What Drives Growth of Jobs and the Arts? A Chicken and Egg Approach

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Abstract

In the classical economic view, jobs attract workers to a city, and as a result, the city grows, as complementary amenities, such as restaurants, shops, and entertainment also flourish. Thus, in the traditional view, jobs are the main factor for city growth. In this study, we consider that the arts also attract workers to a city, and thus following the development of non-arts related industries in the region due to the availability of labor. Therefore, do cities grow primarily due to the jobs created by the industries, or do cities also grow due to the presence of arts amenities and entertainment that are seen as essential to the workers before they choose where to live? In this research, we use the Country Business Patterns (CBP) data from the American census to analyze the relationship between the growth of the arts as related to other industries. We use cross-lagged regressions on sixteen years of data in more than 15.000 zip codes in the US, and geographical weighted regressions on the analysis. Results point that the arts are important drivers to the growth of cities.

1 Introduction

When deciding where to live, we not only consider the next job, but also, if the location provides with the desired amenities for a full and satisfying life. Besides working, safety, and basic services, individuals also need opportunities to dedicate to their social networks, leisure, hobbies, interests, and their own well-being. Individuals may search for places according to the availability of jobs *and* lifestyles (rather than either) that based on their taste, personality, and stage in life, would allow them to feel accomplished and fulfilled. At the same time that individuals choices unfold, city governments and private initiatives are also making efforts to promote amenities, arts and entertainment in the cities, which will then be combined into their pleasant locations and aesthetics qualities to be enjoyed ~~by its population, making cities compete to attract more people (Clark, 2011;~~ Storper, 2013) [6, 22]. As many studies suggest (Clark, 1983, 2011) [5, 6], the arts bring aesthetic life to the city, making the cities more attractive to its inhabitants, investors, and businesses.

Therefore, a cycle follows: amenities help revitalize neighborhoods, attracting new inhabitants, creating favorable environment for businesses that can hire new employees, which then attract even more inhabitants to work in these businesses, resulting in even more arts and amenities, and therefore more businesses, more people, more amenities, and so on. This is the cycle that here we refer to as the *chicken and egg problem*: what drives urban growth? Jobs or city amenities? Do jobs attract amenities to the city, or do amenities attract companies (and their jobs) to the city? In between work and life, jobs and the arts, how does one decide where to live while taking into account work-life balance? As individual level decisions sum up to waves of migrants into cities, were those decisions made primarily based on search for jobs or for life-styles?

Both sides of this cycle happen concurrently, and they simply cannot be detached from each other: people move, businesses are created, and amenities are developed all at the same time, and for a sociological study, they should also be observed together across time. In this research, we analyze the development of arts amenities and jobs in the US, and aim to understand the dynamics of the two on a span of sixteen years.

This research suggests that indeed individuals consider all factors simultaneously when choosing where to work and live. To be sure, individuals have different tastes and life options. For example, in between the options of a job in a remote and small city but with higher wages and low cost of living; and a job in a cosmopolitan city with lower wage and high costs of living; if not for a strong personal preference to remote places or economic need, most people would most likely choose to move into the bigger cities, where they can also find more diverse types of amenities and opportunities for work and entertainment. (Rosen, 1979; Roback, 1982) [18, 19] The simple fact that urban population has increased steadly in the past decades is evidence of this movement.

This is not to say that every individual would be steered the same way, and make decisions similarly, but rather, that if given the opportunity, individuals most likely opt to move to places where they are able to express their identities through a combination of choices, participation in groups, self-expressions, and so on, that are more readily available in the bigger cities rather than small cities, as shown by the increasing urban population over the past decades. (Storper, 2013; Glaeser, 2009) [8, 22]

In this paper, I present some of the theoretical background relating to migration and the arts, and then the chicken and egg analysis, where I describe the method, data, and present results for both statistical and spatial analysis.

2 Migration and Development

Muth's (1971) [13] chicken and egg analysis suggest that migration and industry development are related, and one cannot happen without the other. As migration grows, the number of jobs grows, which in its turn, will attract even more migrants.

On the other hand, Storper (2013) [22] suggests that people move first, and jobs follow. Thus, migration comes first, and due to increasing resources and markets, they will create business and develop their new location. These are two job-centric views, however, there are more to consider than just a great job somewhere, such as the social networks, concentration of people of the same interests and profession, crime rates, climate, availability of housing. (Glaeser, 2009; Rappaport, 2007) [8, 17] According to Glaeser's study, the concentration of people in cities bring many advantages, provided that people feel safe (i.e. low crime rate); such as stronger professional networks.

The options of moving cities for jobs in search for a lifestyle might seem as an increasing option specially for the creative class (Florida, 2002) [7], a group of estimated 38 million highly educated, and talented individuals, such as artists, entertainers, writers, engineers, and other professionals, whose work is related to new ideas, technologies, and creative content. Their options to move seem obvious, as their talents are scarce and desired in many different places, especially on locations of high specialization, such as the Silicon Valley, Hollywood, and Wall Street. (Storper, 2013, 2009) [22, 23]

A concentration of skilled professionals in a city increase people's opportunities for a faster exchange of ideas, connections, and favors; so even in the age of telecommuting, being physically present in a location with other people of the same interest, is advantageous. While the creative city is defined as a place where "the dense many-sided human interactions of cities make possible historically and geographically specific forms of learning and innovation". (Storper, 2009, p. 162)

According to Chen and Rosenthal (2008) [4], businesses and young college graduates prefer growing and denser cities, while than near retirement households would most likely move to coastal cities that are less favorable to businesses, but higher on amenities. Young college graduates move towards businesses favorable cities; where they increase their chances of finding a field-specific type of job.

Whether we are referring to the skilled city or the creative city, a more educated and wealthier population leads to an increasing importance of high end and innovative city amenities; especially those that require a large population to support their fixed costs, such as museums, aquariums, concert halls, and so on (Glaeser, 2009; Storper, 2009); but also a trendy coffee house or the underground theater. [1]

Logan and Molotch (1987) [10] suggest that people from lower classes are not able to migrate following amenities or lifestyles, and thus suffer from more constraints to move and are tied to their residence or place of origin. However, if we observe the cases of cities like Los Angeles and New York, we can observe masses of Mexican migrants, for example, who choose these cities for having amenities of their preference, such as family, friends, a Mexican community, access to their ethnic food and goods, and others elements related to their heritage that allows them to live a partially Mexican and partially American life. Other similar cases we might consider are the expansion of Chinatowns in some cities in the US, and the presence of other ethnic neighborhoods such as the Indian neighborhoods in Canada and England, Little Italy in New York, and concentration of Korean, Japanese, and Italians descendants in specific neighborhoods in Brazil and other countries.

Therefore, we cannot assume that lower classes must stay in their homeland or just where the jobs are. If the jobs are elsewhere and not where they were born, then that is the place where even the lower classes will migrate to, in search of better opportunities in life, and in this decision making process, they will also consider the new location's amenities. Therefore, we assume that migrating for jobs and life-styles is not only for the privileged creative class, but an open possibility for a majority of the population.

In summary, there are many reasons why people migrate, including jobs. As discussed, Glaeser and Storper argued for low crime rates, climate, housing availability, convenient transportation and commuting, and easy accessibility to the amenities as essential for the full enjoyment of the city. There are many reasons why places get more attractive than others; and as opposed to the first studies, many variables are being added, or could be added. The current economic, social, and techological situations allow for more and more people to decide how to lead their lives. In a scenario with so many variables, on this paper I will focus on the realm of the arts.

3 The Arts and Jobs

The production and consumption of the arts are interrelated: the arts exist in cities for its consumption, and at the same time, a series of supporting services for the production of the arts are also necessary. For example, we shall consider a concert hall that is formed by a group of musicians and a maestro composing its orchestra, performing classical music for the local population. Besides the artists, a whole team of behind-the-scenes production is also needed, such as marketing managers, box office attendants, musical instrument specialists, stage managers, and even accounting and legal firms. This division of labor in the production of the arts is well detailed in Beckers book (2008) [1], in which an art world is constituted by "all the people whose activities are necessary to the production of the characteristic works which that world, and perhaps others as well, define as art." (Becker, 2008, p. 34) These are all people who, even though they are not artists themselves, are exposed to and influenced by the arts.

The supporting teams for the artists might work directly from within the same organization and from outside of it. Stage managers and box office attendants might be directly employed by the orchestra hall, but the marketing might be done by an outside advertising and press agencies; as well as the specialists that take care of the orchestra's musical instruments, who might also work for their own shop, offering occasional services to the orchestra. Therefore, not only are the artists involved in the production of arts, but also several other types of occupations and organizations are involved. As far as the consumption of arts is related to the presence of commonly known arts institutions, such as concert halls, operas, museums, and art galleries; the production of arts is related to the production of arts materials, such as paint, books, records, and film, as well as the production of art itself, such as live music and theater performances, the transformation of canvas into paintings, and marbles into sculptures.

The production of arts is also part of the consumption of the arts in two senses: first, production is essential for services such as live performances and curation of art exhibitions, as illustrated above. Second, it employs people who are interested in the arts, and therefore, increasing the local population with an interest in not only producing arts but also consuming it. For example, consider now a recoding studio that employs music specialists who enjoy music and perhaps other types of arts. As these specialists most likely live in the city where they also work, during their free time, they will probably appreciate local art, for the convenience of going to amenities close to their homes. Thus, they would appreciate the ease of going to concerts, visiting art galleries, and spending time at a coffee shop or bar nearby. The presence of people who are interested in the arts as producers are also the same people who will pursue similar amenities as an interest or hobbies as consumers. And to keep this lifestyle sustainable, they would probably require a job in their field of expertise to remain in a place that is interesting to them. Therefore, the presence of production of arts also increase the consumption of arts.

