Tatyana Deryugina – research statement

Summary. I am an environmental economist, and much of my research focuses on environmental risk. I study the economic costs of both natural and man-made environmental shocks, including hurricanes, climate change, hazardous substance spills, and air pollution. My research illuminates the roles of local conditions and pre-existing policies in determining the evolution of outcomes following such shocks. My work has yielded significant implications for the economics of climate change, and several of my papers address aspects of climate change policy, such as building energy codes and carbon pricing. I have also studied belief formation, examining how relevant and irrelevant information affects beliefs. All my work is empirical, and I utilize both observational and experimental data to arrive at my conclusions.

Impacts of extreme weather events. Climate change is projected to increase economic losses from natural disasters. My research engages with this societal problem in several important ways. In Deryugina (*AEJ: Policy*, 2017), I evaluate the long-run local economic impacts of all hurricanes that made landfall in the US between 1979 and 2002. I find a small decline in county-level employment that disappears within a few years and no effect on average incomes. Yet transfers through the general safety net, such as unemployment insurance and Medicaid, increase significantly and persistently. The magnitude of these increases exceeds that of direct disaster aid, suggesting that the fiscal impacts of natural disasters are much larger than previously thought and that social safety nets could be important determinants of recovery.

The substantial damages caused by the abovementioned hurricanes pale by comparison with the $150 billion in damages caused by Hurricane Katrina in 2005. In Deryugina, Kawano, and Levitt (*AEJ: Applied*, 2018), my coauthors and I use confidential tax data to study the long-run effects of the hurricane on New Orleans victims' economic outcomes. We find that earnings losses occurred only in 2005–2006; between 2008 and 2013, victims' earnings were *higher* than they would have been absent the hurricane, other things being equal. Two channels are responsible for this surprising effect. First, wages in New Orleans rose following the hurricane, partly reflecting the hurricane's effects on the cost of living. Second, because New Orleans was already in relative decline, displaced individuals generally relocated to higher-wage areas. We thus show that the indirect economic impacts of natural disasters sometimes more than offset their direct effects along some dimensions. More generally, the net economic effects of natural disasters appear to depend on the strength of the local economy.

In Deryugina and Molitor (*AER*, R&R), we continue this line of inquiry and use confidential administrative data from Medicare to study the long-run impacts of Hurricane Katrina on mortality among its elderly and long-term disabled victims. Surprisingly, we find that the hurricane *improved* longer-term survival for members of this vulnerable group. The relocation of victims to areas with better mortality outcomes explains most of this improvement, echoing conclusions reached in my earlier work. Addressing two longstanding research questions in the health literature, we show that (1) a person's place of residence has a causal effect on how long she or he lives, but (2) moving to a place with higher medical spending has no effect on longevity.

Costs of day-to-day environmental risks. Although the dramatic effects of extreme weather events command the public's attention, such events are relatively rare. By contrast, small fluctuations in environmental conditions such as temperature and air quality are ubiquitous and thus can also have significant aggregate effects. In Deryugina, Heutel, Miller, Molitor, and Reif (*AER*, R&R), we use 15 years of administrative Medicare data to estimate the mortality and hospitalization costs of daily fluctuations in fine particulate matter ($PM_{2.5}$). We exploit a novel

source of quasi-random variation in air pollution caused by changes in local wind direction. We also develop novel machine-learning methods to estimate how many life-years are lost to one-day $PM_{2.5}$ shocks and to identify those who are most vulnerable. We find that those most likely to die because of $PM_{2.5}$ shocks are among the sickest individuals, but the monetary benefits of recent reductions in $PM_{2.5}$ concentrations are nonetheless substantial.

Air pollution is a direct product of human activity. I have also studied the costs of an *indirect* product of human activity—a hotter climate (Deryugina and Hsiang, 2017). We first demonstrate the potential to relate the marginal effects of weather to the marginal effects of climate by invoking the envelope theorem and applying it within a flexible empirical framework. We then estimate the marginal effects of climate on county-level incomes in the US. Although many observers argue that developed economies are unlikely to suffer major losses as a result of climate change, we find that the current costs of high temperatures in the US are non-trivial—causing a loss of about 1.7 percent of daily income for every 1-degree-Celsius increase above 15°C. We do find evidence of adaptation—high temperatures have a smaller effect on hotter counties than on colder counties— but our estimates nevertheless imply that by 2090 the net present value of the economic costs of climate change in the US since 1990 will be $6.7 trillion dollars (in 2011 dollars).

Although most of my work focuses on how environmental conditions affect the economy, I have also studied how economic conditions affect the environment. In Cohn and Deryugina (2018), we show that increases in cash flow make it less likely that a firm causes a hazardous substance spill, implying that capital market imperfections have environmental consequences.

