

Connor Lewis and Joseph Nolan

10OCT25

Econ 582: Replication Paper First Steps

Selected Paper: Duranton, Gilles and Turner, Matthew A. (2012). Urban Growth and Transportation, *The Review of Economic Studies*, 79 (4): 1407–1440. DOI: 10.1093/restud/rds010

Extension Summary

For our replication paper, we have selected the Duranton, T. and Turner, M.A. (2012) *Urban Growth and Transportation* from *The Review of Economic Studies*. We intend to replicate the results of this paper by checking submitted data against the following primary sources: the County Business Patterns (CBP, various years), the US Census (all censuses between 1920 and 2000), and the US Highway Performance Monitoring Survey (HPMS, various years); by confirming estimates using an alternative computer package: RStudio and Python, and by comparing the findings of a two stage least squares (2SLS) regression analysis with the original authors' limited information maximum likelihood (LIML) analysis.

Contingent upon finding a sufficient dataset to augment what exists, we are considering a wider extension of the paper by using metropolitan statistical area (MSA) GDP growth as a dependent variable and reviewing the effects of clustering by geographic region. Differences in the effect of highway stock on MSA GDP and employment may suggest the level of job quality that new employment creates. That is, increased employment without a comparable increase in MSA GDP may suggest that low quality jobs are being created as highway stock increases. Duranton and Turner also consider the effect of increased highway stock on employment growth in MSAs of different sizes, finding no significant difference between their overall estimated effect and the effect in different MSA sizes. We plan to explore if there is a regional effect, given the difference in urban fabric or sprawl in cities of different regions, e.g. southern sprawl vs northeast density.

Introduction

Through much of the last century, we have seen the importance of automotive transportation influence countless aspects of American society. Whether it be relying on cars for daily commutes or the emergence of logistics as a key economic sector in centrally located cities such as Memphis, TN and Louisville, KY as evidenced by the investments of industry leaders FedEx and UPS in these cities respectively, automotive transportation is ever-present in our daily lives. When considering the dominance of automotive transportation, it is a disservice to ignore the influence of the interstate

highway system. Considering this, it is of interest to evaluate the system's impact on the growth of metropolitan statistical areas (MSAs) as this can inform future decisions to construct new highways and roads. Further, this also provides a foundation for estimating related externalities that occur after road expansion. These externalities, for example, could include developments in the workforce and changes in preferred leisure activities because of increased or decreased convenience.

Our replication investigates the impact of additional interstate highway stock on US city growth through the use of RStudio and primary data sources. The original authors used employment as a proxy for measuring growth. During our replication, we will also consider MSA GDP as an alternate measure of US city growth. Additionally, we plan to further extend their research by clustering observations to account for regional similarities between MSAs.

Prior to the contributions of Duranton and Turner, economic research highlighting determinants of urban growth failed to focus on transportation due to limitations in the availability of data. Instead, the research primarily highlights topics such as agglomeration, human capital, and the climate. Beyond the literature on urban growth determinants, the research also added to the investigation of theoretical urban models. These theoretical models mostly did not focus on the interstate highway system but rather centered around land prices and use. However, Baum-Snow used instrumental variables (IV) to estimate the effects of the interstate highway system on suburbanization. This found that populations in downtown areas decrease when new highways are implemented that pass through a central city.

Previous research on infrastructure investment is also relevant to our study, as Fernald highlighted the positive impacts of roads on productivity, particularly in industries that have a higher vehicle use. The research in this area is now more focused on more granular areas and has shifted its measurements to modeling population distribution and economic activity instead of productivity. Additionally, research has addressed the shortcomings of early work's reliance on likely exogenous variables.

Since Duranton and Turner published their work in 2012, urban economic research regarding roads has continued to mature. In 2024, Rauch and Brandily evaluated how within city roads fostered growth in cities and towns in Sub-Saharan Africa. This found that high road density and evenness led to city centers growing faster. Though the sample used by Rauch and Brandily differs from our own, this work continues to underscore the importance of transportation networks in fostering growth. Earlier this year, researchers, Hope, Prah, and Adukpo, found that transportation investment has a higher correlation with urban economic growth when compared to investments in broadband and utilities.

This further shows the relative value of our study in the broader topic of infrastructure investment.



Our model estimates the relationship between population growth and road stock, using employment growth as a proxy for population growth and the distance of interstate miles in an MSA as a proxy for road stock. Additionally, the model uses three instrument variables (IVs) to remove the endogenous relationship between road building and employment rates (higher employment rates are correlated with having more roads) by establishing a baseline road stock for each respective MSA. These IVs are the 1947 Interstate system plan, the 1898 US railroad stock, and early exploration routes. These are based upon the ease of building roads rather than the economic activity generated in an MSA.

In addition to the instrumental variables, we plan to utilize historical data to conduct our analysis. This data includes statistics on 1983 and 2003 employment and length of interstates for an MSA using 1999 measurements of American MSAs. In order to measure the change in employment, we leverage County Business Pattern data provided by the United States Census Bureau; however, it should be noted we may replace this data with an alternative measurement of economic growth, contingent upon its availability. Data used to measure road growth originates from the HPMS for the years of 2003 and 1983, which measures the length of interstate highways. Additional data on MSA characteristics such as the log of mean income, percent of the population with a college degree, and indexes of segregation also implement the use of Census data from the 1980 Decennial Census while data from the 1920 to 1970 Decennial Censuses regarding population are used as controls.

Directory Management, Automation, and Version Control

Presently, we are using OneDrive to host our directory for this project. This platform provides version control familiar to us, provides cloud backups, and allows easy integration with Microsoft applications. However, we will explore Git platforms such as GitHub and BitBucket as alternatives to OneDrive. As free and open-source software (FOSS), they will allow us to maintain long-term accessibility to our work and are commonly used in social science research and other programming work. Additionally, they appear to provide specific repository and version control features that will benefit our work.

We plan to structure our directory into a data building file and an analysis file. Within these subdirectories, we will further separate by inputs, code, outputs, and temporary files. This will allow us to clearly understand the nature of each file in the

directory and better design our code. The intended design of our code will conduct all data cleaning and preparation automatically, receiving the raw data as an input and the clean data as an output; will conduct analysis; and will create all tables and export them as .tex files. This may require more than one script, but our goal is to minimize .r scripts.

Works Cited (Not included in the original paper)

Brandily, P., & Rauch, F. (2024). Within-city roads and urban growth. *Journal of Regional Science*, 64, 1236–1264. <https://doi.org/10.1111/jors.12699>

Hope, Jemima & Prah, Linda & Adukpo, Tobias. (2025). Urban Infrastructure Investments and Economic Growth: Examining the Impact of Transportation, Utilities, and Broadband Expansion in the United States. *Asian Journal of Economics Business and Accounting*. 25. 180-191. 10.9734/ajeba/2025/v25i51793.