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Measuring the Impact of Urban Amenities on Metropolitan Wages

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Measuring the Impact of Urban Amenities on Metropolitan Wages

Abstract

My research will be presented as follows. Section II will review noteworthy research on urban amenities. Section III will present my theoretical model. Section IV will discuss data sources. Section V will present the empirical model developed by applying available data to the paper's theoretical model. Section VI will show results obtained from the empirical model. And finally, Section VII will summarize conclusions from my study as well as their implications for public policy and future research.

Measuring the Impact of Urban Amenities on Metropolitan Wages

Ben Burry

I. Introduction¹

Many studies have examined the obvious disparity between the average wages of workers in different metropolitan areas. Traditionally, these studies have attempted to account for average wage differentials with two popular explanations. First, researchers point to substantial differences in job composition. For example, households in San Jose, California have much higher wages than the national average. However, this phenomenon can largely be explained by the fact that San Jose employs 10.2 percent of the nation's information technology workers (O'Sullivan, 2007). With such a disproportionate share of skilled employees, we can account for much of the deviation in wages from the national average.²

The second popular explanation for wage discrepancies is differences in prices. It has been established that there is marked variation in purchasing power between metropolitan areas. This can explain wage differences in that, if the prices of housing and food are particularly high in one city, workers will demand higher wages to be willing to live in that metropolitan area (Gittleman, 2). This concept can be described as intercity cost of living differences.

Still, these traditional explanations are far from a complete explanation. The National Compensation Survey (NCS) published by the Bureau

of Labor Statistics has rated every job from 1 to 15. A higher number corresponds to higher skill levels, more responsibilities, and union status. To examine the two traditional explanations, studies have used these numerical designations to control for differences in job composition as well as real wage (instead of nominal wage) to control for intercity cost of living differences. The results of such studies reveal that significant disparities between average wages across metropolitan areas still exist.

Studies in urban economics have produced a third explanation to account for the remaining discrepancies in average wages across metropolitan areas that focuses on differences in amenities across cities. It is assumed that wages will adjust to achieve a locational equilibrium in which workers are completely indifferent between living and working in different urban areas. The presence of urban amenities (or an absence of disamenities) creates lower wages in a city with otherwise identical characteristics. An amenity is anything that increases the relative attractiveness of a city, which thereby increases immigration to the city. This can be graphically represented by shifting the labor supply curve outward in the framework of a labor market (O'Sullivan, 80). Following from this theoretical framework, which relates labor supply and demand to wages and employment, a labor supply shift outward (as shown in Figure 1) will increase employment and, thus, put downward pressure on wages, all else being equal.

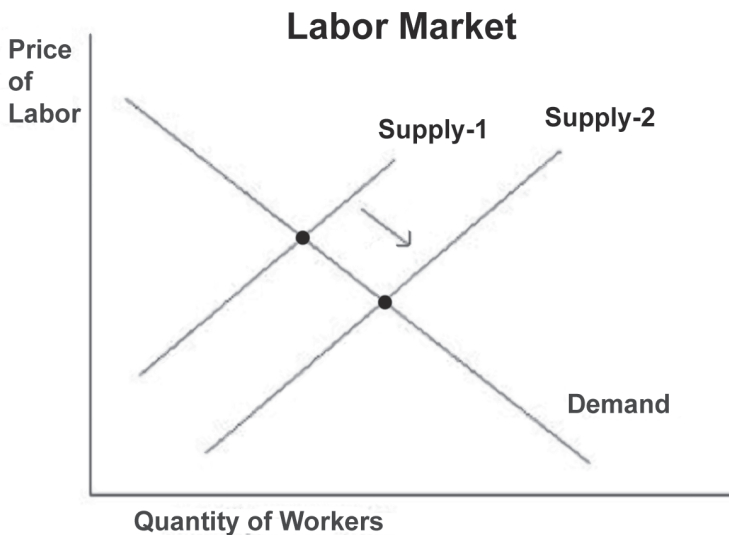
Examples of amenities include relatively clean air, clean water, short commuting time, low crime, a high amount of parks or undeveloped land per acre, high quality public education, a high number of cloudless days per year, coastal

1 *Ben Burry is a senior economics major from Trumbull, Connecticut. He wrote "Measuring the Impact of Urban Amenities on Metropolitan Wages" for his senior project class.*

2 Note: For the purpose of comparing all workers, data from wage-earning employees are treated as if wages earned throughout the year were instead an annual salary. Hence wages and income are interchangeable in this paper.

location, and a temperate climate. By definition, a metropolitan area includes workers who contribute to the city's economy. This means that citizens reside in the same metropolitan area where they work. Since the same amenities are desirable to most workers, average wages should be lower in areas with high levels of amenities to ensure locational equilibrium between met-

Figure 1: The Effect of Urban Amenities on a Labor Market.



ropolitan areas. This study seeks to quantify the impact of various amenities on the average wage in major U.S. metropolitan areas.

