Bohemians, Human Capital, and Regional Economic Growth

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Abstract

An emerging literature on the geography of bohemians argues that a region's lifestyle and cultural amenities explain, at least partly, the unequal distribution of highly qualified people across space, which in turn, explains geographic disparities in economic growth. However, to date, there has been little or no empirical attempt to identify a causal relation. To identify the causal impact of bohemians on economic growth, we apply an instrumental variable approach using as an exogenous instrument the geographic distribution of bohemians prior to the Industrial Revolution in Germany. This distribution was primary the result of competition for prestige between courts and not of economic prosperity. Accordingly, the instrument is independent of today's regional economic development. Focusing on the concentration of highly skilled people today that is explained by the proximity to exogenous concentrations of bohemians, the observed local average treatment effect supports the hypothesis of a positive impact of bohemians on regional economic development.

JEL Code: R11, J24, C31.

Keywords: regional growth, human capital, bohemians, instrumental variables.

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1. Introduction

The connection between the presence of bohemians and the existence of an innovative, economically healthy society has attracted a great deal of interest. In earlier work, for example, that by Grana (1964) and Young (1971), bohemians are traditionally regarded as a subgroup on the margins of society, their libertine lifestyle standing in marked (and often not favorable) contrast to traditional Protestant work ethics. Things have changed, and drastically. Cities are still places in which to work, even though most production facilities have moved to the periphery, but they are also very much places in which to consume (Glaeser *et al.* 2001). Office buildings and research laboratories have taken the place of industrial production facilities (cf. Duranton and Puga 2005; Davis and Henderson 2008; Henderson and Ono 2008) and the white-collar workers employed in them have changed, too. One could perhaps go so far as to say that making a living has been replaced in importance with having a life, with a great deal of attention focused on aesthetics of all types (cf. Clark 2003). This increased demand for culture and an exciting, fulfilling lifestyle eventually integrated "formerly marginalized individuals and social groups into the value creation process" (Florida 2002: 57). In short, bohemians are now smiled at instead of frowned upon.

Highly skilled individuals' preferences for cultural amenities initially suggest leveraging culture to enhance urban or regional economic growth. This strategy seems especially promising in light of studies that illustrate the concentration of both bohemians and human capital in prospering cities (Florida 2002). However, the observed co-allocation of bohemians and human capital is only a correlation that does not allow for a causal interpretation of the empirical results.[1] It could indeed be that a concentration of bohemians attracts human capital. However, it could just as easily be the other way around, that is, that a concentration of human capital in the form of highly skilled workers who have not only an appreciation for

artistic output, but the money to indulge in that taste, attracts bohemians. Therefore, policies intended to improve regional economic growth by providing more cultural amenities may be putting the cart before the horse (cf. Glaeser 2005).

To identify a causal relationship between the concentration of bohemians, human capital, and regional economic development we exploit a quasi-natural historical experiment. During the Baroque era, musical composition and performance was promoted by competing courts or churches. This competition was especially high in what is now Germany because at that time and all the way up to industrialization, the area was politically fragmented into several hundred princedoms. Vaubel (2005) illustrates this nicely when he mentions that Thuringia alone, where the composer J. S. Bach grew up, contained 22 separate courts. Music was so highly regarded that "every local court (*Hof*) worth its salt had its own orchestra or band (*Kapelle* or *Harmonie*), and the more affluent courts maintained opera houses" (Scherer 2001a: 719). These theaters and opera houses, many of which still exist, indicate the prestige of the rulers who had them built. However, this does not mean that these buildings did necessarily indicate regional prosperity and wealth and that is why rulers often encumbered with large debts (cf. Duchhardt 1992; Vierhaus 1984). Accordingly, current concentrations of bohemians around the sites of these theaters and opera houses, which were the result of a now-ancient cultural competition between kings, dukes, and princes, can be regarded as mostly independent of today's economic factors.

