KTH ROYAL INSTITUTE
OF TECHNOLOGY

Department of
Industrial Economics and Management

Electronic Working Paper Series

Paper no: 2013/2

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16-12-2013

INDUSTRIAL ENGINEERING AND MANAGEMENT
Industrial Economics and Management

SPATIAL CLUSTERING OF ARTISTS

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Abstract: Surveys of artists' location choices show that they disproportionately reside in large cities. This paper introduces a model that attempts to explain this urban preference. The model includes four factors: access to other artists, access to consumers, access to service jobs, and housing affordability. These four factors are combined in a spatial equilibrium model. Subsequently, the model is used for an econometric estimation of factor effects.

The results show that access to other artists and local access to service jobs are important localization factors. Educated labor used as a proxy for consumer demand has a significant effect on artists' location choices.

Keywords: location choice; artists; clustering; knowledge externalities

JEL codes: R12; R14; R15; R23; Z11

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1 Introduction

Artists have always been associated with great creative cities. Renaissance Florence was known as a Mecca for artists and other creative individuals, as were Amsterdam and London in the seventeenth and eighteenth centuries (Andersson, 2011). It seems as if artists benefit from agglomeration economies as much as—if not more than—other accessibility-dependent occupational groups such as scientists and stockbrokers (Glaeser and Maré, 2001). In the post-industrial era, this urban orientation remains operative in the location decisions of individual artists, although there are of course now *more* creative agglomerations to choose from. The occupational restructuring that has accompanied de-industrialization has among other things resulted in a greater demand for creative work, including artistic work. Agglomerations of creative workers have become more numerous than in the past. Even so, three quarters of the global value of fashion design, to take one example, is still created in the four leading cities (Wenting, 2008).

In Sweden, a similar centripetal process has made about half of the country's artists choose to move to—or remain in—the Stockholm region, which is home to less than one quarter of the general population. What factors have made Stockholm so much more attractive than other, less costly, Swedish regions? We shall attempt to answer this question by means of an econometric analysis of the location of Swedish artists. In our definition, artists include visual artists, performing artists, musicians, designers, and architects.

The paper is organized as follows. In section 2, we provide a brief overview of the location patterns of artists, with a focus on Sweden, the United Kingdom, and the United States. Section 3 discusses the main location criteria with the help of suitable empirical illustrations. There are four such criteria: accessibility to other artists; accessibility to consumer demand; accessibility to employment opportunities; and affordability. Section 4

formalizes these criteria in the form of an accessibility-based location choice model. In section 5, an equilibrium model shows how accessibility-based choices may result in an equilibrium spatial configuration. The empirical analysis is based on an econometric adaptation of the location choice model. The following three sections are devoted to the econometric analysis of the location choices of Swedish artists. A discussion of the implications of the estimation results concludes.

2 The location pattern of artists

The world of artists is spiky rather than flat, and in that way it resembles the world of inventors and scientists (Andersson, 1985; Florida, 2005). Like other creative people, artists benefit disproportionately from regional knowledge externalities (Gabe, 2011). They do so in three principal ways. First, much of the knowledge that artists can learn from other artists is tacit, and thus requires face-to-face contact rather than disembodied information transmission channels (Palmberg, 2012). Second, knowledge transmission is facilitated by an atmosphere of trust, which is more likely to be forthcoming among people who know one another personally (Leamer and Storper, 2001). Third, creative breakthroughs are often the result of finding what one is not looking for, that is to say that serendipitous discoveries are especially important for people who work in creative occupations (Chesbrough, 2003). All of these three causes of knowledge externality creation are associated with large and dense concentrations of creative workers.

Looking at the distribution of artists (exclusive of architects and designers) in the largest 29 metropolitan statistical areas (MSAs) in the United States, Markusen and Schrock (2006) found that artists made up a much larger share of the workforce in Los Angeles, New York and San Francisco-Oakland than in the other large metro areas in 2000.

Turning to artists and designers, the overall spatial distribution is similar to that of artists (narrowly defined), but there are two main differences. First, architects and designers reveal an even greater preference for large cities as compared with (other) artists (Markusen and Schrock, 2006). This is no doubt related to their somewhat lower rates of self-employment, and their greater reliance on sales to businesses rather than individuals. Second, industrial and commercial designers exhibit a location pattern that bears little resemblance to the other surveyed occupational categories. Indeed, the highest employment location quotient is found in Detroit, with its heavy concentration of automotive designers. Perhaps industrial designers make up one of a few subcategories where the traditional principle of "people following jobs" is still more important than "jobs following people" (ibid.).

Comunian and Faggian (2011) offer a somewhat different approach to analyzing the spatial distribution of artists. They compare the locational choices of arts-related students, graduates and workers in the United Kingdom and find clear evidence of a centripetal life-cycle effect, with London's West End as the center of gravity. The British results allude to the importance of intra-regional location; Inner London—West is clearly a sub-region within London's metropolitan area, if that area is delimited according to the degree of labor or housing market integration. And there are good reasons for why this should be so. Within-industry knowledge agglomeration effects tend to have very steep distance gradients, especially in creative and knowledge-intensive industries.

The spatial clustering of artists seems to look similar in other European countries. Fritsch and Stuetzer (2009) show that German writers, performing artists, musicians and artists in fine arts are overrepresented in urban agglomerations and especially so in their core cities. In another study, Boschma and Fritsch (2009) describe the regional distribution of creative

occupations in seven European countries[5]. Using the definition suggested by Florida (2004) they find that creative occupations are overrepresented in the largest urban regions and that the regional differences are most pronounced for "bohemians", that is artistically creative people such as writers, designers, performing artists and painters.

The location pattern of Swedish artists resembles the pattern in other European countries having a dominant agglomeration. The City of Stockholm hosts the greatest concentration of artists of Sweden's 289 cities, towns and other municipalities.

One third of all Swedish artists live there as compared with less than one tenth of the total population. Using a definition of artists based on having received a specialized arts education, table 1 shows that the percentage ranges from 21 percent for craftspeople to 49 percent for performing artists (i.e. dance, theatre and drama).

INSERT TABLE 1 HERE

In line with American observations, performing and visual artists seem to be more concentrated in space than musicians.

