Research Statement
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I'm a Ph.D. candidate specializing in environmental economics and international trade. I'm particularly interested in estimating the impact of climate change on real economic activities and understanding how micro-level shocks affect the global production process. My research examines how extreme heat shocks associated with climate change impact worker-level labor market layoff, hiring, and job reallocation in Brazil, how temperature shocks affect within-industry resource reallocation among heterogeneous firms in Indonesia, and how the global commodity boom affected worldwide deforestation around mine sites in the early 2000s. In a second research agenda focused on international trade, I study how worldwide natural disasters and country-specific policy changes affect the dynamics of cross-border supply chains using novel data constructed from bill-of-lading records. Across disciplines, my research uses employer-employee linked administrative records, firm-level industrial surveys, customs records and pixel-based satellite data to understand the mechanisms of how micro-level shocks from environmental and policy changes affect economic agents and the global production process, shedding light on aggregate adjustment with targeted policy implications.

Environmental Economics

a. Estimating Climate Change Damages

The first strand of my research focuses on the impact of environmental shocks on real economic activities. According to the Intergovernmental Panel on Climate Change, climate change is associated with an increasing number of extreme heat days and more intensive natural disasters. The first two chapters of my dissertation seek to understand how extreme heat shocks affect labor market outcomes and manufacturing firms in developing country contexts.

In my job market paper, "Labor Market Adjustment under Extreme Heat Shocks: Evidence from Brazil," I examine how extreme heat days affect worker-level layoff, hiring, and subsequent reallocation for manufacturing workers in Brazil. A recent literature shows temperature shocks have significant impact on aggregate GDP growth and labor productivity. However, we know surprisingly little about how heat shocks affect employment outcomes. This question is especially important for developing countries where significant labor market frictions exist and adaptation capacity is limited. To study this, I match pixel-based gridded climate data from satellites with the Brazilian employer-employee linked administrative records. Employing a fixed effects model, I exploit variations in temperature at the municipality-quarter level to causally estimate the effect of heat shocks on worker-level employment outcomes. Further incorporating detailed municipality agricultural census and crop calendars, I isolate heat shocks during the local non-growing seasons to investigate the importance of the direct labor productivity channel. Finally, tracking workers across job spells, I decompose the post heat shock transition outcomes to study job reallocation.

I find that heat shocks lead to higher propensity of worker layoff for both manufacturing and agricultural workers across all seasons. During non-growing seasons, having one additional extreme heat day, defined as daily mean temperature above 31 Degrees Celsius, increases the probability of worker layoff by 0.8 percentage point, or a 11% increase of the baseline propensity. Consistent with the direct labor productivity channel, I find that manufacturing workers engaging in more routine-manual intensive tasks are more likely to be laid off due to heat shocks during the non-growing seasons. Tracking workers across time, post-layoff decomposition reveals that 24.3% of all formal manufacturing workers laid off due to heat shocks fail to find any formal sector employment within 36 months, suggesting significant costs during job reallocation. Together, these results point to targeted adaptation strategies and suggest the cost of climate change for the labor force is potentially larger in developing countries due to adjustment costs during job reallocation.

In a piece of related work, "Heterogeneous Firms under Regional Temperature Shocks: Exit and Reallocation," I turn the focus to manufacturing firms in Indonesia. In a heterogeneous firm model with capital-biased productivity, I incorporate temperature shocks through the direct labor productivity channel and illustrate how less productive firms decide on production and re-optimize factor intensity as temperature increases. Empirically, I match gridded daily weather data with the Indonesian firm-level industrial surveys. I find that

first, under heat shocks, the initially less productive firms are more likely to exit, highlighting the presence of survival bias intrinsic to firm-level intensive margin analysis. Second, on the aggregate, resources reallocate from less to more productive firms within industries. Among surviving firms, we observe factor substitution from unskilled to skilled workers, and firms switching from using domestic to foreign intermediate inputs. This evidence highlights the importance of incorporating the manufacturing sector in climate change damage functions such as those in Integrated Assessment Models. It also provides a potential explanation as to why poor countries are more affected by heat shocks from the perspective of firm size distribution.

There are several natural extensions within this strand of research which I address in ongoing work. The first is to further understand how climate change affects worker transition into informality and associated implications for worker welfare, using the Demographic Census and household surveys (PNAD). Second, exploiting the employer-employee linked feature of RAIS, I expand current work on different adjustment margins to include the firm, industry and regional perspective, which helps us better understand worker re-matching and adjustment process in general equilibrium. Third, given the more pronounced impact on workers in lower-skill occupations and the large fraction of workers near minimum wage in developing countries, the next step is to quantify how existing social welfare programs interact with climate change and how to better design them. Exploiting a recent reform in the Unemployment Insurance scheme in Brazil, I make use of the second wave of RAIS and study how changes in eligibility criteria for the UI affect firm and worker incentives and labor market outcomes under heat shocks.

b. Environmental Sustainability

My other interest in environmental economics makes use of novel satellite imagery combined with machine learning techniques to study environmental sustainability issues. In “Mining Activity and Spatial-Temporal Dynamics of Forest Cover Loss,” joint with Ran Goldblatt, Gordon Hanson and Amit Khandelwal, we collect proprietary microdata on more than 30,000 mines located around the world matched with high-resolution satellite-image-trained data on deforestation to study the environmental impact of the early 2000 global commodity super-cycle. Preliminary results show positive elasticity of deforestation with respect to major commodity prices, with more pronounced impact concentrated in poor countries. In related projects, I also estimate the effect of the commodity super cycle on water quality near mine sites using microdata from the Water Quality Portal.

International Trade

The second theme of my research investigates the resilience and flexibility of the global value chain in the presence of micro-level shocks, both in the form of natural disasters and policy changes. The literature has so far focused on domestic firm networks and parent-affiliate relationships when studying the transmission of shocks along the production process. In “Cross-Border Supply Chains and Natural Disasters: The Role of Search Friction,” joint with Xiao Ma and Natalia Ramondo, we assemble a novel microdata set on cross-border supply chains using U.S. Customs’ Bill of Lading documents and the global establishment-level database from Dun & Bradstreet. We observe transaction-level data from all suppliers of each U.S. importer, with rich establishment-level information on both the foreign suppliers and the U.S. importers. We then link the establishment location with the international disaster database EM-DAT using coordinates to exploit different intensities of natural disasters at the subnational-level. With the linked firm, Customs and global disaster data at fine geographic resolution and high frequency, we empirically examine heterogeneity in international supplier substitution, consignee learning, and structurally derive welfare implications for the cost of natural disasters on the global production process. With transaction-level customs data covering the recent trade war, I’m also interested in investigating how tariff hikes and policy uncertainty affect the choice of international suppliers and firm performance for U.S. and Chinese firms. I further explore the possibility of using machine learning techniques to help form a broader and more precise definition of State Owned Enterprises in China and examine their roles in international trade.