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Boualam, Brahim

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Does culture affect local productivity and urban amenities?*

Brahim Boualam†

University of Geneva

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Abstract

Does a better cultural milieu make a city more livable for residents and improve its business environment for firms? I compute a measure of cultural specialization for 346 U.S. metropolitan areas and ask if differences in cultural environment capitalize into housing price and wage differentials. Simple correlations replicate standard results from the literature: cities that are more specialized in cultural occupations enjoy higher factor prices. Estimations using time-series data, controlling for city characteristics and correcting for endogeneity weaken the magnitude of this effect. Even though the arts and culture might be appealing to some people and firms, such determinants are not strong enough to affect factor prices at the city level.

Keywords: urban economics, location choice, local amenities, culture.

JEL classification: R3, R23, Z10, O18

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†Geneva School of Economics and Management, University of Geneva, 40 Bd. du Pont D'Arve, 1211 Geneva 4, Switzerland. E-mail: Brahim.Boualam@unige.ch. Tel: +41.22.379.9881.

1 Introduction

This paper asks if a better cultural milieu can improve the attractiveness of a city. Cities like Paris, London or New York tend to be more attractive partially because of their remarkable cultural milieus. But are these differences strong enough to be considered as relevant determinants of the location of firms and residents? Are people and firms really willing to pay more to live in the so-called *creative cities*? To answer these questions, this paper evaluates how culture shapes the relative demand for a city by estimating how differences in cultural specialization across cities capitalize into housing price and wage differentials. Such strategy allows distinguishing the relative contribution of culture on productive amenities - the ability of culture to stimulate productivity throughout sectors - from its effect on consumption amenities - its propensity to offer valuable attributes and services to consumers and to improve the urban quality of life. Using a large sample of U.S. metropolitan areas between 2005 and 2011, the empirical analysis shows that cultural determinants are not strong enough to affect factor prices at the city level.

Addressing these questions is important for policy and academic reasons. Cultural policies are increasingly considered as drivers of economic growth and urban recovery. A large share of these policies are justified by the effect of culture on city attractiveness: through its effects on creativity and livability, a better cultural environment may improve the attractiveness of places for firms and households. For instance, the Organization for Economic Co-operation and Development considers that developing cultural equipment and infrastructures favors urban regeneration by helping "to attract creative and innovative populations" and highlights the ability of culture to foster "city's livability and attractiveness" (OECD 2006). Similarly, the European Commission (2010) argues that cultural and creative sectors generate economic growth through enhanced creativity and innovation. In the United States, the Center for Urban Future (2002) states that creative economy's "greatest strength is the ability to attract other businesses and jump-start neighborhood development. Arts and culture do this by giving local economies their *soul*. And this is everything, given that "knowledge workers" demand vibrant and dynamic settings in which they can work, live and create."

Empirical evidence on the contribution of the arts on the attractiveness of places is surprisingly more mitigated. According to Eurobarometer (2006), 77% of European citizens state that they care about culture while data on cultural participation show that very few Europeans really enjoy cultural amenities. For instance, 55% of Europeans never attended a live performance or visited a cultural site over the year (Eurostat 2011). Similarly, evidence on firms' location remains ambiguous: while Kotkin (2000) finds that cultural amenities can have a crucial role in attracting high-tech firms, Bille & Schulze (2006) stress that studies based on interviews usually emphasize that cultural variables are not important determinants in their location decisions.

In spite of a growing interest from policy makers and urban planners, research from scholars in this field remains sparse. An emerging literature offers valuable insights on this topic and some developments received extraordinary attention from policy makers and the media as illustrated by the famous contributions from Richard Florida (2002*a*,*b*). Nevertheless, some of these studies face important limitations. First, they often fail to provide well-defined and exhaustive measures of the cultural intensity of places. Second, they rarely take account of the impact of other city-specific characteristics that might also influence the location choice of

economic agents. Third, they do not consider potential problems of reverse causality between cultural variables and economic outcomes. This paper seeks to address these three limitations.

In order to achieve this aim, I propose a measure of cultural employment based on the type of tasks performed by employees to evaluate how cities differ in their specialization in cultural occupations. In that respect, I rely on occupational employment data from the U.S. Bureau of Labor Statistics (BLS) and compute the relative size of cultural employment for 346 U.S. metropolitan areas covering 82% of total U.S. population between 2005 and 2011. To my knowledge, this is the largest sample used to study this topic so far. I focus on occupations that are intrinsically oriented towards the production of non-tradable cultural goods and services since only these may potentially affect the utility of economic agents at the local scale. Similarly, I propose an alternative output-based measure of culture, which describes the accessibility of cultural goods and services for local inhabitants in each city.

Next, I rely on an identification procedure derived from Roback (1982) and estimate hedonic wage and rent equations to evaluate the impact of culture on urban production and consumption amenities. I include in the specifications a full set of factors that could potentially influence the location of economic agents by controlling for natural, political and other location-specific variables. I also correct for the endogenous determination of cultural supply in the city by implementing an instrumental variable strategy. I use the amount of federal grants received by individual artists and art organizations every year in each city as an instrument for culture. Federal grants may be quite substantial and therefore constitute a significant shock to the supply of culture at the local scale. Besides, they are not otherwise determined by the current values of wages and rents and instead, mirror the average quality of art work in each city.

The simplest specifications recover findings from the extant literature (Florida & Mellander 2010, Sheppard et al. 2006, Clark & Kahn 1988). In the cross-section of American cities, my estimates report a positive effect of culture on city attractiveness: everything else equal, city specialization in cultural occupations is positively correlated with median housing rents, consistent with the existence of a higher demand for these locations. When trying to disentangle the relative contribution of culture on households and firms, I find that culture might be considered as a production amenity. However, further empirical investigations using time-series data and controlling for city-specific features reduce the estimated coefficient of the cultural environment on factor prices. Lastly, estimations that correct for endogeneity reveal that the effect of culture becomes negligible. I conclude that the positive effect associated with culture captures the impact of omitted variables and results from the simultaneous determination of culture, wages and rents. This interpretation is supported by various additional checks. In line with previous critics, this finding helps to question the existing empirical literature on this topic.

The rest of this paper is organized as follows: Section 2 selectively reviews recent empirical developments related to this topic. Section 3 describes the identification strategy that is applied to assess the effect of the culture on amenities. Section 4 describes the data. Section 5 presents the main econometric results and address several identification problems that arise when estimating this type of hedonic equations. Finally, Section 6 concludes.

2 Related literature

Initially considered as minor and valueless economic sectors, culture-related industries received a growing attention from policy makers and scholars. Non-negligible efforts have been made recently to evaluate the economic contribution of the cultural sector on the economy of cities. An important series of developments emphasizes the short-run effects of cultural attributes by looking at the contribution of specific cultural events, industries or infrastructures. Based on study cases and economic impact evaluations, these studies reveal the existence of multiplier effects associated with cultural spending and most of these papers focus on the direct and indirect effects of culture on tourism[1].

In the field of urban economics, several attempts have been made to evaluate the contribution of cultural attributes on city attractiveness. The seminal work of Clark & Kahn (1988) evaluates the returns of six cultural infrastructures[2] using traditional hedonic approaches and find a positive willingness to pay for five of these amenities. Glaeser et al. (2001) take into account a series of cultural indicators - live performance venues, art museums, movie theaters and bowling alley - to assess the role of such consumption amenities on population growth across cities. Similarly, Glaeser & Saiz (2003) introduce the number of museums as a control variable to explain population growth[3]. Next, Albouy (2008) uses a raking based on Places Rated Almanac (Savageau 1999) to take into consideration artistic and cultural amenities in evaluating quality of life indices and finds a positive valuation of cultural and recreational amenities by consumers. Carlino & Saiz (2008) use the number of leisure trips as revealed preferences for local recreational amenities and find that beautiful cities enjoy relatively higher population growth. Sheppard et al. (2006) also emphasize the positive influence of cultural vitality - measured as the expenditure of local non-for-profit cultural organizations - on housing values for 11 cities in the U.S. Finally, Ahlfeldt & Mastro (2012) find a positive willingness to pay for living close to iconic architecture.

The most striking development arises with the contribution of Richard Florida (2002*a*,*b*). Florida (2002*a*) examines the geographic distribution of a new socioeconomic class of workers, the *creative class*, characterized by their specific lifestyle and their strong involvement in creative activities. The author intends to show that the presence of this class of people is associated with higher levels of openness and human capital. Similarly, a particular attention is paid on a smaller category of creative people, called *bohemians*, mainly made of artists and cultural workers. Florida eventually finds a positive correlation between its *bohemian* index - measured as the relative number of artists in the metropolitan area compared to the national equivalent - and the relative share of educated people as well as the concentration of high-tech industries. He concludes that the presence of this class of people tends to attract more intelligent, talented and tolerant people[4] which in turns favor the expansion of skill-intensive and innovative activities such as high-technology industries. Furthermore, Florida & Mellander (2010) extend this analysis and show that the prevalence of bohemians and gay people is associated with higher housing values and wages on a cross-section of 331 American cities in 2000.

[1] See Bille & Schulze (2006) for a critical review of these empirical studies. Such papers include the study of single cultural events such as the economic contribution of the Guggenheim Museum in Bilbao (Plaza 2006), the creation of a new cultural center in Catalonia (Llop & Arauzo-Carod 2011) or the global influence of the arts on a geographical area (Myerscough (1988) in Glasgow or Scanlon & Longley (1984) in New York).

[2] The number of museums, zoos, dance companies, theaters, opera and instrumental music groups.

[3] The coefficient on this variable appears to be insignificant.

[4] The *bohemian index* being significantly correlated with both *melting-pot* and *gay* indices.