Table 2 and 3 presents the location quotients for the same categories of artists in all three Swedish metropolitan areas with total populations exceeding one million[6] respectively for their core cities (Stockholm, Gothenburg, and Malmö). Taken together, the tables show that artists cluster in the largest metropolitan areas and, additionally, that artists are even more over-represented in the core than at the periphery of these large conurbations.

[5] Denmark, England and Wales, Finland, Germany, the Netherlands, Norway and Sweden

[6] The regions are defined in terms of commuting patterns between municipalities. In Sweden, there are 289 municipalities that jointly correspond to 75 metropolitan areas (i.e. "labor market areas").

INSERT TABLE 2 HERE

INSERT TABLE 3 HERE

The location quotients tend to be higher in Stockholm than in Gothenburg and Malmö both at the metropolitan and at the core municipality level. In spite of its slightly smaller size, Malmö is associated with higher location quotients than Gothenburg, which probably reflects Malmö's good accessibility to the Copenhagen region in Denmark. As is the case in the United States, performing and visual artists seem to benefit especially much from a central location. Designers and craftspeople are over-represented in Gothenburg in much the same way as American industrial designers are over-represented in Detroit. This may point to the close link between design-based activities and the automotive industry (Volvo was founded in Gothenburg, while SAAB originated in the nearby municipality of Trollhättan).

Case studies of individual cities confirm the high preference for a central location among artists. For example, Markusen (2006) found that artists in the Minneapolis MSA disproportionately live in inner-city areas, with 35 percent of all artists living in the City of Minneapolis, which accounts for only 11.5 percent of the overall population. Markusen writes that

> [a]rtists gravitate more toward residences in the denser, more central urban neighborhoods than do residents as a whole—often to seedy, transitional neighborhoods … Performing artists—actors, dancers—are more inner-city centric than musicians, writers, and visual artists, but all artists are more central-city oriented than are other occupations. Central cities offer access to art schools, performance and exhibition spaces, affordable live/work and studio space, training institutions, artists'

> centers, and amenities from nightlife to recreational opportunities. Younger artists are more drawn to very close-in neighborhoods … and they are more apt to rent than to own. (Markusen, 2006, p. 1930)

This passage brings to mind Jane Jacobs' well-known study of what made neighborhoods such as New York's Greenwich Village extraordinarily attractive to creative people in the 1950s and 1960s (Jacobs, 1961), and serves as a suitable starting point for thinking about *what* artists want to have access to and *why* that is.

3 Location criteria

It is our view that knowledge externalities and other agglomeration effects such as distribution and commuting costs jointly influence the locational preferences of artists. They do so in four important ways. First, expectations of valuable knowledge spillovers between artists make artists prefer to live near other artists. Second, artists need a market for their output, and the demand for their output is distance-attenuated. Third, full-time artists are disproportionately self-employed, while many aspiring artists can only practice their art on a part-time basis. This makes artists unusually keen to have good access to sites for short-term contractual arts-related work and even to part-time work in other occupations. Fourth, many types of art production have pronounced "winners-take-all" phenomena, which implies that median incomes are lower than for other occupations with similar levels of education and creativity. We therefore turn to a brief discussion of each of these four factors, which are subsequently modeled as four partial location determinants in our location choice model.

3.1 Accessibility to other artists

To understand the importance of accessibility to other artists, it is important to remember that artists are unusually creative workers. Gabe (2011) uses a questionnaire-based survey to rate the relative creativity content of all major occupations. Among the top five creative occupations, four are arts-related, with only "astronomers and physicists" being more creative than actors, writers, visual artists, or architects. The most creative of the broader occupational categories is consequently "arts, design, entertainment, sports and media," with 86.5 percent of its members in high-creativity jobs (ibid.).

Gabe (ibid.) also presents an econometric estimation of wage determinants in the United States that encompasses all distinct occupations. He finds that there is a highly significant wage premium for creativity on top of the wage premium for education. Moreover, the creativity wage premium is not uniform across the United States; it ranges from a low of minus 13.7 percent to a high of plus 34.0 percent depending on MSA location, with The mean premium across MSA´s is in the neighborhood of 25 percent and there is a highly significant and positive interaction effect between the wage premium of the individual and the percentage of workers in a metropolitan area in high-creativity occupations.

That this is so should come as no surprise. Creative work such as art production is known for its high "buzz" factor (see Storper and Venables, 2004). "Buzz" signifies activities that rely disproportionately on private tacit knowledge and for which the economic coordination environment tends to be rapidly changing (it is "fluid"). Tacit knowledge requires spatial proximity for successful transmission, and an unstable coordination environment also implies that it is advantageous to have good access to a location where new ideas are being created. The combined effect is that workers specializing in "buzz activities" value spatial proximity to creative people more than other workers do. The arts encompass many such activities, as do science, high technology, and state-of-the-art finance (Palmberg, 2012).

It is not only tacit knowledge and a fluid environment that characterize the arts. As we have seen, the arts are also unusually creative. Creativity usually proceeds by combining ideas that have hitherto not been combined, with more distant connections being associated with more radical creative breakthroughs. Unexpected and unplanned stimuli often propel creative people into making such connections, and it is quite reasonable to expect such stimuli to be more frequently encountered in large, dense, and diverse urban environments (Andersson, 2011).

All in all, we should expect artists to value accessibility to other artists for at least three reasons that are more important to them than they are to most other workers: the possibility of learning tacit knowledge from others; an unusually fluid market with short product life cycles; and the possibility of serendipitous discoveries that can be used as creative sparks for new art.

3.2 Accessibility to consumer demand

The demand for artistic goods and services is usually subject to spatial friction. This is quite obviously the case for the performing arts, where consumers have to incur transport costs in order to consume. Thus it comes as no surprise that actors and dancers are more "inner-city centric" than other artists. But distance matters for other artists too, albeit to a somewhat lesser extent. While normal distribution costs are often negligible, it will still be advantageous to be able to rely on a multitude of information channels in order to reach the potential consumers to which an artist's output may eventually be distributed: not only the internet, but also bricks-and-mortar bookstores and exhibition spaces, university auditoria, and face-to-face networks. For all these reasons, we should expect that even artists with low distribution costs per unit of output—such as novelists and studio musicians—will prefer a central over a peripheral location, other things being equal.

