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Abstract

If being around smart people makes us smarter and more productive, what can regions do to attract smart people? This paper considers endogenous cultural amenities as a location factor for high-skilled workers. To overcome selection in the provision of cultural amenities, we exploit the variation in contemporaneous cultural amenities stemming from baroque opera houses in Germany that emerged during a time when the decision for an opera house was mainly determined by the ruler's preferences and rarely by funding constraints. To assess spillovers from high-skilled workers attracted by cultural amenities, we use a 1-percent sample drawn from the population of all West German workers under social security during the period 1975-2010. This panel of individual observations allows us to compare wages of similar individuals who work in locations with different levels of high-skilled workers who are attracted by cultural amenities. To account for non-random selection of workers among cities, we use individual-location fixed effects. Our results show that cultural amenities are an important factor in the location decision of high-skilled workers. The positive effect of the local share of high-skilled workers on unskilled, skilled and high-skilled wages indicates strong and productive spillovers.

JEL-Code: I200, J300, Z100.

Keywords: cultural amenities, social returns, higher education.

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1. Introduction

It is well accepted that being around smart people makes us smarter and more innovative (cf. Lucas 1988). By clustering geographically, innovators can foster each other's creative spirit, learn from each other and become overall more productive.[1] This implies that once a city attracts some innovative workers and companies, its economy may change in ways that make it even more attractive to other innovators. This multiplier effect is one explanation for self-enforcing agglomeration economies. From a policy perspective, there are two approaches to attract innovative workers that may jump start self-enforcing agglomeration economies. *Demand-side approaches* aim at attracting firms by direct or indirect subsidies with the hope that workers will follow ("people follow jobs"). *Supply-side approaches* pursue the reverse direction and focus on attracting workers with consumptive amenities that contribute to the city's quality of life, with the hope that firms will follow ("jobs follow people"). While there is an increasing literature on place-based policies for firms, we know comparatively little about place-based policies for workers.[2] However, Moretti (2012) expresses doubts about the effectiveness of supply-side policies and references the example of Berlin, a city that managed to become the world's coolest city with only one problem: there are not enough jobs.

This paper analyses how differences in the local supply of cultural amenities affect the share of high-skilled workers and whether high-skilled workers generate productive spillovers that benefit other individuals in the same local labor market. To assess productive spillovers from high-skilled workers, we use a 36-year panel of individual wage data from the German social insurance records. The data allow us to distinguish low, medium- and high-skilled workers who are nested in 325 West German districts (NUTS-3 regions). We exploit the panel structure of our data to absorb individual characteristics as potential drivers of non-random selection of workers among locations (Combes et al. 2008; Glaeser and Mare 2001). Specifically, we allow unobserved individual abilities to vary across regions by including individual-location fixed effects (cf. Moretti, 2004). Doing so restricts our estimation to the effect on high, medium- and

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[1] For a recent summary of this extensive literature, see Carlino and Kerr (2014).
[2] See Neumark and Simpson (2014) for an extensive overview of place-based policies.

low-skilled *stayers* who are exposed to changes in the share of high-skilled workers over time. Put differently, we investigate how high-skilled workers who choose to move to locations that supply more cultural amenities affect other workers' productivity in the same local labor market.

Since we are interested in spillovers from high-skilled workers who are attracted by endogenous cultural amenities, we need to find exogenous variation in the spatial distribution of amenities that cause spatial variation in the share of high-skilled workers. Otherwise, it may simply be the case that the supply of cultural amenities follows high-skilled workers, spurred by their willingness and ability to pay for such amenities (Diamond 2013; Shapiro 2006). To solve this endogeneity, we draw on a quasi-natural experiment in German history that relates the spatial distribution of baroque opera houses today to the past rulers' competition for prestigious cultural amenities (cf. Falck et al. 2011). In the era following the Thirty Years' War, many rulers spent vast amounts of money on prestigious buildings, extravagant parties, or unusual hobbies. In these wasteful times, some rulers chose to build opera houses, thus sowing the seed for a concentration of cultural life. Opera performances are a particularly complex type of artistic activity that requires not just musicians and singers – sometimes also a ballet – but also stage and costume designers, make-up artists and, not to forget, poets and composers. One may additionally think that artists attract pubs and other cultural activities, such as music clubs and independent small theatres, that exist on the fringes of well-established mainstream institutions. As a result, we observe today that early agglomerations of a cultural scene turned out to be highly path-dependent. Today, baroque opera house locations host significantly more artists as locations where an opera house was built more recently. Apparently, some of the variation in cultural amenities today is the unintended consequence of baroque ruler's idiosyncratic preferences. Under the assumption that the choice to build an opera house is not related to any historic factors of time-persistent economic importance —and we will show that hardly any observable historic factors can explain the existence of a baroque opera house—this leaves us with an exogenous shifter in the regional share of high-skilled workers who value cultural amenities.

Our results suggest that high-skilled workers are attracted by cultural amenities. We further find that all skill groups in a location benefit from the agglomeration of high-skilled workers. In our preferred specification, a one-percentage point increase in the share of high-skilled workers causes low-skilled workers' wages to increase by 1.4 percent; skilled workers' wages increase by

1.6 percent; and high-skilled workers enjoy 1.1-percent higher wages. A simple spatial equilibrium model with heterogeneous workers helps rationalize these findings. Standard demand and supply considerations suggest that low- and medium-skilled workers benefit from an increasing share of high-skilled workers because they are imperfect substitutes. An increasing share of high-skilled workers will for instance not reduce the demand for taxi services or restaurants. By contrast, high-skilled workers' wages should decrease with increasing supply. This may change when we allow for knowledge spillovers from high-skilled workers (cf. Moretti 2004). In that case, we would still expect strictly positive net effects on the group of low-skilled and medium-skilled workers. However, for high-skilled workers, the sign depends on the size of the knowledge externality. Our findings imply the existence of strong and productive spillovers since we find that knowledge spillovers more than offset the negative supply effect.

We are confident that we have identified a causal relationship between cultural amenities and the location choice of high-skilled workers. This finding is in line with a number of studies that are summarized in Thorsby (1994) and for Germany, the McKinsey survey *Perspektive Deutschland* finds that high-skilled movers name "cultural offerings and an interesting cultural scene" among the top five reasons (out of 15 possible reasons) for their location choice (cf. Buettner and Janeba 2013). We further find that high-skilled workers who are attracted by a location's cultural life benefit other individuals in the same local labor market. This finding corroborates a stream of literature in public economics discussing whether cultural amenities like theaters or opera houses should be considered as public goods that need to be financed by tax-payers' money. One of the first and most prominent arguments in support of the public aspect of cultural goods is developed in Baumol and Bowen (1966), who assign an existence value to cultural amenities that even matters to those individuals who never intend to actually use the amenity. They argue that cultural amenities benefit the community as a whole, justifying thus the provision of public money. Our results provide empirical evidence for this argument.

Our findings further connect to two other strands of the literature. Starting with Rosen (1979) and Roback (1982), there is an established literature on the effect of amenities and quality of life on the spatial distribution of economic activities. This strand of literature has most recently been advanced by Albouy (2012). Following Brueckner et al. (1999), we may distinguish three different types of amenities. First, natural amenities like the sea, climate or mountains that are plausibly exogenous. Second, historical amenities like monuments, buildings, or opera houses that we observe today are considered exogenous because their existence was typically not determined by location factors that drive current economic development. And third, modern amenities like theaters or restaurants that are clearly demand-driven and thus endogenous. In this paper, we combine the latter two amenity types and use variation in modern amenities that originates in history. We then use this variation in cultural amenities to assess spillover effects from high-skilled workers who value these amenities. This latter part of our analysis relates to a second strand of literature that examines spillovers from high-skilled workers (cf. Moretti 2004, Glaeser and Mare 2001).

In the following, Section 2 will provide a more detailed discussion of the historic argument underlying our instrument. Section 3 lays out the empirical strategy, and Section 4 introduces our data. We present our results in Section 5 and discuss their robustness in Section 6. Finally, Section 7 concludes with policy implications and an outlook to future research.

2. Baroque Opera Houses in Germany as a Quasi-Natural Experiment

In the centuries following Charlemagne, France, Spain, England, and Habsburg Austria developed into states where power was wielded by a centralized sovereign. In contrast, the Holy Roman Empire became increasingly fragmented because the emperor had to buy the loyalty of kings, princes, and dukes within the empire by granting territorial and governance concessions. When the Treaty of Westphalia finally ended the Thirty Years' War in 1648, what we know as Germany today was comprised of hundreds of sovereign kingdoms, principalities, and dukedoms. This environment of political fragmentation continued until the German Empire was established in the second half of the 19th century. During this period, European instrumental music experienced its apogee with the Baroque era, the most famous composers of which came from politically fragmented areas in Germany and Italy (Scherer 2001a; Vaubel 2005).[3] Elias

[3] Among these composers were Johann Sebastian Bach, Georg Friedrich Handel, Georg Philipp Telemann, Joseph Haydn, Christoph Willibald Gluck, Ludwig van Beethoven, Wolfgang Amadeus Mozart, and Antonio Vivaldi.