This theory received extraordinary attention from urban policy makers and media. It strongly contributed to popularize the idea that culture may be an important driver of growth in modern cities. However, this analysis has been sharply criticized by academic researchers. The definition of the creative class and the bohemian community and measures of talent and urban openness are subject to strong controversies. Florida (2002*a*)'s *creative class* indeed encompasses a very large variety of working occupations which are strongly unrelated to creativity[5]. As a result, some of Florida's empirical findings capture the impact of human capital and educational attainment rather than the effect of culture or creativity (Glaeser 2005, Markusen 2006). Similarly, Hoyman & Faricy (2009) show that Florida's theory is not very helpful in explaining urban growth. By contrast, standard human and social capital models better predict employment and income growth in the U.S. In addition, Montgomery (2005) criticizes the ranking of creative cities proposed by Florida based on his indices that, for instance, makes Manchester be the most creative city in the U.K. even before London. The causal relationship described by Florida is also deeply criticized since causality is only driven by simple correlations (Sawicki 2003, Marcuse 2003, Peck 2005). Similarly, we may suspect positive relationships between culture and both housing values and incomes found in Florida & Mellander (2010) to capture the impact of other omitted city-characteristics because the econometric specification do not include any control variables.

Even if such attempts prove that growing efforts are made to evaluate the effect of culture on households and firms' location, these contributions remain sparse and face important limitations. First, many empirical studies fail in providing a well-defined measure of culture. Actually, studies often account for a restricted number of cultural attributes and then tend to underestimate the size of cultural sector. Inversely, measures based on employment data usually encompass all high-skilled workers or employment in cultural industries even if the tasks performed by workers are not related to culture (Scott 1997). Likewise, some measures tend to overlap cultural indicators with recreational variables such as parks or sport infrastructures. One contribution of this paper is to propose a more accurate measure of culture that only includes workers occupied in cultural and artistic activities based on very detailed employment data. Second, many empirical studies do not control for the influence of city specific characteristics that are not otherwise related to culture. This failure will be addressed in Section 5. Third, concerns regarding the causal relationship between culture and economic outcomes are rarely mentioned. I correct for potential endogeneity biases using instrumental variable techniques in the empirical section.

3 Identification strategy

To determine how differences in the cultural landscape across cities affect the location of households and firms, I rely on an identification strategy proposed by Roback (1982). This model extends the standard hedonic approach from Rosen (1979) to heterogeneous labor markets[6].

We consider a finite number of non-overlapping cities in which people chose to live and work. People and firms move freely across space in order to reach the highest level of utility and economic profit. Preferences

[5]For instance, occupations such as managers, tax collectors or dental hygienist are included in his definition of the creative class (Markusen 2006).

[6]The model is now widely used to estimate the influence of localized amenities. See Ottaviano & Peri (2006) for a full analytical description of the model.

of the representative household are defined over the consumption of a composite and a housing good. The iso-utility curve of this household is represented by the upward-sloping curve U_1 in Figure 1. The indirect utility function being strictly increasing in wages and non-increasing in prices, any increase in housing prices must be compensated by a rise in wages in order to keep the level of utility constant at $\bar{u}$.

FIGURE 1 HERE

Similarly, firms determine their optimal consumption of labor and land in order to maximize profits. Firms behavior is described by the downward-slopping iso-profit curve Π_1 in Figure 1: any increase in wages must be compensated by a fall in land prices in order for total costs and economic profits to remain constant. Wages and rents prevailing in city c are determined at equilibrium point a.

I allow both indirect utility and profit functions to be affected by a city specific attribute S_c that varies across cities. S_c is defined as a consumption amenity as long as it positively affects consumer's utility and as a productive amenity when it enhances firms productivity and therefore economic profits. S_c will represent the state of the cultural environment in city c hereafter.

At a spatial equilibrium, workers and firms must be indifferent among locations. Perfect mobility allows residents and firms to relocate if they can reach a higher level of utility and profit in a different location. Hence at the equilibrium, both utility and economic profits are equalized across cities in order to eliminate further inducements to move. In the presence of a consumption amenity, any increase in S_c must be compensated either by a decrease in wages or by a rise in rents to eliminate residents' incentives to move to city c. In the case of a production amenity, firms' cost function being increasing in both factor prices, firms' incentives to move are arbitraged away either by a rise in wages and in rents.

The impact of an increase in the level of city-amenity is summarized in Figure 1. With a consumption amenity, an increase in S_c shifts the iso-utility curve up to U_2: at equilibrium point b, we observe that residents pay higher rents and receive lower wages but attain the same level of utility thanks to this amenity. With a production amenity, the iso-profit curve shifts from Π_1 to Π_2: at equilibrium point c, firms endure higher wages and higher rents and reach the same level of economic profits thanks to a higher level of S_c.

We can easily derive from this analysis the hedonic rent and wage equations that describe the relationship between local amenities and factor prices. First, the analysis of the rent equation allows determining the overall effect of culture: the fact that *cultural* cities experience higher (lower) rents suggests the existence of a higher (lower) demand for these locations induced either by firms or workers. Next, the wage equation helps us to determine if this positive (negative) effect is dominated by a positive (negative) impact on firms or households. A negative impact on wages mirrors the fact that workers are willing to give up wages to live in high-amenity cities. In contrast, higher wages imply that firms are likely to incur higher costs to be located in such high-amenity cities, reflecting the fact that S_c is a productive amenity.

Therefore, the Roback (1982) model provides a very suitable identification procedure for assessing how households and firms are affected by inter-city differences in cultural environment. Table B.1 summarizes the main results of this model in the case of positive or negative amenities in both consumption or production.

TABLE B.1 HERE

4 Data description

4.1 Measuring culture

Measuring culture at the urban scale might be quite challenging. I first use recent Occupational Employment Statistics (OES) from the U.S. Bureau of labor statistics (BLS) describing employment for 372 U.S. Metropolitan Statistical Areas between 2005 and 2011. The occupational classification system (SOC) reports employment statistics based on the type of activities and tasks performed by workers independently on the industry in which they take place[7]. Employment data are then disaggregated into 22 major occupations which are in turn broken down into 840 detailed occupations. Markusen (2006) or Glaeser et al. (2001) show that existing measures of cultural employment based on broadest occupational categories can face major limitations. For instance, including the major category "Arts, Design, Entertainment, Sports and Media occupations" tends to overestimate the size of cultural employment because this category encompasses occupations like "Public relations specialists" or "Athletes and sports workers" unrelated to cultural activity. Conversely, other artistic and culture-related occupations can be found in other major categories such as "Archivists", "Curators" or "Museum technicians and conservators". Therefore, I delineate the sample of cultural occupations by inspecting each detailed occupation title rather than broader occupational categories.

Well-established definitions found in Throsby (2001, 2010), World Intellectual Property Organisation (2003), Unesco Institute of Statistics (2009), KEA European Affairs (2006) or UNCTAD (2008, 2010) traditionally define cultural occupations as including:

- Core art and heritage occupations, including visual arts (painting, sculpture), performing arts (theater, dance) and heritage (museums, monuments, libraries).

- Cultural occupations, including activities related to films, TV, radio, broadcasting, music recording, press and book publishing.

- Creative occupations, encompassing fashion, design and architecture.

This classification includes all workers occupied in culture related activities. However, it does not reflect the production for or the consumption by local inhabitants. Indeed, several cultural products are easily tradable such that this measure of local production does not coincide with local consumption. *Cultural* and *creative* occupations basically encompass workers occupied in cultural industries who create goods and services that are traded and not locally consumed. Remarkable examples are radio or TV programs: the production of such services in a city is not directly consumed by local residents and therefore is unlikely to enhance the attractiveness of the city in which they are produced. This is why I take benefit of the classification presented above to restrict cultural employment to a few number of occupations that are traditionally consumed where they are produced and which require proximity to final consumers. This includes for instance art teachers,

[7]See Lin (2011) for additional details on the Standard Occupational Classification System.

curators, museum technicians, conservators or librarians. A description of these occupations is given in Table C.1. Using this definition, the share of cultural employment ranges between 0 and 0.8% with a median value of 0.2%. In section 5.3.1, I also use an alternative measure of culture based on the accessibility of cultural goods and services for residents as a robustness check.

The variable is disaggregated at the Metropolitan Statistical Area (MSA) level using the 2003 definition[8]. These geographical units correspond to local labor markets with strong commuting ties between each component. Cultural employment is annually computed for 372 MSAs. I restrict the sample to cities located in contiguous continental US states and exclude New England City and Town Areas (NECTAs) for which a corresponding MSA cannot be found. This leaves us with 346 MSAs, covering 82% of total US population.

4.2 Dependant variables: wages and housing rents

BLS's Employment Statistics provide data on wages and income distribution at the MSA level for all occupations. I use the median wage defined as the median hourly wage for all occupations in each MSA. The subsequent sections intend to study whether variations in the cultural supply are associated with differences in wages. However, if wages in cultural occupations are higher than average, a bigger share of cultural workers in total employment will automatically translate into higher wages in the city. To avoid this problem, I compute the median wage of non-cultural workers only.

Data on rental prices comes from the "50th percentile series" of the U.S. Department of Housing and Urban Development (HUD). HUD annually reports median gross rent estimates for all U.S. metropolitan areas. These latter correspond to gross rent estimates, including utilities (except telephone and other communication medias), at the 50th percentile point of the rent distribution of rental housing units[9]. This indicator already controls for major differences in housing quality by including only rents of "standard-quality rental housing units (occupied rental units paying cash rent, with full plumbing, with full kitchen, unit more than 2 years old) occupied by recent movers [and excludes] public housing units, newly built units and substandard units"[10]. To control for an additional major difference in housing characteristics, I use the median gross rent of a 2-bedroom rental unit (Saiz 2007). One minor limitation of these data is that the HUD geographic criterion to compute these estimates may not perfectly match with the definition of metropolitan areas applied by the BLS such that some MSAs might be discomposed into several components. In such a case, I weight each county component by its population within the MSA to compute the median gross rent of the entire area.