My research will be presented as follows. Section II will review noteworthy research on urban amenities. Section III will present my theoretical model. Section IV will discuss data sources. Section V will present the empirical model developed by applying available data to the paper's theoretical model. Section VI will show results obtained from the empirical model. And finally, Section VII will summarize conclusions from my study as well as their implications for public policy and future research.

II. Review of Literature

Research in this area began relatively recently and is fairly sparse. At first, studies presented conflicting results, and initially there was support both for and against the presence of regional

wage differentials. Ladenson (1973), Coehlo and Ghadi (1973), Sahling and Smith (1983), and Cullison (1984) all conclude that after adjusting for human capital characteristics, job composition, and regional inflation, real wage differentials still exist, thus allowing the possible explanation of locational amenities (cited in Brown, 1994). However, Coehlo and Ghali (1971),

Bellante (1979), Gerking and Weirick (1983), and Dickie and Gerking (1987) all conclude that after these same adjustments, real wage differentials do not exist, meaning amenities do not impact income (cited in Brown, 1994). Research by Roback (1982) and Beeson and Eberts (1989) extend the affirmative findings to more substantially confirm real wage differentials (cited in Brown, 1994). Their research suggests that the wage differentials are accounted for by differences in locational amenities and goes on to argue that workers will accept lower wages as compensation for greater amenities (Brown, 1994).

One widely accepted methodology for assessing an individual's willingness to pay for something is the hedonic technique. In general economic theory, the hedonic approach concerns a good with a number of components, each of which has an implicit price. The market price is then the sum of the prices of the individual components (O'Sullivan, 2007). However, only recently, as Katrin Rehdanz and David Maddison (2004) note, has the approach been deliberately applied to the valuation of amenities for households. Applied to urban economics, the hedonic approach rests on the assumption that each amenity attracting households to a particular location can be assessed an implicit price. These implicit prices are quantifiable through the examination of households' locational decisions, since households will be willing to pay higher property prices and/or earn lower wages in order to benefit from urban amenities. The willingness to pay for each amenity is then derived from observable market prices.

David Clark and James Kahn (1987) present

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an interesting study on environmental amenities. The study uses a two-stage hedonic wage methodology in order to value environmental amenities. Ultimately this approach is applied to the recreational fishing amenity and the recreational fishing benefits of water quality improvements. The contribution made to the field of urban economics is the first application of a hedonic approach to estimate marginal willingness to pay and supply functions capable of being used to estimate social benefits.

Essentially, what Clark and Kahn (1987) argue is that by assuming a continuous wage opportunity locus, marginal implicit prices in the market will accurately reflect the marginal willingness for all residents to pay for an amenity. However, if instead, there is not a perfect matching between worker taste groups and the available amenity selections, the marginal willingness to pay for the amenity will only reflect the willingness to pay of a portion of the locality's population. With this weighty assumption in place, stage two of the hedonic wage approach can occur. In stage two, occupational dummy variables are used to control for different wage opportunity loci. This allows identification of a willingness to pay function (Clark and Kahn, 1987). The development of the two stage hedonic wage methodology shows its usefulness in order to determine marginal willingness to pay for amenities as long as its continuity assumption is reasonable. In this paper, a hedonic approach is used. However, a two-stage model presents additional complexities and, in this author's opinion, unrealistic assumptions including homogeneity of tastes within a city, perfect information, and instantaneous adjustments to achieve short-run locational equilibrium.

After Clark and Kahn's (1987) study, literature on the impact of amenities shows widespread support for locational amenities compensating for regional real wage differentials of workers. This movement quickly gained momentum, and no single study published after 1987 denies the impact of locational amenities on

workers' incomes. The resolution of this debate among economists ushered in a new era where researchers honed their econometric techniques, introduced new perspectives on amenities, and utilized better and more recent data sets.

We resume our discussion with a study by Ralph Brown published in 1992. Uniquely, he uses amenity data for states rather than metropolitan areas in order to consider whether theories which showed utility equalization across metropolitan areas are also relevant to entire states. Brown's (1992) research supports the view that locational amenities are in fact utility equalizing across states. He uses aggregate state data as the unit of analysis and more recent data on the cost of living by state as well as a new amenity index, both of which were developed by Halstead in 1992. I include this study in my discussion because it provides further justification for this study's attempt to explain regional wage differentials through urban amenities.

Also in 1992, research by James Kahn and Haim Ofek argues that there is a positive relationship between wages and the population size of a city. Rather than appealing to compensating wage differentials, Kahn and Ofek (1992) rely upon a dynamic spatial equilibrium. In the study, Kahn and Ofek (1992) convincingly point out that the theory of compensating wage differentials can provide misleading answers regarding the relationship between wages and city size. On one hand, theory predicts a positive relationship due to greater cost of living, crime, pollution, and congestion. On the other, we expect a negative relationship due to amenities such as cultural and recreational opportunities, economies of scale in consumption, and lower costs of a job search in larger urban labor markets.

