New Evidence on Trends in the Cost of Urban Agglomeration

Matthew E. Kahn

UCLA and Tufts University
March 2007

Preliminary --- comments welcome

mkahn@ioe.ucla.edu

Prepared for the 3/23/2007 Cities Pre-Conference

Introduction

Big cities feature more crime, more pollution and more congestion than smaller cities. These non-market local public bads can significantly reduce quality of life in big cities (Tolley 1974, Glaeser 1998). Compensating differentials studies have used hedonic methods to quantify cross-city wage premium and housing discounts for living in a low quality of life city (Rosen 1979, Roback 1982, Blomquist et. al. 1988, Gyourko and Tracy 1991). A second literature has estimated reduced form "production functions" to measure how urban population size increases local public bads such as air pollution, crime and congestion (Kahn 1999, Glaeser and Sacerdote, and Glaeser 1998).

In contrast to these local public bads, larger cities offer greater cultural and restaurant amenities than smaller cities. Big cities facilitate restaurant and store specialization because such niche businesses anticipate that aggregate demand for their services will be high enough to cover their fixed costs (Waldfogel 2006). This suggests that big cities offer a quality of life tradeoff such that big cities offer a higher quality of consumer goods and services than smaller cities but the big cities have worse levels of non-market local public goods than smaller cities. These non-market local public goods and marketable consumer amenities are likely to be complements. Metropolitan areas that make progress with respect to congestion, pollution and crime have a better opportunity to compete as "consumer cities" (Glaeser, Kolko and Saiz 2001).[1]

This paper examines trends in the "cost" of urban bigness as measured by progress in urban pollution, congestion and crime. A central theme of this paper is that big cities are becoming less "satanic" over time (Williamson 1981a, 1981b). This paper

---

[1] For his part, Mr. Fertitta, who has lived nearly all his 60 years in Manhattan, sounds like the city's chief cheerleader. "New York is at its all-time high in all the positive things and at an all-time low in all the negative things," Mr. Fertitta said, To change people's negative views of New York's grime, crime and prices, he said, the city can piggyback on the invaluable boost it gets from pop-culture cynosures like Carrie Bradshaw, the lead character in "Sex and the City," the internationally popular TV show. February 27, 2007 Remaking the City's Image, With 50 Million Tourists in Mind By PATRICK McGEEHAN

will first take a long run look at pollution in cities. I then turn to studying commute times in big cities and finally examine recent crime trends.

While there are multiple reasons for why quality of life progress has taken place, I will mainly emphasize the role of population decentralization, i.e sprawl, as an important contributor to this trend. Why might sprawl cause improvements in quality of life in large metropolitan areas? At the turn of the 20th century, high density cities featured ample contagion and disease risk. Reduced population density lowers these risks. Communities further from the CBD feature lower levels of pollution. As employment decentralizes, suburban workers can commute faster to suburban employment centers than to the congested CBD. In cities around the United States, the poor tend to cluster in the center city. The durability of the housing stock via filtering and the access to public transit in center cities encourages the poor to cluster there (Brueckner and Rosenthal 2006, Glaeser, Kahn and Rappaport 2007). If the poor live in the center city, and the rich live in their own center city oasis (i.e 5th Avenue) then as the middle class suburbanize, the average person's exposure to urban ills declines.[2] For example, as the middle class live further from the center city poor, they are exposed to less crime.

This paper's empirical contribution is to use a number of data sets to examine trends over time and across cities with respect to pollution, congestion and crime. Most of this evidence will focus on estimating reduced form "production functions". In the last section of the paper, I will return to the urban cross-city quality of life literature's approach of using hedonic techniques to estimate the compensating differentials for living in big cities (Rosen 1979, Roback 1982, Gyourko and Tracy 1991). Using repeat cross-sections from 1980 through 2005, I test whether compensating differentials for living in big cities are declining over time. I document that house price evidence in big cities is consistent with the hypothesis that big cities are becoming "more livable" over time.

---

[2] A critic might counter that suburbanization lowers the quality of life of the poor who remain in the center city. This paper will not attempt to measure whether center cities experience a degradation of public services, such as public school quality and public transit quality, as the tax paying middle class suburbanize.

Progress in Reducing Pollution in Big Cities in the Past

At the turn of the 20th century, the average white urbanite paid a ten year "mortality penalty" for not living in the countryside (Haines 2001). By 1940, this mortality premium had vanished.

Both cross-city research (Cutler and Miller 2004, Cain and Rotella 2001) and city specific case studies such as Ferrie and Troesken's (2004) investigation of Chicago highlight the importance of large scale water treatment infrastructure in reducing death from water borne disease.

While urban economists have emphasized the negative quality of life consequences of urban growth, one benefit of city bigness is that this reduces the average cost of providing expensive high fixed cost infrastructure. Haines (2001) documents that while middle sized cities had higher death rates than small cities that these middle sized cities also had higher death rates than large cities who had the scale to pay for infrastructure.[3]

Rising income and declining transportation costs increase the demand for living at lower density further from the city center (Margo 1992, Gin and Sonstelie 1992, Baum-Snow 2007). Using data for 31 Philadelphia Wards, Condran and Cheney (1982) find that tuberculosis and pneumonia death rates were higher in 1880 in wards with higher population density. These coefficient estimates are borderline statistically significant. Based on their ward estimates from 1930, Condran and Cheney (1982) find that the population density effect on death rates from these diseases shrinks sharply.

Ambient air pollution in major cities such as London, New York City and Pittsburgh first increased and then decreased over the 20th century. The causes of this Environmental Kuznets Curve pattern can be traced in part to the use of dirty fuel sources

[3] Cutler and Miller (2004) highlight the importance of municipal bond market growth as a facilitator of debt finance that allowed major cities to build municipal water systems. A similar financing issue exists today in large cities in the developing world. As discussed by Noll, Shirley (2002) there is a fundamental time consistency issue in LDC cities. Capital exporters recognize that investment in urban water systems are an irreversible investment. Once the system is built, cities with a significant number of poor people have an incentive to void the original "price gouging" deal. Anticipating this ex-post expropriation discourages capitalists from investing in such high rate of return systems.

such as coal for home heating and cooking and the rising scale of industrial manufacturing activity in major cities. Environmental historians have documented these patterns.. London in response to the fog of December 1952 enacted the Clean Air Act of 1956 which sharply regulated domestic coal smoke. This helped London switch to gas and electric heat. Same story in Pittsburgh; converted to cleaner anthracite coal, oil and natural gas piped in from Texas rather than bituminous coal (McNeil 2000). From a public health perspective, the rising and declining levels of ambient particulates is especially important given their impact on morbidity and mortality risk (Chay and Greenstone 2004).

The rise of private vehicle use contributed to rising levels of ambient smog and lead in cities (Reyes 2006). Under the Clean Air Act, new vehicles only faced stringent emissions standards starting in the early 1970s (Kahn 2006). The introduction of the catalytic converter for 1970s makes forced vehicle owners to drive using unleaded gasoline. This caused a sharp drop in urban lead emissions. Similar to particulates this suggests a dynamic EKC pattern. In major cities, ambient pollutants such as lead and smog first increased due to scale effects and then regulation helped to reduce emissions per mile of driving such that overall pollution levels have declined (Kahn and Schwartz 2007).

Urban industrial transition is another cause of declining pollution in big cities. In Figures One and Two, I graph the share of workers by county who work in manufacturing as a function of the log of the county's population. In 1969, there were many big cities where a large share of workers worked in manufacturing. Note that by the year 2000, there is a clear negative correlation between manufacturing's employment share and county population size. There are large public health gains from removing older polluting manufacturing plants from heavily populated areas. New York City offers one example. Between 1969 and 2000, the number of manufacturing jobs in New York County (Manhattan) declined from 451,330 to 146,291. Manufacturing accounted for 16.2 percent of the county's employment in 1969 compared to only 5.3 percent in 2000.