(1993, p. 26) explains this conjunction of circumstances as the result of competition for prestige among rulers of principalities:[4]

> In France and England the decisive musical positions were concentrated in the capitals, Paris and London, as a result of state centralization. A high-ranking musician in these countries therefore had no chance of escape if he fell out with his princely employer. There were no competing courts that could rival the king's in power, wealth and prestige, and that could have given refuge to, for example, a French musician who had fallen from favor. But in Germany and Italy there were dozens of courts and cities competing for prestige, and thus for musicians. It is no exaggeration to trace the extraordinary productivity of court music in the territories of the former German empire among other things to this figuration—to the rivalry for prestige of the many courts and the correspondingly high number of musical posts.

Based on these initial ideas, Scherer (2001b) analyzes the biographies of 645 composers born between 1650 and 1849 and traces the evolution of professional music composition over this period. His findings suggest that professional composing increased in intensity across this entire period. At this time musical performances became more and more popular at the courts as well as among larger parts of the population.[5]

An opera performance at court was a particularly glamorous and prestigious spectacle that was supposed to demonstrate the glory and the power of the ruler. Such performances were single events that normally took place in the court's premises with admission restricted to the members of the court and some invited nobles (Raynor 1972).[6] Since they have in no way been part of everyday life they cannot be considered as early cultural concentrations that could predict today's distribution of cultural amenities. In some places, however, the rulers' enthusiasm for

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[4] Scherer (2004) provides empirical evidence in support of this assumption.

[5] This tendency was reflected in the emergence of societies organizing musical performances (for details see Raynor 1972, chapter 12). Typically, these societies were comprised of citizens, nobles, and students who shared a pronounced interest in music (e.g. in the form of a Collegium Musicum). After 1800, the market for music experienced a particular upswing when an increasingly wealthy middle class began demanding sheet music for home entertainment. In Scherer (2004), this change in the music scene is reflected by a significant increase in professional composing activity by composers born in the 1800–1849 period.

[6] Helm (1960) gives a detailed description of such events at the courts of Frederik the Great in Berlin and Potsdam.

operas became so strong that they constructed a special opera house. This was a significant commitment to the musical arts, involving the permanent maintenance of an orchestra and singers, stage designers, costume designers, and so forth. With a dedicated opera house, performances were no longer single events for a restricted audience but became regular and much more frequent—one could rent a seat for the season—and they were opened to the general public spreading this type of artistic culture among the population. Only a part of the people involved in opera performances—often singers and musicians—had a contract for a longer period of time that was not always well paid. Many contributions were made on a freelance basis often as a supplement to one's regular occupation (e.g., architects as stage designers).[7] Many of the professional artists, particularly those who worked more or less on a freelance basis, developed all kinds of cultural activities in order to earn additional income to support their living. In this way, singers and musicians often spread their abilities as music teachers. As a result, the presence of a stand-alone opera house in the baroque era marked the nucleus of a wide range of cultural activities in the respective location.

These findings suggest that the initial stimulus for building opera houses in the baroque period resulted from the cultural competition between kings, dukes, and princes at a time when strategic marriages and war alliances instead of economic factors determined regional prosperity. Of course, one could argue that the funds needed to build a prestigious opera house did not just magically appear but must have been, at least to some degree, based in the region's economic status. However, as discussed by Duchhardt (2007) and Vierhaus (1984), the theory that you can only spend what you have was not a popular one among the absolutistic rulers of this era. Indeed, it was not uncommon for rulers to incur huge debts and engage in deficit spending in their quest for grandeur. Furthermore, it was general practice to sell subjects as mercenaries to foreign sovereigns in order to improve public finances (Loewenstein 2001).

<< Figure 1 here >>

Figure 1 maps the locations of the 29 stand-alone opera houses in Germany built before 1800 (cf. Falck et al. 2011). Interestingly, all of these opera houses still operate today, some of those were

[7] Generally, the members of the choir were amateurs coming from all kinds of professions.

destroyed by fires or during war times having been rebuilt afterwards. The map clearly shows that the baroque opera houses were not located solely in today's big cities such as Berlin, Munich, or Hamburg, but also in several smaller towns such as Bautzen, Neustrelitz, Weimar, Passau, or Stralsund. Many of these smaller courts were petty princedoms that could hardly afford expensive opera performances but nevertheless committed themselves to this type of artistic culture.[8] These cases clearly demonstrate that setting up an opera house at that time was rather independent of economic wealth.

<< Insert Table 1 here >>

To support our argument that early cultural agglomerations still persist today, Table 1, Panel A, shows a simple comparison of cultural activities in locations with a baroque opera house and locations with an opera house that was built after the baroque era. Overall, we observe 92 opera houses today in Germany, 29 of which can be traced back to the baroque era (cf. Zöchling 1983). To measure cultural activities, we exploit detailed information from social insurance records and a special social insurance for freelance artists (cf. Haak 2005), and calculate the number of artists per 1,000 inhabitants on the German district level as an average over the years 2002-2007. Together, these two data sources allow us to draw a comprehensive picture of locations' cultural amenities today, which, among other things, led us to observe significantly higher shares of artists in baroque opera house locations. Interestingly, these differences are not restricted to those types of artists that are typically employed in opera houses, such as singers and musicians. They include a wide range of artists and thus truly support our argument that baroque opera houses initiated a diverse cultural scene that is still present today. Further support for our argument is provided in the last row of Table 1, where we exploit information from the 1907 census (Statistik des Deutschen Reichs 1909a and b). Here, we find information on the number of workers engaged in creative businesses. Using this data, we compare the employment share of artists in 1907 across the same two types of locations. Again, we find a significantly higher share of artists

[8] Fischer-Dieskau (2006) gives a lively and detailed description of the development of opera performances around 1800 in the city of Weimar. At that time, Weimar was the small capital of the rather poor and petty dukedom of Saxe-Weimar that, however, became one of the leading centers for arts in 19th century Germany.

in baroque opera house locations, thus underlining the time-persistence of these early cultural concentrations.

We finally compare public expenditure for different categories between baroque opera house locations and other opera house locations. If our argument was true, we should indeed see differences between public expenditure for culture but not for other categories. Table 1 , Panel B, shows public expenditure in 2004 for the categories “Theater, Concerts and cultivation of music”, “Sports Facilities, Swimming Pools, and other Recreational Facilities”, and “Popular Education”.[9] In line with our expectations, we see a significant difference for the category “Theater, Concerts, and Cultivation of Music”, but not for the other categories.

3. Empirical Strategy

Our empirical strategy is based on a simple theoretical framework outlined in Moretti (2004). The spatial equilibrium approach considers two representative locations, *A* and *B*, and two types of workers, low-skilled and high-skilled. If location A increases its spending on cultural amenities and thus becomes more attractive for high-skilled workers, the relative share of high-skilled workers increases in location A. Standard demand and supply considerations suggest that an increasing supply of high-skilled workers has a negative effect on high-skilled workers’ wages, while unskilled workers’ wages increase if we assume complementarity between high- and low-skilled workers. If we additionally allow for productive spillovers from high-skilled workers, we still expect a strictly positive effect on low-skilled workers’ wages. For high-skilled workers, the direction of the effect depends on the strength of the spillover; if spillovers overcompensate the negative supply effect, we would observe a wage increase, otherwise a decrease. In equilibrium, workers are indifferent between location A and B, since higher rents in the relatively more attractive location A will equalize *real wages*. The higher real wage earned in location B thus acts as compensating differential for the lower level of amenities. Any observed differences in *nominal wages* point to productivity advantages that firms must obtain to offset

[9] The underlying data were supplied by the statistical offices of the German states. They are part of a report on the 2004 municipal budgets.

paying higher wages. Without productivity gains, producers of tradable goods would relocate to locations with lower wages. This condition holds as long as every location hosts some firms producing traded goods and as long as workers are free to move between tradable and non-tradable sectors (Moretti 2012).

