THREE ESSAYS ON AMENITIES, EARNINGS, AND CITY PRICES

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Brian E. Glassman
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Examining Committee Members:

Dr. Michael Leeds, Advisory Chair, Economics
Dr. Moritz Ritter, Economics
Dr. Douglas Webber, Economics
Dr. Carolyn Adams, External Member, Geography and Urban Studies

ABSTRACT

This dissertation examines the interaction between amenities, earnings, and city prices. The first essay uses three different methodologies to investigate whether, given a fixed level of amenities, workers are fully compensated, in terms of higher wages, for higher price levels across cities. In the first, I use the overall city price level and aftertax earnings as endogenous variables in a two-stage least squares (2SLS) system and find that owners and renters are not fully compensated for higher city price levels. In the second, I split city price levels into housing prices and non-housing goods prices and use housing prices and aftertax earnings as endogenous variables in a 2SLS system. Using this method, I find that highly-educated homeowners and renters are fully compensated for higher housing prices while less-educated homeowners and renters are not fully compensated for higher housing prices. I also find that all homeowners and renters of all education levels are fully compensated for higher non-housing good prices. Finally, I assume that homeowners and renters are fully compensated for higher nonhousing goods prices and use housing prices and aftertax earnings as endogenous variables in a 2SLS system. Using this method, I again find that highly-educated homeowners and renters are fully compensated for higher housing prices while less-educated homeowners and renters are not fully compensated for higher housing prices. In addition, I determine implicit prices for 13 different amenities for both owners and renters with different education levels. While I am not the first to calculate these implicit prices, I am the first to differentiate these implicit prices among education levels and ownership status.

In the second essay, I use the implict price results from the first essay to create a city ranking. There are two main approaches in the city ranking literature. The implicit price

of amenity approach uses implicit amenity prices as weights that are multiplied by the amount of each amenity in each city. The sum of the "market values" of a city's amenities can then be used to create a city ranking. The real wage approach involves finding the logarithmic difference in nominal wages across areas and subtracting this from the logarithmic difference in housing prices across areas, using either a rent-based or housing-value based index. The idea behind this approach is that, after typical housing characteristics and worker characteristics are accounted for, the differences in rents and wages must reflect differences in local amenities. I use similar methodologies to both of these approaches, but I improve upon what I view as shortcomings in both strands of the literature. First, I include the effect of educational attainment, income inequality, and job growth. Second, I look at how city rankings differ by level of education and by ownership status. Third, I add new components to the existing literature on firm rankings. All of these additions give a richer, more accurate view of how workers and firms view cities.

In the third essay, I look at the same issues from the first essay, but I shift the focus to how the results differ by gender, marital status, and the presence of children in the household. The first question deals with how well compensated people are, in terms of higher wages and better amenities, for higher housing prices. I find that single people fare better than married people, and people without children fare better than parents. Also, I find little difference between men and women overall. The second question deals with the implicit price of amenities. I find significant differences in the price people are willing to pay for amenities by gender, marital status, and the presence of children in the household.

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Chapter 1

SHOULD I STAY OR SHOULD I GO: THE INTERACTION OF AMENITIES, EARNINGS, AND CITY PRICES

1.1 INTRODUCTION

The main motivation for this paper comes from a simple but important decision that people often make in their lives: is a person better off receiving higher wages and enjoying better attributes that a city has to offer, such as climate, lack of pollution, and arts and culture, which are called amenities, but paying higher prices for goods and for land in a more expensive city? In other words, are workers fully compensated, in terms of higher wages and better amenities, for higher price levels in a city?

I answer two main research questions in this paper. First, the spatial equilibrium theory says that utility for workers is equal across cities. In essence, this means that wages and city prices adjust, given a set of city amenities, to equalize utilities. While this theory is well established in the literature, little has been done to test to see if it actually holds in practice. To test this theory, I check to see if earnings change by the same percentage as city prices, given a set of city amenities. If this occurs, then cities with higher earnings and better amenities compensate people for higher prices. Therefore, utilities are equalized and the spatial equilibrium theory is validated.

I use three different methodologies to investigate whether people are fully compensated for higher city price levels. First, using the overall city price level and aftertax earnings as endogenous variables in a two-stage least squares (2SLS) system, I find that owners and renters are not fully compensated for higher city price levels which means that the spatial equilibrium theory is invalidated. Next, I split city price levels into housing prices and non-housing goods prices and use housing prices and aftertax earnings as endogenous variables in a 2SLS system. Using this method, I find that homeowners with a graduate degree are fully compensated for higher housing prices while homeowners without a graduate degree are not fully compensated for higher housing prices. I also find that all homeowners are fully compensated for higher non-housing good prices. For renters, workers with at least a bachelor's degree are fully compensated for higher housing prices while workers without a bachelor's degree are not fully compensated for higher housing prices. Similar to homeowners, all renters are fully compensated for higher non-housing goods prices.

Finally, I assume that homeowners and renters are fully compensated for higher non-housing goods prices and use housing prices and aftertax earnings as endogenous variables in a 2SLS system. I use this method to calculate implicit prices of amenities as well since the previous two methods were used primarily as comparisons to previous work. Using this method, I find that homeowners with a graduate degree are fully compensated for higher housing prices, while less-educated homeowners are not fully compensated for higher housing prices and renters with at least a bachelor's degree are fully compensated for higher housing prices, while renters without a bachelor's degree are not fully compensated for higher housing prices. Therefore, the spatial equilibrium theory is validated for more-educated homeowners and renters and it is invalidated for less-educated homeowners and renters.

The second research question comes from the idea that people do not explicity play for amenities. Using the conclusion from the theoretical model that workers accept lower wages and pay higher housing prices to enjoy better amenities, I determine implicit prices for 13 different amenities for both homeowners and renters with different education levels. While

I am not the first to calculate these implicit prices, I am the first to differentiate these implicit prices among education levels and ownership status. These prices are valuable pieces of information for city officials when they decide how to make their cities more attractive to certain types of people and for business owners when they decide where to locate their business.

Scholars used to claim that cost of living differences among cities was the cause of differences in wages and land prices across cities. This begged the question: what led to these differences in the cost of living among cities? Roback (1982) reframed the inter-city differences in wages and land prices as adjustments to equalize utilities of workers given a set of amenities. This paper laid the theoretical groundwork for nearly all the empirical work done in this area. The basic premise of the paper was that wages and rents were determined by the relative value of local amenities to both firms and workers. In other words, workers might be willing to pay, in terms of lower wages and higher rents, to enjoy the qualities of a particular locale.

Roback (1982) also used a fairly restrictive assumption: that individuals are identical. In a follow-up paper, Roback (1988) relaxed the assumption of worker homogeneity by allowing for two different types of labor, which she referred to as skilled and unskilled labor, while Beeson (1991) allowed for N different types of workers who differ in terms of their endowments of education. I adopt the framework of the theoretical model from Roback (1982 and 1988) as well as two basic assumptions that she used. The first is that the firms produce a composite good using a constant returns to scale production function. The second is that the migration of workers from city to city is costless. However, Roback (1982 and 1988) did not solve for the explicit conditions under which land prices increase with amenities and wages decrease with amenities, did not differentiate types of workers by home ownership status or allow for more than two types of workers, and did not allow wages and rents to be simultaneously determined, each of which I do in this paper. I adopt Beeson's use of cities with N different types of workers, but I include rent in my empirical model which is run using two-stage least squares (2SLS) rather than OLS.

The empirical strategy I employ is partially adapted from two papers. Hoehn, Berge, and Blomquist (1987) looked at the separate effects of 16 amenities on housing prices and on wages. However, there was no joint determination of housing and wages, and housing was measured using apartment rents. Voith (1991) expanded on Hoehn et al. (1987) by using a simultaneous equations framework in which wages and rents were jointly determined. Voith is closest in concept and in style to this paper. However, Voith used the 1975 PSID which includes only 2,258 total observations for 33 cities. Furthermore, the PSID overrepresents the minorities and the poor. I take a wider view by using 268 cities and over 2 million total observations from the American Community Survey which is more representative of the American population. I also adopt the use of separate regressions based on ownership versus rental status used by Ozanne and Thibodeau (1983) and Potepan (1996).

Winters (2009) uses wages and housing prices to determine whether workers are fully compensated, in terms of higher incomes, for cost of living differences between cities. I adopt Winters methodology, but I use a residential land use regulation index and an age of structure variable to instrument for housing prices while Winters uses lagged housing values and city prices as instruments. I also allow for separate determinations by level of education.

Section 2 of this paper presents the theoretical model and the conditions under which the conclusions that workers accept lower wages and pay higher land prices to enjoy higher amenity levels holds. Section 3 presents the empirical model, a description of the variables used in the estimation, and the results from the estimation. Section 4 concludes the paper.

1.2 THEORETICAL MODEL

1.2.1 Description of the model

Since workers and firms never explicitly pay for the amenities they consume in a particular city, the value of these amenities is capitalized into land prices and wages. The model I use in this paper extends this idea of the capitalization of amenities into wages and land

prices first presented in Roback (1982), for one type of worker, and Roback (1988), for two types of workers, to allow for N types of workers. There are four basic parts to the model: the environment, the worker's problem, the firm's problem, and the equilibrium concept.

Environment. There are J cities in the model, each assigned its own unique bundle of amenities, a, and land, L, and indexed by j. Land is made up of land used for production, L^c and land used for residential purposes, L^r.

Amenities are characteristics of a location, such as climate, crime rate, leisure activities, or education spending. Certain amenities are clearly exogenous, such as the number of sunny days. It is possible that other amenities, such as the availability of cultural or leisure activities, could be set by the community. However, this is a model of individual decision making, while changing a particular amenity is a group decision. Therefore, I treat the decision to have higher or lower levels of amenities as exogenous to the individual decision making process. Furthermore, it is sometimes argued that such variables as air and water quality are affected by local economic conditions. Again, these variables are determined by the city as a whole and not by an individual location decision.

Each city is made up of workers and firms. Workers have an initial endowment of education, i, one unit of time, an equal share of all land in the economy, and preferences over a variety of city amenities, a. Therefore, the model allows for different preferences across educational groups but not within the groups. The purpose of the equal share of land endowment is to ensure a closed model. Land generates rent and that rent has to go to someone. I assume that these rents go to workers. Furthermore, workers are freely mobile across all cities and migration is assumed to be costless. However, intercity commuting costs are assumed to be prohibitive, so a worker lives and works in the same city.

Firms produce a composite good, X, according to a constant returns to scale production function, $X = \mathrm{f}(\mathbf{n}, L^c; a)$ using land and each type of labor, $\mathbf{n}$, where $\mathbf{n} = (n_1, n_2, ..., n_N)$. Therefore, wages of workers of different types, i, are allowed to differ within a city. The

composite good, X, is a freely and costlessly tradeable final consumption good, which is the same across all cities and is produced in all cities in a perfectly competitive environment. The price of the composite good, X, is taken as the numeraire.

The worker's problem. The worker of type i lives in city j, earns wage w_{ij} and receives rents generated by the land share the worker owns, $\theta\pi$ [1], selects a consumption basket of land, L^r, and a tradeable composite consumption commodity, X, to maximize his utility in location j. Thus, the worker's budget constraint is $w_{ij}h_{ij} + \theta\pi = P_j^r L_j^r + X_{ij}$ where h_{ij} is the hours worked by a worker of type i in city j and P_j^r is the price of residential land in city j. The worker has an indirect utility function $V^i(w_{ij}, P_j^r; a_j)$. The total number of workers in the economy is normalized to one.

The firm's problem. The representative firm minimizes costs subject to its production function. Therefore, it chooses a city in which to operate, j, as well as an appropriate mix of land, L_j^c, and workers, n_i for all i, based on the price of commercial land, P_j^c, and the price of workers, w_i for all i. The firm, therefore, is a price taker of both land and workers which means that the wage of each type of worker is equal to that type of worker's marginal product, $w_i = F_{L_i^c}$.

Equilibrium. The market equilibrium condition for land is

$$P_j^c = P_j^r = P_j \tag{1.1}$$

where P_j^c is the price of commercial land, P_j^r is the price of residential land, and P_j is the price of overall land in city j. The land market clearing condition is $L = L^r + L^c$. If $P_j^c > P_j^r$, then landowners covert residential land to commercial land in city j. This increased supply of commercial land leads to a decrease in P_j^c and the decreased supply of residential land leads to an increase in P_j^r until the prices are equal. If instead $P_j^c < P_j^r$, then landowners convert commercial land to residential land in city j. This decreased sup-

[1] Workers earn an equal percentage of rent from the total land from all cities in the economy. $\pi = \sum_j P_j \times L_j$ and $\theta = \frac{1}{\sum_i n_i}$

ply of commercial land leads to a increase in P_j^c and the increased supply of residential land leads to an decrease in P_j^r until the prices are equal. Therefore, P_j is used as the relevant price of land for both workers and firms.

The market equilibrium condition for workers is given by

$$V^i(w_{ij}, P_j; a_j) = k_i. \tag{1.2}$$

where k_i is the utility level common to all workers of type i across all cities. Therefore, wages and the price of land must adjust, given the level of amenities, to equalize utilities for each type of worker in all cities. Otherwise, some workers would have an incentive to move. This equation means that people are fully compensated, in terms of wages and amenities, for higher city prices and it is referred to as the spatial equilibrium theory.

The equilibrium condition for firms is that unit cost must equal the product price, which is assumed to be unity:

$$C(\mathbf{w_j}, P_j; a_j) = 1. \tag{1.3}$$

where $\mathbf{w_j} = (w_{1j}, w_{2_j}, ..., w_{Nj})$. Otherwise, firms would have an incentive to enter the industry.

Given an equilibrium distribution of firms and workers across locations, wages and price of land differences can be characterized as functions of the amenities.

In order to draw some conclusions, I simplify the model by reducing to two types of labor, high-skilled, HS, and low-skilled, LS. All conclusions based on this simplification can be easily generalized to a situation in which there are N types of labor. The literature uses the assumption that workers are imperfect gross substitutes for one another. I use this assumption to solve the model and then I relax this assumption and allow workers to be gross complements.

Assuming workers are imperfect substitutes for one another, if a high-skilled worker sees his wages, w_{HS}, increase, then, holding all else constant, the demand for low-skilled labor increases. Firms will substitute away from the more expensive high-skilled workers, towards low-skilled workers, which means that the marginal product of low-skilled workers decreases. Since workers are paid their marginal product in perfectly competitive markets, w_{LS} will decrease. The more substitutable that each low-skilled worker is for high-skilled workers, the more that the wages of low-skilled workers will decrease. A decrease in the wages of high-skilled workers would have the opposite effect on the wages of low-skilled workers for the same reasons mentioned above, so the wages of low-skilled workers would increase.

Now I relax the assumption that workers are imperfect substitutes and allow workers to be imperfect complements in order to determine if my conclusions are still valid. If a high-skilled worker sees his wages, w_{HS}, increase, then, holding all else constant, the demand for low-skilled labor decreases. Firms will hire fewer high-skilled workers because high-skilled workers are now more expensive than they were. Since there are fewer high-skilled workers employed in the firms and high-skilled workers and low-skilled workers are complements, having fewer high-skilled workers reduces the productivity of low-skilled workers. Therefore, the marginal product of low skilled workers decreases. Since workers are paid their marginal product in perfectly competitive markets, w_{LS} will decrease. Furthermore, the effect of a decrease in the wages of high-skilled workers would have the opposite effect on the wages of low-skilled workers for the same reasons mentioned above, so the wages of low-skilled workers would increase.

A similar argument can be made for the other input in the production process, land. If land and workers are imperfect substitutes, then the more expensive land is in a city, the more firms reduce their use of land and increase their use of labor in production of the composite good and the more land in a city is used for residential rather than production purposes. Using more highly labor-intensive production processes results in lower wages for

all types of workers due to diminishing marginal producitvity.

If land and workers are imperfect complements, then the more expensive land is in a city, the more firms will reduce their use of land in the production of the composite good and the more land in a city will be used for residential rather than production purposes. Since land and workers are imperfect complements in production, using less land makes workers less productive. Therefore, workers of all types will be paid lower wages due a decrease in their marginal products.

I draw the same conclusions whether workers are imperfect substitutes or imperfect complements for one another. Therefore, I assume that workers are imperfect complements for one another in my analysis because it is more realistic. All the comparative statics that I do in the next section hold if I were to assume that workers are imperfect substitutes for one another.

1.2.2 Comparative Statics

The key idea of this model is that, since workers and firms do not explicitly pay for the amenities they consume, the value of these amenities is capitalized into the price of land and wages. To determine how amenities affect wages and land prices, equation 1.2 and equation 1.3 can be differentiated with respect to amenities and then be solved for $\frac{\partial w_i}{\partial a}$ and $\frac{\partial P}{\partial a}$. First, I completely differentiate equation 1.2 with respect to a:

$$V^i_{w_i}\frac{\partial w_i}{\partial a} + V^i_P\frac{\partial P}{\partial a} + V^i_a = 0$$

Next, I solve the equation for $\frac{\partial w_i}{\partial a}$:

$$\frac{\partial w_i}{\partial a} = \frac{-V^i_P\frac{\partial P}{\partial a} - V^i_a}{V^i_{w_i}} \tag{1.4}$$

I then completely differentiate equation 1.3 with respect to a:

$$\sum_k C_{w_k} \frac{\partial w_k}{\partial a} + C_P \frac{\partial P}{\partial a} + C_a = 0 \tag{1.5}$$

Rather than solve completely for $\frac{\partial P}{\partial a}$ at this point, I plug equation 1.4 into equation 1.5 in order to eliminate $\frac{\partial w_i}{\partial a}$ from the solution, group like terms, and solve for $\frac{\partial P}{\partial a}$:

$$\frac{\partial P}{\partial a} = \frac{\sum_k V_a^k \frac{C_{w_k}}{V_{w_k}^k} - C_a}{-\sum_k V_P^k \frac{C_{w_k}}{V_{w_k}^k} + C_P} \tag{1.6}$$

The last step is to plug equation 1.6 into equation 1.4 and add the fractions together in order to solve for $\frac{\partial w_i}{\partial a}$:

$$\frac{\partial w_i}{\partial a} = \frac{C_a V_P^i - V_P^i \sum_k V_a^k \frac{C_{w_k}}{V_{w_k}^k} + V_a^i \sum_k V_P^k \times \frac{C_{w_k}}{V_{w_k}^k} - V_a^i C_P}{V_{w_i}^i (-\sum_k V_P^k * \frac{C_{w_k}}{V_{w_k}^k} + C_P)}$$

Then, I cancel out identical terms of the summations that are subtracted from each other:

$$\frac{\partial w_i}{\partial a} = \frac{C_a V_P^i - V_P^i \sum_{k \neq i} V_a^k \frac{C_{w_k}}{V_{w_k}^k} + V_a^i \sum_{k \neq i} V_P^k * \frac{C_{w_k}}{V_{w_k}^k} - V_a^i C_P}{V_{w_i}^i (-\sum_k V_P^k \frac{C_{w_k}}{V_{w_k}^k} + C_P)} \tag{1.7}$$

To see the effects of amenities on the price of land and on wages, I fully explore the signs of equations 1.6 and 1.7. I first examine the signs of the individual components of these equations. V_P shows how utility changes when the price of land changes. All else equal, there are two effects on utility when the price of land changes. First, an increase in the price of land makes workers worse off because they have to pay more for land. Secondly, an increase in the price of land makes workers better off because the rent generated by land goes to workers. I conclude that workers will be worse off if the price of land increases because the city a particular worker lives in is small compared to the overall economy which means the worker will receive little added benefit from the additional rents while having to pay the additional costs of more expensive land. Therefore, $V_P < 0$.

V_{w_i} shows how utility changes when the wage for people with education i changes. All

else equal, people with education i will be better off if their wage increases. Therefore, $V_{w_i} > 0$. C_{w_i} shows how a firm's costs changes when the wage for people with education i changes. All else equal, a firm's costs will increase if the wages of a group of its workers increases. Therefore, $C_{w_i} > 0$. C_P shows how a firm's costs changes when the price of land changes. All else equal, a firm's costs increase as the price of land increases because land is an input to the firm's production process. Therefore, $C_P > 0$.

The remaining variables, V_a and C_a, are less easily signed for two reasons. First, each type of worker has a different indirect utility function. This means that not all types of workers value amenities to the same degree. Some types of workers may consider a city attribute to be an amenity while other types of workers may consider it a disamenity. The second reason is that amenities can be productive or unproductive. The presence of an amenity could raise or lower costs to a firm. Therefore, the signs of equations 1.6 and 1.7 will depend on whether the amenity is productive or unproductive to firms and whether workers consider it an amenity or disamenity.

Complications arise when more than one of these three groups, type i workers, workers of type $j \neq i$, and firms, consider the city attribute an amenity, so more than one of the cases are non-zero. This can easily be seen with an example. Assume that all types of workers consider the attribute an amenity, and the amenity is productive to firms. Since all types of workers and firms desire to locate in an area with high levels of this amenity, land prices rise. However, the effect on type i workers' wages is ambiguous. The reason is that, though worker i accepts lower wages due to the desirability of the amenity, other types of workers also accept lower wages and firms are more productive. The relative strengths of the effects determines how amenity levels affect wages, but this cannot be determined a priori. This is analagous to the uncertain price and quantity outcome due to a substitution and income effect.

Let's begin by assuming that worker i views the city attribute as an amenity (i.e., $V_a^i > 0$). If the amenity is inherently costless to firms (i.e., $C_a = 0$) and valued only by workers

of type i (i.e., $V_a^k = 0$ for all $k \neq i$) then $\frac{\partial P}{\partial a} > 0$ and $\frac{\partial w_i}{\partial a} < 0$. In other words, if firms neither benefit nor lose from the presence of the amenity and only type i workers enjoy the amenity, then land prices increase and the wages of type i workers decrease as amenity levels increase. Type i workers want to live in areas with better amenity levels, which leads to higher land prices, and type i workers are willing to give up some wages in order to live in a higher amenity area.

Now I assume that the other types of workers and firms also place a value on the amenity. Then, land prices increase with the level of the amenity (i.e., $\frac{\partial P}{\partial a} > 0$) if the other types of workers, on net, consider the attribute to be an amenity (i.e., $\sum_{k \neq i} V_a^k \frac{C_{w_k}}{V_{w_k}^k} > 0$) and the amenity is productive to firms (i.e., $C_a < 0$). If this is the case, then all types of workers and firms want to locate in a city which has high values of this amenity, and they bid up the price of land. If these conditions are not met, it is still possible for land prices to increase with amenities as long as type i workers value the amenity more than all the other types of workers and firms, on net, dislike the amenity (i.e., $C_a - \sum_{k \neq i} V_a^k \frac{C_{w_k}}{V_{w_k}^k} < V_a^i \frac{C_{w_i}}{V_{w_i}^i}$).

While still assuming that type i workers consider the city attribute an amenity, wages of type i workers decrease with the level of the amenity (i.e., $\frac{\partial w_i}{\partial a} < 0$) if the other types of workers, on net, consider the attribute to be a disamenity (i.e., $\sum_{k \neq i} V_a^k \frac{C_{w_k}}{V_{w_k}^k} < 0$) and the amenity is unproductive to firms (i.e., $C_a > 0$). When everyone else is indifferent to the amenity, type i workers' wages decrease with amenities. If the other types of workers dislike the amenity, then those workers will require a compensating variation (i.e. a higher wage) to live and work in areas with high values of the amenity. This leads firms to hire fewer type k workers. Since fewer type k workers are employed, the productivity of type i workers decreases since these workers are imperfect complements. Therefore, the marginal productivity of type i workers is lower which leads firms to pay type i workers lower wages. Since the amenity is also unproductive to firms, productivity is lower which leads firms to pay all workers lower wages, including type i workers.

If the conditions stated above do not hold, then it is still possible for the wages of type i

workers to decrease with the level of the amenity as long as the relative value of the amenity to type i workers is greater than the relative value of the amenity, on net, to firms and all the other types of workers (i.e., $\frac{V_a^i}{V_P^i} < \frac{\sum_{k\neq i} V_a^k \frac{C_{w_k}}{V_{w_k}^k} - C_a}{\sum_{k\neq i} V_P^k \frac{C_{w_k}}{V_{w_k}^k} - C_P}$). The effect of other workers and firms valuing the amenity pushes the wages of type i workers up since firms are more productive and firms hire more of the other types of workers since these workers are willing to take lower wages for higher amenity values. This, in turn, increases the productivity of type i workers while the effect of type i workers valuing the amenity is a decrease in the wages of type i workers. If type i workers value the amenity more than firms and all other types of workers, on net, then the second effect dominates and type i workers wages decrease with the level of the amenity.

