The Investment Determinants of Cultural Building

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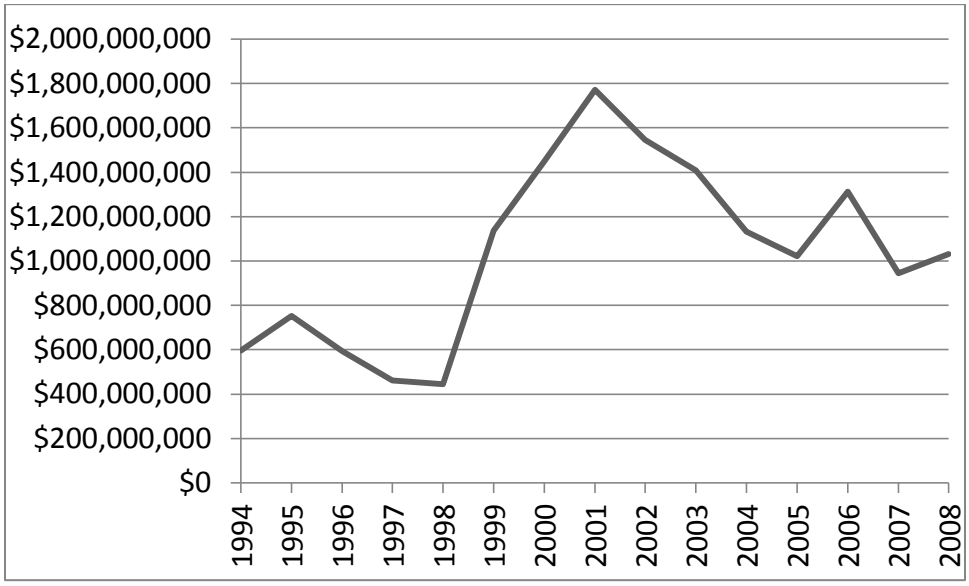
Abstract

Investment into the supply of cultural facilities exceeded the demand for them, particularly between 1998 and 2003. Consequently, cultural organizations in cities across the U.S. were faced with dilemmas about how to remain viable after indulging in capital projects. Using data for all MSAs across the U.S., I develop a model that explains the investment determinants of cultural building. I use a two-part model to estimate the effects of capital and labor stock, cultural, demographic, and economic variables on per capita total investment into cultural facilities. I estimate these effects for the period between 1994 and 2008, the period with the greatest level of building – the boom period (1998-2003) – and then the entire period excluding the boom. My findings suggest that increases in investment were in part due to rising population, education and wealth levels. I present evidence for a positive relationship between the existing level of capital stock in a city and the amount it invests and a negative relationship between per capita investment and labor stock. Finally, I show that in the period between 1998 and 2003 – the boom period – there was a misalignment of investment and its determinants and suggest that there was overinvestment into cultural facilities during this period.

I. Introduction

A previous article summarizing the landscape of cultural infrastructure[2] in the U.S. between 1994 and 2008[3] came to the following conclusions. First, the total cost of cultural infrastructure investment increased between 1994 and 2008, and this increase was the greatest between 1998 and 2001 (Figure 1).

Figure 1. Total Infrastructure Investment in the U.S. by Year



Notes: Project costs adjusted to 2005 dollars using fixed investment nonresidential Gross Private Domestic Investment (GPDI) indexes.
Source: McGraw-Hill Construction, Inc.; Bureau of Economic Analysis, U.S. Department of Commerce

Second, there was greater investment into performing arts centers (PACs) than museums and theaters (Table A).

[2] Museums include traditional art museums, ethnic museums, history museums and historical societies and organizations, and cultural art centers that focus primarily on exhibiting art; children's museums, science museums, natural history museums, halls of fame, and specialty museums including museums devoted to the study and/or display of one object (i.e. Balloon Museum), one industry (i.e. Police Museum), or a person (i.e. Ernest Hemingway Museum) are not included. Theaters include single-use performance spaces such as those concentrating on hosting Broadway tours or those with their own resident companies). PACs include spaces that host multi-disciplinary performance acts (i.e. comedians, pop concerts, dance groups, theater groups), cultural art centers primarily focused on performance, dance theaters, opera houses, symphony halls, concert halls, and auditoriums. University-owned institutions are included, but those owned by high schools, middle schools, and elementary schools are not included.
[3] I use data between 1994 and 2008 because these are the years for which data were available from McGraw-Hill Construction, Inc.

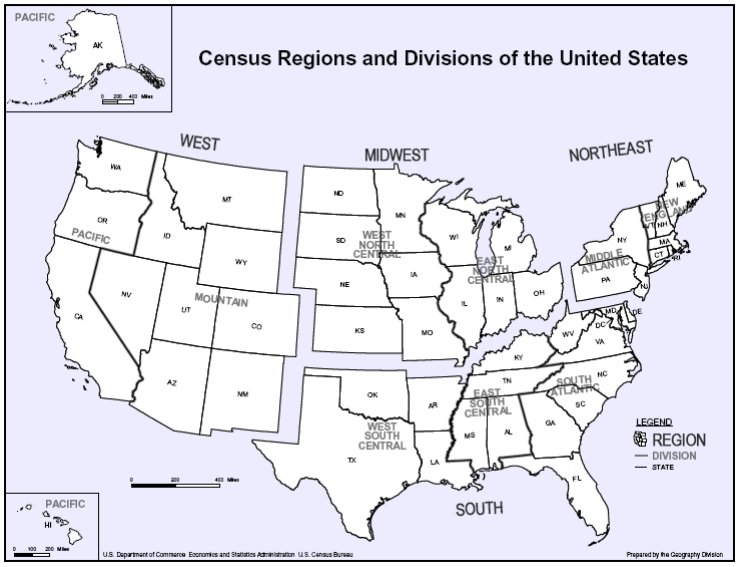
Table A. Cost of Projects by Type

Type	N	Total	Mean	Median	Standard Deviation	Min	Max
Museums	281	$5,943,841,797	$21,152,462	$11,312,699	$31,052,080	$4,000,000	$328,571,240
Theaters	80	$1,231,777,945	$15,397,224	$10,035,571	$19,559,671	$4,000,000	$152,116,240
PACs	364	$8,351,256,456	$22,943,012	$11,415,471	$33,043,050	$4,000,000	$335,142,670

Notes: Project costs adjusted to 2005 dollars using fixed investment nonresidential GPDI indexes.
Source: McGraw-Hill Construction, Inc.; Bureau of Economic Analysis, U.S. Department of Commerce

Third, the Southern region (Figure 2) had higher levels of raw dollar investment into cultural infrastructure than did other regions, but the Midwestern region had higher levels controlling for other factors such as regional gross domestic product (GDP) and disposable personal income (DPI) (Table B, Figure 3, Figure 4).

Figure 2. Census Regions of the United States



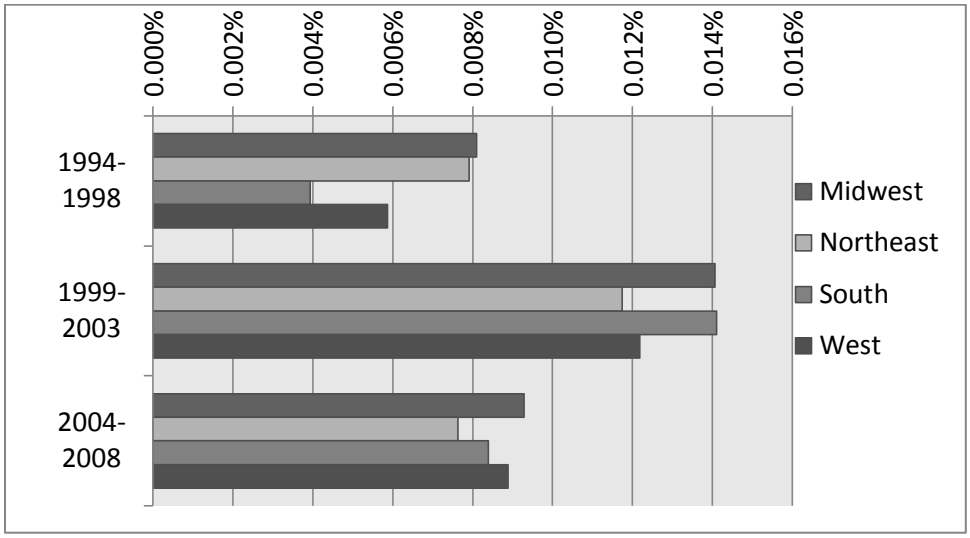
Source:U.S. Census Bureau, U.S. Department of Commerce, Economics and Statistics Administration

Table B. Cost of Projects by Region

Region	N	Total	Mean	Median	Standard Deviation	Min	Max
Midwest	172	$3,822,924,859	$22,226,307	$11,239,198	$27,942,384	$4,000,000	$154,974,230
Northeast	152	$3,163,928,327	$20,815,318	$11,248,350	$34,766,170	$4,000,000	$328,571,240
South	246	$5,030,299,519	$20,448,372	$10,947,125	$30,723,377	$4,025,000	$335,142,670
West	155	$3,509,723,493	$22,643,377	$12,074,058	$31,894,906	$4,000,000	$221,306,260

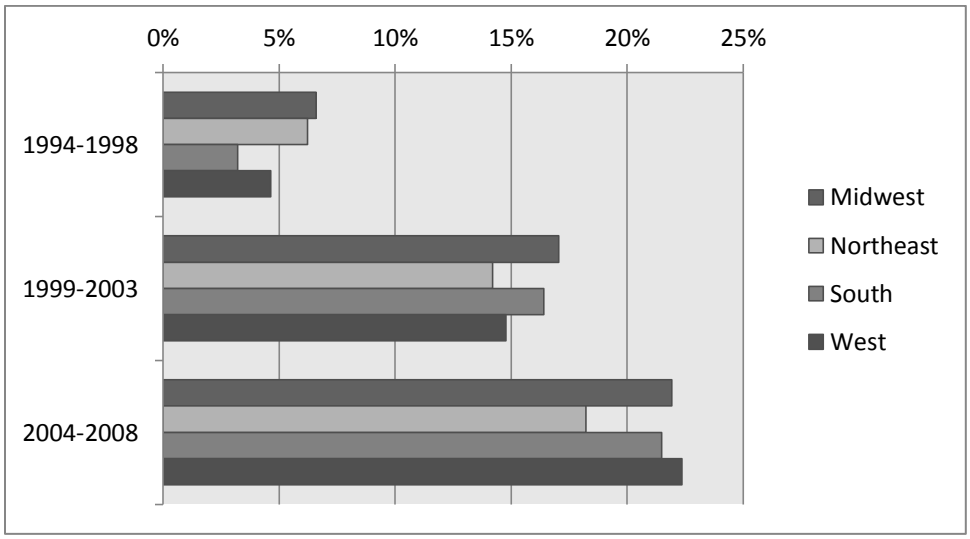
Notes: Project costs adjusted to 2005 dollars using fixed investment nonresidential GPDI indexes.
Source: McGraw-Hill Construction, Inc.; Bureau of Economic Analysis, U.S. Department of Commerce