Since we are interested in productive spillovers from high-skilled workers that value cultural amenities, we have to look at nominal wage differences across locations with different shares of high-skilled workers. Specifically, in our empirical model, we extend the specification in Moretti (2004) and estimate individual wage regressions for *three* skill levels (high, medium, low). For a given skill group the wage regression is of the form:

$$\ln(w_{ilt}) = \beta_1 hs_{lt} + X'_{it}\beta_{2s} + X'_{lt}\beta_3 + \alpha_{li} + \alpha_t + \varepsilon_{ilt} \qquad (1)$$

where $ln(w_{ilt})$ is the natural logarithm of the nominal wage of individual *i* with a given skill level working in location *l* at time *t*. The coefficient of interest is β_1, the effect of the share of high-skilled workers (hs_{lt}) on the skill group's wages. X_{it} is a vector of time-variant individual controls including nationality (since workers may become German over time), experience, experience^2, industry or occupation controls, and interactions between experience/experience^2 and gender/nationality as suggested in Beaudry et al. (2012). X_{lt} are time-variant location characteristics that may be correlated with hs_{lt} and the dependent variable. Specifically, we include log population to account for general agglomeration effects and the labor force participation rate as proxy for changes in labor demand. α_{li} is a set of individual-location fixed effects, which implies that identification of the coefficient of interest does not come from movers but from stayers who experience different shares of high-skilled workers over time. Finally, α_t is a set of year dummies for 1975-2010 which capture such factors as wage increases compensating for inflation. ε_{ilt} is an error term clustered on the individual-location level.

To focus on the effect of high-skilled workers who are attracted by cultural amenities, we introduce a first-stage relationship that links the location's share of high-skilled workers to the exogenous spatial distribution of baroque opera houses. Strictly speaking, this is a reduced form of two stages: the first relates today's local cultural amenity to the exogenous factor of a baroque opera house; the second relates access to today's cultural amenities to the local share of high-skilled workers. We prefer this reduced form because there are multiple dimensions of culture that are affected by the existence of a baroque opera house. It would be difficult to aggregate these dimensions into a comprehensive indicator for contemporaneous local cultural amenities.

Since the effect of cultural amenities like an opera house is not restricted to a location itself but may also benefit surrounding locations, we use the minimum distance from each location *l* to the closest baroque opera house as instrument. The underlying logic is that being closer to a baroque opera house location means better access to cultural amenities, which is particular attractive for high-skilled workers. In the robustness test in Section 6, we will also present an alternative specification where we only consider a dummy variable that indicates baroque opera house locations. Our first-stage regression of the share of high-skilled workers on the minimum distance to the next baroque opera house location takes for a given skill group the following form:

$$hs_{lt} = \sum_{t=2}^{36} \delta_1 \mu_t dist_l + X'_{ilt}\delta_2 + X'_{lt}\delta_3 + \mu_{il} + \mu_t + \omega_{ilt} \quad (2)$$

Here, hs_{lt} represents the share of high-skilled workers in a first-stage regression for individuals *i* of the given skill group at location *l* and at time *t*. The coefficients of interest are $\delta_1\mu_t$, which give us the time-variant effect of distance to the closest baroque opera house ($dist_l$) over the period 1976-2010. 1975 is the base category. We estimate time-variant effects $\delta_{1s}\mu_t$ for two reasons: First, cultural amenities as one contribution to a district's quality of life might have gained increasing importance over our 36-year observation period (Rappoport 2009). Second, the existence of a baroque opera house might have kick-started a cumulative process of attracting high-skilled workers, that is, high-skilled workers were initially attracted by the closeness to a baroque opera house; further high-skilled workers followed expecting higher wages due to human capital spillovers. Note that these spillovers are not necessarily limited to the opera house location, but may also come from high-skilled workers in surrounding locations that are also close to a baroque opera house. The main effect of distance is captured in the location-individual fixed effects. The remaining control variables are the same as the ones employed in equation 1.

Our instrumental-variable strategy thus identifies the effect of changes in the local share of high-skilled workers on *non-mobile workers* at the same location. Changes in the share of high-skilled workers come from *mobile* high-skilled *workers* who are either directly attracted by the proximity to cultural amenities or indirectly by other culturally disposed mobile high-skilled workers.

The key requirement on our instrument is that it affects individual wages only through the assumed channel as location factor for high-skilled worker but not through any direct channel. As discussed in Section 2, we argue that baroque rulers' decision to build an opera house was purely idiosyncratic and not determined by any regional location factors that may affect funding. The competing argument would be that only rich rulers could afford to build an opera house and the same factors that contributed to the rulers' wealth in the past may still determine regional prosperity today. To the extent that these location factors are completely time-invariant, our fixed effects will absorb them. However, one remaining concern can be that past location factors may affect future outcomes by causing a movement from one equilibrium state to another. This transition would create path dependencies that are not captured by fixed effects (Nunn 2009). In the robustness checks we will explore the assumed randomness of the baroque opera house locations in more detail, by checking whether observable historic location factors can explain the existence of a baroque opera house.

4. Wage Data 1975-2010

Our data stem from the Historic Employment and Establishment Statistics (HES) database (cf. Bender et al. 2000, for a detailed description). The administrative origin of HES implies that the data are restricted to information relevant for social insurance purposes. This includes information on daily wages, a range of socio-demographic variables (such as educational attainment, gender, and age) and the industry, occupation, and place of work for all German workers subject to social insurance. To be represented in the HES, individuals must be subject to Germany's social security system. As a result, civil servants and self-employed individuals are not included in our database. We further choose to exclude workers younger than 18 or older than 65. Finally, we exclude all individuals in training and in part-time jobs since there is no information on hours worked in the HES.

There is no information for East Germany prior to 1990. After 1990, East Germany is a special case, since qualifications from the former GDR were sometimes formally no longer valid or knowledge and experience diminished in value (cf. Fuchs-Schündeln and Izem 2012; Burda and Hunt 2001). Consequently, we are not sure what types of spillovers to expect from high-skilled workers and thus focus in our main specifications on West Germany excluding Berlin, since we cannot distinguish between East and West Berlin in our data. In doing so, we can also exploit our exceptionally long time series from 1975 to 2010. Workers in West Germany are nested in 325 West German districts (NUTS-3 regions) – our spatial level of analysis.

The wage information is very reliable, since it is used to determine social insurance contributions, but wages are censored due to the limit for compulsory social insurance payments. To deal with this, we use Gartner's (2005) procedure to impute the truncated distribution. The educational attainment of workers is differentiated into three categories: low-skilled (workers without vocational training), medium-skilled (with vocational training), and high-skilled (workers with a degree from a university or a university of applied sciences).

In the period from 1975 to 2010, we can follow more than 53million West- German full-time employed workers in the age group between 18 and 65 throughout their working lives. However, to reduce the computational burden, we restrict our analysis to a 1-percent random sample. Our random sample thus consists of 530,624 workers who spent their working live in West Germany and who were at least once recorded as full-time workers during this 36-year period. Descriptive statistics for our West German random sample are provided in Table 2.

<< Insert Table 2 here >>

We complement the individual worker information with district-level information on the share of high-skilled workers, our treatment variable, on population size in order to account for time-variant general agglomeration effects, and on the labor force participation rate calculated as the share of workers in the overall population as a control for cyclical changes in the local labor market that may simultaneously affect the share of high-skilled workers and wages.

Finally, we use information on 19 stand-alone baroque opera houses in West Germany (excluding Berlin). We geocode the address of each of these opera houses and use this information to calculate the distance to all 325 West German districts, using both the district's centroid and today's population center as reference point.[10] Centroid and the population center are both located within the district-polygons and they are correlated by 0.965. The average distance of all West German districts to the closest baroque opera house across all West Germany is 53.5 km (based on the district's centroid), meaning that cultural amenities at the baroque opera house location tend to be within a reasonable travel distance. Figure 2 shows kernel density estimates for distance to the centroid or population center. Small differences between the two measures may occur if redrawing districts' boundaries has induced an uneven population distribution across space or generated irregular shapes. We will use distance to the centroid in our baseline specifications and show alternative specifications using distance to the population center in our robustness checks.

<< Insert Figure 2 around here >>

5. Results

5.1. Baseline

Figure 3a illustrates the first-stage relationship for the specification with high-skilled workers as a dependent variable in the second stage. As we can see, distance to the next baroque opera house has the expected sign in all years—the share of high-skilled workers increases as distance to the next baroque opera house decreases—and the 95% confidence interval around the point estimates shows that the relationship is persistently different from zero in all years after 1982. F-tests of the joint significance of the instruments formally support the visual impression that we are dealing with strong instruments. The absolute rise of the distance coefficient clearly corroborates our arguments of an increasing importance of cultural amenities as one determinant of quality of life of high-skilled workers and of the cumulative process of attracting high-skilled workers initiated by the closeness to a baroque opera house.