Artists can reach a larger audience with constant space-bridging costs the larger is the size of the city where they are located, and the more central is the location of the city relative to other population concentrations. Both intra-regional and inter-regional accessibility are relevant. But the income and wealth of these populations should also be taken into account. Arts-related goods tend to be highly income-elastic, with estimated elasticities ranging from about 1.1 to as much as 2.4 (e.g. Andersson, 1985; Felton, 1994-95; Gapinski, 1984; Houthakker and Taylor, 1970; Pommerehne and Kirchgassner, 1987; Throsby and Withers, 1979). *Ceteris paribus*, we should expect artists to value accessibility to people weighted by purchasing power more than they value accessibility to people without such weighting.

3.3 Accessibility to employment opportunities

Artists have unusually high levels of self-employment. This is particularly true for artists as narrowly defined (fine artists; performing artists; musicians; writers), which exhibited a self-employment rate of 45 percent in the United States in 2000 (Markusen and Schrock, 2006). The average for all artistic occupations (including architects and designers) was 38 percent in the same year. Similar levels of self-employment can be observed in Sweden. Excluding writers, about 18 percent of artists with tertiary educational qualifications are self-employed and an additional 25 percent combine self-employment with wage employment.[7]

Self-employment normally means that the worker constantly has to be on the lookout for short-term project opportunities with clients, be they corporate or further downstream, as when individual households contract with photographers or musicians in conjunction with weddings. Having a large pool of potential clients is obviously beneficial for self-employed artists, and this is therefore an additional factor that should favor large conurbations (Andersson and Andersson, 2006).

[7] See Daghbashyan and Hårsman (2013), page 8.

We should therefore expect self-employed and part-time artists to be attracted by the regions that host specialized clusters with potential employment opportunities for artists. Unlike the other accessibility factors, however, the reach of employment opportunities is usually limited by the possibility of commuting on a daily basis. Consequently, the feasible workplace locations tend to coincide with the labor market region, and inter-regional accessibility therefore becomes less relevant. Studies of commuting behavior show that commuting propensities decrease in a highly non-linear fashion with increases in the commuting time distance (Johansson et al., 2003).

3.4 Affordability

Earnings statistics show that on average, American and Swedish artists earned much less than other professionals with similar levels of education[8]. Since there is usually also a wage premium associated with high-creativity occupations (cf. Gabe, 2011), the income shortfall of artists vis-à-vis other workers with similar levels of education *and* creativity is even greater. Within the general category of artists there is however a great deal of variability.

The low median incomes among artistic occupations are conditioned by the "winners-take-all" character of many of these occupations (Andersson and Andersson, 2006). Books, recorded music, and movies, in particular, are associated with negligible marginal costs in production, and bestsellers can therefore make the creators earn extremely high incomes. At the same time, the success of a project is unlikely in the case of artists who are not widely known, since imperfectly informed consumers largely rely on the fame of the artists (e.g. Steven Spielberg, Kevin Costner, Bruce Springsteen) when making their consumption decisions (Andersson, 2008). Since most consumers are subject to severe time constraints

[8] See National Endowment for the Arts, undated and Daghbashyan and Hårsman (2013), page 9.

associated with those activities in which they only have a minor interest, mass markets are only associated with a handful of artists for each type of artistic output (Andersson and Andersson, 2006).

Since the mean salary of artists is lower than their skill set would imply, and the median salary is lower still because of winners-take-all phenomena, this subset of the population mostly cannot afford high-quality housing in good and centrally located neighborhoods. And yet they have a strong bias in favor of accessible locations in the most dynamic cities. There are only two ways to mitigate the effect of relatively modest incomes. First, artists may choose housing that is old, small and run-down. This is related to Jacobs's (1961) insight that "new ideas need old buildings." Second, they may choose inner-city areas with socio-economic attributes that are avoided by high-income residents and thus are less expensive. It is therefore not all that surprising that artists often cluster in poor inner-city neighborhoods such as the Downtown Eastside (Vancouver) or Kreuzberg (Berlin).

To sum up, artists should be expected to value access to other artists and to consumers both within and without their host region, while their valuation of accessibility to work opportunities has a more intra-regional character. In addition, they should be expected to prefer relatively affordable housing and neighborhoods, given the level of attained accessibility. We can now turn to the formal model that integrates these expectations.

4 Location modeling

4.1 Accessibility to other artists

Assume space to be subdivided into N geographically delimited areas. The artist must select one location from these N areas. One location preference argument is thus the accessibility to other artists from an area i to all N areas. Artists can be expected to prefer other artists to have

proximate rather than distant locations. Similarly, artists are expected to aim for the greatest possible number of other artists at a given distance.

The definition of accessibility to artists from area *i* is

$$a_i^x = \sum_{j=1}^{N} f(d_{ij}) x_j; \quad (1)$$

where

a_i^x = accessibility to artists, *x*, from area *i*;

$f(d_{ij})$ = a strictly decreasing function of the distance between two areas *i* and *j*;

x_j = the number of artists in area *j*.

The positive convex distance function $f(d_{ij})$ implies that the accessibility to a given number of artists decreases with increases in the distance between area *i* and *j*.

A reasonable and commonly used measure of $f(d_{ij})$ is

$e^{-\beta d_{ij}}$ with $\beta \geq 0$ and $d \geq 0$. (2)

Here *d* is defined as the time distance by the transport mode that is normally used by artists. β is a measure of spatial friction associated with commuting. This functional form implies that accessibility is a spatial analogue to the discounted total value of revenue flows in capital theory. An advantage of this functional form is the property that $e^{-\beta d}$ has the limits 1 for $d \to 0$ and 0 for $d \to \infty$.

4.2 Accessibility to consumer demand

Artists want good access to consumer demand. The demand for most artistic outputs such as paintings, books, and live performances is income-elastic. Other things being equal, an

increase in the number of artists producing a specific output can be expected to reduce the demand for the output of each individual artist. The demand function is thus as follows:

$$D_i = k y_i^{\gamma} x_i^{-1}; \quad (3)$$

where

D = demand for arts products;

y = consumer income;

x= number of artists;

i = location (region or municipality).