The relationship between the regional concentration of bohemians, the regional stock of human capital, and regional economic growth will be analyzed as follows. Section 2 develops a simple cross-regional growth regressions framework with human capital and bohemian lifestyle and shows empirical evidence for 403 German districts. In section 3, we analyze

[1] See, e.g., Angrist and Pischke (2009) and Heckman (2000) for more details on the necessity of causal relationships when motivating political activity.

whether the presence and concentration of bohemians attract high human capital individuals. Section 4 concludes.

2. Bohemians, Human Capital, and Regional Economic Growth

A simple cross-region growth regression framework

We start from a simple neoclassical macro-economic production function with constant returns to scale and three capital inputs: physical capital, human capital, and bohemian lifestyle:

$$\log y = \log A \ + \alpha \log k + \beta \log h + \gamma \log b\,, \qquad (1)$$

where y is GDP per capita; A is the technological state; k is physical capital intensity; h is the average human capital stock of the labor force; and b is the average bohemian lifestyle which can be interpreted as a special form of human capital. To reconcile the empirical observation of permanent GDP per capita growth with the neoclassical framework, one has to assume that the technological state exogenously increases over time. Assuming that A evolves along an exponential growth path over time, A can be written as follows:

$$A = A_0 e^{\lambda_i t}\,, \qquad (2)$$

where λ is the growth parameter. This results in a modified Equation (1) when taking first differences.

$$\Delta \log y \ = \lambda + \alpha \Delta \log k + \beta \Delta \log h + \gamma \Delta \log b \qquad (3)$$

Theories of endogenous growth (cf. Lucas 1988; Romer 1990; Aghion and Howitt 1998), however, are not content to limit the effects of human capital to only increasing labor productivity, but also the innovative capacity of an economy, which, in turn, results in new

processes and products, consequently promoting growth. The same applies to bohemian lifestyle. Thus, the level of human capital and bohemian lifestyle should affect λ:

$$\lambda = f(h,b,\cdot)\,. \tag{4}$$

Substituting λ in equation (3) by equation (4) results in:

$$\Delta \log y \;\; = f(h,b,\cdot) + \alpha \Delta \log k + \beta \Delta \log h + \gamma \Delta \log b \tag{5}$$

Accordingly, a cross-region growth regression should include the initial level of human capital and bohemian lifestyle.[2] Changes in capital input might be the result of innovation, e.g., labor saving technological progress leading to capital deepening and skill-biased technological change (cf. Acemoglu 2002). We therefore do not include changes in capital inputs leaving us with the following cross-region growth regression equation:

$$\Delta \log y_i = \alpha + \beta_1 h_{it=0} + \beta_2 b_{it=0} + D\beta_3 + \beta_4 y_{it=0} + \varepsilon_i \tag{6}$$

Thereby, $\Delta \log y_i$ is the average yearly growth of GDP per capita in region *i* over a longer time span. The levels of human capital and bohemian lifestyle are included at the initial time *t=0*. Following Barro (1991), we include initial GDP per capita to control for the catching-up of poorer regions. ε is a standard error term.

The regional framework of our analysis comprises 403 German districts (*Kreise*).[3] Exploiting regional variation within a single country has the advantage that there is a uniform framework of common laws and institutional settings. However, our model might be compromised if urbanization has an impact on regional growth. We therefore include eight dummies (matrix

[2] For a discussion, see Hanushek and Woessmann (2008), Section 4.2.

[3] We initially started with all 439 districts, covering 324 territorial districts and 115 city districts (*kreisfreie Stadt* or *Stadtkreis*) but then merged 36 city districts (*kreisfreie Städte*) with the surrounding territorial districts. In these cases, the capital of the surrounding territorial districts coincides with a *kreisfreie Stadt*. For instance, the capital of the territorial district of *Munich* in Bavaria is the correspondent city of *Munich* which is also a city district (*kreisfreie Stadt*).