<< Insert Figure 3 here >>

[10] We used Google Earth and the Corine Land Cover database to determine each district's population center.

Tables 3-5 present the results of our wage estimations for high-skilled (Table 3), medium-skilled (Table 4) and low-skilled (Table 5) workers. In column I, we present a specification without instrumenting the share of high-skilled workers. This corresponds to equation 1. In columns II-VI, we instrument the share of high-skilled workers with the distance to the next baroque opera house as specified in equation 2. The results of the first-stage regression are omitted from the tables, but Figure 1 illustrates the size and significance of the first-stage relationship throughout the specifications. The Anderson Rubin F statistics and the Kleibergen Paap F statistic both suggest that weak instruments are not a major concern in our estimations. In column II, we present the instrumental variable regression without individual controls, district-level controls, or year dummies. We only condition on individual-location fixed effects, a dummy variable indicating whether we imputed the wage or not and whether the individual is working full time in this year or not. In column III, we add time dummies and individual time-variant controls including interactions between gender/nationality and experience to allow for differential effects for females or foreigners. We also include interactions between the individual controls and the censoring dummy. In column IV, we include ten one-digit industry controls and again interact them with the censoring dummy, and in column V we include district-level controls. Finally, column VI presents a specification where we replace the industry controls with one-digit occupation controls.

<< Insert Tables 3-5 around here >>

Our preferred specification is in column V, where we consider the full set of individual and district controls and one-digit industry controls. Our results suggests that a one-percentage-point increase in the share of high-skilled workers increases high-skilled workers' wages by 1.1 percent, medium-skilled workers' wages by 1.6 percent, and low-skilled workers' wages by 1.4 percent. As predicted by the theory underlying our estimations, the effect is positive for the two less-educated groups, which indeed should experience a strictly positive effect. Since we also observe a positive effect on high-skilled workers' wages, we conclude that spillovers form high-skilled workers exceed the negative supply effect. Since recent literature has shown that spillovers are highly localized (Ahlfeldt et al. 2014) we interpret these findings as combined effect of localized spillovers on the district level.

The estimated coefficients are qualitatively comparable to the effects reported by Moretti (2004) for the USA. He finds that a one-percentage-point increase in the share of college graduates raises high school drop-outs' wages by 1.9 percent, high school graduates' wages by 1.6 percent, and college graduates' wages by 0.4 percent. However, our effect on the low-skilled workers is somewhat lower than Moretti's effect for the high school drop-outs. The reason for this might be that our group of low-skilled workers primarily consists of workers without a basic degree from secondary school while Moretti looks at workers who have at least attended high school for some time. Furthermore, we find a stronger effect for high-skilled workers than Moretti does for college graduates. The reason for this might be that we observe a particularly interesting group of high-skilled workers—those who value cultural amenities and who are willing to move to be close to them. These workers might generate especially productive spillovers for other high-skilled workers. By contrast, Moretti looks at college graduates in general or college graduates who are immobile (in the land grant college specification) since they also work at the college location. To further quantify the wage effects, we relate our estimates to the 2005 average wages of the three skill groups. We find that the average high-skilled worker, who earns €39,457 per year, would earn an extra €415.48 if the share of high-skilled workers in the local labor market increases by one percentage point. The average medium-skilled worker, who earns €30,295, would earn an extra €473.51, and the average low-skilled worker, with an income of €21,189, would earn an additional €289.02.

5.2. Effect Heterogeneity

We will now explore the effect heterogeneity and show that our results are robust to a number of sample splits. The results of all exercises are summarized in Table 6. The three different columns represent estimation results for high-skilled (Column 1), medium-skilled (Column 2) and low-skilled (Column 3) workers. Each line includes the result from a different model and each cell stands for a separate regression.

<< Insert Table 6 here >>

We start with subsample estimations for female and male workers, as well as manufacturing workers. In these estimations, we look at different subsamples of recipients of the spillovers, while the source of spillovers, high-skilled workers, remains unchanged. While the overall results do not change qualitatively, one interesting finding is that spillovers on females are in general stronger than on males. Looking at manufacturing vs. non-manufacturing industries, we find even stronger effects for our three skill groups. This is important because manufacturing industries are typically producers of tradable goods which would relocate to locations with lower wages if higher nominal wages did not imply productivity advantages. Finally, we split the sample into below/above mean distance to the closest baroque opera house. The idea behind this sample split is that we should see effects for districts that a located close enough to a cultural center so that one can e.g. attend an evening performance. The mean distance to the closest baroque opera is 53.5 km kilometers. Thus, districts with a below mean distance to the closest baroque opera house are in travel-distance. Reassuringly, we find that our effects especially come from the short-distance sample.

6. Robustness Tests

6.1. Instrument Validity

To explore the randomness of the baroque opera house locations, we try to identify historic twin locations of the baroque opera house locations. Twin locations did not receive a baroque opera house, but had the same initial probability of having one given a large set of observable historic location factors. The idea to identify twin locations reflects our assumption that having a baroque opera house is the result of a baroque ruler's idiosyncratic preferences. To exploit our search for twins, or counterfactual baroque opera house locations, we calculate the distance to the closest counterfactual baroque opera house location and check whether closeness to a counterfactual baroque opera house location can predict the share of high-skilled workers in a district. If this was the case, one may argue that factors other than the existence of a baroque opera house drive our results.

We consider a large number of historic district characteristics to determine historical twins of the opera house locations. Differences in rulers' wealth are the most obvious reason why some regions got an opera house while others did not. Factors that may have contributed to a places' wealth were the availability of mineral deposits, agricultural productivity, the size of the state, degree of urbanization, access to the coast or large rivers, existence of a historic university, and free, Hanseatic or imperial city status. Beyond that, we may think that the rulers' religious determination may have influenced the decision to build an opera house, with religion affecting educational attainment and subsequent economic development (Becker and Woessmann 2009).

To proxy for these location factors, we use a combination of current and historic information. Specifically, we account for the percentage of land that is located on coal, ore, quartzite, or slate deposits as proxy for mineral deposits. To proxy agricultural productivity, we rely on the Food and Agricultural Organization's (FAO) Global Agro-Ecological Zones (GAEZ) 2002 dataset and choose the suitability for cereal (rain-fed at moderate input) or pasture as in Nunn and Qian (2011); the size of the principality (out of 99) and the log of its population in 1700 according to Bairoch et al. (1988); the cumulative population in all 'Bairoch' cities within today's district borders in 1700 and the population growth between 1700 and 1800, access to the coast and cumulative kilometers of large rivers within today's district boundaries; the existence of a historic university (Eulenburg 1904); free, Hanseatic or imperial city status; and the principalities' religious determination (Shepherd 1923).[11]

<< Insert Table 7 here>>

Using these location factors, we perform a propensity score matching and determine the nearest neighbor of each actual opera house location. To determine the propensity score, we estimate a probit model of having a baroque opera house using historic location factors plus the district size today (in km^2) and an indicator for city district as explanatory variables. Based on the predicted probabilities, we determine a counterfactual opera house location with the closest predicted probability to receive an opera house. This is the nearest neighbor of each actual opera house location predicted on the base of the observable historic location factors discussed above.

We find relatively close twins for all actual baroque opera house locations. However, for seven actual baroque opera house locations, we find the city district of Mainz to be the best twin. Table

[11] A detailed variable description is provided in Falck et al. (2011).

7 shows the pairs of actual and counterfactual opera house locations along with the predicted probabilities (columns 2 and 4) and the difference in the predicted probabilities (column 5).

We now calculate the minimum distance of all districts to these counterfactual baroque opera house locations and use this distance to instrument the share of high-skilled workers in the wage regressions. Figure 4 shows the first-stage relationship over time between distance to closest counterfactual baroque opera house and the share of high-skilled workers as compared to the relationship between distance to closest actual baroque opera house and the share of high-skilled workers. The figure reveals that distance to the closest counterfactual opera house location has hardly any predictive power. This finding supports the validity of our instruments.

6.2. Robustness Tests and Extensions

Robustness tests and extensions are summarized in Table 8. In a first robustness check, we consider that our sample consists of workers who were at least once recorded as full-time workers. This, however, means that they might have been part-time employed for some period during their career. In this period, the wage data is not comparable to the period during in which a worker has been full-time employed, since the data does not contain exact information about the hours worked. To check whether this might hamper our results, we exclude workers with at least one part-time observation in one robustness test. Doing so results in overall smaller coefficients that are, however, still significantly different from zero for all skill groups.