Ultimately, Kahn and Ofek (1992) posit a long-term static equilibrium model in which there is no incentive for relocation and cities expand geographically until the residential rental price is equal to the agricultural rental price. However since private costs and benefits are not aligned with aggregate social costs and benefits,

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cities often expand past the point of optimal utility, generally becoming too large, both numerically in terms of population and geographically in terms of total area, so that each marginal immigrant makes the city a less pleasant place to live (this is graphically represented in Figure 2). Since workers in a metropolitan area must be compensated for diminished utility due to each marginal immigrant and cities have populations greater than optimal, we can expect a positive relationship between metropolitan population and workers' wages (Kahn and Ofek, 1992). The ramification of this study is that urban growth can be reasonably expected to constitute an urban disamenity. By examining some interesting questions Kahn and Ofek (1992) have inspired the inclusion of each locality's population size as an explanatory variable for its average wage rate in this study.

In 1999, Stuart Gabriel and Stuart Rosenthal published a study which brought to light some important econometric issues which must be addressed while conducting studies on amenities. Using data from the American Housing Survey for 1985 and 1989, the researchers conducted three regressions on each year to elucidate some important concepts. Their first regression is the least specific and ignores location, their second regression controls for SMSA (an earlier designation for MSA), and their third regression is the most specific, controlling for each neighborhood location within each SMSA. This approach is easily implemented through the use of dummy variables.

The results are instructive. The regression ignoring location suffers from omitted variable bias because it fails to control for the educational and demographic attributes of each location which affect worker skill level and worker geographic choice. On the other hand, the most specific regression, which controls for individual neighborhood, introduces a simultaneity bias because of "the endogenous choice of location on the basis of income" (Gabriel and Rosenthal, 1999 p. 445). Finally, the regression controlling

only for SMSA is an appropriate middle ground in that it suffers from neither omitted variable bias nor simultaneity bias.

This study illustrates that failing to use control variables for a sufficiently specific location results in a failure to consider many palpable yet directly unobservable locational attributes. For example, Gabriel and Rosenthal's study (1999) overestimates the black earnings deficit by six percent and overestimates the gender income gap by three to six percent. The reason for this seems to be that black workers and male workers more often live in cities that are expensive in relation to the amenities offered by those labor markets. Conversely, controlling for a more specific geographical area than appropriate will result in simultaneity bias, possibly rendering the t-statistics of explanatory variables insignificant.

This study prompts me to consider whether using only a single control variable for an entire MSA is appropriate. For example, in the single MSA designating Boston, Massachusetts, median individual annual income ranges from \$12,100 to \$98,900 across neighborhoods (O'Sullivan, 2007). Additionally, the percent of adults with a college degree varies from five percent to 89 percent across census tracts in Boston's MSA (O'Sullivan, 2007). This enormous disparity begs the question: do both of these groups value urban amenities in the same way? I believe the answer is no. It certainly seems likely that each neighborhood would not exhibit the same willingness to pay for a public park or better sailing weather, largely because of the diminishing marginal utility of income.

A study by Stephen Brown, Kathy Hayes, and Lori Taylor (2003) primarily concerned with the effects of public policy on factors of production and economic growth includes an equation which uses local amenities as an explanatory variable for the price of labor. This study includes taxes, the unemployment rate, and provision of government services such as health care, education, public safety, and transportation, as well as local amenities as important

factors explaining an individual's overall utility in a location. Assuming long-run equilibrium and that income differences represent compensating differentials for locational amenities, Brown, Hayes, and Taylor's (2003) study reaches some interesting conclusions. They find that while sales and income taxes spent on transportation increase private employment (as a proxy for population), property taxes spent on nearly any government service (i.e. welfare, housing, public safety, higher education, and elementary/secondary education) decrease the number of workers in a location. The overall conclusion from the study is that citizens are generally taxed too heavily, since most types of taxation intended to raise money for government services ultimately leads to less employment in a location (Brown, Hayes, and Taylor, 2003).

Brown, Hayes, and Taylor's (2003) study is unique in the thoroughness with which it addresses the efficiency of state and local government as an amenity. Their results clearly fit with general theory. Since citizens would like to be taxed only enough to provide for services they deem worthwhile, an efficient government represents an amenity for which one must forgo some income to enjoy, while an inefficient government represents a disamenity that is rewarded with additional income in order to achieve locational equilibrium. Granted, government efficiency is difficult to measure, and, thus, it is difficult to include as an explanatory variable in studies of average wages in metropolitan areas. Nevertheless, differences in the efficiency of local and state governments remain a valid potential explanation for unexplained variation in average incomes between metropolitan areas in studies on urban amenities.

