Fluctuations of Real GDP in Metropolitan Cities Based on Transportation Infrastructure

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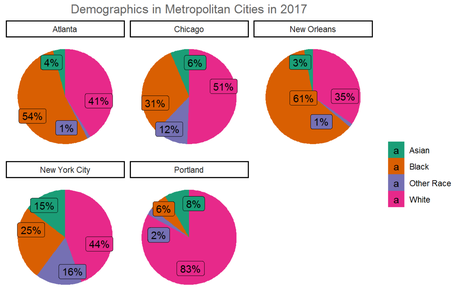
Abstract

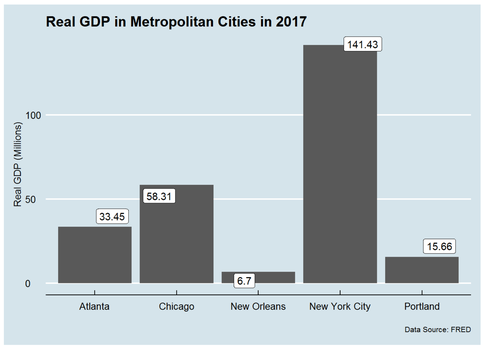
Public transportation is a popular topic of continuous partisan divide as while buses and trains ease urban migration in densely populated areas, they rarely turn a profit due to large overhead costs and cheap fares. Motor vehicles still outcompete public transportation in terms of time efficiency, and alternative modes of transportation (including ride-sharing, walking, and bike commuting) are favored due to personal convenience and health benefits. To evaluate the economic value public transportation provides to real GDP, five metropolitan cities were selected to run panel data fixed effects analysis including city and train ridership interaction terms on 8 waves of data. When looking at Portland and Atlanta, a one unit increase in train ridership in Portland is associated with an increase in real GDP compared to Atlanta. Surprisingly, every selected metropolitan city experiences an increase in real GDP when annual train ridership is controlled. Arguably, the main aim of public transportation is service to the public rather than profitability, yet municipal budgetary constraints should be addressed.

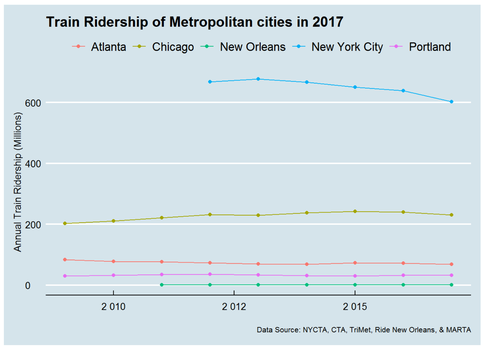
Literature Review

Previous economic studies on public transit systems found that the relationship between public expenditure and real GDP (GDP adjusted for inflation) is negative (Devarajan, Swaroop, and Zou 1996). Because they operate under municipal transit authorities, mass transit requires government investment to function through levying taxes. In a typical undergraduate macroeconomics course, GDP is defined as $Y = C + I + (T - G) + NX$ where government spending (G) reduces national economic output (Y) (Mankiw 2016). However, GDP fails to account for economic well-being which is what public transit is designed for people of all socioeconomic backgrounds. Interestingly, the demand for mass transit services vary heavily in the short-, medium-, and long-run as fare elasticity increased as the time period expanded (Paulley et al. 2006).

Figures







Methods

By performing a panel data regression with fixed effects, the influence train ridership has on each city is controlled for:

$$Y_{it} = \alpha_{it} + \beta_1 X_1 t + \beta_2 it X_2 it + \beta_3 X_1 t X_2 it + \ldots + u_{it}$$

where

- Y_{it} is real GDP where i = city and t = year
- α_{it} is the unknown intercept for a city
- β is the coefficient for an independent variable (IV)
- $X_1 t$ represents a city
- $X_2 it$ represents annual train ridership
- $\ldots$ indicates other variables are included
- u_{it} is the error term

The model will be based on 5 major metropolitian cities with sufficient and non-sufficient public transportation infrastructure (Boston was not included due to the lack of public data on ridership statistics):

- Atlanta
- Chicago
- New Orleans
- New York City
- Portland

and the model will be tested for 8 years from 2009 to 2017 to perform panel data analysis with fixed effects (Torres-Reyna 2007). Unlike (Paulley et al. 2006), the time period will not be separated into categories as the model will isolate the effects of time on real GDP (Millo 2017).

Results

	Dependent variable:	
	log(real_gdp_millions)	
	Base Model	Interaction
	(1)	(2)
Log(Train)	-0.313**	-1.097***
	(0.150)	(0.242)
Log(Population)	-0.057	0.212
	(0.191)	(0.174)
White	0.00000	0.00000
	(0.00000)	(0.00000)
Black	0.00000	0.00000
	(0.00000)	(0.00000)
Asian	0.00000	0.00000
	(0.00000)	(0.00000)
Other Race	-0.00000	-0.00000
	(0.00000)	(0.00000)
Chicago * Log(Train)		0.291
		(0.864)
New Orleans * Log(Train)		1.088***
		(0.364)
New York City * Log(Train)		1.801*
		(0.941)
Portland * Log(Train)		1.371***
		(0.319)
Observations	40	40
R^2	0.374	0.678
Adjusted R^2	0.158	0.498
Note:	*p<0.1;* ***p<0.05;*** p<0.01	

Conclusion

The effects of annual train ridership on real GDP compared to Atlanta have the largest effect in New York City although the effect is more significant at Portland and New Orleans. While the results imply that the actual effects are small, annual train ridership for all the listed cities increase real GDP rather than decrease. The base and interaction models share little effect from the influence of demographics on real GDP. Limitations exist in the data itself as annual train ridership for New Orleans and New York City are missing some observations due to its availability. For future research to account for economic well-being, information on commute time, departure delays, and arrival delays for each train trip from one city to another as if commute times decreased over time, investing in public transit may have merit.

References

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