According to Clark and Ferguson (1983) [5] , production and consumption of arts co-constitute each other, and in the simultaneous choice of workplace and lifestyle, the work becomes more similar to one's lifestyles, especially for the self-employed and highly skilled professionals. Thus, "people select a location for many reasons, including amenities, and once they are there, they contribute to the character of the place, including its scenes." (Scenes, chapter 8, p. 64)

Therefore, here we can draw the first assumption for this paper: the presence of arts amenities can be illustrated by the number of arts jobs in each location, not only artists and art producers

(narrow categories), but also those jobs that support the arts (wide categories). In this paper, we count arts jobs as an indicator of the presence of the arts industries in each zip code. *Where the arts jobs are, the arts are.* And by extension, the number of jobs of the non-arts related industries will illustrate the number of jobs associated to them in each zip code.

One might infer that because the arts industries are small compared to other industries, its impact aren't significant to the creation of jobs in the cities just as any other jobs are. However, the arts have shown to have a multiplier effect that benefit other industries other than only itself. (Moretti, 2010) [12] According to Blau (1989) [2], investment in the arts is a safe investment for cities that want to attract other industries, i.e. if the city invests in a museum and an opera, that will attract and improve the city's environment at very low risk, bringing companies headquarters or branches and encouraging the foundation of new companies, that will create more jobs for the region.

Still according to Blau, differently from the idea that the high arts are investments associated with large metropolitan areas, the top cities in development of high culture are not the biggest cities, but smaller cities throughout the US that have invested in the arts, aiming to attract companies and industries, which will then create new jobs for the local population. Thus, if the small cities are also receiving arts investments aiming to increase the number of jobs in all of their industries, then it makes sense to do an analysis of the development of arts in the entire US and not only for the largest metropolitan areas. Thus, we consider arts jobs investments as a random variable, not biased by city size.

The rigor of the traditional arts (for example, classical music, opera, European paintings) in form, expectation, and conformity makes the investment in the type of art safer, as the traditional forms have a general format to be followed, and even known costs and return on investments. Thus, traditional arts are safer to implement and maintain, than, for example, alternative art forms (new bands, pop music composers, new artists), which require the spontaneous, and daring creativity of local artists, which also depends on the local Zeitgeist to be executed, and thus more variable in terms of continuity and investment. Hence, if a city government invests in a classical music orchestra, the enthusiasts of this type of music will have a certain expectation of the performance of that art, and upon succeeding in delivering the performance, the orchestra can be said to be a success. However, the expectation is not the same for the alternative arts, as it is hard to anticipate. Although the alternative arts are maybe equally or even more influential in attracting young talented people to the city who search for different types of entertainment than the traditional forms, which are often more sought after by older generations. The point here is that in order to attract young talented people, a city should not only invest in the traditional art forms, but they also need to set the artistic ground for contemporary types of arts to flourish. Thus, individuals might feel compelled to accept other forms of art other than high culture, if they are offered different options. This choice-option structure allows one to combine different interests that form the individuals personality and network, providing him with the right amount of stimuli to act blasé, thus, acting indifferent to whatever is not of their personal interest. (Simmel, 1994a, 1994b) [20, 21] And at the same time, they learn to tolerate the presence of things that are not of their interest or that might be strange to them, but that will compose an overall diverse urban environment. Eventually, they may even get interested in a type of amenity that they weren't interested before.

This argument leads us to the diversity analysis in which we are able to understand the level of omnivoreness or tolerance of a certain location. Bourdieu (1987) [3] separates individual taste

distinctions according to different levels of appreciation of types of art, such as classical music and paintings. The individuals who appreciate types of art that are not their primary type according to Bourdieu's expected classification, thus, are cultural omnivores, in an analogy to the biological concept. Peterson and Kern (1996) [16] also define different levels of cultural consumers, into highbrow, middlebrow, and lowbrow; and they proceed to explain that "among highbrows, the snob is one who does not participate in any lowbrow or middlebrow activity, while the omnivore is at least open to appreciate them all." (Peterson and Kern, 1996, p. 901)

However, in some cases, systematic investments in the arts and amenities for revitalization of specific areas might result in what some analysts call as gentrification. Some researchers argue in favor of and against gentrification, as its process involves the renovation of low income and deteriorated inner city neighborhoods through the construction of new amenities, renovation of the aesthetics, preservation and restoration of historic buildings, execution of new commercial and residential projects, and improving the neighborhood, in order to value the land, and attract business with a greater economic appeal. The consequences of gentrification is the displacement of the existing population, such as the lower classes from the inner cities, in favor of the reversal of urban decline. Thus, for Zukin (1987) [24], gentrification as a cultural practice might lead to the preservation and restoration of old buildings in a location, making these estates more valuable because of the historical value that it carries. On the other hand, gentrification might be the cause for colonization by economic institutions and investors in the central areas.

Taking these theoretical points into consideration, we then proceed to the methods of analysis used in this study.

4 Methodology

When trying to understand the driver of growth, we temp to ask "which came first?", but it is the wrong question, as both arts and other industries depend on each other to exist. Therefore, this is not about one direct causal relationship, but about causal relationships that influence each other over time and concurrently. For this research, we use the cross-lagged regression method to analyze the impact of the arts on jobs and vice-versa.

4.1 Data

The raw data was downloaded from the Census' County Business Patterns (CBP). The initial CBP data provides the number of companies in each industry [2] by zip code and in 9 ranges of number of employees for the period of 1998 to 2014. The number of jobs dataset used in this study estimates the number of arts and non-arts jobs (the later, exchangeably called just "jobs") per industry, per zipcode, according to equation 1.

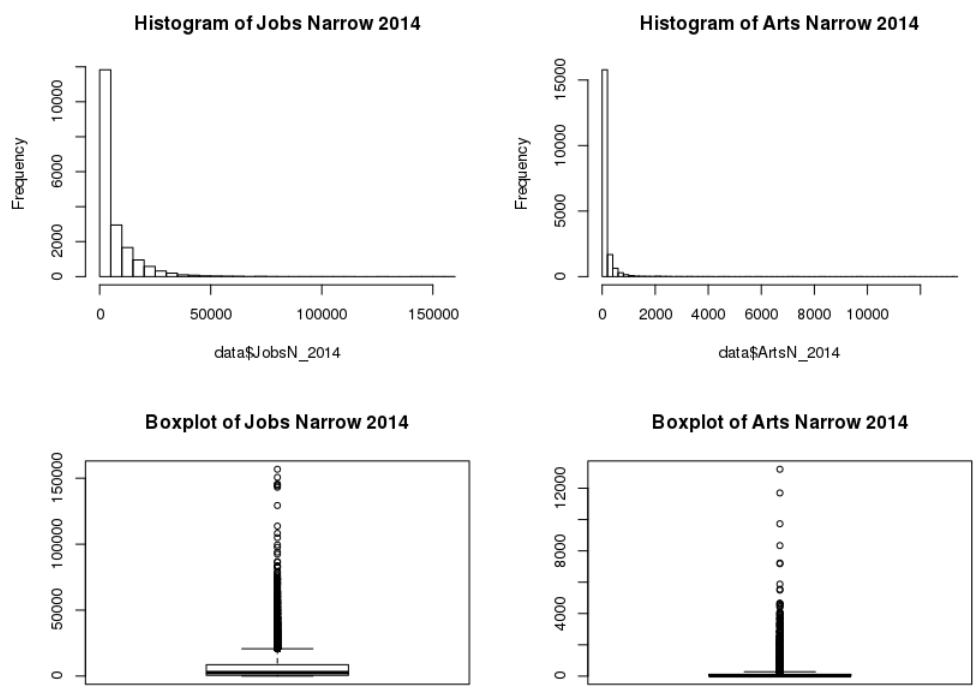
$$\begin{aligned} estimated\ jobs = {} & n_{1\ 4} * 2.5 + n_{5\ 9} * 7 + n_{10\ 19} * 14.5 + \\ & + n_{20\ 49} * 34.5 + n_{50\ 99} * 74.5 + n_{100\ 249} * 174.5 \\ & + n_{250\ 499} * 374.5 + n_{500\ 999} * 749.5 + n_{1000} * 2000 \end{aligned} \tag{1}$$

Where n is the number of companies in the corresponding subscripted range of number of employees according to the census.

The main assumption about the arts is that the presence or not of arts in a city is defined by the number of arts jobs, and their extent is represented by its numbers. We created two arts categories based on the theory presented above: arts jobs narrow categories refer to amenities directly involved in producing entertainment (studios, publishers, dance companies, theaters), and the arts jobs wide also includes the establishments that complement the narrow category, as detailed in appendix A. The descriptive statistics for a few variables are presented in appendix 7.[3]

The final dataset is considered count data, meaning that they are result of counting real objects, rather than a ranking. As O'Hara and Kotze (2010) [14] suggest, count data should *not* be log transformed, or any type of transformation. Even though all jobs variables in this data are positively skewed, as we can observe in the histogram for the 2014 narrow variables in figure 1, the data was not transformed.[4]

Figure 1: 2014 variables histograms and boxplots



Since there are more of less populated zip codes in the US than highly populated, this is reflected in the national dataset. The boxplots in figure 1 show a long tail line of what could be considered outliers, but those are in reference to the metropolitan areas and densely populated zip codes.