Another important study, by Rehdanz and Maddison (2004), assesses the amenity value of climate to German households. Their paper cites several implications of climate conditions for households including the need for heating and cooling, clothing, housing, nutritional expenditures, recreational possibilities, and human

health. Additionally, "Certain types of climate are also known to promote a sense of happiness and the sorts of fauna and flora supported by particular sorts of climate are also a source of pleasure to households" (Rehdanz and Maddison, 2004 p. 2). This line of reasoning shows that not only are moderate climates more desirable for comfort, but they also can reduce expenditures on home climate control, clothing, nutrition, and health problems. Rehdanz and Maddison (2004) leave us to consider to what extent, if any, citizens are actually paying for the benefits of comfort rather than simply accepting lower net wages in order to reduce future expenditures on these items.

Results show that climate variables exercise a statistically significant effect on wage rates, especially in East Germany (Rehdanz, 11). In particular, households pay a substantial premium for living in areas characterized by higher temperatures in January and lower temperatures in July (Rehdanz, 14). However, the question I infer from their research is left unanswered: to what extent is the premium paid to alleviate future expenditures rather than personal comfort. Climatic variation features prominently in my study. Evidence here that favorable climate has direct monetary implications, other than the comfort it provides, further justifies its inclusion in my study.

A study by Maury Gittleman (2005) illustrates the necessity of using a methodology that takes into account variation in employment concentrations across cities. His results, which use regression-based techniques and the National Compensation Survey of 2002, show that it can be misleading to measure wage differentials with mean hourly wage by area because this does not control for the fact that job characteristics differ from one area to the next. This is an important effect to consider, and despite the fact that it has only recently been acknowledged in the literature, its effect can be substantial when attempting to quantify the impact of urban amenities on wages.

Gittleman's (2005) study elucidates that

a comparison between San Jose, an information technology capital, and Milwaukee, “The Blue Collar City,” would inaccurately portray the monetary impact of urban amenities unless one was able to control for the unequal shares of skilled labor between the two cities. Using data from the National Compensation Survey, this study effectively controls for worker skill level by using the data’s number codes of 1-15 to designate occupation skill level. Additionally, the data reveal whether or not the position is covered by collective bargaining agreement, which generally increases pay.

Gittleman (2005) also expounds a more technical reason why comparing overall mean salary information may be misleading. Surveys taken in the same year will produce different results based on what time during the year they were taken. Information on wages at the end of the year will be misleadingly higher due to “inflation and other secular trends” (Gittleman, 2005 p. 1). In order to account for this discrepancy, Gittleman introduces a dummy variable for which quarter the census data was gathered.

Gittleman’s study justifies my inclusion of worker skill level as a control variable to equalize job concentration across metropolitan areas. It is reasonable to assume that the skill set obtained by a worker through education will possess a strong positive correlation with the monetary compensation of that worker’s occupation. The quarter in which data are collected, according to theory, should have an impact on wages. But such an effect would be miniscule and is often incapable of being controlled for, given most data sets.

In this study I will use more recent data in order to quantify the impact of urban growth and a favorable climate on urban wages, which have been previously examined in the literature. Additionally, I will use more recent data to quantify the impact of crime and coastal location on urban wages. In contrast to urban growth and climate, crime and coastal location have rarely been treated independently as urban amenities.

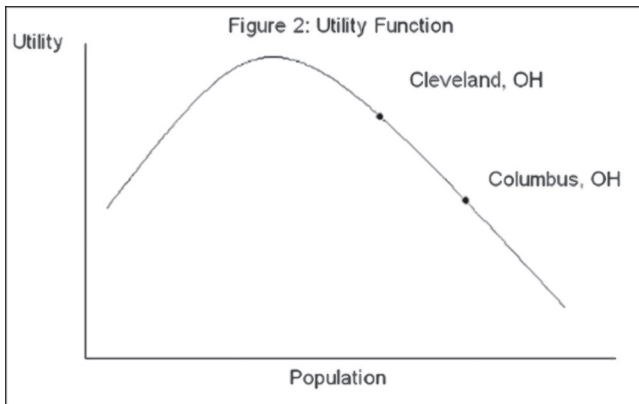
Some climatic studies, such as Rehdanz and Maddison (2004), indirectly examine one of the benefits of coastal location in that it generally has a moderating effect on temperature. Brown, Hayes, and Taylor (1992) also use coastal location as a dummy variable in their study of statewide amenities. However, due to Brown, Hayes and Taylor’s (1992) econometric approach, the impact of coastal location is not fully explored because its effects are held constant for any climatic effect it may possess. Furthermore, since the study uses statewide data, it can not assess the impact of residing in a location with immediate coastal access. Analysis of crime’s effect has been less extensive as well. Only with regard to amenities for corporate locational decisions has it been thoroughly examined (Gottlieb, 1995).