Recent Urban Air Pollution Progress

I use the U.S. Environmental Protection Agency's Annual Summary Table Query database to examine the relationship between urban population size and ambient pollution levels between 1973 and 2000.[4] The EPA widely monitors air pollution, and most of these monitoring stations are located in relatively heavily populated counties. County level year data on population and the share of employment in manufacturing is available from the REIS data base.

For each seven different measures of ambient pollution, I calculate the county mean concentration by calendar year and regress this on a state fixed effect, the log of the county's population, the county's manufacturing share of total employment and a time trend.[5] Table One presents the results from six OLS regressions based on estimates of equation (1) using county level panel data from 1973 to 2000. The estimation equation is:

$$\text{Log(ambient Pollutant)} = \text{state fixed effect} + b_1 * \log(\text{Population}) + b_2 * \text{Trend} + b_3 * (\%\ \text{Manufacturing}) + U$$

As shown in Table One, for five of the six pollutants (the one exception is ozone), county population has a positive and statistically significant effect on county ambient pollution levels. Nitrogen Oxide emissions has the highest population elasticity of .29. Particulates and PM10 are especially bad for health because of the risk of mortality (Chay and Greenstone 2004). The population elasticites for these pollutants are small at .09 and .06 respectively. Holding county population size constant, the time trends indicate

[4] See U.S. Environmental Protection Agency, "Monitor Data Queries: Annual Summary Table Query" (www.epa.gov/aqspubl1/annual_summary.html).

[5] This specification implicitly imposes that emissions activity in one county does not drift over into adjacent counties.

significant annual progress in reducing ambient pollution. Ozone is the only ambient pollutant with a non-negative time trend. Consider PM10. This ambient pollutant is declining by 3.4% per year. Given that big cities have higher pollution levels, this percentage reduction translates into greater overall pollution progress. I have tested for whether larger counties have experienced greater percentage progress and can not reject the hypothesis of no differential.

Big city deindustrialization has helped to improve urban air quality.[6] For counties that had at least 250,000 people in 1969 the average share of manufacturing declined from 21.9% to 10.6% in the year 2000. The results in Table One provide some indication of how this deindustrialization translates into pollution progress. Consider the results for sulfur dioxide and nitrogen oxides. A 10 percentage point decline in manufacturing's share (an industrial composition shift) is associated with a 10% reduction in sulfur dioxide and a 6% decline in nitrogen oxide and a 3% decline in particulates.[7]

Technological innovation induced by environmental regulation has helped to reduce emissions per unit of economic activity. Burtraw and Evans (2003) document the sharp reductions in electric utility emissions per unit of power generated over time. Sulfur dioxide emissions trading and an aggregate cap on total emissions has provided incentives for dirty utilities to reduce their emissions (Stavins 1998). The vehicle fleet has been a major contributor to carbon monoxide, nox and ozone pollution. The phase out of pre-1975 vehicles on the roads has helped to green the average vehicle over time (Kahn and Schwartz 2006).

While the results in Table One suggest that there has not been much national ozone progress, some of the most polluted counties with respect to smog have experienced sharp progress over time. Consider Los Angeles time trends over the last 25 years. For ambient ozone, a leading indicator of smog, the average of the top 30 daily peak one-hour readings across the county's 9 continuously operated monitoring stations

---

[6] Declining transportation costs have allowed manufacturing to locate in low labor cost regions. Big cities are more likely to face more stringent Clean Air Act regulation and this has displaced footloose dirty industries to less regulated attainment counties (Henderson 1996, Becker and Henderson 2000, Greenstone 2001).

[7] Chay and Greenstone (2003) report that a 1% decline in TSP is associated with a .5% reduction in the infant death rate.

declined 55% from 0.21 to 0.095 parts per million between 1980 and 2002. The number of days per year exceeding the federal one-hour ozone standard declined by an even larger amount—from about 150 days per year at the worst locations during the early 1980s, down to 20 to 30 days per year today.[8]

Recent pollution gains are especially notable because Los Angeles County's population grew by 29 percent between 1980 and 2000, while total automobile mileage grew by 70 percent (California Department of Transportation 2003). For air quality to improve as total vehicle mileage increases indicates that emissions per mile of driving must be declining sharply over time. This suggests that technological advance is helping to reduce an important external cost of urban living (Kahn and Schwartz 2007).

This section has focused on trends in urban ambient air quality. In closing, it is relevant to note that major cities have also experienced large water quality gains (see http://www.epa.gov/owm/wquality/benefits.htm). In New York City, people are fishing in its rivers again and wild creatures such as beavers are spotting swimming in its waters. While here I have only offered an anecdote, nobody is concerned that a recurrence of the 1969 fire on Cuyahoga River in Cleveland could take place.

Does Sprawl Reduce Exposure to Urban Pollution?

Pollution is not uniformly distributed within cities. This section tests the intuitive claim that pollution levels are higher in center cities relative to the suburbs of the same metro area. If environmental quality is higher in the suburbs, then population suburbanization reduces average pollution exposure. Such suburbanization creates a "Moat" Effect. If pollution is concentrated in the dense, industrial core of a city featuring older grandfathered capital then the aggregate social cost caused by such externalities is reduced as people increase their distance from this polluted area. Figure Three presents the urban population CDF in 1970 and 2000 of the location of metro area residents. The

[8] Data source: California Ambient Air Quality Data CD, 1980-2002 (California Air Resources Board). This CD-ROM provides all air quality readings taken in the state during this time period. In this dataset, the unit of analysis is a monitoring station.

median resident of a metropolitan area in 2000 lived approximately three miles further from the CBD than the median resident of a metropolitan area in the 1970.

Does ambient air pollution get better with distance from CBD? To answer this question, I focus on ambient monitoring stations in metropolitan areas with at least 500,000 people living in a 30 mile radius around the CBD. This yields 89 metropolitan areas. For this subset of major cities, I calculate each ambient monitoring station's distance to the Central Business District. For six different measures of ambient pollution I then run OLS regressions of the form:

Log(Pollution) = MSA fixed effect + controls + b*(Monitor Distance to CBD) + U

I test whether b<0. Table Two reports general evidence supporting this claim. Per mile of distance from the CBD, within the same metro area, ambient particulates and sulfur dioxide decline by 1% while carbon monoxide and nitrogen dioxide decline by 2%. Ozone is the only pollutant that does not decline as a function of distance to the CBD. Here I am implicitly assuming that monitoring station average annual readings are a good measure of what the air is like at that radius from the CBD.

A second indicator of local environmental quality is the presence of noxious facilities such as Toxic Release Inventory sites or Superfund sites. Site level from the Environmental Protection Agency provides each site's zip code. I use this information to code up for 15,000 zip codes whether there is at least one noxious site in the zip code. I estimate linear probability models of the form:

Noxious site Present =MSA Fixed Effect + controls + b*(Zip Code distance to CBD) + U

I test whether b<0. In Table Two, I report regressions where the unit of analysis is a zip code. The sample includes all zip codes within 25 miles of 297 different metropolitan area CBDs. Controlling for a metro area fixed effect and a zip code's land area (a dart board measure), I test whether there are fewer noxious Superfund sites and Toxic Release Inventory sites in zip codes further from the CBD. In column (7) of Table Two, I document that the probably that a TRI site is located in a zip code declines by 1.5

percentage points for each mile of distance from the CBD. In column (8), I show that the probability that there is at least one superfund site in a zip code declines by 1 percentage point for each mile of distance from the CBD.

While suburbanization reduces the average urbanite's exposure to local public bads, it increases the likelihood that this person consumes more energy resources. Low density, car centered living increases resource consumption by around 30% relative to living and working in more compact cities and living in multifamily housing units (Bento et. al , Kahn 2000). Given the current absence of a carbon tax, the typical household ignores its greenhouse gas contribution in its own pursuit of high quality of life.

