The Built Environment, Travel and Income Inequality

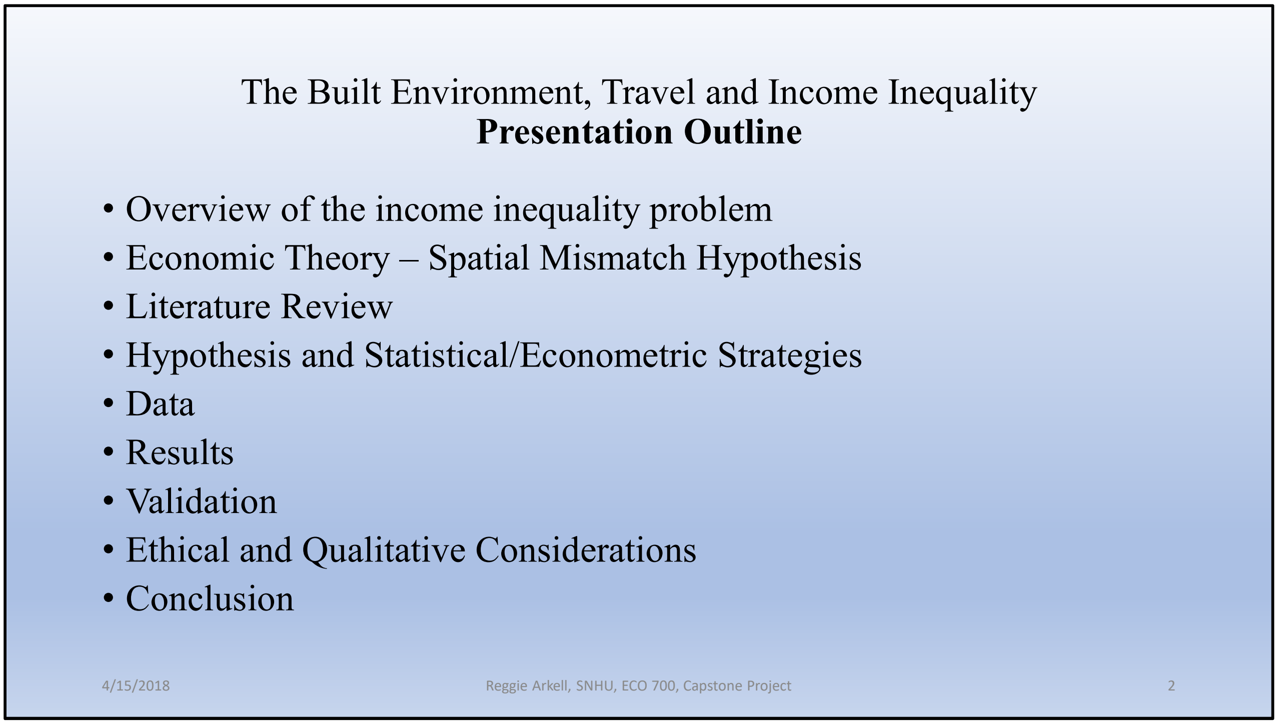
Reggie Arkell
Southern New Hampshire University

ECO 700 Applied Economics Capstone

9-1 Final Project: PowerPoint Presentation

April 15, 2018

Hello. My name is Reggie Arkell. I am a student in the Southern New Hampshire University Master of Science in Applied Economics program. My capstone project is an econometric analysis of the relationship between both the built environment and travel with income inequality in the United States. I chose this topic as I wanted to know if there is an association as the results could help to inform land use and transportation planners and decisionmakers to strategically address income inequality. In other words, can income disparities be predicted based upon population and employment growth planning scenarios such as geographic expansion versus infill and more compact development?



The outline of my presentation will begin with an overview of the income inequality problem in recent decades. This will be followed by a look at related economic theory in the form of the Spatial Mismatch Hypothesis. We will then delve into past research on the association between urban form and inequality. The null and alternate hypotheses will then be stated followed by the statistical and econometric techniques used in the analysis, and identification of the data, i.e. the dependent variable of income inequality to be predicted from the independent variables or predictors. Next will be a discussion on the results of the analysis and the validation methodologies. I will then discuss ethical and qualitative concerns. Finally, a conclusion will be provided regarding the key findings, limitations, and recommendations for future research.

The Built Environment, Travel and Income Inequality

Income Disparity

- Gini Index
- Measure of disparity in distribution of income on a scale of 0 to 1.
- Higher number equates to more inequality.
- U.S. Gini increased from 0.351 in 1968 to 0.467 in 2013 (U.S. Census, 2016).
- U.S. has 41st highest GINI level of 156 countries (U.S. CIA, 2018).

The Gini Index is a common measure of income disparity in the population for a given geographic area. The scale is from a low of 0 which is indicative of perfect income equality to a high of 1 which is perfect inequality. In other words, a Gini Index value of 0 is indicative that everyone has the same income. A value of 1 means that one person has all of the income. The U.S. Census Bureau documents a gradual rise in the Gini Index over about the past 50 years from a low of 0.351 in 1968 to a high of 0.467 in 2013. According to the U.S. Central Intelligence Agency, World Fact Book, in recent years the U.S. had the 41st highest Gini coefficient amongst 156 countries.

The Built Environment, Travel and Income Inequality

Income Disparity

- Factors in Rise of Gini Index
- Increasing demand for skills to match developing technology
- Countered by lower growth in those completing college
- Stagnant minimum wage rates
- Declining union membership
- Polarization of the labor market
- Disproportionate increases in top wage rates
- Limited countermeasures of income redistribution

(Autor et al., 2006; Hatch & Rigby, 2015)