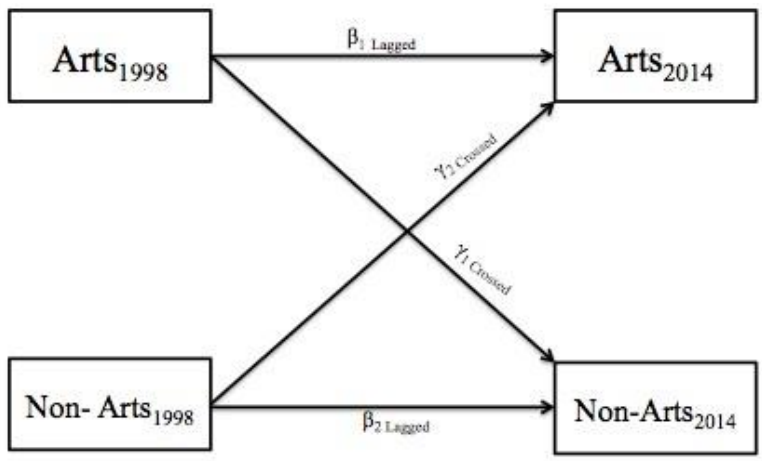
In figures 15 and 16 in the appendix, the plots of the arts and jobs in 1998 and 2014 in both narrow and wide categories show us the changes in the number of arts and non-arts jobs in the

sixteen year period. Since the variables do not find themselves in a strict line, there was change in the number of arts and non-arts jobs in the period, thus, the data is not multicollinear.

4.2 Cross-lagged regression

In this research[5], we use the cross-lagged regression method to analyze the impact of the arts on jobs and vice-versa. In this model, we compare the results of two equations simultaneously: one with arts as the dependent variable (DV), and another with jobs as DV for each combination of two years. The main feature of this model is to allow for comparisons over time, which is not possible in the regular cross-sectional linear regression model. The model is represented in the path diagram in figure 2.

Figure 2: Path Diagram



Where t is the later year, and x is the difference between the years. β represents the lagged coefficients, in other words, the impact of the variable on itself (arts on arts, or non-arts on non-arts). γ represents the crossed coefficients, or the impact of the variable on the other opposing variable. Therefore, in this method, two linear regressions are required for the analysis of the changes in any two years. Both arts and non-arts jobs are included in each equation, plus any control variables. 2 3 [6]

$$Arts_t = \alpha + \beta_{[NA-A]} * Arts_{[t-x]} + \gamma_{[NA-A]} * NonArts_{[t-x]}(+controlvariables) + ' \quad (2)$$

$$NonArts_t = \alpha + \beta_{[NA-A]} * NonArts_{[t-x]} + \gamma_{[NA-A]} * Arts_{[t-x]}(+controlvariables) + ' \quad (3)$$

As we have data from 1998 to 2014, the model for this project should be a matrix instead of two equations. From the regression results, we observe how the two γ coefficients differ from each other, and which one represented a bigger growth on the other for the same time period. We should keep in mind that mean proportion of the arts on total jobs is about 3.4% in 2014, as we can see on table1. To be sure, in general, non-arts jobs are more predominant, as non-arts jobs

exist in larger numbers than arts jobs, therefore, we should expect that results would show that non-arts jobs are more influential than arts jobs, but we will see further that is not the case.

Table 1: Mean Proportions of Arts on Total Jobs

Proportions of Arts on Total Jobs					
1998	1999	2000	2001	2002	2003
2.864%	2.939%	2.956%	3.016%	2.932%	3.046%
2004	2005	2006	2007	2008	2009
3.094%	3.158%	3.235%	3.294%	3.270%	3.383%
2010	2011	2012	2013	2014	
3.394%	3.386%	3.347%	3.366%	3.409%	

After obtaining the coefficients for both equations, we need to test the hypothesis to verify that the coefficients are statistically different (Paternoster et al., 1998) [15]. To test the hypothesis:

$$\begin{aligned} H_0 &: \gamma_{JobsToArts} = \gamma_{ArtsToJobs} \\ H_A &: \gamma_{JobsToArts} \neq \gamma_{ArtsToJobs} \end{aligned} \tag{6}$$

We calculate the z-score for the difference between coefficients using the following equation, as suggested by Paternoster et al. (1998). [15]

$$z = \frac{b_1 - b_2}{SE_{b1}^2 + SE_{b2}^2} \tag{7}$$

If $z-score > 1.96$ or < -1.96, we reject $H0$, and the two standardized coefficients can be considered statistically different. And the higher coefficient indicates a larger influence than the other in that same period.

5 Analysis

The path diagram (2) illustrates the two basic regressions that are used to compare the standardized coefficients in order to conclude which of the arts or the non-arts jobs had more impact in the growth of the other.

There are many ways to run the same model. I have calculated the coefficients for every single year as a dependent variable and independent variable, and in many different statistical approaches using R. But since most of the models teach us similar results, I show here a few models that helps us improve our understanding.

5.1 Linear Regression Model

Let's start with the simplest model based on the equations 2 and 3: only arts and non-arts jobs in the regression model, without any other variable. The table on appendix 2 [7] shows us the β and γ coefficients for both equations, and the difference of the γs, with the dependent variable fixed on 2014; i.e., the regression results for the two independent variables in 1998 with the dependent variable in 2014, and then again the independent variables in 1999 with the dependent variable in 2014, and so on, until 2013. It is important to note that the year of the independent variables need to be less than the year of the dependent variable, since we're looking at change over time.

The beta coefficients, or *lagged coefficient*, represent change in the mean of the variable on itself: if the dependent variable was jobs in 2014, then in the first line we're looking at is the impact of jobs in 1998 to jobs in 2014, and so on. The γ coefficients, or *crossed coefficient*, represent the changes in mean of one variable on the other. For example, if the dependent variable was jobs in 2014, then the first line shows the impact of arts in 1998 on jobs in 2014, and so on. The same goes for the arts as dependent variable. The delta is the difference between the jobs impact on arts (equation 2) minus the arts impact on the jobs (equation 3). A negative value shows arts being stronger than jobs for that time period.

Table 2 [8] shows us that if we consider 1998 and 2014, the arts had a multiplier effect of 1.47, meaning that, in the national average, each arts job attracted 0.47 more of non-arts jobs, while at the same time period, we see that the jobs attracting arts is almost zero. So the delta for 1998 shows that in the sixteen years period, arts had definitely more impact than non-arts jobs.

Table 2: β and γ coefficients, with dependent variables fixed on 2014

Regression Results for Dependent Variable Fixed on 2014

	DV Year	Jobs Impact on Jobs	Jobs impact on Arts	Arts Impact on Arts	Arts Impact on Jobs	Delta*
Data	**IV Year**	**Beta**	**Gamma**	**Beta**	**Gamma**	**Gamma**
Narrow	1998	0.8657	0.0069	0.9858	1.4669	*-1.4599*
	1999	0.7683	0.0077	0.9767	1.2183	*-1.2107*
	2000	0.7437	0.0073	0.9640	0.9420	*-0.9347*
	2001	0.7061	0.0075	0.9670	0.6825	*-0.6750*
	2002	0.7977	0.0081	1.0064	0.9966	*-0.9885*
	2003	0.8306	0.0053	1.0024	1.0054	*-1.0001*
	2004	0.8180	0.0053	0.9953	1.0262	*-1.0209*
	2005	0.8204	0.0053	0.9877	1.0250	*-1.0197*
	2006	0.8093	0.0046	0.9669	0.9927	*-0.9881*
	2007	0.8029	0.0046	0.9706	1.0256	*-1.0210*
	2008	0.8213	0.0035	0.9786	0.6414	*-0.6379*
	2009	0.8584	0.0041	1.0416	0.4999	*-0.4958*
	2010	0.8776	0.0044	1.0727	0.5020	*-0.4976*
	2011	0.9131	0.0035	1.0601	0.3383	*-0.3348*
	2012	1.0070	0.0014	1.0313	0.3675	*-0.3661*
	2013	0.9848	0.0010	1.0141	0.2606	*-0.2596*
Wide	1998	1.1148	0.0122	0.9470	0.3918	*-0.3796*
	1999	1.0790	0.0141	0.9375	0.3603	*-0.3462*
	2000	1.0289	0.0149	0.9233	0.3413	*-0.3265*
	2001	1.0257	0.0153	0.9283	0.2760	*-0.2606*
	2002	1.1617	0.0110	0.9634	0.3314	*-0.3203*
	2003	1.0829	0.0107	0.9738	0.2620	*-0.2512*
	2004	1.0554	0.0117	0.9717	0.2351	*-0.2233*
	2005	1.0158	0.0137	0.9658	0.2343	*-0.2206*
	2006	1.0010	0.0113	0.9489	0.2087	*-0.1974*
	2007	1.0056	0.0108	0.9469	0.2585	*-0.2477*
	2008	0.9544	0.0123	0.9592	0.1921	*-0.1799*
	2009	1.0138	0.0128	1.0244	0.1495	*-0.1367*
	2010	1.0520	0.0117	1.0577	0.1347	*-0.1230*
	2011	1.0489	0.0108	1.0510	0.0626	*-0.0518*
	2012	1.0436	0.0038	1.0200	0.1094	*-0.1055*
	2013	1.0195	0.0024	1.0057	0.0838	*-0.0814*

Note: Calculated z-scores show that the difference between the two coefficients for each year is significant
Coefficients are significant at at least 95% confidence.
*Delta: Difference between the jobs to arts coefficient minus arts to jobs coefficient.
Negative values show a higher impact of the arts on jobs.

The arts narrow categories had a larger impact on the jobs than the arts wide categories. The arts narrow are a smaller number of categories, but had 3.6 times more impact than the arts wide. In other words, amenities directly related to the production of the arts and entertainment such as museums, dance companies, and theaters, show a higher impact than the wider categories.

Table 3: Z-scores Between Coefficients

	z-score	
IV year	**Narrow, 2014**	**Wide, 2014**
1998	12.236	10.273
1999	12.211	10.414
2000	10.427	11.111
2001	8.340	9.615
2002	11.992	11.166
2003	13.594	10.420
2004	14.849	9.974
2005	15.595	10.787
2006	16.853	10.661
2007	21.550	16.357
2008	15.211	13.752
2009	12.485	10.725
2010	13.583	10.296
2011	10.105	4.877
2012	14.070	13.678
2013	13.374	14.021

Table 3 shows the z-scores for the differences between the two gamma coefficients, as calculated with equation 7. The values are over 1.96, therefore, we conclude that the two gamma coefficients for a set of equations are significantly different.