III. Theoretical Model

The theoretical model used in this analysis is first derived from a utility function. Utility is the term used for the total benefit to an individual when all the costs and benefits of living in a particular city are taken into consideration. In this model, the utility received by citizens of each metropolitan area is a function of income, amenities, and purchasing power. The individual values of these three factors will likely be different for each city; however, in order for locational equilibrium to exist, these three factors must yield the same utility for all cities when taken together. For example, if Cleveland, Ohio provides greater utility than Columbus, Ohio, but both face identical utility curves, citizens from Columbus would move to Cleveland until both cities had identical utility levels. As we can see in Figure 2, and following from Kahn and Ofek’s (1992) research, cities will generally be too large, so population growth will adjust utility to a point of equilibrium. In this case, utility from Columbus increases as it experiences population decline and Cleveland’s decreases as it experiences population growth.

This nationwide phenomenon also occurs between cities with different utility curves. These

cities simply reach identical utility at different population levels. Locational equilibrium is represented for each city with the basic supply-demand model used to represent an individual city's labor market (see Figure 1). Based on this graphical model and the fundamental assumption in urban economics that wages and urban amenities are inversely related, I plan to test my hypotheses. It is also important to bear in mind that a change in amenities is not the only factor which can change wages rates and employment.



A multitude of factors, such as a minimum wage increase, better education, more skilled labor, price of capital inputs, and technological advances, may shift these curves as well.

As previously discussed, urban amenities will be used to explain variation in average wages across metropolitan areas. In order to accurately assess the impact of these urban amenities, income must be adjusted for intercity cost of living differences. Additionally the model must control for variation in skill levels of workers in different metropolitan areas. By removing the impact that cost of living and skill level have on average wages, my study will be able to quantify the implicit value of several urban amenities using a hedonic model.

The hypotheses of my study are as follows:

After controlling for intercity cost of living and job composition differences,

1) Cities located in more moderate climates with more sunshine will pay lower wages.

2) Cities with higher levels of personal crime will have lower adjusted familial income.

3) The inherent desirability of living in a coastal city will force residents to accept lower adjusted incomes in order to enjoy these benefits.

4) Cities with greater populations will, on average, pay their residents higher wages.

The following will explain the theoretical justification for each of the four hypotheses. First, as shown by Rehdanz and Maddison (2004), climactic discrepancies can have a significant effect on the locational decisions of households. The United States is a large country and weather patterns vary in different regions. Following from theory, desirable weather should entice households to pay a premium in order to reside in such areas. Conversely, households residing in inferior climatic conditions will be compensated with higher wages or a lower cost of living for residing in inferior conditions. This arrangement will allow locational equilibrium. It is important to note that even if workers are not enticed to less desirable locations by higher wages, the resulting high population density in desirable locations would cause a greater cost of living and lower utility (Kahn and Ofek, 1992), ensuring locational equilibrium.

Next, we must consider the impact of the crime disamenity on household's locational decisions. Although individual weather preferences may vary, unanimous aversion to crime may be realistically assumed. So, who gets to live in crime free areas? It is the households willing to pay a premium to do so. Since high income households have more to lose through injury and property loss from crime, as well as more money available to pay a premium, they should be the most willing to pay a higher premium to live in low crime areas.

But crime is more complex than this. Crime can be broken down into two categories: personal crime and property crime. Personal crime occurs when the victim is placed in physical danger. Examples include murder, rape, and assault. Property crime occurs stealthily and includes burglary, larceny, and auto theft (O'Sullivan, 2007). So, although high income individuals may

be willing to pay a higher premium (in terms of lower wages or a greater cost of living) to live in areas with low property crime, the presence of high income individuals in a community creates a greater incentive for rational individuals to engage in property crime. The reason behind this is that the expected payoff resulting from the decision to commit a crime is greater (O'Sullivan, 2007). Thus, the impact of crime on wages is ambiguous since there are two opposing effects in play.

When considering personal crime, the implications are not conflicting. Not only is it likely that high income households are willing to pay a higher premium to avoid personal crime, once this income segregation has occurred, there is no greater incentive to commit personal crime in high income neighborhoods. Since there are generally no monetary payoffs to committing personal crime, we solely consider the fact that high income earners face a greater opportunity cost to possible imprisonment which results in forgone income (O'Sullivan, 2007). Thus, personal crime should be much more concentrated than property crime. Additionally, this presents the possibility of self-reinforcing effects which would likely occur as follows. First, a lower income city experiences higher personal crime since, on average, residents face lower opportunity costs for committing these crimes. This increase in crime compels more of the remaining high income households to emigrate as well. Following from this, even lower average income will produce higher levels of personal crime, and so on. These self-reinforcing effects ultimately produce severe income segregation across cities.