By using median rents and wages, I implicitly assume that changes in the size of the cultural sector uniformly affect all workers and residents. This choice is dictated by two main factors. First is the availability of data on urban rents, that are provided at the 50th percentile only. Second, the identification strategy is directly derived from a model of representative consumers and firms. Nevertheless, culture may mostly attract educated, skilled and therefore healthy workers. Hence, it may disproportionately affect the top of the wage distribution. This

[8] See *Standards for Defining Metropolitan and Micropolitan Statistical Areas*, U.S. Office of Management and Budget.
[9] These data are calculated on the same basis as Fair Market Rents but focuses on the 50th percentile point. See Saiz (2006).
[10] Federal Register Vol. 65, No. 191, Monday October 2, 2000, pages 58870-58875.

limits the interpretation of the result. However, I expect this phenomenon to translate into higher median rents and wages as it may shift the income distribution.

4.3 Control variables

To control for major determinants of rents and wages that are not otherwise related to culture, I include a full set of control variables in the empirical analysis. Differences in the level of human capital across cities may affect both wages and rents through higher productivity of workers or heterogeneous preferences for housing goods. I control for these differences by including the average level of education of each city. I extract data on educational attainment from the annual American Community Survey estimates (ACS) and define *Education* as the share of population of 25 years or more with a bachelor degree (or more).

Using ACS data, I compute the share of foreign born residents in total population to control for the impact of migrants on labor and housing markets. I also control for the racial composition of MSAs by including the share of 'non-white' workers in total population using the Population by Race and Hispanic Origin Table derived from U.S. Census and the Selected Social Characteristics from the ACS estimates. These variables control for the racial composition of cities and the effect of cultural diversity on prices (Glaeser et al. 1995, Markusen 2006, Ottaviano & Peri 2006, Saiz 2007).

Ciccone & Hall (1996) show how population density matters for explaining differences in labor productivity while Duranton & Puga (2004) emphasize the gains from agglomeration experienced in cities. Rappaport (2008) underlines the relationship between density and urban consumption amenities. I use density, defined as the total population per square mile of land area, to control for inter-city differences in urbanization and traditional agglomeration economies.

To control for differences in public goods supplied by local governments, I include spending on public schools approximated by the total per pupil current spending in elementary and secondary schools. Primary data are extracted from the Public Elementary - Secondary Education Finance Data from the U.S Census Bureau for the year 2009. Data reported at the school districts level are aggregated to compute an average value at the MSA level.

To account for differences in natural amenities, I follow Saiz (2007) by adding the monthly average temperatures in January and July, the average number of hours of sunlight in January and the average relative humidity in July as control variables. These average data are computed over 30 years (1941-1970) and extracted from the Natural Amenities Scale Dataset from the U.S. Department of Agriculture.

To capture differences in safety conditions across cities and their impact on quality of life, I use data from the Federal Bureau of Investigation (FBI) and compute an indicator of *violent rates* defined as the number of murders, forcible rapes, robberies and aggravated assault per 100'000 inhabitants.

I also include two economic variables: the annual rate of unemployment by metropolitan area provided by the Smoothed Seasonally Adjusted Metropolitan Area Estimates series from the BLS as well as the annual share of employment in the service sector extracted from the U.S. County Business Patterns to account for the shift towards services in the U.S. economy. Including a variable that measures changes in the composition of local production is in line Glaeser & Saiz (2003) or Carlino & Saiz (2008).

Finally, I control for the role of non-tradable consumption goods and their variation over time by including two additional consumption amenities as explanatory variables: the variety of restaurants and drinking places - measured by the number of food and beverage establishments per capita - and the number of amusement, gambling and recreational establishments[11] per capita extracted from the County Business Patterns. These variables mirror analyses made by Glaeser et al. (2001), Glaeser & Saiz (2003) or Albouy (2008).

A statistical summary of the dataset is provided in Table C.2.

4.4 Stylized facts on culture, wages and rents

Table B.2 provides information on average and median hourly wages and median gross rents. The first column displays general statistics for the whole sample whereas columns (2) to (5) report statistics for cities ranked according to their degree of specialization in cultural occupations. Both wages and rents tend to increase as the level of cultural specialization rises: in average, cities that have a relatively high share of cultural employment face higher wages and higher rents.

TABLE B.2 HERE

Figures 2 depicts the relationship between the variable of interest - the cultural employment share - and wages and rents for all U.S. metropolitan areas over the year 2005 and 2011. The graph also reports the fitted line and the estimates of the regression line. Wages and rents are positively correlated with this measure of cultural supply. The estimate associated with the rent equation shows that a 10% increase in cultural employment share is associated with a 1.32% increase in local rents and a 1.14% increase in wages. The results are similar when using an alternative measure of culture based on the access to cultural establishments (described in Section 5.3.1) even if the maginitude of the coefficient is smaller. At first sight, a higher specialiation or accessibility to culture seems to positively capitalize into higher factor prices. Such relationship is in line with Florida & Mellander (2010) who interpret it as evidence of a positive impact of culture on production amenities.

FIGURE 2 HERE

5 Empirical results

The aim of this paper is to determine if the willingness of residents and firms to locate in cities is influenced by the cultural environment of these places. In line with the identification procedure described in Section 3, I perform two sets of econometric estimations using alternatively rents and wages as the dependent variable.

5.1 Baseline regressions

To determine the effect of culture on both production and consumption amenities, I estimate the following reduced form equation on the panel of U.S. cities over the period 2005 - 2011:

$$ln(Y_{ct}) = \beta_0 + \beta_1 \cdot ln(S_{ct}) + \beta_2 \cdot ln(Z_{ct}) + \beta_3 \cdot ln(X_c) + \gamma_c + \epsilon_{ct} \quad (1)$$

[11] This variable includes amusement parks, golf courses, fitness and recreational sports centers or bowling alleys.

where $ln(Y_{ct})$ alternatively stands for the logarithm of the median gross rent and the median hourly wage in city c in year t. $ln(S_{ct})$ is the proxy for cultural supply in city c (in log) while Z_{ct} and X_c respectively correspond to vectors of time-varying and invariant city attributes. I also include a set of city fixed effects γ_c to control for unobserved city characteristics. To finish ϵ_{ct} represents the error term.

TABLES B.3 AND B.4 HERE

Tables B.3 and B.4 summarize the main results of the baseline regressions using the measure of culture described in Section 4 as the main explanatory variable. Column (1) of the tables displays correlations between the share of cultural employment - not dedicated to the production of tradable cultural services - and rents and wages, respectively. American cities specialized in cultural occupations seem to experience higher factor prices. The estimated coefficients are positive and highly significant in both regressions: a 10% increase in cultural employment share is associated with a 1.1% rise in median rents and a 0.9% increase in median wages. This result is consistent with a prevailing positive effect of culture on production amenities and is in line with Florida & Mellander (2010) even if the size of the coefficients is strongly smaller than in their analysis. This finding can be interpreted as evidence that Florida's *Bohemian* index encompasses more occupations than those that are strongly related to culture[12] as stated by Glaeser (2005) and Markusen (2006).

Columns (2) include additional city covariates to control for major determinants of rents and wages that are not otherwise related to culture at the metropolitan level. These specifications turn out to explain about 75% of the total variance of median rents and 61% of median wages in American cities. Most of the control variables are statistically significant. To address one major issue of Richard Florida's empirical strategy, I include the level of education in the metropolitan area to control for differences in human capital endowments. The coefficient on this variable is positive and strongly significant in both estimations as in Shapiro (2006) or Glaeser & Saiz (2003). Consistent with Ottaviano & Peri (2006), Saiz (2007) and Glaeser et al. (2001), the level of migration and the share of non-white people in total population also have positive impacts on both prices. A 10% increase in the share of foreign born is on average associated with an increase in rental prices by 0.8% and in median wages by 0.1%. In line with Ottaviano & Peri (2006), such finding reflects a positive impact of cultural diversity on productive amenities. Similarly, coefficients on population density are positive and highly significant consistent with the existence of agglomeration economies in dense and populated areas (Rosenthal & Strange 2004, Melo et al. 2009). The number of amusement and recreational places appears as a consumption amenity in these estimations as it is positively correlated with local rents and negatively with local wages (albeit insignificantly). The variety of food and drinking places per inhabitant also positively attracts economic agents as it is associated with higher rents and lower wages (insignificantly also). The proxy for local government spending and the share of the service sector also positively influence rental prices and hourly wages. Two major natural amenities - temperatures in January and the number of days of sunlight - seem to be also positively valued by residents (Albouy 2008) while high temperatures in July have a negative impact on rents and wages

[12]Using a broadest measure of cultural employment encompassing all in artistic, cultural and creative occupations (occupations described in Table C.1), the estimated coefficient reaches the value of 0.219 in the rent equation and 0.137 in the wage regression. In both cases, the estimates remain smaller than the ones found in Florida & Mellander (2010).

emphasizing the existence of a higher demand for cities with nice weather - in line with Rappaport (2007). Finally, safe cities positively equally attract workers and firms as shown by the negative effect of violence rate on local rental prices.