We also calculated the autocorrelation of the same variable on itself over time, and for both arts and non-arts jobs variables the autocorrelation between any one year period is around .3, which is an acceptable level for this study.

5.2 Linear Regression Model with Control Variables

Now, we move on to the same analysis but including the control variables from the Scenes project. The control variables used are shown on table 4.

Table 4: Control Variables

Variable name	**Description**
CollProfLv90	Percent of college graduates in 1990
CrimeRate1999county	Crime rate in the county level in 1999
Democ92	Percent democrats in 1992
NonWhite_90	Percent non white residents in 1990
Pop1990	Population in 1990
RentMed	Median rent

Due to space limitations, I discuss the regressions with control variables only for the model including 1998 and 2014. On table 5 we can observe similar results. Arts have a stronger impact on jobs than the reverse. And arts narrow again show a stronger impact than arts wide on jobs. The results are consistent with the first analysis.

Table 5: Regression Coefficients with Control Variables

2014	Jobs Narrow		Arts Narrow		Jobs Wide		Arts Wide	
Variable name	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Intercept	1102.7300	0.000	-82.9459	0.000	967.193	0.000	9.4042	0.778
Arts 1998	1.0170	0.000	0.85578	0.000	0.3708	0.000	1.033	0.000
Jobs 1998	0.9692	0.000	0.006367	0.000	0.9297	0.000	0.0125	0.000
CollProfLv90	4134.8800	0.000	137.6647	0.000	3494.644	0.000	533.584	0.000
CrimeRate1999county	0.1160	0.000	–	–	0.0875	0.000	0.019511	0.000
Democ92	-40.5500	0.000	1.1034	0.000	-34.7375	0.000	-3.6768	0.000
NonWhite_90	-0.0092	0.087	-0.00126	0.000	-0.0124	0.102	–	–
Pop1990	0.0001	0.000	0.00000828	0.000	0.0000646	0.005	0.00004255	0.000
RentMed	–	–	0.04201018	0.018	–	–	0.15586	0.004

The control variables that were not significant for the analysis were excluded, and the regression run again.

Depending on the model, some control variables become not significant, while in other models, they remain significant. This is due to the diversity and dynamism of the changes on every year. For the equation 2 model, median rent was not significant; while for the equations 3 models, crime rate was not significant for the arts narrow categories, and percent of non-white residents was not significant for the arts wide categories.

5.3 Geographically Weighted Regression

The linear regression models provides us with a general national analysis. However, the United States are much more diverse than what a single coefficient can explain. The data includes from the crowded zip codes in Manhattan to the suburban areas of major cities to the buffalo plains in Montana, thus, an enormous variance. As seen in figure 1, the data is extremely skewed, since there are more of the less to moderately populated zip codes, and less of the densely populated zip codes. After many trials on different methods [9], the method that better captures the diversity and allows for a more detailed analysis is the *geographically weighted regression* (GWR) [10], which considers the adjacent neighbors in the calculation of an individual zip code's coefficients, rather than just one single analysis, as in the linear regressions.

The map can be visualized interactively on ArcGIS Online (http://arcg.is/2flwTV3). This and other maps on my website (http://crissakamoto.com/maps.html).

5.3.1 National Averages

In figure 3, we see the distribution of narrow categories of arts jobs (blue dots) and total jobs (red dots) in 2009. Both dots overlap on the geometric centroid of the zipcodes. The dots sizes correspond to the number of arts and non-arts jobs, and the blue dots are slightly smaller than the red dots for easier visualization. As expected, we see higher concentrations of arts jobs in metropolitan areas, especially on the coasts. However, we also see blue dots, as much as red dots throughout the whole map, on the Midwest and the South. This map shows that the arts are as ubiquitous as jobs, and not an exclusive product of metropolitan areas.

The results for the GWR[11] analysis are shown in figures 4 and 5 by the quintiles distributions of the γ coefficients' values. The GWR generates regression coefficients for each zip code, and these coefficients were divided into fifths (quintiles) and color-coded on the map. We cut the data on the zero point, to show where the jobs and arts left (negative coefficients), and to where they moved (positive coefficients).

The legend for γ_{jobs} coefficients show smaller values than γ_{arts} coefficient, thus the arts present a larger variation on the impacts of non-arts jobs than the reverse. By looking at the map, more jobs were created in the sixteen year period than lost.

On the jobs impact map 4, the yellow, orange, and red zip codes had increases in arts jobs due to the presence of non-arts jobs. The coefficients are generally smaller for γ_{jobs} than for γ_{arts} map. The blue zip codes may be due to loss in both categories of jobs. The New England area, and the Seattle area seem to have higher values of jobs impact coefficients, while most areas are yellow, thus, a .01 to .02 increase in the arts for each non-arts jobs.

On the arts impact map 5, the yellow, orange, and red zip codes present increases on jobs due to the presence of arts; with the red categories having the highest impact: from 19 to 617 new jobs for each arts job. This is a highly significant multiplier effect of the arts on those zip codes. The red and orange zip codes seem to be predominante throughout the country.

The histograms in figure 6 show the count of each size of coefficients as in the maps, with their corresponding ranges. Most coefficients concentrate around zero, however, the arts coefficients present a larger variance than the jobs coefficients.

On the plots of figure 7, each point represents both β and γ coefficients for each zip code on the map, on the equivalent colors as the map. The blue and red dots are more sparse than the lighter blue, yellow, and orange dots. This is due to the symmetry of the histogram in figure 6.

5.3.2 Local Growth

Here we zoom in some areas to show the details of local growth that are harder to see on the national map [12]. The legends for each map in the city focus are the same as the national maps.

On the overall ranking, less populated zip codes reach the top of the most impact of jobs on arts and arts on jobs, but considering the subset of zip codes with over 70,000 inhabitants, the top 40 cities in jobs and arts γ coefficients are shown in tables 8 and 9 in the appendix. On table 8, we see the cities where jobs attracted arts, and their respective coefficients; the highest of them being .10.

California, Illinois, and New York lead on arts per job rates; with the presence of Florida and Virginia. For the areas in this ranking, the jobs attracted people, and then the arts and entertainment amenities flourished. San Francisco, CA, leads in attracting arts after jobs; together with New York and Chicago.

Table 9 shows the cities where arts attracted jobs over the last sixteen years, with the highest coefficient being 122 of new jobs for each new arts job. Chicago lead in areas of growth of jobs due to the investment in the arts over the past few decades, together with areas in California, New York city, Philadelphia and Houston. These results is consistent with other studies.

The coefficients shown on the map are represented on the histograms (figure 6) and scatter-

plots (figures 7 and 8) below.

Even though the initial data was positively skewed, we see here that the resulting coefficients are normally distributed. The length of the histograms represent their ranges. Most coefficients are around zero, but many go over the 95% mark, thus being outliers. The jobs coefficients show a smaller range (within -.27 to .9), while the arts coefficients show a wider range (from -542 to 501). This means that the arts have a much stronger pull than jobs; which are closer to zero.

The scatterplots show the distribution of both the crossed and the lagged coefficients. Figures 7 and 8 show a concentration of crossed and lagged coefficients around zero, with three quintiles mashed together in the center. The darker blue and darker red quintiles are more disperse. These plots show that the higher the γ coefficient value, the lower the beta coefficient value; therefore, as one type of job pulls the other stronger, the other type of job loses strength on the β.

1491.894; 501.561)