Other things being equal, an increase in the number of artists producing a specific output can be expected to reduce the demand for the output of each individual artist

4.3 Accessibility to employment opportunities and affordability

It is well known that the size and variety of short-term and part-time employment opportunities increase with the size of the regional economy (Johansson and Klaesson, 2011; Glaeser et.al. 2001). We can thus define employment opportunities in an area i as the number of jobs within the corresponding local labor market, E_i.

The fourth key factor is affordability in terms of housing rent. Each area (*i*) is associated with an area-specific level of housing costs, measured as the mean rent R_i per square meter.

4.4 The four key factors

Summarizing the four key factors yields a function where the returns to an artist's work, r, depend on her choice of location:

r_i = F(a_i^x(**x**), $ky_i^\gamma x_i^{-1}$,E_i, R_i); (i = 1, … , N) (4)

where x represents relevant artists in the areas j = 1, … , N for x.

We use equation (4) for two purposes. First, we show that it can be used to derive a spatial equilibrium model of artists' location choices (given certain assumptions). Second, we use it as the basis for an econometric model.

5 A general spatial equilibrium model

We first assume that the equations have the following form:

$$\ln r_i = \alpha_1 \ln a_i^x(\mathbf{x}) + \alpha_2 \ln y_i + \alpha_3 \ln E_i + \alpha_4 \ln R_i - \ln x_i; \ (i = 1, \dots, N); \quad (5)$$

We further assume that all the weights α_l are equal in size and that the artists will be competitive in their choices of location so that r_i approaches ρ. The number of artists x_i represents the impact of competition between artists. Thus we can multiply both sides of equation (5) by x_i. As a consequence we can formulate a spatial equilibrium condition as the following eigen-equation (or characteristic equation):

$$\rho \mathbf{x} = \mathbf{Q}\mathbf{x}; \quad (6)$$

where **Q** = (q_{ij}) =($e^{-\beta dij} * y_i^{\alpha_2} * E_i^{\alpha_3} * R_i^{\alpha_4}$).

As all the elements of the **Q** matrix are strictly greater than 0 we are assured by the Frobenius-Perron theorem of the existence of an equilibrium solution with the characteristic value of ρ=ρ(max), which is associated with a vector **x** = **x´**, where **x´** is the strictly positive equilibrium vector of locations of artists in all areas (Debreu and Herstein, 1953). We further know that an increase in any element of **Q** will increase the maximum returns (ρ(max)). Among other things, this implies that increasing demand, decreasing rent or decreasing distance all contribute to higher equilibrium returns, thereby causing the artists to relocate, as indicated by the change of the equilibrium vector **x´** to **x´´**.

An area with a consistently higher vector of q-values than other areas (for example as a result of better accessibility combined with more affordable housing) will have a larger agglomeration of artists than the other areas.

The linear eigen-equation (6) is somewhat special, but it can be shown that a non-linear version (7) has an equilibrium solution with a positive equalized rate of return and an associated positive vector **x´**:

$$\rho \mathbf{x'} = \mathbf{Q(x')}; \qquad (7)$$

where Q(x´) is a continuous, concave mapping from $R^+$to R^+ (Nikaido, 1968).

6 The econometric model

The theoretical framework is anchored in general equilibrium theory and we assume the spatial allocation to be determined as a fixed point of (7) and as the linear approximation of (6). The returns to human capital will be equal in all locations, if we assume that the x-vector approximates a simultaneous equilibrium allocation (implying that all r_i = ρ).

Using this assumption, the equilibrium number of artists in different locations can be derived directly from (6) by first computing each element of the Q matrix and then solving the

equation for the vector that maximizes the returns to each artist's work. A comparison between the equilibrium configuration and the observed number of artists provides an initial empirical test of the equilibrium model: if the correlation is zero, negative, or only weakly positive, it would indicate that the spatial distribution of artists is in disequilibrium. For this reason, we computed the elements of the matrix for municipalities using the accessibility variable in (6). The squared correlation coefficient between the computed equilibrium values and the observed values is close to 0.1 for performing as well as non-performing artists, which implies that the real-world distribution does not closely approximate the equilibrium distribution, which is obviously caused by market imperfections or missing variables. The low positive correlation coefficient in this simplified form with accessibility to artists also indicates moderate endogenous impacts of the simultaneous x variables.

Since the Swedish housing market is partly regulated – the rents are administratively decided for a comparably large share of the dwellings in multifamily houses - we will disregard the affordability factor and estimate the following logarithmic specification:

ln (number of artists located in area i) = α_0 + $\alpha_1$ln (accessibility to artists from i) + $\alpha_2$ln (consumer income in i) + α_3 ln (employment opportunities in i) + control variable effects + μ;

(8)

with the following hypotheses:

α_k> 0 for k = 1, 2, 3;

The causal interdependence between the number of artists located in area i and the accessibility to artists from area i makes it necessary to use an estimation method that can handle the corresponding endogeneity problem. However, there is little need for an auto-correlation analysis with this specification; it has been shown that the use of accessibility

measures of spatial dependencies normally eliminate spatial autocorrelations (Andersson and Gråsjö, 2006; 2011).

7. Artists in Sweden

The data that we use in this study were provided by Statistics Sweden and include education, occupation and location variables for the Swedish labor force from 2004 to 2008. Additionally we use aggregate observations on the 289 Swedish municipalities that constitute our basic geographical areas.

7.1 The definition of artists

Since it is not self-evident how artists should be defined we initially considered two alternatives. One alternative is to define artists as a set of occupations, which in practice amounts to assessing a wide range of individual occupations and categorizing each one according to artistic content. It seems self-evident that actors, for example, should be counted as artists while dentists should not be counted as such. It is however more difficult to decide how to classify occupations such as bookbinders and furriers. If—as in Sweden—information about occupations is not available for self-employed workers one option is to exclude them.