Commuting

In this section, I use several data sets to investigate how commute times vary within cities and across cities. While this section is descriptive, the causal mechanism is the suburbanization of jobs. Suburbanites and working and living in the suburbs and this allows them to commute faster, further.

To begin to present some new commuting facts, I use micro data from the 2001 National Household Transportation Survey. This survey samples people from over 73 major metro areas. An attractive feature of this data is that it is possible to obtain residential zipcode identifiers. Table Three reports three sets of regressions using this sample of metropolitan area residents. In the top panel, the dependent variable is the speed that workers commute at measured in miles per hour. I estimate:

Speed = constant + b*log(Metro Pop) + b*(Distance to CBD) + b*1(Commute using PT)

The standard errors are clustered by metro area. A doubling of a metro area's population is associated with a reduction of speed of 1.6 miles per hour. For every extra mile that a household lives from the CBD, it can commute at .44 miles per hour faster. The third column shows how slow public transit is. People in big cities are more likely to commute using public transit and this increases their commute times. All else equal, a worker who commutes using public transit travels 11 miles per hour slower than a worker who commutes by car. Public transit use explains 25% of the big city speed penalty.

Based on census data; in 1970 average person lived 8.72 miles from CBD in 2000 lives 11.44 miles from CBD, this suburbanization has increased road speed by 1.2 MPH. In the middle panel of Table Three, I estimate:

Time = constant + b*log(Metro Pop) + b*(Distance to CBD) + b*1(Commute using PT)

A doubling of metro size increases the average one way commute time by 2 minutes. Public transit use in big cities explains half of this relationship. The average public transit user's commute is 23 minutes longer than the average car commuter's. The fourth panel presents a new result. Controlling for city size and distance to work, commute times are shorter for people who live further from the CBD. In the bottom panel of Table Three, I estimate:

Distance to Work = constant + b*log(Metro Pop) + b*f(Distance to CBD) + U

In this regression, I specify the f function to be a quadratic. As shown in the bottom panel of Table Three, distance from the CBD has a concave effect on distance to work. This suggests that many suburban workers commute to suburban jobs.

To study trends over time in commuting, I use census tract data from geolytics (Baum-Snow and Kahn 2005). Figure Four presents results from 1980 and 2000. For all people who live within 25 miles of a CBD, I calculate the share of workers who have a commute over 45 minutes long by mileage distance to the CBD of the metro area they live in. The Figure's lines are roughly parallel. Very few commuters who live close to a CBD have a long commute in 1980 or 2000. The share with long commutes increases out to about 10 miles from the CBD and then in both years, the slope flattens. It is important to note that in the year 2000, a larger share of commuters do have long commutes relative to in the year 1980. This gap equals roughly 2 percentage points.

Figure Five examines time trends in short commutes (less than 25 minutes one way) in 1980 and 2000. The 1980 line falls steeply with respect to distance from the CBD. This is consistent with a more monocentric world where people work downtown. Relative to the 1980 line, the year 2000 line always lies above it. In the year 2000, at every distance from the CBD, there has been a growth in the percentage of workers who have a short commute. The gap between the 1980 and 2000 lines is maximized at 10 miles from the CBD. Consistent with the claim that quality of life for suburbanites has improved. Job suburbanization's consequences are clearly visible in the year 2000 as the share of workers with a short commute is roughly constant from 10 miles from the CBD to 25 miles from the CBD.

Figures Six and Seven are identical to Figures Four and Five but now I focus on just New York City, Los Angeles and Chicago. This cut of the data allows me to investigate changes in commuting patterns in the very biggest cities. Figure Six focuses on the share of workers with long commutes in these major cities. The first point to note is that the figure does not look like Figure Four at all. From zero miles to the CBD to ten miles, the share with a long commute increases but in the eight to twenty mile range it declines sharply. Job suburbanization in these major cities has reduced mega-commuting. Figure Seven looks more like Figure Five but the benefits of job suburbanization in causing short suburban commutes is even more clearly seen in the big three major cities than in the overall metro area diagram (Figure Five). As shown in Figure Seven in the year 2000, people who live 18 miles from the CBD had the same share of short commutes as people who live two miles from the CBD. These figures present suggestive evidence that job suburbanization increases the capacity of "mega-cities" to absorb growth without significant degradation of non-market quality of life factors.

To study actual commute types in the year 2000, I use census tract level data on commute times. In Figure Eight, I report average commute times for metropolitan area workers by mile of distance from their CBD. I report three different lines. One for all urban workers, one for workers who live in metropolitan areas with more than four million people and one for workers who live in metropolitan areas with less than four million people. The average line highlights that average commute times rise with distance from the CBD. As expected, the big cities have higher commute times. At seven miles from the CBD, the average commute time in big cities is roughly 12 minutes longer one way than in small cities. But, note the convergence! Big city commutes decline sharply from seven miles to the CBD out to 20 miles to the CBD.

Crime

Crime is a key urban disamenity (Berry-Cullen and Levitt 1999). Big city crime rates are higher than smaller cities (Glaeser and Sacerdote 1999). Crime and poverty go hand in hand. Given that the poor are over-represented in center cities and often do not have access to cars, crime is concentrated in urban neighborhoods and other neighborhoods that can accessed using public transit (Bowes and Ihlandfelt 2001).

Crime has declined in big cities starting in the early 1990s (Levitt 2004). An ongoing research effort continues to try to parse out why urban crime has declined. For my purposes, this does not really matter but it is relevant to note the wide ranging possible explanations including abortion (Donohue and Levitt 2001, leaded gasoline (Reyes 2006), the decline in crack cocaine in cities, the decline in the big city crack epidemic of the 1990s (Heaton, Fryer, Levitt and Murphy), the legalization of abortion (Donohue and Levitt 2001), increased incapacitation and more police being hired (Levitt 2004).

To present some results on crime, I focus on counties that are located in metropolitan areas and use county FBI victimization data over the years 1994 to 2002 **(http://fisher.lib.virginia.edu/collections/stats/crime/).** I report results on the murder rate and the violent crime rate and the log of the county murder rate.

Crime Rate = c + b*log(population) + b*Trend + b*(Poverty Rate) + b*Trend*Poverty Rate + U

Table Four highlights the fact that in recent years crime levels and rates have been declining. Based on the log-levels results presented in the left two columns of the table, the murder count has been declining by 6% per year and the violent crime count has declined by 8% per year in cities. Perhaps more interesting are the results where I interact the time trend with the county's 1990 overall poverty rate. These are reported in the bottom panel of Table Four. While high poverty rate counties have higher initial rates of crime, they have also enjoyed greater trend progress in reducing crime. The results in the bottom left column of Table Four indicate that a 4 percentage point increase in a county's poverty rate increases the baseline murder count by roughly 25% but that such a county experiences a time trend reduction in the murder rate of 4% per year relative to 3% a year in a similar sized county.

Time Series Evidence on Compensating Differentials for Living in Big Cities

Consider a given state that has some large cities and some small cities. At any point in time, hedonic methods can be used to recover the wage premium and rent premium for living and working in the big city versus the small city. If big cities are becoming nicer over time, then compensating differentials theory would predict that the implicit compensation for living in big cities should be declining over time. In this section, I use large cross-sectional Census data sets in 1980, 1990, 2000 and 2005 to test this claim.[9]

These hedonic regressions yield new facts about the time trends in the implicit compensation for city "bigness" and they also speak to the incidence question of who benefits from local public goods improvements. The popular media often publishes Harlem gentrification stories that stress that incumbent renters can no longer afford their old apartments as rents rise in response to falling crime rates. If cross-state migration costs are low, then big city land owners will be the main beneficiaries from declining crime and pollution.

An analysis of implicit compensation for big city living also is related to recent research on the consequences of housing supply regulation and durable capital. Glaeser and Gyourko (2005) emphasize the importance of housing supply elasticities in determining whether prices or quantities change in response to increased local demand

---

[9] I use the 1980, 1990, and 2000 1% IPUMS sample and the 2005 American Community Survey sample.

for housing. If an area such as Houston or Phoenix that can sprawl experiences an improvement in quality of life, then developers can build more housing at fringe. In a built up metropolitan area such as New York City or San Francisco, increases in housing demand (due to improvements in urban quality of life) will translate into rising prices.