Figure 7: Distribution of Jobs to Arts Equation Coefficients

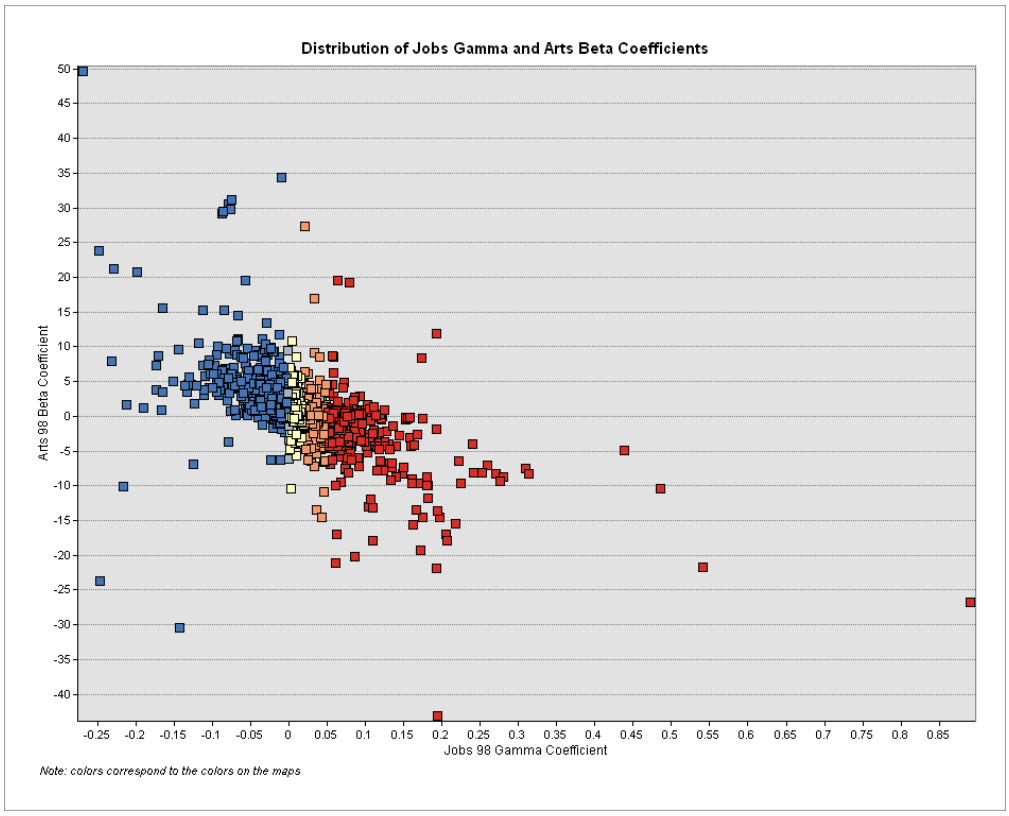
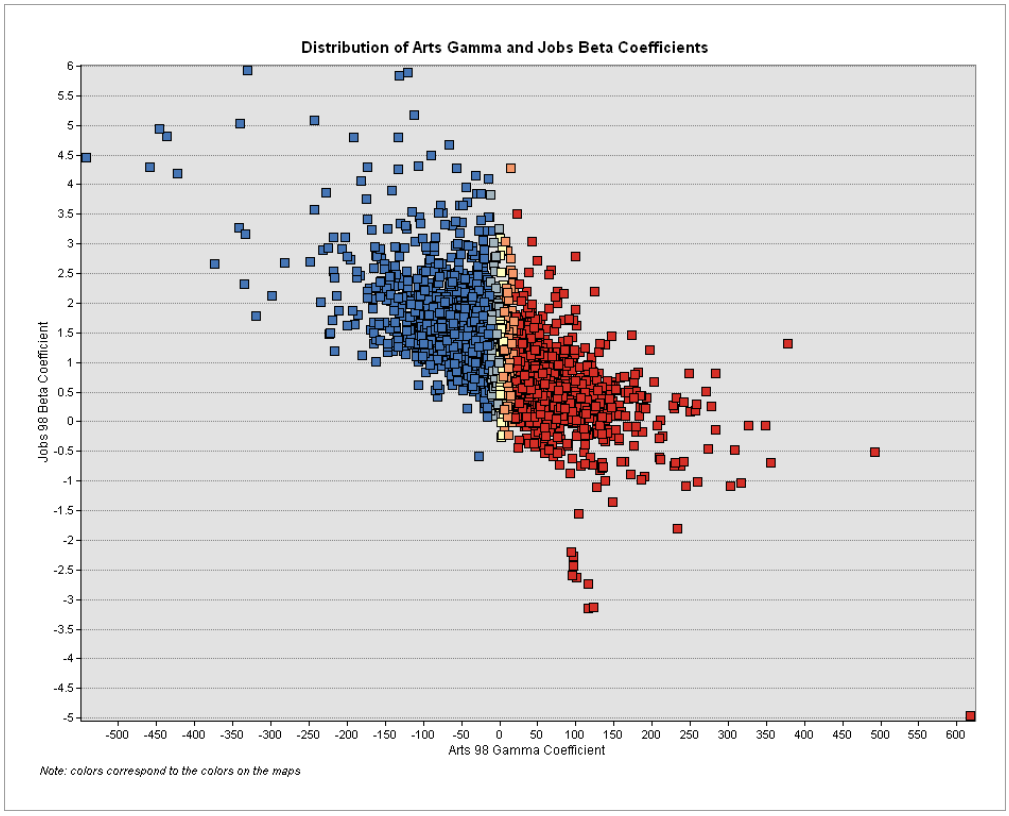


Figure 8: Distribution of Arts to Jobs Coefficients



5.3.3 New York

In a closer look on New York, we should look first at the changes in number of arts and non-arts jobs in the zip codes on figure 9 and 10. Both maps in this figure show the growth by standard deviation of the general data. We see that most zip codes in New York have larger than average growth on both arts and jobs, with a few exceptions.

The Upper East Side shows a smaller growth in jobs, while three zip codes in Manhattan show smaller growth for the arts. The Battery Park area shows a stronger growth in jobs than arts. The Lower West side of Manhattan show a great increase in arts and jobs. The Upper West Side of Manhattan shows a great arts growth in the last sixteen years, as there is a concentration of students, and cheaper rent.

In Brooklyn and Queens, the arts show a higher growth in general than jobs, specially in the nearest zip codes to Manhattan, such as Williamsburg, Long Island City, and Forest Hills. The Bronx show a similar growth as the East of Brooklin and Queens. Even the East side of New Jersey presents higher arts than jobs growth.

Figure 11 shows the values of γ coefficients for each zip code for easy comparison. The reader may find the coefficients by clicking on any zip code on the interactive map online.

Both direction exists in the city, in an equally divided analysis. Comparing the same zip codes in both maps allows us to see which direction had a stronger pull.

An interesting point in Manhattan is the Midtown Chealse area, or also known as the Garment District. According to the "Save the Garment Center" movement, this area is historically known for a concentration of fashion companies; however, in recent years, non-fashion related companies (such as lawyer offices, accontants, etc.) took over the area. [13] This is shown in the map with the negative coefficients of arts attracting jobs; while jobs are atracting arts to the area. Thus, confirming the movement's theory that a new shift in the neighborhood is happening, from Garments to Businesses, that will attract the amenities; rather than the arts (or in this case, fashion), attracting jobs.

Another interesting point in New York is Battery Park, where the Financial District is located. We see a great jobs growth in the area, and even though the arts did not show the greatest increase in the city, it still pulled many jobs to the area, at 38 new jobs per arts job in the period. The same happened in the Lincoln Center area. In the same way, in West Brooklyn (Williamsburg and Brookling Heights), there was a weaker pull from jobs to arts, while arts attracted more jobs to the area. As it is well known, rents and real estate prices in these areas increased. As Lees (2003) suggest, there is a case for super-gentrification in Brooklyn; and our analysis corroborate to that.

The area around the United Nations Headquarters also had a high arts pull of jobs than the other direction: a zero coefficient of jobs attracting arts; while the arts attract jobs on a rate of 14 to 22 jobs per arts job. This is due to the development of the Third Avenue bar and restaurants scene, a nightlife scene, and an influx of college students to the area.

Even though the Upper West side of Manhattan showed an increase in arts and jobs, they don't seem to be too related, as the γ coefficients in both maps are negative in the area.

Figure 9: Changes in Jobs in New York

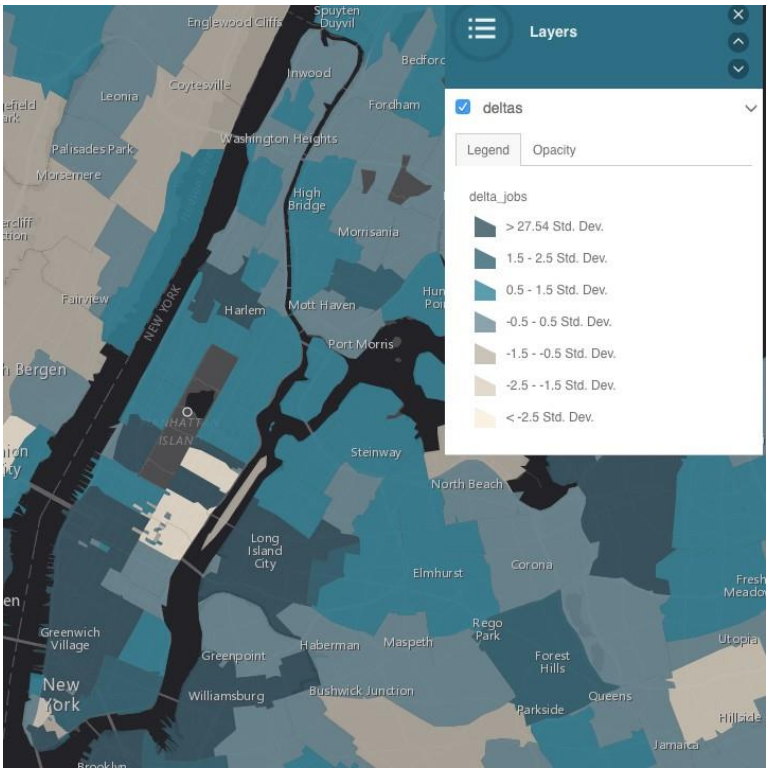


Figure 10: Changes in Arts in New York

5.3.4 Chicago

On a similar analysis as the one for New York, we now look to Chicago, an attractive city well known for its investments in the arts, and artistic diversity.

Figures 12 and 13 show the changes in number of arts and jobs. The highest jobs increases in the city are in the areas of Wicker Park, Maplewood, West Town, and Cicero; while the other neighborhoods in the city showed a lower increase in comparison.

On the other hand, the number of arts seem to have had a higher than average increase throughout the city, except the River North and Streetville areas. There seem to have a movement of the arts from the higher rent areas in the city to the lower rent areas in the city. Even though rents in Chicago are not as high as in New York, the north of the river area is relatively more expensive; and with such competition in rent prices, the art dispersed to the neighboring areas.

On the Chicago maps in figure 14, we observe how many more arts driven zip codes there are, rather than jobs driven zip codes. From the north to the south of the city, the arts have a stronger pull in attracting new jobs, rather than the reverse direction. Most of the city has positive coefficient for both arts and non-arts jobs, which is a positive growth indicator.

The Southwest red area of the city shows the strongest arts to jobs pull, while the jobs to arts pull is near zero. The same can be observe north of the city, but not on the same strength.