<< Table 8 about here >>

Next, we include rent controls for some periods and locations where available rent data are incomplete, with a bias towards larger cities. It is important to note that we are ultimately interested in whether productive spillovers increase the pie in a district and not how the pie is distributed among workers and land owners. Thus, nominal wages are the relevant outcome of interest and not real wages. The reason why we nevertheless include rents as a control is to show that our effect is not driven by higher wages that are being paid to compensate for higher costs of living. Indeed, it is reassuring to see that our results do not change qualitatively when including the rent control, even though the effect on high-skilled workers' wages is no more significantly different from zero but still positive.

We then check whether our results are mainly driven by imputation of censored wages. Censoring is first of all an issue among high-skilled workers. If our results are not mainly driven by imputation, we should still find a positive effect for the high-skilled workers. However, we expect the effect to be lower, since spillovers resulting in wages above the threshold are not captured in the non-imputed data. Indeed, the effect for high-skilled workers significantly decreases as compared to the baseline specification where we use imputed wages, while the effects for the two lower education categories are only marginally affected by not imputing censored wage data.

Another robustness check considers the district's population weighted center instead of the district's centroid to derive the minimum distance to the closest baroque opera house. The population center is a contemporaneous snapshot of a district's spatial structure which may lead to a better approximation of the average distance a high-skilled worker has to travel to visit the nearest opera house. The results show that using the centroid or the population center does not make a difference across all specifications. However, since neither measure can fully capture the changing spatial structure of a district both measures may suffer from measurement error which downward biases of our estimates.

We next use a dummy variable indicating the 19 opera house locations interacted with the year dummies, instead of distance interacted with the year dummies. Figure 3b illustrates the first-stage relationship for the specification with high-skilled workers as a dependent variable in the second stage. In this case, the first stage does not capture that high-skilled workers might benefit from proximity to an opera house located in a neighboring district. However, it turns out that the second-stage results in the dummy specification are even slightly larger than those in the distance specification. The spillover effect on high-skilled workers is still positive, but no more significantly different from zero (due to a large standard error) when we concentrate on contemporaneous opera house locations in the baroque-opera-house-dummy specification.[12]

[12] Moretti (2004) shows a comparable specification when he concentrates on college locations and instruments the share of college graduates with a historical land-grant-college dummy.

In a further specification, we include district-specific 10-year trends in addition to the general year dummies. These district specific time trends control for time-variant district characteristics that may bias our results. For instance, one may think that an inflow of high-skilled workers in an earlier period shifts the district to another development path. It is reassuring to see that our results do not qualitatively change when we control for district-specific time trends.

In our baseline specification (Tables 3 to 5), we cluster standard errors on the individual-district level. This approach corrects for serial correlation in the individual wage profiles as long as workers do not move. In an alternative specification, we use two-way clustering on the district and year level, allowing for serial correlation within districts, and cross sectional correlation within years. We also consider a very conservative specification in which we cluster standard errors on the district level. This is the level on which our 'raw' instrument (distance to the closest baroque opera house) in the first-stage regression varies. These standard errors allow for serial and spatial correlation in unobservable factors within districts. In both specifications, our coefficients of interest are highly significantly different from zero.

The instrument validity checks show that we cannot find close twins for some baroque opera house locations. In these cases, we are especially worried about unobserved location factors that might affect our results. We thus exclude seven actual baroque opera house locations with Mainz as twin from the distance calculation in our initial analysis (cf. Table 7). Reassuringly, this procedure also does not qualitatively change our results.

One may also be concerned that free and imperial cities (*Reichsstadt*) as well as Hanseatic cities ruled by the bourgeoisie and not absolutistic rulers may be a problem for our instruments since economic factors may have determined the early emergence of an opera house at these locations. Similarly, the co-existence of an early university built before or during the baroque era might challenge our instrument. In these cases, we might confound the effect of closeness to an early cultural center with the effect of closeness to an early economic or knowledge center. To account for that, we drop eight cities from the list of baroque opera houses that were free or imperial cities as well. These cities are Aachen, Augsburg, Bremen, Frankfurt am Main, Hamburg, Luebeck, Regensburg, and Ulm. Additionally, we drop the Hanseatic city Brunswick and the university cities Muenster, Trier and Wuerzburg. This leaves us with 7 baroque opera house locations. Despite this significant reduction, we see that excluding these locations from our minimum-distance-calculations does not qualitatively change our results.

Since we include as instruments for the share of high-skilled workers interactions of distance to the closest baroque opera house with year, our model is overidentified. 2SLS estimators might thus be biased. This is particularly so when individual instruments are weakly correlated with the instrumented variables (despite the overall relatively high Kleibergen-Paap value). We thus reproduce our 2SLS model using LIML and find that results come out similar suggesting that the high degree of overidentification is not a major problem.

To look at movers instead of stayers, we replace the individual-location fixed effects with separate individual and location fixed effects. Doing so implies that we now identify from individuals who move between locations and, in doing so, experience different shares of high-skilled workers. Our IV isolates variation in a district's share of high-skilled workers that stems from mobile workers who are attracted by cultural amenities. We thus face an endogeneity problem when looking at wages of mobile high-skilled workers. This endogeneity should result in a downward bias, since such mobile workers are willing to accept lower nominal wages as a trade-off for the cultural amenity. In line with that, the coefficient on the share of high-skilled workers gets much smaller and insignificant in a regression on high-skilled workers' wages. By contrast, medium- and low-skilled movers' wages do not change very much, in line with our argument that especially mobile high-skilled workers are attracted by cultural amenities.

Finally, when we adopt our analysis to East Germany, we still find comparable effects on high-skilled and medium-skilled workers' wages. By contrast, we find an even negative effect for the group of low-skilled workers which is not in line with our theoretical predictions. However, as discussed above, we do not want to over-interpret these findings.

7. Conclusions

Our results suggest that "music in the air" does indeed pay off for a location. We exploit comprehensive individual-level panel data over a long period of 36 years and find that high-skilled workers who are attracted to locations with a rich and diverse cultural scene generate productive knowledge spillovers. Importantly, these knowledge spillovers do not just benefit other high-skilled workers but also lower-skilled workers.

From our first-stage regressions, we further see that proximity to cultural amenities—here measured as distance to the next baroque opera house—becomes increasingly important during the observation period of 36 years. This finding provides an interesting perspective on regional location factors. In the past, physical capital and infrastructure were probably the best predictors for a location's economic success. With the shift from manufacturing goods to the more knowledge-intensive production of innovation, factors that increase a location's quality of live and help attract innovative people have gained increasing importance. In this paper, we cannot separate this increasing amenity effect from a cumulative effect where innovative workers who value a location's quality of live attract more innovative workers. However, in both cases, variation in the share of high-skilled workers across locations (initially) comes from cultural amenities. We can thus isolate the effect of culture on the agglomeration of high-skilled workers and their productive spillovers.

From a policy perspective, our findings clearly raise the question whether investing in cultural amenities is a promising place-based policy. The answer is twofold. On the one hand, our results suggest that economic activities can benefit from the presence of consumptive amenities, in our case culture. This may explain why local spending on culture is hotly debated among local policymakers. For "cool" places like Berlin, this further suggests that there is hope that jobs will follow people.

On the other hand, we advise caution, since our analysis focuses on regions that benefit from an increasing share of high-skilled labor. If the overall supply of high-skilled workers is constant, this would imply a beggar-thy-neighbor policy: one region's gain in high-skilled employment means a loss to another region. To end up with an overall positive welfare effect, the positive effect of the knowledge spillovers must therefore be larger in the gaining regions than the diseconomies in the losing regions. Evaluating the overall welfare impact is beyond the scope of this paper and we thus refer it to future research.

The relevance of our distance instrument further suggests that locations can benefit from cultural amenities in neighboring locations. Instead of investing in own cultural amenities, local policymakers might thus choose to free-ride. Since we do not explicitly look at the financing side of cultural amenities, we cannot contribute to answering the question of how one could solve this coordination problem. Instead, we again refer this to further research.