Another important urban amenity, one not considered in the study on German households, is the benefit of living in a coastal city. A coastal city itself can be considered an urban amenity because, to name just a few reasons, the more moderate climate offered, the greater opportunities afforded for recreational activities, an aesthetic value of living adjacent to an ocean, and economic and cultural benefits associated with

residing and working in a city with immediate access to the Atlantic or Pacific Oceans.

Finally, as previously discussed, past research suggests that cities are generally too large. Thus, high population cities should then be inhabited by residents who are paid higher wages to compensate for longer commuting times, pollution, crime, noise, more inefficient local government, and all other negative effects of a congested city with overburdened infrastructure.

IV. Data

In order to test my hypotheses, data from the U.S. Census and the Bureau of Labor Statistics are used for family income in twenty-three U.S. cities. Income levels are adjusted for cost of living using the Sperling Cost of Living Index, which is derived from the Consumer Price Index from the Bureau of Labor Statistics.

The number of days with the minimum temperature falling below 32° F and the number of days with the maximum temperature exceeding 90° F are determined using The Weather Almanac produced by Gale Research. The number of clear days and the percent of days considered "good" by the Air Quality index are taken from NOAA National Weather Center observation reporting stations, the National Oceanic and Atmospheric Administration, and the Environmental Protection Agency. Personal crime and property crime data are taken from 2004 FBI and State Crime Reports. Commuting data are taken from the U.S. Census Bureau data. Data concerning the percent of residents having attended some college are available through the National Center for Education Statistics.

My study includes complete data for twenty-one cities, a relatively small sample size. There are several constraints which limit my study. Firstly, my study focuses on cities rather than metropolitan areas due to the difficulty obtaining many of measures for metropolitan areas. Metropolitan statistical areas (MSAs) would have been a more theoretically sound subject to study since, by definition, they include all areas which con-

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tribute to the economy of a city. The boundaries of cities, on the other hand, are determined politically and have no bearing on which residents contribute to the economy, crime, and burden the infrastructure of an urban area.

Secondly, while the Weather Almanac I use includes extremely in-depth information on the locations studied, there are not a large number of them. Thus, I input data for all nine U.S. cities with population greater than one million people as well as cities like Anchorage, Honolulu, Denver, Indianapolis, Miami and Seattle, in order to create wide geographical variation.

Thirdly, since personal crime data is not reported by the city of Chicago and the air quality index for Houston has not been released, these cities could not be included in all regressions. Without these two major American cities, the remaining 21 cities yield less accurate results. Certainly with such a small sample size, this study faces challenges concerning the limited degrees of freedom and robustness of results.

frequency, property crime frequency, commuting time, college education, and coastal location. The dependent variable in my study is family income adjusted for intercity cost of living differences. This enables me to determine the monetary impact that urban amenities have on the average wage in a given urban environment.

As Gittleman's (2005) research illustrates, controlling for worker composition is essential in order to properly evaluate average wages in a metropolitan area. Taking into consideration difficulties in obtaining data, the most effective way I am able to do this is by including the percent of residents having attended some college as an independent variable. Since there should be a strong correlation between earnings and education, I should be able to compare cities employing more high income professionals with cities employing mostly lower income manufacturing workers on equal footing by controlling for educational attainment.

I expect a positive sign for EXTRMTEMP and negative signs for CLEARDAYS and AIR-QUALITY in accordance with their climatic

Table 1–Empirical Model

Variable	Definition	Expected
Dependent Variable		
famp	Family income adjusted for city cost of living	
Explanatory Variables		
extrmtemp	Number of days each year where the minimum temperature falls below 32 °F plus days where maximum temp.exceeds 90°F	+
cleardays	Number of days each year that are cloudless	-
airquality	Percent of days which the Air Quality Index ranks as "good."	-
perscrime	Incidents of murder, rape, robbery, and assault per 100,000	-
propcrime	Incidents of larceny, burglary, and motor vehicle theft per 100,000	?
commute	Average number of minutes to commute to work	+
somecoll	Percent of resident who have attended some college	?
Coast	Dummy variable equal to 1 if city exists on either coast	+
Population	Number of residents inhabiting the city	-

V. Empirical Model

In order to explain the most amount of variation possible between different levels of urban amenities, I use the following independent variables defined in Table 1: extreme temperature, clear days, air quality, personal crime

implications. Cities with more extreme weather should compensate residents with greater adjusted income. Likewise, more clear days and superior air quality should be penalized with lower adjusted income.

I expect a negative sign for PERSCRIME

as implied from the theoretical discussion. I predict a self-reinforcing effect between low income residents and high personal crime. The sign for PROPCRIME is unclear because of the theoretical reasons previously discussed. High income households should pay a higher premium to avoid high property crime cities, but as soon as these households congregate in an area, their collective presence will create an incentive for property crime to occur.