D) that characterize the type of district. These dummies range from core cities to sparsely populated rural districts and should capture (non-linear) differences across district types.[4]

Regional Data on Human Capital and Bohemian Lifestyle

Vandenbussche *et al.* (2006) and Aghion *et al.* (2005) argue that primary and secondary education tend to produce imitators and that tertiary education is more likely to produce innovators. As we are primarily interested in human capital increasing the innovative capacity of a region, our human capital indicator concentrates on tertiary education. Our data on regional human capital are derived from the *German Social Insurance Statistics*. The *German Social Insurance Statistics* requires every employer to report information about each employee subject to compulsory social insurance. Thus, employees are not assigned to their place of residence but by workplace (establishment). Our human capital measure is simply the share of employees subject to social insurance with a tertiary (university) degree over all employees subject to social insurance in a district.

Our data on Bohemians come from two sources. The first dataset (Bohemians I) stems from the *German Social Insurance Statistics* and covers publicists, musicians, actors, painters, and designers who are subject to social insurance.[5] These data are available from 1998 to 2004. These bohemians are assigned to their place of work, not to place of residence. Therefore, the share of bohemians is calculated as the share of people subject to social insurance in this region. A shortcoming of the *German Social Insurance Statistics* is that entrepreneurs, freelancers, and civil servants are not included. This is particularly troublesome when counting bohemians because many of them are freelancers. In fact, it is estimated that about

[4] These dummies are based on a standard classification of German districts (*siedlungsstrukturelle Kreistypen*) according to their density and their spatial status (cf. Federal Office for Building and Regional Planning 2003). Districts are classified according to their density of economic activity (core city, highly congested, moderately congested, rural) as well as their location in large agglomerations, urbanized regions and rural areas.

[5] According to the International Standard Classification of Occupations (ISCO), these occupations are classified as ISCO Code 245, Writers and creative or performing artists.

half the active artists in Germany are working as freelancers and are not recorded in the *Social Insurance Statistics* (Haak, 2005). Therefore, we gather information about freelance artists from a second database (Bohemians II) available from 2002 to 2004. These data stem from the statistics of a special insurance (*Künstlersozialkasse*) created for those artists who are not in regular employment and, therefore, not subject to obligatory social insurance payments. The freelance artists included in Bohemians II are engaged in the fields of writing, performing arts, fine arts, and music. In contrast to Bohemians I, they are assigned to their place of residence. Accordingly, in the case of Bohemians II, we consider the share of bohemians over the resident population.

Table 1: Descriptive Statistics

	Mean	Std. Dev.	Minimum	Maximum
GDP per capita growth 1999-2004	0.033	0.020	-0.047	0.111
Average share of employees with a tertiary degree 1998-2004	0.075	0.042	0.025	0.351
Average share of bohemians 1998-2004 (Bohemians I)	0.002	0.001	0.000	0.013
Average share of bohemians 2002-2004 (Bohemians II)	0.002	0.002	0.000	0.015

Table 1 shows descriptive statistics of our variables. The average share of employees with a tertiary degree over all districts between 1998 and 2004 was 7.5 percent. The average share of bohemians according to the first definition (Bohemians I) reached 0.2 percent. The average share of bohemians according to the second definition (Bohemians II) reached 0.2 percent in the period 2002 to 2004. Average GDP per capita growth was 3.3 over all districts between 1999 and 2004. The latter data are provided by the Statistical Offices (Arbeitsgemeinschaft Volkswirtschaftliche Gesamtrechnung der Länder 2008).

Results

Table 2 shows the results of our simple cross-region growth regressions divided into two panels. The left panel shows the results when using Bohemians I. The right panel shows the results when using Bohemians II.

Table 2: Results—Cross-Region Growth Regressions

	(1) Bohemians I 1999-2004			(2) Bohemians II 2002-2004		
Human capital	0.30*** (0.030)		0.31*** (0.035)	0.22*** (0.043)		0.24*** (0.045)
Bohemians		2.49*** (0.799)	-0.62 (0.744)		0.15 (0.783)	-1.52* (0.794)
Initial GDP per capita	-0.15*** (0.044)	-0.11** (0.052)	-0.15*** (0.044)	0.09* (0.048)	0.15** (0.064)	0.14** (0.058)
District-type dummies	Yes***	Yes***	Yes***	Yes***	Yes***	Yes***
R^2	0.30	0.09	0.30	0.15	0.05	0.16
F statistic	13.84***	4.07***	12.60***	4.64***	2.29**	4.65***
Number of observations	403	403	403	403	403	403