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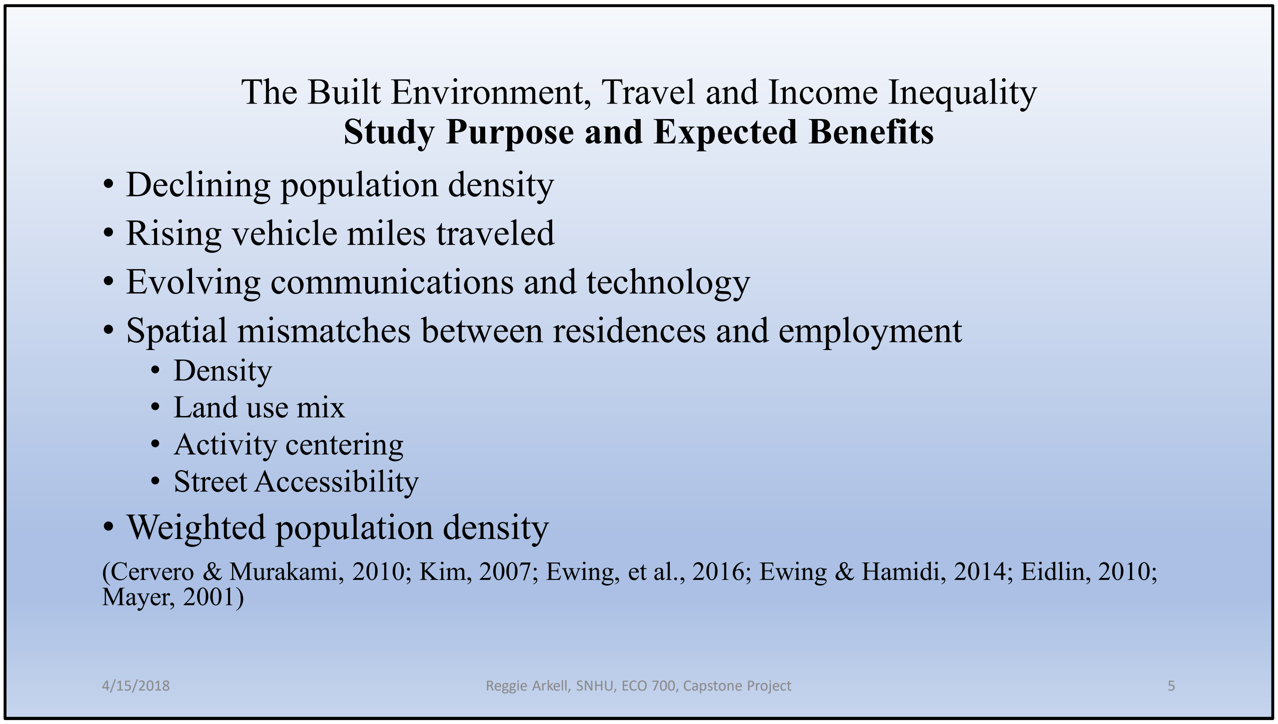
As outlined Autor, et al. (2016), extensive research exists on increasing trends of income inequality in the U.S. over the last several decades. One reason is the rising demand for higher skills due in part to technological advances countered by lower growth in persons with college educations. Other factors are decreasing purchasing power due to stagnant minimum wage rates and reductions in union memberships. Another influence is the lack of middle-income job growth and the rise in both high and low-income employment, otherwise known as polarization of the labor market (Autor et al., 2006). Hatch and Rigby (2015) cite studies identifying disproportionate increases in top wage rates and rent-seeking along with shortcomings in state/federal market and redistribution policies.



The negative relationship between standard population density (SPD) and per capita vehicle miles traveled (PCVMT) is well documented as outlined by Cervero & Murakami (2010). U.S. urban area SPD has been declining for decades due mainly to rising incomes and falling transportation costs as shown by Kim (2007). According to Mayer (2001), those businesses and households with the financial means take advantage of the evolution in transport and communications by moving outward from urban cores resulting in residential income segregation which is associated with increasing income inequality. Thus, spatial mismatches are created between low-income residential areas and employment locations resulting in larger income disparities per research by Ewing et al. (2016). These associations have been confirmed and measured via the use of a somewhat complex compactness index with metrics of development density, land use mix, activity centering and street accessibility based on research by Ewing & Hamidi (2014).

More simplified metrics of the built environment that may provide insight to income inequality are weighted population density (WPD) and vehicle miles traveled (VMT). WPD is calculated by determining SPD at census tract levels, weighting each by its proportion of the metropolitan statistical area (MSA) population and adding the results. WPD is a superior metric over SPD in measuring clustering of the population

(Eidlin, 2010). Further clarity on the elements associated with income inequality can help to inform decisionmakers on the appropriate policies necessary to address the problem.

The Built Environment, Travel and Income Inequality
Economic Theory

Spatial Mismatch Hypothesis – Distance to employment is negatively associated with income, particularly for minorities (Kain, 1994).

- Income Inequality Factors
  - Dispersed employment locations
  - Housing discrimination
  - Lack of transportation
  - Commuting travel time disparities
- Solutions (challenges)
  - Increase affordable housing with geographic uniformity (NIMBYISM)
  - Subsidies for personal vehicle vouchers (not cost-effective, exacerbates traffic congestion, energy usage, emissions, noise, etc.)
  - Roadway expansions (similar externalities)
  - Expanded public transportation (not cost-effective)

(Kain, 1994; Kain, 2004; Holzer, 1991; Andersson et al., 2014)

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The spatial mismatch hypothesis is an economic theory stating that restrictions on residential choice together with employment disbursement is responsible for high joblessness and low income, particularly for minority populations (Kain, 1994). This hypothesis has roots in groundbreaking econometric analyses in the 1960'ss by Kain of workplace and residential locations. The findings were that racial bias in housing markets greatly restricted residential choices of black households which impacted the spatial distribution of black employment and caused higher unemployment for this segment of the population. Public transportation solutions were devised in the late 1960's in an attempt to address the problem but it became clear that it was not cost-effective. Various subsequent studies of the spatial mismatch hypothesis either concurred, refuted, or found some validity in the theory with other more critical factors (Kain, 2004).

Holzer (1991) reviewed the empirical literature on the spatial mismatch hypothesis and found that the theory is valid for explaining disparities in black/white employment rates (as opposed to income) but the degree of these impacts is not certain. Most studies have relied upon cross-sectional data which limits predictive ability over time (Holzer, 1991). Andersson et al., (2014) alludes to the different accessibility measures used in the relative studies such as commute times, distance, car/transit availability. More recent longitudinal research of nine Great Lakes Region MSA's focusing on low-income displaced workers during 2000-2005 found support for the spatial mismatch hypothesis as improved job accessibility measured by lower commute time is consistent with lower duration of unemployment.