Climate change policy. The risks created by climate change are one of humanity's greatest challenges in the twenty-first century. In Bruegge, Deryugina, and Myers (*JAERE*, 2019), we evaluate the effectiveness and distributional consequences of a common proposal for reducing greenhouse gas emissions: improved building energy codes. We exploit the 1982 introduction of "climate zones" in California, which created spatial discontinuities in the strictness of energy codes. Using confidential billing data from over 350,000 homes located near climate-zone borders, we conclude that California's building energy codes affect energy use less dramatically than engineering estimates predict, casting doubt on their effectiveness.

An alternative to non-price policies such as building codes is a price-based policy, such as a carbon tax. A carbon tax's potential for reducing emissions depends partly on how energy use responds to changes in energy prices (i.e., the price elasticity of demand). In Deryugina, MacKay, and Reif (*AEJ: Applied*, forthcoming), we exploit a unique natural experiment in Illinois to study how the price elasticity of electricity demand evolves over time. We find that this elasticity grows in magnitude from about -0.1 in the first six months following a price reduction to about -0.3 over the subsequent two years. This small magnitude—even of the long-run elasticity—suggests that demand-side reductions in electricity use are difficult to achieve through price-based policies.

Agriculture is particularly vulnerable to climate change. Crop insurance can help stabilize farm incomes, but it is important to understand farmers' adoption decisions and any unintended consequences that may arise. In Deryugina and Kirwan (*Economic Inquiry*, 2017), we find that government disaster payments cause farmers to reduce their crop insurance coverage. In interdisciplinary work with Megan Konar that was published in a top-ranked water resources journal (*Advances in Water Resources*, 2018), I investigate the effects of crop insurance on water use. Using a natural experiment made possible by the 1994 Federal Crop Insurance Reform Act, we find that an increase in crop insurance uptake increases water use, primarily by encouraging

farmers to switch to more water-intensive crops. This line of work suggests that agricultural social safety nets should be designed carefully to avoid undesirable side effects.

Beliefs and bias. Neoclassical economic models assume that agents are either fully informed or at least that their beliefs are unbiased. Theoretical and empirical work in psychology and behavioral economics suggests, however, that such assumptions are often unjustified. For example, Americans' opinions about man-made climate change are consistently in conflict with those of experts. In two related papers, I investigate the determinants of beliefs about climate change. In Deryugina (*Climatic Change,* 2013), I find that such beliefs are substantively influenced by recent local weather, especially if it has been abnormal for several months. In Deryugina and Shurchkov (*PLOS ONE*, 2016), we conduct a survey experiment and show that information about scientists' views on man-made climate change significantly strengthens respondents' own beliefs in this phenomenon.

Biased beliefs can lead to biased behavior such as discrimination. In Deryugina and Shurchkov (*Economic Inquiry*, 2015), we use confidential data from a women's college to study possible bias in favor of or against more attractive students. We find that more attractive students do not receive better *or* worse grades, but they are more likely to major in management and less likely to major in the sciences. Thus, they self-select into careers that offer larger "beauty premiums." In Deryugina and Shurchkov (*JEBO*, 2015), we study the beauty premium in a laboratory setting, with "employers" hiring "employees" to perform a task. We find the beauty premium to be highly task-dependent, with analytical and data-entry tasks exhibiting no beauty premium in wage offers. By contrast, when workers engage in a bargaining task where they can see their opponents, we find a significant beauty premium. After it is revealed that more attractive individuals do not perform better at this task, however, the beauty premium disappears. In line with my other work, these two papers show that certain phenomena are highly context-dependent.

Future research directions. In line with the specific projects described above, I will continue researching the societal costs of natural and man-made environmental shocks. In other work related to extreme events, I (with Benjamin Marx) am studying the effects of tornadoes and subsequent media coverage on charitable donations to both disaster-related and other causes. These findings also have implications that extend beyond the economics of extreme events: the literature on charitable giving has long sought (with little success) to measure the extent to which increased donations for one purpose crowd out those for other purposes. David Molitor and I are expanding our investigation of the long-run health effects of natural disasters by studying the long-run health effects of all large tornadoes that have affected the United States since 1999.

In current work on environmental risk with Julian Reif, we are applying quasi-experimental variations to study the mortality costs of sulfur dioxide among all infants, children, and adults in the US over a period spanning more than 40 years. In new interdisciplinary work with Erica Myers, Nicole Riemer, and Matthew West, we are developing a more sophisticated model of wind-based pollution transport to isolate longer-run variations, using this model to study the mortality and morbidity effects of chronic pollution exposure. In new work with Jonathan Cohn and David Matsa, we are examining whether increased competition—which is widely believed to benefit consumers—reduces or increases environmental risk, as measured by spill occurrence. In future work on bias, I will continue working with Olga Shurchkov to investigate whether informational interventions also work in a more realistic setting and whether they affect beliefs in the longer run. I hope that my work will not only inform sound policy decisions but—as my current research has done—also elucidate fundamental processes in our economic system.