Notes: The Table presents OLS estimates for the effect of human capital and Bohemians (represented by our two definitions of Bohemians) on average yearly growth of GDP. Bohemians I relates to those bohemians that are subject to social security and Bohemians II to those subject to a special insurance. In Panel (1), the dependent variable ranges from 1999-2004 and the independent variables are measured in the initial year 1998. In Panel (2), the the dependent ranges from 2002-2004 and the independent variables are measured in the initial year 2002. Robust standard errors are reported in parentheses.
**** statistically significant at the 1% level; ** statistically significant at the 5% level;* statistically significant at the 1% level.*

In all specifications human capital is significantly positive. An increase of the share of employees with a tertiary degree by on standard deviation results in an increase of yearly GDP per capita growth of about 0.9 to 1.2 percentage points. By contrast, bohemian lifestyle is only significant when considering Bohemians I and when not controlling for human capital. In a horse race between human capital and bohemian lifestyle, the coefficient of the share of bohemians turns out to be insignificant or even significantly negative. These results are in line with Glaeser (2005) and suggest that the effect of bohemians on economic growth is at least indirect in the sense that bohemians attract high human capital individuals to the region but do not have a direct effect on GDP per capita growth.

3. Do Bohemians Attract High Human Capital Individuals?

Multivariate, Cross-Regional Evidence

Research in the field of urban and regional economics shows that human capital is unequally distributed across space, which provides an explanation for regional disparities (Duranton and Puga 2001; Glaeser *et al*. 1992). Early research by Jacobs (1969) on urban diversity suggests

that cities rich with cultural life and other amenities support a certain lifestyle that is attractive to human capital and hence economic growth (Glaeser *et al.* 2001). Such amenities include the quality of public infrastructure (e.g., good schools or transportation-related facilities), the cultural infrastructure (e.g., restaurants and theaters), the region's aesthetics and physical setting (e.g., architecture or parks), and, finally, a variety of social contacts. Drawing on this research, Florida (2002) introduces the geography of bohemia and argues that "the presence and concentration of bohemians in an area signals an environment or milieux that attracts other types of talented or high human capital individuals."(p. 56).

Following this line of argumentation, a region's stock of human capital should be related to the presence of bohemians, who contribute to an overall attractive environment:

$$\overline{h}_i = \alpha + \beta_1 \overline{b}_i + D\beta_2 + \beta_3 y_{it=0} + \varepsilon_i \,. \qquad (7)$$

Here, $\overline{h}_i$ stands for region *i*'s average stock of human capital over time, $\overline{b}_i$ is the average share of bohemians over all employees subject to social insurance in a district, and the matrix *D* contains the district-type dummies introduced in Section 2. We additionally control for initial GDP per capita.

German districts have a mean size of 812.67 square kilometers with a standard deviation of 596.95 square kilometers. For the sake of simplicity, imagine each district as a circle, the average diameter of which is 29.57 kilometers with a standard deviation of 12.67 kilometers. As these are relatively small units of observation, it is plausible to assume that it is not just the bohemians in one district who shape that district's overall cultural environment but also artists from easily traveled to neighboring districts. For example, districts located in proximity to a large city will benefit from a higher supply of public cultural goods due to that proximity (cf. Solé-Ollé 2006). It is plausible to assume that cultural attractiveness is not equally distributed over all neighboring districts but is mainly determined by the district with the highest number

of bohemians. Hence, to account for the potential extension of the regional cultural environment, we only include the neighboring district with the maximum number of bohemians, $\overline{b}_{\max(j)}$, leading to:

$$\overline{h}_i = \alpha + \beta_1 \overline{b}_i + \beta_2 \overline{b}_{\max(j)} + D\beta_3 + \beta_4 y_{it=0} + \varepsilon_i \qquad (8)$$