In Table Six, I report estimates of Blomquist, Rosen/Roback style cross-sectional hedonic wage and home price regressions. One twist is that I include state fixed effects to soak up taxes and climate. Second twist is that the only city attribute I include is log(population). Its coefficient reflects the total package of "goods" and "bads" of living in a big city. Just look at migrants who take the wage and home price gradients as given. I recognize that big cities differ from small cities along a number of dimensions; some of these dimensions are goods (such as more diverse cuisine and high end stores) while others are bad. A simple hedonic regression estimated at multiple points in time recovers the trend in such net capitalization effect of metropolitan area population.

$$\text{Log(Home Price}_{jlt}) = c + b_t\text{*log(Population}_{jt}) + \text{controls} + U$$

$$\text{Log(Wage}_{jlt}) = c + b_t\text{*log(Population}_{jt}) + \text{controls} + U$$

Cross-metropolitan area hedonic studies suffer from several well known issues. Workers are likely to be sorting on unobserved skills such that superstars choose to live in superstar cities. For the typical baseball player, economist, real estate developer living in Tulsa does he learn what he would earn in New York City from observing Jeter, Sach's and Trump's wages there? It is likely that that in the wage regression, that workers with high unobserved skills self select and work in the largest cities. This leads OLS estimates of the b in the wage regression to recover a large positive coefficient. Given this point, I have more confidence in the home price regressions.

Table Five reports the estimates of "b" from the home price and wage regressions. In each year, I report the results with and with out state fixed effects. The home price coefficient pattern is consistent with the hypothesis that the big city capitalization effect is growing over time. The wage coefficients also suggest this pattern. One explanation for these findings is that some large cities have become "Superstar Cities". Growing demand for living in big cities combined with inelastic supply in cities such as San Francisco, Los Angeles and New York yields “Superstar Cities” (Gyourko, Mayer and Sinai 2006). Declining crime, and pollution in these cities may contribute to their “superstardom”. If non-market amenity improvements attract the skilled then a type of social-multiplier can be induced such that high income people move to these areas and this triggers further demand among the skilled who seek high quality peers, clean air and high quality restaurants and shopping opportunities.

Housing supply regulations will only enhance this “superstar” effect. Recent work has highlighted the role of housing supply regulation as a force for raising local home prices (Glaeser, Gyourko and Saks 2005). Such regulation is a commitment device signaling that quality of life will be maintained in such metro areas. Fischel (1990) has argued that zoning regulation is a type of insurance policy to protect homeowners against negative shocks. The value of such regulation to incumbent home owners is highest in cities with high quality amenities.

Conclusion

How much would the average person be willing to pay to live and work in New York City versus a rural area or a small city such as Buffalo or Rochester in the year 1900, 1950 or 2000? This differential should reflect both the urban wage premium (Glaeser and Mare 2001) and any quality of life premium. In this paper, I have argued that big city “bads” have gotten better over time and thus this willingness to pay for big city living has increased.

Thinking of cities as differentiated products, the research challenge is to define how to parsimoniously represent a city as a list of its quality of life attributes. While I cannot claim to have offered an exhaustive list, I have been able to provide new trend for specific important components of urban quality of life namely pollution, congestion in crime. Recently, each

It is important to note that within big cities, households can Tiebout sort into neighborhoods whose local public goods match their needs. A household can find a low smog area of Los Angeles (i.e Santa Monica) even though on average Los Angeles has above average smog levels relative to other cities. This ability to migrate to one's favorite community within the metro area, taking the within city hedonic pricing gradient as given, further reduces the cost of city "bigness" (DiPasquale and Kahn 1999).

This paper has been less ambitious about pinpointing why urban quality of life progress has taken place. The causes of pollution dynamics are now well understood and ongoing research continues to try to explain crime and congestion dynamics. The most novel "causal" evidence advanced in this paper has been my claim that sprawl has been a beneficial quality of life force. This contrarian view counters claims that sprawl reduces social capital, and makes us fat. While sprawl offers the obvious benefit of access to cheaper, newer housing it also leads to less congestion, decline in demand for public transit, less exposure to center city pollution and if the poor are in central cities, to less exposure to violent crime.

There are certainly other "ingredients" for building a vibrant "consumer city" (Glaeser, Florida, Waldfogel) but I cam confident that even in the absence of sunshine that a low pollution, low crime city will be able to attract the educated to live and work there and this aggregate market potential will attract upscale restaurants and shopping centers.

This paper has had little to say about the role of modern center city governments in providing high quality services per tax dollar spent. Clearly, cities would have higher quality of life if they provided garbage, police, public schools and fire protection efficiently (Gyourko and Tracy 1991). Are big cities doing a better job now than in the past? Sprawl may increase jurisdictional competition within a metro area encouraging center cities to provide better services. Alternatively, sprawl may strip center cities of a key source of tax revenue for financing local services.

This paper's evidence has all been based on U.S data but the findings may speak to mega city growth around the world. As mega cities grow in developing countries how much does urban quality of life decline? Similar to the U.S experience at the turn of the 20^{th} century, the negative quality of life consequences of living in a growing city hinges on whether government has the resources (Cutler and Miller 2004) and the incentives to provide necessary pubic infrastructure and regulation.

References (incomplete)

Baum-Snow, Nathaniel and Matthew E. Kahn (2005) The Effects of Urban Rail Transit Expansion: Evidence from Sixteen Cities from 1970 to 2000, Brookings-Wharton Conference on Urban Affairs . Volume, edited by Gary Burtless and Janet Rothenberg Pack.

Becker, Randy, and Vernon Henderson. 2000. "Effects of Air Quality Regulations on Polluting Industries." *Journal of Political Economy* 108, no. 2: 379–421.

Bento, Antonio M., Maureen Cropper, Ahmed Mushfiq Mobarak and Katja Vinha: "The Impact of Urban Spatial Structure on Travel Demand in the United States" Review of Economics and Statistics, 87(3) 466-478

Berry-Cullen and Levitt 1999).

Bowes, David and Keith Ihlanfeldt 2001. Identifying the Impacts of Rail Transit Stations on Residential Property Values. *Journal of Urban Economics* 50, 1-25.

Brueckner, Jan and Stuart Rosenthal. Gentrification and Neighborhood Housing Cycles: Will America's Future Downtowns be Rich? U.C Irvine Working Ppaer

Burtraw, Dallas, and David Evans. 2003. "The Evolution of NOx Control Policy for Coal-Fired Power Plants in the United States." Discussion Paper 03-23. Washington: Resources for the Future: (December).

Cain, Louis P., and Elyce J. Rotella. 2001. "Death and Spending: Urban Mortality and Municipal Expenditure on Sanitation." Annales de Démographie Historique 1: 139–54.
.
Chay, Kenneth Y., and Michael Greenstone. 2003. "The Impact of Air Pollution on Infant Mortality: Evidence from Geographic Variation in Pollution Shocks Induced by a Recession." Quarterly Journal of Economics 118, no. 3: 1121–67.

Condran, Gretchen and Rose Cheney. Mortality Trends in Philadelphia: Age and Cause Specific Death Rates 1870-1930. Demography 19(1) 1982 97-123.

Cutler, David M., and Grant Miller. 2004. "The Role of Public Health Improvements in Health Advances: The 20th Century United States." NBER working paper #10511.

Cutler, David, and Grant Miller. 2005. "Water, Water, Everywhere: Municipal Finance and Water Supply in American Cities." Working Paper 11096. Cambridge, Mass.: NBER (January).

DiPasquale, Denise, and Matthew E. Kahn. 1999. "Measuring Neighborhood Investments: An Examination of Community Choice." *Real Estate Economics* 27, no. 3: 369–424.

