Research Statement

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My research interests are International Trade and Labor Economics, mainly related to the effect of automation and globalization on employment. Employment is central to people's life. A secured job with satisfactory compensation serves to a quality physical and mental health and well-being, not to mention the means of living. Therefore, a mass deprivation of jobs causes social anxiety and political upheaval. Such a mass deprivation is rhetorically associated with automation and globalization. On one hand, a new technology that automates jobs (e.g., industrial robots, artificial intelligence) previously performed by workers could make them unemployed. On the other hand, a deepened economic tie across the world and regions can shift employments geographically and across sectors. Therefore, a clear theoretical understanding and thorough empirical investigation of the impact of automation and globalization on labor markets are needed.

Current Research. Motivated by these observations, my doctoral dissertation explores the impact of industrial robots and multinational enterprises on labor market outcomes in the US and Japan. My findings highlight the quantitative importance of these automation and globalization on earnings inequality measured by wage inequality and factor shares. I also define geographic units for empirical analysis in another technical paper since geography is an essential margin of labor market adjustments.

In my job market paper and the first chapter of my dissertation, I study the distributional and aggregate effects of industrial robots. In the last three decades, the global market size of industrial robots, measured by the number of robot arms, has grown by 12% annually. International trade of robots is also sizable as 41% of all robots are imported. Robots have gradually substituted for workers in some occupations, raising concerns about the distributional effects of such trends. These facts led me to study the distributional and aggregate impacts of industrial robots by combining new data on robots with a model with substitution between robots and labor within an occupation, international trade of robots, and dynamic robot accumulation. I find that robots contributed to the wage polarization across occupations in the US in 1990-2007. A commonly advertised robot tax could increase the US real income in the short run, but leads to a decline in the income in the long run due to robot de-accumulation. These findings indicate that robots can have broader distributional impacts than those considered in the previous literature, and regulating robots can positively impact the aggregate income.

The second chapter of my dissertation examines the impact of industrial robots on employment in Japan, the country with the longest tradition of robot adoption. We obtain a novel data set of robot shipments by destination industry and robot application (specified task) in quantity and unit values, from the Japan Robot Association. The data show that there is a heterogeneity in robots' application across industries and differential price changes across applications. Using an identification strategy leveraging these variations, we find that across sectors and regions (commuting zones, constructed in our separate project detailed below), a decline in robot prices increased the number of robot arms and total employment. This finding suggests that robots and labor are gross complementary

at the industry level. Note that each industry aggregates the occupations, and thus the result is consistent with the above finding that robots are substitutes with labor within an occupation. This chapter's conclusion raises caution for the commonly advocated interpretations that industrial robots deprive humans of jobs.

In the third chapter of my dissertation, my coauthor and I investigate the impact of multinational enterprises (MNEs) on the labor share in the headquarter country. We leverage a unique natural experiment: the 2011 Thailand Floods. The floods had a substantial impact on manufacturing clusters in areas north of Bangkok city and affected Japanese MNEs by forcing them to halt operations of plants located in the cluster. We employ a uniquely combined Japanese firm- and plant-level microdata that track wages, employment, fixed assets in Japan, and employment in foreign subsidiary plants. We estimated demand elasticities of factors (capital and labor) employed in Japan with respect to foreign productivity. Our theoretical analysis suggests that foreign factor augmentation increased capital demand in Japan more than labor demand, implying that the foreign factor augmentation contributes to reducing Japan's labor share. Therefore, we established an association between the rise of MNEs and earnings inequality measured by the labor share.

In other work, we construct commuting zones (CZs) in Japan. Geography is critical when considering the effects of various shocks on labor markets because many workers are closely tied to the local labor market. At the same time, workers commute to other municipalities, complicating the impact of automation and globalization on labor markets. On the academic front, due to administrative reasons, rich sources of data typically exist at the region level. Economists from several fields (e.g., trade, labor, macro) are intensively using such data to draw insights. These points make it essential to define geographic units for empirical analysis properly. We constructed CZs based on the observed commuting patterns across municipalities and a machine learning method of agglomerative hierarchical clustering. Although the technique involves an ad-hoc choice of the number of units, our paper yields an internally consistent set of CZs in Japan quinquennially between 1980 and 2015, which is currently available to the public.

Work in Progress. As a part of my future research agenda, I plan to extend the first and second chapter of my dissertation to obtain further evidence of the labor market consequences of automation, including a uniquely designed plant-level analysis. This currently comprises two projects. In the first project, we are negotiating to access the list of plants that adopted industrial robots with the cooperation of the Japan Robot Association. We will also leverage the change of corporate tax regime and study its effect on adopting robots and employment within each plant. Upon successful completion, the analysis would give explicit knowledge about the impact of adopting robots on employment using microdata and an exogenous source of variation of policy changes. In the second project, we design a plant-level survey of robots and other automation technologies (e.g., artificial intelligence) in Japan. Although industrial robots received attention due to the data availability relative to other automation technologies, it is still vital to empirically and theoretically study the effect of other automation technologies on employment at the micro-level. We collaborate with Japan's Research Institute of Economy, Trade, and Industry, to design the plant-level survey of the use of automation technologies, including artificial intelligence. We expect that the effect on occupations is starkly different across the specific type of automation technology.

I also have been exploring the concept of optimal commuting zones (OCZs) for regional empirical analysis. Although I learned and applied the method of internally consistent delineation of geographic units in the project mentioned above, the choice of the number of units, or the coarseness of the delineation, remains reasonably arbitrary. I am not aware of a theoretically coherent choice of such coarseness or the optimal commuting zones to the best of my knowledge. Furthermore, the delineation of regions is rarely comparable across countries. Because the number of units is critical for regional empirical analysis, there is a great demand from academic researchers for regional units consistent with economic theory. The OCZs should take the right balance between the bias resulted from fine delineation and the estimation precision—the granular the unit of analysis is (e.g., from states to country to zip codes), the more precise the estimation result is due to the large sample size. However, across granular geographic units such as zip codes, the level of economic integration, such as movements of goods (e.g., shipment) and people (e.g., commuting), is substantial, making the interpretation of the estimation result tricky. I plan to formalize this problem using the classical statistical framework of bias-variance trade-off and quantitatively explore the OCZs. For example, the economic model with tight connection across regions such as an economic geography model with commuting would imply that the bias from the geographic regression analysis is sizable, preferring the coarser delineation of commuting zones. In the future, applying such an established method to commuting data in the world, I desire to construct the OCZs comparable across the globe.