The sign for COMMUTE should be positive because workers should be compensated for experiencing congestion, which creates a longer commute to work, in order to ensure locational equilibrium. Although other authors have not included this variable in studies, I chose to include it based upon general ideas about the concept of an urban amenity.

educated neighbors is itself an urban amenity. People generally prefer well-educated neighbors because of their inherent positive externalities. Namely, these externalities include connections to better job prospects and the benefit of sending one's own children to school with peers who will generally be more intelligent and more motivated. Thus, the sign for this variable is unclear.

Finally, COAST is a dummy variable equal to 1 for cities with immediate access to the Atlantic or Pacific Ocean. I predict a negative sign here of because better climate, greater opportunities afforded for recreational activities, aesthetic value of living adjacent to an ocean, and economic and cultural benefits associated with residing and working in a coastal city should decrease wages in coastal locations.

Table 2-Regression: Dependent = Annual Household Income adj. for Purchasing Power

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	39,216.65	53,573.55	29,091.47	63,275.83	100,727.51	65,353.65
	-1.71	(2.12)*	-1.47	(2.78)*	(4.09)**	(2.84)*
Extreme Temp	115.33					45.79
	(2.58)*					(-0.98)
Clear Days	-0.25					-75.42
	(-0.00)					(-1.37)
Personal Crime		-12.63				-9.48
		(-2.29)*				(-2.03)
Property Crime		3.16				-0.54
		(2.43)*				(-0.33)
Coast			-16,496.43			-16,594.53
			(3.71)**			(-2.25)*
Population				0	0	0
				(-1.67)	(-0.45)	(-1.18)
Commute					-1,943.79	
					(-2.61)*	
College Experience	-179.11	-275.8	383.4	-318.45	-258.32	77.12
	(-0.47)	(-0.70)	(-1.03)	(-0.79)	(-0.72)	(-0.21)
R squared value	0.26	0.3	0.41	0.13	0.35	0.68
Sample size	23	22	23	23	23	22

** Significant at 0.01 level

* Significant at 0.05 level

As a control variable, SOME COLL is expected to have a positive sign since a greater share of city residents with college experience should raise average adjusted income. However, we must also take into account that having well-

VI. Results

The results of my regressions are shown in Table 2. The selected explanatory variables explain 68.1 percent of the variation in adjusted household income across major U.S. cities. Ad-

ditionally, all the individual regressions display significant results. All variables have the expected signs with one notable exception.

I did not include COMMUTE in my aggregate regression because doing so only raises the R^2 value from 0.681 to 0.697, while lowering the adjusted R^2 value from 0.532 to 0.524. Additionally, no coefficients are significant once COMMUTE is included in the regression. Similarly, I chose not to include AIR QUALITY as an explanatory variable in the study. I considered including it in the climatic regression, but its significance was greater than 0.9. When included in the aggregate regression, AIR QUALITY actually reduces the overall R^2 value and has a significance of 0.85.

The one notable exception mentioned above is that the COMMUTE sign is negative, despite the fact that its status as an urban amenity predicts a positive sign. One initial explanation for this is that the variable is correlated with population size, which would obscure the results.

However, in the final three regressions, I include POPULATION as a control variable in order to test this explanation. As shown in Model 4 (Table 2), commuting time is still inversely related to household income. Furthermore, this relationship is significant at the two percent level, making it unlikely that this is simply a spurious correlation. In response to these results, I hypothesize two alternative explanations for this unexpected relationship. Generally, workers who face the longest commuting times are those who use public transportation. This is because these individuals must spend time waiting for a bus, train, or subway and may even use more than one line, necessitating even more waiting time. Furthermore, these modes of transportation often only bring commuters within a reasonable distance of their home or workplace, so that these individuals still must walk several blocks. Since low income workers are more likely to use public transportation, this could account for the inverse relationship between income and commuting time.

A second explanation is that higher income workers, with skilled professions, more often have the freedom to choose which hours they work and whether they can work from home. As a result, skilled workers may work from home several days during the week or drive to work early and leave early in order to avoid the heaviest traffic. Conversely, less skilled workers, who may be employed in a manufacturing job, for example, do not possess the same freedom to choose which hours they work or have the option of working from home.

In sum, the COMMUTE variable's impact as an urban amenity may have been overcome by its impact as an explanatory variable in that lower income cities may face longer commuting times because these workers more often use public transportation and face inflexible work schedules.

The regression indicates an inverse relationship between PROPERTY CRIME and INCOME. The theory is ambivalent regarding the relationship between PROPERTY CRIME and INCOME. The results of this study suggest that high income households may be able to successfully isolate themselves from property crime by paying a premium.

Finally, COLLEGE EXPERIENCE carries both a positive sign and a negative sign in these regressions. This leaves the question unanswered as to whether the variable's ability to control for skill level composition between cities is more powerful than its properties as an urban amenity. However, unlike most other explanatory variables used, the relationship is never significant. Thus, basing conclusions upon this result may be unjustified.