Figure 12: Changes in Jobs in Chicago

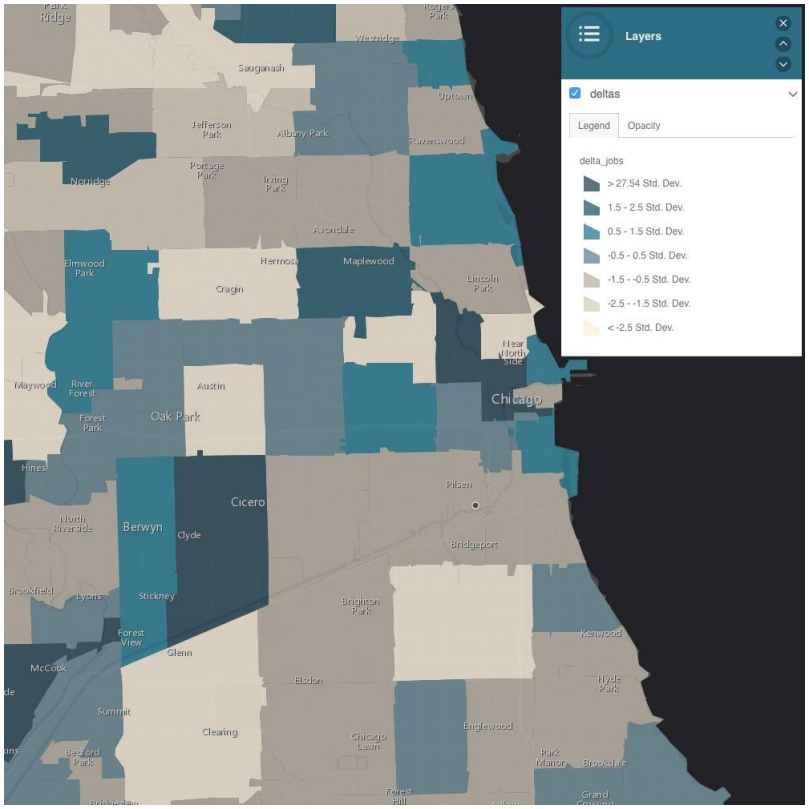
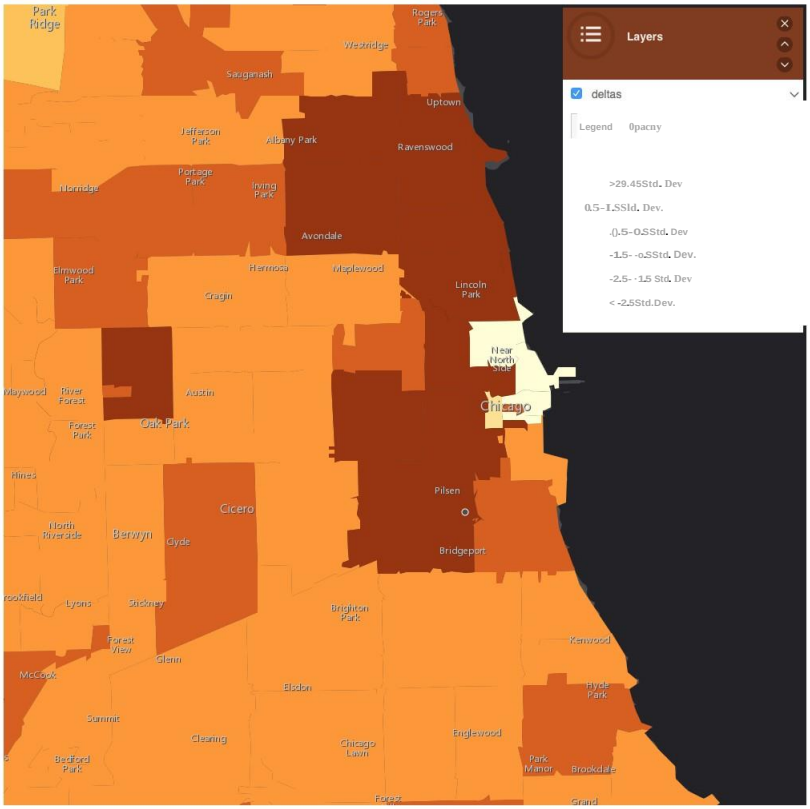


Figure 13: Changes in Arts in Chicago



6 Errors or Variances?

The GWR analysis allows us to see the subtleties in the zip code changes; however, the analysis is more laborious, as we have twice the number of coefficients as there are zip codes in the original data. So, this kind of analysis doesn't summarize the data and findings, but allows us to see movement, while potentially making it more complex.

Thus, I believe the challenge of the social sciences for the coming decades will be to reconcile the power of statistical analysis and big data to the variation of human activity and its impredictability. I chose the GWR method here because it allows us to see those small differences, whereas a linear regression would seek to force the different zip codes into a straight line; a task I leave to the economists.

The coefficients were calculated in a power of 95% confidence. This means that there should be some error, which I call here as variance.

Considering that the data is very skewed to the left, it is no surprise that the residuals plots would also concentrate to the left of figure 19 and 20 in the appendix. However, we see that the right of the graph shows a fan shaped variation. This means that the errors are normally distributed; but also that within the same level of zip codes, they start varying more and more as their size increases. In other words: bigger zip codes will vary more among each other than smaller zip codes.

The same can be noted on figures 21 and 22 in the appendix. The standard errors are more concetrated to the left, and the right of the graph shows a greater variance among the bigger zip codes.

Thus, with so many different stories, applied policies, and organic developments across the country, it is of no surprise that as the size of the zip code grows, their variation also grows. In order to capture the nuances, I hope that this paper serves as a guide to fellow ethnographers.

7 Conclusion

The challenge in the social sciences is how to use this type of big data statistical study. I presented in this paper general analyses, but each place has its own idiosyncracies. We cannot assume that a "package of arts amenities" will "fix" a place, because those amenities are not necessarily desired just everywhere, but depends on the local context and culture.

When we consider the data for an entire country, specially a large country as the US, the comparison among the different zip codes becomes difficult, as there are large variations. As a whole, we do have more non-arts jobs than arts jobs, and thus, we should expect that the larger group would have a greater influence over the smaller group. However, if we include specific characteristics to the analysis, specially geographic locations, the results become more detailed.

Using geographically weighted regression, we observed how with the influence of ten neighbors each zip code in the US had its arts and non-arts job impact on the other. While the national linear regression show the case for the arts, the map shows that depending on the area (and what

the reader may know about it), the subtleties in the growth of each is influenced by the individual characteristics of the zip code.

In general, we observed a larger impact of the arts attracting non-arts jobs. But this is not the case for every zip code.

For further research on this topic, we could analyze the diversity of establishments and number of companies over time; how much it changed or stayed the same. And also analyze what is the underlying characteristics of zip codes that attract more the arts or jobs.

Notes

[1] "First, rising incomes have produced a class of people who are willing to pay for high end urban amenities. In the 1970s and earlier, cities always had an edge in restaurants, museums and entertainment venues, because of the advantages that come from scale. Theaters and museums use large buildings that can only be supported by large audiences which are hard to find outside of big cities." (Glaeser, 2009)

[2] NAICS is the classification system by the Census that is used in the CBP data

[3] Two other data sets are appended to the dataset in order to provide us with demographic information in each zip code: the core data from the Scenes Project as on table 4, and the Geolytics data (demographic data).

[4] Even if we had transformed the data, the residual plots did not show improvement.

[5] The data and the analysis were all run in R. And can be found on Github. The maps were run in ESRI's ArcMap.

[6] Due to the skewness of the data, we have considered fitting the data to a Poisson or negative binomial distribution; however, the residuals did not show any improvement. Thus, we decided to keep the simpler method of linear regression.

[7] Coefficients showed a p-value approaching zero. And adjusted r-squares of over 0.9.

[8] The table confirms the statistical rule that larger time periods will show bigger impacts than shorter ones.

[9] Experimented with control variables, quartile analysis, interaction effects, multilevel models, and clustering.

[10] Run on ESRI's ArcGIS, ArcMap

[11] Adaptive kernel, bandwidth of ten neighbors

[12] A link with the interactive map will be posted.

[13] "Today due to new development, illegal conversions to office space, and production outsourcing pressures, the center contains 1.1 million square feet of garment manufacturing space and employs 7,100 factory workers." (Save the Garment Center)

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Appendices

A Arts Categories

Table 6: The arts categories

Arts Wide Categories

Book printing
Musical Instrument Manufacturing
Musical Instrument and Supplies Stores
Bookstores
Scenic and Sightseeing Transportation, Land
Scenic and Sightseeing Transportation, Water
Scenic and Sightseeing Transportation, Other
Newspaper Publishers
Periodical publishers
Book publishers
Motion Picture and Video Production
Motion Picture and Video Distribution
Motion Picture Theaters (except Drive-Ins)
Integrated Record Production/Distribution
Sound recording studios
Television Broadcasting
Cable and Other Subscription Programming
Recreational Goods Rental
Other Commercial and Industrial Machinery and Equipment Rental and Leasing
Surveying and Mapping (except Geophysical) Services
Media Buying Agencies
Media Representatives
Display Advertising
Advertising Material Distribution Services
Other Services Related to Advertising
Photography Studios, Portrait
Commercial Photography
Convention and Visitors Bureaus
Convention and Trade Show Organizers
All Other Support Services
Sports Teams and Clubs
Historical Sites
Zoos and Botanical Gardens
Amusement and Theme Parks
Amusement Arcades
Skiing Facilities
Food Service Contractors
Caterers
Limited-Service Restaurants
Snack and Nonalcoholic Beverage Bars
Full-Service Restaurants
Cafeterias

Arts Narrow Categories

Prerecorded Compact Disc (Except Software), Tape, and Record Manufacturing
Camera and Photographic Supplies Stores
Prerecorded Tape, Compact Disc, and Record Stores
Teleproduction and Other Post-Production Services
Other Motion Picture and Video Industries
Record Production
Music Publishers
Other Sound Recording Industries
Radio Networks
Radio Stations
News Syndicates
Libraries and Archives
Architectural Services
Drafting Services
Interior Design Services
Industrial Design Services
Graphic Design Services
Other Specialized Design Services
Fine Arts Schools
Sports and Recreation Instruction
Theater Companies and Dinner Theaters
Dance Companies
Musical Groups and Artists
Other Performing Arts Companies
Other Spectator Sports
Promoters of Performing Arts, Sports,
Agents and Managers for Artists, Athletes, Entertainers, and Other Public Figures
Independent Artists, Writers, and Performers
Museums
Nature Parks and Other Similar Institutions
Casinos (except Casino Hotels)
Other Gambling Industries
Fitness and Recreational Sports Centers
All Other Amusement and Recreation Industries

