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Research Statement

I am an environmental and resource economist who works at the intersection of development and trade. I combine empirical, structural, and theoretical approaches to examine the adverse effect of climate change on developing countries. My work aims to inform public policy that supports effective climate change adaptation. The economics of climate change is often characterized by a fundamental tension between the pursuit of short-term economic growth and long-term environmental sustainability. This tension creates a complex trade-off between developmental and environmental goals. My research agenda is focused on tackling this trade-off by examining how domestic market distortions, international trade policy, and natural resource misallocation shape climate adaptation and environmental outcomes in low and middle-income countries, with applications to labor, water, and energy markets in India and globally.

Water Governance and Industrial Policy

Current Works

In my job market paper, *Fuel vs. Water: Is ethanol renewable?*, I study India's ethanol blending mandate, which makes three promises - to reduce the import bill, decarbonize transport, and raise farm incomes. India's ethanol-blending mandate rose from 1.5% in 2014 to 10% in 2022 and 20% in 2025, becoming a flagship industrial and energy-security policy. I study how this mandate has generated an unpriced groundwater externality by shifting agricultural land toward water-intensive feedstock crops such as sugarcane, rice, wheat, and maize. India's biofuel policy raises demand for these feedstocks, but this demand shock is not accompanied by any pricing or regulation of the groundwater used to irrigate them, creating a channel through which industrial policy can accelerate an already severe groundwater crisis. I identify the effect of the mandate with a shift-share instrument that interacts the national blending schedule with each district's baseline feedstock-crop exposure. I estimate a 2SLS regression and find that a one standard deviation increase in mandate exposure raises a district's feedstock crop share by 0.81 percentage points. This increase is entirely through crop switching rather than new land coming under cultivation. Overall, this feedstock expansion causes groundwater levels to decline by 11.34 cm. The crop-switching response comes specifically at the expense of pulses, whose production falls by 11.9%, translating into roughly 16 kcal and 1.1 grams of protein lost per capita per day nationally.

Using a model which accounts for farmer and distillery's decsions, I further show that the mandate's groundwater cost is gated by policy design on two margins: electricity rationing and monopsony ethanol distillery market. A tighter electricity rationing mutes mandate's effect on groundwater. This is because with more hours of electricity supply, with the same pump capacity farmer can pump for more hours at zero marginal cost. Therefore mandate effect rises in electricity supply hours. While moving a catchment from a monopsonist to a competitive ethanol-distillery market structure increases mandate-driven depletion by 3.33 cm, as competition raises the price distilleries pay farmers for feedstock. Building a simple incidence model, I find that between distillery and farmer, who captures the unpaid cost of groundwater depends on the market structure (monopoly/competitive), catchment saturation, and margin that distillery can make per litre of ethanol when it uses government procured crops such as rice and wheat.

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Translating these estimates into district-level renewability status, I find the mandate tips eleven districts from renewable into non-renewable groundwater status. This paper contributes to the political economy of industrial policy by showing that a policy justified on energy-security and farmer-income grounds can undermine an already-fragile natural resource, and it underscores the importance of pairing industrial policy with resource governance in water-stressed developing economies.

Works in Progress

Building on recent work on the global spatial efficiency of water use under trade distortions by Carleton, Crews, and Nath (2025), I am coauthoring a project that focuses on the Indian context, with Elizabeth Sorensen Montoya (Assistant Professor at the Kansas State University) and Bhavya Srivastava (Economist at The World Bank). This paper asks the question, why are water-intensive crops not grown in water-abundant areas in India? We document that rice and wheat cultivation show no systematic relationship with local water abundance. This striking pattern is also exemplified by North India, which is simultaneously the largest rice exporter and faces the most severe groundwater crisis. We investigate three main mechanisms driving this misallocation: a) lack of tradable groundwater rights, b) government policies such as electricity subsidies and the minimum support price that distort the incentives of crop choice for risk-averse and subsistence farmers, and c) internal state-level trade barriers in agriculture in India, that generate autarky-like cropping patterns — directly extending the institutional framework developed in my JMP. Disentangling these sources of inefficiency will help policymakers identify which interventions can most effectively address India's looming water security crisis.