Combining these two conclusions, $\frac{\partial P}{\partial a} > 0$ and $\frac{\partial w_i}{\partial a} < 0$ if all types of workers value the amenity, the amenity is productive to firms, and type i workers value the amenity more than all other types of workers and the firms, on net, do.

I come to similar, but opposite, conclusions if worker i views the city attribute as a disamenity (i.e., $V_a^i < 0$). For instance, $\frac{\partial P}{\partial a} < 0$ and $\frac{\partial w_i}{\partial a} > 0$ if all types of workers dislike the amenity, if the amenity is unproductive to firms, and if type i workers dislike the amenity more than all other types of workers and the firms, on net, dislike the amenity.

1.2.3 Implicit Price of Amenities

Equations 1.6 and 1.7 show how land prices and wages change when the level of amenities change. In equation 1.7, I factor out $-V_P^i$ from the first two terms in the numerator, factor out $-V_a^i$ from the second two terms of the numerator, and use Roy's identity to substitute p_a^i for $\frac{V_a^i}{V_{w_i}^i}$:

$$\frac{\partial w_i}{\partial a} = \frac{-V_P^i(\sum_k V_a^k \frac{C_{w_k}}{V_{w_k}^k} - C_a)}{V_{w_i}^i(-\sum_k V_P^k \frac{C_{w_k}}{V_{w_k}^k} + C_P)} - p_a^i \tag{1.8}$$

Using equation 1.6, I can simplify equation 8, solve for p_a^i, and once again use Roy's identity to substitute for $L = \frac{-V_P^i}{V_{w_i}^i}$:

$$p_a^i = L\frac{\partial P}{\partial a} - \frac{\partial w_i}{\partial a} \tag{1.9}$$

Equation 1.9 says that the implicit price of the amenity, a, can be measured by the extra cost of housing a worker must pay minus the wages that a worker must give up in order to enjoy the amenity. Unlike products sold on the market, these characteristics of a city have no real market value. Equation 1.9 creates market valuations for these amenities which can inform city officials and business owners about where they should apply their energy to attract workers.

1.3 EMPIRICAL MODEL

1.3.1 Specification of the Model

In order to test the implications of the theoretical model, I need a framework that allows wages and the price of land to adjust, given a fixed level of amenities. The two main difficulties with this are that wages and the price of land are simultaneously determined and I do not have a measure of the price of land in a city. Furthermore, much of the previous literature uses either the price of a house, the price of land, or the rental price of an apartment to measure the price of land, and the choice of one of these measures over another has led to different results. I assume that apartment prices and house prices are proxies for land prices, and I use each value to separately test the conclusions from the theoretical model.

Furthermore, I use metropolitan statistical areas (MSAs) as proxies for cities. MSAs are a geographical region with a high population density at its core and close economic ties throughout the area as defined by the Office of Management and Budget and used by the U.S. Census Bureau and other government agencies for statistical purposes. I use

MSAs because they generally contain the surrounding areas of a city, which makes the assumption that people live and work in the same area significantly more realistic.[2] I also use aftertax annual earnings in place of hourly wages for two main reasons. First, I am using an annual housing value so it makes sense to use an annual earnings value. Since I will be using average hours worked per week as an explanatory variable, annual earnings will be capturing the decision to work in a city rather than a labor supply decision. Second, aftertax earnings are important because higher wages in one city may be less attractive if they move a household into a higher tax bracket. Using aftertax earnings accounts for this.

Since earnings and housing prices are jointly determined, using OLS would give biased results. If I ran an OLS regression with housing prices as my dependent variable, then I would have to include earnings as an independent variable since higher earners can afford and tend to live in more expensive housing. However, the earnings variable is correlated with the error term. The same will be true for an equation with earnings as my dependent variable. This means that any shock to either housing or earnings would affect both housing prices and earnings.

My solution to this problem is to use a simultaneous equations framework in which house prices and earnings are allowed to affect one another and rents and earnings are allowed to affect one another. I use a two-equation 2SLS estimation procedure for homeowners and renters.

The two-equation system for homeowners and renters is:

$$w_{ij} = \alpha_{0i} + \alpha_{1i} h_{ij} + \alpha_{\mathbf{2i}} \mathbf{ind_{ij}} + \alpha_{\mathbf{3i}} \mathbf{work_{ij}} + \alpha_{\mathbf{4i}} \mathbf{a_j} + \alpha_{\mathbf{5i}} \mathbf{m_j} + \alpha_{\mathbf{6i}} \mathbf{H_{ij}} + \alpha_{7i} yr + \alpha_{8i} hours_{ij} + \mu_1 \tag{1.10}$$

$$h_{ij} = \gamma_{0i} + \gamma_{1i} w_{ij} + \gamma_{\mathbf{2i}} \mathbf{ind_{ij}} + \gamma_{\mathbf{3i}} \mathbf{work_{ij}} + \gamma_{\mathbf{4i}} \mathbf{a_j} + \gamma_{\mathbf{5i}} \mathbf{m_j} + \gamma_{\mathbf{6i}} \mathbf{H_{ij}} + \gamma_{7i} yr + \gamma_{8i} regulation_j + \gamma_{9i} aos_j + \mu_2 \tag{1.11}$$

[2]Due to the unique nature of New York City where a significant number of people live in other states but work in manhattan, I ran regressions with NYC as a dummy variable and with all people who live in NYC dropped out of the dataset. There were no significant differences in my results in either case.

where α, γ, ϕ, and β are coefficients to be estimated and

i indexes education and j indexes the metropolitan statistical area (MSA);

w_{ij} is the earnings received by people with education i in MSA j;

$\mathbf{ind_{ij}}$ is a vector of individual characteristics for education i in MSA j;

$\mathbf{work_{ij}}$ is a vector of job characteristics for education i in MSA j;

h_{ij} is the housing costs for workers with education i in MSA j;

$\mathbf{a_j}$ is a vector of amenities in MSA j;

$\mathbf{m_j}$ is a vector of MSA specific characterisitics in MSA j;

$\mathbf{H_{ij}}$ is a vector of housing characteristics for education i for MSA j;

yr is a dummy variable for the year of the sample;

$hours_{ij}$ is average hours worked per week for education i in MSA j;

$regulation_j$ is an index for residential land use regulations for MSA j;

aos_{ij} is the age of housing owned or rented by education i in MSA j;

μ_1 is random variation in wages;

μ_2 is a random variation in housing costs;

The main coefficient of interest for the first research question is α_{1i} in the earnings equations. These coefficients tell me how earnings change when prices changes, holding amenities and other explanatory variables constant.

For the second research question, the vector of coefficients $\alpha_{\mathbf{4i}}$ in the earnings equations show how wages change when each individual amenity changes. These coefficients are the counterparts to $\frac{\partial w_i}{\partial a}$ in the theoretical model. Similarly, the vector of coefficients $\gamma_{\mathbf{4i}}$ in the housing costs equation show how the price of housing changes when each individual amenity changes. These coefficients are the counterparts to $\frac{\partial P}{\partial a}$ in the theoretical model.

About half of the variables I use vary with the individual, but the rest, amenities and MSA specific characteristics, vary only by MSA. Therefore, observations within an MSA are likely correlated but observations across MSAs are not correlated. If I ignore this fact, I have unbiased estimates but standard errors are wrong leading to incorrect inference.

Therefore, I use clustered standard errors to account for this.

1.3.2 Data

Individual level data comes from two samples from the Integrated Public Use Microdata Series (IPUMS) [3]. These samples are the American Community Survey's 2005-2007 3-year sample and the 2000 5% sample. From these samples I use male heads of households, aged 25 to 54, who rent or own an apartment or a house. The Amenity and MSA-specific characteristic data comes from the 2002 and 2007 Cities Ranked and Rated Almanac. The 2002 Cities Ranked and Rated Almanac contains data on MSAs from 2000-2002, while the 2007 Cities Ranked and Rated Almanac contains data on MSAs for 2004-2007. The edited samples contain 268 MSAs with 1,219,796 workers for 2000 and 655,012 workers for 2005-2007. All monetary variables are measured in constant 2000 dollars. The datasets from the two time periods are combined because the more important dichotomy is between owners and renters. There are 1,368,200 owners and 506,608 renters in the dataset.

The first category of variables is endogenous variables. This category includes house prices, rents, and earnings variables for each level of education. To determine aftertax earnings, first taxable earnings are calculated using a standard deduction of $5,350 for 2005-2007 sample and $4,400 for the 2000 sample. Each household is given one deducton each for a spouse and each child under 18 years of age. Using income tax brackets from 2000 and from 2007, the amount of federal taxes households had to pay is subtracted from overall earnings. Secondly, a state and local tax variable is provided by the Cities Ranked and Rated Almanac. This variable is an average of state and local tax rates for each MSA. This rate is used to subtract state and local taxes from overall earnings. After federal taxes and state and local taxes are subtracted from overall earnings, I am left with aftertax earnings.

In order to make apples-to-apples comparisons, annual rent and annual cost of housing

[3]Steven Ruggles, J. Trent Alexander, Katie Genadek, Ronald Goeken, Matthew B. Schroeder, and Matthew Sobek. Integrated Public Use Microdata Series: Version 5.0 [Machine-readable database]. Minneapolis: University of Minnesota, 2010.

are used for rent and house prices. Monthly rent is multiplied by 12 to get annual rent and the annual cost of housing is calculated using a formula created in a working paper for the Federal Reserve Bank of Philadelphia by Crone, Nakamura, and Voith in 2004. The authors claim that the annual cost of housing is equal to the purchase price of the house multiplied by a capitalization rate. To estimate the capitalization rate, the following regression is run:

$$ln(h_{ij} + r_{kj}) = \alpha D_0 + \beta H_{ij} + \mu \tag{1.12}$$

where D_0 is a dummy variable equal to one if the unit is owned and zero if it is rented and H is a vector of housing characteristics. The capitalization rate is calculated using $e^{-\alpha}$ and results in $C = .0735$

The final step is to multiply C by h_{ij} and then add this value to the yearly cost of utilities and annual property taxes in order to get a measure of annual housing costs. This value is used for house price in the upcoming regression results. Table 1.1 lists the average aftertax earnings and average annual housing costs for owners and renters of different levels of education.

Table 1.1: **Endogenous Variables**

	Owners			Renters		
Education Level	Observations	Earnings	House Price	Observations	Earnings	Rent
High School Grad or less	29.48%	$37,991.34	$15,134.71	41.92%	$23,161.59	$8,089.153
Some College	30.46%	$47,424.94	$18,146.98	28.24%	$29,853.30	$9,252.52
Bachelor's Degree only	25.14%	$64,162.35	$24,333.64	19.28%	$38,458.59	$10,974.48
Graduate Degree	14.92%	$80,090.63	$29,920.48	10.55%	$46,574.44	$12,223.55
Total	1,368,200	$53,724.73	$20,570.65	506,608	$30,472.60	$9,410.51

The second category is the instrumental variables, which are discussed in-depth in the next section. The regulation index is a compilation of 11 sub-indexes, all dealing with how much regulation on residential land use is in place in a city, put together by the Wharton School at the University of Pennsylvania. The larger the number, the more regulations are in place.

Table 1.2: **Instruments**

Owners				
	Mean	Std. Dev.	Min	Max
average hours	43.22	13.24	0	99
Regulation	.1616	.669	-1.677	4.304
Age of structure	29.37	20.09	2	68
Renters				
	Mean	Std. Dev.	Min	Max
average hours	37.92	16.9	0	99
Regulation	.2562	.6435	-1.677	4.304
Age of structure	34.92	19.01	2	68

The exogenous variables are divided into four categories. Individual characteristics are characteristics of the the worker which include age, marital status, number of children, race, english speaking ability, occupation categories, and a dummy variable for the states hit hardest by the housing bubble. Housing variables include the number of bedrooms in a house or apartment, a dummy variable for whether the house is a single family home, and a dummy variable for whether or not the household has moved in the recent past. The MSA controls include measures of population, density, unemployment, libraries, an index measuring the price of non-housing goods and services[4], and a variable measuring the percent of children in the MSA who attend public school.

The fourth category of exogenous variables are amenity variables whose descriptive statistics are presented in Tables 1.3 and 1.4. These variables are broken into two categories based on whether the amenity variables are outside the control of city officials, Table 1.3, or within the control of city officials, Table 1.4. In table 1.3, *coastal city* is a dummy variable equal to one if the city is located on the coast and zero otherwise and miles of inland water is the miles of lakes and rivers located in the city.

In Table 1.4, *Environment* is a combined index of air quality and water quality which are both measured on a scale from 0 to 100, with better quality represented by a larger

[4]This index includes the cost of food, transportation, healthcare, and miscellaneous goods such as clothing, restaurants, repairs, and entertainment

Table 1.3: **Fixed Amenity Variables**

	Mean	St. Dev.	Min	Max
Mean January Temperature	29.49°	11.92°	−3.6°	65.3°
Mean July Temperature	86.48°	6.09°	65.6°	104.8°
Inches of snowfall	19.82	21.94	0	109
Inches precipitation	35.38	13.92	4	70
Days mostly sunny	216.34	34	131	300
Miles inland water	5.54	2.92	1	11
Coastal City	.4484	.4973	0	1

number. *Entertainment* is an index consisting of leisure and arts. Leisure is an index ranging from 9 to 90 covering 9 areas that are rated on a 1 to 10 scale. These areas include restaurants, sports, zoos and acquariums, amusement parks, gardens, golf courses, ski areas, and national parks. Similarly, Arts is an index ranging from 9 to 90 covering 9 areas that are rated on a 1 to 10 scale. These areas include arts radio, classical music, ballet, theater, university arts programs, and museums.

Spending per pupil is the amount of money each MSA spends on education per student measured in hundreds of dollars. While this variable may not be a true measure of student performance, it is an indication of how important the community values education. Finally, the variable *crime* is the number, in hundreds, of violent crimes and property crimes per 100,000 people in the MSA.

Table 1.4: **Control Amenity Variables**

	Mean	St. Dev.	Min	Max
Sales Tax	7.05%	1.51%	0%	10%
Spending per pupil	$56.99	$12.83	$30.98	$98.02
Environment	78.08	37.20	6	195
Entertainment	112.22	40.53	19	178
Crime	43.93	11.51	9.07	77.23
Commute Time	28.85	5.38	18.1	42.4

1.3.3 Identification strategy

In order to estimate this system of equations, each individual equation must be identified. For this to occur, valid instruments are needed for both housing prices and earnings and the order and rank conditions for identification must be met.

First, a valid instrument appears on the right hand side of one structural equation in the 2SLS system of equations and not in the other structural equation. For equations 1.11 and 1.13, the instruments for housing prices are the age of the structure the worker owns or rents and a regulation variable which is an index of how much residential land use regulations are in place in a particular MSA. To be valid instruments, these two variables must be partially correlated with housing prices but not be correlated with earnings other than through their correlation with housing prices. Table 1.5 below presents the first-stage results of the 2SLS regression. For both owners and renters, the regulation index has a positive and significant effect on housing prices while the age of structure variable has a negative and significant effect on housing prices. Furthermore, F statistics for the excluded instruments are significantly greater than 10 for each category. Therefore, both instruments are strongly correlated with housing prices.

Table 1.5: **First-stage results: Dependent Variable - Housing prices**

Owners					
Education Level	regulation index	Std. error	age of structure	Std. error	F statistic
HS or less	.1309	.017	-.1239	.0047	395.12
Some college	.1233	.0167	-.1189	.004	487.00
Bachelors	.0975	.0182	-.0831	.0048	174.93
Graduate	.0792	.0201	-.0589	.0056	64.67
Renters					
Education Level	regulation index	Std. error	age of structure	Std. error	F statistic
HS or less	.0446	.0126	-.0692	.0041	153.99
Some college	.0463	.0115	-.0965	.003	552.31
Bachelors	.0402	.0132	-.1027	.0034	513.33
Graduate	.0404	.0153	-.1017	.003	664.34

My contention is that the age of a structure and the regulation index are not correlated with the earnings of workers. While more regulation can be expected to lead to higher

house prices, there is little reason to believe that more regulation on land use in a city should affect earnings. It is possible that cities with more regulation on land use may have more regulations and restrictions in other areas which may affect earnings, but I expect this effect to be weak or non-existent. I include the regulation index in a first-stage regression of the earnings equation and find that regulation does not have a significant effect on earnings for owners or renters of any education level.

Similarly, the age of a house or an apartment that a household owns or rents can be expected to affect housing prices, but it should not affect earnings. It is possible that households in higher income brackets may prefer newer houses. In a simple regression of age of structure on earnings, I find that, while earnings has a significant and negative impact on age of structure, the earnings variable explains far less than 1% of the variation in age of structure for owners and renters of all levels of education. While a correlation does exist, it is very weak. Furthermore, I include the age of structure variable in a first-stage regression of the earnings equation and find that while age of structure does have a significant and negative effect on earnings, age of structure explained at most .03% of the variation in earnings.

One final check on the validity of the instruments is an overidentification test which can be used since there are two instruments and one endogenous variable. The results of a Sargan test and Basmann test of overidentifying restrictions are reported in Table 1.6.

Table 1.6: **Overidentification tests**

Owners				
Education Level	Sargan	p-value	Basmann	p-value
HS or less	2.58225	.1081	2.58204	.1081
Some college	.823677	.3641	.823609	.3641
Bachelors	.212485	.6448	.212463	.6448
Graduate	.321925	.5705	.321871	.5705
Renters				
Education Level	Sargan test	p-value	Basmann test	p-value
HS or less	1.33376	.2481	1.33358	.2482
Some college	.165064	.6845	.165029	.6846
Bachelors	.924881	.3362	.924605	.3363
Graduate	.464486	.4955	.464229	.4957

I am unable to reject the null hypothesis that the instruments are uncorrelated with the error terms for owners and renters of all levels of education. Based on the results of these tests and the arguments made in the preceding paragraphs, I conclude that age of structure and the regulation index are valid instruments for housing prices in the 2SLS regression.

For equation 1.10, the instrument for household aftertax earnings is the average hours per week by the head of household. To be a valid instrument, average hours must be partially correlated with household earnings but not correlated with housing prices other than through its correlation with earnings.

Table 1.7 presents the first stage results for the earnings equation. For both owners and renters, average hours have a postive and significant effect on household earnings, as expected. The F statistics in the table show that average hours is strongly correlated with household earnings. My contention here is that average hours are not correlated with housing prices. People who work long hours may want to live closer to the central business district of a city in order to maximize the time they spend at home. Since property values are higher closer to the city center due to the rent gradient, working longer hours may lead to higher house prices.

Table 1.7: **First stage results: Dependent Variable - Household wages**

Owners			
Education Level	average hours	Std. error	F statistic
HS or less	.0885	.0009	10,718
Some college	.0629	.0007	7,060
Bachelors	.0483	.0009	2,925
Graduate	.0382	.0008	2,154
Renters			
Education Level	average hours	Std. error	F statistic
HS or less	.1445	.0009	24,099
Some college	.1204	.0011	11,351
Bachelors	.1041	.0011	8,874
Graduate	.0902	.0017	2,767

To determine if this possibility is a problem, I include average hours worked per week as an independent variable in a first stage regression of housing prices. I find that while

average hours has a significant and negative effect on housing prices for owners with up to some college education and a significant and positive effect on housing prices for owners with at least a bachelors degree and for renters of all education levels, average hours explains at most 1.3% of the variation in home prices and at most 2.2% of the variation in apartment rents. When earnings is included as an explanatory variable, average hours remains significant but the explanatory power of average hours drops to .28% of the variation in home prices and 1.26% of apartment rents. Though there is a slight effect of average hours on house prices, the average hours worked per week is still an acceptable instrument as no instrument is perfect and the problems here are minimal [5].

In addition, people who buy a more expensive house may feel the need to work longer hours in order to pay for the house. In other words, the direction of causality may be going the other way. To determine if this is a problem, I run a regression of average hours on house prices and earnings and find that while house prices have a positive and significant effect on average hours, house prices explain at most only .24% of the variation in average hours worked by owners and .52% of the variation in hours worked by renters. Although it is possible that some correlation exists between house prices and average hours, the correlation is small enough for me to conclude that average hours is a valid instrument for household earnings.

Second, the order condition for identification requires that, for each equation, the number of excluded exogenous variables from the equation be at least as large as the number of right-hand side included endogenous variables. In equation 1.10, the earnings equation has one endogenous right-hand side variable, housing prices, and regulation and age of structure are excluded from this equation. The housing price equation also has one endogenous variable, earnings, and average hours worked per week is excluded. Therefore, equation 1.10 is overidentified and equation 1.11 is exactly identified.

[5] I tried a city minimum wage variable and a percent of the city population that is obese variable as instruments and neither variable had significant second stage results

Third, though the order condition is satisfied, to satisfy the rank condition the exogenous variables excluded from the first equation must have a statistically significant effect on the left-hand side variable of the second equation and vice versa. OLS regressions of house price and rent on regulaton and age of structure return significant coefficients. The same is true for OLS regression of earnings on the average hours worked per week. Therefore, the rank condition is satisfied which means that I am able to identify both sets of equations.

1.3.4 First Research Question: Does the spatial equilibrium theory hold in practice?

As discussed in section 1.3.1, the empirical strategy in this paper is to use 2SLS with annual aftertax earnings and a measure of housing cost as the endogenous variables of interest. The questions I am trying to answer are the following:

1) To what level are workers compensated for higher price levels among cities?

2) What are amenities worth to workers?

1st methodology

I use three slightly different methodologies to answer these questions and to compare my work to that of previous authors. The first method duplicates previous efforts in which I use the overall price level and aftertax annual earnings as my endogenous variables. This first methodology uses the following equations:

$$lnW_{ij} = \beta_1 X_{ij} + \beta_2 lnP_j + \beta_3 a_j + \mu 1_{ij} \tag{1.13}$$

$$lnP_j = \alpha_1 X_{ij} + \alpha_2 lnW_{ij} + \alpha_3 a_j + \mu 2_{ij}$$

where W is aftertax annual earnings, X is a vector of exogenous variables, P is the price level in the MSA, and a is a vector of amenities.

Table 1.8: **Elasticity Results: 1st method**

Author (year)	Results (Std. error)
Roback (1988)	$.9724^c$ (.0156)
DuMond et al. (1999)	$.46^a$ (.007)
Winters (2009)	$.760^a$ (.078) for homeowners
	$.416^a$ (.049) for renters
My results	$.8009^b$ (.08896) for homeowners
	$.5614^b$ (.1824) for renters

Notes: ^{a} significantly different from 1 at the 1% level; ^{b} at 5%; ^{c} at 10%

The coefficients listed in table 1.8 are β_2, which explains how earnings change when the

price level changes holding amenities and other exogenous variables constant. For workers to be fully compensated for cost-of-living differences, a 10% increase in the price level would have to be associated with a 10% increase in earnings. Therefore, the city price elasticity of earnings would have to equal one. Each of the previous authors used OLS regressions while I use a 2SLS regression. Each 2SLS regression uses clustered standard errors. Since none of these previous authors have taken into account the simultaneity of earnings and housing prices, their results will be biased.

In addition to using different econometric techniques, I use 268 MSAs in my data while Roback uses 32 MSAs, Winters uses 167 MSAs, and Dumond uses 185 MSAs. Since the equations for homeowners are slightly different from the equations for renters in my methodology, I can only produce separate estimates for owners and renters and not a combined one like Roback and DuMond provide. Although the estimates of previous researchers appear to differ from my results, statistically they are equivalent.

More specifically, my result for homeowners is statistically equivalent to Roback's result while my result for renter's is not equal to Roback's result. My result for renters is statistically equivalent to DuMond's result while my result for owners is not equal to DuMond's result. Not surprisingly, since Winters (2009) is the paper closest in form and execution to mine, Winters' homeowner result is statistically equivalent to my homeowner result and Winters' renter result is statistically equivalent to my result for renters.

Using this first methodology, it appears that owners are better compensated for higher city price levels than renters. However, the two results are not statistically different. Furthermore, both results are statistically significant and statistically different from 1 at the 5% level. This means that a 10% increase in city price levels is associated with less than a 10% increase in earnings for both owners and renters. Therefore, I can conclude that owners and renters are not fully compensated for changes in city price levels using this methodology. Therefore, the spatial equilibrium theory is invalidated.