B Descriptive Statistics

Table 7: Descriptive Statistics of a few variables

Descriptive Statistics

	n	mean	sd	min	max	skew	kurtosis	sc
Arts Narrow 1998	10102	139.51	282.55	2.50	5146.50	6.02	51.21	2.81
Arts Narrow 2002	10102	148.50	307.94	2.50	7722.50	6.98	84.71	3.06
Arts Narrow 2014	10102	187.01	349.11	2.50	5873.00	5.62	46.05	3.47
Arts Wide 1998	10102	1028.78	1207.01	2.50	22135.00	3.24	22.12	12.01
Arts Wide 2002	10102	1069.86	1221.19	2.50	19121.00	3.13	19.97	12.15
Arts Wide 2014	10102	1330.43	1554.85	2.50	25691.50	3.54	27.03	15.47
Jobs Narrow 1998	10102	9059.87	9755.98	7.50	114731.50	2.48	9.99	97.07
Jobs Narrow 2002	10102	9333.44	9872.31	19.00	120765.00	2.48	10.60	98.22
Jobs Narrow 2014	10102	9804.11	10427.44	22.00	129323.50	2.60	11.64	103.75
Jobs Total 1998	10102	9199.38	9916.27	14.50	116512.50	2.50	10.17	98.66
Jobs Total 2002	10102	9481.93	10036.23	26.00	122288.00	2.49	10.74	99.85
Jobs Total 2014	10102	9991.12	10630.71	24.50	130812.00	2.61	11.69	105.77
Jobs Wide 1998	10102	8170.61	8943.68	7.50	111103.50	2.57	10.83	88.98
Jobs Wide 2002	10102	8412.07	9063.01	19.00	116516.50	2.58	11.58	90.17
Jobs Wide 2014	10102	8660.69	9388.27	12.50	125200.50	2.73	12.95	93.41
Supporting Arts 1998	10102	889.27	1021.25	0.00	18492.50	3.01	19.99	10.16
Supporting Arts 2002	10102	921.37	1025.40	0.00	16303.00	2.84	17.26	10.20
Supporting Arts 2014	10102	1143.42	1314.07	0.00	22276.50	3.41	27.11	13.07
Median Income 2000••	10102	46550.44	18663.64	5787.00	200001.00	1.57	4.62	185.69
Population 2000•	10102	20448.65	15208.83	143.00	114124.00	1.25	2.30	151.32
Median Rent•	10102	452.10	130.12	182.00	926.00	0.69	-0.07	1.29
Percent Democrdts*	10102	41.67	9.82	0.00	84.60	0.26	1.64	0.10
Percent Non-White 1990*	10102	3591.69	7137.90	0.00	102388.00	4.70	32.31	71.02
Percent College Gmduates 1990*	10102	0.22	0.13	0.00	1.00	1.21	1.25	0.00
Crime Rate 1999 county•	10102	4142.03	2047.30	45.00	20965.00	0.96	1.98	20.37
ARTGOSLG98*	10102	-0.27	0.92	-4.56	4.00	-0.07	0.89	0.01

*Core variables from Scene

**Variables from Geolytics dataset

C Distribution of Arts and Jobs

Figure 15: Changes in Distribution of Arts and Jobs in Sixteen Years, Narrow Categories

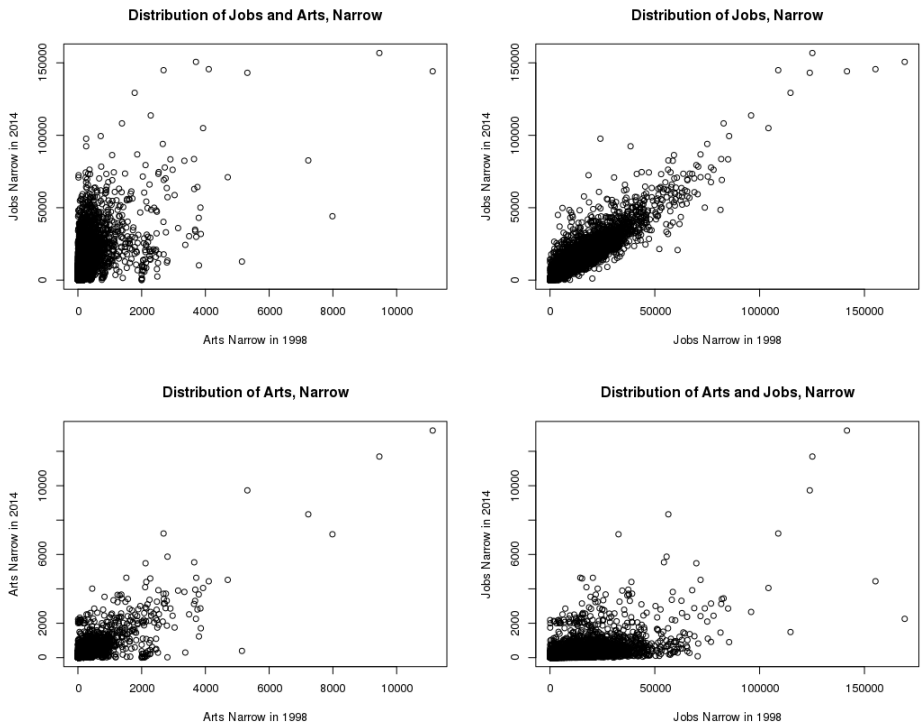
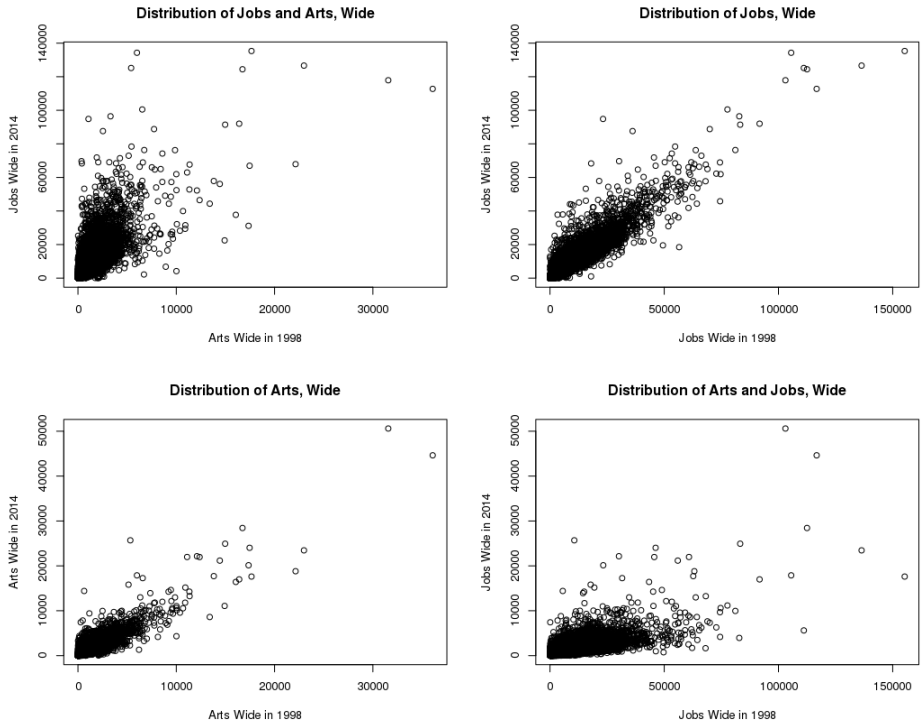


Figure 16: Changes in Distribution of Arts and Jobs in Sixteen Years, Wide Categories



D Top 40 Cities

Table 8: Top 40 Cities and Zip Codes on Jobs Gamma Coefficients

zip	City	State	Jobs to Arts Gamma Coefficient
94112	SAN FRANCISCO	CA	0.107
10002	NEW YORK	NY	0.040
60647	CHICAGO	IL	0.037
60618	CHICAGO	IL	0.033
11211	BROOKLYN	NY	0.032
60625	CHICAGO	IL	0.030
60085	WAUKEGAN	IL	0.026
91331	PACOIMA	CA	0.023
33012	HIALEAH	FL	0.022
60620	CHICAGO	IL	0.020
92105	SAN DIEGO	CA	0.020
91710	CHINO	CA	0.019
23464	VIRGINIA BEACH	VA	0.016
60641	CHICAGO	IL	0.016
11234	BROOKLYN	NY	O.Q15
94565	PITTSBURG	CA	0.013
11221	BROOKLYN	NY	0.013
94110	SAN FRANCISCO	CA	0.013
11236	BROOKLYN	NY	0.011
78539	EDINBURG	TX	0.011
92683	WESTMINSTER	CA	0.011
11207	BROOKLYN	NY	0.010
60634	CHICAGO	IL	0.010
10456	BRONX	NY	0.009
90280	SOUTH GATE	CA	0.009
92503	RIVERSIDE	CA	0.009
90044	LOS ANGELES	CA	0.008
60103	BARTLETT	IL	0.008
11208	BROOKLYN	NY	0.008
92054	OCEANSIDE	CA	0.008
91911	CHULA VISTA	CA	0.007
92126	SAN DIEGO	CA	0.006
91342	SYLMAR	CA	0.006
91706	BALDWIN PARK	CA	0.006
93030	OXNARD	CA	0.006
10029	NEWYORK	NY	0.006
60640	CHICAGO	IL	0.006
95076	WATSONVILLE	CA	0.006
60632	CHICAGO	IL	0.005
78572	MISSION	TX	0.005