Climate Change Adaptation

Current Works

In my job market paper, *Barriers within Borders: Structural Transformation and Climate Change in India*, I examine how climate change hinders labor reallocation and the role that inefficient markets play in inhibiting climate adaptation. In this paper, structural transformation is limited to the reallocation of labor from agriculture to manufacturing and services. I explore how climate change is altering both supply-side drivers (productivity changes) and demand-side drivers (income effect) of structural transformation. These disruptions exacerbate the "food problem" - where labor ends up specializing in the low-productivity agricultural sector to maintain food security. Therefore, in a developing country like India which should be undergoing a rapid structural transformation, climate change is acting as a counter-force. I further investigate to find that internal trade barriers within India in the agricultural sector further exacerbate the food problem, worsening the effect of climate change on structural transformation. I create a novel district-level panel dataset on Indian economy which spans twenty-five years and captures labor shares, consumption patterns, agricultural and manufacturing productivity, road network, and climate variables. I then use panel fixed effect regression estimation utilizing the spatial and temporal variation in temperature, to establish certain facts about climate change and structural transformation in India. I find that climate change has a worse affect on productivity of the agricultural sector than manufacturing and services. Increasing temperatures result in decline in Income and increase in food

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share of expenditure (consistent with the Engel's law). Overall, agricultural labor share increases as temperature worsens, therefore inhibiting structural transformation. Agriculture is also the worst affected sector in terms of productivity due to climate change since both land and labor productivity declines. Both economic growth and climate adaptation should enable movement of labor out of the agricultural sector.

Trade is often acknowledged as an adaptation tool in both the climate change and food problem literature. To test its efficacy in breaking the positive relationship between temperature and agricultural labor share, I create a measure of agricultural market access for each district in India using changing travel times over time as a consequence of highway construction. I find that trade is ineffective in India due to internal trade barriers created by an agricultural policy from the 1960s that forces farmers to sell their produce at government-designated marketplaces. The farmers are faced with declining agricultural productivity, combined with low prices due to limited access to markets, this results in employing all family labor on farms (subsistence farming), therefore creating a new poverty trap.

I then develop a static spatial equilibrium model with internal trade barriers in agriculture. Using counterfactual analysis, I find that removing these trade barriers can help agricultural labor to adapt to climate change by reallocating their labor away from agriculture. Removing internal trade barriers can help decrease agricultural labor share by 11% for every district in India, which is equivalent to 28.9 million people across India.

This research underscores the importance of internal market reforms to enable smoother structural transformation and enhance adaptation in response to climate change. Beyond India, these findings have broader implications for other developing countries facing similar challenges, indicating that internal political economy reforms may be as critical as international trade policy in mitigating the economic impacts of climate change. This is the first paper to examine the role of internal trade barriers in creating barriers in adaptation to climate change.

In another paper in my dissertation, *Stumped by the Sun, Saved by the Side: The role of peer and adversarial effects in adaptation to heat*, I explore how peer dynamics can mitigate the negative effects of heat on labor productivity. Using high-frequency data from international cricket combined with climate variables, I find that while rising temperatures reduce individual productivity, peer effects significantly compensate for these losses. My analysis shows that peers with complementary skills are particularly effective in helping workers adapt to high temperatures, highlighting the role of team dynamics in labor market adaptation to climate stressors. This work aligns with my broader research agenda by emphasizing the importance of both individual and collective responses to climate change. By uncovering how environmental stressors interact with team settings, this paper contributes to a deeper understanding of adaptation mechanisms in labor markets and informs policies aimed at enhancing resilience in sectors where teamwork is critical. This paper contributes to the existing literature on temperature and productivity and advances the field by incorporating inter-worker interactions under heat stress. This paper also contributes to the literature that shows that coordination mitigates negative outcomes. This phenomenon

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has been observed in kinship networks in development literature. Most importantly, this paper makes a methodological contribution by being the first to utilize split-sample variance decomposition analysis to estimate the magnitude of variance in components at low and high temperature.