Aside from these results mentioned above, in Model 1 we observe a significant positive relationship between EXTREME TEMP and INCOME and a negative relationship between CLEAR DAYS and income (although CLEAR DAYS is insignificant). In Model 2, we observe a significant negative relationship between PERSONAL CRIME and INCOME. In Model 3, we observe a very significant negative relationship

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between COAST location and INCOME. Finally, in Model 4, we observe a negative relationship between POPULATION and INCOME (although not significant). The results of these first four models support the four hypotheses presented in this study's theoretical model. Additionally, although only COAST location is significant in the aggregate model (Model 6), EXTREME TEMP, PERSONAL CRIME, COAST, and POPULATION all show similar coefficients. This indicates that some degree of robustness has been achieved through the results in the first four models.

VII. Conclusion

In conclusion, this index of urban amenities successfully accounts for most of the variation in adjusted household income in metropolitan areas. Unfortunately, only one of the amenities has high individual significance in the complete regression. This may be ameliorated by increasing the sample size. The significance obtained using separate regressions augurs well for this possibility.

Generally we find support for the existence and importance of urban amenities on adjusted incomes in urban areas. This shows that these specific urban amenities can play a significant role in the locational decisions of households.

As I continue this research project, I plan to use data for metropolitan areas. In the process of conducting this study I have come across three assumptions generally overlooked in studies on urban amenities which I would like to point out.

First, as I touched upon earlier in my discussion of Gabriel and Rosenthal's (1999) study, I believe that assuming that all households within an entire metropolitan area value amenities equally is unrealistic. Ideally, further research could include dummy variables for distinct regions within each MSA.

Second, assuming that all households are completely mobile within the entire United States is unrealistic. I believe that, in order to achieve more accurate valuation of amenities, studies

should only assume that households are willing to relocate within a smaller region. Would a household accustomed to living in Atlanta be willing to move to Honolulu or Anchorage because they expect to earn \$200 more each year in either of those locations? My answer is certainly not. However, this study and many others are predicated upon the answer: yes. Perhaps further research should focus only on a single region, such as Great Lakes states, a single state, or a few hundred mile radius.

Thirdly, studies on urban amenities often assume all citizens have perfect information. But are people really even aware of which sets of amenities are available and where to find them? After all, it seems unlikely that a Bostonian would know that in Los Angeles there is roughly 25 percent less property crime and, on average, 49 more days of sunshine per year. Compensating for imperfect information concerning locational decision making is something I have not encountered in the previous literature. However, the approach suggested above—only considering locational decisions within a smaller region—would at least partially address this consideration since it's realistic to think that households have greater information about locations closer to their own. A second approach would be to consider that perhaps more educated or skilled workers have more information about other locations. These households probably have greater mobility as well. Furthermore, future research could address the unrealistic assumption of perfect information by incorporating a lag into the models. Citizens would not likely be immediately aware of current levels of amenities such as crime rates and government efficiency in other cities, but as this information is disseminated through the public a citizen will be more likely to become aware of it. This is especially true in extreme situations. Doubtlessly, many Americans became aware of the extremely high crime rate in New York City during the late 1980s and early 1990s. It is likely that it took some time after crime rates dropped for Americans not living in New York City to re-

place their previous impressions of crime in New York with current reality, if they have at all.

Turning back to this study, the results support the theory of locational equilibrium which presents some implications for individual households. Since regression results present averages, if a family is indifferent between a coastal and interior city or the number of days with extreme temperature they experience, for example, the household would benefit by moving inland to a city with an unfavorable climate in order to be rewarded for their indifference with higher income or lower cost of living. Also, the results of this study allow citizens to take further assurance that however miserable conditions in their city are; they are most likely compensated for enduring them.

Finally, previous research has put forth very few policy implications for studies on urban amenities. However there are several I can discern. First, policies which increase urban amenities for private citizens will attract firms to the area. So if a city increased public safety, reduced crime, increased health care, or increased the amount of cultural and recreational opportunities without overtaxing its citizens, those citizens would be willing to accept lower wages to live in the metropolitan area. Firms would also be drawn by several of these amenities. For example, firms, especially elite firms, have been shown to locate in areas with low violent crime (Gottlieb, 1995). But, they would be further enticed by their ability to pay lower wages and still attract their required workforce.

Secondly, it is clear from research by Kahn and Ofek (1992), and to a small degree this paper, that most metropolitan areas are so large that the overpopulation represents a disamenity. An appropriate public policy response would be to enact an effective combination of zoning alongside an urban growth boundary in order to effectively limit the influx of immigrants to your desirable city. This would give residents greater utility.

Generally, however, the most important ur-

ban amenities, like climate and coastal location, cannot be changed by public policy. And, the effect of public policies on cultural opportunities seems limited as well. But, research has provided several opportunities for elected officials to use knowledge of urban amenities and their impact on average wages to better the lives of their constituencies.

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