Figure 3. Average Five-Year Cost of Projects as a Proportion of Regional GDP



Notes: Project costs adjusted to 2005 dollars using fixed investment nonresidential GPDI indexes. Regional GDP figures adjusted to 2005 dollars using GDP indexes.
Source: McGraw-Hill Construction, Inc.; Bureau of Economic Analysis, U.S. Department of Commerce

Figure 4. Average Five-Year Cost of Projects as a Proportion of Regional DPI

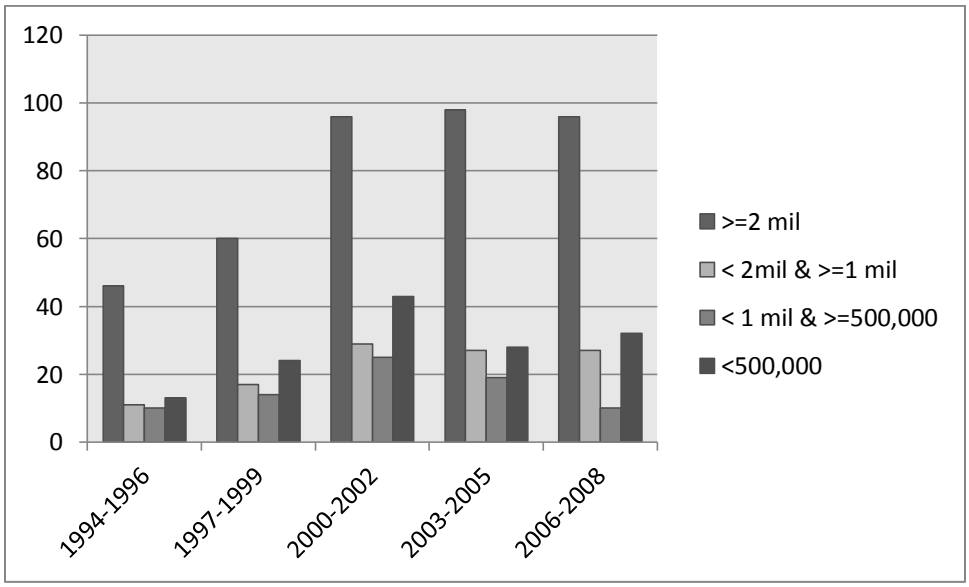


Notes: Project costs adjusted to 2005 dollars using fixed investment nonresidential GPDI indexes. DPI figures adjusted to 2005 dollars using PCE indexes.
Source: McGraw-Hill Construction, Inc.; Bureau of Economic Analysis, U.S. Department of Commerce

Lastly, smaller metropolitan statistical areas (MSAs)[4] had relatively high first-time investment into cultural infrastructure as compared to their larger MSA counterparts (Figure 5).

[4] In the article, I define smaller MSAs as those with less than 500,000 in population, and larger MSAs as those with greater than two million in population.

Figure 5. Number of MSAs with At Least One Project by Population Category of MSA



Source: McGraw-Hill Construction, Inc.; U.S. Census Bureau, Population Division

The article came to a number of other conclusions about cultural infrastructure building between 1994 and 2008 as well[5], but the ones listed above were its primary findings (Woronkowicz 2011).

While the conclusions are illuminating, they do not provide insight into why the phenomena occurred. All we know from the article is between 1994 and 2008 the cultural infrastructure landscape changed. Therefore, this article's primary objective is to explain why the landscape of cultural infrastructure changed and whether there is evidence for overinvestment

[5] The article also concludes, "As compared to capital expenditures in selected social and entertainment sectors, investment into cultural infrastructure building was low, but the rate of change of investment into cultural infrastructure building was higher than or comparable to rates of change in other social and entertainment sectors, particularly between the years 1999 and 2003 … all regions had increases in the proportion of spending relative to regional gross domestic product (GDP) and disposable personal income (DPI), particularly between 1999 and 2003. All regions, except for the Northeastern region, invested more into PACs than museums and theaters. Large MSAs invested more into cultural infrastructure building than small MSAs, and large MSAs increased their investment into cultural infrastructure building over the years more than small MSAs … Finally, investment into privately-owned projects was greater than academic- and government-owned projects, and all ownership types increased their investment over time. Museums were mainly privately-owned; government and academic institutions pursued PAC projects more than they did museums and theaters. Furthermore, most regions invested more into government-owned projects as compared to academic projects. However, all regions had more private-owned projects than government- or academic-owned projects" (Woronkowicz 2011).

in this period. In other words, this article identifies the determinants of cultural infrastructure investment between 1994 and 2008.

Identifying the determinants of cultural infrastructure investment is important for many reasons. Being able to identify the reasons for why the cultural landscape changed provides insight into causal relationships between investment into cultural facilities and city dynamics which can be tested in future research. The current literature in urban policy focuses primarily on the impact of cultural investment on regional development. While this paper examines the alternative relationship – the effects of city dynamics on cultural investment – its purpose is partly to fill the wide gap between using descriptive statistics to test causal hypotheses in urban policy research and using multivariate inferential modeling which can control for confounding variables. Also, understanding how institutions made cultural building decisions can help establish feasibility guidelines for future projects. Nonprofit organizations – including cultural organizations – pursuing projects currently have limited resources to help understand capital facility development. This paper, and other similar in subject-matter, is among the first to aide practitioners in this domain. Finally, being able to identify the determinants of cultural building during a specific period holds an interesting history lesson for us – one that we can use to compare other periods in history when similar phenomena occurred (or will occur).

There are various hypotheses for the ebbs and flows of cultural infrastructure investment that occurred between 1994 and 2008. One may argue that fluctuating levels of investment were a result of the dot-com bubble that occurred in the mid-to-late 1990s, or the economic bubble that occurred throughout the 2000s. The fruitful financial returns that many philanthropists enjoyed during these periods may have been translated into greater contributions for arts organizations across the country. Another may argue that the spike in cultural infrastructure investment was due to it frequently being used as an urban and regional development tool by cities across the country. Cultural investment as a means to stimulate regional economic growth is perhaps the most widely cited reason to invest into new facilities (Markusen 2010). However, cultural investment as a path to economic development really only became popular after 2002 after Richard Florida's creative class began to be published (Florida 2002). Therefore the timing of this and the cultural building spike that occurred between 1998 and 2003 do not directly coincide.

While there are various reasons for investing into culture, they are unfortunately coupled with fuzzy theories about investing, and little or no data. Attempts to test causal hypotheses about the effect of cultural investment on regional development have been made, however, these attempts do nothing more than show correlations between cultural investment and growth measures (often as "fuzzy" as the theories they are being used to test) (Pratt 1997; Currid 2006; Markusen and Schrock 2006). Cities around the country continue to use impact arguments based on these hypotheses for making enormous investments into cultural facilities, even though they do not have strong evidence for the benefits of investing. Cities risk squandering public resources, and seriously harming the health of their cultural sectors by continuing to invest blindly. Already, all around the country, cities have struggled with failing cultural institutions, and have in some instances been forced to bail them out with public money, or worse, see their demise.

The study of cultural infrastructure in the U.S. was launched in 2008 by researchers at NORC at the University of Chicago in response to what appeared to be a building boom in the cultural sector coupled with institutions failing to make ends meet. At that time, we observed that cultural organizations around the country were increasingly investing large amounts of capital into infrastructure, and frequently running into financial difficulties post-project completion. Therefore, the goals were to study the landscape of cultural infrastructure during a specific time period, identify the direct impacts of building on cultural organizations that pursued projects, identify the indirect impacts of building on cultural organizations located near major building projects, and examine the strategic management decisions behind major building projects.

This article further examines the landscape of cultural infrastructure in the U.S. between the years 1994 and 2008 in order to illustrate what variables are associated with cultural building investment. I develop a model that helps explain the determinants of investment into cultural building. To test the model's hypotheses, I estimate the relationships between various demographic and economic variables using sixteen years of data on all MSAs in the U.S. From interpreting the results of the analyses, I provide insights into why the landscape of cultural infrastructure changed in cities across the country during this time and whether there was overinvestment.

First, I discuss the theory behind examining cultural infrastructure investment at the city level. While there are no tested theories about this subject, I draw from related theories about corporate firm-level investment, creative cities, and arts and cultural demand to posit a theory about the predictors of cultural investment. I also draw from other research in the study of cultural infrastructure and make assumptions about why we invest to inform the model. Next, I describe the data and empirical strategy I use to conduct the analyses. Finally, I show the results of the analyses, and discuss their implications for cities and the cultural sector.

II. A Theory of Investment into Cultural Infrastructure

I use a simple theory of investment—where the total level of per capita investment in city *i* and time *t* is equal to a function of a set of explanatory variables—to describe investment into cultural infrastructure at the city level.

$$I_{i,t} = f\,(K_{i,t-1}, L_{i,t-1}, r_t, C_{i,t-1}, D_{i,t-1}, E_{i,t-1}) \qquad (1)$$

Here, *I* represents total per capita investment, *K* and *L* represent capital and labor stock respectively, *r* is the interest rate, *C* represents a vector of cultural sector variables, *D*, demographic variables, and *E*, economic variables. The subscripts *i* and *t* represent MSA and year. I include lagged versions of all but one explanatory variable (*r*) on the right-hand side of the function.

The current literature about investment into infrastructure deals primarily with investment by profit-maximizing firms, but we can gain some insight into the investment behavior of nonprofit firms – which cultural institutions are primarily – as well by becoming acquainted with firm-level economic investment theory. The basis of all investment theory is the flexible accelerator model where investment is written in terms of the stock of capital in times *t* and *t-1*, and a lag between the time it takes a change in desired capital to be translated into a change into capital stock (Chenery 1952; Koyck 1954).

$$K_t - K_{t-1} = [1-\lambda]\,[K^*_t - K_{t-1}] \qquad (2)$$

K represents the actual amount of capital stock, *K** represents the desired amount of capital stock, and $(1 - \lambda)$ represents the lag between the time it takes a desired level of capital stock to be

translated into a change in actual stock. Commonly integrated with the flexible accelerator model is a model of replacement that helps provide an explanation of investment.

$$K_t - K_{t-1} = I_t - \delta K_{t-1} \tag{3}$$

Here, I represents per capita investment into capital stock and δ is some constant of depreciation. From combining equations (2) and (3), we have a model of investment expenditures.

$$I_t = [1-\lambda]\,[K^*_t - K_{t-1}] + \delta K_{t-1} \tag{4}$$

Investment theories for profit-maximizing firms generally determine the desired level of capital stock based on some proportionality to firm output (i.e. quantity, profit, or liquidity)[6]. This seems reasonable for profit-maximizing firms, but not so for non-profit organizations whose goal it is to maximize the delivery of mission. Therefore, the decision of how much capital stock the cultural firm desires can best be thought of as exogenous, and not part of the theory of investment into cultural infrastructure. Therefore, let equation (5) represent a more simplified version of the theory of investment.

$$I_t = K_t - K_{t-1}\delta \tag{5}$$

In equation (5), I have eliminated the lag structure and replaced $K^* - K_{t-1}$ with the current level of capital stock (K_t). In other words, I substitute the difference between the desired level of capital stock and the actual level of capital stock in time $t-1$ with the actual level of capital stock in time t. Therefore, I assume that the decision of how much to invest is made with respect to how much is desired. Applying this model at the city level requires a simple re-specification.

$$I_{i,t} = K_{i,t} - K_{i,t-1}\delta \tag{6}$$

Equation (6) shows that investment at time t in city i is equal to the difference of the level of capital stock at time t in city i and the level of capital stock in time $t-1$ in city i multiplied by some constant of depreciation.

