformation of the American City,” NBER Working Paper No. 8117, February 2001.

³ M. Kahn, “Urban Policy Effects on Carbon Mitigation,” NBER Working Paper No. 16131, June 2010.

⁴ S. Zheng, R. Wang, E. Glaeser, and M. Kahn, “The Greenness of China: Household Carbon Dioxide Emissions and Urban Development,” NBER Working Paper No. 15621, December 2009.

⁵ L. Davis and M. Kahn, “International Trade in Used Durable Goods: The Environmental Consequences of NAFTA,” NBER Working Paper No. 14565, December 2008.

⁶ D. Costa and M. Kahn, “Why Has California’s Residential Electricity Consumption Been So Flat Since the 1980s? A Microeconomic Approach,” NBER Working Paper No. 15978, May 2010.

⁷ D. Costa and M. Kahn, “Electricity Consumption and Durable Housing: Understanding Cohort Effects,” NBER Working Paper No. 16732, January 2011.

⁸ M. Cragg and M. Kahn, “Carbon Geography: The Political Economy of Congressional Support for Legislation Intended to Mitigate Greenhouse Gas Production,” NBER Working Paper No. 14963, May 2009.

⁹ M. Kahn and M. Kotchen, “Environmental Concern and the Business Cycle: The Chilling Effect of

Recession,” NBER Working Paper No. 16241, July 2010.

¹⁰ M. Kahn and E. Mansur, “How Do Energy Prices and Labor and Environmental Regulations Affect Local Manufacturing Employment Dynamics? A Regression Discontinuity Approach,” NBER Working Paper No. 16538, November 2010.

¹¹ M. Kahn, “Do Greens Drive Hummers or Hybrids? Environmental Ideology as a Determinant of Consumer Choice,” *Journal of Environmental Economics and Management*, 54(2) pp.129–45, 2007.

¹² D. Costa and M. Kahn, “Why Has California’s Residential Electricity Consumption Been So Flat Since the 1980s?: A Microeconomic Approach,” *op. cit.* and “Energy Conservation ‘Nudges’ and Environmentalist Ideology: Evidence from a Randomized Residential Electricity Field Experiment,” NBER Working Paper No. 15939, April 2010.

¹³ D. Costa and M. Kahn, “Shame and Ostracism: Union Army Deserters Leave Home,” NBER Working Paper No. 10425, April 2004.

¹⁴ M. Kahn, *Climatopolis: How Our Cities Will Thrive in the Hotter World* (see climatopolis3.com), Basic Books, 2010.

¹⁵ O. Deschenes and E. Moretti, “Extreme Weather Events, Mortality, and Migration,” NBER Working Paper No. 13227, July 2007.

¹⁶ D. Acemoglu and J. Linn, “Market Size in Innovation: Theory and Evidence from the Pharmaceutical Industry,” NBER Working Paper No. 10038, October 2003.