But since self-employment is common among artists we have instead categorized the self-employed by judging whether the industry to which each firm is assigned is artistically oriented or not. According to this occupation-industry based definition, 73,000 out of a total of 4.4 million employees and self-employed were artists in Sweden in 2008. [9]

Another way of defining artists is to use an education-based definition. Since specialization usually occurs at higher levels of education, this approach in practice limits the selection to workers with tertiary educational qualifications. In our case, workers (employees or self-

[9] The list of occupations and industries categorized as artistic is given in Appendix 1. Representatives of the Arts Colleges in Stockholm helped with the categorization.

employed) with a degree from a specialized arts college or with a degree in architecture from a university are identified as artists. A possible advantage of using an education-based definition is that a willingness to invest in higher education may imply a greater concern with choosing a location that offers a reasonable rate of return on one's educational investments. In addition, numerous migration studies show that there is a significant positive correlation between the duration of formal education and the probability of migration. A drawback of using this definition is that it excludes large groups that are generally regarded as artists, for example musicians without an arts-related college education and—even more importantly—all writers. As a result there are only 17,000 artists in Sweden according to our education-based definition.

In spite of the difference in the number of artists the spatial patterns look much the same regardless of whether we define artists in terms of their education or occupation. As shown in Figure 1 the relationship between the two is close to linear.

INSERT FIGURE 1 HERE

The upper part of Figure 1 shows the relationship for performing artists, defined as actors, dancers and musicians, while the lower part of Figure 1 plots the relationship for non-performing artists, which includes all other artists. The strong correlation implies that the choice of definition does not matter much when estimating the econometric equation described by equation (8).10 Since we have access to a full dataset we use both definitions in our econometric analyses as a robustness check.

7.2 Descriptive statistics

Table 4 provides a descriptive summary of all variables used in the empirical analysis.

[10] The correlation coefficient is around .98 between performing and non-performing artists

INSERT TABLE 4 HERE

As shown by Table 4 there is a great deal of variability in the number of artists in Swedish municipalities. The number of performing artists defined by education is less than 4 in about half of all Swedish municipalities; the corresponding number is 8 for non-performing artists. Using the occupation-based definition increases the median numbers rise to 11 for performers and to 54 for non-performers.

The accessibility measures have been calculated according to the definitions of equations (1) and (2), using a matrix that provides driving times within and between all 289 municipalities. The estimated time sensitivity parameters are .02, .01, and .05 for driving within municipalities, between municipalities belonging to the same labor market area, and between municipalities belonging to different labor market areas, respectively[11]. As expected, the mean, median and maximum values are considerably higher for the number of accessibility-weighted artists than for artists within the same municipality.

The road accessibility indicator—which we us as an instrumental variable—is defined as $\sum_{j=1}^{N} e^{-\beta d_{ij}}$, where β is the measure of spatial friction associated with commuting and d_{ij} is the distance from municipality *i* to municipality *j*. The reason for using this measure as an instrument is that it provides a long-term indicator of general accessibility that is unaffected by the location of artists.

Our proxy for consumer demand is the median income of the population in the labor market, which refers to the commuting region to which the municipality belongs. As an alternative we use the percentage of the population having at least 3 years of tertiary education. The corresponding proxy for employment opportunities is the number of service jobs in the labor

[11] The travel time matrix and the sensitivity estimates were provided by Börje Johansson and Johan Klaesson of Jönköping International Business School.

market area divided by its population size. Service jobs are defined as the total number of jobs in all industries except for agriculture, fishing, mining, manufacturing, financial intermediation, real estate and education. To control for the location of arts colleges we include a variable indicating the number of arts students in the respective municipality. We also include a dummy variable which is intended to capture historical centres of culture; regional capitals are such centres since they were designated as capitals already in the seventeenth century and have thus received the bulk of governmental investments in theatres, museums and other tax-funded cultural infrastructure. Given that numerous Swedish municipalities are located in northern Sweden with its unusually harsh winters, we also include controls for the number of days with below-freezing temperatures and the number of days with measurable precipitation.

8. Estimation method and results

One of the main estimation problems is the potential endogeneity between the dependent variable and accessibility to artists: to what extent does accessibility to artists cause artists' location choices and vice versa? We address this problem by using road accessibility (a_i^{Road}) as an instrument for accessibility to artists. Historical investments in transport infrastructure determine road accessibility and thus the direction of the causal relationship is unambiguous. In addition, the road accessibility variable fulfills the usual requirement for an instrument; the squared correlation coefficient is about .11 with the dependent variable and about .64 with accessibility to artists.[12]

Table 5 presents the resulting estimates. Column (1) and (2) report the estimated coefficients for performing artists using education-based and occupation-based definitions, whereas

[12] The differences are small between performers and non-performers and between education-based and occupation-based definitions.

columns (3) and (4) show the results for non-performers. A five-year panel makes it possible to use municipality-specific random effects. A fixed-effect model is however not feasible, since road accessibility is a time-invariant instrument.

INSERT TABLE 5 HERE

The results support the hypotheses of a positive influence of accessibility to artists as well as to service jobs. We find that accessibility to artists is an important location criterion for both performing and non-performing artists, irrespective of the definition used. As expected the estimated accessibility coefficients are rather similar, regardless of whether artists are defined by education or occupation. However, the results do not support the hypothesis that accessibility to other artists is more important for performers than for non-performers. According to the occupation-based estimates the coefficient is actually somewhat lower for performers than non-performers; .21 as compared with .37.

The results also support the hypothesis that access to service jobs is important. All coefficients are positive and significant except for occupation-based non-performers. On the other hand, the estimated income coefficients seem almost random. One explanation might be that the income variable does a poor job as a proxy for effective demand. As an alternative, we used the fraction of people having a university education.13 Table 6 shows that this results in positive and significant coefficients for both categories of artists, irrespective of definition.

INSERT TABLE 6 HERE

[13] The variable is defined as a weighted average of the percentage of the municipal population having at least three years of tertiary education.

The accessibility coefficients remain significant though somewhat smaller in magnitude. Service jobs also stay significant but with a smaller quantitative estimate. The changes among the other variables are minor.

The control variable estimates also point to some interesting patterns that go beyond our theoretical model. First, the number of arts students in each municipality has a positive effect on artists' location decision, which is line with earlier studies showing that more that 50 percent of graduates tend to stay close to the place of graduation (Daghbashyan and Hårsman, 2010). Second, the estimate of the capital city dummy is positive and significant in all specifications, which implies that an historical role as a political center makes it easier for a municipality to attract artists. Third, harsh winters seem to repel artists. Note however, that this significance disappears when the share of college-educated replaces income as a proxy for consumer demand.