[6] Various theories of investment assume proportionality to different output measures. Investment proportional to output is commonly referred to capacity utilization theory and is used by Chenery and Koyck. Different theories where investment is proportional to profit (liquidity theory) are proposed by Tinbergen in 1938, in addition to Meyer and Kuh in 1957, Anderson in 1964, Meyer and Glauber in 1964, and Kuh in 1963 (Jorgenson and Siebert 1968).

The above model illustrates that investment in time *t* is a function of the level of capital stock in time *t-1*. I also assume that investment is a function of all other variables in the function in time *t-1,* except for the interest rate. In other words, I assume that the decision to invest into cultural infrastructure in the current year depends on a variety of observable (and unobservable) variables in the previous year. I do not include a lagged variable for the interest rate in the investment function because I assume that the current interest rate is what matters to the investment decision and subsequent financing options.

III. Inclusion of Variables in the Investment Function

As stated above, there is currently no theory of investment into cultural infrastructure. Hence, I draw from other theories related to firm-level investment, creative cities, and arts and cultural demand. I also draw from other research in the study of cultural infrastructure, and I make assumptions about the determinants of investment to decide upon which variables to include in the cultural infrastructure investment function.

Parts of corporate investment theory assume that the desired level of capital stock is proportional to firm output, and firm output is modeled by the production function which typically includes capital and labor stock as inputs. Therefore, I include both capital and labor stock in the cultural infrastructure investment function. The following rationale is also sensible. The existing level of cultural capital stock has an impact on cultural infrastructure investment decisions since the existing level of stock is in essence the current supply of cultural infrastructure. For example, if a city already plays host to one major PAC, ten theaters and five museums all located in a downtown area, then the decision to invest into a new cultural facility is constrained by how much demand there is for a new facility. If this is true, then we would expect that the more capital stock a city has, the less it invests. Or it may be that a city with a large lot of capital stock has a greater need to update or replace that stock due to the depreciation of it; therefore, it may be that the relationship between capital stock and investment is positive[7].

In terms of labor stock, we can expect that as organizations grow in size and programmatically, so do their staff capacity needs. Consequently, the more workers an

[7] The data I use aggregates new construction projects with additions and renovations. Therefore, I am not able to estimate the effect of capital stock on new investment and replaced/updated investment separately.

organization needs to hire, the more physical infrastructure it needs to house these workers. However, the opposite may be true if more investment into physical infrastructure means organizations have less to invest into human resources due to unforeseen operating costs and organizational budgetary constraints[8]. Quite frequently, organizations that invest into physical capital must trim their staff post-project opening when they are met with greater than predicted operating expenses. The results from the cultural infrastructure project's survey of directors of fifty-six organizations that invested into cultural building projects showed that many organizations laid off staff post-project opening due to these types of budgetary constraints[9]. Therefore the relationships between investment and capital stock and investment and labor stock are ambiguous.

I also include the number of artists in a city as a measure of cultural labor stock. While not all artists work in cultural facilities, many do by being actors in plays, musicians in orchestras, or singers in operas. Moreover, it is performance artists – not visual artists – who most frequently work within facilities. Visual artists generally exhibit work in galleries or alternative spaces such as residential loft spaces and restaurants[10]. Rarely do we see local visual artists who exhibit work in a museum. Museums typically display works of art by either extremely well-established or deceased artists. Since there was greater investment into performance facilities than museums during this period, we can expect that the effect of the number of artists in a city on investment will be positive.

In the survey of directors, we found one of the primary reasons to build a new facility or renovate an existing facility for PACs and theaters was to provide space to community arts groups[11]. However, this was not true in the case of museums. Not surprising, considering that museums typically do not function as homes to multiple arts organizations but rather, display works of art by individual artists. Again, since the period between 1994 and 2008 exhibited greater investment in terms of performance facilities, I hypothesize that the more arts groups there are in a city, the greater the need for physical infrastructure. Therefore, we can expect that

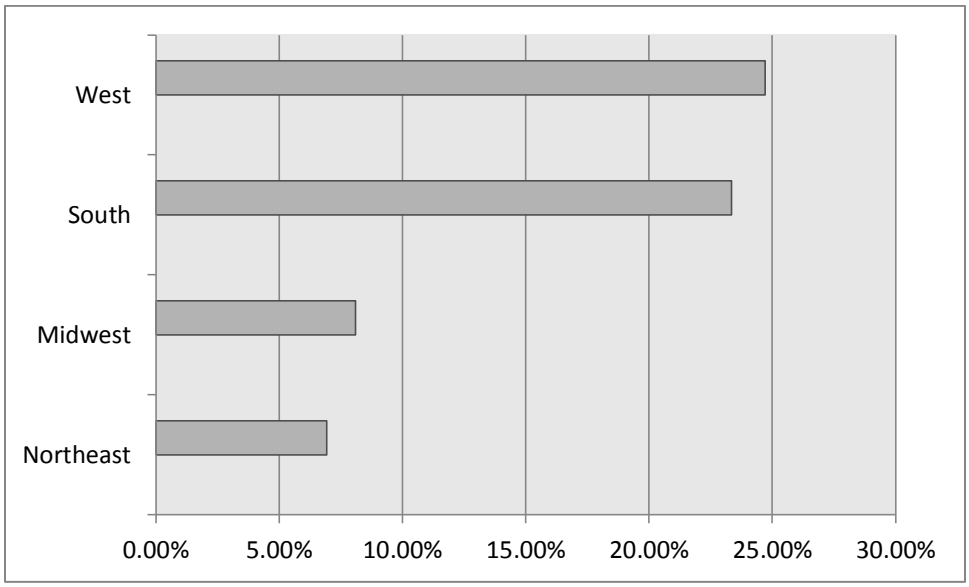
[8] This reasoning is more in line with the economics literature that generally treats capital and labor as substitutes.
[9] 28 out of 56 organizations stated "budget cuts" as part of their organization sustainability plan post-project completion. Included within budget cuts were staff layoffs.
[10] Galleries and alternative spaces do not fall within our definition of cultural infrastructure.
[11] Approximately 15 out of 37 PACs and theaters indicated that one of the primary reasons for pursuing the project was to provide a home for a resident arts group or provide space for community arts groups to perform.

the relationship between investment and the number of cultural organizations in a city will be positive.

One must also take into account the financial health of the cultural sector when contemplating the decision to build since in addition to using borrowed funds for a project, most projects depend on some portion of the organization's revenue – both earned (i.e. ticket revenue) and unearned (i.e. contributions). Before most cultural facility projects begin, a fundraising campaign of some sort usually occurs to generate needed funds for the capital project. Many organizations in the survey of directors experienced higher than average net income levels in the year prior to breaking ground. Hence, it would make sense to observe some measure of net income across all cultural organizations in a city in the year prior to when the investment decision was made in order to assess the financial health and readiness of the cultural sector before building begins. I hypothesize that the greater the level of MSA total net income (measured as the sum of all cultural organizations' revenue in an MSA minus the sum of all organizations' expenses), the more financially healthy and ready a city is to begin a building project.

I include population change as a demographic input in the investment function based on a previous paper that concludes there was more building in the south (Woronkowicz 2011). Figure 6 shows the percentage by which each region's population increased between 1994 and 2008. It is clear from the graph that there was a larger change in population in the southern region than in any other region.

Figure 6. Percentage Increase in Population between 1994 and 2008 by Region



Source: U.S.Census Bureau, Population Division

I also include population level as a control since we would expect that the larger the city is in population, the more it would invest into cultural infrastructure. Table C shows that three out of the five top investing cities are also the three largest MSAs in the U.S. However, there could also be economies of scale that take place across cities of different sizes. All in all, we should expect to see a positive relationship between population change and investment controlling for population level.

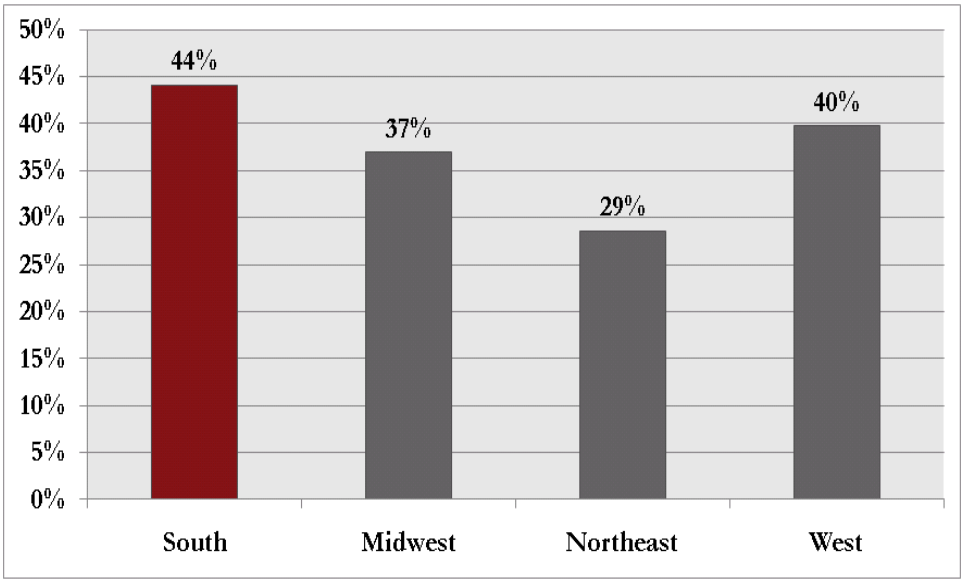
Table C. Top 5 MSAs by Total Investment and Population

Total Cultural Infrastructure Investment	2000 Population
New York-Northern New Jersey-Long Island, NY-NJ-PA	Los Angeles-Long Beach-Santa Ana, CA
Washington-Arlington-Alexandria, DC-VA-MD-WV	New York-Northern New Jersey-Long Island, NY-NJ-PA
Los Angeles-Long Beach-Santa Ana, CA	Chicago-Naperville-Joliet, IL-IN-WI
Chicago-Naperville-Joliet, IL-IN-WI	Philadelphia-Camden-Wilmington, PA-NJ-DE
Miami-Fort Lauderdale-Miami Beach, FL	Dallas-Fort Worth-Arlington, TX

Notes: Investment adjusted to 2005 dollars using fixed investment nonresidential GPDI indexes.
Source: McGraw-Hill Construction, Inc.; Bureau of Economic Analysis, U.S. Department of Commerce; U.S. Census Bureau, Population Division

I include other demographic variables based on theories of arts and cultural demand and the creative city literature. The demographic variables I include are a measure of how educated a city is, how young the population is, and the number of same-sex partners who live in a city. It is widely known throughout the cultural economics literature that education is the best predictor of cultural attendance. Numerous studies have shown evidence for this statement across the years (Globerman 1989; Heilbrun 2001; Gray 1998; Peterson 2000; Ford Foundation 1974; National Endowment for the Arts 2004). We also saw greater increases in education levels in the southern region which could help explain why this region saw greater levels of investment (Figure 7). Therefore we can expect that a city's education level will influence investment into cultural facilities.