Cities with high unemployment rates seem to experience higher factor prices. Such a positive coefficient has already been found in Saiz (2007) when explaining the price of housing goods using the log of Freddie Mac repeat sales index. Similarly in Roback (1982), the coefficient on unemployment rate turns out to be positive (although insignificantly) in all wage equations. She also finds a positive and significant impact of unemployment on land prices. When she estimates the monetary equivalent of local amenities, she even finds a positive marginal valuation for high unemployment rates of about 21 dollars per year. According to the model, this finding implies that cities with unemployment rates disproportionately attract firms. This may be explained by the easy access to an available labor force in such areas.

Overall, the inclusion of the full set of controls affects the coefficients on culture. The effect of culture on factor prices remains positive but the magnitude of the coefficients (and the significance level in the rent equation) decreases with the number of controls. This can be interpreted as evidence that simple correlations between culture and factor prices are spurious and capture the impact of omitted variables. However, a one percentage rise in the specialization of cities in cultural occupations is still associated with a 0.012% increase in rental prices and a 0.011% rise in wages.

One step further is taken by using the time dimension of the data in order to control for all time invariant and unobserved city-specific features using fixed effects. Estimates of equation 1 with fixed effects are reported in column (3) of Tables B.3 and B.4. From now on, all regressions also include a fixed effect for the highest cultural cities in the panel. Coefficients associated with time-varying control variables remain stable in the within regression except for a few number of covariates. The coefficient on amusement and recreational places becomes negative in both regressions in line with Glaeser et al. (2001) who use a closely related variable for explaining city growth. This result suggests that such consumption goods can be considered as negative production amenities. Similarly, the coefficient on the variety of food and drinking places on wages becomes positive and highly significant in the wage regression while violence rates do not affect rental prices in the fixed effect estimations. This result is consistent with Albouy (2008).

Fixed-effects estimations confirm the previous findings as the estimated effect of culture turns out to be smaller in both equations and remains significant only at a 5% significance level. When all city-specific characteristics are controlled for, inter-city differences in the cultural milieu still capitalize into factor price differences but the size of this impact is weakened. The estimated rent and wage elasticities are quite small at 0.01 and 0.005 respectively. These results cast additional doubt on the potential positive effect of culture on city attractiveness. Besides, it reinforces the suspicion that cultural variables may overlap with other city specific attributes. However, the coefficient on culture being positive, this finding suggests that variations in the cultural intensity across cities play a positive role - albeit rather moderate - in explaining the location choice of economic agents. More precisely, culture is considered as a productive amenity.

5.2 Instrumental variables

Interpreting the previous results as causal relationships from culture to factor prices is not feasible since endogeneity problems may severely bias the OLS estimates. I already made progress on potential endogeneity biases stemming from measurement errors and omitted variable problems by using a well-defined measure of culture at the metropolitan level and by including a full set of city specific variables that affect factor prices. However, it is hard to claim that any approximation of culture perfectly estimates the cultural supply nor that estimations do not suffer from an omitted variables bias. Besides, endogeneity may arise from reverse causality concerns. For instance, we may suspect cultural entertainment to be affected by all determinants of local employment, wages or factor prices: if culture reacts to changes in factor prices at the local scale, estimates will be biased making statistical inferences subject to severe criticisms. One way to circumvent this problem is to apply instrumental variable techniques that consist on finding an instrument that is directly correlated with the endogenous regressor (the cultural environment) but not otherwise correlated with the dependent variable (factor prices).

Revenues of art organizations in the U.S. come from three different sources: earned income (membership fees, ticket sales...), contributed income by private donors (through gifts, donations or bequests) and government support provided by federal, state or local agencies[13]. The largest direct government support are made at the federal level through a grant-making system provided by the National Endowment for the Arts (NEA). Federal grants satisfy the requirements of a valid instrument. First, it is correlated with the cultural vitality of the city as it constitutes a positive and significant shock to the cultural supply of the city. Individual grants may indeed be quite substantial and they are used as a leverage to raise additional funding from other available sources[14]. In addition, they mostly subsidize local art organizations rather than individual artists. Therefore, federal grants provide a substantial support to the local production of art and culture and stimulate the supply of art and culture at the urban scale. Second, NEA's grant-making system is not directly correlated with local wages and rents: established at the federal level, any idiosyncratic shock in factor prices in a given city is unlikely to affect NEA's financial endowment. One may argue that artists working in cities with high prices or lower wages will tend to request more funding. However, more requests from a city do not imply that more grants will be awarded in the area. Indeed, federal grants are awarded based on the quality of selected projects and not automatically awarded upon request. They are eventually allocated after a peer review process that evaluates the quality of art projects. Applications are reviewed by a panel of experts from each discipline (museums, opera, arts education, local art agencies, performances...). This panel recommends projects that are transmitted to the National Council on the Arts, a council made of independent renowned artists, arts administrators, patrons and scholars nominated by the President for six-years in accord with the U.S. Senate. They review and recommend some of these projects for grants to the NEA chairman who takes the decision. Besides, federal grants never finance the bulk of a project and other financial resources are required for grants to be effectively awarded[15].

[13] Public support to Art organizations represents 7.9% of current revenues of non-profit cultural organizations in 1999 (Netzer 2006).

[14] Between 2005 and 2011, 16,393 grants were awarded with a median value of $20,000. Besides, according to National Endowment for the Arts (2012) "it is estimated that for each $100 the Arts Endowment awarded [in 2012], arts groups raised an estimated $910 in contribution and earned revenues."

[15] "In any case, direct grants do not finance the bulk of artistic activity in the U.S.: they fill gaps, enhance arts education, nourish

Therefore, even if the number of requests is high in a city because of labor market determinants, it does not guarantee that more grants will be awarded in that city. Conversely, a high number of grants awarded in a city simply mirrors the fact that the quality of art works is greater in this area. Therefore, I use the total amount of grants per inhabitant (to eliminate the influence of city size) annually awarded in each MSA as an instrument for the main measure of cultural employment.

Columns (4) of Tables B.3 and B.4 describe the results of the IV estimations for the rent and wage equation, respectively. Tables also report a full set of statistics designed to assess the validity of the instrument including the F-statistics of the first stage, the under-identification KP-LM statistics and the Kleinbergen-Paap statistics testing for weak instruments in the presence of robust standard errors. The Kleinbergen-Paap statistics on the instruments shows that the F-statistics is above the 15% Stock & Yogo (2005) critical size suggesting that the instrument is pretty strong, i.e. correlated with the endogeneous regressor. Similarly, the F-statistics of the first stage regression is above 10 which is the traditional rule of thumb for testing the relevance of instruments in the first stage regression in case of a single endogenous regressor. Similarly, the underidentification KP-LM test suggests that the instruments are *relevant* and therefore that the model is identified. Overall, all statistical tests show that this instrument is valid for the estimations.

The coefficient associated with culture turns out to be insignificant in both equations. When controlling for endogeneity issues with a valid instrument confirmed by statistical tests, culture does not play a significant role in explaining factor prices at the local scale. This result suggests that our previous OLS estimates were upwardly biased, consistent with the intuition that artists tend to locate in cities with high wages and high rents. The sign of both coefficients would suggest that culture may be a consumption amenity that positively affects city livability and attractiveness - since it affects wages negatively and rents positively - but the impact on factor prices is too low to significantly capitalize into factor price differences. The estimates on the other explanatory variables are not affected by the IV estimations since they are perfectly similar to the baseline results described in the previous column.

5.3 Additional robustness checks

5.3.1 Alternative measure: local access to cultural goods and services

In the baseline analysis, I measure culture as the share of workers whose main working task is to create or disseminate goods and services with a cultural and artistic content. This measure is basically an approximation of the labor input used to supply culture at the local scale. However, it may not perfectly reflect the accessibility of cultural goods and services to local inhabitants and firms. In defining this input measure of culture, I already eliminate cultural workers devoted to the production of goods and services that may be easily traded - for instance in the movie or music industry - in order to focus on the production of goods that may be directly consumed locally. In this section, I propose an alternative variable that directly measures the accessibility of cultural goods and services for local inhabitants and its variation over time. Local residents and firms can access cultural goods and services either through commercial establishments that sell these goods (such as

arts creation, assist in the presentation and delivery of artworks, and enable preservation. These grants thus complement, and do not replace, other means of arts funding" (National Endowment for the Arts 2012)

stores) or through non-profit art organizations. I compute the total number of museums, theaters, libraries and archives as well as bookstores, prerecorded tape, CD and record stores, and motion picture and video exhibitions establishments per 1'000 inhabitants using indicators from the U.S. County Patterns that report the number of establishments by industry for all U.S. counties. All these establishments allow local residents to access cultural goods and services. These numbers are used as an alternative measure for cultural supply reflecting the accessibility to cultural goods and services for local residents.

The results using access to cultural goods and services as the main explanatory variable are provided in Tables C.3 and C.4. For the sake of simplicity, I do not report estimates on control variables since they have the same magnitude and signs across estimations and are similar to the ones described in the baseline estimations. Table C.3 reports the estimates without city fixed effect. The coefficient associated with the three *commercial* establishments (book, music and video stores) are negative in both equations and most of them are statistically significant. According to the Roback model, this suggests that a higher variety or easier access to these commercial establishments might be considered as a negative production amenity. This result may be explained by a negative impact of competition (measured by the number of commercial plants per capita) on firms in these areas. Besides, stores and shops are highly land intensive such that they reduce the ability for outside firms to relocate in the city.

TABLE C.3 HERE

Interestingly, traditional *non-profit* art establishments such as libraries, archives, theaters and museums positively affect wages and rents. However, the coefficient on museums is the only one to be statistically significant. On average, if the number of museums per resident doubles, the median wage increases by 6% and the median rent by 4%. This result is consistent with the baseline findings that culture may actually be considered as a production amenity. Estimations using a synthetic measure of access to all of these local *commercial* and *non-commercial* establishments that supply cultural goods and services are provided in the last column. Overall, the estimated coefficients is negative and highly significant in both equations but this coefficient is driven by the negative impact of commercial stores.