Table 9: Top 40 Cities and Zip Codes on Arts Gamma Coefficients

Zip Code	City	State	Arts Gamma Coefficient
60804	CICERO	IL	122.514
60632	CHICAGO	IL	115.126
90650	NORWALK	CA	80.261
95823	SACRAMENTO	CA	79.957
11219	BROOKLYN	NY	68.139
94533	FAIRFIELD	CA	58.188
60629	CHICAGO	IL	51.138
19143	PHILADELPHIA	PA	44.978
91744	LAPUENTE	CA	41.212
60609	CHICAGO	IL	36.328
11220	BROOKLYN	NY	33.377
91910	CHULA VISTA	CA	30.197
77036	HOUSTON	TX	24.780
89014	HENDERSON	NV	23.459
78521	BROWNSVILLE	TX	23.322
60608	CHICAGO	IL	22.909
11211	BROOKLYN	NY	22.421
11377	WOODSIDE	NY	21.887
10458	BRONX	NY	21.478
7087	UNION CITY	NJ	20.131
10467	BRONX	NY	19.785
10468	BRONX	NY	18.713
60651	CHICAGO	IL	17.964
60623	CHICAGO	IL	17.726
11230	BROOKLYN	NY	16.562
91706	BALDWIN PARK	CA	16.273
60634	CHICAGO	IL	15.667
60641	CHICAGO	IL	15.664
92704	SANTAANA	CA	15.187
92335	FONTANA	CA	15.154
60618	CHICAGO	IL	12.329
60639	CHICAGO	IL	11.936
60647	CHICAGO	IL	11.784
60640	CHICAGO	IL	11.650
60620	CHICAGO	IL	8.932
11214	BROOKLYN	NY	8.817
85364	YUMA	AZ	8.768
11226	BROOKLYN	NY	8.473
92804	ANAHEIM	CA	8.246
60628	CHICAGO	IL	8.075

E Distribution of R-Squares

Figure 17: R-Squares for Jobs to Arts GWR

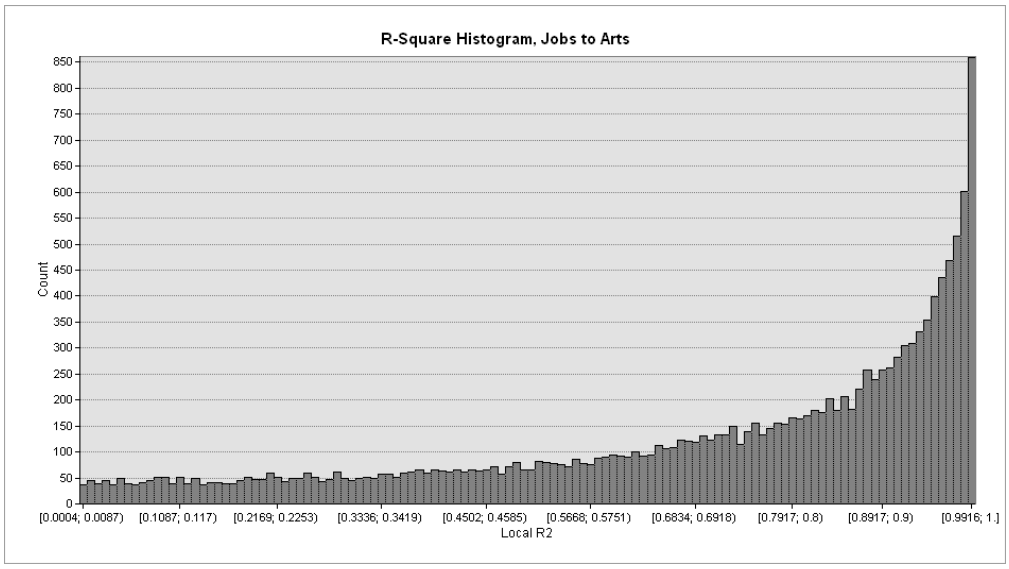
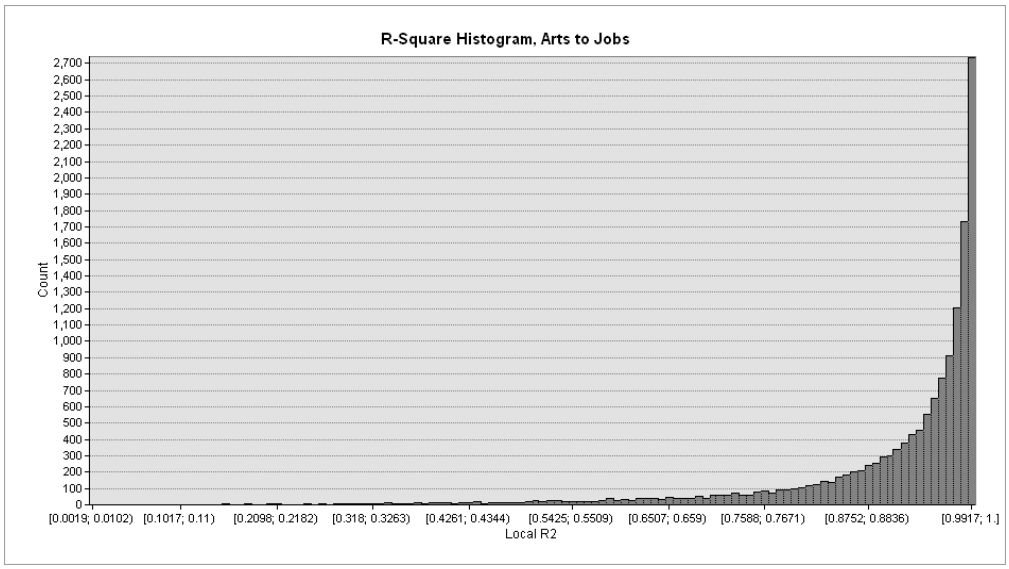


Figure 18: R-Squares for Arts to Jobs GWR



F Residuals vs Predicted Plot

Figure 19: Residuals vs Predicted Plot - Jobs to Arts

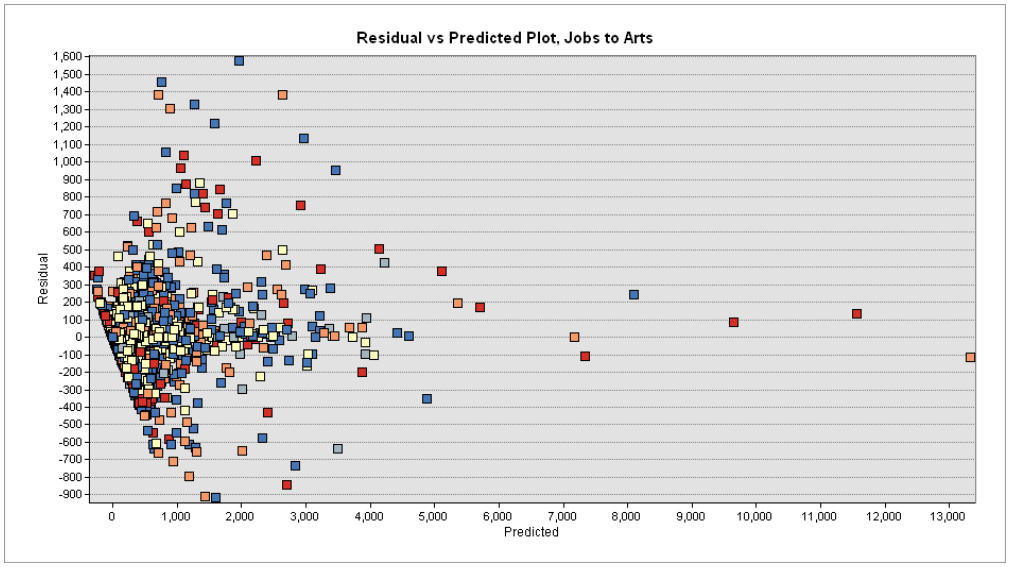
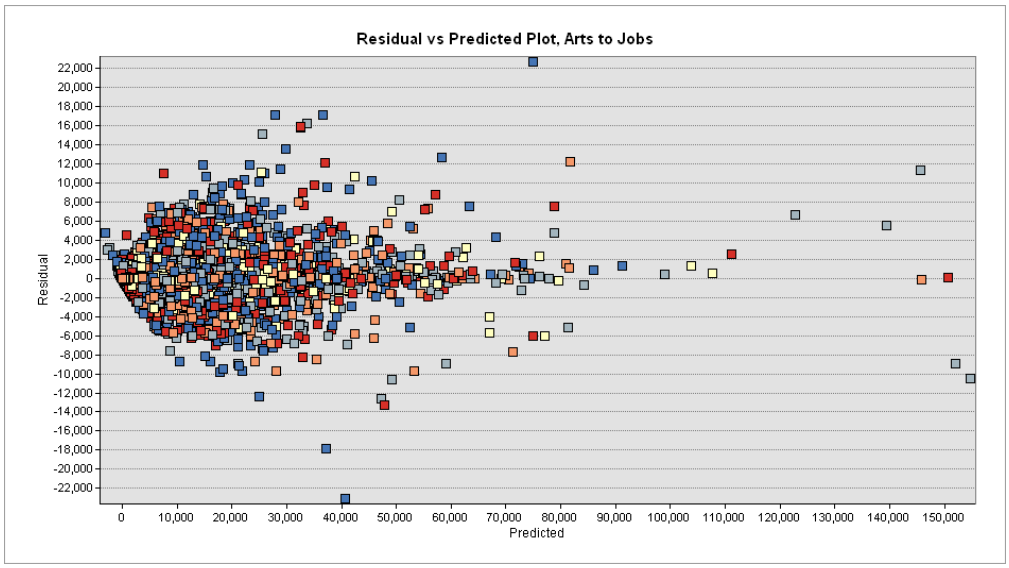


Figure 20: Residuals vs Predicted Plot - Arts to Jobs



Standard Error Arts 98 Gamma Coefficients