Figure 7. Growth in Percent of Population with at Least a B.A. by Region from 1990 to 2000



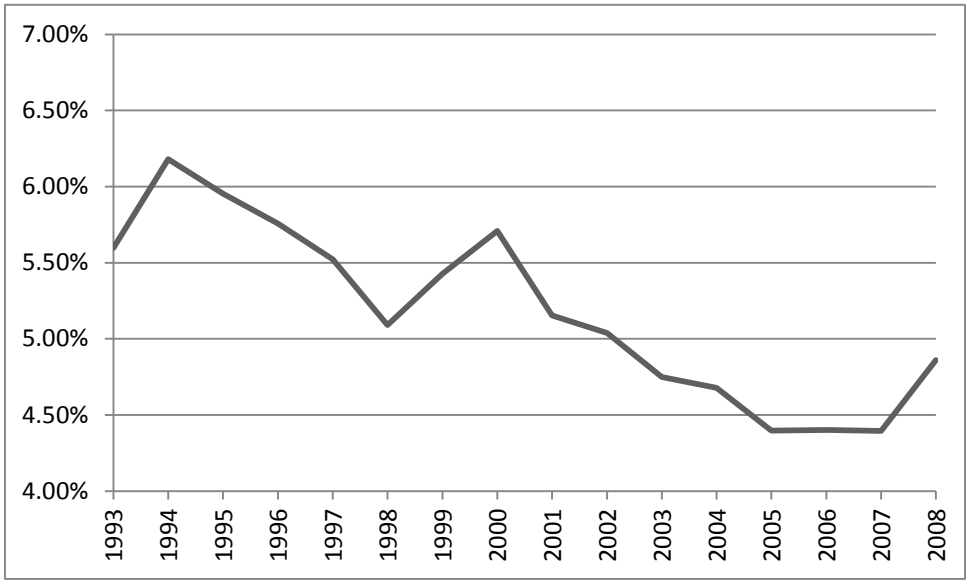
Source: U.S.Census Bureau, Population Division

In his work on creative cities, Richard Florida posits that populations of young working people help drive creative cities, and the higher the number of gay persons in a city (the "gay" index), the more creative that city is (Florida 2002). I include measures of both as controls[12].

I include median household income, the interest rate, and the health of the stock market as economic inputs. The reasoning behind including the interest rate in the investment function is obvious. Since borrowing increases when rates decrease, we can expect to see greater investment with lower rates. Figure 8 shows the trend in the average annual state and local bond interest rate from 1993 to 2008. Since many cultural infrastructure projects used borrowed money in the form of bank loans and bonds[13], we can expect the interest rate is a determinant of the investment decision.

[12] Since my objective is not to confirm or argue with the Florida's hypotheses, I choose not to focus on these last two demographic variables as variables of interest.
[13] Out of the 56 organizations surveyed, approximately 19 used bonds to help fund their project.

Figure 8. Annual Average Interest Rate for State and Local Bonds



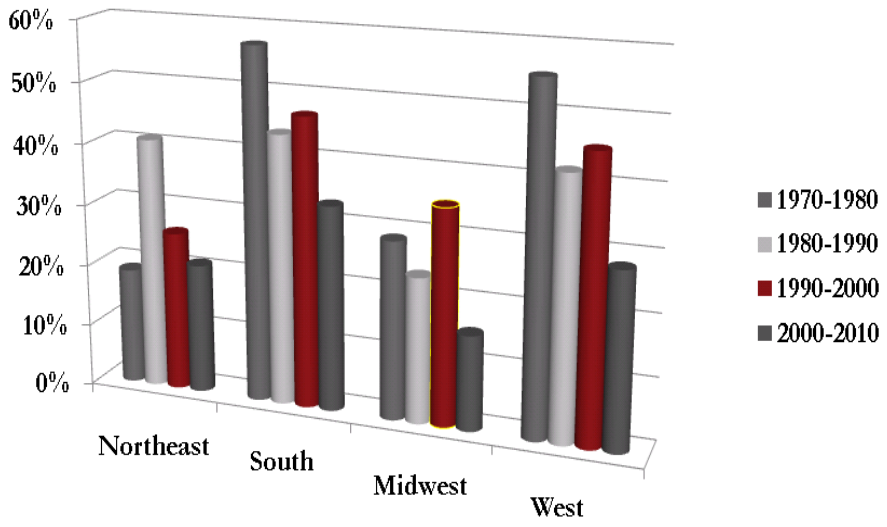
Source: Board of Governors of the Federal Reserve System

Income has also been shown to have a positive effect on cultural attendance[14]. Based on the same reasoning as stated above in regards to education (income is widely known to be a predictor of cultural demand and there were greater increases in income in the southern region (Figure 9) we can expect that income to have a positive effect on investment. However, income is even more important to cultural infrastructure investment than it is to cultural attendance. Since many cultural infrastructure projects are largely funded by private donations, we expect that a greater availability of funds from private donors will increase the level of investment. Measuring the wealth level of a city is relatively uncomplicated, but measuring the so-called "arts wealth", or the wealth of those who donate to the arts, is more complicated. In reality, it is usually the wealthiest portion of the population that donates to cultural organizations. In that respect, a more appropriate measure of arts wealth would be the number of people or percentage of the population that falls into the highest income categories. Since to my knowledge no measure of this kind exists for all MSAs in the U.S., I use the best measure I could locate:

[14] The same studies that cite education as a predictor of arts attendance also show income as a significant predictor, though the high correlation between education and income makes it difficult to separate out the individual effects (Seaman 2006)

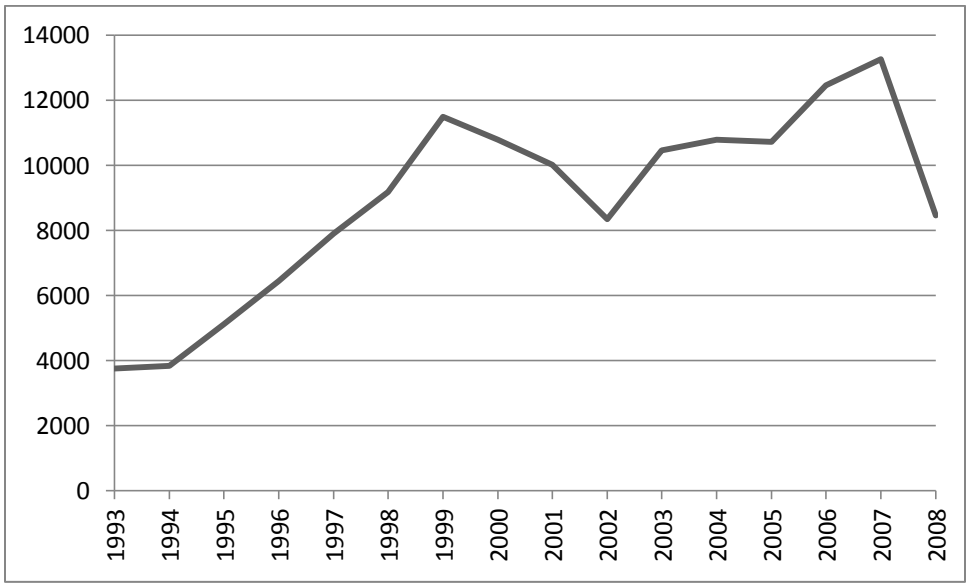
median household income. Even with using this crude measure of arts wealth, I hypothesize that income and investment move in the same direction.

Figure 9. Growth in Disposable Personal Income by Region: 1970-2010



A final economic variable to consider as being part of the investment function is a measure of how the stock market was doing. As previously suggested, investment increases may have partly been due to the growth of the stock market. If the stock market was doing well, then we can hypothesize that its beneficiaries had more money to donate to cultural infrastructure projects. Figure 10 shows the closing level of the Dow Jones Industrial Index between 1993 and 2008. From 1994 until 1998, there was a sharp increase in the value of the index. Since this period precluded the boom period when investment into cultural facilities was the greatest, we can expect that the relationship between investment and the Dow Jones index will be positive.

Figure 10. Dow Jones Industrial Index at Close of Year



Source: Dow Jones Industrial Index

IV. Measurement of Variables in the Investment Function

The task of measuring variables in the cultural investment function was a difficult one due to a lack of data on cities and cultural sectors. Data of cities are generally difficult to locate – especially data before the year 2000 – or have consistency problems across datasets and years. For this reason, I do not include many variables I believe are also a part of the investment function simply because I was not able to measure them, or I include variables that are not ideal measures of inputs. For example, tourism is certainly associated with cultural infrastructure investment, but I could not locate tourism statistics at the city-level. As previously mentioned, median household income may not be the best way to measure a city's wealth, but it is the best measure that is available at the city-level. Therefore, for some measures, I turn to imputation in order to be able to estimate the model. The data I do use to measure variables in the cultural infrastructure investment function are building permit data from McGraw-Hill Construction, Inc., U.S. Census and American Community Survey (ACS) data, Federal Reserve data, Dow Jones Index data, and data from the National Center for Charitable Statistics (NCCS)[15]. Table D

[15] Appendix A lists all variables, how they were measured, and their data source.

lists each input in the investment function, how it is measured and the expected direction of its relationship with per capita investment.

Table D. Inputs, Measures, and Hypotheses of Relationships

Inputs	Measures	Hypotheses
I = Per Capita Construction Cost	construction cost	
K = Capital Stock	number of existing cultural facilities	$\frac{dI}{dK} \geq 0$ or $\frac{dI}{dK} \leq 0$
L = Labor Stock	number of arts managers; number of artists	$\frac{dI}{dL} \geq 0$ or $\frac{dI}{dL} \leq 0$
r = Interest Rate	average interest rate	$\frac{dI}{dr} \leq 0$
C = Cultural Sector Variables	number of arts orgs; MSA total net income	$\frac{dI}{dC} \geq 0$
D = Demographic Variables	population; population change; proportion of population that has at least a B.A., aged 21-35, lives with same-sex partner	$\frac{dI}{dD} \geq 0$
E = Economic Variables	median household income; Dow Jones closing index	$\frac{dI}{dE} \geq 0$

I use data on building permits from McGraw-Hill Construction, Inc. to measure per capita value of cultural infrastructure investment by year in each MSA. As mentioned above, the earliest year for which these data are available is 1994 and the latest is 2008. These data include information on every building permit that was issued in the U.S. between these years including the MSA in which the project was to take place, the proposed value of construction and start year[16], and other information including owner's name and contact information, architect's name and contact information, the address of the project, and in some cases, proposed total square footage[17]. Three categories – museums, theaters, and auditoriums[18]– were initially included in the dataset; these data were cleaned based on the study's definition of "cultural infrastructure" detailed earlier. Altogether, the data include 846 individual projects totaling approximately $16.5 billion 2005 dollars (Table E).

[16] This value is most likely far understated. Based on the results from a previous paper where I estimate the difference between the construction cost listed on the building permit and the actual final value of the project indicated by a project representative, the cost of museums was on average 69% greater than what was listed on the building permit, 82% greater for PACs and 18% greater for theaters.
[17] In the majority of observations, square footage is missing.
[18] I changed the label "auditorium" to "performing arts center" in the dataset.