Estimations including city fixed effects are reported in Table C.4. The estimates are quite similar when using the synthetic measure of access to cultural goods and services as the associated coefficients are both negative and highly significant in the last column. When disaggregating this explanatory variable, I find that the number of commercial establishments (access to book and music stores mostly) is negatively correlated with factor prices. In contrast, the coefficients associated with non-commercial art organizations are not statistically different from zero. Therefore, the positive influence of non-profit organization - e.g. museums in Table C.3 - was mainly driven by the impact of other city characteristics that were not controlled for in the cross-section analysis.

TABLE C.4 HERE

5.3.2 Correlation between errors across equations

The Roback (1982) model is made of a combination of two linear equations using similar explanatory variables but different sets of dependent variables. It is nevertheless likely that wages and rents in a city respond to common shocks. I take into account this interdependency across equations using a seemingly unrelated regression (SUR) technique. This technique accounts for the potential contemporaneous correlation between disturbances across equations and therefore increases the efficiency of the estimates. The estimated coefficients are reported in Table C.5. Columns (1) and (2) are simple cross-section estimates while column (3) and (4) apply the SUR method to the within transformation of the model. When comparing these results to the baseline estimates provided in Tables B.3 and B.4, we observe that the magnitude of the coefficients decreases (apart from the coefficient on wages in the cross-section analysis). When eliminating the influence of unobserved city characteristics in columns (3) and (4), the elasticities are quite small at 0.008 for rents and 0.004 for wages. The estimates remain significant only at the levels of 5 and 10% respectively. When we take into account the contemporaneous correlation between equations, the effect of culture on city attractiveness is lower even if culture still positively affects the livability and the business environment of the area.

TABLE C.5 HERE

5.3.3 Concentration of cultural employment

When trying to evaluate the influence of the cultural sector on city attractiveness, it is important to identify the mechanism underlying this relationship - or more specifically the absence of link that is observed when implementing more demanding estimation techniques than simple correlations. To this aim, I distinguish in this section the influence of culture employment per se from the effect of a specialization in a few number of cultural activities and from deviations in the specialization of cities with respect to the average American city.

Cultural goods and services are particularly heterogeneous (Scott 1997) and so are cultural occupations. Therefore, we might improve the analysis by looking at the specialization of cities within cultural activities. If there are externalities associated with cultural diversity, a city characterized by an equal distribution of its workers among cultural occupations may benefit more from these externalities than a city that is fully specialized in one activity. Conversely, there may be agglomeration economies from the specialization in a specific cultural occupation. To account for this dimension, I compute an Herfindahl index of concentration of cultural employment for each city defined as:

$$H = \sum_{i=1}^{n} \left(\frac{Emp_{cit}}{Emp_{ct}} \right)^2$$

with Emp_{cit} being the number of persons employed in the cultural occupation i and Emp_{ct} the total number of cultural workers in city c at time t. Therefore, this index ranges from 0 - if cultural employment in the city is perfectly distributed along occupations - to 1 if the city is fully specialized in one cultural occupation. I include this variable in the baseline estimations in Tables C.6 and C.7.

TABLES C.6 AND C.7 HERE

We see in columns (1) that including this variable reinforces the influence of culture on rents but weakens its influence on wages. The coefficients associated with the concentration index are not statistically significant in these OLS estimations. In column (2), I add city fixed effects. Interestingly, the coefficient on culture decreases and becomes negative in both equations: when controlling for unobserved and time invariant city characteristics, I find that the relative size of the cultural sector is negatively associated with factor prices. However, when controlling for the size of the cultural sector, being specialized in one or a few number of cultural occupations is positively associated with both factor prices. In column (3), I control for endogeneity of culture through instrumental variables using the same instrument as in the baseline regression (the amount of federal grants per capita). The coefficients on culture and concentration index are both insignificant in all regressions. In contrast, estimates on control variables remain very similar to the ones found in the baseline regressions. It seems then that cities that have a high share of workers devoted to specific cultural activities do not attract more firms or residents. The positive coefficients on the Herfindahl index displayed in columns (2) emphasize the gains that are traditionally associated with specialization rather than a proper effect of culture.

In columns (4) to (6), I replace the main variable of interest - the share of cultural employment - by a location quotient. The location quotient compares the specialization of each MSA in cultural occupations with the national counterpart. This variable is defined as:

$$LQ_{ct}^{cult} = \frac{Emp_{ct}^{cult}/Emp_{ct}}{Emp_{t}^{cult}/Emp_{t}}$$

where Emp_{ct}^{cult} is the cultural employment of city c at time t. Emp_{ct} is the value of total employment in city c at time t, Emp_{t}^{cult} the cultural employment of all U.S. cities (computed by aggregating cultural employment of the whole sample of U.S. cities) and Emp_t the total U.S. labor force. The main difference with the cultural employment share is that location quotients take into account the national average or national trend to estimate the relative specialization of cities.

Columns (4) in both tables replicate the simple OLS estimation on the cross-section of cities, columns (5) use the panel dimension of the data by including city fixed-effect while columns (6) correct for endogeneity. In all specifications, the coefficient on the location quotient is not statistically different from zero meaning that when we take into account the evolution of the average level of specialization of all American cities, variations in cultural employment across cities do not capitalize into factor price differences.

Finally, in the last three columns of Tables C.6 and C.7, I use both the location quotient and the Herfindahl index of concentration as the main explanatory variables. The simple OLS estimates reported in column (7) show that any of these two variables seem to affect factor prices. Estimations with city fixed-effects provide interesting results as the coefficients on the location quotients are negative while concentration is positively correlated with factor prices. This finding is consistent with the results found in column (2): culture per se seems to be negatively valued by firms but specialization can be considered as a production amenity as it is positively correlated with factor prices. Consistent with columns (3) or (6), the IV estimates show that neither location quotient nor specialization are correlated with factor prices when correcting for endogeneity biases.

The Kleinbergen-Paap statistics show that the F-statistics are in all cases above the 20% critical size. Overall, the main implication of these robustness checks is that the positive effect of culture is easily altered when implementing more demanding specifications or when trying to identify the exact mechanism underlying the effect of culture on city attractiveness.

5.3.4 Employment and population growth

Following Glaeser et al. (2001) and Shapiro (2006), I estimate the model in differences by taking the annual change in the log of employment and population as dependent variables. The estimated model is given by:

$$\Delta\ ln(Emp_{ct}) = \beta_0 + \beta_1 \cdot \Delta\ ln(S_{ct}) + \beta_2 \cdot ln(Z_{ct-1}) + \beta_3 \cdot ln(X_c) + \gamma_c + \epsilon_{ct}$$

where $\Delta\ ln(Emp_{ct})$ stands for the annual change in the logarithm of total employment in city c between $t-1$ and t and $\Delta\ ln(S_{ct})$ is the annual change in the cultural employment share. I control for the initial state of the city by including the lagged value of all control variables at $t-1$. Results of these estimations are provided in Table C.8. For the sake of clarity, I do not report the estimated coefficients for the control variables.

TABLE C.8 HERE

We see in Table C.8 that changes in cultural employment significantly affect employment density only in the simple OLS estimations and in the rent regressions. Otherwise, culture does not significantly affect employment or population growth: on average, cities that face an increase in their cultural employment share do not experience higher employment or population growth. I also implement the IV strategy for this specification. To instrument for the change in cultural employment between $t-1$ and t in city c, I compute the change in the total amount of grants received in the city between these two years. The tests for under-identification and weak instruments do not indicate the existence of problems at the usual confidence levels. The results of the IV estimations in column (3) show that variations in the cultural environment are not associated with changes in employment or population. Including the variation in the Henfindahl index in the last column provides the same results but the statistical tests that assess the validity of the instrument are less optimistic so we may have more doubts on the reliability of these last estimated results.

Overall, all the results go in the same direction: simple correlations between culture and factor prices actually reveal the existence of a strong and positive relationship between cultural environment and city attractiveness. However, controlling for (observable or unobservable) city characteristics or implementing other specifications - for instance by looking at employment and population growth, by exploring the mechanism underlying this role of culture or by taking into account the correlation across equations - unambiguously weaken the estimated impact of culture. Then, correcting for endogeneity issues that are very likely to affect the estimated relationships strongly alter the result since, in all IV regressions, the estimated effect of culture becomes negligible. These findings systematically support the idea that simple correlations or naive estimations are actually marred by omitted variable biases, measurement problems and reverse causality issues.

6 Concluding remarks

Initially designed to enhance existing cultural heritage and promote tourism, cultural planning has been progressively integrated into more complex urban development policies that aim at fostering economic and employment growth and promoting urban revitalization. Remarkable examples such as Glasgow in Scotland or Bilbao in Spain strengthened that belief that the arts and culture may shape the image of cities and regenerate urban areas. As a result, policy makers and urban planners increasingly recommend the implementation of culture-led development policies to improve both business and living environments in order to attract firms and residents. As the attention paid on the arts as drivers of urban growth has increased, several attempts have been made to determine if culture really favors city attractiveness.

This paper asks the two following questions: First, is the location choice faced by economic agents really affected by intercity differences in their cultural landscape? Second, if such differences matter, do they mostly affect firms through an impact on productivity and quality of the business environment, or residents through an effect on city livability and quality of life? To answer these questions, I investigate how variations in the relative size of the cultural sector across cities capitalize into rent and wage premia. Following an identification procedure derived from a theoretical model of urban economics proposed by Roback (1982), I estimate a wage and a rent equation on 346 U.S. metropolitan areas between 2005 and 2011.