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Tables and Figures

Table 1: Comparison between baroque opera house locations and other opera house location

	Baroque Opera House Location	Other Opera House Location	Difference (1-2) [p-value]
Panel A: Artists per 1000 inhabitants 2002-2007 or 1907			
Freelance artists, writing	2.639 (0.481)	1.660 (0.226)	0.979 [0.019]
Freelance artists, acting	1.181 (0.178)	0.748 (0.088)	0.433 [0.008]
Freelance artists, music	2.802 (0.288)	1.826 (0.165)	0.976 [0.001]
Freelance artists, graphic arts	3.846 (0.484)	2.457 (0.275)	1.389 [0.005]
Freelance artists, all	10.468 (1.334)	6.691 (0.699)	3.777 [0.004]
Employed artists subject to social insurance	6.697 (0.586)	5.074 (0.438)	1.623 [0.018]
Artists in 1907	2.389 (0.561)	1.573 (0.253)	0.816 [0.065]
Panel B: Public Spending in Euro per inhabitant, 2004			
Theater, Concerts and cultivation of music	100.19 (12.05)	69.47 (6.50)	30.72 [0.008]
Sports facilities, swimming pools, and other recreational facilities	46.12 (3.57)	48.48 (2.97)	-2.36 [0.681]
Popular education	19.47 (2.50)	21.04 (1.55)	-1.57 [0.708]
Number of observations	29	63	-

Notes: The table shows means and standard errors for different measures of local artists per 1,000 inhabitants (Panel A) and public spending in Euro on amenities (Panel B) in 29 baroque opera house locations (Column 1) and 63 locations where the opera house was built after the baroque era (Column 2). Column 3 shows the difference (*diff*) between Column 1 and Column 2 along with the p-value of H_o: $diff < 0$. The share of artists in 1907 is measured per 1,000 workers.

Table 2: Descriptive statistics

	Period 1975-1991	Period 1992-1999	Period 2000-2010
Variables on the individual level			
Log wage high-skilled workers	4.136 (0.403)	4.588 (0.394)	4.748 (0.448)
Log wage skilled workers	3.753 (0.460)	4.190 (0.459)	4.340 (0.496)
Log wage unskilled workers	3.422 (0.565)	3.817 (0.586)	3.984 (0.583)
Experience (years)	19.57 (12.23)	20.29 (11.52)	22.85 (11.07)
Female (%)	36.95	40.00	42.68
Foreign (%)	9.11	9.17	7.73
Manufacturing (%)	42.09	35.99	30.38
Variables on the district level			
Population (in TSD)	378.06. (368.11)	381.09 (363.45)	387.86 (373.86)
Labor force participation rate (%) (workers/population)	31.00 (11.17)	29.90 (10.45)	27.60 (10.00)
Share high-skilled workers (%)	4.61 (2.70)	7.17 (3.83)	9.89 (5.06)
Avg. distance to the next baroque opera house (km) (Distance measured from the district centroid)		51.31 (33.84)	
Avg. distance to the next baroque opera house (km) (Distance measured from the district's population center)		50.77 (35.14)	
Number of districts	325	325	325

Notes: The table shows the mean of all variables. Individual-level variables refer to all full-time employed West German workers in the age group from 18 to 65. District-level variables refer to the 325 West German districts in their 2009 boundaries. Standard deviations of continuous variables are in parenthesis.

Table 3: Second stage results for West Germany – high-skilled workers

Dependent variable: log wage	I FE	II IV-FE	III IV-FE	IV IV-FE	V IV-FE	VI IV-FE
Share high-skilled workers	0.567*** (0.100)	0.958*** (0.371)	1.160*** (0.332)	1.161*** (0.331)	1.053*** (0.360)	1.043*** (0.359)
Individual controls						
Foreign	0.022 (0.021)	-	0.026 (0.021)	0.024 (0.021)	0.025 (0.021)	0.024 (0.021)
Experience	0.057*** (0.013)	-	0.059*** (0.013)	0.058*** (0.013)	0.058*** (0.013)	0.058*** (0.013)
Experience^2	-0.001*** (0.000)	-	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
District controls						
Log population	0.011 (0.030)	-	-	-	0.035 (0.034)	0.040 (0.034)
Labor force participation	0.088* (0.049)	-	-	-	0.105** (0.050)	0.105** (0.050)
Industry dummies (10 categories)	Y	N	N	Y	Y	Y
Anderson-Rubin F-test	-	0.0197	0.0045	0.0041	0.0628	0.0802
Kleibergen-Paap Wald rk F statistic	-	49.90	50.10	49.80	43.69	43.689
Individual × location FEs	73,898	54,827	54,827	54,827	54,827	54,820
Number of observations	375,861	356,790	356,790	356,790	356,790	356,725

Notes: The table reports regressions of log average daily wages of high-skilled workers on the share of high-skilled workers conditional on time-variant individual controls (interactions between foreign/female and experience/experience^2 as well as the censoring dummy and its interactions with all control variables are not displayed in the table) and district controls. Column 1 presents the results of an uninstrumented specification with individual-location fixed effects. In columns 2-6, the share of high-skilled workers is instrumented with proximity to the next baroque opera house. Colum 2 only includes an imputation control and a control for full time employment. Column 3 includes a full set of individual controls, interactions between the individual controls and the censoring dummy, and year dummies. In column 4, we additionally consider 10 industry dummies controlling for one-digit industries and again, we interact these controls with the censoring dummy. In column 5 we add country level controls and in Column 6, we use one-digit occupation controls instead of one-digit industry controls. Across all specifications, standard errors are corrected for individual-district clustering. *** significant at the 1 percent level; ** significant at the 5 percent level; * significant at the 10 percent level.

Table 4: Second stage results for West Germany – medium-skilled workers

	I	II	III	IV	V	VI
	FE	IV-FE	IV-FE	IV-FE	IV-FE	IV-FE
Share high-skilled workers	1.040***	0.959***	1.523***	1.567***	1.563***	1.566***
	(0.037)	(0.154)	(0.135)	(0.135)	(0.142)	(0.143)
Individual controls						
Foreign	0.039***		0.042***	0.043***	0.043***	0.043***
	(0.007)		(0.007)	(0.007)	(0.007)	(0.007)
Experience	0.018***		0.018***	0.018***	0.018***	0.018***
	(0.006)		(0.006)	(0.006)	(0.006)	(0.006)
Experience^2	-0.001***		-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)
District controls						
Log population	-0.061***				-0.032***	-0.032***
	(0.010)				(0.012)	(0.012)
Labor force participation	-0.052***				-0.029	-0.029
	(0.017)				(0.018)	(0.018)
Industry dummies (10 categories)	Y	N	N	Y	Y	Y
Anderson-Rubin F-test	-	0.000	0.000	0.000	0.000	0.000
Kleibergen-Paap Wald rk F statistic	-	366.2	367.1	366.9	357.4	356.9
Individual × location FEs	542,631	542,631	421,492	421,492	421,492	421379
Number of observations	4,269,770	4,269,770	4,148,631	4,148,631	4,148,631	4147129

Notes: The table reports regressions of log average daily wages of medium-skilled workers on the share of high-skilled workers conditional on time-variant individual controls (interactions between foreign/female and experience/experience^2 as well as the censoring dummy and its interactions with all control variables are not displayed in the table) and district controls. Column 1 presents the results of an uninstrumented specification with individual-location fixed effects. In columns 2-6, the share of high-skilled workers is instrumented with proximity to the next baroque opera house. Colum 2 only includes an imputation control and a control for full time employment. Column 3 includes a full set of individual controls, interactions between the individual controls and the censoring dummy, and year dummies. In column 4, we additionally consider 10 industry dummies controlling for one-digit industries and again, we interact these controls with the censoring dummy. In column 5 we add country level controls and in Column 6, we use 1-digit occupation controls instead of one-digit industry controls. Across all specifications, standard errors are corrected for individual-district clustering. *** significant at the 1 percent level; ** significant at the 5 percent level; * significant at the 10 percent level.

Table 5: Second stage results for West Germany – low-skilled workers

	I FE	II IV-FE	III IV-FE	IV IV-FE	V IV-FE	VI IV-FE
Share high-skilled workers	0.978***	-0.041	1.159***	1.276***	1.364***	1.368***
	(0.071)	(0.326)	(0.287)	(0.281)	(0.301)	(0.301)
Individual controls						
Foreign	0.180***		0.178***	0.183***	0.183***	0.183***
	(0.008)		(0.008)	(0.008)	(0.008)	(0.008)
Experience	-0.057		-0.057	-0.057	-0.056	-0.056
	(0.047)		(0.047)	(0.047)	(0.047)	(0.047)
Experience^2	-0.001***		-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)
District controls						
Log population	0.043**				0.066***	0.066***
	(0.017)				(0.024)	(0.024)
Labor force participation	0.117***				0.126***	0.127***
	(0.028)				(0.029)	(0.029)
Industry dummies (10 categories)	Y	N	N	Y	Y	Y
Anderson-Rubin F-test		0.0383	0.00163	0.0004	0.0004	0.0004
Kleibergen-Paap Wald rk F statistic		92.39	93.79	93.64	94.34	94.19
Individual × location FEs	291,952	200,416	200,416	200,416	200,416	200,327
Number of observations	1,421,857	1,421,857	1,330,321	1,330,321	1,330,321	1,329,729

Notes: The table reports regressions of log average daily wages of low-skilled workers on the share of high-skilled workers conditional on time-variant individual controls (interactions between foreign/female and experience/experience^2 as well as the censoring dummy and its interactions with all control variables are not displayed in the table) and district controls. Column 1 presents the results of an uninstrumented specification with individual-location fixed effects. In columns 2-6, the share of high-skilled workers is instrumented with proximity to the next baroque opera house. Colum 2 only includes an imputation control and a control for full time employment. Column 3 includes a full set of individual controls, interactions between the individual controls and the censoring dummy, and year dummies. In column 4, we additionally consider 10 industry dummies controlling for one-digit industries and again, we interact these controls with the censoring dummy. In column 5 we add country level controls and in Column 6, we use one-digit occupation controls instead of 1-digit industry controls. Across all specifications, standard errors are corrected for individual-district clustering. *** significant at the 1 percent level; ** significant at the 5 percent level; * significant at the 10 percent level.