2nd methodology

The results from the 1st method are insufficient because there may be differences in how earnings respond to changes in housing prices and changes in prices of non-housing goods. Therefore, the second methodology involves breaking the overall price level apart into housing prices and the price of non-housing goods and services. Full compensation using this methodology requires that a 10% increase in housing prices be associated with a 3.1% increase in earnings for homeowners and a 3.4% increase in earnings for renters, while a 10% increase in non-housing goods prices be associated with a 6.9% increase in earnings for homeowners and a 6.6% increase in earnings for renters. These numbers are calculated from the Consumer Expenditure Survey Expenditure shares for housing, which is .31 for homeowners and .34 for renters. Equations for this method are:

$$lnW_{ij} = \beta_1 X_{ij} + \beta_2 lnHP_{ij} + \beta_3 lnNHP_j + \beta_4 a_j + \mu 1_{ij} \tag{1.14}$$

$$lnHP_j = \alpha_1 X_{ij} + \alpha_2 lnW_{ij} + \alpha_3 lnNHP_j + \alpha_4 a_j + \mu 2_{ij}$$

where NHP is the non-housing goods price index which includes prices of food transportation, healthcare, and entertainment and HP is housing prices.

Since NHP appears in both equations, there is both a direct effect on earnings and indirect effect of NHP on earnings through its effect on housing prices. Therefore, I calculate a total effect (direct + indirect) of NHP on earnings for homeowners and renters of each education level. These total effects are reported in the NHP column in Table 1.9 below.

Winters(2009) is the only paper I found that uses this second method. My overall result and Winters (2009) result for the housing price elasticity of earnings is not statistically different for owners while it is statistically different at the 10% level for renters. For the nonhousing good price elasticity of earnings, my result and Winters' result for owners is statistically different at the 5% level while the result for renters is significantly different at the 1% level. This is not surprising since Winters' used past values of housing prices

and nonhousing goods prices to instrument for housing prices and nonhousing goods prices while I used regulation index and the age of the structure as discussed in section 3.3.

Table 1.9: **Elasticity results: 2nd method**

	Owners		Renters	
Education Level	house (s.e.)	NHP (s.e)	rent (s.e)	NHP (s.e.)
High School Grad or less	$.1637^a$ (.0333)	1.085^b (.1907)	$.1202^c$ (.1166)	1.672^a (.359)
Some College	$.2402^a$ (.0214)	.9093 (.1777)	$.1595^c$ (.0906)	1.77^b (.5008)
Bachelor's Degree only	$.2510^a$ (.0191)	.7096 (.1508)	.2561 (.0765)	1.726^b (.5397)
Graduate Degree	.3295 (.0572)	.6400 (.2146)	.3969 (.1024)	2.594^a (.6001)
Overall	$.1993^a$ (.0201)	.9235 (.1769)	$.1645^a$ (.0631)	1.8728^a (.3422)
Winters(2009)	$.143^a$ (.024)	$.165^a$ (.132)	.337 (.038)	$.231^a$ (.106)

Notes: ^{a} significantly different from the budget share (.31 for housing and .69 for nonhousing for owners and .34 for housing and .66 for nonhousing for renters) at the 1% level; ^{b} at 5%; ^{c} at 10%

My overall results and Winters' results share other similarities. Our results for house price elasticity of earnings for owners are both statistically different from the housing budget share for owners. However, while Winters' results for nonhousing goods elasticity of earnings is statistically different from the nonhousing goods budget share for owners, my result is not statistically different for the nonhousing goods budget share for owners. For renters, on the other hand, Winters' result for rent elasticity of earnings is not statistically different from the rent budget share while my result is statistically different from the rent budget share. However, both Winters' result and my result for the nonhousing goods price elasticity of earnings are significantly different from the nonhousing goods budget share for renters.

As far as I am aware, this is the first paper to break these results down by levels of education. Each coefficient is statistically significant for both owners and renters of all education levels except for the housing price elasticity of earnings for renters with a high school degree or less. For owners, though the housing price elasticity of earnings increases as education increases, the results for owners who do not have a graduate degree are statistically less than the housing budget share while the result for owners with a graduate degree is not statistically different from the housing budget share. Furthermore, though the nonhousing goods price elasticity of earnings decreases with education for owners, the result for owners with a high school degree or less is statistically greater than the nonhousing goods budget

share while the results for owners with all higher levels of education are not statistically different than the nonhousing goods budget share.

For renters, the situation is a bit different. The housing price elasticity of earnings increases with education, but the results for renters with up to some college education are statistically less than the housing budget share while the results for renters with at least a bachelor's degree are not statistically different from the housing budget share. Unlike for owners, for renters the nonhousing goods price elasticity of earnings increases with education and each result is statistically greater than the nonhousing goods budget share.

The results show that renters are substantially over-compensated for higher non-housing goods prices. A few things to keep in mind. First, each of the coefficients have very large standard errors. These errors are two to three times as large as the standard errors for homeowners. Therefore, these results are not measured with a lot of accuracy. Second, renters face significantly less restrictions than homeowners in being able to move to cities with low goods prices and high earnings. Taken together, it is less surprising that the results are so large.

From the results in Table 1.9, I conclude that, except for owners with a graduate degree, owners are not fully compensated for increases in housing prices and renters with at least a bachelor's degree are fully compensated for increases in higher housing prices while renters who do not have a bachelor's degree are not. I also conclude that owners are fully compensated for increases in higher nonhousing goods prices and state further that owners with a high school degree or less receive larger percentage increases in their wages than the percentage increase in nonhousing goods prices. Renters, on the other hand, are all more than fully compensated for increases in nonhousing goods prices. In order to determine if overcompensation in one area makes up for undercompensation in the other area, I add the housing price and nonhousing price coefficients together in Table 1.10.

While the results from Table 1.9 show that some owners are not fully compensated for

Table 1.10: **Total Results**

Education Level	Owner's Total (s.e.)	Renter's Total (s.e)
High School Grad or less	1.245 (.1936)	1.793^{b} (.3775)
Some College	1.15 (.179)	1.929^{c} (.509)
Bachelor's Degree only	.9606 (.152)	1.983^{c} (.5451)
Graduate Degree	.9695 (.2221)	2.991^{a} (.6087)
Overall	1.228 (.178)	2.037^{a} (.3479)
Winters(2009)	$.308^{a}$ (.1342)	$.568^{a}$ (.1126)

Notes: ^{a} significantly different from 1 at the 1% level; ^{b} at 5%; ^{c} at 10%

price changes, Table 1.10 shows that owners of all education levels are fully compensated for changes in overall city price levels. There is also a substantial difference between my overall result for owners and Winters' result as Winters' result is statistically less than 1 and my overall result is not statistically different from 1. For renters, I find that the coefficient is statistically greater than 1 for all levels of education. Also, though both Winters' result and my overall result are statistically different from 1, Winters' result is less than 1 while my overall result is greater than 1.

3rd methodology

Using the second method, I find that homeowner and renters of all education levels are fully compensated for higher non-housing goods prices. Therefore, the third methodology I use involves constraining the coefficient on the non-housing goods price index such that earnings adjust fully. In other words, this coefficient is assumed to be equal to households budget share of non-housing goods and services. For homeowners, this value is .69 and for renters this value is .66. Equations for this methodology are the following:

$$lnW_{ij} - (share) \times lnNHPij = \beta_1 X_{ij} + \beta_2 lnHP_{ij} + \beta_3 a_j + \mu 1_{ij} \tag{1.15}$$

$$lnHP_j = \alpha_1 X_{ij} + \alpha_2 [lnW_{ij} - (share) \times lnNHP_{ij}] + \alpha_3 a_j + \mu 2_{ij}$$

The coefficients listed in table 1.11 are β_2 which explains how earnings change when the housing price level changes holding amenities and other exogenous variables constant. If this coefficient equals .31 for owners or .34 for renters, then workers are fully compensated for higher price levels.

Table 1.11: **Elasticity results: 3rd method**

	Owners		Renters	
Education Level	house price	Std. error	Rent	Std. error
High School Grad or less	.1644[a]	.0296	.1701[c]	.0897
Some College	.2414[a]	.0194	.1859	.0985
Bachelor's Degree only	.2518[b]	.0246	.2618	.0578
Graduate Degree	.3333	.0441	.4144	.0938
Overall	.2004[a]	.0188	.1323[a]	.0597
Winters(2009)	.091[a]	.021	.297	.042

Notes: [a]Significantly different from the housing budget share (.31 for owners and .34 for renters) at the 1% level; [b] at 5%

Using the third methodology, a few patterns emerge among the different levels of education. First, the coefficient on house price and rent for the earnings equation for owners and renters, respectively, increases as education increases. This coefficient is statistically significantly less than .31 for homeowners with a High School degree or less, with some college, and with a bachelor's degree only. Homeowners with a graduate degree have a coefficient that is not statistically different from .31. Therefore, I conclude that homeowners with education up to and including a bachelor's degree are not fully compensated for higher housing price levels in a city and homeowners with a graduate degree are fully compensated for higher housing price levels in a city when I assume that owners are fully compensated for higher non-housing good prices. This means that the spatial equilibrium theory is only validated for homeowners with a graduate degree.

For renters, the coefficient of interest is statistically significantly less than .34 for people with High School degree or less, while the results for all more highly educated renters are not statistically different from .34. Therefore, I conclude that renters with a high school degree or less are not fully compensated for higher housing price levels in a city and all renters with at least some college education are fully compensated for higher housing price levels in a city when I assume that renters are fully compensated for higher non-housing good prices. This means that the spatial equlibrium theory is validated for all renters with at least some college education.

Furthermore, it is apparent that, at low levels of education, homeowners are better compensated than renters for higher housing prices, while, at high levels of education, renters are compensated at least as much as homeowners for higher housing prices. Although these differences in coefficients across groups, both education level and homeownership status, are not all statistically significant, it is the case that homeowners and renters with a graduate degree are better compensated for higher housing prices than homeowners and renters with a high school degree or less, respectively.

A partial explanation for the pattern in Table 1.11 is that less-educated workers are more likely to operate in a local labor market while more educated workers are more likely to operate in a national labor market. Table 1.12 lists the percentage of workers in the samples who remained in the same house, moved to a new MSA within the same state, or moved into an out-of-state MSA. Two things are readily apparent. Renters are significiantly more likely to migrate across state lines than homeowners and migration across state lines increases as education increases for both renters and homeowners.

Table 1.12: **Migration Status last 5 years**

Owners			
Education Level	Same House	Moved within State	Moved from out of state
High School Graduate or less	73.3%	23.6%	3.1%
Some College	70.3%	25.1%	4.6%
bachelor's Degree	66.9%	25.5%	7.6%
Graduate Degree	68.6%	21.8%	9.6%
Renters			
High School Graduate or less	46.0%	43.0%	11.1%
Some College	39.4%	45.5%	15.2%
bachelor's Degree	35.2%	40.0%	24.8%
Graduate Degree	33.5%	31.7%	34.9%

One reason renters may be better compensated than owners for higher housing prices at high levels of education is that owners are much less likely and less able to move to take advantage of better amenities and/or higher wages. Furthermore, the fact that migration increases with education for both owners and renters can explain why both renters and

owners are better compensated for higher housing prices as education increases. In both cases, it is likely that there is some kind of migration cost, whether it be psychological or financial in nature, that is keeping certain groups of people from moving to areas in which they would be better off in terms of earnings, housing prices, and amenities.

Another reason why workers are not fully compensated is that the dependent variable is earnings. Non-earnings income, such as health insurance, pensions, 401k, stock options, and subsidized housing bring workers of each level of education closer to full compensation. Non-earnings income is especially significant for workers with more education, which means that the differences in elasticities between workers with little education and workers with much education is probably greater than it appears in the table.

Lastly, since Winters (2009) did not break down results by education, I compared my overall result to Winters' overall result. Though my coefficient for owners is smaller than Winters' coefficient and my coefficient for renters is larger than Winters' coefficient, these differences in coefficients are not statistically significant.

I further examine how housing prices and earnings change with population and over time. First, the coefficient on population in the earnings equation for owners, how earnings increase when MSA population increases, rises with education, as seen in Table 13. Population has both a direct and indirect effect on earnings and housing prices. Therefore, I calculate a total effect (direct + indirect) of population on earnings and housing prices for owners and renters of each education level.

Table 1.13: **Population elasticity of earnings**

	Owners	Renters
Education Level	estimate (Std. error)	estimate (Std. error)
High School Grad or less	−.0191 (.0205)	$-.0495^a$ (.0172)
Some College	.0178 (.0177)	−0.0129 (.0266)
Bachelor's Degree only	$.0403^b$ (.0173)	−.0225 (.0245)
Graduate Degree	$.0426^b$ (.0208)	−0.0074 (.0328)
Overall	.017 (.0147)	−.0251 (.0168)

Notes: ^{a} denotes significance at the 1% level; ^{b} at 5%; ^{c} at 10%

More educated owners are better off in bigger MSAs than are less educated owners, since more educated workers see their earnings increase in larger cities while less educated workers see no change in earnings. For renters, workers with a high school degree or less receive lower earnings in larger cities. However, all more educated renters do not see significant changes in their earnings in larger cities.

Table 1.13 also shows that owners are at least as well off as renters at all levels of education. There is a statistically significant difference in coefficients between renters and owners for all education levels except for owners and renters with some college education.

Second, Table 1.14 shows the coefficients on population in the housing equations, how housing prices change as population changes, for renters and owners. Houses are cheaper in bigger MSAs for owners of all education levels and, there is no significant difference in rent between different size cities for renters of all education levels. There is a statistically significant gap between the two sets of coefficients which means that owners are significantly better off in larger MSAs than are renters since owners face larger decreases in the price of housing than renters in bigger MSAs. The results for homeowners seem counter-intuitive. However, these results are holding MSA characteristics, amenities, and earnings constant. Using a simple correlation, housing prices and population are actually positively correlated. Based on tables 1.13 and 1.14, I conclude that owners are better off than renters in larger MSAs since owners receive bigger increases in earnings and receive bigger decreases in housing costs than renters in larger MSAs.

Table 1.14: **Population elasticity of housing prices**

	Owners	Renters
Education Level	estimate (Std. error)	estimate (Std. error)
High School Grad or less	$-.1124^a$ (.0279)	$-.025$ (.0165)
Some College	$-.1262^a$ (.027)	$-.0306$ (.019)
Bachelor's Degree only	$-.1132^a$ (.0301)	$-.0284$ (.0258)
Graduate Degree	$-.085^a$ (.0256)	$-.0155$ (.025)
Overall	$-.1117^a$ (.025)	$-.0263$ (.0212)

Notes: ^{a} denotes significance at the 1% level; ^{b} at 5%; ^{c} at 10%

A third area is how workers fare in the two different time periods in the data. Table 1.15 shows the percentage change in earnings for renters and owners over the two time periods in the sample, the year 2000 and the years 2005-2007. I again look at both the direct and indirect effect of the changing time period in the regression results. Owners with higher levels of education appear to be increasingly better off in the later time period, though the differences in coefficients are not statistically significant. Renters are better off over time and this change in wages increases as education increases, though these differences in coefficients are not statistically significant. Furthermore, less-educated owners became better off over time than less educated renters while owners with a graduate degree became worse off over time than renters with a graduate degree, though none of these differences are statistically significant.

Table 1.15: **Change in earnings over the two time periods**

	Owners	Renters
Education Level	estimate (Std. error)	estimate (Std. error)
High School Grad or less	$.1542^a$ (.0324)	$.1031^a$ (.0343)
Some College	$.1675^a$ (.0216)	$.1277^a$ (.034)
Bachelor's Degree only	$.1784^a$ (.0237)	$.1613^a$ (.0375)
Graduate Degree	$.1949^a$ (.0325)	$.245^a$ (.0434)
Overall	$.1717^a$ (.0174)	$.1301^a$ (.0252)

Notes: ^{a} denotes significance at the 1% level; ^{b} at 5%; ^{c} at 10%

Finally, Table 1.16 shows the percentage change in housing costs for renters and owners over the two time periods in the sample. At all levels of education, over the two time periods housing costs went up for both owners and renters. These large increases in housing values over the two time periods are likely a result of the housing bubble. The differences in coefficients for renters of all the education levels are not statistically significant. Though the owners trend appears to be downward, none of the differences in coefficients for owners of the five educational levels is statistically significant. The table also shows that housing costs for owners went up more than housing costs for renters and these differences in coefficients between owners and renters of all levels of education are statistically significant.

Table 1.16: **Change in housing prices over two time periods**

	Owners	Renters
Education Level	estimate (Std. error)	estimate (Std. error)
High School Grad or less	$.3969^a$ (.0362)	$.17^a$ (.0204)
Some College	$.3934^a$ (.0334)	$.1642^a$ (.0161)
Bachelor's Degree only	$.392^a$ (.0377)	$.1845^a$ (.0245)
Graduate Degree	$.3519^a$ (.0413)	$.1907^a$ (.0253)
Overall	$.3897^a$ (.0347)	$.1754^a$ (.0171)

Notes: ^{a} denotes significance at the 1% level; ^{b} at 5%; ^{c} at 10%

Based on tables 1.15 and 1.16, I conclude that renters are better off over the two time periods than owners are, since there are no statistically significant differences in the changes in earnings for owners and renters and housing prices for owners increase by a much higher percentages than housing prices for renters.

1.3.5 Second research question: What are amenities worth to people?

Based on the results from the theoretical model, for a variable to be an amenity, the coefficient on the variable in the earnings equation must be negative, indicating that workers give up earnings for a higher level of the amenity. Similarly, the coefficient on the variable in the housing equation must be positive, indicating that workers pay more for housing in order to enjoy a higher level of the amenity. For a variable to be a disamenity, the coefficient on the variable in the earnings equation must be positive, indicating that workers give up earnings for a lower level of the disamenity, and the coefficient on the variable in the housing equation must be negative, showing that workers pay more for housing in order to enjoy lower levels of the disamenity. If both coefficients are of the same sign or one or both coefficients are not statistically significant, then the variable is not a true amenity or disamenity.

I use the regression results for owners and renters of each education level to estimate the implicit value of amenities for both owners and renters. Since people do not actually pay for amenities, Equation 1.9 in Section 1.2.3 can be used to determine an implicit price of amenities using the amount of earnings the worker is willing to give up to enjoy a particular

amenity subtracted from the amount of rent or yearly cost of housing the worker is willing to pay to enjoy the amenity. In terms of the regression results, this is the coefficient on the MSA attribute in the housing equation minus the coefficient on the MSA attribute in the earnings equation.

An important caveat to keep in mind is that I find that only homeowners with a graduate degree and renters with at least some college education are fully compensated for higher housing prices. This is important because the implicit price of amenities equation depends on workers being fully compensated for higher city housing prices. Therefore, I present the implicit prices of amenities for all workers, but the results for less-educated workers are somewhat biased.

There are two ways of expressing amenities in the equations. The first is amenities in the level form. Equation 1.9 is modified in the following way:

$$p_a^i = [\frac{PL}{w_i} \cdot \frac{\partial logP}{\partial a} - \frac{\partial log w_i}{\partial a}]w_i \tag{1.16}$$

$\frac{PL}{w_i}$ is the share of land in the worker's budget and is calculated by dividing the average annual value of housing for workers of type i divided by the average annual earnings for workers of type i. This gives an implict price in terms of dollars per one unit change in the amenity value.

The second is amenities in the log form. Equation 1.9 is modified to deal with this as well:

$$p_a^i = [\frac{PL}{w_i} \cdot \frac{\partial logP}{\partial loga} - \frac{\partial log w_i}{\partial loga}]\frac{w_i}{a} \tag{1.17}$$

This price is equal to dollars per unit change in each of the amenity variables. I multiply this value from equation 1.16 and equation 1.17 by the standard deviation of the variable in order to get the price for a one standard deviation change in the amenity value. Tables 1.17 and 1.18 list the implicit prices of amenities for owners and Table 1.19 and 1.20 list

the implicit prices for renters.

Table 1.17: **Implicit Prices of Amenities for Owners**

Fixed Amenities (units)	HS Grad or less	Some College	Bachelor's Degree	Graduate Degree
Avg temp in January (degrees)				
1 unit change	$192.70^a	$133.66^c	$96.01	$91.56
1 Std. Dev. change	$2,297.28^a	$1,593.43^c	$1,144.59	$1,091.54
Avg temp in July (degrees)				
1 unit change	-$50.30	-$134.51	-$173.96	-$297.51
1 Std. Dev. change	-$306.15	-$818.70	-$1,058.81	-$1,810.81
Inches of snow (inches)				
1 unit change	-$18.56	-$31.51	-$75.36^a	-$98.95^c
1 Std. Dev. change	-$407.13	-$691.21	-$1,653.11^a	-$2,170.58^c
Inches of precipitation (inches)				
1 unit change	-$25.27	-$35.71	-$68.77	-$58.14
1 Std. Dev. change	-$351.78	-$497.12	-$957.35	-$809.37
Sunny Days (days)				
1 unit change	$67.72^a	$61.88^a	$62.71^b	$101.35^a
1 Std. Dev. change	$2,302.48^a	$2,103.92^a	$2,132.14^b	$3,445.90^a
Inland water (miles)				
1 unit change	$285.12^b	$330.42^c	$348.06	$355.18
1 Std. Dev. change	$831.87^b	$964.03^c	$1,015.50	$1,036.27
Coastal City (dummy)				
1 unit change	$721.26	$709.05	$1,144.50	$2,766.52
1 Std. Dev. change	$721.26	$709.05	$1,144.50	$2,766.52

Notes: [a]Significant at the 1% level; [b] at 5%; [c] at 10%; standard errors are in the appendix

A positive price signifies that workers are willing to pay for higher levels of the MSA attritbute which means that workers consider the attribute an amenity. A negative price means workers are willing to pay for lower levels of the MSA attribute, which means that the attribute is a disamenity. I listed implicit prices for all amenities, though not all prices are statistically significant. The significance level of each implict price is marked on the table and standard errors for each implicit price are listed in tables in the appendix.

The implict prices can easily be compared across education levels for a one unit change in each individual amenity. It is difficult to make comparisons across amenities since a one unit change in number of sunny days is completely different from a one unit change in crime. Therefore, I also present the prices of a one standard deviation change in the amenity value.

For the set of amenities not under the control of city officials in Table 1.17, people of all education levels agree that they are willing to pay to live in cities with more sunny days. People of all education levels appear to be in agreement about summer temperatures, rain, and the value of a coastline, but these implict prices are not statistically significant.

There is disagreement among educational groups about the value of winter temperatures, snow, and inland water. Since less educated workers are more likely to be working outside than more educated workers, they may be willing to pay more for warmer winter weather. Snow, unlike crime, is not a universally disliked amenity. Some people like snow and like to live in areas where they can go skiing and take part in outdoor winter activities. More-educated people prefer to live in cities with less snow, while less-educated people are not willing pay a statistically significant amount of money to live in cities with less snow. Less-educated people are willing to pay to live in cities with more inland water, while more-educated people are not willing to pay a significant amount of money to live in cities with more inland water.

In Table 1.18, which lists the amenities over which city officials have control, homeowners with different levels of education disagree on whether each of the attributes is an amenity and differ on how much they like or dislike a particular amenity.

For the amenity variables, more spending per pupil, better entertainment, and better air and water quality are valued more highly as education increases. The only exception is that owners with a graduate degree value education spending less than owners with a bachelors degree. This may be due to the children of these owners being more likely to attend private school. For the disamenity variables, a shorter commute time, a lower sales tax rate, and less crime are more highly valued as education increases.

Within the levels of education the relative valuations of the amenities are compared using the one standard deviation implicit price. Homeowners with a high school degree or

Table 1.18: **Implicit Prices of Amenities for Owners**

Control Amenities (units)	HS Grad or less	Some College	Bachelor's Degree	Graduate Degree
Sales Tax (%)				
1 unit change	-$161.14	-$622.11^b	-$627.38	-$1,013.54^c
1 Std. Dev. change	-$243.00	-$938.14^b	-$946.09	-$1,528.42^c
Spending per pupil (100s of $)				
1 unit change	$228.64^a	$234.77^a	$307.28^a	$270.29^a
1 Std. Dev. change	$2,933.86^a	$3,012.52^a	$3,942.96^a	$3,468.31^a
Air & Water Quality (0-200 index)				
1 unit change	$9.53	$18.02^c	$27.53^b	$35.45^b
1 Std. Dev. change	$354.50	$670.31^c	$1,024.06^b	$1,318.67^b
Crime (in hundreds)				
1 unit change	-$55.93^b	-$73.16^b	-$125.10^a	-$163.10^c
1 Std. Dev. change	-$643.75^b	-$842.07^b	-$1,439.90^a	-$1,877.28^c
Commute time (minutes)				
1 unit change	-$252.18^a	-$241.00^a	-$246.41^a	-$349.08^a
1 Std. Dev. change	-$1,356.73^a	-$1,296.58^a	-$1,325.69^a	-$1,878.05^a
Entertainment (18-180 index)				
1 unit change	$0.23	$58.71^a	$107.11^a	$159.38^a
1 Std. Dev. change	$9.32	$2,379.46^a	$4,341.06^a	$6,459.51^a

Notes: ^{a}Significant at the 1% level; ^{b} at 5%; ^{c} at 10%; standard errors are in the appendix

less and with some college education value education spending highest while homeowners with a bachelor's degree and with a graduate degree value entertainment highest. Therefore, less-educated owners put more value on education and more-educated owners put more value on the restaurants, bars, outdoor activities, shopping, and other entertainment activities available in a city. This may be due to financial constraints. On the one hand, more highly-educated workers are more able to utilize alternatives to public schooling than less-educated workers are. On the other hand, more-educated workers are better able to utilize all the entertainment activities a city has to offer than are less-educated workers.

