As an applied microeconomist, my current interests focus on applying econometrics methods to agricultural and environmental issues. My research seeks to better understand the interplay between agriculture and the environment, both in the US and China, with a focus on the livestock industry. My work also exploits individual preferences on environmental hazards using large-scale datasets such as Zillow's nationwide residential housing transactions data and an interdisciplinary study between horticulture and economics. Specifically, my research relates to: (*a*) agricultural pollution and water quality in both the US and China; (*b*) individual preference and possible environmental hazards from energy infrastructure; and, (*c*) the cost-efficiency analysis of new agricultural technology and farmers' willingness-to-adopt. The following describes my existing research, contributions, and future goals.

1. Evaluating the effectiveness of environmental regulations and understanding stakeholders' response to the regulations

My job market paper, currently a "Reject and Resubmit" at *American Journal of Agricultural Economics*, focuses on a comprehensive evaluation of the impact of environmental regulation on agricultural pollution in China. Over the last 15 years, China's central government has implemented several regulations to improve environmental quality by abating industrial pollution; however, agricultural pollution is another large pollution source and China faces severe pollution from its hog industry. A news report of dead pigs floating in the river of Shanghai triggered stringent supervision of the livestock industry, including China adopting new regulations in 2014. Differing from US size-based policies, China's 2014 environmental regulation is place-based in nature. Incorporating hog and sow inventory data from 150 province and around 1,000 prefecture statistical yearbooks from 2007 to 2017, I leverage a new econometric method, synthetic difference-in-differences (SDID) (Arkhangelsky et al. 2020), to systematically analyze the impacts of the regulations on the county-level hog and sow inventories in eight provinces in China. SDID has a more desirable bias property than existing conventional difference-in-differences (DID) and synthetic control (SC) methods—SDID uses not only the unit weights included in SC, but also time-weights.[1] Arkhangelsky et al. (2020) show that the SDID estimator is doubly robust, and it is biased only when the model is misspecified AND the unit- and time-weights are incorrect. SDID only requires general overlap in outcome and observables between treatment and control groups, as opposed to the more restrictive parallel pre-trends assumption in DID, and results show SDID mitigates bias introduced by DID and SC methods. I find that the 2014 regulations significantly reduced hog and sow inventories in regulation-affected areas, mainly from extensive margin changes due to existing hog farm closures; however, I find no significant improvement in water quality. This research not only evaluates the overall effects but also uncovers substantial heterogeneous treatment effects both within and across affected provinces and prefectures—the treatment effect for each province and prefecture varies from 5% to -50%. The heterogeneity is closely related to political economy—counties located upstream of big cities see larger hog inventory reduction due to environmental pressure exerted from big cities downstream.

My findings are both meaningful for the hog industry and explore the behavior of local governments and the tradeoffs they face. China reversed the environmental regulations and encouraged hog production due to a pork shortage caused by African swine fever. Furthermore, many of China's local governments recently restarted or re-expanded coal-fired power plant production after a recent electricity shortage due to restricting electricity

[1] SDID uses both the unit- and time-weights in constructing counterfactuals. In contrast, DID essentially assumes the same weights for all control units and periods, and SC only has unit-weights. Specifically, the time weights are generated by balancing the weighted-average outcome in pre-treatment periods and simple-average outcome in post-treatment periods for each control unit.

generation for carbon emission abatement purposes. This type of implementation measure is typical in China; and thus it is worth understanding the mechanism behind it. Currently, I am building a behavioral model showing how local government officials, decision-makers with heterogeneous preferences inclined to environmental protection or economic growth, respond to directives from the central government. This model allows heterogeneous preferences on the tradeoff between growth and environment through resource allocation due to different development levels and locations. Leveraging various types of data on behavioral responses, such as environmental inspections, abatement requirements, and funding support, I am modeling what channels local officials undertake to achieve environmental protection targets under tightening environmental regulations.

2. Understanding individual behavior and preferences from existing or possible environmental hazard from energy infrastructure

The second broad domain of my research aims to understand individual behaviors and preferences from existing or possible environmental hazards from energy infrastructure and water pollution. Using several micro-level datasets including Zillow housing transaction, pipeline incidents, farmland transaction, and lake water quality datasets, I combine a revealed preference approach—a hedonic model—and quasi-experimental designs to analyze the implicit cost and capture individuals' responses to environmental hazards from existing pipeline incidents or harmful algal blooms, and possibly high voltage transmission line incidents.