The Built Environment, Travel and Income Inequality

Literature Review - Income Inequality Associations

- Kerner Commission Report (Glenn, 1968) – Diagnosis of Urban Problems
  - Racism/Income Disparity: housing, credit, criminal justice, jobs, white flight
  - Recommendations: supplemental income, welfare, education initiatives, low-income housing
  - Lack of consensus to implement
  - 50 years Later: Minorities gain income/health but many disparities remain (Jones et al., 2018)
- Reduced health and social cohesion (Deaton, 2003)

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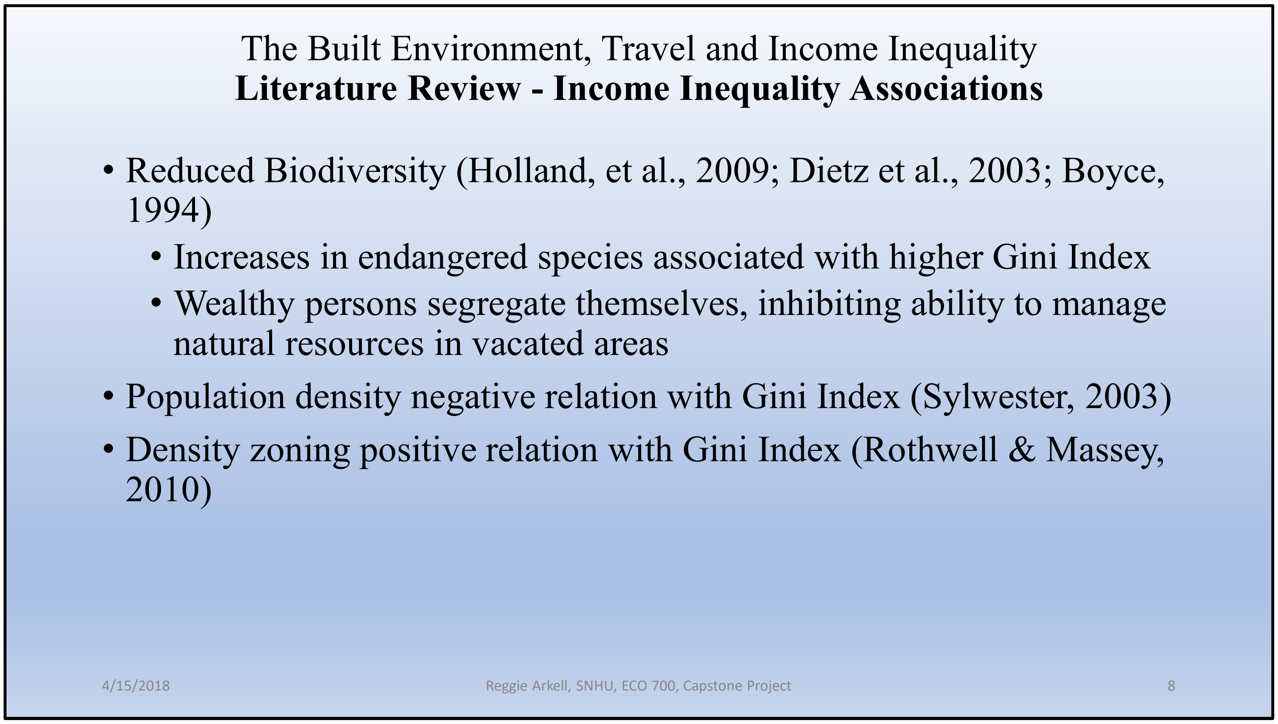
President Lyndon Johnson formed the National Advisory Commission on Civil Disorders (Kerner Commission) to investigate the turbulent race riots of the 1960's. Glenn (1968) summarizes the findings. The Kerner Report, published in 1968, concluded that urban problems were largely attributable to white racism which resulted in expanding concentrations of inner city blacks and the ghettos in which they reside. Growing resentment by blacks led further to the explosive nature of their responses.

The Kerner Report recommendations included a national supplemental income program, a welfare program primarily funded by the federal government, massive expansion of low income housing, and educational initiatives. Unfortunately, consensus was lacking on developing a roadmap to address the problem (Glenn,1968). Recent analysis by Jones et al. (2018) performed on the 50th anniversary of the Kerner Report finds that black Americans have made progress with improved high school/college graduation rates in addition to absolute gains in income and health. However, blacks still trail whiles substantially in these areas. Further, virtually no progress has been made regarding black rates for unemployment, homeownership and incarceration (Jones et al., 2018).

Deaton (2003) cites various studies which generally conclude that income inequality is correlated with reduced social cohesion and higher negative health impacts/mortality. Deaton (2003) concludes from his review of the literature that health status is more directly associated with poverty than income inequality, and that there is no detrimental effect to escalating incomes for the rich if minimal levels of income are maintained by the poor.



Holland et al. (2009) studied the correlation of income inequality and biodiversity losses across about 50 countries. One conclusion is that the proportion of endangered species threatened in the U.S. could be expected to ultimately increase from 2.7 to 3.0 percent based upon the GINI increase of 44 to 49 from 1990 to1997 (Holland, et al., 2009). Increased income inequality can compromise the ability of institutions to manage natural resources as wealthy populations tend to segregate and distance themselves from problems associated with disadvantaged populations (Dietz et al., 2003; Boyce, 1994).

Sylwester (2003) analyzed a cross section of up to 90 nations with controlling variables to determine if there is an association between SPD in several historic periods with current income inequality in 1990 as measured by GINI. The finding is a small but statistically significant negative correlation with income inequality, which diminishes in magnitude as time progresses (Sylwester, 2003).

Rothwell and Massey (2010) studied 50 suburban U.S. metropolitan areas with controlling variables to identify a relationship of SPD as determined by restrictions from local zoning codes (density zoning) with income segregation as measured by both GINI and the poor-affluent exposure index. The finding is that there is a strong statistically significant causal relationship between density zoning and both dependent variables (DVs)(Rothwell & Massey, 2010).

The Built Environment, Travel and Income Inequality

Testable Hypothesis

- Null hypothesis: $H_0: B_j = 0$

  Both WPD and PCVMT do not have respective negative and positive statistically significant relationships with GINI, and the slope of the population regression is 0.

- Alternative hypothesis: $H_1: B_j \neq 0$

  WPD and PCVMT do have respective negative and positive relationships with GINI, and the slope of the population regression is not 0.

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The null hypothesis is that both WPD and PCVMT do not have respective negative and positive statistically significant relationships with GINI, and the slope of the population regression is 0.

The alternative hypothesis is that WPD and PCVMT do have respective negative and positive relationships with GINI, and the slope of the population regression is not 0.

