Research Statement

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I am an economist who specializes in topics at the intersection of international trade and environment. My research focuses on the economic and environmental consequences of international trade in waste across countries. I also study topics on the interplay between regulation and international trade. I particularly investigate the incentives for joining waste trade agreements, the channels of diffusion of regulations in an international trade network, and the regulation and product characteristics affecting such diffusion. My work has delivered insights about waste types and countries to target while framing policies regulating waste trade, how economic incentives can influence countries to adopt health and environmental policies, and the factors that facilitate such regulatory propagation. I utilize observational data to employ both modern econometric techniques and structural estimation methods to answer my research questions.

Waste Trade. International trade in waste has experienced a five-fold increase over the past three decades. Despite the growing volumes, waste trade is a contentious issue among countries and an overlooked component of international trade. In my job market paper, titled "Welfare Effects of International Trade in Waste", I quantify the economic and environmental consequences of this negative-externality-generating component of international trade. I build a structural gravity model of trade with the generation of waste micro-founded as a by-product of manufacturing. To assess heterogeneity in welfare, I decompose waste into low- and high-value types, which differ both in the nature of their trade flows empirically and in the ease of recycling, useful in quantifying environmental costs. To quantify heterogeneity in gains to trade by waste type, I estimate separate trade elasticities for the two types. I find that low-value waste is more sensitive to trade barriers than high-value waste, which suggests that greater benefits accrue from importing high-value waste than low-value waste. The observed trade patterns appear to arise from differences in waste-processing technology available in different countries. Processing high-value waste requires technology that is available in only a select set of countries. As a result, technological availability swamps trade costs in determining flows of high-value waste. Conversely, trade costs swamp technological considerations while determining the direction of low-value waste trade. I also find that richer countries spend a higher fraction on importing high-value waste than low-value waste.

I find that existing patterns of waste trade make countries of all income levels better off even after accounting for environmental costs. However, low-value waste trade, which creates large negative externalities relative to its private value, makes middle income countries, who are major importers of this type, worse off. My results demonstrate that accounting for general equilibrium forces, specifically the scale and compositional changes in waste generation, apart from the re-location of waste due to changes in trade policy can deliver counter-intuitive results. Opening up to waste trade leads to a rise in environmental costs even as more options for dealing with waste become available. I also study the welfare consequences of recent policies regulating waste flows. China's ban on low-value waste imports increases net welfare in China and several lower income countries. I find that the China ban makes both middle- and low-income countries better off relative to an overall low-value waste trade ban which is only beneficial to middle-income countries. I also study the Basel Ban amendment, where exports of all waste is banned from a set of developed countries to a set of developing countries that

ratified the amendment. Countries of all income levels are hurt by this policy. Surprisingly, this policy that is meant to favor developing countries that ratified the amendment hurts them the most, similar to an overall waste trade ban. My findings also show the implications of waste trade policies for other sectors of the economy, particularly for manufacturing where waste is a crucial by-product. I find that while banning high-value waste trade hurts the manufacturing in high-income countries who are major producers of this type, banning low-value waste trade hurts production in the poor countries.

Trade agreements can affect the economic outcomes not only for members but also for non-members, thereby creating incentives for them to join the agreement. In an early-stage paper with George Deltas, titled "Membership in Quasi-Exclusive Multilateral Agreements: The Incentives to Adopt the Basel Convention", we study this aspect of an international waste trade agreement, known as the Basel Convention. The Basel Convention, which regulates the flow of hazardous waste across countries, works on a prior-informed-consent system, whereby before the actual waste shipment takes place, the exporting member country must notify the importing member country and the importing country must consent to that shipment. Members are also prohibited from trading in hazardous waste with non-members unless they have a no less environmentally sound side-agreement with such non-members. Using panel data for accession to the Convention by countries combined with data on bilateral waste flows for 32 years, we find that country pairs where at least one partner hasn't ratified the Convention trade more than pairs where both did. However, as the share of countries part of the Convention increases, the trade among members increases while that among country pairs where either is a non-member decreases. Our results show that once the share of member countries hits the 60-70% threshold, members account for a larger share of world waste trade than non-members, thereby creating economic incentives for such countries to join.