Table 3: Results—Bohemians and Employment with Tertiary Degree

	Share of employees with tertiary degree			
	(1)		(2)	
	Bohemians (I)		Bohemians (II)	
	Avg. 98 – 04	Avg. 98 – 04	Avg. 02 – 04	Avg. 02 – 04
Bohemians (I)	8.772*** (1.793)	8.889*** (1.761)	-	-
Bohemians (I) in neighboring districts	-	1.616** (0.681)	-	-
Bohemians (II)	-	-	8.290*** (1.839)	8.341*** (1.836)
Bohemians (II) in neighboring districts	-	-	-	0.695 (0.714)
Initial GDP per capita	0.202** (0.095)	0.164* (0.091)	0.259*** (0.099)	0.242** (0.095)
District-type dummies	Yes***	Yes***	Yes***	Yes***
R^2	0.49	0.50	0.50	0.50
F statistic	18.44***	17.04***	18.37***	16.93***
Number of observations	403	403	403	403

Notes: The Table presents OLS estimates for the effect of the average share of Bohemians (represented by our two definitions of Bohemians) in the same district (Panel 1) and additionally the neighboring district with the highest average share of bohemians (Panel 2) on the average share of human capital. Bohemians I relates to those bohemians that are subject to social security and Bohemians II to those subject to a special insurance. The dependant variable is claulated as average share over the period 1998-2004 (Bohemians I) and 2002-2004 (Bohemians II) respectively. Initial GDP per capita is either measured in 1998 or 2002. Robust standard errors are reported in parentheses.
**** statistically significant at the 1% level. ** statistically significant at the 5% level. * statistically significant at the 1% level.*

The results presented in Table 3 show a significantly positive correlation of the bohemians in the same district with the regional stock of human capital. However, the correlation of bohemians from bordering districts with the regional stock of human capital is only significantly different from zero for Bohemians I.[6] The positive correlations agree with Florida's (2002) findings for the United States, as well as with Boschma and Fritsch's (2009) analysis of Germany and the Netherlands. For the bohemians in the same district, the

estimated coefficients suggest that a one standard deviation increase in the share of bohemians leads to a rise of the share of employees with a tertiary degree by about 1.7 to 1.8 percentage points.

Historical Geographic Distribution of Bohemians as Exogenous Instrument

Our results from Section 3.1 suggest that there is a positive correlation between a district's share of highly qualified employees and its share of bohemians. The results also show a positive correlation between the share of highly qualified employees in a district and the maximum share of employed bohemians in the neighboring districts. For freelance artists (Bohemians II), however, this effect is not statistically significant.

However, these results are correlations and cannot help us in our search for a causal relationship. It very well may be that bohemians attract highly qualified people, as suggested by Florida (2002), but it could just as well be the case that a large number of highly qualified people attract bohemians due to their demand and willingness to pay for cultural goods and services. Alternatively, maybe it is something else altogether. For example, growing and prospering firms in a region might attract highly qualified people. These firms pay local taxes that are spent for the public provision of cultural goods and services, which in turn offer job opportunities for bohemians.

To discover whether bohemians attract highly qualified people (or vice versa), we need to find an exogenous instrument for the geographic distribution of bohemians. To find an appropriate instrument, we exploit a quasi-natural experiment from German history. 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,

[6] The results are qualitatively the same when taking the sum of Bohemians I and II over the years 2002 to 2004

and dukes within the empire by granting territorial and governance concessions. When the Treaty of Westphalia finally ended the Thirty Years' War and, by association, the Holy Roman Empire, 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 same period, European instrumental music experienced its apogee with the Baroque era, the most famous composers of which came from politically fragmented areas of Germany and Italy (Scherer 2001a; Vaubel 2005).[7] Elias (1991) explains this conjunction of circumstances as the result of competition for prestige among rulers of principalities:[8]

> 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." (p. 26)

Based on these initial ideas, Scherer (2001b) analyzes the biographies of 645 composers born between 1650 and 1849 and traces the evolution of freelance music composition over this period. His findings suggest that freelance composing increased in intensity across this entire period. However, a market for music beyond what churches and the nobility could sustain did

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and calculating the share over the resident population.