The Built Environment, Travel and Income Inequality

Dependent and Tested Independent Variables and Data Sources

Dependent Variable	**Source/Description**	**2000**	**2010/15**	**Change**	**3-Period**
MSA Gini Coefficient	Census, Census-ACS 15' 5-Yr Est. (B19083)	GINI00	GINI15	GINICHG	GINI
Independent Variables	**Source/Description**	**2000**	**2010/15**	**Change**	**3-Period**
MSA Weight. Pop. Density	Census	WPD00	WPD10	WPDCHG	
Urban Area Std. Pop. Density	Census	SPD00	SPD10	SPDCHG	SPD
UA Per Cap. Veh. Mile Trav.	FHWA Statistics (HM-72)	PCVMT00	PCVMT15	PCVMTCHG	PCVMT
UA Fwy. Portion PCVMT	FHWA Statistics (HM-72)	FPPCVMT00	FPPCVMT15	FPPCVMTCHG	
UA Freeway PCVMT	FHWA Statistics (HM-72)	FPCVMT00	FPCVMT15	FPCVMTCHG	
MSA Population	Census Est., Census DP-1/5-yr B01003	POP10	POP15	POPCHG	
MSA Per Cap. Pers. Income	Census P082 (15$)/5-yr B19301	PCPI00	PCPI15	PCPICHG	
MSA Dissimilarity Index	Census via Brown Univ. (racial seg.)	DISSIM00	DISSIM00	DISSIMCHG	
MSA % in Poor/Affluent Areas	Census via Brown University	PAFSEG00	PAFSEG10	PAFSEGCHG	PAFSEG
MSA % Foreign/Not Ctzn.	Census-00 DP22/ACS-15 S0501	PFBNC00	PFBNC10	PFBNCCHG	
MSA Single Fem. Head w/Child	Census-00 DP1/ACS-15/5yr DP02	SFHHC00	SFHHC15	SFHHCCHG	
MSA Median Age	Census-90, 00 PO-13/ACS-15/5yr S0102	MEDAGE00	MEDAGE15	MEDAGECHG	MEDAGE
MSA % Black Population	Census-00 PO-13/ACS-15/5yr B02001	BKPOP00	BKPOP15	BKPOPCHG	
MSA Labor Partic. (Civ.) 16-64	Census-00 DP-3/ACS-15/5yr16 S2301	LFPR00	LFPR00	LFPRCHG	
MSA Unemployment Rate 16+	Census-00 DP-3/ACS-15/5yr16 S2301	UNEMP00	UNEMP15	UNEMP	
MSA Poverty Rate	Census-90, 00 DP-3/ACS-15/5yr S1701	PVRTY00	PVRTY15	PVRTYCHG	PVRTY
MSA percent Pop. 25+ BS+	Census-90, 00 QT-P20/ACS-15/5yr S1501	EDUBS00	EDUBS15	EDUBSCHG	EDUBS
MSA Violent Crime Rate	FBI	VCR00	VCR15	VCRCHG	
MSA Per Capita GDP	Bureau of Labor Stats. (chained 09' $)	PCGDP00	PCGDP15	PCGDPCHG	
MSA Union Membership	BLS via Unionstats.com	UNMEM00	UNMEM15	UNMEMCHG	

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Data are collected as available for the variables shown covering up to 381 MSAs for the periods of 2010/2015 and 2000. Data coverage during the initial stepwise regression was restricted to about one-half of the MSAs due to limited availability of one of the potential controlling variables; union membership. However, the number of observations increased to about two-thirds (254) of the MSAs as the union membership IV relationship with GINI lacked statistical significance (i.e. it could not be shown that the association likely did not occur by chance). The missing MSAs tend to be smaller geographically but include some of moderate size. Thus, the sample size should be sufficient. One of the difficulties has been older geographic data is not consistent with more recent years. This is because definitions of some MSA's have changed over time.

The Built Environment, Travel and Income Inequality
Statistical and Econometric Strategies

- Ordinary Least Squares Regression Analysis – Identifying relationship of independent variables with one dependent variable (Gini index)
- Assumption that relationship is linear.
- Method predicts relationship by minimizing the squared sum of the differences between predicted and observed measures.
- Two cross-sectional models, one for 2000 and one for 2010/2015.

$$\hat{y} = \beta_0 + b_1 x_1 + b_2 x_2 + \cdots b_k x_k + \varepsilon$$

- One first-differenced model.

$$\Delta\gamma_{it} = \beta_0 + \beta_1 \Delta x_{1,it} + \beta_2 \Delta x_{2,it} + \cdots \beta_k \Delta x_{k,it} + \Delta u_{it}$$

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The analysis is conducted initially via the application of ordinary least squares (OLS) regression analysis. The analysis uses cross sectional data with 20 initial controlling independent variables (IVs). The dependent variable (DV) to be predicted is GINI. The primary econometric/statistical software used is STATA. Two separate level-level (raw data) models are developed based upon observations of U.S. MSAs with one based on data for the year 2000 and the other on 2010/2015.

The time-invariant element of the error term is addressed through a first-differencing fixed-effects model combining both periods. The methodology counters serial correlation (aka autocorrelation) which can cause biased estimates due to the association of variable observations over separate timeframes.

The Built Environment, Travel and Income Inequality
Statistical and Econometric Strategies

- Generalized Least Squares Regression Analysis – Applying OLS regression on transformed 3 period data (90'- 00'-10'/15')(within transformation)
- Panel data in a pooled cross-section (random 72 MSAs/216 observations)
- Transforms model to eliminate serial correlation over time which can cause biased estimates.
- Demeaning or removing the average from each observation data point.
- $\tilde{y}_{it} = \beta_0 + \beta_1 \tilde{x}_{1,it} + \beta_2 \tilde{x}_{2,it} + \cdots \beta_k \tilde{x}_{k,it} + \tilde{\varepsilon}_{it}$
- Tests
  - Park
  - Brausch-Pagen
  - Ramset RESET

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The main constraint of the study is the time necessary to convert county-level GINI data to MSA levels. Therefore, 1990 data was gathered for a smaller sample size for use in an expanded three-period model. The appropriate sample size in this expanded data scenario is calculated using Yamane's formula (as cited in Israel, 1992) assuming a 95 percent level of confidence and a margin of error or level of precision of ±10 percent. Thus, 72 observations for each of the three periods equates to 216 observations.

The generalized least squares (GLS) aka weighted least squares (WLS) methodology is also employed for the periods of 1990, 2000, and 2010/2015. This methodology combines the information from all three periods via panel data in a pooled cross-section and involved demeaning to address serial correlation or autocorrelation.

Validation is performed through the Park, Brausch-Pagen and Ramset RESET tests in addition to analysis of normal probability plots and plots of residuals (difference between observed and predicted values) against predicted values. The tests ensure there is not unequal variance in the models which can cause biased results.

The Built Environment, Travel and Income Inequality
General Analytical Methodology
Cross-Sectional Regression Approach

- $GINI00 = 0.2330 + 0.0985(PAFSEG00) + 0.0034(MEDAGE00) + 0.0971(EDUBS00) + 0.4352(PVRTY00) - 0.0000021(FPCVMT00)$; ***$R^2$=0.6489; F=91.31; Sig. F=0.0000*** *(note: 253 observations)*

- $GINI15 = 0.2700 + 0.0818(PAFSEG10) + 0.0021(MEDAGE15) + 0.1302(EDUBS15) + 0.3962(PVRTY00) + 0.0248(BKPOP15) - 0.1645(UNEMPR15)$; ***$R^2$=0.6570; F=78.86; Sig. F=0.0000***

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Data is analyzed for 20 IVs to identify relations with variations in the DV of GINI in U.S. MSAs. The DVs and IVs are first analyzed both in terms of descriptive statistics and Pearson Correlation Matrices for 254 observations. Descriptive statistics provide measures of central tendency, dispersion, and indications of data collection errors. Pearson Correlation matrices identify one-on-one relationship strength between each of the variables and an initial screening for multicollinearity (i.e. highly-related IVs that can hamper predictability). As expected, several IVs are highly associated with each other which is indicative of possible multicollinearity if included in the same model. Multicollinearity creates redundancy which can lead to unreliable results. The correlation threshold used in the analysis is 0.40 for excluding an IV when associated with another IV having a stronger relationship with a DV. This threshold is the amount of variance in one variable that can be explained by another variable.