In line with existing literature, the simplest specifications show that the overall effect of culture is positive: everything else equal, cities that are more specialized in cultural occupations seem to face higher rents, consistent with a higher demand for these locations. When trying to disentangle the relative contribution of culture on households and firms, I find that culture mostly affects firms. According to the model, this suggests that culture may be considered as a production amenity. Nevertheless, alternative specifications using time-series data show that the impact of the cultural milieu - albeit positive - becomes moderate once city-specific characteristics are controlled for. As expected, this finding gives some support to the idea that positive effects usually associated with culture capture the impact of these omitted variables. In addition, estimations using instrumental variables show that the estimated effect of culture becomes negligible when endogeneity problems are controlled for. Empirical findings systematically support the idea that simple correlations or naive estimations are actually marred by omitted variable biases, measurement problems and reverse causality issues.

Several explanations can help to understand this result. Sasaki (2010) emphasizes the importance of social inclusion to become a creative city and suggests a list of criteria that must be fulfilled to regenerate cities through cultural creativity. In his analysis, the arts may be a driver of urban growth and boost city revitalization only if the local population is strongly involved in the cultural process and if the needs of residents are taken into account during the transition process. The geographical dimension may also matter when evaluating the externalities associated with culture. Indeed, cities are known to be places where the arts and culture mostly take place (Scott 1997) such that they appear to be the most appropriate geographical level that must be chosen when studying the external effects of the arts. Nevertheless, the geographic distribution of culture within cities is also particularly diverse: for instance, urban centers or specialized cultural districts usually capture the main part of cultural activities. Therefore, analyses based on metropolitan areas highlight the average effect of the arts

rather than a place-specific willingness of residents and firms to pay to settle down close from artistic centers or cultural equipments. Finally, the time horizon might be particularly crucial. The analysis of this paper reveals that the cultural milieu does not really matter in the short run. Nevertheless, the effect of culture might happen very progressively and cultural attributes might capitalize into factor prices in the very long run.

This paper contributes to the extant research on culture and urban amenities by addressing three main limitations of existing literature: its failure in providing a well-defined measure of cultural intensity at the metropolitan level, its weakness in isolating the impact of cultural variables from other urban features when working on a large sample of cities and the lack of empirical studies that correct for endogenous problems that undoubtedly affect hedonic estimations. Additional theoretical research and rigorous empirical investigations are still required to understand the real mechanisms prevailing between culture, city image and attractiveness. In that respect, additional research on the potential reverse causality problems between cultural variables and economic outcomes must be done to confirm that if any relationship between these two variables is found, it can only be explained by the direct contribution of the Arts.

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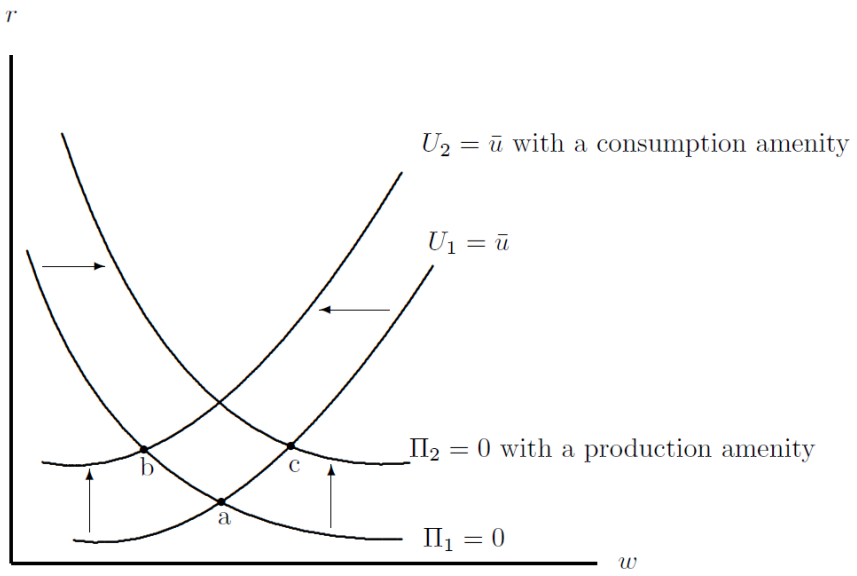
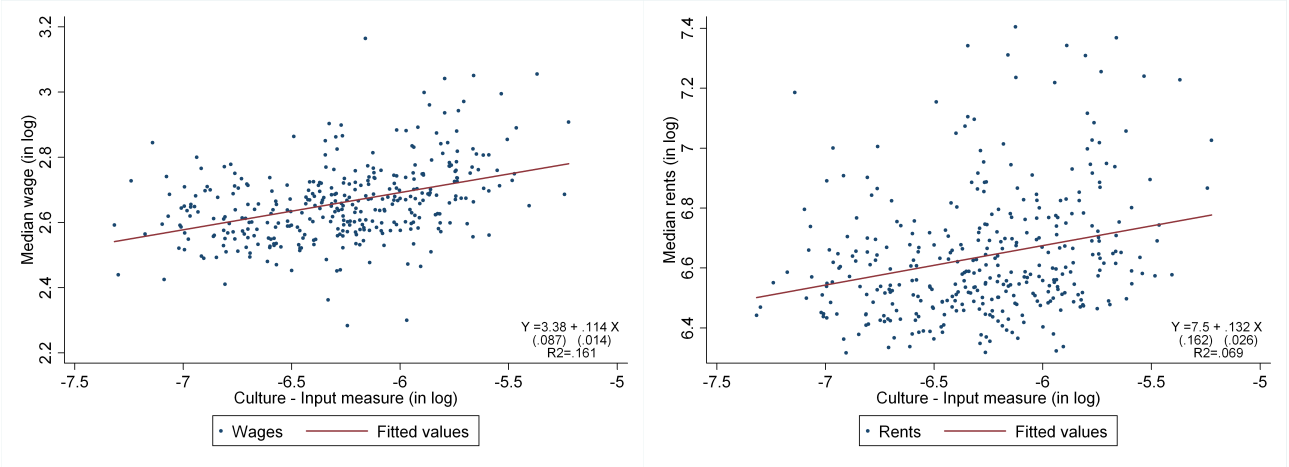
A Figures

Figure 1: Local amenities in a spatial equilibrium





(a) Median wage

(b) Median rent

Figure 2: Wages, rents and culture (average over 2005-2011)

B Tables

Table B.1: Analysis of the wage and rent equations

		Wages $\frac{dw_c}{dS_c}$	
		> 0	< 0
Rents $\frac{dr_c}{dS_c}$	> 0	Production amenity	Consumption amenity
	< 0	Consumption disamenity	Production disamenity

Table B.2: Wages and rents according to the relative specialization of cities in 2010

		Cultural employment			
	All MSAs	Lowest	Low	High	Highest
Average wage	19.24	18.34	18.66	19.20	20.83
Median wage	15.10	14.36	14.65	15.06	16.36
Median rent	833.37	785.76	787.37	843.19	914.58
Cultural emp.	888	94	450	908	2093
N	346	86	87	86	87

Table B.3: Rent regressions

Dependent variable:	(1)	(2)	(3)	(4)
Rents	OLS	OLS	Within	IV
Culture	0.110***	0.012**	0.010**	0.028
	(0.009)	(0.005)	(0.005)	(0.056)
Education		0.174***	0.069***	0.073**
		(0.012)	(0.027)	(0.029)
Migration		0.082***	0.033***	0.034***
		(0.005)	(0.009)	(0.009)
Racial composition		0.042***	-0.063***	-0.062***
		(0.007)	(0.010)	(0.011)
Unemployment		0.097***	0.089***	0.086***
		(0.007)	(0.005)	(0.011)
Density		0.047***	0.949***	0.923***
		(0.004)	(0.112)	(0.126)
Service sector		0.060***	0.039***	0.040***
		(0.010)	(0.007)	(0.006)
Violence rate		-0.031***	0.004	0.004
		(0.007)	(0.012)	(0.010)
Amusement and recreation		0.074***	-0.065**	-0.064***
		(0.013)	(0.027)	(0.020)
Food and drinking places		0.045**	0.385***	0.378***
		(0.021)	(0.056)	(0.049)
Public schools		0.170***		
		(0.013)		
Humidity		-0.019*		
		(0.010)		
Temp. January		0.146***		
		(0.010)		
Temp. July		-1.016***		
		(0.059)		
Sunlight		0.194***		
		(0.012)		
Observations	2331	1949	1949	1943
R-squared	0.061	0.754	0.601	0.595
City Fixed Effects	No	No	Yes	Yes
Kleibergen-Paap Weak Instr.				9.465
Underidentification KP-LM				0.00850
First stage F-statistics				11.23

Robust standard errors in parentheses;
*** Significant at the 1 percent level, ** 5 percent level, * 10 percent level

Table B.4: Wages regressions

Dependent variable:	(1)	(2)	(3)	(4)
Wages	OLS	OLS	Within	IV
Culture	0.092***	0.011***	0.005**	-0.016
	(0.005)	(0.004)	(0.002)	(0.034)
Education		0.149***	0.039**	0.035**
		(0.011)	(0.016)	(0.017)
Migration		0.009**	0.024***	0.023***
		(0.004)	(0.007)	(0.006)
Racial composition		0.032***	-0.053***	-0.054***
		(0.005)	(0.007)	(0.007)
Unemployment		0.075***	0.062***	0.066***
		(0.005)	(0.004)	(0.007)
Density		0.041***	0.881***	0.911***
		(0.003)	(0.095)	(0.085)
Service sector		0.028***	0.022***	0.021***
		(0.006)	(0.005)	(0.004)
Violence rate		-0.002	0.002	0.002
		(0.005)	(0.008)	(0.007)
Amusement and recreation		-0.001	-0.049***	-0.051***
		(0.009)	(0.017)	(0.014)
Food and drinking places		-0.023	0.209***	0.218***
		(0.016)	(0.035)	(0.034)
Public schools		0.075***		
		(0.009)		
Humidity		-0.030***		
		(0.008)		
Temp. January		-0.041***		
		(0.007)		
Temp. July		-0.524***		
		(0.045)		
Sunlight		-0.002		
		(0.009)		
Observations	2340	1947	1947	1941
R-squared	0.125	0.614	0.699	0.685
City Fixed Effects	No	No	Yes	Yes
Kleibergen-Paap Weak Instr.				9.500
Underidentification KP-LM				0.00839
First stage F-statistics				11.25