Air and water quality is one of the least valued control amenities. This is likely due to two effects. One is information problems. It may not be easy for people to know the differences in air or water quality from one city to the next. A second is substitution possibilities. If a city has poor water quality, rather than pay money to live in a city with better water quality, residents can pay for water filters or bottled water.

Table 1.19 presents the implict price of amenities for renters that are outside the control of city officials. While the valuations of renters are similar to those of homeowners in many ways, there are important differences.

Table 1.19: **Implicit Prices of Amenities for Renters**

Fixed Amenities (units)	HS Grad or less	Some College	Bachelor's Degree	Graduate Degree
Avg temp in January (degrees)				
1 unit change	\$97.53[a]	\$118.60[a]	\$96.59	\$29.71
1 Std. Dev. change	\$1,162.56[a]	\$1,413.71[a]	\$1,151.35	\$354.14
Avg temp in July (degrees)				
1 unit change	\$17.00	\$2.26	\$42.94	-\$251.21[c]
1 Std. Dev. change	\$103.47	\$13.98	\$261.35	-\$1,528.99[c]
Inches of snow (inches)				
1 unit change	\$14.52	\$21.60	\$2.28	\$11.00
1 Std. Dev. change	\$318.57	\$473.90	\$50.02	\$241.34
Inches of precipitation (inches)				
1 unit change	\$13.57	\$26.25	\$35.89	\$32.90
1 Std. Dev. change	\$188.91	\$365.43	\$499.62	\$458.00
Sunny Days (days)				
1 unit change	\$34.46[a]	\$32.49[b]	\$54.96[a]	\$97.77[a]
1 Std. Dev. change	\$1,171.64[a]	\$1,104.66[b]	\$1,868.64[a]	\$3,324.18[a]
Inland water (miles)				
1 unit change	\$71.98	-\$79.33	\$104.12	-\$20.06
1 Std. Dev. change	\$210.04	-\$231.48	\$303.82	-\$58.54
Coastal City (dummy)				
1 unit change	-\$58.66	\$414.19	\$279.54	\$3,866.53[a]
1 Std. Dev. change	-\$58.66	\$414.19	\$279.54	\$3,866.53[a]

Notes: [a]Significant at the 1% level; [b] at 5%; [c] at 10%; standard errors are in the appendix

First, renters with a graduate degree pay for cooler summer weather while owners of all education levels are indifferent to cooler summer weather. Renters, in general, place less value than homeowners on temperature when deciding where to locate. This may be due to the temporary nature of renting versus the permanence of buying a home in an area. Second, renters of all education levels are willing to pay to live in cities with more snow, though these prices are not statistically signficant. Homeowners of all education levels view snowfall as a disamenity. This is likely due to the fact that homeowners have to deal with shoveling while renters, in large part, do not.

Third, renters of all education levels are not willing to pay for more inland water in a city while homeowners with a high school degree or less and with some college education are willing to pay for more inland water. Lastly, renters with a graduate degree pay to live in a city on the coast, while no homeowners pay more to live in a city on the coast.

Table 1.20 presents the implict price of amenities for renters that are within the control of city officials.

Table 1.20: **Implicit Prices of Amenities for Renters**

Control Amenities (units)	HS Grad or less	Some College	Bachelor's Degree	Graduate Degree
Sales Tax (%)				
1 unit change	\$319.36[a]	\$217.27	-\$178.42	\$73.19
1 Std. Dev. change	\$481.59[a]	\$327.64	-\$269.06	\$110.37
Spending per pupil (100s of \$)				
1 unit change	\$183.08[a]	\$198.43[a]	\$288.61[a]	\$361.53[a]
1 Std. Dev. change	\$2,348.92[a]	\$2,545.86[a]	\$3,702.87[a]	\$4,638.43[a]
Air & Water Quality (0-200 index)				
1 unit change	-\$3.07	\$0.58	-\$10.00	\$6.60
1 Std. Dev. change	-\$114.20	\$21.57	-\$371.98	\$245.51
Crime (in hundreds)				
1 unit change	-\$14.92	\$13.95	-\$80.76[a]	-\$67.67
1 Std. Dev. change	-\$171.73	\$160.56	-\$929.55[a]	-\$778.88
Commute time (minutes)				
1 unit change	-\$278.47[a]	-\$314.64[a]	-\$390.63[a]	-\$648.81[a]
1 Std. Dev. change	-\$1,498.17[a]	-\$1,692.76[a]	-\$2,101.59[a]	-\$3,490.60[a]
Entertainment (18-180 index)				
1 unit change	-\$26.68[a]	-\$13.54	-\$13.28	\$29.91
1 Std. Dev. change	-\$1081.34[a]	\$548.78	\$538.24	\$1,212.25

Notes: [a]Significant at the 1% level; [b] at 5%; [c] at 10%; standard errors are in the appendix

Similar to homeowners, renters of all levels of education value spending per pupil as an amenity and commute time as a disamenity, though their valuations of these city attributes are not the same. Only renters with a high school degree or less are willing to pay for entertainment and this group of renters is willing to pay to live in cities with less entertainment. This may be due to less-educated renters having less disposable income to spend on entertainment. Therefore, they may prefer to live in cities with lower quality and quanity of entertainment so that when they do go out, they can afford to partake in the activities. Entertainment activities are significantly cheaper in Cleveland than they are in Manhattan.

Just as with the fixed amenities, there are also important differences between renters and owners with control amenities. First, no groups of renters are willing to pay to live in cities with better air and water quality, while owners with at least some college education are willing to pay for better air and water quality. Second, only renters with a bachelor's degree pay to live in cities with lower crime rates, while owners of all education levels pay to live in cities with lower crime rates. This may be due to less-educated renters living in the most crime-infested areas of all cities. A marginal change in crime will not really affect them.

Third, homeowners are willing to pay significantly more than renters of each education level for better entertainment in a city. This may be due to homeowners and renters moving to cities for different reasons. Homeowners are looking to settle down in a city they can see themselves living in for an extended period of time, while renters are moving for a particular employment opportunity. Fourth, renters of all education levels either view sales tax as an amenity or are indifferent to the sales tax while owners of all education levels view a higher sales tax as a disamenity. Fifth, education spending is more highly valued by renters than it is by homeowners. This is likely due to homeowners having to explicitly pay property taxes, while renters only implicitly pay property taxes through rent. Sixth, commute time is valued significantly more highly for renters than it is for homeowners.

Like homeowners, renters value the amenity and disamenity variables more highly as education increases. Renters of all education levels value education spending per pupil most highly. After education spending, commute time is the next most valued variable for renters of all education levels. Furthermore, entertainment is not valued nearly as highly for renters as it is for owners. Therefore, entertainment options play a significantly smaller role in the choice of where to rent as opposed to the choice of where to buy. Homeowners and renters both value control amenities more than fixed amenities. This is good news for city officials who may want to alter their cities mix of amenities in order to attract people.

1.4 CONCLUSION

Several important results come out of this paper which address some shortfalls in the literature on the capitalization of amenities into wages and housing prices. First, I lay out the conditions under which a particular attribute of a city is considered an amenity or disamenity. Previous authors have done this with one or two types of workers but not with N types of workers as I have done.

Second, while previous authors have looked at whether people are compensated in terms of higher earnings and better amenities for a higher city price level, these studies have been insufficient in a few ways. One is that these studies look at the overall price level in the city without taking into account the endogeneity of housing prices or the endogeneity of the prices of non-housing goods and services. Not doing this ensures that the results from these papers are biased. Another is that some of these studies do not separate workers both by education and by whether the worker rents or owns his home. Both of these are addressed in my paper.

Third, while previous authors have looked at the implicit price of amenities, to my knowledge no one has looked at the implicit price of amenities by education or by home-owners and renters. Both of these worker characteristics have a significant effect on a worker's valuation of amenities.

Fourth, even though it is not an explicit result of my paper, a major implication is that choosing only house prices or rents in an amenity capitalization paper or any other study involving housing prices will have a serious impact on one's results. Any study that does not report both opens itself up to significant and valid criticism.

The results in this paper are important to workers, firms, and local governments. First, the model shows city officials what attributes of a city workers consider amenities and how strongly those workers feel about those amenities. If city officials would like to attract

workers of a certain education level, they can put resources into improving amenities that are within their control and are most highly valued by the education group they are trying to woo to their city. Furthermore, city officials can focus on amenities important to either renters or owners depending on whether the city's goal is to attract homeowners or to expand the city's rental market.

Second, this model can inform firms about the most desirable cities in which to locate. The firms can select locations that have high levels of the amenities most desired by the types of workers they demand. Therefore, the firms can pay these workers lower wages. The firms will have to be careful to ensure that the wage savings they earn are not offset by the increase in land prices caused by higher amenity levels. Third, this model allows workers to determine if they will be fully compensated for a move to a new city based on their level of education and if they plan to rent or own their housing.

In future papers, I would like to determine how the compensation for higher price levels differs for husbands and wives in a household and how their respective amenity valuations differ. I would also like to use the implict price of amneity valuations results to construct a city ranking index for owner and renters of each type of education.

Chapter 2

AN IMPROVED CITY RANKING USING IMPLICIT AMENITY PRICES

2.1 INTRODUCTION

What makes a particular city a great place to live? Some say the weather, the restuarants and bars, and the lack of traffic in the city while others posit that it is the high wages or low cost of living. One would think that a city that has high wages and housing prices would be an ideal place to live. However, economists now view areas with high wages and low housing prices as unattractive places to live because the amenities, or positive characteristics that a city has to offer, are capitalized into wages and housing prices. Paradoxically, this means that a city has high wages because it is not a nice place to live, and businesses in the city have to offer high wages to attract workers. Similarly, low housing prices in a city means that sellers have to charge low prices in order to attract people to live in a city that is otherwise undesirable. Therefore, an approach is needed that ranks areas based on the desirability of the area and is not subject to the endogeneity issues that affect wages and housing prices.

There are two main approaches in the city ranking literature. The implicit price of amenity approach, used by Roback (1982), Blomquist et. al (1988), Gyourko (1991) and Blomquist (2006) assumes that the value of amenities are capitalized into housing prices and wages to calculate implicit prices of amenities. These implicit amenity prices are used as weights that are multiplied by the amount of each amenity in each city. The sum of the

"market values" of a city's amenities can then be used to create a city ranking.

The real wage approach, used by Kahn (1995), Gabriel and Rosenthal (2004), Chen and Rosenthal (2008), Albouy (2008), and Winters (2012), involves finding the logarithmic difference in nominal wages across areas and subtracting this from the logarithmic difference in housing prices across areas, using either a rent-based or housing-value based index. The idea behind this approach is that, after accounting for typical housing characteristics and worker characteristics, the differences in rents and wages must reflect differences in local amenities. This approach uses fixed effects and does not explicitly use amenity variables in calculations.

I use similar methodologies to both of these approaches, but I improve upon shortcomings in both strands of the literature. First, I include the effect of externalities like educational attainment and income inequality. Second, I allow the rankings to take recent job growth into account. Third, I look at how city rankings differ by level of education and by ownership status. Overall city rankings lose a lot of information because they are averages for diverse populations. Some cities may be very nice places to live for homeowners but not so much for renters. Similarly, some cities may be attractive to highly-educated people and not be so attractive to less-educated people.

Most importantly, I give my rankings a solid foundation by calculating how important amenity valuations, recent job growth, income inequality, and educational attainment are in migration decisions. While I agree with the literature that amenity valuations play an important role in city rankings, I find that the other three components mentioned are important as well, as they have a significant impact on city migration.

The rankings I compute are useful in a number of ways. First, I am able to calculate city rankings for homeowners and renters of different education levels as well as the correlation among these rankings. Second, I answer empirically the question about the desirability of big cities, which cannot be answered theoretically due to opposing effects of living in a big city. In general, I find that workers do not regard big cities as good places to live. However,

homeowners like big cities more than renters do, and the more educated like big cities more than the less educated do. Third, I find that firms' rankings of cities are quite different than worker rankings, though these differences vary by level of education. I also find that firms have a much more positive view of big cities than workers do. These results help explain why there is a mismatch of skills and needs in cities. Fourth, I look at how each of these results changes over time. Fifth, I compare my results to rankings done in previous studies. In general, I find that previous rankings are highly correlated with one another, but not highly correlated with my rankings.

2.2 NEW CITY RANKING METHODOLOGY

2.2.1 Worker rankings

The indirect utiltiy function for a worker with education level i is:

$$V^i(w_{ij}, P_j; \mathbf{a_j}) \tag{2.1}$$

where w_{ij} is the wages earned by people with education i in city j, P_j is the price of land in city j, and $\mathbf{a_j}$ is a vector of amenities in city j. The equilibrium condition for workers is that the utilities must be equal across cities for each type of worker:

$$V^i(w_{ij}, P_j; a_j) = k_i. \tag{2.2}$$

In other words, wages and land prices adjust, given a set of amenities, to equalize utilities for workers across locations. If this was not the case, workers would have an incentive to move to another city where their utility would be higher.

I begin by completely differentiating equation 2.2 with respect to amenities, a:

$$V^i_{w_i}\frac{\partial w_i}{\partial a} + V^i_P\frac{\partial P}{\partial a} + V^i_a = 0 \tag{2.3}$$

I then divide equation 2.3 through by $V^i_{w_i}$, use Roy's identity to substitute p^i_a for $\frac{V^i_a}{V^i_{w_i}}$,

once again use Roy's identity to substitute for $L = \frac{-V_P^i}{V_{w_i}^i}$, and solve for p_a^i:

$$p_a^i = L\frac{\partial P}{\partial a} - \frac{\partial w_i}{\partial a} \tag{2.4}$$

p_a^i is a vector of implict prices of amenity a for people with education level i in city j. There are a number of different amenities of a city, each with its own implict price. These implict prices can be used to begin to formulate a city ranking. Let

$$Q_j^i = \sum_a p_a^i \times a_j \tag{2.5}$$

where Q_j^i is the sum, in dollars, of what all the amenities in city j are worth to a person of education level i and a_j is the level of amenity a in city j. In the previous literature on city rankings, this is where the authors stopped. They ranked cities based on the size of Q_j^i, where a larger dollar amount meant people valued the city more highly.

While my city ranking measure includes Q_j^i as a significant and important part, using only Q_j^i to measure how desirable cities are is incomplete. To develop the city ranking literature further, I add several important and overlooked characteristics of a city, which speak directly to its desirability.

The first extension I include is recent job growth. A city may offer very nice weather amenities and consumption amenities, but also offer little to no possiblities for workers to come to the city. While those with jobs are willing to pay higher prices for land and accept lower wages to live in this city, those who cannot find work may be ignored if only Q_j^i is used. This leads to a biased city ranking, representing only those people who are currently able to find work.

Second, it is possible that certain segments of society benefit significantly more than others. While in and of itself this is not problematic, when taken to extremes, income inequality can be harmful to society as a whole. This is hardly a revolutionary concept.

Frank (2005) finds theoretical and empirical support for the importance of relative income and consumption in individual utility functions. Persson and Tabellini (1991) find a significant, negative relationship between income inequality and growth. For instance, inequality can limit growth by limiting the majority of the populations' ability to consume. Those at the top of the income distribution tend to save most of their income while those towards the bottom tend to spend most of their income, which means that demand for goods is depressed in cities with highly unequal income distributions. To this end, I include a measure of income inequality for each city, as workers prefer cities with more equal income distributions even if their position within the distribution is unchanged.

Finally, I include a measure of how educated the people of the city are. This is important because an educated populous has positive externalities that benefit the entire city, and not just those of each particular educational level. While these effects may not be large, Acemoglu and Angrist (2001) find that there are modest but statistically significant external returns to education. They find that social returns to education are 8-9%, of which private returns make up 7%. This means that external returns make up somewhere from 12.5% to 22% of overall returns to education.

In order to include each of these measures, I convert each of the four component parts into rankings and combine the components into one city ranking. While this method of using sub-rankings loses some information, it is the best way to combine variables with different units of measurement. The formula I use to make the city ranking is:

$$R_j^i = \alpha_{i1} \times QR_j^i + \alpha_{i2} \times JGR_j + \alpha_{i3} \times IEQR_j + \alpha_{i4} \times ER_j \tag{2.6}$$

where R_j^i is the city ranking for people with education i in city j;
QR_j^i is the ranking of the total amenity valuation for person of education i in city j;
JGR_j is the ranking of recent job growth in city j;
$IEQR_j$ is the ranking of income inequality in city j;
ER_j is the ranking of how educated the population is in city j;

α_{ik} is the weight given to the kth component of the city ranking for people with education i.

2.2.2 Firm rankings

Based on an idea first put forth by Gabriel and Rosenthal (2004), I also create rankings of cities based upon the view of firms. Unlike for workers in which the value of a city is based on how much money the worker is willing to pay, in terms of lower wages and higher land prices, to live in a city with a particular set of amenities, the value of a city for firms is based on the additional costs the firms are willing to incur to locate in a city with a particular set of amenities.

To determine the workers' implict prices of amenities, I differentiate the workers' indirect utility function with respect to amenities. To determine firms' implicit prices of amenities, I differentiate the firm's cost funtion with respect to amenities. The equilibrium condition for firms is that the unit cost of production must equal the product price, which was assumed to be unity:

$$C(\mathbf{w_j}, P_j; a_j) = 1. \tag{2.7}$$

where $\mathbf{w_j} = (w_{1j}, w_{2_j}, ..., w_{Nj})$. Otherwise, firms would have an incentive to enter the industry.

I completely differentiate equation 2.7 with respect to amenities, a:

$$C_{\mathbf{w}} \frac{\partial \mathbf{w}}{\partial a} + C_P \frac{\partial P}{\partial a} + C_a = 0 \tag{2.8}$$

I then divide by $C_{\mathbf{w}}$ and apply Shepard's Lemma to obtain:

$$\frac{\partial \mathbf{w}}{\partial a} + L \frac{\partial P}{\partial a} = -\frac{C_a}{C_{\mathbf{w}}} \tag{2.9}$$

Finally, setting $p_a^f = -\frac{C_a}{C_{\mathbf{w}}}$ gives

$$p_a^f = \frac{\partial \mathbf{w}}{\partial a} + L\frac{\partial P}{\partial a} \tag{2.10}$$

p_a^f is the implicit price that firms are willing to pay, in terms of higher wages and higher land prices, for another unit of the amenity, a. Cities have a number of different amenities, each with its own firm implict price. These implict prices can be used to begin to formulate a city ranking. Let

$$Q_j^f = \sum_a p_{aj}^f \times a_j \tag{2.11}$$

where Q_j^f is the sum, in dollars, of what all the amenities in city j are worth to a firm and a_j is the level of amenity a in city j. In the previous literature on city rankings, authors ranked cities based on the size of Q_j^f, where a larger dollar amount meant the city was valued more highly by firms.

Similarly to what I did with worker rankings, I add some components to this firm valuation because I believe this valuation to be an incomplete tool for measuring how firms value cities. I again include the firm valuation as an important part of the firm city ranking, but I also take other components into account.

The formula I use to make the city ranking for firms is:

$$R_j^f = \beta_1 \times QR_j^f + \beta_2 \times JGR_j + \beta_3 \times BC_j + \beta_4 \times ER_j \tag{2.12}$$

where R_j^f is the city ranking for firms in city j;
QR_j^f is the ranking of the total amenity valuation for firms in city j;
JGR_j is the ranking of recent job growth in city j;
BC_j is the ranking of how friendly the business climate is in city j;
ER_j is the ranking of how educated the population is in city j;
β_k is the weight given to the kth component of the city ranking.

The business climate replaces income inequality in the firm equation because, while

income inequality is important to a worker's relative happiness, it should not affect a firm's view of a city. However, how friendly a business climate is in terms of taxes and costs of labor, energy, and office space does affect the firm's view of the attractiveness of the city. The friendliness of the business climate variable was a ranking done by *Forbes* called the "Best Places for Business and Careers". This ranked cities based on the cost of labor, energy, taxes, and office space. Recent job growth and education are used once again in the firm equation because these each describe the quality of the business environment that the firm will be a part of in the city.

2.2.3 Data

Individual level data comes from two samples from the Integrated Public Use Microdata Series (IPUMS) [1]. These samples are the American Community Survey's 2005-2007 3-year sample and the 2000 5% sample. From these samples I used male heads of households, aged 25 to 54, who rented or owned an apartment or a house. Furthermore, only people who lived in an identifiable MSA were kept in the sample. The amenity and MSA-specific characteristic data came from the 2002 and 2007 *Cities Ranked and Rated Almanac*. The 2002 *Cities Ranked and Rated Almanac* contains data on MSAs from 2000-2002, while the 2007 *Cities Ranked and Rated Almanac* contains data on MSAs for 2004-2007. The edited samples contain 268 MSAs with 1,219,796 workers for 2000 and 655,012 workers for 2005-2007. All monetary variables are measured in constant 2000 dollars. The datasets from the two time periods are combined because the more important dichotomy is between owners and renters. There are 1,368,200 owners and 506,608 renters in the dataset.

I use after-tax annual earnings as one dependent variable and the annual cost of housing as the other dependent variable in a two-stage least squares system. The instruments used to identify this system of equations are average hours worked for the earnings equation and age of housing structures and an index measuring the amount of regulation on land use for the housing equation.

[1] Steven Ruggles, J. Trent Alexander, Katie Genadek, Ronald Goeken, Matthew B. Schroeder, and Matthew Sobek. Integrated Public Use Microdata Series: Version 5.0 [Machine-readable database]. Minneapolis: University of Minnesota, 2010.

The worker control variables are age, number of children, dummies for marital status, race, English proficiency, occupational category, and whether the person is living and working in a state most affected by the housing bubble (i.e. Florida, Arizona, Washington DC, California, and Nevada). Housing control variables are numer of bedrooms and dummy variables for a one-family house and whether or not the person moved in the last 1 to 5 years. City control variables include population, density, unemployment, percent of children in public school, number of libraries, and a non-housing price index. Finally, the amenity variables are average January and July temperatures, snowfall, rainfall, sunny days, miles of inland water, education spending per pupil by the government, pollution, arts and leisure activities, crime, and commute time.

2.2.4 Calibration

The first step is to construct the 4 rankings in equation 2.6. The first ranking, QR_j^i, is a ranking based on Q_j^i, where a lower value of QR_j^i represents a higher value of Q_j^i. Q_j^i is constructed by finding the implict price of 13 amenities using equation 2.4 for homeowners with a high school degree or less and multiplying this value by the quanitity of the amenity in each city. These 13 values are then added together to get a sum that represents the total value of amenities to homeowners with a high school degree or less for each city. This process can then be repeated for each level of education and for renters. The same process can be used for firms using the amenity values with equation 2.10 and 2.11. The average total value of amenities, Q_j^i, are presented in table 2.1 for homeowners and renters of each level of education as well as for firms.

Table 2.1: **Total value of amenities**

	Owners	Renters	Firms
Education Level	Q_j^i	Q_j^i	Q_j^f
High School Grad or less	\$19,429.84	\$15,476.99	
Some College	\$10,305.80	\$16,245.37	
Bachelor's Degree only	\$9,881.37	\$20,240.62	
Graduate Degree	\$3,033.73	\$6,864.35	
Firms			-\$16,316.80

The other rankings are each city averages, which do not vary by level of education or ownership status. The descriptive statistics for the variables that make up these rankings are presented in Table 2.2 below. The job growth ranking ranks each city by the city's respective rate of recent job growth with a lower, or better, ranking corresponding to a higher job growth rate.

Table 2.2: **Components**

	Mean	Std. Dev.	Min	Max
Job Growth	1.39%	1.96%	-3.85%	9.9%
Income Inequality	.122	.0225	.0645	.1951
High School Degree	81.37%	6.3%	50.4%	94.8%
College Degree	15.08%	4.14%	3.2%	28.6%

The income inequality variable is constructed by dividing occupations into quintiles according to the Nakeo and Tres survey about how people view occupations and calculating a gini coefficient. A gini coefficient lies between 0 and 1, with values closer to 0 signifying more equal income distribution and values closer to 1 signifying less equal income distribution. Cities were then ranked based on income inequality with a lower, or better, ranking corresponding to a lower amount of income inequality. Finally, an education rank was constructed using the last two variables in Table 2.2. First, cities were ranked based on how much of the population has a high school degree. Second, cities were ranked based on how much of the population has a college degree. Third, these two rankings were added together. Finally, the cities were ranked based on this ranking with a lower, or better, ranking corresponding to a more educated city population.