Table E. Summary of Cultural Infrastructure Investment Data

Number of Projects	Number of MSAs	Project Value (2005 Dollars)
846	180	$16,487,390,837

Notes: Investment adjusted to 2005 dollars using fixed investment nonresidential GPDI indexes.
Source: McGraw-Hill Construction, Inc.; Bureau of Economic Analysis, U.S. Department of Commerce

To measure the level of capital stock (*K*) and labor stock (*L*), I use Census County Business Patterns data between 1993 and 2008. For the years 1993 through 1997, I totaled up the number of establishments[19] with at least twenty employees in Standard Industrial Classification (SIC) codes 7900 ("Amusement and Recreation Services") and 8400 ("Museums, Botanical, and Zoological Gardens") to measure capital stock; from 1998 to 2008 I totaled up the number of establishments with at least twenty employees in the North American Industry Classification System (NAICS) code 71--- ("Arts, Entertainment, and Recreation")[20]. I use the same system to measure labor stock, but instead of establishments, I totaled up the number of employees in establishments with at least twenty employees[21].

I use Census and ACS data to count the number of artists in each city; specifically, I use occupational codes in decennial Census data for the years 1990 and 2000 and ACS data for the years 2001 through 2008 (Minnesota Population Center). While there may be some overlap between the number of artists and number of cultural workers (cultural stock), this is most likely minimal since artists typically do not work as full-time or part-time employees of organizations – rather they work on a contractual basis. Since data are not available between the years 1990 and 2000, I interpolate values based on total MSA population data[22]. While choosing the type of artist occupation to include in a total count of artists is often a controversial topic, I keep the

[19] "An establishment is a single physical location at which business is conducted or services or industrial operations are performed. It is not necessarily identical with a company or enterprise, which may consist of one or more establishments" (U.S. Census Bureau, County Business Patterns).
[20] Since the SIC codes do not allow for disaggregation within the major code, I aggregated the total amount of establishments and employees across major codes instead of across sub-codes that were more related to cultural infrastructure . The NAICS system does allow for disaggregation within the major code, but in order to maintain consistent measures across years, I aggregated across major codes.
[21] "Paid employment consists of full- and part-time employees, including salaried officers and executives of corporations, who are on the payroll in the pay period including March 12. Included are employees on paid sick leave, holidays, and vacations; not included are proprietors and partners of unincorporated businesses" (U.S. Census Bureau, County Business Patterns).
[22] Interpolation involves running an OLS regression of the interpolated variable on a non-missing variable (in this case, population) and generating a new variable that is a linear prediction of the interpolated variable.

method simple and only include those artist occupations that would be most associated with museums, theaters, and PACs; artists within the occupations I chose had the greatest probability of actually using these facilities. The occupation codes I include are the following: in 1990, I include occupation codes 186 ("Musicians and composers"), 187 ("Actors and directors"), 188 ("Painters, sculptors, craft artists, and artist printmakers"), 193 ("Dancers), and 194 ("Artists, performers, and related workers n.e.c."). From 2000 to 2008, I include the following occupation codes: 260 ("Artists and related workers"), 270 ("Actors"), 271 ("Producers and directors"), 274 ("Dancers and choreographers"), 275 ("Musicians, singers, and related workers"), and 276 ("Entertainers and performers, sports and related workers, all other")[23].

I use data from NCCS to measure cultural sector (*C*) variables. In order to count the number of cultural organizations in each MSA, I extracted Internal Revenue Service (IRS) 990 financial information for all organizations that filed taxes in a given year. I use National Taxonomy of Exempt Entity (NTEE) codes to identify organizations that were most closely related to our definition of cultural infrastructure in that they were organizations most likely to make use of cultural facilities. They are the following: A40 ("Visual Arts"), A51 ("Art Museums"), A54 ("History Museums"), A61 ("Performing Arts Centers"), A62 ("Dance"), A63 ("Ballet"), A65 ("Theater"), A68 ("Music"), A69 ("Symphony Orchestras"), and A6A ("Opera") (National Center for Charitable Statistics). To measure the financial health and readiness of the cultural sector to begin building, I use the total net income of all cultural organizations in the specified NTEE codes for each MSA[24].

I use demographic data from the 1990 and 2000 decennial censuses, as well as from the ACS to measure demographic variables including MSA population, the proportion of people with at least a bachelor's degree, the proportion of people between the ages of twenty-one and thirty-five, and the number of persons who indicate their relationship to the household head is "unmarried partner." Included within the proportion of people with at least a bachelor's degree is all those who indicated that they received a bachelor's degree, master's degree, professional degree beyond a bachelor's degree, or a doctoral degree (Minnesota Population Center). Similar

[23] While it was not ideal to include occupation code 276, I found doing some to be the best way to maintain consistency across years when the occupational categories changed. The number of artists in occupation code 276 was negligible.
[24] All dollar figures are adjusted to 2005 dollars using consumer price indices (United States Department of Labor, Consumer Price Index).

to the case of measuring the number of artists in a city, demographic data, except for population, were not available between the years 1990 and 2000. Therefore, I use the same interpolation method as described above to fill in missing values for demographic variables extracted from Census and ACS datasets.

Finally, to measure the wealth of an MSA, I use median household income data from the 1990, 2000, and 2001-2008 Census and ACS[25]. I interpolate where there are missing values. While this measure does not directly measure arts wealth, it is the most complete measure that exists for measuring the wealth of an MSA.

Measuring the interest rate was relatively simple. I use annual average interest rates documented by the Federal Reserve (Board of Governors of the Federal Reserve System). While generally, the choice of which interest rate to use does not make a difference in analysis over time since interest rate fluctuations are all quite similar, I use the average annual state and local bond interest rate since many cultural infrastructure projects utilize bonds for funding their projects. I use closing Dow Jones Industrial index values to measure the health of the stock market.

Table F shows summary statistics for all variables in the cultural infrastructure investment function. Table G. shows summary statistics for all variables in the period between 1998 and 2003, identified in my previous article as having the most heightened level of building (the boom period)[26] and Table H shows summary statistics for the full-panel excluding the boom period. I perform three separate analyses in order to test my hypothesis that there was overinvestment in the boom period. Evidence of overinvestment would include coefficients in the opposite direction than hypothesized. Non-significant coefficients could also be evidence for overinvestment since we would assume that certain variables that help measure demand for cultural facilities should indeed act as significant determinants. First, I run the model on the full sixteen years of data (1993-2008), then on the boom period (1998-2003), and finally on the full sixteen years excluding the boom period (1993-1997 and 2004-2008).

[25] Median household income data is adjusted for inflation to 2005 dollars using consumer price indexes (CPI).
[26] Even though I identified the year 1998 to 2001 as having the most heightened level of building in my previous article, here I use the year 1998 to 2003 here in order to gain more power in my analysis.

Table F. Summary Statistics for Cultural Infrastructure Investment Function Variables (1993-2008)

Variable	N	Mean	Standard Deviation	Min	Max
Per Capita (PC) Investment	4305	$3.29	$16.66	$0	$348.56
PC Capital Stock (10000s)	4574	2.5	1.9	0	16.3
PC Arts Managers (1000s)	3427	5.4	3.4	0.04	39.8
PC Artists (1000s)	4592	2.2	1.2	0.1	11.2
PC Arts Orgs (10000s)	4192	1.2	4.6	.0021	116.9
MSA Net Income	3888	$7,131,816	$41,000,000	-$28,400,000	$1,380,000,000
Population	4592	762,454	1,640,683	56879	19,000,000
Population Change	4005	.06	.20	-.54	3.58
Proportion with B.A.	4592	.17	.05	.06	.40
Proportion Aged 21 to 35	4592	.21	.03	.11	.38
Proportion Same Sex Partner	4592	.02	.005	.003	.05
Median HH Income	4592	$50,194	$9010	$26,600	$108,842
Interest Rate	4592	5.18	.58	4.40	6.18
Dow Jones Closing Index	4592	8940	2813	9754	13,264

Notes: All dollar figures adjusted to 2005 dollars.

Table G. Summary Statistics for Cultural Infrastructure Investment Function Variables for Boom Period (1998-2003)

Variable	N	Mean	Standard Deviation	Min	Max
Per Capita (PC) Investment	1722	$4.01	$19.76	$0	$348.55
PC Capital Stock (10000s)	1719	3.4	1.8	0	16.3
PC Arts Managers (1000s)	1167	5.7	3.7	1.4	39.8
PC Artists (1000s)	1722	2.2	1.1	0.1	9.0
PC Arts Orgs (10000s)	1572	1.2	3.8	.0020	76.6
MSA Net Income	1458	$8,575,664	$52,300,000	-$28,400,000	$1,380,000,000
Population	1722	763,716	1,646,971	57,115	18,700,000
Population Change	1422	.16	.30	-.48	2.89
Proportion with B.A.	1722	.17	.05	.06	.40
Proportion Aged 21 to 35	1722	.21	.03	.11	.37
Proportion Same Sex Partner	1722	.02	.005	.003	.05
Median HH Income	1722	$52,050	$9604	$27,508	$108,843
Interest Rate	1722	5.19	.30	4.75	5.71
Dow Jones Closing Index	1722	10,047	1039	8341	11,497

Notes: All dollar figures adjusted to 2005 dollars.

Table H. Summary Statistics for Cultural Infrastructure Investment Function Variables for Boom Period (1993-1997 and 2004-2008)

Variable	N	Mean	Standard Deviation	Min	Max
Per Capita (PC) Investment	2583	$2.80	$14.20	$0	$344.81
PC Capital Stock (10000s)	2855	2.0	1.7	0	15.1
PC Arts Managers (1000s)	2260	5.3	3.3	.04	25.4
PC Artists (1000s)	2870	2.2	1.2	0.1	11.2
PC Arts Orgs (10000s)	2620	1.2	5.1	.0021	116.9
MSA Net Income	2430	$6,265,508	$32,500,000	-$16,800,000	$567,000,000
Population	2870	761,698	1,637,186	56,879	19,000,000
Population Change	2583	.01	.08	-.54	3.58
Proportion with B.A.	2870	.18	.05	.06	.40
Proportion Aged 21 to 35	2870	.21	.03	.13	.38
Proportion Same Sex Partner	2870	.02	.006	.004	.05
Median HH Income	2870	$49,080	$8441	$26,600	$92,951
Interest Rate	2870	5.17	.66	4.40	6.18
Dow Jones Closing Index	2870	8276	3292	3754	13,265

Notes: All dollar figures adjusted to 2005 dollars.

V. Empirical Strategy to Estimate the Relationship between Inputs and Output

I use a two-part model in conjunction with panel data analysis methods to estimate the relationship between variables in the cultural infrastructure investment function and total investment. The two-part model has its origins in meteorology, but is now commonly used in health economics. Economists in that field use it specifically to deal with the structure of demand for healthcare data, which commonly includes a large number of observations clustered at zero. In healthcare data, a substantial portion of the population will not use any type of health care in a given year, and out of the portion that does, a small fraction accounts for a substantial part of the average expenditures (Deb 2011). I model the determinants of investment using a two-part model because the same is true for investment into cultural infrastructure. A small proportion of cities actually invest into infrastructure in a given year (Table I). However, out of those cities that do invest, a small fraction makes up a large portion of average expenditures.