As a further robustness test we have also run the regression for each of the seven artistic categories using the education-based definition. The main conclusion from this exercise is that the accessibility coefficient turns out to be significant for each category except for those having an education in crafts.[14]

Furthermore, to exclude the possibility of biased results due to differences in the municipality size, not captured in the empirical setup in order to be close to the theoretical model, we have normalized the dependent variable, i.e. the number of artists in the respective municipality, by dividing it by the total population[15]. Our main results concerning accessibility to artists hold for all groups except for performers defined by occupation, implying that we must treat the estimates in table 4 and 5 with some caution. When it comes to the fraction of service

[14] The results are reported in Appendix 2, Table A1
[15] The results are reported in Appendix 2, Table A2

jobs, as before, the coefficient is positive and significant for all groups except for occupation-based non-performers. Using the fraction of people with higher education as a proxy for consumer demand we find that the fraction of service jobs becomes insignificant for both performers and non-performers defined by education but significant and positive for both groups defined by occupation. This might imply that being more ambitious education based artists are less interested in service jobs. As regards the effect of consumer demand captured by median income/ fraction of people with higher education the results are rather similar.

Summarizing, the results mostly support our theoretical model. Artists value access to other artists when choosing where to live. A location becomes more attractive with greater availability of service jobs with occupation based artists being more interested in service jobs. The demand effect is however insignificant if measured according to the original specification. The share of college-educated residents seems to be a better indicator of the demand for artistic outputs.

9. Summary and conclusions

This paper uses an equilibrium model of the location of artists as the theoretical starting point. The model includes four different factors that may impact location choice. The first factor stipulates that artists value interaction opportunities with other artists. Second, artists prefer locations with good access to relevant consumers, controlling for the number of competitors. Third, artists value access to employment opportunities in normal service jobs. Fourth, artists want affordable housing. In the theoretical model, a Wicksell-Cobb-Douglas form represents the impact of the four factors on location choice.

In an empirical analysis we use observations from all Swedish municipalities to test the propositions suggested by the theoretical model. The model is a slightly revised econometric

model that includes measures of all factors except affordable housing. There is no good measure of housing affordability, since Swedish rent control policies imply other rationing principles than market price.

We estimate separate functions for performing as well as non-performing artists, using both education-based and occupation-based classifications. Using five-year data for all Swedish municipalities, we apply panel data estimation with municipality-specific random effects. The use of a fixed-effect model is impossible since we use a time-invariant instrumental variable in order to avoid potential endogeneity. The main results are as follows.

The coefficient for accessibility to other artists is positive for performing as well as non-performing artists, irrespective of whether we define artists in terms of education or occupation. Our estimates also show that a location becomes more attractive with increasing availability of service jobs. The consumer demand variable is insignificant when measured as the median income of the relevant population. The alternative specification with demand expressed as the university-educated population share does however result in significant positive coefficients. Education is probably a better proxy for consumer demand than income.

This is an exploratory study that hints at a few general tendencies; it does not delve into more fine-grained details such as differences between artistic specializations, the choice between different neighbourhoods within the same municipality or the distance gradients associated with different types of knowledge externalities. There are clearly numerous aspects that future research may analyze in more detail, for example by focusing either on a specific occupation or by looking at more fine-grained spatial effects. The most severe drawbacks of our empirical analysis are the impossibility of measuring the actual housing costs (i.e. the sum of money *and* waiting costs) and the difficulties of measuring the demand for artistic output and activities that artists face in different Swedish localities.

Nevertheless, we believe that our general theoretical framework applies to a great variety of spatial and temporal contexts. And one empirical finding overshadows everything else: artists want to be near other artists. This criterion alone explains not only why artists agglomerate in large regions, but also why they have an unusually strong bias in favor of centrally located neighbourhoods.

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Appendix 1

Categorization of occupations and industries according to the Swedish Standard Classification of Occupations (SSYK 96) and the Swedish Standard Classification of Industries (SNI 2002).[16]

Artistic occupations

Performing artists:

2453 Composers, musicians, and singers

2454 Choreographers and dancers

2455 Directors and actors

3473 Musicians, singers, dancers and others in entertainment

3474 Circus and other artistes

3476 Stage managers and related occupations

Non-performing artists

2141 Architects and urban planners

2451 Journalists, writers, communicators and related occupations

2452 Sculptors, painters and related occupations

2456 Designers

3471 Artistic illustrators, decorators and related occupations

7321 Turners and related occupations

7322 Glass cab workers and related occupations

7323 Glass engravers

7324 Decorative painters

733 Handicraft workers in wood, textile, leather and other materials

7343 Private bookbinders

7431 Tailors, milliners and dressmakers; studio workers

7432 Furriers

7433 Cutters

7434 Stitches

[16] The categorization was done together with heads of arts colleges in Sweden.

7435 Upholsterers

Artistic industries

Performing artists

92110 Motion pictures and video production

92320 Theatre and concert halls

Non-performing artists

74201 Architecture

74811 Portrait, photography

74812 Advertising photography

74813 Press and other photography

74102 Graphic design and service

74872 Other design

92310 Performance and production of artistic, literary and other works

Appendix 2

Table A1: Instrumental variable random-effects estimates; Dependent variable: natural logarithm of the number of artists by educational specialization; Accessibility to artists (ln) is instrumented by road accessibility (ln)