An important second step is to determine the values of each α_{ik} in equation 2.6. In the city ranking literature, previous authors have chosen $\alpha_{i1} = 1$ and set each of the other α_{ik} equal to zero. As I claim in section 2.2.1, this is an incomplete ranking that does not have a theoretical foundation. In order to determine the values for the weights of each component rank, ideally I would want to know how important each component is to the

location decisions of workers. However, these data are not explicitly available.

Instead, I proxy for this information by using net migration per 100,000 people from cities. Net migration is constructed from out-migration and in-migration totals for MSA's which came from IRS data. The migration inflows were adjusted to include only domestic migration, as international immigrants may be moving to cities for other reasons (i.e., proximity to the border). Net migration is, in essence, a revealed preference ranking. Cities with higher net migration are considered attractive and cities with low or negative net migration are considered repulsive.

I regress net migration from the city on the four component ranks and regional dummy variables. I then normalize these coefficients so that they sum to one. These results show how important amenity valuations, job growth, educational attainment, and income inequality are in migration decisions.

The results for owners and renters of each education level, which I use as the individual α_{ik} from equation 2.6, are presented in tables 2.3 and 2.4. This methodology allows me to use different weights for people of different education levels and ownership status, which provides more accurate city rankings.

Table 2.3: **Component weights for owners**

Education Level	Amenity Valuation	job growth	inequality	education
High School Grad or less	.2857	.3299	.1326	.2519
Some College	.3271	.2046	.1021	.3661
Bachelor's Degree only	.445	.1097	.0236	.4216
Graduate Degree	.4636	.1174	.0122	.4068
Overall	.4073	.203	.0442	.3454

For homeowners overall, the value of city amenities is the most important component in their migration decisions, followed closely by the educational composition of the city. Moreover, amenity valuations and educational composition increase in importance and income

inequality and recent job growth decrease in importance as education increases. People with more education desire more cultural activies and are able to afford entertainment activities that a city has to offer. Also, the less educated tend to be on the lower end of the income distribution so less income inequality in a city is of particular importance to them.

The same basic pattern holds for renters, except that job growth grows in importance as education increases and recent job growth is the most important component in renters' migration decisions. Overall, there is also significantly more weight on the amenity valuation for homeowners, while there is significantly more weight on job growth for renters. Homeowners are picking a location based mostly on how desirable it is to live and work in, while renters are moving to cities that have jobs.

Table 2.4: **Component weights for renters**

Education Level	Amenity Valuation	job growth	inequality	education
High School Grad or less	.1317	.186	.4249	.2574
Some College	.5344	.1602	.1084	.197
Bachelor's Degree only	.4567	.2346	.1435	.1652
Graduate Degree	.5121	.3026	.0545	.1308
Overall	.3007	.3395	.2548	.1051

I use a similar methodology for firm rankings. Ideally, I want to know how important each of the component ranks is in a firm's location decision. Due to limitations in the data, I proxy for this information by regressing the change in the number of firms in the city per 100,000 people, from 2000 to 2007, on the change in each of the four component ranks and regional dummy variables. I then normalize these coefficients so that they sum to one. The results, which are the β_k from equation 12, are presented in the table below.

Table 2.5: **Component weights for firms**

Component	β_k
Amenity Valuation	.392
job growth	.1072
business climate	.2383
education	.2625

2.3 CITY RANKING RESULTS

2.3.1 Best and Worst Cities

Table 2.6 lists the top ten cities for homeowners by level of education, using the city ranking value calculated in the previous section.

Table 2.6: **Top ten cities for homeowners**

	High School	Some	Bachelors	Graduate
1	Honolulu, HI	Washington DC-Northern VA	Washington DC-Northern VA	Washington DC-Northern VA
2	Washington DC-Northern VA	Honolulu, HI	Minneapolis-St. Paul, MN	Minneapolis-St. Paul, MN
3	Charlottesville, VA	Madison, MI	Madison, WI	Honolulu, HI
4	San Luis Obispo-Paso Robles, CA	Ann Arbor, WI	Ann Arbor, WI	San Luis Obispo-Paso Robles, CA
5	Gainesville, FL	Minneapolis-St. Paul, MN	Honolulu, HI	Manchester-Nashua, NH
6	Richmond-Petersburg, VA	San Luis Obispo-Paso Robles, CA	Manchester-Nashua, NH	Ann Arbor, WI
7	Madison, WI	Billings, MT	San Luis Obispo-Paso Robles, CA	Madison, WI
8	Billings, MT	Charlottesville, VA	San Francisco, CA	San Francisco, CA
9	Trenton-Ewing, NJ	Barnstable Town, MA	Barnstable Town, MA	San Diego, CA
10	Tallahassee, FL	Manchester-Nashua, NH	San Diego, CA	Barnstable Town, MA

There is some overlap in the top ten rankings for homeowners with different education levels. Though the order differs slightly, owners with a bachelors degree have four of the same cities ranked in the top ten as owners with a high school degree or less. However, this is only a snapshot of the 268 cities included in the owners' rankings. In Table 2.7, I list correlations among the rankings of owners of different education levels in order to get a clearer picture of the level of agreement between rankings.

Table 2.7: **City Ranking correlations for Homeowners**

	HS	Some	B	G
HS	1	.8748	.7497	.7495
Some		1	.9668	.9616
B			1	.994
G				1

From Table 2.7, I conclude that owners' rankings do not vary much by education. The biggest differences in the homeowners' rankings are between owners with a high school degree or less and homeowners with a graduate degree. It makes sense that less-educated

homeowners have different opinions of cities than more-educated homeowners. Less-educated homeowners are likely living in different areas of these cities which may be less attractive and have different characteristics than the areas of the cities that more-educated homeowners are living in. However, homeowners of all education levels have fairly similar views.

Table 2.8 lists the top ten cities for renters by level of education using the city ranking value calculated in the previous section.

Table 2.8: **Top ten cities for renters**

	High School	Some	Bachelors	Graduate
1	Lincoln, NE	Honolulu, HI	Honolulu, HI	San Luis Obispo-Paso Robles, CA
2	Madison, WI	Trenton-Ewing, NJ	Madison, WI	Madison, WI
3	Ann Arbor, WI	Albany-Schenectady, NY	Albany-Schenectady, NY	Trenton-Ewing, NJ
4	Champaign-Urbana, IL	Gainesville, FL	Barnstable Town, MA	Honolulu, HI
5	Provo-Orem, UT	San Luis Obispo-Paso Robles, CA	San Luis Obispo-Paso Robles, CA	Albany-Schenectady, NY
6	State College, PA	Punta Gorda, FL	Punta Gorda, FL	Santa Barbara-Santa Maria, CA
7	Appleton, WI	Barnstable Town, MA	Trenton-Ewing, NJ	San Diego, CA
8	Iowa City, IA	Syracuse, NY	Charlottesville, VA	Portland-Biddeford, ME
9	Sioux Falls, SD	Tallahassee, FL	Appleton, WI	Naples-Marcos Island, FL
10	Billings, MT	Naples-Marcos Island, FL	State College, PA	Ann Arbor, MI

Similar to homeowners' rankings, there is a significant amount of overlap in renters' rankings among different education levels. A cursory review of Table 2.8 reveals that renters with a bachelors degree have three of the same cities ranked in the top ten as renters with a high school degree or less. Since this is only a tiny portion of the overall number of cities, I once again look at correlations among the rankings for renters in Table 2.9.

Table 2.9: **City Ranking correlations for Renters**

	HS	Some	B	G
HS	1	.4009	.6068	.5463
Some		1	.8108	.6567
B			1	.8628
G				1

The correlations for renters are less than the correlations for homeowners. This means

that homeowners as a group are more alike than renters as a group. People who have made the decision and have the ability to buy a house have stability, reliable employment, and community roots in common, while the same cannot be said for renters.

Table 2.10 lists the top ten cities for homeowners and for renters. Homeowners and renters have two of the same cities ranked in the top ten, though not in the same order.

Table 2.10: **Top ten cities for owners and renters**

	Owners	Renters
1	Washington DC-Northern VA	Lincoln, NE
2	Honolulu, HI	Honolulu, HI
3	San Luis Obispo-Paso Robles, CA	Punta Gorda, FL
4	Barnstable Town, MAL	Madison, WI
5	Gainesville, FL	Bryan-College Station, TX
6	Charlottesville, VA	Charlottesville, VA
7	San Diego, CA	Albany-Schenectady, NY
8	Trenton-Ewing, NJ	Wausau, WI
9	Madison, WI	State College, PA
10	Manchester-Nashua, NH	Ann Arbor, MI

There are a number of patterns in Table 2.11, which presents the correlations among the rankings of different education levels for owners and renters. First, being a homeowner is more important than education level in a person's view of his or her city. For example, the rankings for homeowners with a bachelor's degree are less similar to the rankings for renters with a bachelor's degree than they are to homeowners with any other type of education. This same pattern holds for homeowners of other education levels except that owners with a graduate have more similar rankings to renters with a graduate degree than they do homeowners with a graduate degree and homeowners with a high school degree or less.

Table 2.11: **City Ranking correlations: Owners vs. Renters**

		Renters				
		HS	Some	B	G	Overall
Owners	HS	**.6181**	.6142	.8074	.8071	
	Some	.5877	**.4138**	.6838	.8166	
	B	.4426	.3056	**.5764**	.7651	
	G	.41	.2836	.5499	**.7516**	
	Overall					.5399

Second, the same cannot be said for renters. Rankings for renters with a high school degree or less are more like rankings for homeowners with a high school degree or less than rankings for renters with a high school degree or less are like rankings for renters with any other education level. For all other renters' groups, education is more important than being a renter in determining city rankings.

Third, the overall correlation between homeowners and renters rankings is about .52. The significant differences in their views appear to come from the different educational composition of homeowners and renters and the fact that they value different things in the city in which they live and work.

Table 2.12 lists the ten best and ten worst cities for workers overall according to the city ranking measure constructed in this paper.

Table 2.12: **Ten Best and Ten Worst Cities**

Best Cities	ranks	Worst cities	ranks
Honolulu, HI	1	Yakima, WA	268
Charlottesville, VA	2	Joplin, MO	267
San Luis Obispo-Paso Robles, CA	3	Jackson, TN	266
Madison, WI	4	Modesto, CA	265
Barnstable Town, MA	5	Rocky Mount, NC	264
Gainesville, FL	6	St. Joseph, MO	263
Trenton-Ewing, NJ	7	Hickory-Lenoir, NC	262
Ann Arbor, MI	8	Terre Haute, IN	261
Tallahassee, FL	9	Stockton, CA	260
Albany-Schenectady, NY	10	Youngstown-Warren, PA	259

2.3.2 City rankings and population

Another interesting thing that I can look at with these results is how people view big cities versus small cities. This comparison is difficult to analyze because there are two opposing effects of living in a big city. The extra entertainment possibilities and spillover effects from living so closely with other educated people make big cities attractive, while the dense populations, crime, pollution, and commute times make big cities unattractive.

Big cities, then, are an attractive place to live if the consumption possibilities and spillover effects are stronger, while big cities are unattractive if the negative effects of big cities are stronger.

To address this point, in Table 2.13 I list the ten largest cities in the United States and their rankings by owners and renters of each level of education.

Table 2.13: **Rankings for ten largest MSAs**

	Owners				Renters			
MSA	HS	Some	B	G	HS	Some	B	G
Los Angeles-Long Beach-Glendale, CA	145	122	90	84	262	251	223	75
New York-Northeastern NJ	206	147	100	101	267	262	181	136
Chicago-Naperville-Joliet, IL	258	162	88	78	247	268	265	193
Dallas-Fort Worth, TX	147	107	69	71	244	260	252	233
Houston-Sugar Land-Baytown, TX	179	152	110	121	248	258	248	217
Washington DC-Northern VA	2	1	1	1	19	156	44	57
Atlanta-Sandy Springs-Marietta, GA	77	32	23	18	124	217	188	161
Philadelphia, PA	152	87	57	54	190	196	105	107
Detroit-Livonia-Dearborn, MI	188	115	91	93	151	152	146	96
Riverside-San Bernadino-Ontario, CA	98	120	120	114	207	259	207	144

What is immediately clear from Table 2.13 is that the biggest cities in the U.S. are not ranked very highly by owners and renters of all education levels. Since this a small snapshot of the overall number of cities, I once again list correlations of city rankings with city populations in Table 2.14. A positive correlation means that a higher, or worse, city ranking is associated with a larger population. A negative correlation means that a lower, or better, city ranking is associated with a larger population.

Table 2.14: **Rankings and City Population Correlations**

Education Level	Owners	Renters
High School Grad or less	.0037	.2314
Some College	-.1978	.2758
Bachelor's Degree only	-.3193	.1721
Graduate Degree	-.3352	-.0243
Overall	-.2494	.3102

For homeowners, big cities are viewed in a more favorable light as education increases, while cities are viewed in a less favorable light for renters as education increases. Furthermore, homeowners have more favorable views of big cities than renters at each education level. The overall results in Table 2.14 are also interesting. Owners rankings have significant negative correlation with population while renters rankings have significant positive correlation with population. This means that cities with bigger populations are associated with better rankings for owners and worse rankings for renters.

The empirical answer to the question of the desirability of big cities is that it depends. In general, homeowners view big cities as good places to live while renters view big cities as bad places to live. Furthermore, workers with little education view big cities as bad places to live while more highly educated workers view big cities as good places to live.

2.3.3 Worker vs. Firm Rankings

Table 2.15 lists the top ten cities based on firm rankings as well as the relevant rankings for owners, renters, and workers overall. It is clear just from a cursory examination of these rankings that workers and firms vary widely on their views of cities.

Table 2.15: **Top Ten Cities for Firms**

MSA	firm	owners	renters	workers overall
Washington DC-Northern VA	1	1	53	11
Denver-Boulder, CO	2	55	191	78
Anchorage, AK	3	82	114	81
Minneapolis-St. Paul, MN	4	15	100	16
Olympia, WA	5	51	57	38
Seattle-Bellevue, WA	6	50	227	95
Iowa City, IA	7	79	29	54
Bremerton-Silverdale, WA	8	129	130	123
Colorado Springs, CO	9	85	214	106
Wilmington, DE	10	25	90	26

In order to get a fuller picture, Table 2.16 lists correlation of firm rankings with those

of homeowners and renters.

Table 2.16: **Firm and Worker Correlations**

Owners		Renters	
	Firms		Firms
HS	.4529	HS	.439
Some	.7069	Some	-.1405
B	.7383	B	.156
G	.7388	G	.4175
overall	.5857	overall	.14

Overall, there is a stronger correlation between homeowners' rankings and firm rankings than between renters' rankings and firm rankings. However, both of these correlations are significantly less than the correlations of rankings among different types of workers. This has the potential to be somewhat problematic since workers and firms may be locating in different cities and causing structural unemployment due to the mismatch of needs and abilities. Furthermore, homeowners views are more similar to firms' views as education increases. This means that highly educated homeowners are drawn to cities which are attractive to firms whereas the same thing cannot be said for less-educated homeowners or for renters of all education levels.

Table 2.17 lists the correlations of firm rankings with worker rankings and firm and worker correlations with population. Overall, the rankings for workers and the rankings for firms are fairly similar, though this correlation is significantly less than the correlation between homeowners and renters rankings. Furthermore, there is a fairly large, negative correlation between firm rankings and population. This means that firms view larger cities as attractive places to locate, while workers overall have less positive views of big cities. Therefore, it is likely that the benefits of a larger city significantly outweigh the costs of larger cities for firms, but not as much for workers.

In previous tables, correlations between firm rankings and worker rankings have been somewhat similar. In table 2.18, I list the cities in which firm rankings and worker rankings

Table 2.17: **Overall Correlations**

	workers overall	population
firm	.5226	-.2412
workers	-	-.1044

differ by the biggest margin. The first column lists the cities in which firm rankings are better than worker rankings and the third column lists cities in which worker rankings are better than firm rankings. The location of the cities in table 2.18 in which firms have a significantly more positive view are mostly in the middle of the country. The cities in table 2.18 in which workers have a more positive view are almost all located in Florida.

Table 2.18: **Biggest Disagreements betweens firms and workers**

Firms rank city higher	difference in ranks	workers rank city higher	difference in ranks
Nashville-Davidson, TN	142	Punta Gorda, FL	225
Tacoma, WA	142	Fort Myers-Cape Coral, FL	220
St. Cloud, MN	139	Naples-Marcos Island, FL	194
Pueblo, CO	133	West Palm Beach-Boca Raton, FL	193
Spokane, WA	128	Fort Lauderdale-Pompano Beach, FL	191
Springfield, MO	123	Melbourne-Titusville, FL	176
Boise City, ID	122	Gainesville, FL	171
Bloomington, IN	121	Deltona-Daytona Beach, FL	163
Charlotte-Gastonia, NC	116	Panama City, FL	161
Bremerton-Silverdale, WA	115	Abilene, TX	156

In Table 2.19, the ten cities in which firm rankings and worker rankings are the least different are listed. While this is informative about the level of agreement about a city between workers and firms, these rankings do not necessarily say anything about the quality of a city. For instance, the San Diego, CA metro area has firms and workers in nearly complete agreement about the relative ranking of the city and both groups agree the city belongs towards the top of the city rankings. In contrast, the Greenville, NC metro area also has firms and workers in very close agreement, but they both agree that the city belongs towards the bottom of cities in the data. Therefore, ranking cities by how closely firms and workers rank the cities is not a desirable methodology. Instead, agreement among rankings

can be used to supplement city rankings.

Table 2.19: **Biggest agreement betweens firms and workers**

Agreeable Cities	difference in ranks	workers rank	firm ranks
San Diego, CA	1	24	23
Lincoln, NE	1	32	31
New Orleans, LA	1	125	126
Greenville, NC	1	198	199
Kokomo, IN	2	165	167
Fresno, CA	2	228	230
Johnstown, PA	2	241	243
Fort Collins-Loveland, CA	3	19	16
Norfolk-VA Beach, VA	3	28	25
LaCrosse, WI	3	84	81

2.3.4 Changes over time

Since I use samples from two time periods in the dataset, I can look at how rankings for cities change from the year 2000 to the year 2007. Table 2.20 lists the correlations between the rankings for each of the listed categories for these years. Three things are immediately apparent. First, rankings are fairly stable over time, at least on average. Second, homeowners' rankings are more stable than renters' rankings. Third, firm rankings are more stable than worker rankings of cities.

Table 2.20: **correlations across time**

Education Level	Owners	Renters	Totals
High School Grad or less	.7016	.6935	
Some College	.8898	.8583	
Bachelor's Degree only	.9543	.8107	
Graduate Degree	.9557	.8193	
Overall	.8931	.6114	
Workers			.8236
Firms			.9622

In Table 2.21 I list the five cities that had the largest improvement in rank from 2000 to 2007 for homeowners, renters, and firms. An improvement in rank means that the city has a better ranking in 2007 than it did in 2000.

Table 2.21: **Largest improvement in ranking**

Owners	rank gain	Renters	rank gain	Firms	rank gain
Fort Pierce, FL	96	Fort Lauderdale, FL	173	Waterloo-Cedar Falls, IA	77
Lakeland, FL	89	Fort Pierce, FL	164	Jacksonville, FL	56
Las Vegas, NV	86	Allentown-Bethlehem, PA	156	Albuquerque, NM	55
Panama City, FL	84	Reading, PA	153	Las Vegas, NV	51
Miami, FL	80	Las Vegas, NV	146	Charlotte-Gastonia, NC	51

In the next three tables, the improvement in ranks from one period to the next is decomposed into the individual components. This shows how each component affected the city's ranking. In Table 2.22, I decompose the improvement in ranks for owners. For Fort Pierce, FL, a decline in income inequality in the city contributed .6 of the 96 places that the city rose in the rankings, an increase in job growth contributed about 82 places, an increase in amenity values contributed about 6 places, and a increase in educational achievement contributed about 7 places. Adding these all together, Fort Pierce, FL gained 96 places in the rankings from 2000 to 2007.

Table 2.22: **Decomposition of owners' ranks**

	inequality	job growth	education	amenity valuation	total
Fort Pierce, FL	.6	82.4	7	6	96
Lakeland, FL	-2.1	86.9	1.9	2.3	89
Las Vegas, NV	1.4	65.3	15.5	2.8	86
Panama City, FL	8.1	49.4	9.7	16.8	84
Miami, FL	-.1	75.8	.6	3.7	80
average	-3.8	21	1.3	7.6	26.2

It is clear from Table 2.22 that the improvement in ranks for cities among homeowners occurs mainly because of increases in job growth. The results stand in contrast to the effects of each of these components on net migration from Table 2.3 in which amenity valuation was found to be the most important component. This is likely due to job growth being signficantly more volatile than amenity valuations. Therefore, while people find amenities very important in deciding where to locate in a static setting, in a dynamic setting rankings are more likely to change due to changes in job growth.

As discussed above, renters' rankings are more volatile, so there are bigger swings in rank from one period to the next in Table 2.23. Similar to owners, the improvement in renters' rankings for the top 5 cities were mostly due to increases in job growth rates. Decreases in income inequality is the second most important component for three cities and increases in the value of amenities is the second most important component for the other two cities.

Table 2.23: **Decomposition of renters' ranks**

	inequality	job growth	education	amenity valuation	total
Fort Lauderdale, FL	1.7	167.1	-.5	4.7	173
Fort Pierce, FL	4.4	160.4	2.5	-3.2	164
Allentown-Bethlehem, PA	39.6	74.9	4.1	37.5	156
Reading, PA	59.1	77.9	1.4	14.6	153
Las Vegas, NV	9	121.7	5.3	10	146
average	10.7	38.7	.5	2.6	52.6

Table 2.24 lists the decomposition of the improvement in rankings for firms. The biggest factors in the improvement in rankings for firms is increases in the job growth rate, but improvements in the business climate in the city is not far behind.

Table 2.24: **Decomposition of firms' ranks**

	business climate	job growth	education	amenity valuation	total
Waterloo-Cedar Falls, IA	34.2	35.4	4.5	3	77
Jacksonville, FL	16.1	39.3	15.1	-14.4	56
Albuquerque, NM	27.2	-11.2	41.2	-2.2	55
Las Vegas, NV	-11.2	37.2	12.7	12.6	51
Charlotte-Gastonia, NC	5.2	33.6	13.1	-.9	51
average	3	11.7	2.2	.7	17.6

The next table lists the five cities for owners, renters, and firms that experienced the largest loss in ranking from 2000 to 2007. These are mostly different cities, but in a few instances, Racine, WI for homeowners and renters and Green Bay, WI for homeowners and firms, cities have fallen in the rankings for mutiple groups.

Just as I did with the cities that improved in the rankings, I decompose the losses in rankings for owners, renters, and firms. For homeowners, the loss in rankings are due

Table 2.25: **Largest loss in ranking**

Owners	loss in rank	Renters	loss in rank	Firms	loss in rank
Green Bay, WI	-108	Racine, WI	-152	Hattiesburg, MS	-56
Akron, OH	-92	Wichita, KS	-150	Green Bay, WI	-52
Chicago, IL	-88	Augusta, GA	-140	Biloxi, MS	-52
Muncie, IN	-84	Sumter, SC	-136	New Haven, CT	-47
Racine, WI	-81	Elkhart-Goshen, IN	-133	Columbia, SC	-45

mostly to decreases in job growth. However, a decrease in the value of amenities was the most important factor in the decrease in ranks for Chicago.

Table 2.26: **Decomposition of owners' ranks**

	inequality	job growth	education	amenity valuation	total
Green Bay, WI	5.9	-64.7	-16.6	-32.6	-108
Akron, OH	3.8	-55.5	-.6	-39.6	-92
Chicago, IL	-.5	-24.5	-9	-54	-88
Muncie, IN	.4	-59.5	2.9	-27.8	-84
Racine, WI	-1.2	-53.2	0	-26.5	-81
Average	-.5	-17.8	-1.5	-9.1	-29

Similar to homeowners, for renters decreases in job growth was the most important factor in the decrease in ranks for most of the cities as seen in Table 2.27. Sumter, SC fell in the rankings due to an increase in income inequality in the city.

Table 2.27: **Decomposition of renters' ranks**

	inequality	job growth	education	amenity valuation	total
Racine, WI	-8.3	-103.5	0	-40.3	-152
Wichita, KS	-43.5	-106.3	5.5	-5.7	-150
Augusta, GA	-36.2	-107	.7	2.5	-140
Sumter, SC	-84.1	-44.7	.3	-7.5	-136
Elkhart-Goshen, IN	-15.9	-97.1	.2	-20.2	-133
Average	-21.7	-27.7	1.3	-7.3	-55.4

Finally, Table 2.28 lists the decomposition of the decrease of firms' ranks of cities. Decreases in job growth was the most important factor for four cities, while a decrease in educational attainment is the most important factor for the fifth city.