Table I. Description of Panel Dataset

N	n	T	pcinvest > 0	pcinvest = 0
All Years (1993-2008)				
4305	287	16	543 (12.6%)	3762 (87.4%)
Boom Period (1998-2003)				
1722	287	6	224 (13.0%)	1498 (87.0%)
All Years Excluding Boom Period (1993-1997 and 2004-2008)				
2583	287	10	471 (18.2%)	2112 (81.8%)

Notes: N = total person-year observations, n = person observations, T = year observations, pcinvest = total per capita investment

Table J shows the top ten MSAs that invested into cultural infrastructure. These MSAs made up 44% of the total investment between 1994 and 2008.

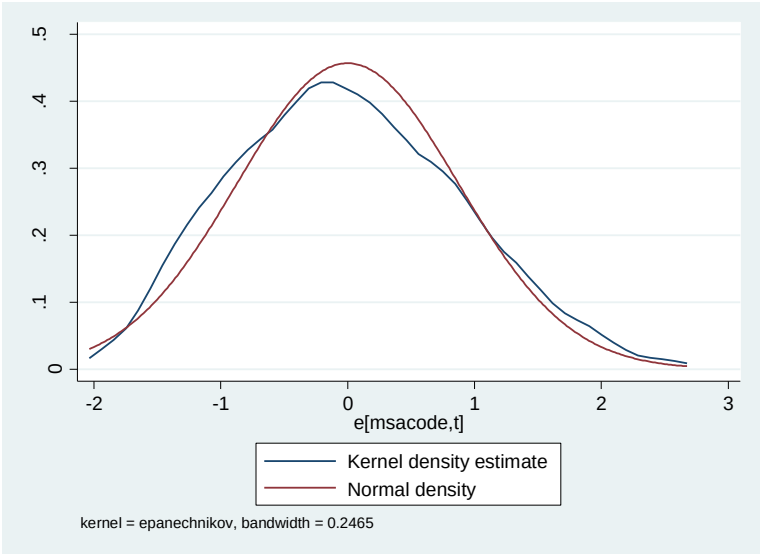
Table J. Top 10 MSAs in terms of Cost of Projects

MSA	Total Cost of all Building Projects
New York-Northern New Jersey-Long Island, NY-NJ-PA	$1,516,082,700
Los Angeles-Long Beach-Santa Ana, CA	$929,959,810
Chicago-Naperville-Joliet, IL-IN-WI	$848,998,170
Miami-Fort Lauderdale-Miami Beach, FL	$662,975,700
Washington-Arlington-Alexandria, DC-VA-MD-WV	$569,779,770
San Francisco-Oakland-Fremont, CA	$546,018,950
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	$503,209,640
Seattle-Tacoma-Bellevue, WA	$433,193,050
Dallas-Fort Worth-Arlington, TX	$402,177,420
Minneapolis-St.Paul-Bloomington, MN-WI	$350,087,210

Notes: Project costs adjusted to 2005 dollars using fixed investment nonresidential GPDI indexes.
Source: McGraw-Hill Construction, Inc.; Bureau of Economic Analysis, U.S. Department of Commerce

There are many variants of the two-part model, but I use one in particular because of the distribution and variance structure of the residuals. First, by transforming the dependent variable, I can assume normality[27] (Figure 11).

Figure 11. Kernel Density Estimate of OLS Regression Conditional on Positive Outcome

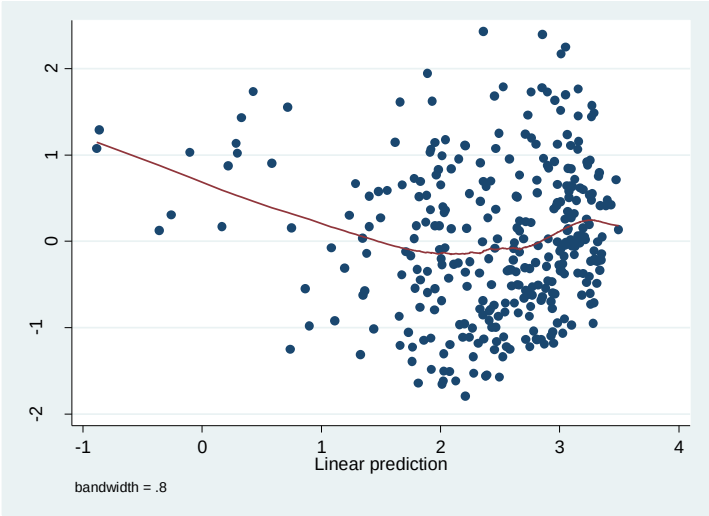


Second, I conclude that the variance is homogenous (Figure 12). Thus, I use a two-part model to explain investment where the first part is a logit model and the second part is an OLS model[28].

[27] The results from a Box-Cox regression show that λ = -.07 (significant at the 10% level) and I conclude that a natural logarithm transformation of the dependent variable is appropriate (Box 1964).

[28] There are different variants of the two-part model based on whether there is heteroskedasticity and the distribution is normal. For example, if the residuals are non-normal, Naihua Duan developed a consistent way to estimate the retransformed dependent variable (Duan 1983). See Deb, 2011 for a discussion of each variant.

Figure 12. Residual Plot OLS Regression Conditional on Positive Outcome



The panel dataset is clustered by MSA (*i*) and each MSA has *t* years of data. The person observation is MSA (identified by Census MSA and Core Based Statistical Areas (CBSA) codes)[29], and the time observation are years 1993 through 2008. The complete panel dataset has sixteen years (1993-2008) of data for each MSA. The dataset includes 287 unique MSAs. As mentioned above, I also analyze the period with the greatest level of investment – the boom period – and the full panel excluding the boom period in order to see if the relationships between function inputs and output are different than those estimated using the full panel.

By using a two-part model, I can deal with the problems of having a mass of zeros and a highly skewed distribution in two separate parts. The first part of the model deals with the first problem, while the second part of the model deals with the second problem, essentially breaking the model apart into two smaller problems. In sum, the two-part model estimates the expectation that the dependent variable *y* conditional on a vector of explanatory variables *x* is equal to the probability of the outcome being greater than zero conditional on *x* times the expectation of the outcome conditional on a vector of covariates and the probability that the outcome is greater than zero (equation 7). In the model, the outcome *y* is per capita investment ($pcinvest_{i,t}$) and the covariates *x* are capital stock ($K_{i,t-1}$), labor stock ($L_{i,t-1}$), artists ($art_{i,t-1}$), interest rate (r_t), arts

[29] In 2000, the Office of Management and Budget (OMB) replaced MSAs with CBSAs. Most data in the dataset – except for County Business Patterns Data – contain MSA codes. I matched MSAs to CBSAs according to their labels when matching County Business Patterns data. See the Census Bureau's description of Metropolitan and Micropolitan Statistical Areas on their website (U.S. Census Bureau, Metropolitan and Micropolitan Statistical Areas).

organizations ($org_{i,t-1}$), median net income ($netinc_{i,t-1}$), population ($pop_{i,t-1}$), population change ($popchg_{i,t-1}$), the proportion of persons with at least a bachelor's degree ($p_babetter_{i,t-1}$), the proportion of persons between the ages of twenty-one and thirty-five ($p_age_2135_{i,t-1}$), the proportion of those who indicated "unmarried partner" on their Census form ($p_gay_{i,t-1}$), median household income ($hhincome_{i,t-1}$), and the annual closing value of the Dow Jones Industrial Index ($dj_close_{i,t-1}$)[30]. For simplicity, I drop the subscripts in the equations.

$$E\,[y \mid x] = \Pr\,(y > 0 \mid x) \cdot E\,[y \mid x, y > 0] \tag{7}$$

In part one, I model the probability that the outcome y is positive using a logit equation.

$$I_{[y>0]} = x\beta + \eta \tag{8}$$

The outcome y is positive if the indicator function I is positive, β is a vector of parameters to be estimated, and η is a logistically distributed error term[31]. In part two, I model the expectation of y based on a subset of data where the indicator function I is positive. With the log transformed dependent variable, the equation of the second part of the model is shown in equation (9).

$$\ln\,(y \mid y > 0, x) = x\alpha + v \tag{9}$$

where v is i.i.d. for $y > 0$.

I calculate the expectation of y conditional on explanatory variables in the cultural infrastructure investment function.

$$E\,[y \mid x] = \frac{1}{1 + e^{-x\beta}} \cdot \exp\,(x\alpha) \cdot \exp\,(0.5\tau^2) \tag{10}$$

where τ^2 is the variance of the normal error v. Equation (10) takes into account the retransformation necessary to interpret the expectation (Deb 2011)[32]. Finally, I calculate the marginal effects that result from using a two-part model.

[30] I include r, $p_age_2135_{I,t-1}$, $p_gay_{i,t-1}$, and $djclose_{i,t-1}$ and $pop_{i,t-1}$ as controls, not as variables of interest. Therefore I do not discuss the results of each.

[31] The main difference between a normally and logistically distributed error term is that the latter has more weight in the tails (Johnston 1997).

[32] If X is a lognormal distributed random variable, then $E\,(X) = e^{\mu + 0.5\sigma\text{^}2}$.

$$p = \Pr(y > 0 \mid x) = \frac{1}{1 + e^{-x\beta}} \tag{11}$$

$$ME_p = \frac{\partial (\Pr[y > 0 \mid x] \cdot E[y \mid x, y > 0])}{\partial x} \tag{12}$$

$$= [p]\,[\alpha_x e^{x\alpha} 0.5\tau^2] + [\beta_x\, p\,(1\text{-}p)] + [e^{x\alpha} 0.5\tau^2] \tag{13}$$

$$= p e^{x\alpha} 0.5\tau^2\,(\alpha_x + \beta_x (1 - p)) \tag{14}$$

$$= E[y \mid x, y > 0]\,(\alpha_x + \beta_x (1 - p)) \tag{15}$$

VI. Findings from the Analysis of the Relationship between Inputs and Output

Using a two-part model, I estimate the relationship between per capita investment and a vector of covariates, indicated in equation (1). For the first part, I estimate the probability of per capita investment being positive using a logit model, and for the second part, I estimate the expectation of the continuous version of per capita investment conditional on per capita investment being positive using OLS. First, I estimate the model on the full-panel using all sixteen years of data. Then I estimate the model on the boom period (1998-2003), and then again on the full-panel excluding the boom period (1993-1997 and 2004-2008) to see if the relationships differ. Throughout the analyses, I vary the use of region (South, Midwest, Northeast, West) dummies and size of MSA (small (under two million in population) and large (over 2 million in population)) dummies. I do not report results from each part of the two-part model since neither part can be interpreted on its own; marginal effects must only be interpreted from combining each part in a two-part model. Furthermore, since marginal effects are a result of combining both parts of the model, I report bootstrapped standard errors[33]. Table K through Table M show the results which I discuss in the following section on implications.

[33] Bootstrapped standard errors are computed using 1000 repetitions.