Development of all models occurs via reverse stepwise regression performed in STATA. Successive runs of the regressions are performed while eliminating those IVs that are not close to approaching statistical significance with the DV. Manipulation of the models throughout the stepwise regressions occur based on strength of the standard statistical measures. Specifically, model robustness is measured by R^2 (proportion of explained variability) and statistical significance (relationship does not occur by chance) as measured by *F* and *significance F.* Model validity is also based on IV *p* values-and *t* scores in relation to a 0.95 level of confidence (repeated sampling mimics the actual population 95 percent of the time).

WPD and PCVMT lack statistical significance in both models and thus are not included in them. However, FPCVMT (a relatively small portion of overall VMT) does have a negative statistically significant relationship with GINI in the 2000 model. A decrease of 1 FPCVMT is associated with a negligible increase in GINI. However, in terms of magnitude, if an MSA in 2000 with no freeway transport had increased such travel to near the top of the distribution, or to about 12,000 annual per capita miles, the predicted change in GINI is -0.02 which is substantial.

The Built Environment, Travel and Income Inequality
General Analytical Methodology
First-Differencing Approach

- $GINICHG = 0.0087 + 0.333(PAFSEG) + 0.0015(MEDAGECHG) + 0.487(EDUBSCHG) - 0.1069\ (EMPRCHG) + 0.2058(PVRTYCHG) - 0.00000219(FPCVMTCHG)$; ***$R^2$=0.1767; F=8.83; Sig. F=0.000***

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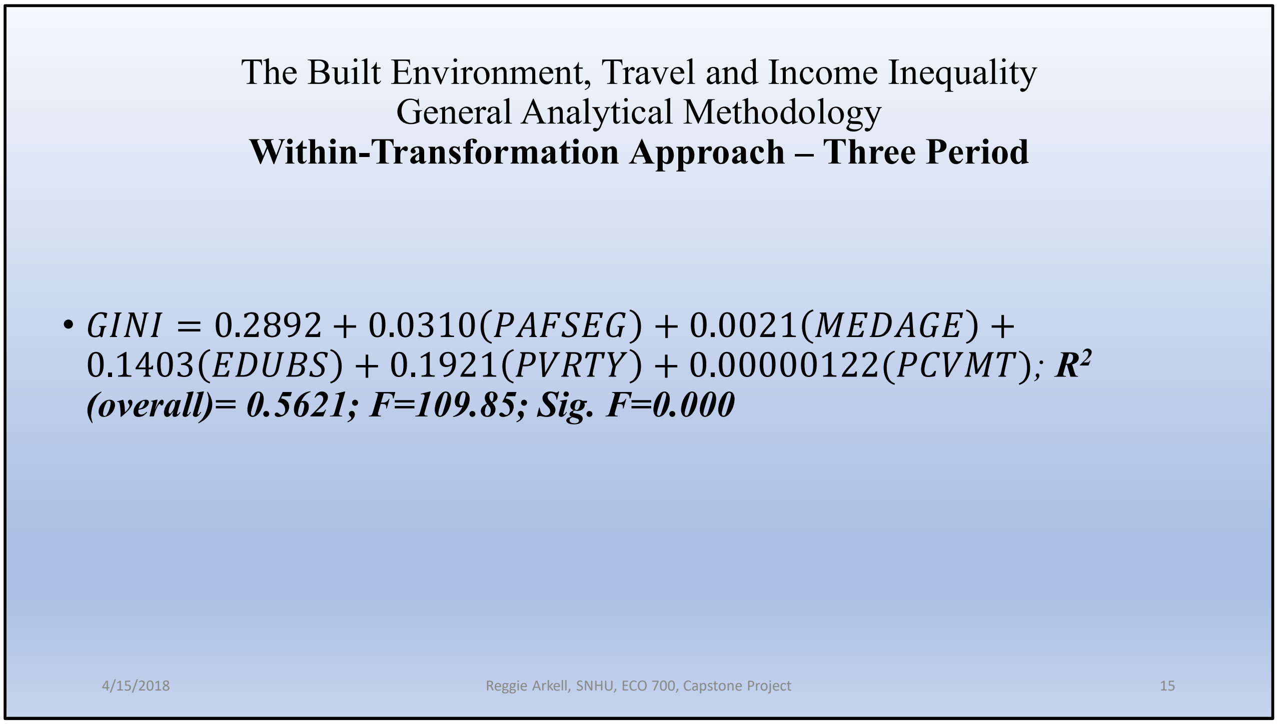
A comparable statistically significant negative association exists between FPCVMTCHG in the first-differencing model. In terms of magnitude, if an MSA at the lower end of the distribution FPCVMTCHG at -2672 had been +4277, at the top of the distribution, the predicted GINICHG is about -0.015 which is substantial.

Of note is that the proportion of poor & affluent persons segregated from the general population (PAFSEG), which is highly correlated with WPD, has a statistically significant positive relationship with the DVs in all three models. Thus, all other circumstances remaining the same, a 1 percent increase in PAFSEG between the two periods is correlated with a considerable increase in GINI of 0.0033 or 0.33 percent. Nevertheless, based on the three models, the null hypotheses are accepted as GINI does not have statistically significant relationships with either WPD or PCVMT.



To increase the number of periods, a random sample was taken of 1990 data for reappearing IVs in the three regression models covering 72 MSAs. SPD was included in the initial run but lacked statistical significance. Time constraints did not allow for developing 1990 WPD data. The data for the three periods was arranged into a pooled fixed effects panel set which effectively created 216 observations. A Durbin-Watson Statistic was used to identify any autocorrelation (errors carryover from one period to the next to create bias).