Table 2.28: **Decomposition of firms' ranks**

	business climate	job growth	education	amenity valuation	total
Hattiesburg, MS	-7.4	-48.3	.6	-.9	-56
Green Bay, WI	-7.3	-30.6	-11.3	-2.8	-52
Biloxi, MS	-8.8	-31	-7.4	-4.8	-52
New Haven, CT	-5.7	-17.2	-24.2	0	-47
Columbia, SC	13.3	-30.9	-20.6	-6.8	-45
Average	0	-14.1	-2.6	.2	-16.5

2.3.5 Have bigger cities become better places to live over time?

In section 2.3.2, I answered the question whether big cities are good or bad places to live. Another interesting question is how the views of workers and firms have changed over time. Table 2.29 lists how much the correlations between rankings and population changed for workers and firms over time. A negative number means that positive views of big cities increased while a positive number means that negative views of big cities increased.

Table 2.29: **Change in Correlations with Population over Time**

Education Level	Owners	Renters	Totals
High School Grad or less	-.0825	-.0166	
Some College	.0141	.3956	
Bachelor's Degree only	.0087	.1511	
Graduate Degree	.0191	-.0649	
Overall	.0266	.0329	
Workers			.0393
Firms			-.028

Overall, bigger cities have become better places for firms over time and worse places for workers over time. There is a bit more variation when workers are broken down by education and ownership status. Both renters' and homeowners' views of big cities become less positive as education increases. Furthermore, overall both homeowners' and renter's views of big cities become less positive.

2.3.6 Are workers and firms moving closer together or farther apart?

In section 2.3.3, I examined how workers' rankings were related to firms' rankings. Another interesting question is how this relationship has changed over time. Table 2.30 lists the change in correlation among firm rankings and worker rankings over the two time periods. A negative number means that the city rankings of workers and firms are moving farther apart, while a positive number means that worker and firms views are moving closer together.

Table 2.30: **Change in Correlations with Firms over Time**

Education Level	Owners	Renters	Totals
High School Grad or less	-.0299	-.1218	
Some College	.0017	-.4208	
Bachelor's Degree only	.0265	-.3301	
Graduate Degree	.0938	.0454	
Overall	.0209	-.1917	
Workers			-.0444

Overall, the views of workers and firms have moved slightly further apart over the two time periods. In 2000, worker rankings and firm rankings had a correlation coefficient of .52 and in 2007 worker rankings and firm rankings had a correlation coefficient of .48. Renters rankings have diverged significantly from firm rankings over time, while homeowners rankings have moved closer towards firms rankings. Among homeowners, rankings for those with a high school degree or less move further apart from firms ranking while rankings for all more educated owners move closer towards firms rankings. For renters, rankings for all education levels, except for those with a graduate degree, diverged from firms rankings over time.

2.3.7 Comparisons to Previous Literature

As discussed in the introduction, I am not the first person to attempt city rankings based on amenity valuations. The three best previous studies are Albouy (2008), Chen (2008), and Winters (2012). Winters (2012) has separate rankings based on housing values

(h) and rent (r). Each of these studies bases rankings on amenity valuations alone. Sperling is the quality of life rankings created by the Sperling's bestplaces website. This ranking system tries to be comprehensive by including the economy, cost of living, climate, eduation, health, crime, transportation, leisure, arts and culture, and quality of life in their ranking scheme. This is exactly what my ranking system and the rankings of the other three studies have done, but using a different method.

Table 2.31 lists the correlations between my rankings and these studies as well as the correlations among these different studies. Three things are immediately apparent. First, my rankings are far different from the rankings in previous studies. Second, rankings from the previous studies are a lot alike. This is not surprising, since the authors of these previous studies used the same methodology, while I use a different one. Third, Sperling's rankings are more similar to my rankings than any of the other studies. This is important because Sperling attempts to factor in people's subjective view of cities through the use of personal experiences, how cities are perceived, and anecdotes from people who spent time in the cities. My ranking system, being the closest match to Sperling indicates that it more accurately reflects the way people actually feel about cities.

Table 2.31: **Correlations with previous studies**

	Glassman	Albouy	Chen	Winters (h)	Winters (r)	Sperling
Glassman	1	.5147	.1736	.2355	.2787	.4899
Albouy		1	.7733	.7276	.7255	.3810
Chen			1	.8031	.8476	.1936
Winters (h)				1	.8312	.1772
Winters (r)					1	.1927
Sperling						1

Being different from previous studies is well and good, but that does not necessarily mean that my results are better. There are two ways I can make this determination. The first is to use the argument I made in section 2.2.1 about the importance of including three additional components into the city rankings. From a theoretical perspective then, my

results are superior. The second is to see if the rankings pass the "smell test". In other words, examine some cities from each set of rankings to see if the city's ranking makes sense.

The major difference between my rankings and the rankings of previous studies centers around the rankings of cities in California, as can be seen in Table 2.32. In the second column, my rankings for the cities are listed as well as rankings when only amenity valuations are used.

These large differences in rankings come from the additional components. For instance, Salinas, CA is ranked very highly in my rankings when only amenity valuations are used. It drops in my rankings because of high income inequality and low job growth in the city. Yuba City, CA is another good example. My amenity valuation is not far off from previous studies but my overall ranking is because Yuba City has very low job growth and low educational attainment. In general, previous studies overrate California cities because the negative aspects of low or negative job growth, income inequality, and low educational attainment are ignored.

Table 2.32: **Rankings for California cities**

City	Glassman (amenity)	Albouy	Chen	Winters (r)	Winters (h)	Sperling
Salinas	203 (18)	3	4	54	5	138
Yuba City	230 (88)	87	47	-	-	255
Fresno	228 (72)	117	89	180	84	107
Visalia	248 (89)	147	106	186	82	185
Santa Barbara	55 (10)	2	5	14	3	4
Stockton	260 (219)	103	146	224	131	267
Redding	126 (45)	40	39	60	23	157
Chico	58 (35)	32	45	19	13	234
San Francisco	90 (30)	6	3	63	6	98
San Diego	24 (30)	7	11	23	10	67
Los Angeles	172 (110)	17	16	91	26	50

Table 2.33 lists some cities for which the rankings of previous studies seem to not pass the smell test. While cities like Philadelphia and St. Louis are not very highly ranked under my rankings, I contend that those cities do not belong in the lowest 10% of cities due to the

amenities these cities offer and the fact that they are both fairly reasonably-priced cities for the amenities that they offer. Similarly, Madison, WI and Raleigh-Durham, NC are ranked far lower than expected based on the amenities and educational level of those cities. The remaining 3 cities, Washington DC-Northern VA, Atlanta, and Minneapolis-St. Paul, are all among the top 50 ranked cities in my rankings and all are in the lower half of ranked cities for the Albouy, Chen, and Winters studies.

Table 2.33: **Rankings That Do Not Make Sense**

City	My results	Albouy	Chen	Winters (r)	Winters (h)	Sperling
Philadelphia	92	184	263	218	203	69
Washington DC-Northern VA	11	116	247	208	189	24
Atlanta, GA	49	175	230	213	274	7
Minneapolis-St. Paul, MN	16	143	244	198	195	22
Raleigh-Durham, NC	44	72	162	199	228	12
St. Louis, MO	137	170	240	273	275	88
Madison, WI	4	28	67	157	103	33

2.4 CONCLUSION

The information presented in this paper is important for city officials, workers, and firms. My rankings let city officials know where their city stands with homeowners and renters of different education levels as well as firms. This can be important for these officials in developing strategies to attract business and improve their housing and rental markets.

For workers, the rankings are important mainly due to the substantial disagreement between firm rankings and worker rankings. Unemployed people or workers who are unhappy in their current jobs can use this information to make better-informed decisions about where to live.

For firms, this information can help explain why they are unable to attract the types of workers they need. The difference in firm and worker rankings may inform them about where to locate a new office if they are thinking of expanding or moving.

Chapter 3

GENDER, MARITAL STATUS, CHILDREN, AND THE VALUATION OF CITY AMENITIES

3.1 INTRODUCTION

In chapter 1, I looked at whether male heads of households were fully compensated for higher city price levels and how these men valued city amenities. In this chapter, I make comparisons among four groups: single men, single women, married men, and married women. I determine whether each of these groups are fully compensated for higher city price levels and how each of these groups value amenities. I then look at how men compare to women, regardless of marital status, how married people compare to single people, regardless of gender, and how parents compare to non-parents.

I examine several issues. First, I look at how men head of households differ from women head of households. Second, I look at how single men head of households differ from single women head of households. While I imagine there was a significant difference between these two groups 30 to 50 years ago, today I expect that they will have similar results. Third, I look at how married men head of households differ from single men and how married women head of households differ from single women. Fourth, I look at how married people differ from single people regardless of sex. I expect these results for these groups to be different

because they are basing their location decisions on different criteria. Married people are likely going to be concerned with quality of schools and neighborhood safety while single people may be more concerned with entertainment possibilities that a city has to offer. Another interesting dichotomy is between people with children and people without children. Again, these two groups likely care about very different things.

Tarrant and Cordell (2002) examine amenity valuations of public and private forests and find that men and women differ on these valuations. The authors also look at how these valuations differ by race, age, and urban/rural status. Whisler et al. (2008) look at the effects of amenities on the decision to migrate. They find that these effects differ by marital status, age, the presence of children, and employment status. Schneider and Kubis (2009) find that men and women value the same characteristics of cities as amenities and disamenities, but some are valued more by men and some are valued more by women.

I have been unable to find any other papers dealing with the spatial equilibrium hypothesis or the valuation of amenities in which different determinations are made for people by gender, marital status, and the presence of children in the household.

3.2 DATA

Individual level data comes from two samples from the Integrated Public Use Microdata Series (IPUMS) [1]. These samples are the American Community Survey's 2005-2007 3-year sample and the 2000 5% sample. I use single men aged 25 to 54, single women aged 25 to 54, and married households in which both the husband and the wife are aged 25 to 54. All individuals are heads of household who who rent or own an apartment or a house. Furthermore, only people that lived and worked in an indentifiable MSA were kept in the sample.

The Amenity and MSA-specific characteristic data came from the 2002 and 2007 Cities

[1]Steven Ruggles, J. Trent Alexander, Katie Genadek, Ronald Goeken, Matthew B. Schroeder, and Matthew Sobek. Integrated Public Use Microdata Series: Version 5.0 [Machine-readable database]. Minneapolis: University of Minnesota, 2010.

Ranked and Rated Almanac, which contains data from 2000 to 2002 and from 2004 to 2007. The edited samples contain 268 MSAs with 2,151,999 households for 2000 and 1,339,252 households for 2005-2007. All monetary variables are measured in constant 2000 dollars.

Table 3.1 lists the number of observations for each group. Since each group is a head of household, there are far fewer married women heads of household than there are married men heads of household.

Table 3.1: **All Comparison groups: head of households**

	Owners			Renters		
group	men	women	overall	men	women	overall
Single	325,181	414,643	739,824	366,419	486,347	852,766
Married	1,239,533	281,756	1,521,289	289,662	87,710	377,372
Total	1,564,714	696,399	2,261,113	656,081	574,057	1,230,138
Parents			1,444,654			585,718
Non-parents			816,459			644,420

In Table 3.2, I list the aftertax earnings for each group. Single men earn more than single women at all levels of education, while married men and women earn nearly the same income on average. This is household income so average income for married people is greater than average income for single people. The table also shows that men make more than women and parents make more than people without children at all levels of education.

Table 3.2: **Aftertax Earnings for homeowners**

	High school or less	some college	bachelors	graduate
Single Men	$20,876.59	$26,938.69	$37,557.62	$47,505.45
Single Women	$15,964.97	$22,319.48	$30,626.48	$36,569.23
Married Men	$40,502.81	$51,335.62	$68,669.13	$81,747.81
Married Women	$40,154.77	$51,178.05	$68,306.72	$79,627.42
Men	$36,071.23	$46,078.89	$62,440.44	$76,048.00
Women	$25,046.73	$33,265.34	$47,578.46	$55,330.68
Single	$18,371.04	$24,229.65	$33,686.03	$40,802.15
Married	$40,449.08	$51,305.33	$68,594.56	$81,331.65
Parents	$35,505.74	$45,334.60	$64,215.01	$77,454.97
Non-parents	$27,987.29	$35,643.56	$47,822.18	$56,414.77

Table 3.3 below lists the average earnings for relevant groups of renters in order to give scale to the results. It is readily apparent that homeowners earn more, on average, than renters. However, the patterns amongst the groups are similar for homeowners and renters.

Table 3.3: **Aftertax Earnings for renters**

	High school or less	some college	bachelors	graduate
Single Men	$14,885.24	$19,724.22	$27,401.63	$32,742.27
Single Women	$10,305.78	$16,047.95	$22,589.16	$26,046.69
Married Men	$27,090.86	$36,454.16	$46,453.08	$52,293.99
Married Women	$25,855.64	$35,216.64	$46,880.06	$54,260.39
Men	$20,735.61	$26,750.63	$34,494.04	$41,811.94
Women	$12,726.90	$18,786.22	$26,345.95	$30,935.11
Single	$12,219.82	$17,521.24	$24,897.61	$29,281.72
Married	$26,821.43	$36,137.32	$46,560.13	$52,698.64
Parents	$18,291.52	$24,640.65	$36,229.98	$45,271.54
Non-parents	$15,201.53	$20,945.09	$28,841.97	$34,221.05

In Table 3.4, I list the annual price of housing for homeowners. To determine an annual cost of housing, I assume a capitalization rate of 7.35%. I multiply this capitalization rate by the price of the house and then add annual utility bills and property taxes to this amount. In general, single men pay more for a house than single women while married women pay more for a house than married men. Overall, men pay more for a house than women, married people pay more than single people, and parents pay more than people without children.

Table 3.4: **Annual House prices for homeowners**

	High school or less	some college	bachelors	graduate
Single Men	$12,398.76	$15,138.92	$19,927.97	$24,139.73
Single Women	$12,056.88	$14,541.74	$18,619.08	$21,041.32
Married Men	$15,171.29	$18,619.71	$25,273.68	$31,015.47
Married Women	$16,793.63	$20,396.67	$27,147.41	$30,461.27
Men	$14,545.26	$17,869.72	$24,203.44	$29,870.96
Women	$13,835.23	$16,762.48	$22,455.89	$25,145.81
Single	$12,224.36	$14,788.69	$19,196.85	$22,240.58
Married	$15,421.76	$18,961.34	$25,659.20	$30,906.70
Parents	$15,022.97	$18,366.62	$25,713.90	$31,097.51
Non-parents	$12,960.88	$15,967.61	$20,483.33	$23,917.88

In Table 3.5, I list the annual rent paid by renters. To calculate annual rent, I multiply monthly rent by 12 and then add annual utility bills. The patterns for rent are exactly the same as the patterns for homeowners.

Table 3.5: **Annual Rental prices for Renters**

	High school or less	some college	bachelors	graduate
Single Men	$7,113.00	$8,148.61	$9,914.12	$10,835.51
Single Women	$7,032.19	$8,189.53	$9,765.71	$10,598.36
Married Men	$8,424.50	$9,736.33	$11,669.01	$12,615.70
Married Women	$8,566.43	$9,737.96	$11,574.10	$12,851.53
Men	$7,741.62	$8,815.43	$10,567.42	$11,661.30
Women	$7,271.07	$8,410.73	$10,045.39	$10,988.75
Single	$7,065.97	$8,173.13	$9,836.90	$10,712.94
Married	$8,455.46	$9,736.75	$11,645.21	$12,664.23
Parents	$7,937.30	$9,067.67	$11,117.04	$12,432.58
Non-parents	$6,921.11	$8,179.11	$10,040.68	$10,971.08

3.3 METHODOLOGY

The methodology I use is separate 2SLS systems for each group. For example, one system has single men's wages and housing prices as the dependant variables and the other system has single women's wages and housing prices as the dependent variables. I follow the same methodology as Chapter 1 to determine if all groups are fully compensated for a higher city price levels as well as who is compensated more. I also use the methodology in Chapter 1 to determine implicit prices of amenities for all groups.

3.4 RESULTS

The first results I discuss are whether the different groups of people in my data are fully compensated, in terms of higher wages when given a set of city amenities, for higher housing prices in a city. To be fully compensated for higher overall city price levels, a 10% increase in the price level must be associated with a 10% increase in wages. However, since I assume that people are fully compensated for higher non-housing goods prices in my estimation, a 10% increase in housing prices must be associated with a 3.1% increase in wages for owners and a 3.4% increase in wages for renters. This is due to homeowners' spending about 69% of their income on non-housing goods and renters spending about 66% of their income on non-housing goods according to the 2000 and 2007 Consumer Expenditure Survey.

3.4.1 Men vs. Women

The first dichotomy is between men and women. Table 3.6 lists the results of separate 2SLS regressions for men and women heads of household who are homeowners and renters of different education levels.

Table 3.6: **men vs. women**

	Owners		Renters	
Education Level	men	women	men	women
High School Grad or less	.2689	.3058	.3731	.4659[a]
	(.0243)	(.0279)	(.0399)	(.0477)
Some College	.3062	.3172	.4529[a]	.4787[a]
	(.0251)	(.0258)	(.0314)	(.029)
Bachelor's Degree only	.3504	.3512	.6192[a]	.5136[a]
	(.05)	(.0543)	(.0278)	(.0384)
Graduate Degree	.3232	.3148	.7144[a]	.6323[a]
	(.0849)	(.0878)	(.0339)	(.051)
Overall	.3111	.3381	.5118	.506
	(.0346)	(.0355)	(.0296)	(.0257)

Notes: [a]Significantly different from the housing budget share (.31 for owners and .34 for renters) at the 1% level; [b] at 5%; [c] at 10%

For homeowners, men and women of each education level are fully compensated for higher housing prices in a city. Furthermore, the results show that less-educated women are slightly better off than less-educated men, while the opposite is true for highly educated

men and women. When I do not separate by education level, women are slightly better off than men. However, none of these differences are statistically significant.

For renters, men and women of each education level are all more than fully compensated for higher housing prices, except for men with a high school degree or less, who are exactly fully compensated for higher housing prices. This is somewhat intuitive in that renters are significantly more mobile than homeowners are and can move from city to city easier as amenities improve or housing prices increase. Similar to homeowners, less-educated women are better off than less-educated men, while the reverse is true for more-educated men and women. Overall, however, men are slightly better off than women.

The results for men are in direct contrast to my results in Chapter 1. This is due to the use of different samples. In Chapter 1, my sample included all men between the ages of 25 and 54 while the sample in this chapter consists of single men between the ages of 25 and 54 and married men whose age and whose wife's age is between 25 and 54.

The results for highly-educated men and women are not surprising, but the fact that less-educated women fare better than less-educated men is a bit of a surprise. However, except for the difference between men and women renters with a bachelor's degree, the differences in compensation for men and women are not statistically significant. Therefore, I conclude that men and women overall fare about the same. This is likely a result of only looking at heads of households since there is something different about women who are heads of the household which makes them more similar to men than women in general.

3.4.2 Single Men vs. Single Women

While informative, table 3.6 from section 3.4.1 is too general. In this section and the next section I break up men and women by marital status. In Table 3.7, I examine the differences between single men head of households and single women head of households. All single homeowners and renters are fully compensated for higher housing prices. This is intuitive because one can assume that a single person is choosing where to locate based on

the amenities, housing price, and wage he or she makes without having to take into account the wages or preferences of a a spouse.

Table 3.7: **Single men vs. single women**

	Owners		Renters	
Education Level	men	women	men	women
High School Grad or less	.3057	.3104	.3673	.4218^{c}
	(.0316)	(.0313)	(.0374)	(.047)
Some College	.3933^{c}	.2725	.49^{a}	.4195^{a}
	(.0352)	(.028)	(.0313)	(.0301)
Bachelor's Degree only	.4863^{b}	.3393	.7464^{a}	.4648^{a}
	(.0868)	(.0511)	(.0373)	(.0439)
Graduate Degree	.6841^{b}	.3334	.9214^{a}	.6113^{a}
	(.1747)	(.1085)	(.0634)	(.0583)
Overall	.4021^{c}	.3107	.5782^{a}	.4497^{a}
	(.0498)	(.0358)	(.0316)	(.0268)

Notes: ^{a}Significantly different from the housing budget share (.31 for owners and .34 for renters) at the 1% level; ^{b} at 5%; ^{c} at 10%

Among single homeowners, men and women with a high school degree or less fare about the same. For more-educated homeowners, men are more than fully compensated for higher housing prices while women are just fully compensated for higher housing prices. This is also the case for single homeowners overall. For single renters with a high school degree or less, women are more than fully compensated for higher housing prices, while men are just fully compensated for higher housing prices. All more-educated renters are more than fully compensated for higher housing prices, but men are better compensated than women are. This is also the case for single renters overall. Therefore, less-educated single women fare as well as or better than less-educated men, while more-educated women fare worse than more-educated men.

The differences between men and women are much greater when only looking only at single people. In general, single men fare better than single women. The only exception is for renters with a high school degree or less for which women fare better than men. Furthermore, unlike for men and women overall, these differences are statistically significant and the results conform with my initial expectations. Therefore, the surprising results for

men and women overall must be due to married people.

3.4.3 Married Men vs. Married Women

In this section, I examine the differences between married men head of households and married women head of households. Unlike single men and women, married men and women homeowners with a high school degree or less are not fully compensated for higher housing prices in a city. This is likely due to single people having greater flexibility and independence in their location decisions.

Table 3.8: **married men vs. married women**

	Owners		Renters	
Education Level	men	women	men	women
High School Grad or less	.2392[a]	.229[a]	.287	.3122
	(.0239)	(.0298)	(.0576)	(.0753)
Some College	.2785	.2781	.3207	.4041
	(.0247)	(.0246)	(.0365)	(.0474)
Bachelor's Degree only	.3119	.3077	.4019[c]	.394
	(.0458)	(.0578)	(.0279)	(.0622)
Graduate Degree	.2461	.2752	.5008[a]	.529[a]
	(.0834)	(.06)	(.0413)	(.0723)
Overall	.2792	.3018	.3561	.4112
	(.0278)	(.0298)	(.0336)	(.0434)

Notes: [a]Significantly different from the housing budget share (.31 for owners and .34 for renters) at the 1% level; [b] at 5%; [c] at 10%

More-educated homeowners, of both genders, are each fully compensated for higher price levels in a city. This is likely due to the more-educated operating on a national job market while the less-educated operate on a local job market. Unlike single men and women, the outcomes for married men and women homeowners are quite similar to one another in magnitude. Overall, married women fare slightly better than married men in more expensive cities, though these differences are not statistically significant.

For renters, while married men and women of all education levels are fully compensated for higher housing prices, both men and women are compensated more favorably as education increases. For the most part, married women renters are slightly better off than married male renters at each education level, though these differences are not statistically significant.

In contrast to single people, married female renters fare better than married male renters, while more-educated married female homeowners fare better than more-educated married male homeowners and, overall, married female owners fare better than married male owners. However, these differences are not statistically significant. This is likely partially due to married women who are considered heads of household being a different group than married women overall. For instance, labor force participation is 78% for married women heads of household and 71% for married women overall in my sample. If instead I looked at married people overall regardless of head of household status, my results would likely skew more favorably towards men.

3.4.4 Married vs. Single

In the previous sections, I delved into the differences between men and women. In this section, I look at how married people differ from single people. As previously mentioned, I expect different outcomes since married people have to account for a spouse's wages and preferences while single people do not. I look at the difference between single men and married men, single women and married women, and the overall difference between single people and married people.

Men

To analyze how single men differ from married men, I use the results already presented in Table 3.7 and Table 3.8. For homeowners and renters, single men fare significantly better than married men in cities with higher housing prices for all levels of education. Furthermore, the difference in compensation increases as education increases for both homeowners and renters. These differences are all statistically significant.

Single men have a few things working in there favor that married men do not. First, single men only have to worry about their own preferences when deciding where to accept a job and choosing where to live, while married men have to also worry about their wife's preferences. Second, single men can accept the highest wage offer in the city with the best

amenities that they receive. Married men have to take into account the wage offer that their wives receive. This means that a married men may somtimes be accepting his second or third choice for a job and location, while a single man is always able to accept his first choice.

The fact that the difference in compensation between single men and married men increase with education is intuitive. The more educated a person is, the more likely they are operating on at least a regional if not national job market. Educated single men are able to move wherever the best opportunity is, while educated married men have a joint search problem. This effects less-educated men less because the best opportunities for them are often located within the same city.

