Graduate Research Plan Statement

Summary: Public transportation is a public good used disproportionately by low-income individuals. Increasing access to public transit could positively impact low-income populations and research on the topic could inform urban policymakers on future infrastructure plans. I will take advantage of new train station openings over the past two decades to measure the effect of increased access to public transportation on wages. I posit two mechanisms that may increase residents' wages. First, residents are more likely to be able to retain current jobs with a more reliable mode of transportation. Second, this newfound mobility allows them to search for higher-paying jobs in a wider selection of areas in their metro region. To measure this effectively, I will exploit the random variation of construction delays to transit projects to parse out transit's effects on wages from exogenous labor-market trends.

Empirical Strategy: Isolating the effect of increased access to public transit on wages is complicated by two confounding dynamics: changing neighborhood compositions and anticipatory effects. I will address these two issues respectively by (1) measuring the effect of increased transit on individuals rather than neighborhoods, and (2) exploiting quasi-random variation in construction delays.

I first address composition effects. Rail stations are a highly valued amenity in many urban neighborhoods. A new rail station is likely to cause an influx of residents as individuals who value transit are sorted into the area. However, this migration will change the composition of the neighborhood – for example, if individuals with the means to live in a sought-after area move in, and incumbent residents are priced out. A comparison of neighborhoods at a spatial level before and after transit access is confounded by this shift in composition – while wages may increase in aggregate, for example, it will be impossible to disentangle the welfare effects of this new rail line from the fact that high-income households have replaced incumbent low-income households, and artificially raised average income. I will therefore track individuals, rather than neighborhoods, over time to isolate the individual-level effect.

Next, I will address anticipatory effects, which arise because of the long timeline of rail transit construction projects. In their 2004 paper on the introduction of Chicago's light rail Orange Line, McMillen and McDonald demonstrate that "the anticipated benefits of the new transit line began to be capitalized into house prices as early as 1987, 6 years before construction was completed," **[1]**. McMillen and McDonald's finding implies that community residents, local businesses, and other individuals invested in the area adjust to the news of enhanced transit years before they gain access to it. It is also likely that characteristics related to the local labor market will change in anticipation of the new transit line.

These anticipation effects must be considered when attempting to measure the impact of transit on wages. A simple event study measuring wages before and after the change in a single neighborhood will not isolate the effects of transit on wages, but rather will include bias from changing neighborhood characteristics. And comparing a neighborhood which was chosen for a new station to one which was not would be confounded by unobserved characteristics which make a given neighborhood more likely to receive such an investment, so growth trends in these two neighborhoods may be fundamentally different. To address anticipatory effects, I will make comparisons only across neighborhoods that eventually received transit projects. I will exploit as-good-as-random variation in the timing of station openings generated by the unpredictable length of environmental reviews, using a difference-in-differences estimator to compare wage growth of residents near newly opened stations to those near a station whose opening is still delayed by review.

I will employ the Longitudinal Employer-Household Dynamics (LEHD) data at the Census Bureau to track the residential location and labor market outcomes of individuals over time. The Transit Costs Project (TCP), a project funded by the NYU Marron Institute of Urban Management, and Tyndall (2019) have together identified 21 U.S.-based rail projects featuring a total of 187 station openings across 10

cities **[2]**. I will identify individuals in the LEHD who live near these stations at the time of announcement and compare their wages before and after station openings.

Any transit project which receives federal funding must complete the National Environmental Policy Act (NEPA) evaluation process. The process requires an environmental impact statement (EIS) if the project is likely to have a significant impact on the surrounding environment, which includes nearly all new rail projects. Delays often result from EIS findings which require projects to adjust to environmental roadblocks in accordance with NEPA. Other delays may result from environmental factors like severe weather or from political factors like local elections. While nearly every transit-related construction project will likely be delayed for some period, the length of these delays will not be foreseeable by residents or stakeholders and will therefore be exogenous to anticipation effects. I will take advantage of this exogenous variation to compare individuals in neighborhoods with a delayed station opening to those in neighborhoods with a completed opening.

I will create a time index in relation to when a given station opening was planned. The Environmental Protection Agency's (EPA) EIS database maintains all records of EIS submissions since 1987. Each EIS reports an anticipated opening date. I will be able to cross-reference this database with the database of transit projects to create the index. I will then execute a difference-in-differences analysis which takes advantage of the exogenous nature of these delays. I will regress wages of individual i during period j on the status of the individual i's proposed station in the same period ($OpenStation_{i,j}$). This treatment effect will vary based on neighborhood type k, accounting for heterogeneous treatment effects by neighborhood type. I will control for neighborhood fixed effects (θ_i) and period fixed effects (γ_j), where $j = 0$ is the period when the station was meant to open. For a given period j relative to announced opening date, stations will be open in some neighborhoods and closed in others due to the unpredictable length of delays. I will also include a vector of worker-level controls (X_i).

$$Wages_{i,j} = \beta_k OpenStation_{i,j} + \theta_i + \gamma_j + X_i + \epsilon_{i,j}$$

Intellectual Merit: While previous papers have focused on the impact of transit on neighborhood-wide employment, the effect of transit on individual welfare is studied significantly less frequently. Neighborhood-level measures of the effectiveness of transit are confounded by changing neighborhood compositions in response to increased access to transit. My analysis will allow me to measure the degree to which bias is introduced as a result of composition effects in the existing transit literature. Further, my approach will allow me to measure the degree to which previous studies are measuring compositional – as opposed to individual – treatment effects.

Broader Impacts: Public transit riders are disproportionately low-income compared to the general population **[3]**. However, transit is not universally available. Nearly half (45%) of Americans have no access to public transportation, and 41% of households have one or fewer vehicles for commuting purposes **[4]**. Therefore, expanding transit could increase commuting and employment opportunities, especially for lower-income households. My proposal will provide policymakers with a crucial benefit component of a cost-benefit analysis of new transit projects. Understanding the way transit impacts residents and neighborhoods differently will inform which neighborhood benefit the most and hence inform location choice.

References: [1] McMillen, D.P. and McDonald, J. (2004), Reaction of House Prices to a New Rapid Transit Line: Chicago's Midway Line, 1983–1999. **[2]** Tyndall, J. (2019), The Local Labour Market Effects of Light Rail Transit. **[3]** U.S. Census Bureau report "Commuting by Public Transportation in the United States: 2019". **[4]** ASCE report "Infrastructure Report Card: Transit".