VARIABLES	(1) Dancers	(2) Musicians	(3) Visual artists	(4) Designers	(5) Media producers	(6) Architects	(7) Crafts people
Access to performers (log)	.150***	.262***					
	(.033)	(.038)					
Access to non-perform. (log)			0129***	.155***	.158***	.295***	.030
			(.046)	(.036)	(.032)	(.048)	(.023)
Weighted median income	.695*	-.178	-.168	-.620	.649	-.605	-.021
	(.391)	(.444)	(.459)	(.420)	(.399)	(.436)	(.291)
Service jobs/population (log)	1.103***	.952***	.467	.915***	.756***	1.023***	.343*
	(.267)	(.304)	(.321)	(.278)	(.256)	(.311)	(.185)
Arts students (log)	.125***	.050	.072**	.214***	.160***	.093***	.106***
	(.027)	(.031)	(.032)	(.029)	(.028)	(.030)	(.020)
Capital city dummy	1.152***	1.612***	1.544***	.464***	.864***	1.961***	.209*
	(.180)	(.207)	(.225)	(.177)	(.158)	(.229)	(.113)
Days with temperature<0°C	-.000	-.001***	-.001	-.002***	-.000	-.001	-.001*
	(.000)	(.001)	(.001)	(.001)	(.001)	(.001)	(.000)
Days with rain or snow	-.000	-.002***	.000	-.000	-.000	.001	.001
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.000)
Constant	-1.544	3.228	1.841	4.535**	-2.364	4.014*	.594
	(2.029)	(2.304)	(2.401)	(2.164)	(2.045)	(2.295)	(1.487)
Number of municipalities	289	289	289	289	289	289	289
Number of observations	1,445	1,445	1,445	1,445	1,445	1,445	1,445

Standard errors in parentheses
*** p<.01; ** p<.05; * p<.10
Time dummies included

Table A2: Instrumental variable random-effects estimates; Dependent variable: natural logarithm of the number of performing and non-performing artists normalized by municipality population; Accessibility to artists (ln) is instrumented by road accessibility (ln)

VARIABLES	Performers		Non-performers		Performers		Non-performers	
	Education-based (1)	Occupation-based (2)	Education-based (3)	Occupation-based (4)	Education-based (5)	Occupation-based (6)	Education-based (7)	Occupation-based (8)
Access to performers (log)	.108***	-.033			.093***	-.049		
	(.029)	(.033)			(.030)	(.033)		
Access to non-perfrm. (log)			.096***	.157***			.066**	.152***
			(.033)	(.027)			(.033)	(.028)
Weighted median income	.126	-.633*	-.070	-.544				
	(.396)	(.382)	(.429)	(.343)				
College-educated (%)					.048***	.037***	.085***	.009
					(.012)	(.011)	(.013)	(.010)
Service jobs/pop. (log)	.958***	1.010***	.442	1.591***	.438	.468*	-.406	1.423***
	(.258)	(.236)	(.283)	(.216)	(.277)	(.257)	(.297)	(.239)
Art Students (log)	.002	.037	.050*	.041*	.003	.041	.049*	.043*
	(.028)	(.027)	(.030)	(.024)	(.027)	(.026)	(.029)	(.024)
Residence city dummy	.355**	.300**	.459**	.274**	.353**	.284**	.454***	.265**
	(.161)	(0.142)	(.180)	(.131)	(.156)	(.134)	(.170)	(.130)
Days with temperature<0°C	-.001*	-.001**	-.001**	-.000	-.000	-.001**	-.001	-.000
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.000)
Days with rain or snow	-.001**	.000	.001	-.000	-.001**	.000	.001	-.000
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
Constant	-7.415***	-2.333	-7.112***	-1.272	-8.229***	-6.757***	-9.806***	-4.302***
	(2.039)	(1.946)	(2.211)	(1.747)	(.544)	(.522)	(.582)	(.489)
Number of municipalities	289	289	289	289	289	289	289	289
Number of observations	1,445	1,445	1,445	1,445	1,445	1,445	1,445	1445

Standard errors in parentheses
*** p<.01; ** p<.05; * p<.10
Time dummies included

Figures and tables

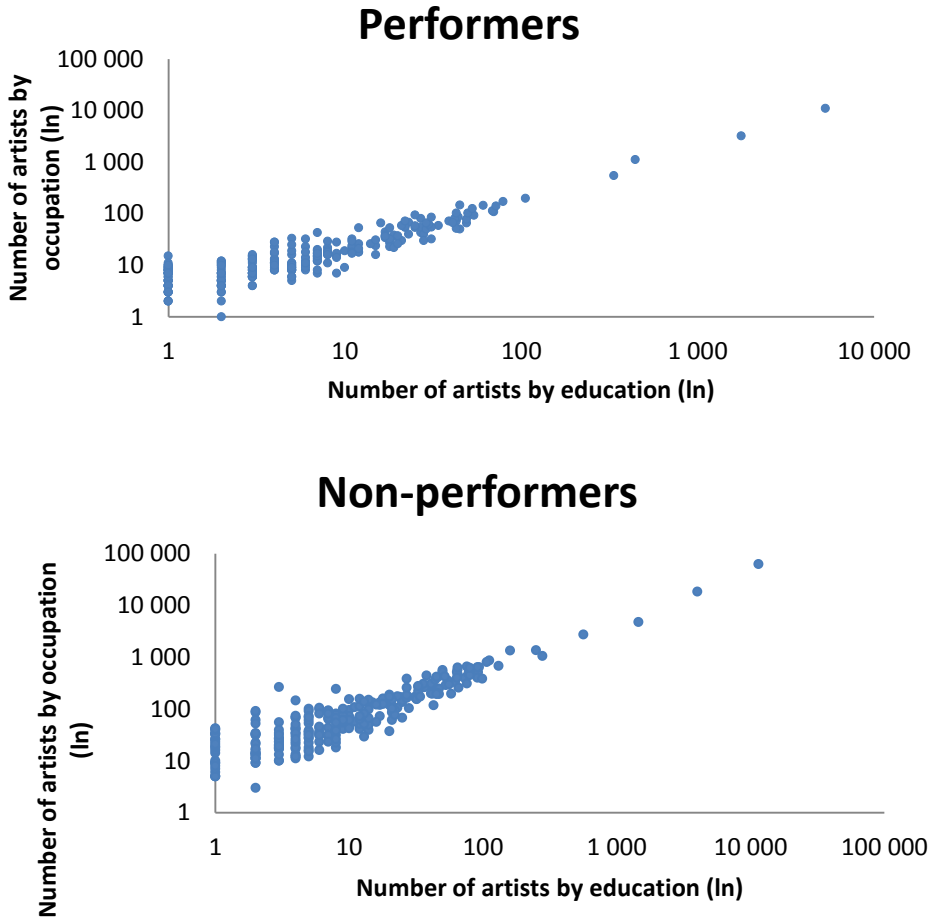

Figure 1: The relationship between artists defined by occupation and education

Table 1 Artists, City of Stockholm and Sweden, 2008.