Regulatory Diffusion. Regulatory Diffusion. In contrast to the aforementioned works that focus on the impact of regulation on economic outcomes, I also investigate how the trade structure creates economic incentives for adoption of regulations. In a joint work with Sergio Rocha, titled "Trade Networks and Diffusion of Regulatory Standards", we use panel data on adoption of regulations—Technical Barriers to Trade—by countries and spatial econometric techniques to study network effects in the diffusion of regulatory standards through international trade. We find that countries tend to domestically adopt regulations that they comply with when exporting internationally, suggesting that the pressure induced by regulation-imposing importers is a meaningful channel of diffusion. A country's incentives for unilateral adoption of regulations that impose constraints on domestic producers are limited when competing against non-regulated foreign producers. However, when a country is pressured to comply with these regulations while exporting, the gains to domestic adoption can outweigh the costs imposed by such constraints. Thus, countries that adopt stricter standards can effectively encourage further implementation in exporting countries, possibly resulting in widespread adoption of these policies.

We also assess heterogeneity in diffusion by regulation types and a country's trade openness. We show that diffusion is stronger for *product* standards—regarding physical attributes of the final product—than *process* standards. This finding likely reflects that compliance with product standards is easier to observe in the imported product and that these regulations are more cost-effective than those that involve adjustments to the manufacturing process. Both these factors confer a competitive edge to exporters implementing product standards in international markets. Consistent with such network propagation, we show that countries more open to international trade are the drivers of regulatory diffusion, providing evidence that economic integration is a main driver of regulatory propagation. Using descriptions of

measures necessary for the admissibility of products into regulation-imposing countries and text-analysis, we also develop an understanding of regulatory diffusion at an even more granular level. Our results suggest that requirements ensuring safety are most widely adopted as labelling regulations diffuse across countries. Further, we find that countries tend to adopt regulations with requirements similar to those imposed by their export destinations, suggesting a *within* regulation diffusion in individual requirements, which provides additional evidence in favour of a network effect.

In "Transboundary Diffusion of Regulations: Role of Product Proximity and Product Heterogeneity", Sergio and I intend to continue this line of inquiry by expanding the empirical framework to incorporate several products. The ease of adoption of a regulation depends on the value added from adoption, which varies by type of commodity, and the proximity of the commodity to one for which the regulation has already been implemented. Expanding the spatial econometric techniques to high-dimensional panels, we intend to quantify this indirect channel of diffusion of regulations across commodities. Combining our data with information on product complexity, hazardousness, and end-use should also allow us to determine product characteristics more strongly associated with diffusion due to pressure from importers. In essence, we expect that our framework will allow us to delve into indirect channels of propagation of regulations and product characteristics driving diffusion as opposed to the literature that has focused on trade of a single commodity or aggregate flows.

Future Research. In the near future, I will continue to investigate topics on waste trade and the interplay between regulations and international trade. George Deltas and I plan to develop a dynamic model capturing the main forces driving the decisions by countries to join the Basel agreement and the time duration before their entry. In addition to our findings on economic incentives driving such decisions, we plan to incorporate other factors, particularly information on country-level environmental preferences. In my work with Sergio Rocha, we hope to combine our already rich setting that has information on adoption of 30 different types of regulations on several commodities with information on end-use, hazardousness, and product complexity to identify product characteristics driving diffusion of regulations in a trade network. Our current finding that diffusion is stronger for product regulations than process regulations is partly because conformity with product regulations can relatively easily be monitored by regulatory bodies. Extending that reasoning to heterogeneity across commodities, we expect stronger diffusion for final goods than intermediate goods. The diffusion should also be stronger for products for which the value of expanding implementation from other related commodities exceed the costs. Our dataset would also allow us to uncover the extent of this indirect cross-commodity diffusion.

In the long-run, I see myself using advanced estimation methodologies to study topics at the intersection of international trade and the environment. Many topics related to waste are unexplored, e.g. long-run effects of China's ban on waste imports or how reductions in demand for energy from fossil fuels would impact generation of plastic waste, especially in light of growing plastic waste regulations. I hope that through a finer understanding of the underlying economic forces in my research, I can help inform sound policy-decisions.