Donohue and Levitt

Ferrie, J.P. and Troesken Death and the city: Chicago's mortality transition, 1850-1925, W. | NBER Working Paper No. 11427 (June).

Glaeser, 1998 JEP

Glaeser, Edward L, Joseph Gyourko, and Raven Saks. 2005. Why is Manhattan So Expensive? Regulation and the Rise in House Prices." *Journal of Law and Economics*. 48(2): 331-370.

Glaeser, Edward and Matthew E. Kahn: (2004) "Sprawl and Urban Growth" (Chapter in the Handbook of Urban Economics Volume IV) , edited by Vernon Henderson and J. Thisse. Volume 4, North Holland Press.

Glaeser, Edward., Matthew E. Kahn, and Jordan Rappaport: (2007) "Why Do the Poor Live in Cities?" Journal of Urban Economics, forthcoming

Glaeser and Sacerdote 1999

Gordon, Peter, Ajay Kumar and Harry Richardson: (1991) "The Influence of Metropolitan Spatial Structure on Commuting Time." Journal of Urban Economics 26(2): 138-151.

Greenstone 2001.

Gyourko and Tracy (1991 and Gyourko, Mayer, Sinai (2006)

Haines, Michael. 2001. "The Urban Mortality Transition in the United States, 1800–1940." Historical Paper 134. Cambridge, Mass.: NBER (July).

Heaton, Fryer, Levitt and Murphy)

Henderson, Vernon. Urban primacy, external costs, and quality of life, Resource and Energy Economics, Volume 24, Issues 1-2, 15 February 2002, Pages 95-106.

Henderson, Vernon. 1996. "The Effect of Air Quality Regulation." *American Economic Review* 86, **no. 4**: 789–813.

Kahn, Matthew E. Green Cities: Urban Growth and the Environment. Brookings Institution 2006.

Kahn, Matthew E: "The Environmental Impact of Suburbanization" Journal of Policy Analysis and Management, Vol. 19, No. 4, Fall 2000, pp. 569-86

Kahn, Matthew E. 1999. "The Silver Lining of Rust Belt Manufacturing Decline." Journal of Urban Economics 46, no. 3: 360–76.

Kahn, Matthew E. and Joel Schwartz Urban Air Pollution Progress Despite Sprawl: The "Greening" of the Vehicle Fleet. 2007.

Levitt, Steven D: "Understanding Why Crime Fell in the 1990s: Four Factors that Explain the Decline and Six that do Not" Journal of Economic Perspectives, 2004 18(1) pages 1673-190.

Margo 1992)

Marshall, Julian, Thomas McKone, Elizabeth Deakin and William Nazaroff. Inhalation of Motor Vehicle Emissons: Effects of Urban Popualtion and Land Area. Atmospheric Environment 2005 39 283295

McNeil, J.R., Something New Under the Sun: An Environmental History of the 20th Century World. Norton Press. 2000

Melosi, Martin V. 2000. The Sanitary City: Urban Infrastructure in America from Colonial Times to the Present. Baltimore: The Johns Hopkins University Press.

Noll, Roger, Mary M. Shirley, and Simon Cowan. 2000. "Reforming Urban Water Systems in Developing Countries." In Economic Policy Reform: The Second Stage, NBER Volume edited by Anne O. Krueger. University of Chicago Press.

Reyes, Jessica. (2006) "Environmental Policy as Social Policy? The Impact of Childhood Lead Exposure on Crime

Roback 1982,
Rosen 1979

Stavins, Robert. 1992. 1998. "What Can We Learn from the Grand Policy Experiment? Lessons from SO_2 Allowance Trading." *Journal of Economic Perspectives* 12, no. 3: 69–88.

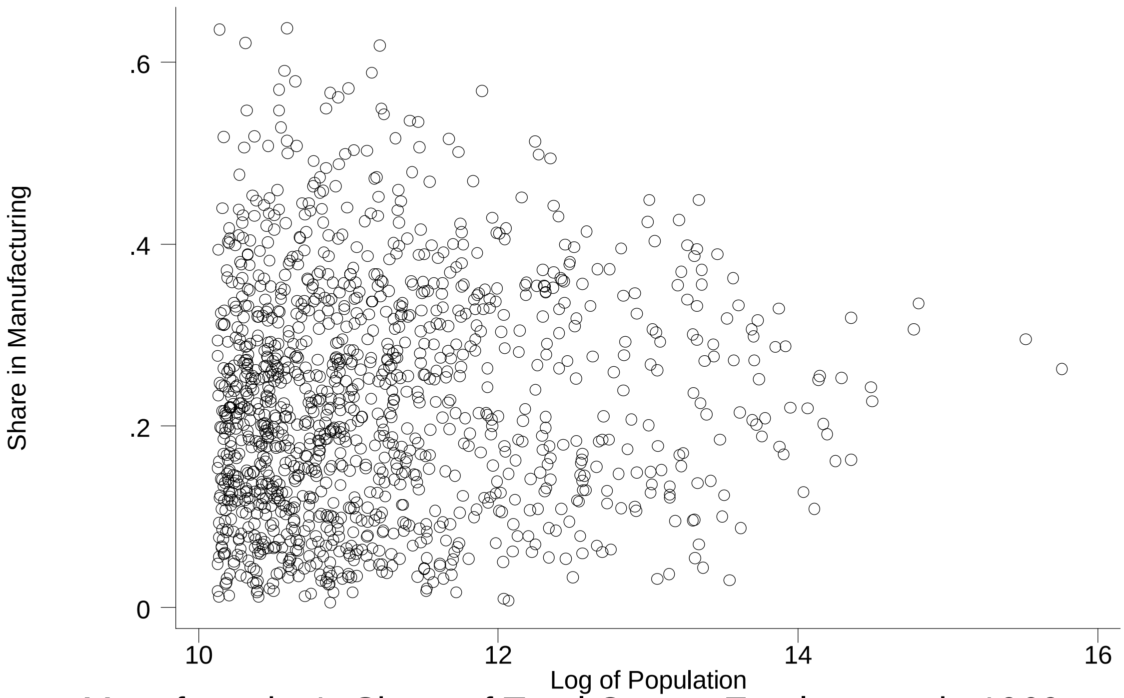
Tolley

Waldfogel, Joel 2006. The Median Voter and the Median Consumer. Local Private Goods and Residential Sorting.   NBER Working Paper #11972.

Williamson, Jeffrey. 1981a "Urban Disamenities, Dark Satanic Mills, and the British Standard of Living Debate." Journal of Economic History. March 75-83

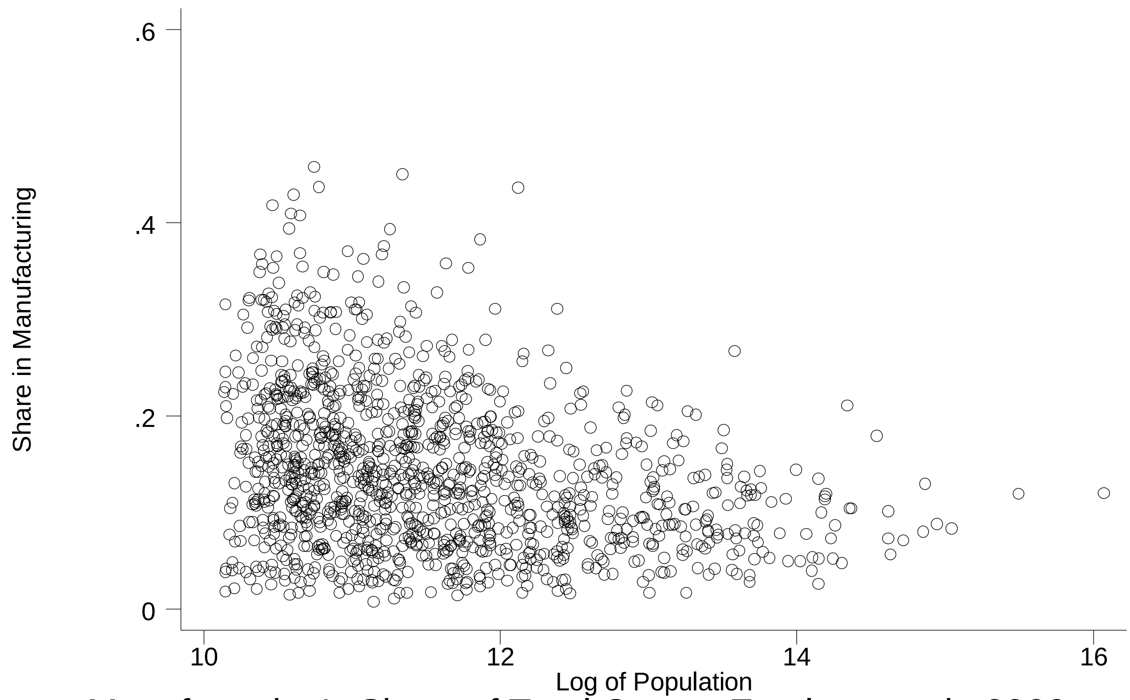
Williamson, Jeffrey. 1981b "Some Myths Die Hard --Urban Disamenities One More Time: A Reply." Journal of Economic History. XLI(4) 905-907.