Women

While the direction of the difference in compensation results between single and married men is also true for women, the magnitude of the difference in compensation for single women and married women is much less than the difference for men. However, the differences in compensation for women are not statistically significant. In fact, when I do not separate by education, single women and married women homeowners are compensated about the same for higher housing prices and single women renters are compensated slightly more than married women renters, while single men homeowners and renters are compensated significantly more than married men homeowners and renters, respectively.

These results suggest that married women, when they are considered the head of household, are less likely than married men to take the preferences or the wage offers of their spouses into account when making location decisions. The traditional view of the man moving his family wherever his best opportunity arises, seems to no longer hold true. Men, in contrast to stereotypes and popular lore, are the more flexible and accomodating gender, which results in marriage negatively affecting the utility of men, but not women.

Overall

In this section, I look at how single people differ from married people, regardless of gender. The results for homeowners and renters of different education levels are presented in Table 3.9.

Table 3.9: **married vs. single**

	Owners		Renters	
Education Level	married	single	married	single
High School Grad or less	.2418[a]	.3023	.3143	.3861
	(.0237)	(.028)	(.0537)	(.0335)
Some College	.2793	.3227	.346	.4358[a]
	(.0234)	(.0282)	(.0323)	(.0265)
Bachelor's Degree only	.3131	.4036	.4143[a]	.6151[a]
	(.046)	(.0639)	(.0263)	(.0343)
Graduate Degree	.246	.4612	.5044[a]	.7773[a]
	(.072)	(.116)	(.0415)	(.0582)
Overall	.2863	.3497	.3794	.4997[a]
	(.0299)	(.043)	(.0286)	(.0281)

Notes: [a]Significantly different from the housing budget share (.31 for owners and .34 for renters) at the 1% level; [b] at 5%; [c] at 10%

Single homeowners and renters fare better in cities with higher housing prices than married homeowners and renters, respectively. The difference in compensation is low and not statistically significant for the less-educated and increases and become statistically significant with education for both homeowners and renters. Furthermore, when I do not separate by education, single homeowners are slightly better off than married homeowners and single renters are signiificantly better off than married renters.

From the previous sections, I know that these differences are largely due to men. I conclude that single people are able to take advantage of better amenities and wage opportunities than married people are because of the flexibility and independence that single people have. In other words, sinlge people need not worry about a spouse's job opportunities or preferences when considering a move to a new city. Like anything else, this is a tradeoff.

3.4.5 Parents vs. People without children

In this section, I compare people who have children under 18 living at home with people who do not have children under 18 living at home, regardless of their gender or marital status. For both homeowners and renters, parents do not fare as well as non-parents in cities with higher housing prices. The difference in compensation increases as education increases, though these differences are larger among renters than among homeowners. The differences in results are statistically significant for homeowners with a graduate degree and for renters with at least some college education.

Table 3.10: **Parents vs. Non-parents**

	Owners		Renters	
Education Level	Parents	Non-parents	Parents	Non-parents
High School Grad or less	.2405[a]	.3116	.3551	.4225[b]
	(.0243)	(.0245)	(.042)	(.0352)
Some College	.2776	.3278	.3655	.4964[a]
	(.0219)	(.0301)	(.0371)	(.0295)
Bachelor's Degree only	.2997	.3986	.3553	.6418[a]
	(.0437)	(.06)	(.0271)	(.0344)
Graduate Degree	.2339	.3972	.5164[a]	.7486[a]
	(.0767)	(.0919)	(.0433)	(.0517)
Overall	.2759	.3513	.3708	.5651[a]
	(.0279)	(.0413)	(.0223)	(.0353)

Notes: [a]Significantly different from the housing budget share (.31 for owners and .34 for renters) at the 1% level; [b] at 5%; [c] at 10%

Similar to the married vs. single dichotomy, parents have to think about the well-being and preferences of their children while non-parents do not. Job offers that require a move to a new school district and away from family and friends are significantly easier for non-parents then they are for parents. Once again, the more people affected by the moving decision, the less flexibiltiy the person has which means he or she is more likely to settle in a place with amenities and wages that are second best.

When breaking down workers into the different categories, I find that the vast majority of workers are fully compensated for higher housing prices. The only exceptions are married men and women homeowners with a high school degree or less, married homeowners with

a high school degree or less, and parent homeowners with a high school degree or less. In the next section, I calculate implicit prices of amenities for all groups. These implicit prices rely on the fact that workers are fully compensated for higher housing prices. Therefore, I list the implicit prices for all groups, including the exceptions mentioned above, but the prices for these workers may be biased.

3.4.6 Implicit prices

In the second set of results in the paper, I look at how all these groups differ on their valuations of amenities. Since there are so many different groups and implicit prices, I break this section down by each amenity. In the implicit price of amenities tables listed below, the prices are all for a one standard deviation change in each of the amenity variables. This is done in order to make comparisons across amenities. A positive dollar amount means that people are willing to pay money, in terms of higher housing prices and lower earnings, to enjoy a higher value of the amenity, while a negative dollar amount means that people are willing to pay money to enjoy a lower value of the amenity. Standard errors should be calculated for each of these prices similar to Chapter 1, but I have been unable to do this due to time constraints.

Entertainment

The overall percentages listed in the tables are the percentage of total spending on all amenities that is constituted by spending on the individual amenity in the table. This allows for more accurate relative comparisons across groups due to the different groups having different characteristics, earnings, prices for housing, and preferences.

In Table 3.11, implicit prices and overall percentages are listed for entertainment in a city. These two types of results do not always move in the same direction. For example, single men renters are willing to pay more than single women renters at each education level for better entertainment, while the overall percentage is higher for single women than for single men. This is likely due to single men earning more and paying more for housing than single women, which means single men are able to pay more than single women for each amenity regardless of strength of preferences. The overall percentage value takes this into account and shows which group values entertainment the most.

For homeowners, single men value entertainment highest followed by single women, married men, and finally married women. For renters, single women value entertainment

the highest followed by single men, married women, and finally married men. Regardless of gender, single people value entertainment more than married people. At most education levels, married people are willing to pay more for entertainment, but this is less of a signal of preferences than it is a signal of a secondary income and need for more housing space. I also find that women and men value entertainment similarly and people without children value entertainment more than parents do.

Table 3.11: **Implict prices of Entertainment**

Owners						
	Single		Married			
	Men	Women	Men	Women		
HS or less	$\$1,778.00^a$	$\$1,263.51^a$	$\$1,411.43^a$	$\$2,174.65^a$		
Some College	$\$3,075.82^a$	$\$2,206.48^a$	$\$3,420.12^a$	$\$3,636.57^a$		
Bachelors	$\$4,988.59^a$	$\$3,556.71^a$	$\$5,142.26^a$	$\$5,418.28^a$		
Graduate	$\$7,872.77^a$	$\$3,764.11^a$	$\$4,878.33^a$	$\$5,286.33^a$		
Overall	24.15%	21.14%	19.47%	17.81%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	$\$1,587.65^a$	$\$1,621.86^a$	$\$1,436.58^a$	$\$1,553.33^a$	$\$1,176.22^a$	$\$1,723.23^a$
Some College	$\$3,386.44^a$	$\$2,869.95^a$	$\$2,536.16^a$	$\$3,435.08^a$	$\$2,999.66^a$	$\$3,259.35^a$
Bachelors	$\$5,218.57^a$	$\$4,460.28^a$	$\$4,137.95^a$	$\$5,205.52^a$	$\$4,876.89^a$	$\$4,777.04^a$
Graduate	$\$5,872.13^a$	$\$4,534.20^a$	$\$5,051.11^a$	$\$5,196.37^a$	$\$4,766.26^a$	$\$5,622.91^a$
Overall	21.04%	20.47%	22.21%	19.34%	19.13%	22.53%
Renters						
	Single		Married			
	Men	Women	Men	Women		
HS or less	$\$638.17^a$	$\$473.21^a$	$\$591.16^c$	$\$694.27^c$		
Some college	$\$1,662.55^a$	$\$792.73^a$	$\$1,391.94^a$	$\$1,949.52^a$		
Bachelors	$\$2,289.14^a$	$\$1,573.76^a$	$\$1,994.46^a$	$\$2,203.72^a$		
Graduate	$\$3,575.06^a$	$\$2,214.20^a$	$\$2,275.14^a$	$\$2,088.27^b$		
Overall	20.76%	21.04%	14.45%	16.73%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	$\$755.34^a$	$\$580.09^a$	$\$521.94^a$	$\$714.34^a$	$\$605.82^a$	$\$627.00^a$
Some college	$\$1,549.26^a$	$\$1,003.89^a$	$\$963.75^a$	$\$1,569.55^a$	$\$900.56^a$	$\$1,391.59^a$
Bachelors	$\$2,305.18^a$	$\$1,841.40^a$	$\$1,921.48^a$	$\$2,152.62^a$	$\$1,525.84^a$	$\$2,198.26^a$
Graduate	$\$3,185.25^a$	$\$2,401.40^a$	$\$2,863.12^a$	$\$2,204.46^a$	$\$2,267.38^a$	$\$2,992.93^a$
Overall	18.71%	21.58%	20.47%	15.41%	17.30%	20.19%

Notes: ^{a}Significant at the 1% level; ^{b} at 5%; ^{c} at 10%

The results for entertainment are intuitive for the most part. Single people and people

without children are more likely to take advantage of the restaurants, bars, cultural activities, and outdoors activities that a city has to offer, while married people and parents are more likely to stay home with their spouse and children. It is the far more important for single people without children to locate in cities with good entertainment possibilities than it is for married couples or for parents.

The results for single men and single women reinforce the idea that men and women heads of household are not different from one another. Once again, the results would likely look different if I looked at men versus women, regardles of head of household status.

Education spending per pupil

In Table 3.12, I present the results for education spending per pupil by the city in hundreds of dollars. For homeowvers, married women value education spending the most followed by married men, single women, and finally by single men. For renters, married men value education spending the most followed by married women, single men, and single women. Furthermore, renters value education spending significantly more than homeowners do. This is likely due to education spending being a function of property taxes, which are explicitly paid by homeowners and only implicitly paid by renters through higher rent. Women homeowners value education spending more than men, while men renters value education spending more than women. Furthermore, married people value education spending more than single people, and parents more than people without children.

The results for education spending are intuitive for the most part. Married people are more likely to either have children or are to be thinking about having children than single people so it makes sense that married people value education spending more. Parents valuing education spending more is also expected.

The one result that stands out is the difference between homeowners and renters in how men and women value education. There are two things likely going on here. One is that homeowners choose locations for different reasons that renters do. Homeowners look for a

place to settle down while renters move to where jobs are. A second is the unique nature of only looking at people who are heads of households. For instance, 69% of men in the sample are married while only 29% of women are married. This is due to restricting to heads of households, which are less likely to be women in married households. The result for renters may be based simply on more men than women being married and thinking about children.

Table 3.12: **Implict prices of Education Spending**

Owners						
	Single		Married			
	Men	Women	Men	Women		
HS or less	$\$2,587.61^a$	$\$2,141.97^a$	$\$3,331.14^a$	$\$4,565.51^a$		
Some college	$\$2,642.09^a$	$\$1,887.57^a$	$\$3,359.18^a$	$\$4,553.37^a$		
Bachelors	$\$3,541.04^a$	$\$2,240.69^a$	$\$4,233.31^a$	$\$6,967.16^a$		
Graduate	\$1,760.08	\$1,897.11	$\$4,139.68^b$	$\$5.554.27^a$		
Overall	14.35%	15.93%	19.75%	23.33%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	$\$3,204.93^a$	$\$3,082.31^a$	$\$2,348.46^a$	$\$3,556.50^a$	$\$3,382.27^a$	$\$2,782.06^a$
Some college	$\$3,103.29^a$	$\$2,971.33^a$	$\$2,175.22^a$	$\$3,553.95^a$	$\$3,159.31^a$	$\$2,543.05^a$
Bachelors	$\$4,164.74^a$	$\$4,193.99^a$	$\$2,780.85^a$	$\$4,779.04^a$	$\$4,189.80^a$	$\$3,840.83^a$
Graduate	$\$4,285.93^a$	$\$3,390.22^c$	\$2,008.06	$\$4,756.80^a$	$\$4,335.61^a$	\$2,888.43
Overall	19.33%	20.70%	15.72%	20.92%	20.86%	17.65%
Renters						
	Single		Married			
	Men	Women	Men	Women		
HS or less	$\$1,285.30^a$	$\$712.63^a$	$\$1,903.78^a$	$\$2,641.81^a$		
Some college	$\$1,600.70^a$	$\$877.18^a$	$\$2,102.76^a$	$\$2,018.87^b$		
Bachelors	$\$3,232.27^s$	$\$1,579.23^a$	$\$4,146.58^a$	\$1,792.05		
Graduate	$\$3,702.73^a$	$\$1,983.95^a$	$\$4,561.36^a$	$\$4,863.56^a$		
Overall	24.97%	21.46%	29.38%	27.29%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	$\$1,569.74^a$	$\$945.33^a$	$\$929.74^a$	$\$2,129.73^a$	$\$1,283.24^a$	$\$1,127.80^a$
Some college	$\$1,815.40^a$	$\$1,077.18^a$	$\$1,101.39^a$	$\$2,111.66^a$	$\$1,104.73^a$	$\$1,469.71^a$
Bachelors	$\$3,635.87^a$	$\$1,784.62^a$	$\$2,343.53^a$	$\$3,660.86^a$	$\$1,741.89^a$	$\$3,047.19^a$
Graduate	$\$4,266.63^a$	$\$2,474.48^a$	$\$2,863.58^a$	$\$4,523.40^a$	$\$3,923.48^a$	$\$3,206.18^a$
Overall	27.09%	23.26%	23.63%	28.82%	26.30%	24.79%

Notes: ^{a}Significant at the 1% level; ^{b} at 5%; ^{c} at 10%

Commute time

In Table 3.13, I present the results for average commute time to work in the city. For homeowners, married men value a shorter commute time the most followed by single women, single men, and married women. Furthermore, married people value a shorter commute time more than single people, regardless of gender. It makes sense that a married person may want to live closer to work in order to have more quality time at home with his or her spouse, whereas amenities such as entertainment possibilities may dominate for single people.

Table 3.13: **Implict prices of Commute time**

Owners						
	Single		Married			
	Men	Women	Men	Women		
HS or less	-$696.52^a	-$610.42^a	-$1,472.71^a	-$834.54^a		
Some college	-$1,159.12^a	-$1,123.05^a	-$1,825.63^a	-$1,513.69^a		
Bachelors	-$1,857.84^a	-$1,873.94^a	-$2,656.22^a	-$2,143.34^a		
Graduate	-$2,295.83^a	-$1,629.75^a	-$3,214.86^a	-$2,125.19^a		
Overall	8.19%	10.26%	12.02%	7.13%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	-$1,661.32^a	-$453.58^a	-$691.65^a	-$1,372.1^a	-$1,002.69^a	-$690.80^a
Some college	-$1,612.59^a	-$1,022.98^a	-$1,194.23^a	-$1,788.89^a	-$1,580.67^a	-$1,240.06^a
Bachelors	-$2,425.63^a	-$1,716.09^a	-$1,947.40^a	-$2,622.24^a	-$2,565.75^a	-$1,919.92^a
Graduate	-$3,398.92^a	-$1,655.66^a	-$1,911.62^a	-$3,478.68^a	-$3,381.43^a	-$2,176.31^a
Overall	11.92%	7.36%	9.70%	11.64%	11.81%	8.83%
Renters						
	Single		Married			
	Men	Women	Men	Women		
HS or less	-$219.97^a	-$197.88^a	-$306.74^a	-$194.19^c		
Some college	-$574.79^a	-$535.10^a	-$915.81^a	-$367.77^a		
Bachelors	-$931.54^a	-$801.33^a	-$1,427.96^a	-$674.88^a		
Graduate	-$1,081.18^a	-$896.95^a	-$1,113.06^a	-$311.51		
Overall	7.14%	10.12%	8.70%	3.73%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	-$164.29^a	-$69.81^b	-$246.77^a	-$225.70^a	-$132.52^a	-$124.68^a
Some college	-$598.73^a	-$400.77^a	-$586.82^a	-$765.40^a	-$583.35^a	-$471.51^a
Bachelors	-$979.46^a	-$611.06^a	-$880.77^a	-$1,181.51^a	-$854.38^a	-$879.40^a
Graduate	-$911.64^a	-$606.77^a	-$1005.01^a	-$872.01^a	-$588.32^a	-$1,010.47^a
Overall	6.37%	6.25%	8.88%	7.06%	7.05%	6.96%

Notes: ^{a}Significant at the 1% level; ^{b} at 5%; ^{c} at 10%

For renters, single women value a shorter commute time the most, followed by married men, single men, and married women. Furthermore, single people value a shorter commute time more than married people. In this case, differences in migration motivations for homeowners and renters may be leading to this result. While homeowners may be settling down for good, renters may be more likely to be moving for a particular job and are just less likely in general to be concerned about commute time. This can be seen in homeowners having higher willingness to pay for shorter commute time than renters for all groups.

I also find that men value a shorter commute time more than women and parents value a shorter commute time more than people without children. The results for parents is intuitive as one would expect parents to want to be a short distance from home in order to spend more time with their children. The result for men does not necessarily have an intuitive explanation, but it is a reflection of preferences. Men would pay more money than women would in order to avoid sitting in traffic or riding public transportation for an extended period of time.

Crime

In Table 3.14, I list the implict prices of crimes per 100,000 people. This is a total crime figure which includes violent crime and property crime. To some degree or another, all my results suffer from using metropolitan statistical areas due to how heterogeneous they are. Crime, however, suffers the most from this problem. Most cities have very nice areas, very bad areas, and marginal areas in-between. This crime variable really attempts to get at the size of these marginal areas in a city. However, many people, especially the more well-to-do, have less of a preference for lower crime rates not because they are indifferent to crime, but because they live, work, and socialize only in the nicer areas of a city. This is an important caveat to keep in mind while analyzing the results in Table 3.14.

For homeowners, married men value lower crime rates the most followed by single men, single women, and married women. For renters, single men value lower crime rates the

most followed by single women, married men, and married women. For both homeowners and renters, men value lower crime rates more than women, married people value lower crime rates more than single people, and parents value lower crime rates more than people without children.

Table 3.14: **Implict prices of crime**

Owners						
	Single		Married			
	Men	Women	Men	Women		
HS or less	-$597.48^c	-$654.31^a	-$922.17^a	-$731.21^c		
Some college	-$770.30^a	-$726.33^a	-$1,202.17^a	-$987.50^b		
Bachelors	-$999.61^c	-$571.12	-$1,363.77^a	-$1,330.25^b		
Graduate	-$1,975.89^c	-$892.15	-$1,796.92^a	-$1,416.21^c		
Overall	5.92%	5.57%	6.93%	4.81%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	-$824.06^a	-$698.8^a	-$636.08^a	-$902.94^a	-$832.82^a	-$648.81^a
Some college	-$1,089.69^a	-$838.73^b	-$758.61^a	-$1,164.02^a	-$1,090.64^a	-$837.15^a
Bachelors	-$1,275.06^a	-$772.11	-$712.81^c	-$1,378.52^b	-$1,280.81^b	-$875.73^c
Graduate	-$1,981.07^a	-$1109.81^c	-$1,250.04^c	-$1,876.05^b	-$1,791.39^a	-$1,406.45^c
Overall	6.77%	5.19%	5.67%	6.69%	6.92%	5.52%
Renters						
	Single		Married			
	Men	Women	Men	Women		
HS or less	-$49.59	-$119.87	-$231.54	-$56.88		
Some college	-$298.91^b	-$179.19^c	-$254.87	-$356.41		
Bachelors	-$306.04	-$259.32	-$82.08	-$584.97		
Graduate	-$1,199.74^a	-$385.29	-$716.76	-$22.63		
Overall	4.71%	3.93%	2.97%	2.35%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	-$109.62	-$119.62	-$97.45	-$154.47	-$156.79	-$56.88
Some college	-$310.86^c	-$206.63	-$227.78^b	-$271.32	-$226.70	-$294.77^b
Bachelors	-$219.26	-$306.93	-$289.20	-$215.66	-$338.04	-$283.53
Graduate	-$991.26^b	-$357.58	-$708.85^b	-$604.35	-$626.09	-$736.48^c
Overall	3.91%	3.67%	4.32%	2.89%	4.40%	3.84%

Notes: ^{a}Significant at the 1% level; ^{b} at 5%; ^{c} at 10%

The only expected or intuitive result for crime is the results for parents. Parents want to make sure that their children are playing and going to school in safe neighborhoods. The results for all other groups are a bit unexpected.

There are a few explanations for what may be driving these results. First, there is the fact that an MSA is so heterogeneous that these results may not have an interpretation. Due to limitations of the data and the fact that my methodology only holds if people live and work in the same area, I am unable to reduce the scope of my project to smaller, more homogenous areas. Second, while I might expect single people, especially single women, to value lower crime rates highly, married people value lower crime rates more because they may be choosing to live in a location for different reasons. Single people may be moving to an area for a job or for better entertainment possiblities while married people may be settling down and looking for areas conducive to raising children.

Third, single women not valuing lower crime rates highly may be due to single women not living in the marginal areas of any city. It may not be worth it for a single woman to pay more for a house or except lower earnings in a city with a lower crime rate because she will choose to live in the safest area where crime is low in any city she lives in. This same aversion and avoidance of crime may not hold for single men or married people.

Air & Water Quality

In Table 3.15, I present the implict prices of air and water quality. Air and water quality is an index from 0 to 200 of the quality of air and water in an MSA. For homeowners, single men value air and water quality the most followed by single women, married men, and married women. Furthermore, single people value air and water quality more than married people, regardless of gender.

For renters, single women value air and water quality the most followed by single men, married men, and married women. Furthermore, married people value air and water quality more than single people, regardless of gender. For both homeowners and renters, women value air and water quality more than men, and people without children value air and water quality more than parents.

Table 3.15: **Implict prices of Air & Water Quality**

Owners						
	Single		Married			
	Men	Women	Men	Women		
HS or less	$318.63^c	$277.62^c	$461.96^c	$399.20^c		
Some college	$743.30^b	$396.66^c	$723.73^b	$653.14^c		
Bachelors	$1,249.36^a	$862.11^a	$1,159.50^b	$1,364.62^a		
Graduate	$1,618.89^a	$1,110.14^a	$1,093.26^a	$1,320.00^a		
Overall	5.36%	5.19%	4.51%	4.03%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	$428.24^c	$332.66^c	$297.75^c	$446.89^c	$417.43^c	$286.07
Some college	$734.05^b	$506.95^c	$522.84^b	$715.52^c	$647.62^b	$593.89^b
Bachelors	$1,217.45^b	$1,123.22^a	$1,014.71^a	$1,190.71^a	$1,144.92^b	$1,157.25^a
Graduate	$1,264.29^b	$1,328.74^a	$1,293.78^a	$1,165.28^b	$1,136.99^b	$1,355.22^a
Overall	4.77%	5.00%	5.28%	4.42%	4.63%	4.97%
Renters						
	Single		Married			
	Men	Women	Men	Women		
HS or less	$58.16	$15.61	-$17.55	-$218.85		
Some college	$202.07	$70.61	-$50.36	$58.58		
Bachelors	$470.25	$375.01^b	$294.64	$219.33		
Graduate	$579.53	$480.13^b	$471.29^c	$465.06		
Overall	3.33%	3.92%	1.61%	1.26%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	$43.71	-$22.52	$30.60	-$75.73	-$30.74	$40.49
Some college	$130.44	$78.67	$121.84	-$6.77	$11.89	$195.31
Bachelors	$456.05	$403.60^a	$426.49^c	$280.19	$131.79	$524.41^b
Graduate	$533.41	$520.13^b	$524.89^c	$468.75^c	$375.68	$591.69^c
Overall	2.79%	3.63%	3.60%	1.55%	1.60%	3.79%

Notes: [a]Significant at the 1% level; [b] at 5%; [c] at 10%

The finding that women value air and water quality more than men is expected. However, this valuation does differ by education, as less-educated men value air and water quality more than women and more-educated women value air and water quality more than men. Similarly, previous evidence on environmental concern by gender is somewhat mixed. Studies have found that women express greater concern for the environment than men do, though the magnitude of this difference is small. Men, on the other hand, are more involved

in environmental activism (Mohai 1992, Stern et al 1993, and McStay and Dunlap 1983).