The three-period data was demeaned (removing the means to address bias/autocorrelation between periods) to reveal the shown equation and fourth model. All the IVs have positive statistically significant relationships with GINI at the 95 percent level of confidence except for PAFSEG which is at the 90 percent confidence level. Therefore, predicted increases in GINI will be within 10 percentage points of the actual population value 95 percent of the time (except in the case of PAFSEG it will be 90 percent of the time). Thus, a one unit increase in PCVMT is associated with a very small increase in GINI which is negligible. However, an MSA near the high end of the PCVMT range at 15,000 can be expected to have a GINI of 0.014 (margin of error ±0.0014) higher than an MSA at a low end of 3,500 PCVMT 95 percent of the time. Thus, using the within-transformation demeaning approach, the null hypothesis that PCVMT is not associated with GINI can be rejected. Poverty rate and education by far have the highest degree of associations as respective 1 percent increases in each can be expected to increase GINI by 0.001921 (0.1921%) and 0.001403 (0.1403%). A 1 percent increase in PAFSEG and a one-year increase in MEDAGE is associated with respective increases in GINI of 0.00031 (0.031%) and 0.0021.

A possible concern is that the OLS estimated IV coefficients are determined pursuant to the mean values and only indicate average marginal effects on the DV. Therefore, quantile regressions were run at selected percentiles to identify different marginal effects of PCVMT on GINI. The results show that PCVMT increases only have a statistically significant relationship with GINI at the 95 percent confidence level from about the 40^{th} through the 65^{th} quantiles.

The Built Environment, Travel and Income Inequality
General Analytical Methodology
Within-Transformation Approach – Three Period

- $\log(GINI) = 1.0463 + 0.0566 \log(EDUBS) + 0.2284 \log(MEDAGE) + 0.0699 \log(PVRTY) + 0.0232 \log(PCVMT)$; ***$R^2$ (overall)= 0.5263; F=117.77; Sig. F=0.000***

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In an effort to improve the three-year panel model, the data was transformed to log-log and reverse stepwise regression was performed to reveal the best configuration. Of note is that SPD and PAFSEG are not statistically significant. PCVMT is only statistically significant at the 90 percent level of confidence. A Ramsey RESET test showed the model just on the cusp of mis-specification. Both the Park Test and Brausch-Pagen Test confirmed validity. The Durbin-Watson statistic was satisfactory as it showed no indication of serial correlation. The log-log version of the model indicates that a one percent increase in PCVMT is associated with a 0.023 percent increase in GINI. Quantile regression was comparable to the level-level model.

The Built Environment, Travel and Income Inequality
Ethical Considerations

- Data range and accuracy limitations
- Predictions and evolving technology
- Balance findings with other local priorities
- Spatial Mismatch Hypothesis limitations

(Blumenberg & Manville, 2004)

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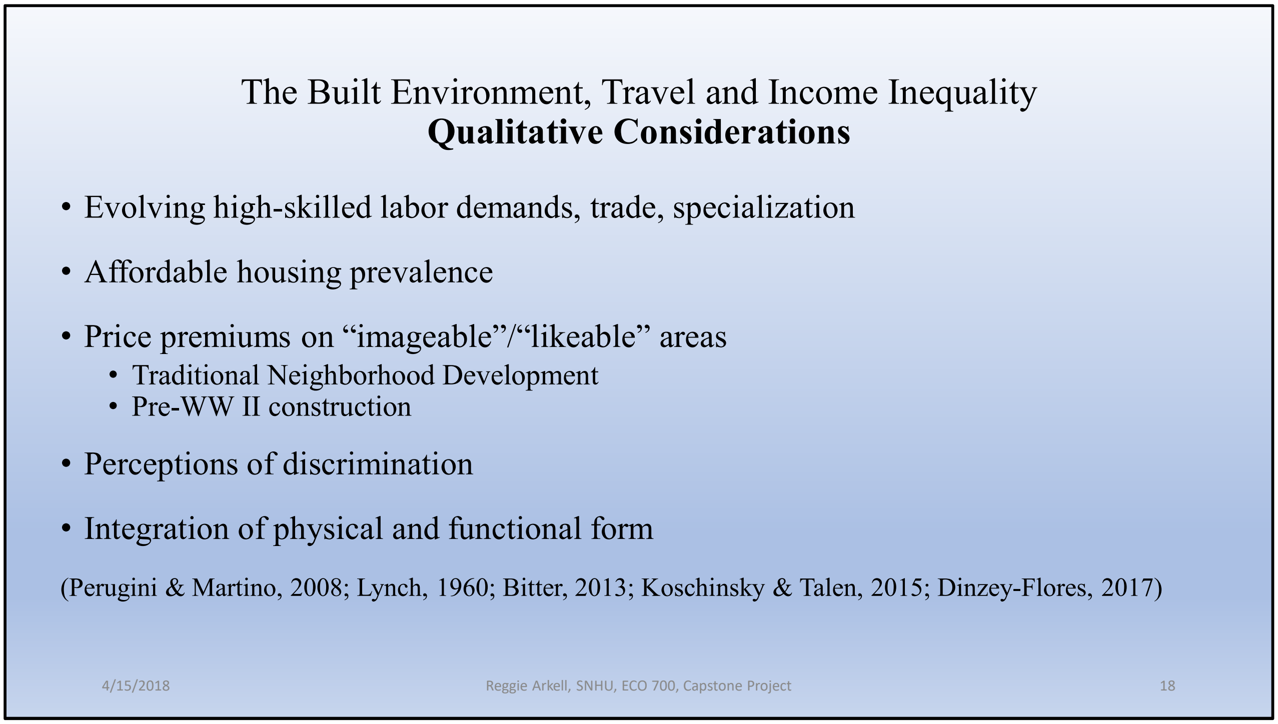
Caution should be used in applying the research models to the practice of urban planning as the findings are conditioned on the range and accuracy of the contributing data. Additionally, predictions for changes in income inequality could be impacted in the future by unforeseen circumstances due to evolving technology in transport or other fields. Possibilities include alternate fuels that limit emissions, development of renewable fuels, or increases in typical travel speeds. In any of these scenarios, distance within the built environment may not be as much of an impediment to achieving lower income inequality or other social objectives. Ultimately, the subject research should not be looked upon as a rigid prescription for solving the problem by altering urban form or transportation patterns. Rather, it should be used by localities to inform decision-making in balance with other priorities and fiscal realities in relation to collective quality of life values.

It should also be acknowledged that there is criticism of the spatial mismatch hypothesis. As discussed by Blumenberg and Manvillle (2004), researchers have made the case that income inequity is based more on racial discrimination and ethnic separation of the labor market as opposed to distance-based seclusion. Evidence has revealed that distance is not always a factor in income disparities, but it is often intertwined with discriminatory practices to the point where race and space is synonymous with each other. Metropolitan areas such as those in the west and south that matured in later decades tend not to have the same spatial mismatches as in other U.S. urban areas. Other factors are number of jobs available versus number of applicants in addition to skill levels of the local workforce which is consistent with the strong inverse association between education and income inequality (Blumenberg & Manvillle, 2004).