Robust standard errors in parentheses;
*** Significant at the 1 percent level, ** 5 percent level, * 10 percent level

C Additional Tables

Table C.1: Cultural occupations

Code	Detailed occupation title
Core Art and Heritage	
25-1121	Art, Drama, and Music Teachers, Postsecondary
25-4011	Archivists
25-4012	Curators
25-4013	Museum Technicians and Conservators
25-4021	Librarians
25-4031	Librarian Technicians
27-1012	Craft Artists
27-1013	Fine Artists, Including Painters, Sculptors, and Illustrators
27-1019	Artists and Related Workers, All Other
27-2031	Dancers
27-2032	Choreographers
39-3021	Motion Picture Projectionists
Cultural occupations	
27-1014	Multimedia Artists and Animators
25-9011	Audio-Visual and Multimedia Collections Specialists
27-1011	Art Directors
27-2011	Actors
27-2012	Producers and Directors
27-2041	Music Directors and Composers
27-2042	Musicians and Singers
27-3011	Radio and Television Announcers
27-3012	Public Address System and Other Announcers
27-3021	Broadcast News Analysts
27-3022	Reporters and Correspondents
27-3041	Editors
27-3042	Technical Writers
27-3043	Writers and Authors
27-3099	Media and Communication Workers, All Other
27-4011	Audio and Video Equipment Technicians
27-4012	Broadcast Technicians
27-4013	Radio Operators
27-4014	Sound Engineering Technicians
27-4021	Photographers
27-4031	Camera Operators, Television, Video, and Motion Picture
27-4032	Film and Video Editors
27-4099	Media and Communication Equipment Workers, All Other
Creative occupations	
17-1011	Architects, Except Landscape and Naval
17-1012	Landscape Architects
27-1021	Commercial and Industrial Designers
27-1022	Fashion Designers
27-1023	Floral Designers
27-1024	Graphic Designers
27-1025	Interior Designers
27-1027	Set and Exhibit Designers
27-1029	Designers, All Other

Table C.2: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Cultural employment	857.951	2288.325	0	30500	2387
Culture (Share of cultural employment in total labor force, in %)	0.2	0.1	0	0.8	2387
Average wage	18.175	2.509	12.201	33.531	2498
Median wage	14.397	1.955	8.643	25.586	2498
Median rent	782.533	198.075	483.128	1864	2486
Total population	702473.1	1584074.43	55007	19069796	2502
Total employment	310403.48	705555.49	15120	8455130	2502
Bachelor degree (Share of population of 25 years or more having at least a bachelor degree, in %)	25.19	7.93	10	59.1	2492
Migration (Share of foreign born in total population, in %)	7.91	6.76	0.38	38.82	2502
Racial composition (Share of non-white people in total population, in %)	20.394	11.526	2.754	56.751	2475
Public schools (Total per pupil current spending on elementary and secondary schools, in 2009)	9649.794	2699.577	5085.667	30189.637	2502
Unemployment rate	0.068	0.031	0.02	0.301	2502
Density (population per square mile of land area)	283.63	319.52	6.703	2851.8	2502
Temp. January (Monthly average temperature)	35.586	12.2	3.95	66.150	2488
Temp. July (Monthly average temperature)	75.710	5.498	61.8	93.7	2488
Sunlight (Average number of hours in January)	150.025	39.117	52	266	2488
Humidity (Average relative humidity)	56.757	16.118	14	80	2488
Violence (Total number of murders, forcible rapes, roberries and aggravated assaults per 100'000 inhabitants)	407.995	197.417	0	1482.409	2143
Amusement, gambling and recreational establishments (per capita)	0.259	0.122	0.027	1.36	2477
Food and drinking places (per capita)	1.757	0.403	0.881	6.004	2477
Bookstores (per capita)	0.038	0.017	0	0.16	2477
Pre-recorded tape, CD and record stores (per capita)	0.014	0.008	0	0.05	2477
Motion picture and video exhibition (per capita)	0.018	0.009	0	0.102	2477
Libraries and archives (per capita)	0.007	0.015	0	0.11	2477
Theaters (per capita)	0.009	0.008	0	0.061	2477
Museums (per capita)	0.017	0.013	0	0.113	2477
Amount of federal grants (per capita)	0.114	0.274	0	5.512	2502

Table C.3: Alternative measure: access to cultural goods and services

	Access to culture						
	Commercial			Non-commercial			All
	Book stores	Music stores	Video stores	Libraries	Theaters	Museums	establishments
Dependent variable: Rents							
Culture	-0.025***	-0.002	-0.009*	0.001	0.002	0.006***	-0.024**
	(0.006)	(0.003)	(0.005)	(0.001)	(0.002)	(0.002)	(0.010)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City Fixed Effects	No	No	No	No	No	No	No
Observations	2072	2072	2072	2072	2072	2072	2072
R-squared	0.752	0.750	0.750	0.750	0.750	0.751	0.751
Dependent variable: Wages							
Culture	-0.035***	-0.012****	-0.008**	0.002*	0.001	0.004**	-0.049***
	(0.004)	(0.002)	(0.004)	(0.001)	(0.001)	(0.002)	(0.007)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City Fixed Effects	No	No	No	No	No	No	No
Observations	2069	2069	2069	2069	2069	2069	2069
R-squared	0.623	0.619	0.612	0.612	0.611	0.612	0.621

Culture is defined as the per capita number of book stores (column (1)), pre-recorded tape and CD stores (column (2)), motion picture and video exhibitions establishments (column (3)), libraries and archives (column (4)), theaters (column (5)) and museums (column (6)) and as as the total number of these six types of establishments in column (7).
All control variables are included. Robust standard errors in parentheses;
*** Significant at the 1 percent level, ** 5 percent level, * 10 percent level

Table C.4: Alternative measure: access to cultural goods and services (with fixed-effects)

	Access to culture						
	Commercial			Non-commercial			All
	Book stores	Music stores	Video stores	Libraries	Theaters	Museums	establishments
Dependent variable: Rents							
Culture	-0.047***	-0.008**	-0.003	-0.003	-0.002	-0.001	-0.100***
	(0.010)	(0.003)	(0.006)	(0.002)	(0.002)	(0.003)	(0.014)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2072	2072	2072	2072	2072	2072	2072
R-squared	0.613	0.606	0.603	0.604	0.603	0.601	0.620
Dependent variable: Wages							
Culture	-0.039***	-0.004*	-0.002	-0.002	-0.002	-0.001	-0.079***
	(0.007)	(0.002)	(0.005)	(0.001)	(0.002)	(0.002)	(0.010)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2069	2069	2069	2069	2069	2069	2069
R-squared	0.714	0.701	0.700	0.700	0.700	0.696	0.722

Culture is defined as the per capita number of book stores (column (1)), pre-recorded tape and CD stores (column (2)), motion picture and video exhibitions establishments (column (3)), libraries and archives (column (4)), theaters (column (5)) and museums (column (6)) and as as the total number of these six types of establishments in column (7).
All control variables are included. Robust standard errors in parentheses;
*** Significant at the 1 percent level, ** 5 percent level, * 10 percent level

Table C.5: Seemingly Unrelated Regressions - cultural employment

	Cross-Section		Within	
Dependent variable:	Rents	Wages	Rents	Wages
	(1)	(2)	(3)	(4)
Culture	0.011*	0.011***	0.008**	0.004*
	(0.006)	(0.004)	(0.004)	(0.002)
Education	0.175***	0.149***	0.071***	0.041***
	(0.012)	(0.009)	(0.022)	(0.013)
Migration	0.082***	0.009***	0.034***	0.023***
	(0.005)	(0.003)	(0.007)	(0.004)
Racial composition	0.040***	0.032***	-0.060***	-0.052***
	(0.006)	(0.005)	(0.008)	(0.005)
Unemployment	0.098***	0.074***	0.089***	0.062***
	(0.007)	(0.005)	(0.004)	(0.002)
Density	0.045***	0.041***	0.934***	0.868***
	(0.004)	(0.003)	(0.057)	(0.034)
Service sector	0.060***	0.028***	0.040***	0.023***
	(0.008)	(0.006)	(0.004)	(0.003)
Violence rate	-0.030***	-0.002	0.002	0.001
	(0.007)	(0.005)	(0.009)	(0.006)
Amusement and recreation	0.077***	-0.001	-0.067***	-0.049***
	(0.012)	(0.009)	(0.016)	(0.010)
Food and Drinking places	0.039*	-0.022	0.378***	0.210***
	(0.021)	(0.016)	(0.036)	(0.022)
Public schools	0.171***	0.075***		
	(0.012)	(0.009)		
Humidity	-0.017*	-0.030***		
	(0.009)	(0.007)		
Temp. January	0.146***	-0.041***		
	(0.009)	(0.007)		
Temp. July	-1.000***	-0.526***		
	(0.053)	(0.039)		
Sunlight	0.189***	-0.002		
	(0.011)	(0.008)		
Observations	1947	1947	1947	1947
R-squared	0.756	0.614	0.589	0.692