Figure One



Manufacturing's Share of Total County Employment in 1969

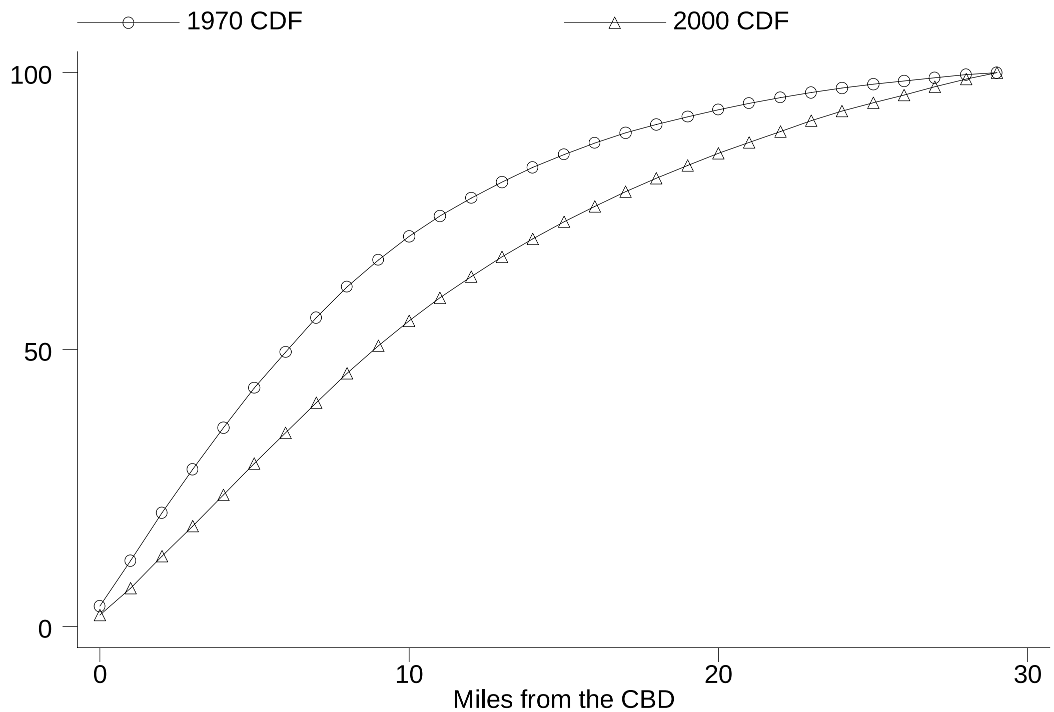
Figure Two



Manufacturing's Share of Total County Employment in 2000

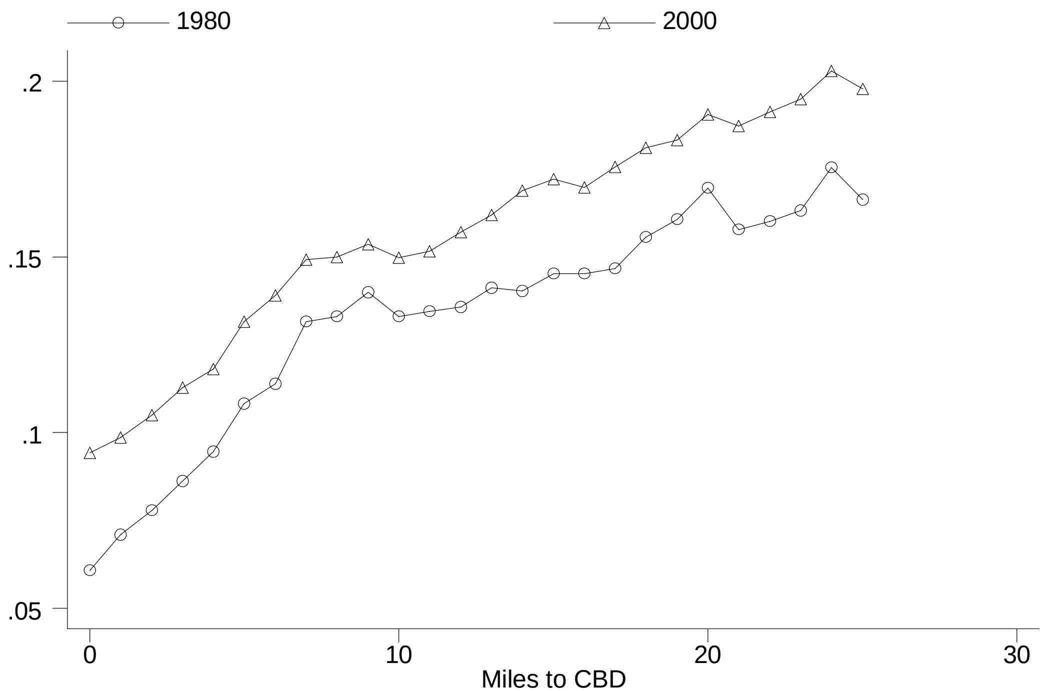
N=1242; at least 25,000 people in 1969

Figure Three



The Spatial Distribution of the Urban Population in 1970 and 2000