Table 6: Effect Heterogeneity

	I **High-skilled workers** Baseline: 1.053***	II **Skilled workers** Baseline: 1.563***	III **Unskilled workers** Baseline: 1.364***
Female	1.706* (0.976)	1.863*** (0.266)	1.417*** (0.495)
Male	0.824** (0.354)	1.337*** (0.152)	1.307*** (0.355)
Manufacturing	1.629*** (0.55)	1.732*** (0.249)	1.221*** (0.459)
Non- manufacturing	0.989** (0.436)	1.434*** (0.175)	0.799** (0.404)
Above mean distance	-0.002 (1.045)	1.194*** (0.382)	-0.369 (0.743)
Below mean distance	0.874*** (0.285)	1.939*** (0.113)	2.166*** (0.230)

Notes: Each cell presents the result from a separate regression. The independent variable is the share of high-skilled workers and the dependent variable is the log of the daily wage of high-skilled workers (column 1), skilled workers (column 2) and low-skilled workers (column 3). We instrument the share of high-skilled workers in in a region with the minimum distance to the next baroque opera house interacted with year dummies. Individual controls include foreign, experience, experience^2, censored wage dummy, time dummy, interactions of experience with female and foreign and interactions of the censoring dummy with individual controls. Industry controls are dummies for ten 1-digit industries. District-level controls include log population and the labor force participation rate. If not otherwise stated standard errors are corrected for individual-location clustering. *** significant at the 1 percent level; ** significant at the 5 percent level; * significant at the 10 percent level.

Table 7: Predicted probabilities using historic location factors

Opera House Location	Predicted Probability (1)	Counterfactual Location	Predicted Probability (3)	Difference (2)-(4)
Munich	0.7894	Mainz	0.8425	-0.0531
Coburg	0.2841	Memmingen	0.3120	-0.0279
Luebeck	0.4762	Emden	0.5017	-0.0255
Muenster	0.5379	Stuttgart	0.5447	-0.0068
Mannheim	0.3234	Bielefeld	0.3300	-0.0066
Trier	0.4466	Nuremberg	0.4490	-0.0024
Aachen	0.0110	Herford	0.0125	-0.0015
Passau	0.2129	Straubing	0.2139	-0.0010
Brunswick	0.2547	Duesseldorf	0.2540	0.0007
Augsburg	0.0762	Krefeld	0.0751	0.0011
Wuerzburg	0.3363	Bielefeld	0.3300	0.0063
Darmstadt	0.4557	Nuremberg	0.4490	0.0066
Frankfurt	0.8497	Mainz	0.8425	0.0072
Bayreuth	0.2731	Duesseldorf	0.2540	0.0191
Ulm	0.8954	Mainz	0.8425	0.0528
Regensburg	0.9209	Mainz	0.8425	0.0784
Koblenz	0.9719	Mainz	0.8425	0.1293
Bremen	0.9760	Mainz	0.8425	0.1334
Hamburg	0.9800	Mainz	0.8425	0.1375

Notes: The Table shows pairs of 19 actual and counterfactual opera house locations in West Germany. Counterfactual opera house locations result from a Mahalanobis matching on the predicted probabilities from probit estimations of the baroque opera house dummy on the area of today‘s district; an independent city status dummy; log of slope measured as difference between the highest and lowest elevation; the log of the area of the historic principality that covers the most of today's district; the log of the historic population in 1700 and the population growth between 1700-1800 in all Bairoch cities within the district today; the log of river-km in the district; a coast dummy; a dummy if the location was home to a university before 1800; Hanseatic city status dummy; free city status dummy; percent of the area that contains coal, ore, quarzite, and/or slate; soil's suitability for cereal and pasture at medium input; an indicator for the dominant religion. Column (5) shows the difference between the predicted probability for the actual and counterfactual opera house.

Table 8: Robustness checks

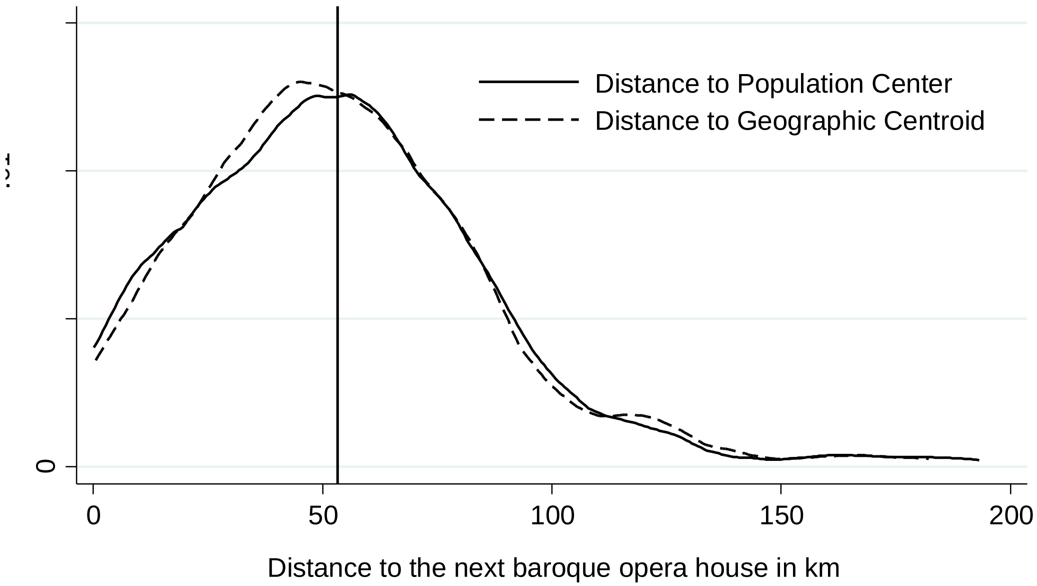
	I **High-skilled workers** Baseline: 1.053***	II **Skilled workers** Baseline: 1.563***	III **Unskilled workers** Baseline: 1.364***
Always Full Time	0.748** (0.360)	0.856*** (0.175)	1.057*** (0.302)
Rent control	0.697 (0.545)	1.523*** (0.199)	1.550*** (0.390)
No Imputation	0.590* (0.325)	1.518*** (0.141)	1.359*** (0.300)
Distance to population centroid	1.036*** (0.363)	1.585*** (0.140)	1.307*** (0.293)
Opera house dummy *(All locations)*	1.190*** (0.289)	1.811*** (0.099)	1.945*** (0.197)
Opera house dummy *(Only opera locations)*	0.728 (0.555)	1.360*** (0.236)	2.174*** (0.454)
Control for district-specific 10-year Trends	0.704*** (0.255)	1.839*** (0.103)	1.554*** (0.201)
SE clustered by district and year	1.053*** (0.364)	1.563*** (0.329)	1.364*** (0.418)
SE clustered by district	1.053*** (0.385)	1.563*** (0.337)	1.364*** (0.432)
High propensity score regions dropped from distance calculation	1.578** (0.660)	1.740*** (0.250)	0.705 (0.518)
Imperial, university, and Hanseatic cities dropped from distance calculation	0.525* 0.281	1.151*** (0.137)	0.939*** (0.295)
LIML	1.054*** (0.360)	1.564*** (0.143)	1.364*** (0.301)
Movers	0.384 (0.392)	1.556*** (0.185)	1.378*** (0.479)
East Germany	1.480*** (0.617)	1.729*** (0.349)	-0.834 (1.519)

Notes: Each cell presents the result from a separate regression. The independent variable is the share of high-skilled workers and the dependent variable is the log of the daily wage of high-skilled workers (column 1), skilled workers (column 2) and low-skilled workers (column 3). We instrument the share of high-skilled workers in in a region with the minimum distance to the next baroque opera house interacted with year dummies. Individual controls include foreign, experience, experience^2, censored wage dummy, time dummy, interactions of experience with female and foreign and interactions of the censoring dummy with individual controls. Industry controls are dummies for ten 1-digit industries. District-level controls include log population and the labor force participation rate. If not otherwise stated standard errors are corrected for individual-location clustering. *** significant at the 1 percent level; ** significant at the 5 percent level; * significant at the 10 percent level.