Culture is defined as the share of cultural workers in total labor force.
Robust standard errors in parentheses;
*** Significant at the 1 percent level, ** 5 percent level, * 10 percent level

Table C.6: Concentration index and location quotients - **Rent equation**

	(1) OLS	(2) OLS	(3) IV	(4) OLS	(5) OLS	(6) IV	(7) OLS	(8) OLS	(9) IV
Culture	0.018**	-0.012*	0.028						
	(0.007)	(0.007)	(0.077)						
Location Quotient				-0.000	-0.000	0.041	-0.001	-0.035***	0.028
				(0.007)	(0.005)	(0.063)	(0.009)	(0.008)	(0.078)
Concentration index	-0.005	0.021***	0.001				0.002	0.027***	0.006
	(0.005)	(0.006)	(0.039)				(0.005)	(0.005)	(0.026)
Education	0.169***	0.069**	0.073***	0.185***	0.061**	0.070**	0.184***	0.065**	0.075***
	(0.013)	(0.027)	(0.027)	(0.012)	(0.027)	(0.030)	(0.013)	(0.027)	(0.029)
Migration	0.082***	0.035***	0.034***	0.081***	0.034***	0.035***	0.082***	0.036***	0.034***
	(0.005)	(0.009)	(0.009)	(0.005)	(0.008)	(0.008)	(0.005)	(0.008)	(0.009)
Racial composition	0.042***	-0.061***	-0.062***	0.039***	-0.064***	-0.063***	0.042***	-0.061***	-0.062***
	(0.007)	(0.010)	(0.010)	(0.007)	(0.010)	(0.010)	(0.007)	(0.010)	(0.010)
Unemployment	0.098***	0.087***	0.086***	0.101***	0.090***	0.090***	0.098***	0.083***	0.089***
	(0.007)	(0.005)	(0.005)	(0.007)	(0.005)	(0.005)	(0.007)	(0.005)	(0.009)
Density	0.046***	0.935***	0.922***	0.048***	0.979***	0.953***	0.048***	0.920***	0.940***
	(0.005)	(0.111)	(0.100)	(0.004)	(0.116)	(0.102)	(0.005)	(0.110)	(0.099)
Service sector	0.060***	0.040***	0.040***	0.060***	0.039***	0.040***	0.061***	0.039***	0.040***
	(0.010)	(0.007)	(0.005)	(0.010)	(0.007)	(0.006)	(0.010)	(0.006)	(0.006)
Violence rate	-0.032***	0.004	0.004	-0.029***	0.005	0.007	-0.030***	0.003	0.005
	(0.007)	(0.012)	(0.010)	(0.007)	(0.012)	(0.011)	(0.007)	(0.011)	(0.011)
Amusement and recreation	0.074***	-0.066**	-0.064***	0.072***	-0.074***	-0.070***	0.071***	-0.068***	-0.063***
	(0.013)	(0.026)	(0.020)	(0.013)	(0.026)	(0.020)	(0.013)	(0.026)	(0.021)
Food and Drinking places	0.043**	0.390***	0.378***	0.041*	0.365***	0.357***	0.047**	0.387***	0.385***
	(0.021)	(0.056)	(0.050)	(0.021)	(0.054)	(0.046)	(0.021)	(0.056)	(0.045)
Public schools	0.171***			0.173***			0.171***		
	(0.013)			(0.012)			(0.013)		
Humidity	-0.017			-0.020**			-0.018*		
	(0.010)			(0.010)			(0.010)		
Temp. January	0.147***			0.144***			0.143***		
	(0.011)			(0.010)			(0.011)		
Temp. July	-1.012***			-1.016***			-1.016***		
	(0.060)			(0.059)			(0.060)		
Sunlight	0.192***			0.191***			0.194***		
	(0.012)			(0.012)			(0.012)		
Observations	1949	1949	1943	1987	1987	1982	1949	1949	1943
R-squared	0.754	0.607	0.595	0.751	0.600	0.583	0.754	0.613	0.591
City Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kleibergen-Paap Weak Instr.			6.995			8.025			6.364
Underidentification KP-LM			0.0257			0.00918			0.0215

Culture is defined as the share of cultural workers in total labor force. Location quotient compares this share with the national counterpart. Concentration index is the Herfindahl index of concentration in cultural occupations. Robust standard errors in parentheses.
*** Significant at the 1 percent level, ** 5 percent level, * 10 percent level

Table C.7: Concentration index and location quotients - **Wage equation**

	(1) OLS	(2) OLS	(3) IV	(4) OLS	(5) OLS	(6) IV	(7) OLS	(8) OLS	(9) IV
Culture	0.010*	-0.006	-0.028						
	(0.006)	(0.005)	(0.049)						
Location Quotient				0.007	-0.001	-0.016	0.001	-0.019***	-0.027
				(0.005)	(0.003)	(0.037)	(0.007)	(0.005)	(0.048)
Concentration index	0.002	0.010***	0.021				0.005	0.014***	0.016
	(0.004)	(0.004)	(0.025)				(0.003)	(0.003)	(0.016)
Education	0.150***	0.039**	0.037**	0.154***	0.038**	0.034**	0.158***	0.037**	0.035**
	(0.011)	(0.016)	(0.016)	(0.010)	(0.016)	(0.017)	(0.011)	(0.016)	(0.017)
Migration	0.009**	0.024***	0.025***	0.010**	0.023***	0.023***	0.009**	0.025***	0.025***
	(0.004)	(0.007)	(0.006)	(0.004)	(0.006)	(0.006)	(0.004)	(0.007)	(0.006)
Racial composition	0.032***	-0.052***	-0.052***	0.031***	-0.053***	-0.053***	0.032***	-0.052***	-0.051***
	(0.005)	(0.007)	(0.006)	(0.005)	(0.007)	(0.007)	(0.005)	(0.007)	(0.006)
Unemployment	0.074***	0.061***	0.062***	0.077***	0.062***	0.062***	0.075***	0.059***	0.058***
	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)	(0.003)	(0.005)	(0.004)	(0.005)
Density	0.042***	0.875***	0.882***	0.041***	0.891***	0.900***	0.043***	0.867***	0.864***
	(0.003)	(0.095)	(0.077)	(0.003)	(0.092)	(0.075)	(0.003)	(0.094)	(0.082)
Service sector	0.028***	0.022***	0.023***	0.028***	0.022***	0.021***	0.029***	0.022***	0.022***
	(0.006)	(0.005)	(0.004)	(0.006)	(0.005)	(0.004)	(0.006)	(0.005)	(0.004)
Violence rate	-0.002	0.002	0.002	-0.001	0.002	0.001	-0.001	0.002	0.001
	(0.005)	(0.008)	(0.006)	(0.005)	(0.008)	(0.007)	(0.005)	(0.008)	(0.007)
Amusement and recreation	-0.001	-0.050***	-0.051***	-0.002	-0.054***	-0.056***	-0.002	-0.051***	-0.051***
	(0.009)	(0.017)	(0.014)	(0.009)	(0.017)	(0.014)	(0.009)	(0.017)	(0.014)
Food and Drinking places	-0.022	0.212***	0.219***	-0.026*	0.205***	0.208***	-0.020	0.211***	0.211***
	(0.016)	(0.034)	(0.034)	(0.016)	(0.034)	(0.031)	(0.016)	(0.034)	(0.030)
Public schools	0.074***			0.077***			0.074***		
	(0.009)			(0.008)			(0.009)		
Humidity	-0.031***			-0.029***			-0.032***		
	(0.008)			(0.008)			(0.008)		
Temp. January	-0.041***			-0.043***			-0.043***		
	(0.007)			(0.007)			(0.007)		
Temp. July	-0.526***			-0.521***			-0.527***		
	(0.044)			(0.044)			(0.044)		
Sunlight	-0.002			-0.002			-0.001		
	(0.009)			(0.009)			(0.009)		
Observations	1947	1947	1941	1985	1985	1980	1947	1947	1941
R-squared	0.614	0.703	0.695	0.613	0.701	0.696	0.613	0.706	0.705
City Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kleibergen-Paap Weak Instr.			6.947			8.010			6.302
Underidentification KP-LM			0.0262			0.00925			0.0222

Culture is defined as the share of cultural workers in total labor force. Location quotient compares this share with the national counterpart. Concentration index is the Herfindahl index of concentration in cultural occupations. Robust standard errors in parentheses.
*** Significant at the 1 percent level, ** 5 percent level, * 10 percent level

Table C.8: Employment and population growth

Dependent variable: **Δ Employment**	(1) OLS	(2) OLS	(3) IV	(4) IV
Δ Culture	-0.005***	-0.003*	0.059	0.091
	(0.002)	(0.002)	(0.049)	(0.079)
Δ Herfindahl				0.083
				(0.068)
City Fixed Effects	Yes	Yes	Yes	Yes
Observations	1912	1912	1902	1902
Kleibergen-Paap Weak Instr.			9.263	6.337
Underidentification KP-LM			0.00737	0.0185

Dependent variable: **Δ Population**	(1) OLS	(2) OLS	(3) IV	(4) IV
Δ Culture	0.001	0.001	-0.009	-0.014
	(0.001)	(0.001)	(0.012)	(0.018)
Δ Herfindahl				-0.012
				(0.005)
City Fixed Effects	Yes	Yes	Yes	Yes
Observations	1912	1912	1902	1902
Kleibergen-Paap Weak Instr.			9.263	6.337
Underidentification KP-LM			0.00737	0.0185

Culture is defined as the share of cultural workers in total labor force.
Robust standard errors in parentheses.
*** Significant at the 1 percent level, ** 5 percent level, * 10 percent level