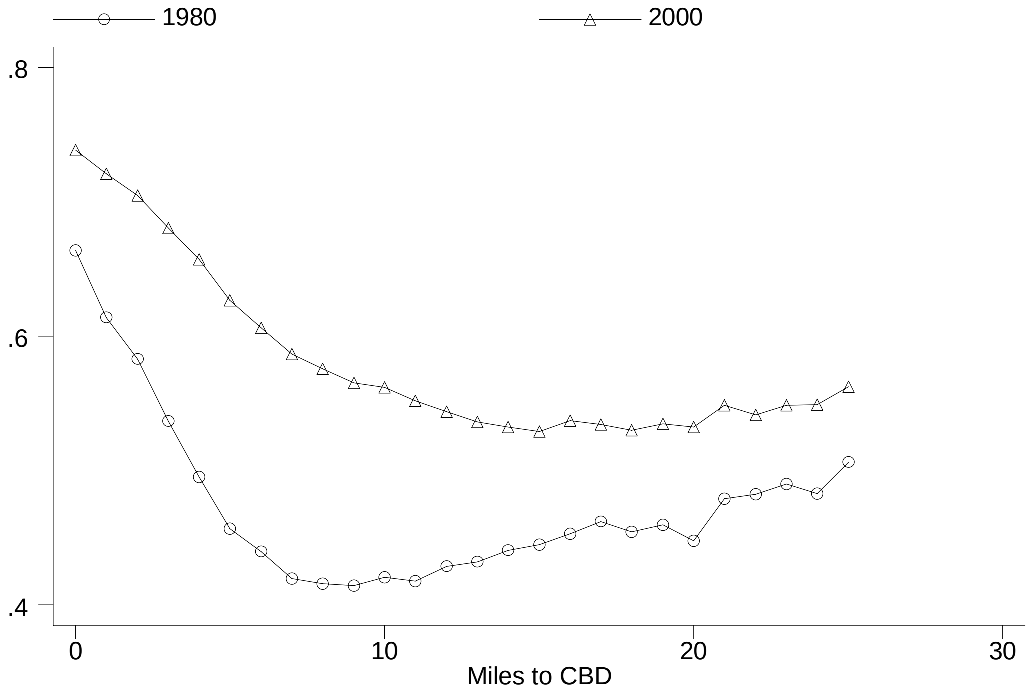
Figure Four



Share with Commute Over 45 Minutes

All Metro Areas

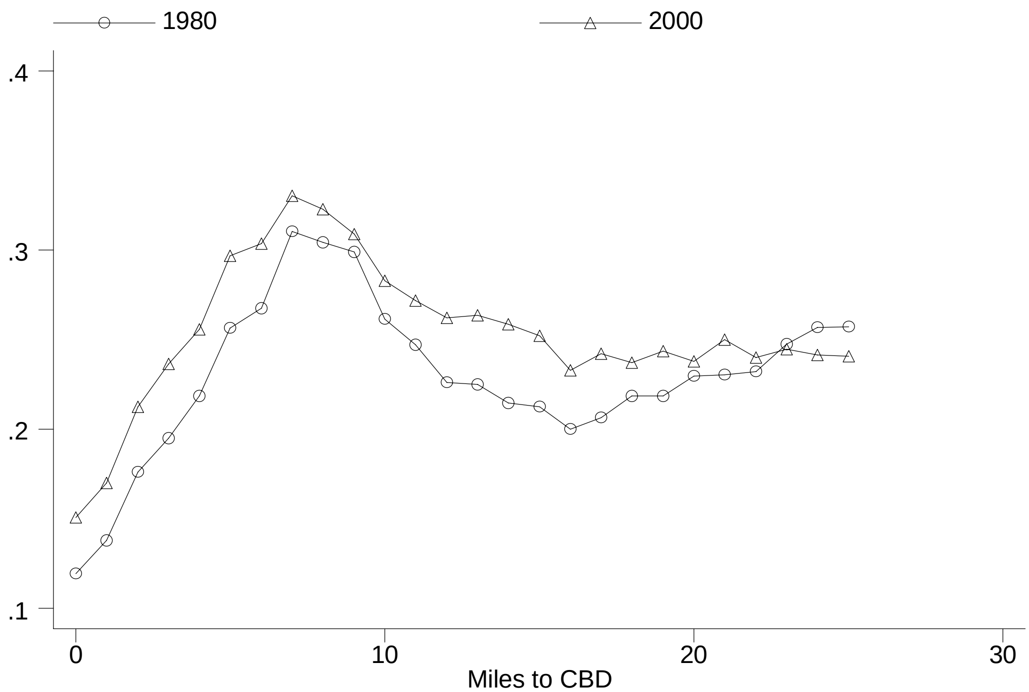
Figure Five



Share with Commute Less than 25 Minutes

Figure Six

NYC, Chicago and Los Angeles



Share with Commute Over 45 Minutes

Figure Seven

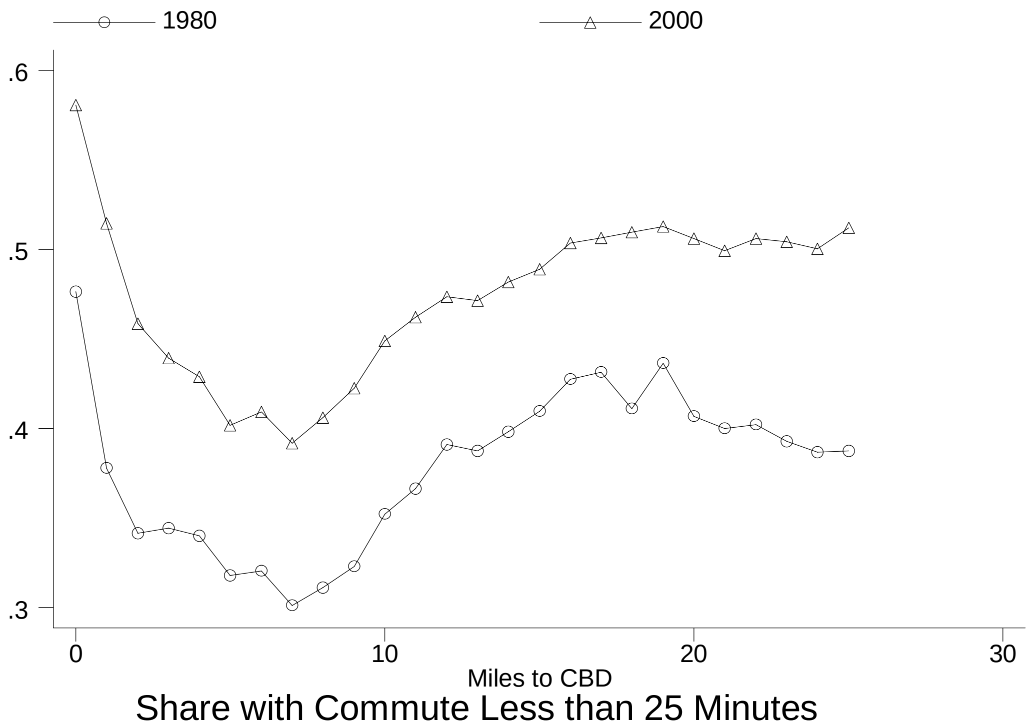
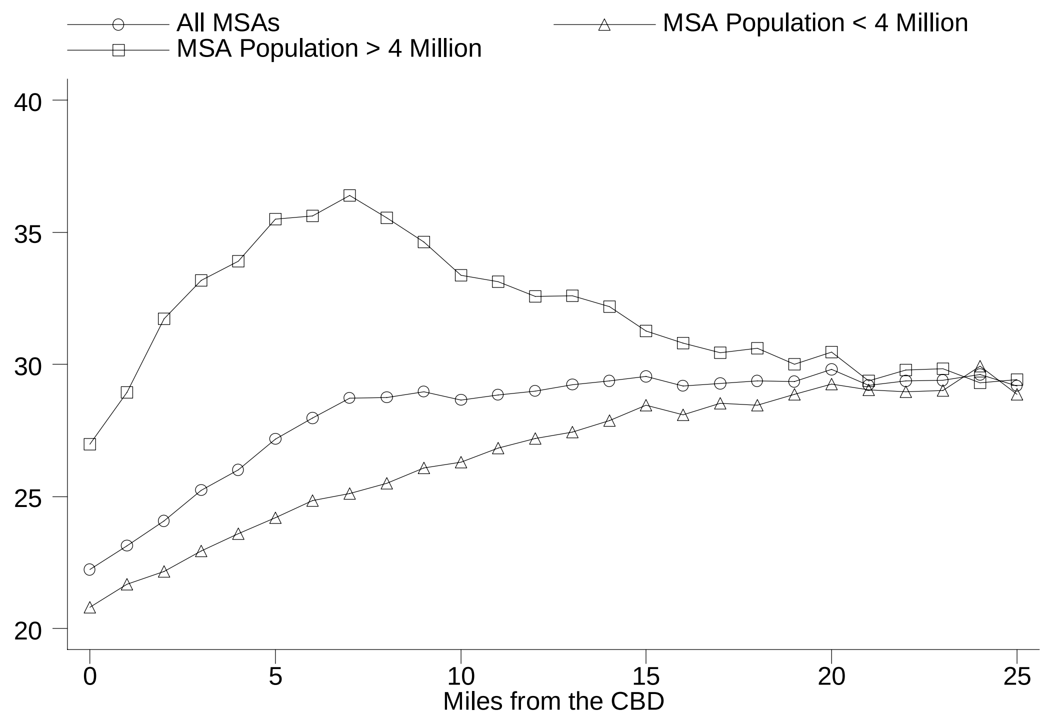