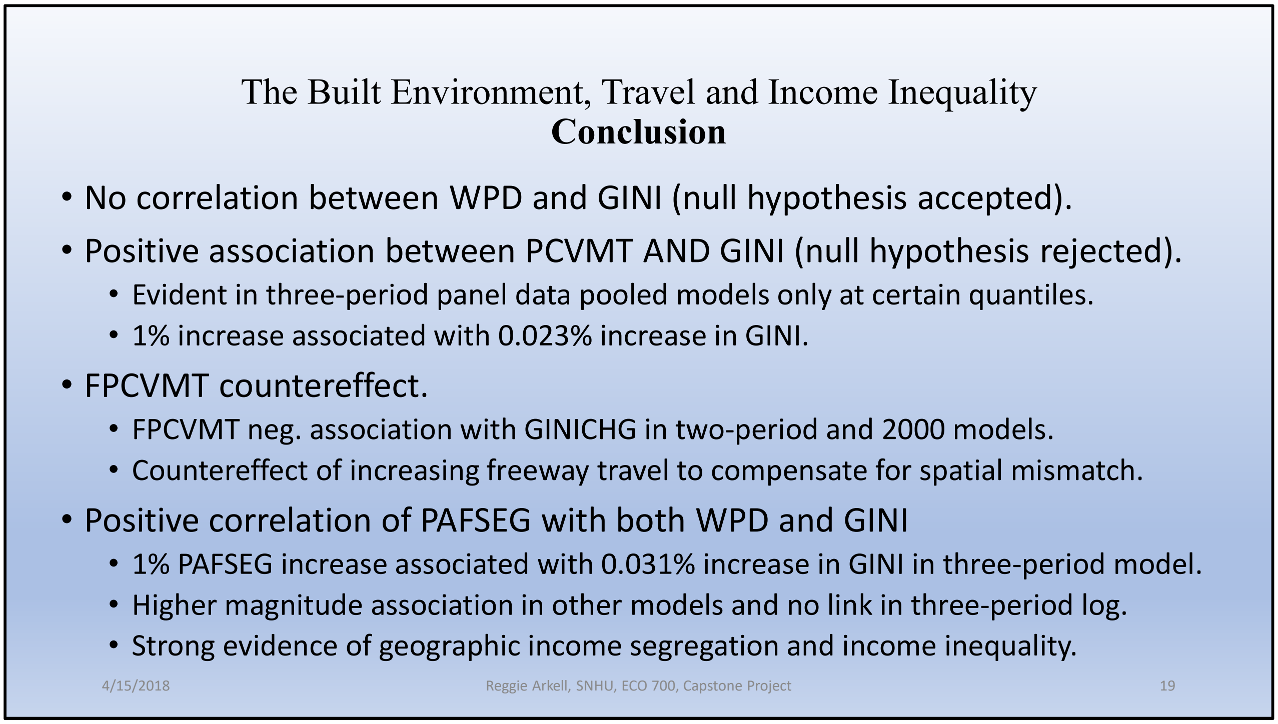


In identifying and selecting land use and transportation projects, there are qualitative factors that should be taken into account apart from the quantitative elements relating to urban form, travel and income inequality. As discussed by Perugini and Martino (2008), qualitative factors includes the development of intensified highly skilled labor demands in association with evolving trade and specialization. The distributive impacts relative to income inequality can vary based upon the available labor pool, willingness to adapt, country, and the position or strength of a given nation regarding particular industries or services. Anti-distributive policies can also vary by country or within countries based upon local politics.

In another vein, survey quality standards based on households, inclusion of all income sources and appropriate population representation are critical components of accurate enumerations. These can be compromised by poor oversight and human error (Perugini & Martino, 2008).

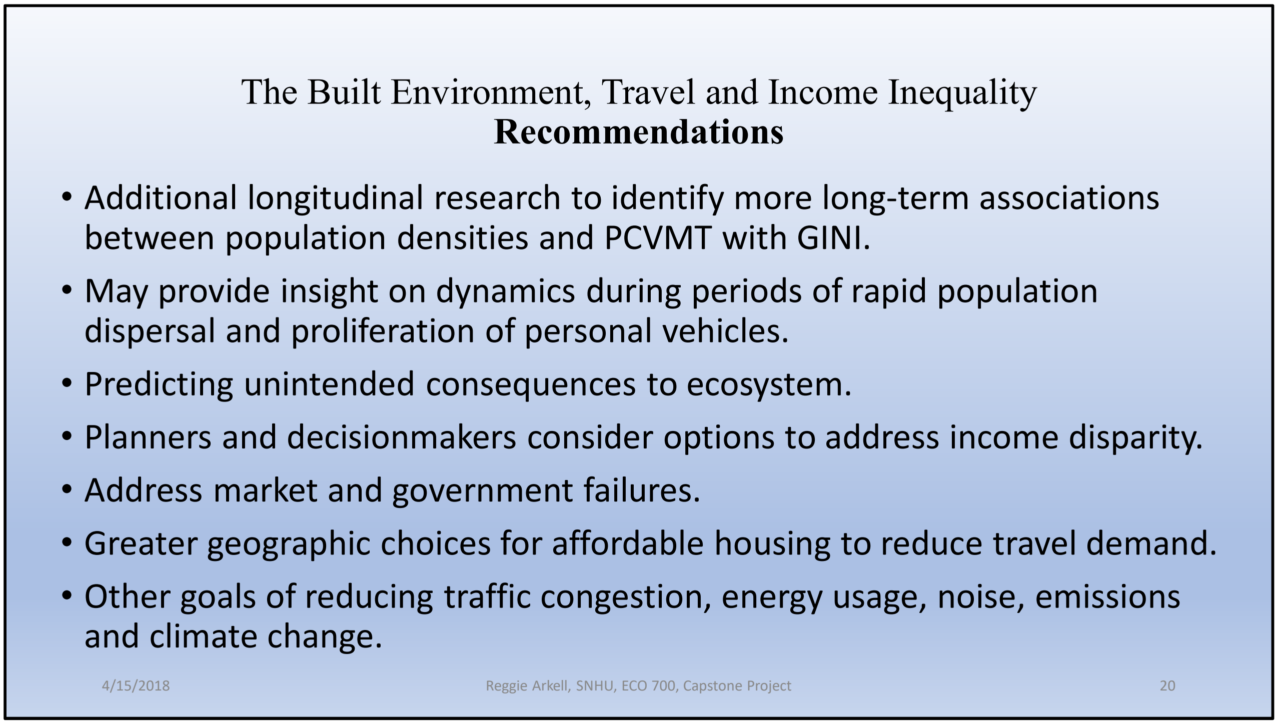
Studies by Lynch have found that imageability or preferences for urban form tend to be consistent with Traditional Neighborhood Development (TND) more prevalent in the pre-World War II period typified by concepts of gridded streets with compact and walkable or more human-scale urban form and community character. Further, studies have shown that older homes in such prewar TND residential areas tend to command price premiums compared to most newer subdivisions, controlling for other factors (Bitter, 2013). Therefore, without affordable housing, these qualitative elements can potentially be a factor in segregation, income inequality and gentrification (Koschinsky & Talen, 2015).