Table K. Marginal Effects of Cultural Infrastructure Investment Function Inputs (Full-Panel) (Dependent Variable Per Capita Total Investment)

Variables	I	II	III	IV
Capital Stock	.11 (.09)	.12*** (.03)	.11** (.06)	.12* (.07)
Labor Stock (10s)	-.01 (.02)	-.02 (.01)	-.02 (.02)	-.02 (.02)
Artists (10s)	-.03 (.04)	-.03 (.02)	-.03 (.06)	-.03 (.05)
Arts Organizations	-.007 (.03)	-.002 (.06)	-.008 (.15)	-.004 (.11)
MSA Net Income (100,000s)	-.004 (.03)	-.01 (.04)	-.004 (.02)	-.01 (.03)
Population (1000s)	-.004 (.02)	-.004 (.02)	-.004 (.04)	-.005 (.07)
Population Change	26.83 (17.53)	25.53** (13.27)	27.11** (13.25)	26.39* (15.41)
Proportion with B.A. or Better	154.90*** (55.42)	177.56** (78.31)	159.51 (522.97)	186.69*** (66.24)
Proportion Aged 21 to 35	74.45 (175.76)	22.12 (166.74)	78.39 (147.37)	33.54 (108.91)
Proportion Same Sex Partner	485.15 (785.87)	508.30 (425.65)	460.74 (651.89)	471.65 (616.23)
Median HH Income (1000s)	1.75*** (.60)	1.69*** (.36)	1.76*** (.42)	1.74*** (.51)
Interest Rate	-3.36 (9.68)	-4.11 (9.64)	-3.57 (14.48)	-4.96 (11.69)
Dow Jones (100s)	-.35 (.29)	-.35 (.24)	-.36 (.33)	-.35 (.38)
Region Dummies		X		X
Size of MSA Dummies			X	X
N	2308	2308	2308	2308

Notes: Bootstrapped standard errors in parentheses; Standard errors clustered at the MSA level; *** = p < .01, ** = p < .05, * = p < .1.

Table L. Marginal Effects of Cultural Infrastructure Investment Function Inputs (Boom Period) (Dependent Variable Per Capita Total Investment)

Variables	I	II	III	IV
Capital Stock	.18 (.12)	.19 (.21)	.17** (.09)	.17 (.14)
Labor Stock (10s)	-.05 (.06)	-.05 (.05)	-.03 (.03)	-.04 (.04)
Artists (10s)	-.11 (.32)	-.11 (.33)	-.11 (.35)	-.11 (.56)
Arts Organizations	-.06 (2.87)	-.06 (1.60)	-.11 (1.65)	-.03 (1.71)
MSA Net Income (100,000s)	-.04 (.44)	-.02 (.43)	-.05 (.45)	-.03 (.44)
Population (1000s)	.01 (.05)	.02 (.07)	.01 (.06)	.02 (.02)
Population Change	17.01 (40.42)	32.54 (45.28)	14.40 (46.23)	32.00 (47.55)
Proportion with B.A. or Better	168.96 (172.02)	143.63 (158.56)	157.10 (165.23)	133.01 (150.93)
Proportion Aged 21 to 35	-85.69 (298.65)	-175.59 (288.10)	-94.45 (245.23)	-174.55 (275.68)
Proportion Same Sex Partner	2507.97 (3459.56)	2941.28** (1346.69)	2559.98 (3682.59)	2927.48 (3500.25)
Median HH Income (1000s)	1.80** (2.50)	1.50 (2.28)	1.88 (2.82)	1.53** (.72)
Interest Rate	-18.60 (316.87)	-35.80 (350.20)	-14.49 (319.22)	-34.69 (325.82)
Dow Jones (100s)	.17 (.58)	.27 (.69)	.15 (.65)	.30 (.76)
Region Dummies		X		X
Size of MSA Dummies			X	X
N	907	907	907	907

Notes: Bootstrapped standard errors in parentheses; Standard errors clustered at the MSA level; *** = p < .01, ** = p < .05, * = p < .1.

Table M. Marginal Effects of Cultural Infrastructure Investment Function Inputs (Full-Panel Excluding Boom Period) (Dependent Variable Per Capita Total Investment)

Variables	I	II	III	IV
Capital Stock	.23** (.14)	.17** (.09)	.17** (.09)	.14** (.08)
Labor Stock (10s)	-.04 (.09)	-.03 (.05)	-.03 (.05)	-.03 (.08)
Artists (10s)	.09 (.08)	.06 (.09)	.12 (.09)	.09 (.09)
Arts Organizations	.07 (.18)	.06 (.16)	.05 (.18)	.04 (.15)
MSA Net Income (100,000s)	.06 (.08)	.04 (.06)	.05 (.05)	.03 (.07)
Population (1000s)	-.03 (.09)	-.02 (.10)	-.004 (.02)	-.00082 (.02)
Population Change	159.30 (357.28)	103.53 (333.51)	111.33 (358.62)	78.97 (318.87)
Proportion with B.A. or Better	288.85* (188.25)	252.49* (152.95)	216.16* (110.12)	227.75* (122.94)
Proportion Aged 21 to 35	434.84 (354.25)	364.76 (268.69)	341.36 (226.52)	363.11 (252.95)
Proportion Same Sex Partner	-1525.01 (2026.28)	-696.10 (1058.23)	-1132.32 (2200.58)	-445.27 (1023.32)
Median HH Income (1000s)	3.68 (5.50)	3.43 (5.12)	2.85 (5.13)	3.00 (5.23)
Interest Rate	-28.47 (35.98)	-26.26 (33.45)	-27.65 (32.93)	-29.58 (35.41)
Dow Jones (100s)	-1.04** (.53)	-.85 (.92)	-.86 (.90)	-.80 (.92)
Region Dummies		X		X
Size of MSA Dummies			X	X
N	1401	1401	1401	1401

Notes: Bootstrapped standard errors in parentheses; Standard errors clustered at the MSA level; *** = p < .01, ** = p < .05, * = p < .1.

I adjusted the scale of some covariates in order to make the effects more interpretable. In the results, I focus on the direction of effects – not so much the magnitude – but interpreting effects is easier if they are greater than one cent (in most cases). Furthermore, from running the model with various specifications – for example, including and excluding different types of dummies, higher-order terms, and additional covariates – I am able to be somewhat confident of the direction of the effects even if the effects are not statistically significant. One of the limitations of the analysis no doubt is missing data which affects the power of my results. Statistically significant effects are of course desirable, but future research that builds upon my results as a basis for formulating a model can focus on a model of a more robust specification. Estimating the model in a variety of different ways and observing whether the results change from one specification to the next is in some sense a robustness check of the validity of the results. Again, I only discuss the results in regards to the variables of interest, not the controls[34].

VII. Implications for Cities and the Cultural Sector

In the following section, I discuss possible interpretations of the results from analysis and their implications for cities and the cultural sector. First I discuss the results which are in line with my hypotheses. Then I discuss those that are not, but from which we see differing effects across the three separate periods. We can interpret the effects in which the results are aligned with my hypotheses as being determinants of investment across the full-panel, and perhaps in regards to cultural facilities investment in general. In contrast, we can interpret the effects in which the results are not aligned as being specific to the heightened level of building that took place between 1998 and 2003 and consider whether they are evidence that there was overinvestment during this period.

I hypothesized that the effect of capital stock on investment would be either positive or negative. The primary reason for this ambiguity was that the data I use to measure investment include both new construction and renovations/additions. Therefore, I could not separate between the effects of capital stock on of each type of investment. It could be that more capital stock gives way to more investment in the form of renovations and additions, or that less capital

[34] I do however list the coefficient estimates and their standard errors in the appendix.

stock precipitates greater investment in the form of new construction. The estimated effects of capital stock on investment are positive and significant. Since the data include all types of investment, one interpretation of this result can be that the more capital stock a city has, the greater the need to replace and maintain it.

The theory of investment, presented earlier, includes a constant of depreciation (δ), but I do not explicitly include it in the analyses. Depending on what δ is equal to, this could change the magnitude of the effect. Specifically, the greater the rate of depreciation is, the larger the effect of capital stock on investment. Therefore, including a depreciation rate as part of the analysis would not change the direction of the effect of stock on investment, but it would change the magnitude. All in all, even accounting for depreciation, there is evidence for a positive relationship between capital stock and investment.

The effect of labor stock on investment is negative in all cases however, it is not statistically significant. Since I ran the model on a number of different specifications and the direction of the effect did not change, we can be somewhat confident the effect of labor stock on investment is negative. Therefore, it may be that labor stock is not a predictor of cultural investment or that in the cultural sector, increases in physical infrastructure go hand-in-hand with decreases in labor supply. When organizations overinvest, they divert funds from other organizational resources, such as human resources. Plenty of organizations, after completing a large-scale building project, must decrease staff sizes by laying off workers in order to stay within the constraints of their budget. This may be temporary for some organizations, and they may plan and be able to hire back staff after their financial situation stabilizes. However, recognizing this is important for any organization planning to embark upon a project. It may be that an organization has to make do with less human capital in order to accommodate its greater physical size.

Population change, education and median household income all are positive and significant predictors of cultural facilities investment according to the results of the model. The effect of each variable is significant even controlling for region and size of MSA. These results are not surprising given those from a previous paper which show that the southern region and smaller MSAs were investing at high rates during this time period. We also saw population,

education and wealth increases in these areas. Therefore, it may very well be that cultural investment is a response to population growth, education and wealth.

Where the results do not align with my hypotheses are in regards to the relationships between per capita investment and the number of artists, arts organizations, and MSA total net income. The directions of all these coefficients are negative and not statistically significant. In regards to the number of artists, it may be that the effect of the number of artists on investment is highly localized, and this is not fully captured by my measure. In order for artists to influence investment into facilities, a substantial portion of the population may have to locate in the specific neighborhood where investment takes place. Ann Markusen's work on "Artists' Centers" seems to suggest that this is the case (Markusen 2006). However, when I estimate the model on the boom period and then the full-panel excluding the boom period, I observe that the boom period may have influenced the full-panel results if we are to believe the directions of the coefficients across models.

The coefficient estimates on the number of artists, arts organizations and MSA total net income are all negative and greater in magnitude in the boom period than the estimates from running the model on the full-panel data. When I run the model on the full-panel excluding the boom period, the estimated coefficients are all in the expected direction – in other words, the directions change. Since the boom period's results are greater in magnitude, they may be outweighing the results from running the model on data of the surrounding years. Thus we have reason to believe that there was something unique going on during the boom period that caused there to be a misalignment of investment and its determinants

Since the effects are not statistically significant, it is difficult to say what really was going on during this period. However, as I mentioned above, the consistency of the results from varying model specifications suggests there are relationships between these variables and per capita investment which have important implications for cities and their cultural sectors. Moreover, even if we do not believe that consistency across models can serve as evidence, we can still interpret a result that is not statistically different from zero as evidence that there was a misalignment of investment and its determinants during this period. For the former case, we see that the relationship between the number of artists, arts organizations and MSA total net income is positive not taking into account periods of heightened investment. If artists and arts

organizations partly represent the demand for cultural facilities, then the results suggest that there may have been an oversupply of cultural facilities in this period. Similar are the findings in regards to the relationship between the total net income of all arts organization in a city and total per capita investment. The effect is positive, except in the boom period. If MSA total net income is a good proxy for cultural sector health and readiness to invest into a major capital project, then the results suggest that the cultural sector was over-strained during the boom period. Finally, in the latter case – the case where the effects of these variables on investment is zero – the findings still suggest that there was still at least a misalignment of investment and its determinants. If cultural facility investment was not being driven by an apparent need from the cultural sector, then how were we to be confident that the cultural sector could sustain these facilities after they were completed? As with any industry, supply and demand work in tandem; the findings in this analysis suggest that this was not the case during the boom period. All in all, there is reason to believe that the number of artists and arts organizations and the health of the cultural sector are all positive predictors of cultural facilities investments. A misalignment of investment and its determinants – as was exhibited in the boom period – suggests that there may have been overinvestment in this period and increases in the supply of cultural facilities did not occur as a response to an increase in cultural facility demand.