Group	City of Stockholm	Sweden	Stockholm (%)
Performing artists	991	2,042	49
Visual artists	1,202	2,938	41
Designers	688	1,920	36
Media producers	437	1,299	34
Architects	1,605	4,944	32
Musicians	781	3,287	24
Craftspeople	88	411	21
All groups	5,792	16,841	34
Total population	810,000	9,256,000	9

Table 2 Location quotients for different categories of artists in Sweden's three largest metropolitan areas, 2008.

Category	Stockholm region	Gothenburg region	Malmö region
Performing artists	2.41	.91	.94
Visual artists	2.14	.94	1.04
Architects	1.84	1.53	1.37
Designers	1.81	2.01	1.07
Media producers	1.79	1.40	.59
Musicians	1.63	1.16	1.30
Craftspeople	1.09	3.28	.50
All artists (education-based)	1.89	1.37	1.13
All artists (occupation-based)	1.74	1.06	1.04
Total population	2,353,000	1,072,000	1,048,000

Table 3 Location quotients for different categories of artists in Sweden's three largest municipalities, 2008.

Category	City of Stockholm	City of Gothenburg	City of Malmö
Performing artists	5.11	1.51	2.16
Visual artists	4.31	1.43	2.06
Designers	3.77	3.12	1.98
Media producers	3.54	2.02	1.18
Architects	3.42	2.30	1.90
Musicians	2.50	1.52	2.48
Craftspeople	2.26	5.34	.73
All artists (education-based)	3.62	2.04	2.00
All artists (occupation-based)	3.09	1.44	1.65
Total population	810,000	500,000	287,000

Table 4: Summary statistics of variables used in the empirical analysis (all values refer to municipalities, except for variables marked with *, which refer to labor markets). Average of 2004-2008.

Variables	Mean	Median	Std. Dev.	Min	Max
Dependent variable					
Number of performers by education	18	4	109	0	1,772
Number of performers by occupation	39	11	203	1	3,195
Number of non-performers by education	41	8	258	0	4,020
Number of non-performers by occupation	214	54	1,123	2	18,219
Accessibility indicators					
Accessibility to performers (by education)	71	27	155	0	1,651
Accessibility to performers (by occupation)	142	61	290	1	3,116
Accessibility to non-performers (by education)	161	53	376	0	4,023
Accessibility to non-performers (by occupation)	838	345	1884	4	20,743
Road accessibility	3	3	1	0.3	6
Other variables					
Median income (1,000 SEK, fixed prices)*	129	130	10	96	162
College-educated (%) *	11.5	11.2	3.8	5	18
Number of service jobs/population size*	0.20	0.20	0.02	0.12	0.30
Control variables					
Number of arts students	15	0	79	0	963
Capital city dummy	0.08	0	0.28	0	1
Number of days with temperature < 0°C	106	116	51	31	246
Number of days with rain or snow	187	179	19	128	243
Number of municipalities	289	289	289	289	289

Table 5: Random-effects estimates using road accessibility as an instrument for accessibility to artists. The dependent variable is the natural logarithm of the number of performing or non-performing artists

Variables	Performers		Non-performers	
	Education-based (1)	Occupation-based (2)	Education-based (3)	Occupation-based (4)
Access to performers (log)	.289***	.200***		
	(.040)	(.050)		
Access to non-performers (log)			.284***	.368***
			(.046)	(.044)
Median income (log)	.371	-.865*	.010	-.567
	(.453)	(.477)	(.485)	(.422)
Service jobs/population (log)	1.189***	1.296***	.255	1.919***
	(.314)	(.325)	(.341)	(.298)
Arts students (log)	.051	.097***	.094***	.086***
	(.031)	(.033)	(.033)	(.029)
Capital city dummy	1.742***	1.620***	1.869***	1.646***
	(.219)	(.215)	(.250)	(.213)
Days < 0°C	-.001***	-.002***	-.001**	-.001
	(.001)	(.001)	(.001)	(.001)
Days with rain or snow	-.002***	.000	.001	-.001
	(.001)	(.001)	(.001)	(.001)
Constant	1.003	8.100***	1.182	7.966***
	(2.352)	(2.486)	(2.524)	(2.211)
Number of municipalities	289	289	289	289
Number of observations	1,445	1,445	1,445	1,445

Standard errors are given in parentheses.
*** p<.01; ** p<.05; * p<.10
Time dummies are included.

Table 6: Instrumental variable random-effects estimates; Dependent variable: natural logarithm of the number of performing or non-performing artists; Accessibility to artists (ln) is instrumented by road accessibility (ln); The proxy for consumer demand is the population share with at least three years of tertiary education

Variables	Performers		Non-performers	
	Education-based (1)	Occupation-based (2)	Education-based (3)	Occupation-based (4)
Access to performers (log)	.261***	.166***		
	(.040)	(.050)		
Access to non-performers (log)			.240***	.348***
			(.046)	(.046)
College-educated (%)	.074***	.064***	.112***	.042***
	(.015)	(.015)	(.017)	(.015)
Service jobs/population (log)	.675**	.663**	-.453	1.565***
	(.322)	(.338)	(.345)	(.306)
Arts students (log)	.057*	.108***	.098***	.088***
	(.031)	(.033)	(.033)	(.029)
Capital city dummy	1.715***	1.573***	1.837***	1.630***
	(.210)	(.204)	(.237)	(.210)
Days with temperature <0°C	-.001	-.001**	-.001	-.000
	(.001)	(.001)	(.001)	(.001)
Days with rain or snow	-.001***	-.000	.001	-.001
	(.001)	(.001)	(.001)	(.001)
Constant	1.148*	2.171***	-1.118*	4.210***
	(.625)	(.667)	(.669)	(.627)
Number of municipalities	289	289	289	289
Number of observations	1,445	1,445	1,445	1,445

Standard errors are given in parentheses.
*** p<.01; ** p<.05; * p<.10
Time dummies are included.