According to Dinzey-Flores (2017), close proximity of new and prestigious development with urban ghettos may not provide a pathway to reduced income inequality if there is not true integration of physical and functional form of the two areas. It is the perceptions by disadvantaged populations of prejudice and lack of opportunities that can be more meaningful than quantitative measures.



Overall, the research revealed that there is not a statistically significant negative relationship between WPD and GINI, therefore, the null hypothesis is accepted and the alternate hypothesis is rejected. Conversely, on average, there is a statistically significant positive relationship between PCVMT and GINI at the 95 percent confidence level (level-level, 90 percent for log-log), thus, the null hypothesis is rejected, and the alternate hypothesis is accepted. The caveat to the latter conclusion is that the association held true in panel data pooled cross-sectional analysis over three periods together at certain mid-range quantiles while the finding could not be verified in single period or more short-term cross-sectional examination. Additionally, the magnitude of the association is relatively small. The log-log transformation of the model revealed that a 0.023 percent increase in GINI can be expected with a 1 percent increase in PCVMT (MOE: 0.0023). The one instance where the null hypothesis is rejected is at least indirectly consistent with the spatial mismatch hypothesis which states that restrictions on residential choice, particularly for black populations, together with employment disbursement is responsible for high joblessness and low income for those minority populations (Kain, 1994). This is inherent due to the demand of increased travel needs created in part by more scattered urban form.

In a similar vein, the level-level OLS and demeaned GLS analysis did find that PAFSEG, which is highly correlated with WPD, does have a statistically significant positive relationship with GINI. A 1 percent increase in PAFSEG is associated with an increase in GINI ranging from 0.33 percent in the OLS first-differenced two-period model, to 0.031 percent in the GLS demeaned three-period model, and 0.10 in the OLS cross-sectional model for the year 2000 (all level-level). The magnitude of these changes is substantive at the high end but not at the low end.



In U.S. metropolitan areas, only about 30 percent of all jobs and less than one-fourth of low and middle-skilled jobs are located within a 90-minute commute by public transportation (Tomer et al., 2011). Therefore, consistent with other research, it is ostensible that there are long-term ramifications from population disbursement and segregation. Consequently, there is value in planning and subdivision/zoning regulations that maintain clustered development patterns, limit new land consumption, provide incentives for affordable housing, and support for public transportation. The research is useful for decisionmakers contemplating the potential inequitable ramifications of continued low density development lacking affordable housing in relation to other regional goals of reducing traffic congestion, energy usage, noise and transport emissions associated with climate change.

The main impediment of the study was the inability to expeditiously obtain data from earlier periods before 1990. In relation, the data used was challenging as some of it was unavailable for various MSAs and some required time-intensive conversions. Therefore, further research is recommended to acquire and analyze the necessary data as far back as the early 20th century for use in a follow-up longitudinal study. Results could be more revealing from earlier periods during construction and maturation of the national highway system, mass exodus from major cities and rampant suburbanization, and the related escalation in PCVMT with proliferation of the automobile.

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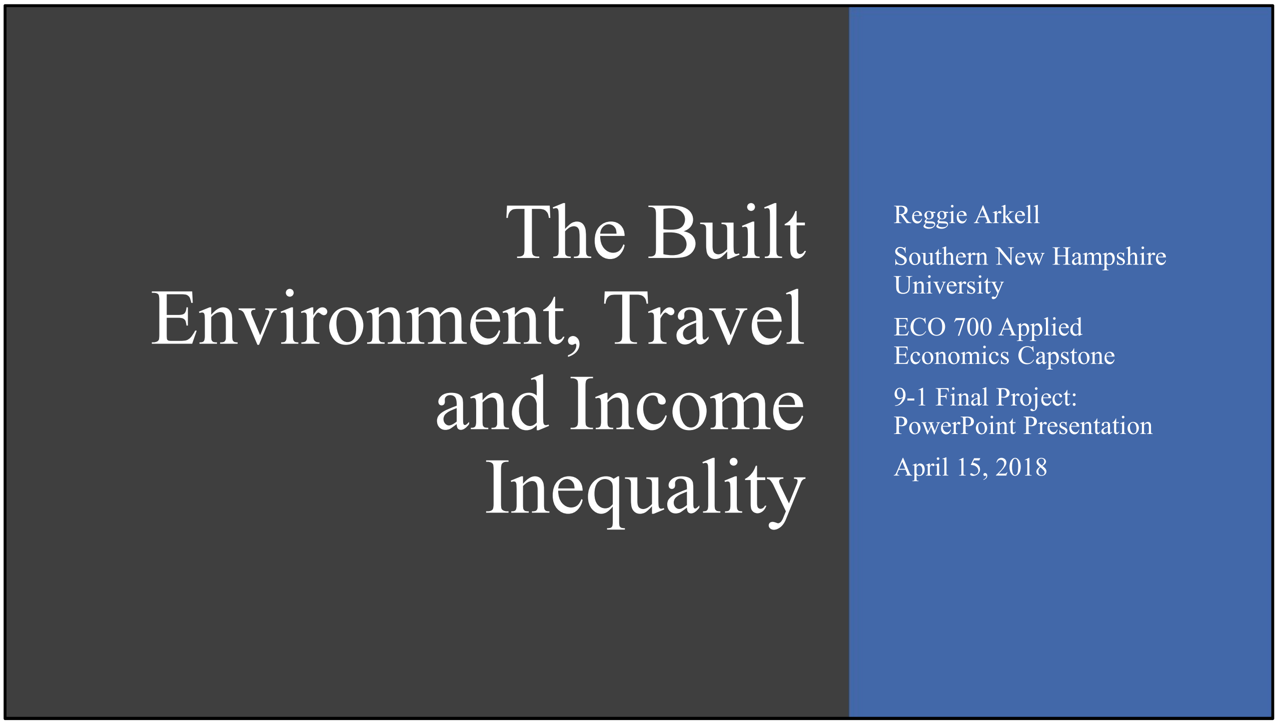
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Reggie Arkell
Southern New Hampshire
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Economics Capstone
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April 15, 2018

Thank you!