Sales Tax

Table 3.16: **Implict prices of sales tax**

Owners						
	Single		Married			
	Men	Women	Men	Women		
HS or less	-$300.98	-$81.44	-$216.05	-$79.50		
Some college	-$632.64	-$460.13^c	-$860.43^c	-$777.12		
Bachelors	-$891.14	-$913.44^b	-$1,257.33^c	-$1,377.36^c		
Graduate	-$1,532.27	-$961.18	-$862.71	-$1,653.10^b		
Overall	4.58%	4.73%	4.19%	4.19%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	-$272.61	-$115.52	-$176.80	-$197.87	-$49.86	-$123.21
Some college	-$848.63^c	-$636.59^c	-$525.82^c	-$856.35^c	-$696.95^c	-$853.56^b
Bachelors	-$1,201.90^c	-$1,2053.43^c	-$915.58^c	-$1,260.75^c	-$1,214.27^c	-$1,121.60^c
Graduate	-$1,1088.90	-$1,338.77^c	-$1155.25	-$1,187.15	-$990.58	-$1,362.49^c
Overall	4.47%	5.00%	4.68%	4.40%	4.19%	5.35%
Renters						
	Single		Married			
	Men	Women	Men	Women		
HS or less	-$177.38	-$20.53	$120.48	$83.58		
Some college	-$328.15^c	-$204.43	-$405.57	-$462.38		
Bachelors	-$620.98	-$380.77	-$539.25	-$686.42		
Graduate	-$676.17	-$669.06^b	-$494.74	-$929.07		
Overall	4.58%	5.31%	3.05%	4.81%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	-$84.60	-$49.86	-$72.74	-$109.27	$51.19	-$150.15
Some college	-$414.23^c	-$257.30^c	-$241.62^c	-$416.69	-$220.50	-$384.06^b
Bachelors	-$633.91^c	-$468.95^c	-$468.59^c	-$569.53^b	-$194.46	-$657.58^c
Graduate	-$576.68	-$830.35^b	-$684.20^b	-$631.60	-$578.57	-$708.62^b
Overall	4.10%	5.95%	4.85%	3.50%	3.08%	5.32%

In Table 3.16, the implict prices of the sales tax percentage in a city are listed. Unlike other amenities, the pattern of results are the same for homeowners and for renters. Single women value a lower sales tax rate the most followed by married men, single men, and married women. Women value a lower sales tax rate than men, single people more than married people, and people without children more than parents.

These results are likely largely due to the regressive nature of a sales tax. Women, single people and people without children earn less than men, married people, and parents, respectively. It follows than that each of these former groups also value a lower sales tax more than the latter groups. This pattern is probably also due to the former groups spending a larger percentage of their earnings on consumption goods than the latter groups. This means that a higher sales tax will have a disproportionate impact on the former groups.

While there is significant agreement among types of homeowners and renters, homeowners are willing to pay significantly more than renters to live in cities with lower sales tax rates. This may be due to homeowners buying expensive goods, like appliances, which renters, in large part, do not purchase.

Snow

In Table 3.17, the implicit prices of snowfall in a city are listed. In general, homeowners value less snowfall more than renters. There are even groups of renters willing to pay to live in cities with more snowfall. This is likely due to homeowners having to shovel sidewalks and driveways and renters being able to avoid shoveling. For homeowners, married women value less snowfall the most followed by single women, single men, and married men. For renters, single women value less snowfall the most followed by single men, married men, and married women.

For both homeowners and renters, women value less snowfall more than men, regardless of marital status, and people without children value less snowfall more than parents. The stronger preference for less snow for women may be due to women having a stronger aversion to shoveling and driving in snow than men do. People without children may value less snowfall more than parents because they do not have children to shovel the snow and they do not have children to enjoy playing in the snow. For renters, married people value less snowfall more than single people while married and single homeowners value less snowfall

similarly.

Table 3.17: **Implict prices of snow**

Owners						
	Single		Married			
	Men	Women	Men	Women		
HS or less	-$767.70^a	-$688.85^a	-$917.57^c	-$1,712.83^a		
Some college	-$1,089.38^b	-$1,034.50^a	-$1,417.42^a	-$2,276.62^a		
Bachelors	-$2,241.25^b	-$1,596.63^a	-$2,044.75^b	-$3,778.28^a		
Graduate	-$2,807.68^c	-$1,533.41	-$2,271.40^a	-$3,551.87^a		
Overall	9.41%	9.51%	8.72%	12.20%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	-$870.04^c	-$1,043.48^a	-$728.43^b	-$1,045.27^a	-$901.43^b	-$738.04^c
Some college	-$1,283.05^a	-$1,503.43^a	-$1,048.15^a	-$1,581.58^a	-$1,337.58^a	-$1,302.72^a
Bachelors	-$2,095.77^a	-$2,426.80^a	-$1,865.42^a	-$2,418.88^b	-$2,168.79^a	-$2,240.61^a
Graduate	-$2,542.51^c	-$2,212.40^c	-$1,977.05^c	-$2,542.61^c	-$2,276.67^c	-$2,306.85^c
Overall	8.90%	10.91%	9.48%	9.54%	9.28%	9.65%
Renters						
	Single		Married			
	Men	Women	Men	Women		
HS or less	-$163.47	$87.88	-$190.29	$231.64		
Some college	-$276.87	-$197.81	-$370.23	$170.90		
Bachelors	-$846.09^c	-$702.78^a	-$503.39	-$219.99		
Graduate	-$861.63	-$640.88	-$1,071.25^c	-$950.16		
Overall	5.46%	6.05%	4.93%	1.85%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	-$181.92	$154.25	-$0.22	-$86.02	$81.55	-$89.89
Some college	-$271.78	-$142.33	-$212.43	-$222.16	-$40.51	-$321.11
Bachelors	-$752.56	-$708.17^b	-$781.09^b	-$483.40	$160.11	-$1,038.49^a
Graduate	-$921.80^c	-$732.44	-$798.17	-$1,122.38^c	-$736.72	-$949.53
Overall	5.11%	5.29%	5.85%	4.44%	1.75%	6.72%

Rain

In table 3.18, the implicit prices of inches of rain in a city are listed. For homeowners, married men value less rain the most followed by married women, single men, and single women. For renters, married men value less rain the most followed by married women, single women, and single men. For both homeowners and renters, married people value less

rain more than single people, men value less rain more than women, and parents value less rain more than people without children. It makes sense that parents place a higher value than people without children on less rain since children are stuck inside with their parents when it rains. For married people and men, their is not an intuitive explanation, but the results do signify who has stronger preferences for nice weather.

Table 3.18: **Implict prices of rain**

Owners						
	Single		Married			
	Men	Women	Men	Women		
HS or less	-\$851.47^a	-\$495.38^b	-\$1,103.05^a	-\$1,331.04^a		
Some college	-\$1,036.89^a	-\$720.77^a	-\$1,423.99^a	-\$1,726.40^a		
Bachelors	-\$1,535.55^a	-\$839.36^b	-\$2,071.45^a	-\$1,958.17^a		
Graduate	-\$1,645.59^b	-\$1,071.50^c	-\$1,016.42^a	-\$1,737.18^a		
Overall	6.91%	6.13%	8.01%	7.28%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	-\$1,054.35^a	-\$829.71^a	-\$647.57^a	-\$1,152.21^a	-\$957.94^a	-\$409.84^a
Some college	-\$1,305.35^a	-\$1,153.93^a	-\$832.20^a	-\$1,485.15^a	-\$1,252.03^a	-\$1,083.52^a
Bachelors	-\$1,935.91^a	-\$1,345.06^a	-\$1,093.08^a	-\$2,050.45^a	-\$1,759.9^{a}8	-\$1,481.23^a
Graduate	-\$1,647.96^b	-\$1,465.98^b	-\$1,299.58^b	-\$1,699.12^b	-\$1,327.25^c	-\$1,727.86^a
Overall	7.78%	3.20%	6.54%	8.03%	7.33%	6.89%
Renters						
	Single		Married			
	Men	Women	Men	Women		
HS or less	-\$255.18^c	-\$200.19^a	-\$409.49^c	-\$311.39		
Some college	-\$273.96^c	-\$264.20^a	-\$668.66^b	-\$876.69^a		
Bachelors	-\$127.50	\$24.59	-\$1,155.24^a	-\$584.52^c		
Graduate	\$73.80	-\$64.24	-\$1,016.42^a	-\$663.70		
Overall	1.48%	2.18%	7.51%	5.88%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	-\$346.05^b	-\$231.30^b	-\$231.24^b	-\$408.35^c	-\$310.04^a	-\$118.40^b
Some college	-\$471.70^b	-\$368.26^a	-\$256.20^b	-\$737.25^a	-\$491.24^a	-\$307.58^c
Bachelors	-\$505.23^c	-\$69.20	-\$43.29	-\$1,026.00^a	-\$190.41^c	-\$206.11
Graduate	-\$404.01	-\$169.35	-\$6.82	-\$1,009.79^b	-\$899.70^a	-\$42.87
Overall	4.14%	3.10%	1.75%	7.38%	6.18%	1.89%

Sunny Days

In Table 3.19, I list the implict prices of sunny days in a city. Even after taking the amount of snow and rain in a city into account, the number of sunny days in a city is still important.

Table 3.19: **Implict prices of sunny days**

Owners						
	Single		Married			
	Men	Women	Men	Women		
HS or less	$\$1,362.01^a$	$\$903.63^a$	$\$1,379.46^a$	$\$1,669.89^a$		
Some college	\$799.34	\$464.90	\$860.48	\$963.73		
Bachelors	\$1,387.68	$\$1,121.65^b$	\$965.63	\$1,437.15		
Graduate	\$2,071.14	\$1,308.77	\$998.20	\$1,702.80		
Overall	8.07%	8.03%	5.81%	6.51%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	$\$1,421.01^a$	$\$1,263.54^a$	$\$1,129.00^a$	$\$1,418.93^a$	$\$1,301.57^a$	$\$1,559.76^a$
Some college	$\$1,099.92^b$	$\$762.27^c$	\$1,087.46	\$1,225.69	\$1,039.59	$\$1,131.17^c$
Bachelors	\$1,149.89	$\$1,399.34^c$	$\$1,259.60^c$	\$1,059.46	\$1,054.94	$\$1,451.68^c$
Graduate	\$1,310.73	\$1,728.34	\$1,549.58	\$1,226.58	\$1,392.82	\$1,498.08
Overall	6.53%	8.17%	8.20%	6.02%	6.63%	8.26%
Renters						
	Single		Married			
	Men	Women	Men	Women		
HS or less	$\$580.30^a$	$\$221.82^c$	$\$576.46^b$	\$535.60		
Some college	$\$740.83^a$	$\$451.14^a$	\$574.42	\$320.32		
Bachelors	$\$1,751.62^a$	$\$867.93^a$	$\$1,018.20^b$	\$714.60		
Graduate	$\$2,208.61^a$	$\$1,401.46^a$	$\$1,424.50^a$	$\$2,133.70^a$		
Overall	13.43%	12.25%	8.30%	8.93%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	$\$620.50^a$	$\$326.09^b$	$\$368.47^a$	$\$584.09^b$	$\$364.06^b$	$\$599.19^a$
Some college	$\$689.73^b$	$\$459.81^b$	$\$557.24^a$	\$501.91	\$294.81	$\$786.32^a$
Bachelors	$\$1,551.94^a$	$\$958.79^a$	$\$1,280.73^a$	$\$989.29^b$	$\$724.65^b$	$\$1,456.20^a$
Graduate	$\$1,924.99^a$	$\$1,190.49^a$	$\$1,778.56^a$	$\$1,469.78^b$	$\$1,578.80^a$	$\$1,830.23^a$
Overall	11.49%	10.87%	13.01%	8.22%	9.67%	13.08%

However, there are significant differences between homeowners and renters. First, renters of all groups have a higher willingness to pay for more sunny days than homeowners do. Pleasant weather is a much bigger factor in the location decisions of people who are not

settling down, while it is of lesser importance to those making the life-changing decision to buy a home. Second, women homeowners value sunny days more than men, while men renters value sunny days more than women. This makes sense as their is no intuitive reason why men would value sunny days more than women or vice versa.

For both homeowners and renters, single people value more sunny days more than married people and people without children value more sunny days more than parents. This may be related to the idea that single people and people without children are the people going out and enjoying themselves on the weekend while married people and parents are staying home.

Average temperature in January

In Table 3.20, I list the implicit prices for warmer winter weather. Unlike other amenities, there are a lot of groups, when broken down by education, who are indifferent to winter temperatures. By indifferent, I mean that the price of snow is not statistically significiant. Or at the very least, these groups of people are not willing to pay extra money for warmer winter temperatures when they have already paid for less snow and more sunny days. Another explanation is that there are goups of people who dislike cold weather and all that comes with it, while there are other groups who like cold weather because it allows them to enjoy certain activities (i.e., skiing, ice-fishing, etc.). These different preferences cancel each other out when looking at average implicit prices.

Warmer winter weather is valued significantly more highly by renters than by homeowners. Temperature seems to play a very small role in the migration decisions of homeowners, after sunny days, rain, and snow are taken into account. For both homeowners and renters, men value warmer winter weather more than women, married people value warmer winter weather more than single people, and parents value warmer winter weather more than people without children. Parents may value warmer winter weather because it allows children to be out of the hosue more. As for married people and men placing higher values on

warmer weather, it can be thought of as these groups simply having stronger preferences.

Table 3.20: **Implict prices of winter weather**

Owners						
	Single		Married			
	Men	Women	Men	Women		
HS or less	\$122.29	\$308.99	\$720.41	\$176.66		
Some college	\$266.89	-\$75.58	\$21.85	-\$98.16		
Bachelors	-\$532.17	-\$152.46	-\$219.42	-\$632.24		
Graduate	-\$906.40	\$226.81	\$183.06	\$86.60		
Overall	1.43%	0.60%	0.93%	0.50%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	\$508.11	\$299.19	\$248.12	\$614.44	\$583.92	\$416.77
Some college	\$41.34	-\$118.31	\$88.32	-\$22.39	\$92.16	-\$127.00
Bachelors	-\$282.72	-\$286.54	-\$292.21	-\$300.46	-\$260.30	-\$398.53
Graduate	\$93.38	\$377.43	-\$98.08	\$297.40	\$211.44	\$112.44
Overall	0.47%	0.41%	0.09%	0.74%	0.87%	0.01%
Renters						
	Single		Married			
	Men	Women	Men	Women		
HS or less	\$426.84^a	\$404.51^b	\$1,037.78^a	\$406.98		
Some college	\$679.37^a	\$341.65^c	\$704.61	\$1,174.61^b		
Bachelors	\$495.08	\$54.57	\$1,404.00^c	\$1,259.62		
Graduate	\$580.42	\$109.28	\$881.03	\$956.36		
Overall	5.55%	3.79%	9.31%	9.16%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	\$625.42^a	\$463.85^b	\$445.92^a	\$897.60^a	\$689.51^a	\$476.56^a
Some college	\$767.79^b	\$471.82^c	\$472.08^b	\$836.23^c	\$658.87^a	\$586.16^c
Bachelors	\$750.77	\$212.03	\$265.73	\$1,362.28^b	\$1,122.52^a	\$265.27
Graduate	\$859.68	\$214.94	\$303.26	\$859.45	\$1083.68	\$289.98
Overall	7.21%	5.05%	4.85%	9.18%	11.61%	4.53%

Inland water

In Table 3.21, the implicit prices for inland water are listed. These prices show how much people are willing to pay for more miles of lakes and rivers in the city they live and work in. For both homeowners and renters, women value inland water more than men, married people more than single people, and parents more than people without children. While the patterns are similar, renters are willing to pay more than homeowners for more

inland water. In other words, lakes and rivers are more important in the location decisions of renters than they are for homeowners.

Table 3.21: **Implict prices of inland water**

Owners						
	Single		Married			
	Men	Women	Men	Women		
HS or less	\$453.38	\$472.11	\$721.78	$\$1,026.71^{b}$		
Some college	\$690.25	$\$509.64^{c}$	$\$1,005.91^{c}$	$\$1,141.12^{b}$		
Bachelors	\$729.64	\$826.10	\$1,225.07	\$1,693.70		
Graduate	$\$2,293.38^{b}$	$\$1,202.42^{c}$	\$1,469.91	$\$2,201.02^{b}$		
Overall	5.68%	5.90%	5.80%	6.54%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	\$669.97	$\$676.45^{c}$	\$464.61	$\$776.89^{c}$	$\$752.39^{c}$	\$801.45
Some college	$\$946.36^{c}$	$\$779.13^{b}$	$\$569.80^{c}$	\$1,030.65	$\$995.23^{b}$	\$608.49
Bachelors	\$1,089.29	$\$1,234.93^{c}$	\$799.78	$\$1,324.98^{b}$	\$1,404.52	\$754.70
Graduate	$\$1,690.38^{b}$	$\$1,736.32^{a}$	$\$1,535.48^{a}$	$\$1,769.30^{c}$	$\$1,842.65^{a}$	$\$1,442.60^{b}$
Overall	5.76%	6.72%	5.69%	6.16%	6.91%	5.28%
Renters						
	Single		Married			
	Men	Women	Men	Women		
HS or less	$\$332.88^{a}$	$\$261.37^{a}$	$\$474.78^{c}$	\$195.85		
Some college	$\$298.87^{c}$	$\$278.42^{c}$	$\$703.67^{b}$	$\$614.62^{c}$		
Bachelors	$\$822.96^{b}$	$\$537.35^{b}$	\$895.65	$\$1,209.37^{a}$		
Graduate	$\$1,141.76^{b}$	$\$624.06^{a}$	\$575.19	$\$2,331.48^{a}$		
Overall	6.60%	7.08%	6.12%	10.49%		
	Gender		Status		children?	
	Men	Women	Single	Married	yes	no
HS or less	$\$418.09^{b}$	$\$292.68^{b}$	$\$285.20^{a}$	$\$425.56^{c}$	$\$334.75^{b}$	$\$332.49^{a}$
Some college	$\$453.74^{c}$	$\$337.67^{a}$	$\$271.16^{b}$	$\$671.04^{b}$	$\$383.71^{b}$	$\$363.33^{b}$
Bachelors	$\$798.19^{c}$	$\$663.65^{b}$	$\$671.09^{b}$	$\$1,324.98^{c}$	$\$643.97^{c}$	$\$801.52^{c}$
Graduate	\$890.36	$\$845.73^{b}$	$\$849.14^{a}$	\$861.21	$\$1,127.22^{c}$	$\$825.22^{a}$
Overall	6.14%	7.92%	6.78%	6.86%	8.13%	6.50%

Patterns

In Table 3.22, I list the five most valued amenities for homeowners based on the percentage of overall amenity spending people are willing to spend on each of the amenities. While single men and single women value entertainment more than education spending, married men and married women value education spending more than entertainment.

Table 3.22: **Most valued amenities for homeowners**

	1st	2nd	3rd	4th	5th
Single Men	Entertainment	Education	Snowfall	Commute time	Sunny Days
Single Women	Entertainment	Education	Commute time	Snowfall	Sunny Days
Married Men	Education	Entertainment	Commute time	Snowfall	Rainfall
Marrried Women	Education	Entertainment	Snowfall	Rainfall	Commute time
Men	Entertainment	Education	Commute time	Snowfall	Rainfall
Women	Education	Entertainment	Snowfall	Sunny days	Commute time
Single	Entertainment	Education	Commute time	Snowfall	Sunny Days
Married	Education	Entertainment	Commute time	Snowfall	Rainfall
Parents	Education	Entertainment	Commute time	Snowfall	Rainfall
Non-parents	Entertainment	Education	Snowfall	Commute time	Sunny Days

Men and women, regardless of marital status differ as well. In deciding where to live and work, men find entertainment to be the most important while women find education more important the entertainment. Men and women also disagree about the importance of commute time, snowfall, rainfall, and sunny days.

Single and married people are more similar, though they disagree on the ordering of entertainment and education spending. Intuitively, single people value entertainment more than education spending, while the reverse is true for married people. The exact same patter holds true for parents and people without children.

In Table 3.23, I list the most valued amenities for renters. First of all, it is clear from the tables that renters have significantly different priorities than homeowners. Renters are more likely than homeowners to value education as the most important amenity and renters value commute time as the 4th most valued amenity while homeowners value commute time as the 3rd most valued amenity. Also, there is a lot more variation in the 3rd through 5th position for renters than there is for homeowners.

Men and women, regardless of marital status are similar except that men value higher winter temperatures in the top five and women value a lower sales tax. This is likely due to men having a stronger preference for warmer weather and women being more likely to shop.

Table 3.23: **Most valued amenities for renters**

	1st	2nd	3rd	4th	5th
Single Men	Education	Entertainment	Sunny days	Commute time	Inland water
Single Women	Education	Entertainment	Sunny days	Commute time	Snowfall
Married Men	Education	Entertainment	Winter temps	Commute time	Sunny Days
Marrried Women	Education	Entertainment	Inland water	Winter temps	Sunny days
Men	Education	Entertainment	Sunny days	Winter temps	Commute time
Women	Education	Entertainment	Sunny days	Commute time	Sales tax
Single	Education	Entertainment	Sunny days	Commute time	Snowfall
Married	Education	Entertainment	Winter temps	Sunny days	Rainfall
Parents	Education	Entertainment	Winter temps	Sunny days	Commute time
Non-parents	Education	Entertainment	Sunny days	Commute time	Snowfall

Unlike for homeowners, all groups of renters value education spending over entertainment. This may be due to renters not having to explicitly pay for education spending through property taxes. Therefore, single people in anticipation of having children, may move into cities with higher education spending per pupil.

3.5 CONCLUSION

There are two main purposes of this paper. The first is to determine if men and women, single people and married people, and parents and people without children are fully compensated, in terms of higher wages, for higher city housing prices, given a set of city amenities. I find that for the most part workers of all types are fully compensated for higher housing prices. The only exceptions are less-educated married people and people with children who own their homes.

One of the main results coming out of this paper is that single people fare better than married people and people without children fare better than parents. This result is due to married people and people with children having to take other people into account when deciding on where to live and work, while single people can choose the job and location that is best for them.

The second purpose is to calculate implicit prices of amenities for several different groups. In general, entertainment activities and education spending per pupil are the most important amenities for all groups. Single men are willing to pay more than single women for better entertainment and more education spending, while single women are willing to pay more than single men for better air and water quality. Conversely, married women are willing to pay more than married men for better entertainment and more education spending, while married men are willing to pay more than married women for less crime and a shorter commute time.

Regardless of marital status, men are willing to pay more than women and married people are willing to pay more than single people for nearly all the control and fixed amenities. Parents are willing to pay more than people without kids for more education spending and a shorter commute time, while people without kids are willing to pay more than parents for better entertainment.

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Appendix A

STANDARD ERRORS

Table A.1: **Standard Errors for Implicit Amenity prices for Owners**

Fixed Amenities (units)	HS Grad or less	Some College	bachelor's Degree	Graduate Degree
Avg temp in January (degrees)	51.89	70.14	107.33	145.98
Avg temp in July (degrees)	137.59	143.84	220.33	255.01
Inches of snow (inches)	21.13	26.52	29.41	53.53
Inches of precipitation (inches)	25.4	27.9	57.08	53.46
Sunny Days (days)	17.66	20.68	31.54	42.44
Inland water (miles)	122.11	174.57	247	377.22
Coastal City (dummy)	791.32	1193.16	1324.76	2189.72
Sales Tax (%)	189.19	273.72	471.19	590.57
Spending per pupil (100s of $)	44.97	77.2	77.82	106.68
Air & Water Quality (0-200 index)	8.53	10.36	12.08	17.56
Crime (in hundreds)	26.2	37.4	45.21	92.22
Commute time (minutes)	5.48	5.77	6.69	12.01
Entertainment (18-180 index)	13.58	13.94	23.28	32.27

Notes: [a]Significant at the 1% level; [b] at 5%; [c] at 10%; standard errors are in the appendix

Table A.2: **Standard Errors for Implicit Amenity prices for Renters**

Fixed Amenities (units)	HS Grad or less	Some College	bachelor's Degree	Graduate Degree
Avg temp in January (degrees)	27.44	48.73	66.15	89.46
Avg temp in July (degrees)	65.9	102.2	80.58	132.94
Inches of snow (inches)	14.73	22.81	32.85	47.1
Inches of precipitation (inches)	13.57	26.25	35.89	32.9
Sunny Days (days)	10.63	14.67	16.32	29.68
Inland water (miles)	82.46	107.11	172.99	215.16
Coastal City (dummy)	602.67	809.7	872.95	1175.1
Sales Tax (%)	120.91	165.1	223.31	367
Spending per pupil (100s of $)	39.01	50.86	63.04	91
Air & Water Quality (0-200 index)	4.57	5.75	10.43	13.05
Crime (in hundreds)	14.73	23.58	30.67	64.09
Commute time (minutes)	9.03	8.8	15	26.09
Entertainment (18-180 index)	11.11	12.03	15.12	28.69

Notes: ^{a}Significant at the 1% level; ^{b} at 5%; ^{c} at 10%; standard errors are in the appendix