VIII. Conclusion

By looking at the relationship between investment into cultural infrastructure and other variables at the city-level, we gain insight into the rationale behind cultural building during the period studied. We also learn about how the current landscape of cultural infrastructure emerged.

Investment into the supply of cultural facilities exceeded the demand for them, particularly between 1998 and 2003. Consequently, cultural organizations in cities across the U.S. were faced with dilemmas about how to remain viable after indulging in capital projects. Using data for all MSAs across the U.S., I develop a model that explains the investment determinants of cultural building. I use a two-part model to estimate the effects of capital and labor stock, cultural, demographic, and economic variables on per capita total investment into cultural facilities. I estimate these effects for the period between 1994 and 2008, the period with the greatest level of building – the boom period (1998-2003) – and then the entire period

excluding the boom. My findings suggest that increases in investment were in part due to rising population, education and wealth levels. I present evidence for a positive relationship between the existing level of capital stock in a city and the amount it invests and a negative relationship between per capita investment and labor stock. Finally, I show that in the period between 1998 and 2003 – the boom period – there was a misalignment of investment and its determinants and suggest that there was overinvestment into cultural facilities during this period.

Many organizations that invested into cultural infrastructure projects between 1994 and 2008 still struggle to sustain themselves. Cities across the U.S. continue having to make decisions in regards to the longevity of these institutions. Hopefully, with more research about the investment determinants of cultural building, and a greater availability of data on cities and their cultural sectors, we can help decision-makers make better-informed decisions about future investment projects, leading to stronger and more sustainable cities and organizations.

References

Board of Governors of the Federal Reserve System. "State and Local Bonds." http://www.federalreserve.gov/releases/h15/data.htm (accessed June 9, 2011).

Box, G.E.P. and D.R. Cox. "An Analysis of Transformations." *Journal of the Royal Statistical Society*, 1964: 211-252.

Bureau of Economic Analysis, U.S. Department of Commerce. "Table 1.1.4. Price Indexes for Gross Domestic Product. Line 9 (Gross Private Domestic Investment; Fixed Investment; Nonresidential)." http://www.bea.gov/national/nipaweb/TableView.asp?SelectedTable=4&ViewSeries=NO&Java=no&Request3Place=N&3Place=N&FromView=YES&Freq=Year&FirstYear=1994&LastYear=2008&3Place=N&Update=Update&JavaBox=no#Mid (accessed November 23, 2010).

- National Income and Product Accounts Table. "Table 2.3.4. Price Indexes for Personal Consumption Expenditures by Major Type of Product. Line 1 (Personal Consumption Expenditures)." Accessed on November 23, 2010. http://www.bea.gov/national/nipaweb/TableView.asp?SelectedTable=64&ViewSeries=NO&Java=no&Request3Place=N&3Place=N&FromView=YES&Freq=Year&FirstYear=1994&LastYear=2008&3Place=N&Update=Update&JavaBox=no#Mid.

Chenery, Hollis B. "Overcapacity and the Acceleration Principle." *Econometrica*, 1952: 1-28.

Currid, E. New York City as a global creative hub: A competitive analysis of four theories on world cities. *Economic Development Quarterly*, 2006: 330–50.

Deb, Partha, Willard G. Manning, and Edward C. Norton. *Health Econometrics of Health Cost, Expenditure, and Use Data.* 2011.

Duan, Naihua, et al. "A Comparison of Alternative Models for the Demand for Medical Care." *Journal of Economic and Business Statistics*, 1983: 115-126.

Florida, Richard. *The Rise of the Creative Class.* New York: Basic Books, 2002.

Ford Foundation. *The Finances of the Performing Arts, Vol. II: A Survey of the Characteristics and Attitudes for Theater, Opera, Symphony, and Ballet in 12 U.S. Cities.* New York: Ford Foundation, 1974.

Globerman, S. "What We Know and Don't Know About the Economics of Culture." In *Cultural Economics '88: A Canadian Perspective*, by H.H., et al (Eds.) Chartrand, 3-20. Akron: Association for Cultural Economics, 1989.

Gray, C.M. *Trends in Arts Participation: 1982-1987.* Washington, D.C. : National Endowment for the Arts, 1998.

Heilbrun, J. and Gray, C.M. *The Economics of Art and Culture, 2nd Edition.* Cambridge: Cambridge University Press, 2001.

Johnston, Jack and John DiNardo. *Econometric Methods.* Singapore: McGraw-Hill International Editions, 1997.

Jorgenson, Dale W. and Siebert, Calvin D. "A Comparison of Alternative Theories of Corporate Investment Behavior." *The American Economic Review*, 1968: 681-712.

Koyck, L.M. *Distributed Lags and Investment Analysis.* Amsterdam, 1954.

Manning, Willard, Naihua Duan, and William H. Rogers. "Monte Carlo Evidence on the Choice between Sample Selection and Two-Part Models." *Journal of Econometrics*, 1987: 59-82.

Markusen, Ann and Anne Gadwa. "Arts and Culture in Urban/Regional Planning: A Review and Research Agenda." *Journal of Planning, Education, and Research*, 2010.

Markusen, Ann and Amanda Johnson. "Artists' Centers: Evolution and Impact on Career, Neighborhoods, and Economies. http://www.hhh.umn.edu/projects/prie/pdf/artists_centers.pdf (accessed August 19, 2011), 2006.

Markusen, A., and G. Schrock. The artistic dividend: Urban artistic specialization and economic development implications. *Urban Studies*, 2006: 1661–86.

McGraw-Hill Construction, Inc.

Minnesota Population Center. "University of Minnesota, IPUMS USA." http://usa.ipums.org/

National Center for Charitable Statistics. http://nccs.urban.org/.

National Endowment for the Arts. *2002 Survey of Public Participation in the Arts, Research Division Report #45.* Washington, D.C. : National Endowment for the Arts, 2004.

Peterson, R.A., Hull, P.C., Kern, R.M. *Age and Arts Participation: 1982-1997, Research Division Report #42.* Washington, D.C. : National Endowment for the Arts, 2000.

Pratt, A. The cultural industries production system: A case study of employment change in Britain, 1984–91. *Environmental and Planning*, 1997: 1953–74.

Seaman, Bruce. "Empirical Studies of Demand for the Performing Arts." In *Handbook of the Economics of Art and Culture, Volume I*, by Victor A. Ginsburgh and David Throsby (Eds.), 440-441. Elsevier B.V., 2006.

U.S. Census Bureau

- U.S. Department of Commerce, Economics and Statistics Administration. "Census Regions and Divisions of the United States." http://www.census.gov/geo/www/us_regdiv.pdf (accessed November 23, 2010).

- Population Division. "Population Estimates; National." http://www.census.gov/popest/national/national.html (accessed on November 23, 2010).

- County Business Patterns. http://www.census.gov/econ/cbp/ index.htm (accessed March 14, 2011).

- Metropolitan and Micropolitan Statistical Areas. http://www.census.gov/population/www/metroareas/aboutmetro.html (accessed June 10, 2011).

United States Department of Labor, Consumer Price Index. "Table Containing History of CPI-U.S. All Items Indexes and Annual Percent Changes From 1913 to Present." http://www.bls.gov/cpi/#tables (accessed April 14, 2011).

Woronkowicz, Joanna. "An Overview of Cultural Infrastructure in the United States: 1994-2008." 2011.

Appendix A. Construction of Variables

Investment Function Variable	Description	Source	Years	Source Variable	Source Codes	Restrictions
year	Construction start year	McGraw-Hill	1994-2008	constructionstartyear		
msacode	MSA Code	Census/ACS	1990/2000/2001-2008	metaread		
pcinvest	Per Capita Total Investment	McGraw-Hill/BEA	1994-2008	i, pop		adjusted to 2005 dollars using gross private domestic investment indexes
msapop	Number of persons	Census/ACS	1990/2000/2001-2008	perwt		
p_babetter	Proportion of persons with at least a bachelor's degree	Census/ACS	1990/2000/2001-2008	educd, perwt	bachelor's degree, master's degree, professional degree beyond a bachelor's degree, doctoral degree	interpolated
artists	Number of artists	Census	1990	occ	musicians and composers (186), actors and directors (187), painters, sculptors, craft-artists, and artist printmakers (188), dancers (193), artists, performers, and related workers n.e.c. (194), artists and related workers (260)	interpolated

Appendix A. Construction of Variables (continued)

		Census/ACS	2000/2001-2008	occ	actors (270), producers and directors (271), dancers and choreographers (274), musicians, singers, and related workers (275), entertainers and performers, sports and related workers, all other (276), artists and related workers (260)	
org	Total number of arts organizations	NCCS	1993-2008	nteecc	A40, A51, A54, A60, A61, A62, A63, A65, A68, A69, A6A	

Appendix A. Construction of Variables (continued)

netinc	Median net income of all arts organizations	NCCS	1993-2008	nteecc, totrev, exps	A40, A51, A54, A60, A61, A62, A63, A65, A68, A69, A6A	median(totrev-exps) adjusted using consumer price indexes to 2005 dollars
hhincome	Median household income	Census/ACS	1990/2000/2001-2008	hhincome		Adjusted to 2005 dollars using CPI
pop	MSA population	BEA	1990-2008			
k	Number of arts facilities	County Business Patterns	1993-1997	n20_49, n50_99, n100_249, n250_499, n500_999, n1000	7900 (“Amusement and Recreation Services”) and 8400 (“Museums, Botanical, and Zoological Gardens”)	establishments with >= 20 employees
		County Business Patterns	1998-2008	n20_49, n50_99, n100_249, n250_499, n500_999, n1000	(71----) Arts, Entertainment, and Recreation	

Appendix A. Construction of Variables (continued)

l	Number of employees in arts facilities	County Business Patterns	1993-1997	n20_49, n50_99, n100_249, n250_499, n500_999, n1000	7900 (“Amusement and Recreation Services”) and 8400 (“Museums, Botanical, and Zoological Gardens”)	establishments with >= 20 employees
		County Business Patterns	1998-2008	n20_49, n50_99, n100_249, n250_499, n500_999, n1000	(71----) Arts, Entertainment, and Recreation	
r	Interest Rate	Federal Reserve	1993-2008	state and local bonds		average annual rate
page_2135	Proportion of persons between 21 and 35 years of age	Census/ACS	1990/2000/2001-2008	age	21-35	Interpolated

Appendix A. Construction of Variables (continued)

p_gay	Proportion of persons who indicated their relationship the household head is "unmarried partner"	Census/ACS	1990/2000/2001-2008	relate	Unmarried partner	Interpolated
djclose	Closing Dow Jones Industrial Index Value at end of year	Dow Jones	1993-2008			