Works in Progress

Additionally, in a joint project with Matthew Gordon (Assistant Professor at the Paris School of Economics), I am interested in examining how climate change impacts informal insurance networks in India, which are critical for helping households cope with shocks, especially in the absence of formal insurance markets. These networks rely on a significant mass of participants to function effectively, but climate-induced pressure may drive individuals to seek temporary migration in search of better opportunities or more secure livelihoods, thereby weakening the network's collective capacity. This project will explore this tension between individual adaptation strategies, such as temporary migration, and the continued viability of informal networks that are more essential than ever as environmental shocks become more frequent and severe. We will be focused on informal insurance networks in India in this project. I have acquired ICRISAT Micro-level dataset which is a panel of households from six villages of Andhra Pradesh and Maharashtra. Temporary migration is often undercounted for in household surveys, ICRISAT dataset asks households about temporary migration in detail. Using this data, we seek to understand how climate change alters the dynamics of informal insurance networks and the importance of it for designing policies that balance individual and community resilience. This paper ties climate change related risks to an existing literature on rural informal insurance networks and migration (Townsend 1994; Morten 2019).

Deforestation, Trade, and the EUDR

Works in Progress

In an ongoing project with Matthieu Stigler (Assistant Professor at GSEM, University of Geneva) and Sabine Stillger (Postdoc at GSEM, University of Geneva), I study how international environmental regulation, such as EUDR (European Union Deforestation Regulation), reshapes global trade patterns. EUDR is a major shift in global trade governance and an effective ban on seven commodities grown on land cleared after 2020. The EUDR is an import ban rather than a tax such as Carbon Border Adjustment Mechanism. Physically identical units are priced apart once their land of origin is documented. Additionally EUDR only targets new clearing rather than the stock of deforestation. Whether it lowers deforestation globally is not obvious, since excluded output can be rerouted to non-EU buyers or producers can substitute into non-EUDR commodities that the regulation does not cover.

We develop a static multi-region general equilibrium trade model with endogenous land use and crop choice. EUDR act as a market-access constraint that confines newly cleared land output to non-EU markets once old-land supply can no longer cover EU demand. We solve for four counterfactuals: i) the EUDR against a first-best Pigouvian tax on clearing, ii) A deforestation-rate tariff, which depends on embedded CO2 emissions in deforestation linked commodities, iii) Certification-cost incidence, since certifying your land to be EUDR compliant can be costly, we estimate who bears the cost of proving

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compliance. does it show up as distributional effect across producers or as additional leakage, iv) an extension to buyer coalition beyond the EU (including UK, USA, China) to trace how large a coalition must be before diversion stops being possible. This paper contributes to the literature on unilateral environmental regulation by quantifying how effective is a demand-side ban in reducing deforestation.

Energy Transition and Climate Policy

Current Works

In a solo-authored paper, *Fragile Flames: Geopolitical Shocks and Clean Energy Transition*, I study the resilience of clean energy transitions to supply-side shocks in import-dependent economies. The February 2026 closure of the Strait of Hormuz cut off approximately 60-70% of India's LPG imports, generating an abrupt exogenous supply disruption to the cooking fuel used by over 300 million households, including beneficiaries of Ujjwala, the world's largest clean cooking initiative. Using pre-shock variation in LPG adoption across districts as the primary source of identification, I estimate the causal effect of this disruption on local air quality estimated using a Difference-in-Difference estimation. Contrary to the expectation of a reversion to biomass, I find that districts with high pre-shock LPG usage experience declines in CO and SO_2 alongside an increase in NO_2, which is a pollutant fingerprint consistent with substitution toward grid electricity rather than solid fuels. This pattern is concentrated in wealthier districts, this reveals that there is a wealth-mediated fragility in the clean energy transition. These findings suggest that policymakers in import-dependent countries must pair clean cooking programs with investments in affordable and reliable electricity access to ensure the durability of energy transitions under supply shocks.

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