Figure Eight



Average Commute Time in the Year 2000 By City Size

Table One: Time Trends in U.S Ambient County Pollution Levels

	Pollutant											
	Carbon Monoxide		Sulfur Dioxide		Ozone		Nitrogen Dioxide		Particulates		PM10	
	coeff	s.e	coeff	s.e	coeff	s.e	coeff	s.e	coeff	s.e	coeff	s.e
time trend	-0.0438	0.0007	-0.0121	0.0007	0.0029	0.0002	-0.0205	0.0006	-0.0201	0.0004	-0.0337	0.0070
log(county population)	0.1926	0.0054	0.1480	0.0049	-0.0061	0.0015	0.2892	0.0039	0.0939	0.0019	0.0608	0.0025
% of County Employment in Manufacturing	-0.3126	0.0820	0.9928	0.0672	0.0959	0.0240	0.6294	0.0550	0.3030	0.0247	0.1625	0.0439
constant	-1.6960	0.0707	-0.0870	0.0592	3.8881	0.0201	-0.6492	0.0480	3.0432	0.0219	3.1827	0.0340
State Fixed Effects	Yes		Yes		Yes		Yes		Yes		Yes	
Observations	6735		13318		12200		8397		21089		8897	
R2	0.564		0.446		0.282		0.602		0.37		0.3980	

The unit of analysis is a county/year. The dependent variable is the log of a specific ambient pollutant. The data are from the years 1973 to 2000.

Table Two: Exposure to Ambient Pollution and Noxious Facilities as a Function of Distance to the CBD

	The dependent variable is the Log of the Ambient Pollutant												Dummy Variable			
	Particulates		Carbon Monoxide		Sulfur Dioxide		Nitrogen Dioxide		Ozone		PM10		Toxic Release Inventory Site present		Superfund Site present	
Column	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	beta	s.e	beta	s.e	beta	s.e	beta	s.e	beta	s.e	beta	s.e	beta	s.e	beta	s.e
Miles to CBD	-0.0107	0.0002	-0.0245	0.0007	-0.0137	0.0006	-0.0274	0.0005	0.0051	0.0002	-0.0102	0.0003	-0.0148	0.0005	-0.0098	0.0004
Constant	4.3896	0.0044	0.8880	0.0127	-4.7545	0.0114	-3.3816	0.0087	-3.1386	0.0048	4.5327	0.0365	0.3725	0.0087	0.2590	0.0081
Observations	27413		10650		15251		11349		28680		13585		15463		15463	
R2	0.436		0.613		0.585		0.593		0.332		0.511		0.163		0.126	
Unit of Analysis	Monitor		Monitor		Monitor		Monitor		Monitor		Monitor		zip code		zip code	
MSA Fixed Effect	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	

This table reports eight regression models. In columns (7) and (8), I report linear probability models where the unit of analysis is a zip code. These regressions include the zip code's total land area as a control. The sample includes all residential zip codes that are within 30 miles of a CBD.
In columns (1) through (6), the sample includes all monitoring stations within 30 miles of a CBD in metropolitan area that has at least 500,000 people.
The sample covers the years 1973 to 2005.

Table Three: Commuting in Cities Based on 2001 NHTS Micro Data

Speed Measured in Miles Per Hour

	beta	s.e	beta	s.e	beta	s.e
Log(City Size)	-2.2870	0.4227	-2.4625	0.2774	-1.8149	0.2067
Distance to CBD			0.4472	0.0363	0.3847	0.0306
Commute Using Public Transit					-10.5490	0.7344
constant	62.5491	6.1644	59.9064	3.8177	51.6993	2.9003
observations	25778		25778		25778	
R2	0.023		0.0680		0.1010	

Commute Time in Minutes

	beta	s.e	beta	s.e	beta	s.e	beta	s.e
Log(City Size)	2.8024	0.1982	2.7324	0.1968	1.3495	0.3275	2.5958	0.2796
Distance to CBD			0.1784	0.0317	0.3117	0.0395	-0.1998	0.0325
Distance to Work							1.2649	0.0311
Commute Using Public Transit					22.5271	1.7225		
constant	-18.8196	2.8554	-19.8738	2.9573	-2.3477	4.4455	-27.4718	4.0011
observations	25778		25778		25778		25778	
R2	0.029		0.0360		0.1650		0.529	

Distance to Work in Miles

	beta	s.e	beta	s.e
Log(City Size)	0.2250	0.2577	0.0997	0.1096
Distance to CBD			0.6181	0.0846
Distance to CBD Squared			-0.0116	0.0029
Constant	7.7779	3.7549	4.5597	1.5724
observations	25778		25778	
R2	0		0.0590	

This table reports nine OLS regressions. The unit of observation is a commuter. Standard errors are clustered by metropolitan area. The data source is the 2001 National Household Transportation Survey.

Table Four: Metropolitan Area Crime Trends from 1994 to 2002

	Log(1+ murder)		Log(1+violent)		Murders per 1000		Violent Crimes per 1000	
	coeff	s.e	coeff	s.e	coeff	s.e	coeff	s.e
log(county population)	0.9452	0.0094	1.1486	0.0122	0.0151	0.0007	0.3656	0.0150
time trend	-0.0638	0.0036	-0.0771	0.0046	-0.0035	0.0003	-0.0975	0.0057
constant	-9.2512	0.1112	-8.3101	0.1443	-0.1178	0.0087	-2.0449	0.1775
State Fixed Effects	Yes		Yes		Yes		Yes	
Observations	7467		7467		7467		7467	
R2	0.666		0.746		0.168		0.382	
	coeff	s.e	coeff	s.e	coeff	s.e	coeff	s.e
log(county population)	0.9492	0.0090	1.1523	0.0120	0.0154	0.0007	0.3736	0.0141
time trend	-0.0316	0.0082	-0.0813	0.0109	0.0014	0.0006	-0.0440	0.0128
County Poverty Rate	0.0583	0.0031	0.0396	0.0041	0.0052	0.0002	0.1107	0.0049
time trend*County Poverty Rate	-0.0027	0.0006	0.0003	0.0008	-0.0004	0.0000	-0.0045	0.0010
constant	-10.0014	0.1134	-8.8308	0.1508	-0.1833	0.0089	-3.4732	0.1772
State Fixed Effects	Yes		Yes		Yes		Yes	
Observations	7467		7467		7467		7467	
R2	0.692		0.755		0.233		0.455	

The unit of analysis is a county/year. The sample includes all counties between 1994 and 2002 for the subset of counties that are part of a metro area. The County poverty rate is based on 1990 data. The mean poverty rate is 12.06 and the standard deviation is 5.59. The murder rate has a mean of .046 and a standard deviation of .068. The violent crime rate has a mean of 1.855 and a standard deviation of 1.6143.

Table Five: Compensating Differential for City Size Based on Hedonic Regressions from 1980 through 2005

Coefficient on Log(Metro Area Population)

Year	Home Prices		Wages	
	No State Fixed Effects	With State Fixed Effects	No State Fixed Effects	With State Fixed Effects
1980	0.097	0.077	0.03	0.026
1990	0.18	0.124	0.06	0.04
2000	0.13	0.088	0.048	0.017
2005	0.17	0.13	0.054	0.04

This table reports the coefficient on the Log(Metropolitan Area Population) from sixteen OLS hedonic regressions. The wage sample includes working men ages 18 to 65. The wage data has been trimmed to remove outliers. In the wage regression, standard demographic covariates such as age, ethnicity and education are controlled for.
In the log(home price) regressions, I control for the housing unit's number of rooms and the age of the unit.