In the past 20 years, the US has witnessed 12,308 pipeline incidents, with an average of 650 incidents per year. Recently, pipeline leaks in California's coastal region spilled at least 126,000 gallons of crude oil into coastal waters, which brought about tremendous economic loss and damage to the local ecology. Recognizing concerns about pipeline transportation's safety, I assess how pipeline incidents impact nearby housing markets, thus capturing the implicit cost of pipeline incidents. Previous literature only focuses on a single pipeline incident and finds no significant impact on housing values. We provide the first nationwide assessment of pipeline incidents' impacts on housing prices by incorporating 1,222 gas distribution pipeline incidents from Pipeline and Hazardous Materials Safety Administration over the past decade and Zillow's housing transaction dataset. Applying binscatter regression, I find that houses located inside and outside a one-kilometer radius have significant price differences. Utilizing this source of variation and leveraging a difference-in-differences approach by comparing prices of houses within one mile of pipeline accidents and those one-to-two-kilometer away before and after pipeline incidents, I find that a pipeline incident depresses housing prices by 5%–7% on average. The results also reveal larger impacts if incidents raise public awareness due to evacuation, explosion, or ignition. This study helps promote rigorous cost-benefit analyses on pipeline transportation.

In addition to assessing the implicit cost of pipeline incidents, I am also involved in an analysis of the impact of high voltage transmission lines on farmland value. Farmland is a major part of a farmer's investment decision and the potential risk to farmland value could shape farmers' preferences. This ongoing work aims to understand farmers' preferences on possible disruptive events caused by nearby transmission lines. Another ongoing work relates to individuals' responses to existing harmful algal blooms. Harmful algal blooms degrade water quality, impact drinking water quality, and reduce recreational value. Incorporating publicly accessible lake water quality data from the LAGOS database and Zillow housing transaction dataset, I aim to assess how housing prices change due to nearby harmful algal blooms (house prices are treated as a proxy of individual's preferences).

3. Estimating cost-efficiency of new agricultural technology and farmer's willingness-to-adopt

The third part of my research is the economics of specialty crop growers' technology adoption and profitability analysis as part of two USDA-funded interdisciplinary projects involving plant pathologists, horticulturists,

sociologists, and engineers. One project examines apple growers' views and adoption of a new intelligent sprayer that uses a real-time camera to detect the presence and size of apple tree canopies and automatically adjusts the quantity of pesticide spray volume. Working with experimental trials data in Iowa and Ohio, I apply both partial budget analysis and a techno-economic model to calculate the relative cost efficiency ratio and payback periods, thus alleviating growers' concerns about cost efficiency and the time to achieve a breakeven point compared to a conventional airblast sprayer.

The second project focuses on mesotunnels, a new technology organic cucurbit crop growers could use beyond the conventional low or high tunnels. Mesotunnels are 36–42 inch hoops with breathable nylon-mesh fabric covering that protect organic cucurbit crops from striped beetles. As the graduate RA on the $2 million USDA-funded project, I conduct the partial budget analysis examining the cost-efficiency of mesotunnels relative to existing low-tunnels. We find that, on average, mesotunnels are only cost-efficient for operations larger than one acre and that they are more cost-efficient to adopt for muskmelons than acorn squash. Due to this work, as well as the one dozen cooperative grower interviews I led via Zoom, AAEA selected me as one of ten finalists for their 2021 nationwide graduate student extension competition. Moreover, I am designing surveys targeting 500 organic cucurbit (e.g., acorn squash and muskmelon) growers across 13 states from Iowa to New York, and plan to analyze their willingness-to-adopt mesotunnels and understand the factors that encourage or discourage adoption.

4. Broader research agenda and future directions

My training in agricultural and environmental economics provides me with tools and frameworks to study policy-related issues, the mechanisms behind them, and the unexpected consequences. Moreover, I am equipped with the knowledge to explore data and answer these questions. Furthermore, the interdisciplinary study enriches my work and allows me to analyze practical questions and growers' concerns.

In the next three to five years, I plan to focus on my research questions to the aforementioned domains. Firstly, my job market paper focuses on the impact on hog farms at an aggregate level and does not uncover the responses of hog producers. My future research will incorporate farmer-level data, such as the National Fixed Point Survey, and analyze farmers' responses to China's environmental regulations, as small-scale hog producers may behave differently than large-scale producers. Secondly, my assessment on pipeline impacts focuses on disruptive incidents and ignores possible pipeline construction impacts. Incorporating the impact of pipeline construction will provide a more comprehensive analysis. Thirdly, I plan to extend the interdisciplinary study beyond cucurbit and apple growers to other types of growers to broadly understand their technology adoption behaviors.

Beyond the existing projects, I see myself continuing to examine the interplay among agriculture, energy infrastructure, and the environment. Specifically, I want to exploit the factors impacting China's local governments' decision-making processes. As an example, I would examine the behavior change of local governments when faced with administrative rights reform in terms of environmental protection targets (i.e., the reform of the vertical management system of environmental monitoring, supervision, and law enforcement). This is a good case study to understand local governments' behaviors with conflicting targets in their political achievement portfolios. Another example would be incorporating micro-level datasets to examine behavior change due to competition for the "Civilized City" title, as well as assess if there exists either positive or negative externality in or out of their jurisdictions. Secondly, I want to discover more about how environmental hazards influence social-economic disparity and environmental injustice, especially in energy infrastructure themes. One example would be to check heterogeneous responses by income level, race, and age groups in areas with a high density of pipeline incidents.