Figure 1: Locations of baroque opera houses in Germany

Notes: The map shows the 29 baroque opera house locations in Germany.

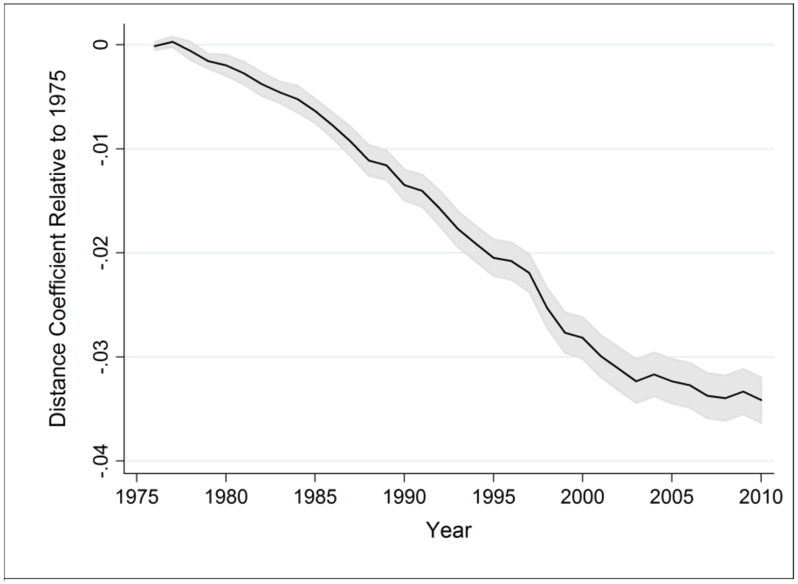
Figure 2: Kernel density of distance to the next opera house in West Germany



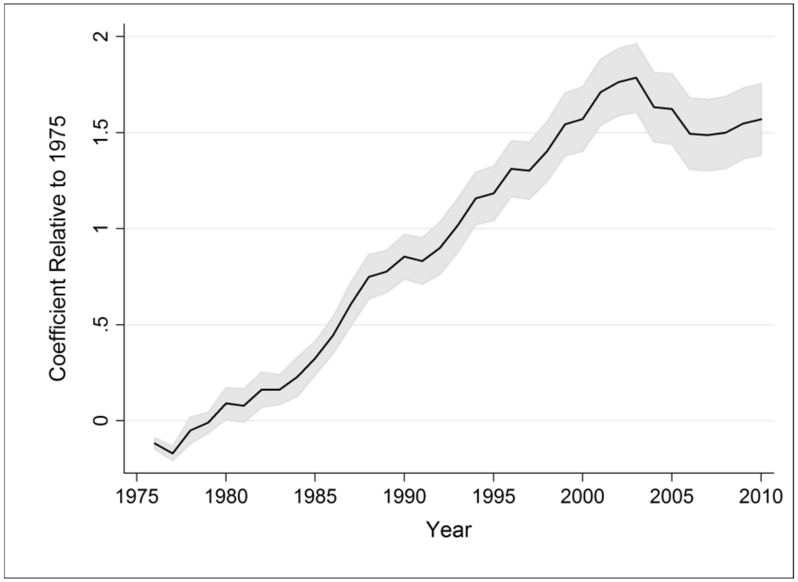
Notes: The figures shows kernel density plots of the all distances between (i) districts' population center (solid line) and (ii) countries' centroids (dashed line) to the closes West German baroque opera house. Excluding West Berlin, we observe 19 baroque opera houses across West Germany. The vertical line represents both the mean minimum distance to the population center of 53.3 km as well as to the centroid of 53.5 km. The two are not distinguishable from each other in the figure.

Figure 3: First stage relationship

(a) Distance to the closest opera house

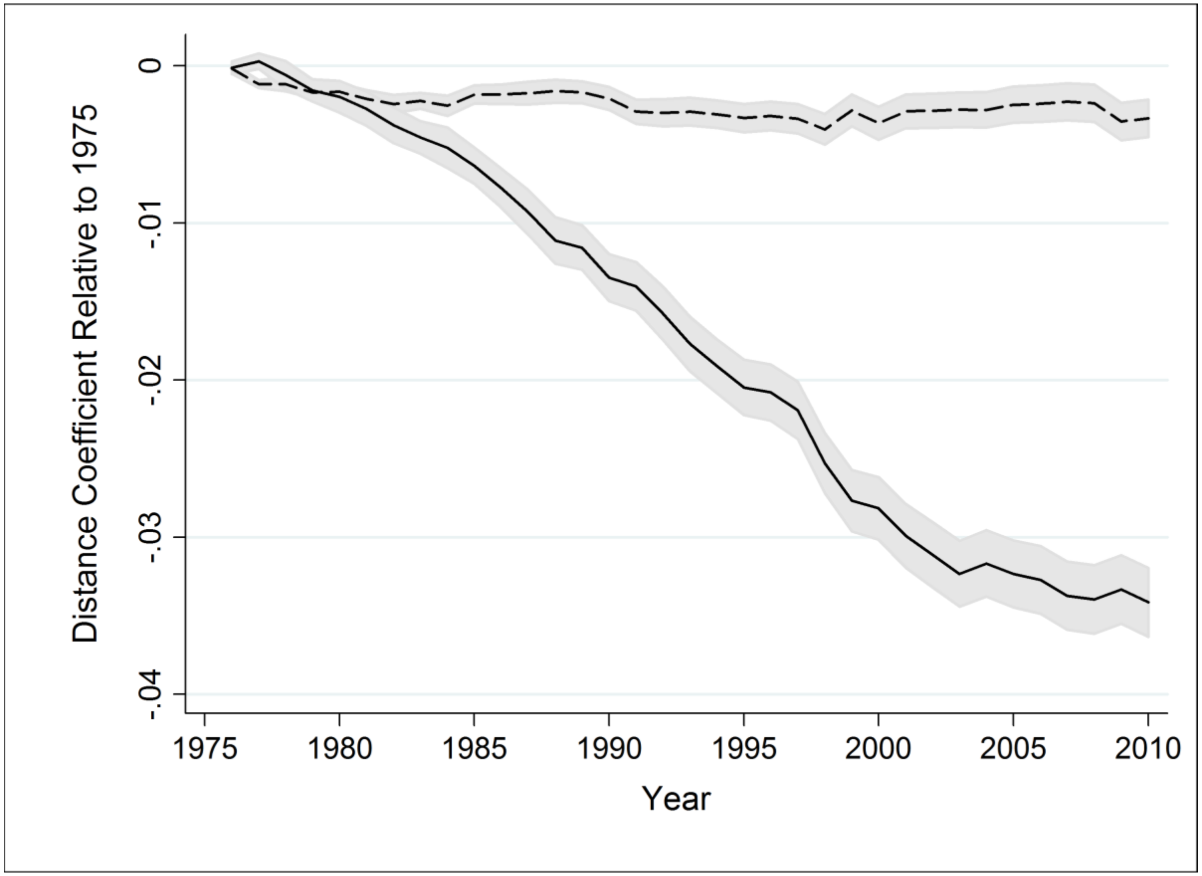


(b) Opera house dummy



Notes: The figure is a graphic representation of the time-variant coefficients from the first stage regression in equation (2) with 1975 as base year. Panel (a) shows coefficients on the interactions between the minimum distance to the next opera house and year dummies and panel (b) shows coefficients of interactions between opera house dummies and year dummies. Each coefficient shows the expected relative percentage point increase in the share of high-skilled workers when moving 1 km closer to a baroque opera house location. This specification considers the subset of high skilled workers. Coefficients are enclosed by 95 percent confidence band. Standard errors are corrected for individual-district clustering.

Figure 4: First stage relationship for distance to the actual and counterfactual opera house locations, 1976-2010



Notes: The figure is a graphic representation of the time-variant distance coefficients from the first stage regression in equation 2 with 1975 as base year. The solid line represents distance coefficients for the actual distance to the closest baroque opera house (cf. Figure 3a) and the dashed line represents the first stage using the counterfactual distances. The coefficients are enclosed by 95 percent confidence band. Standard errors are corrected for individual-location clustering. Each coefficient shows the expected relative percentage point increase in the share of high-skilled workers when moving 1 km closer to a baroque opera house location. This specification is for the case of high skilled workers.