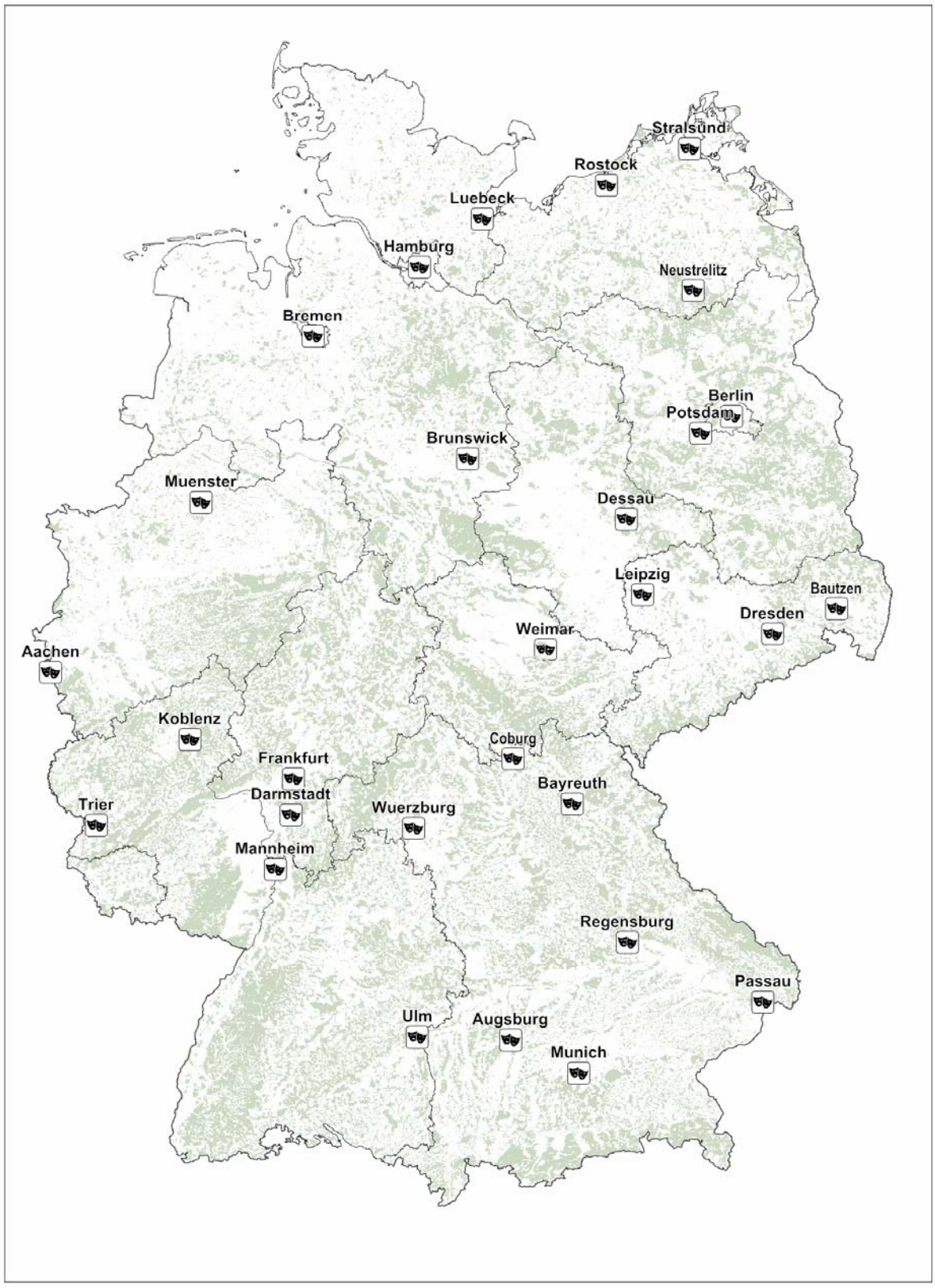
[7] Among these composers were Bach, Handel, Telemann, Haydn, Gluck, Beethoven, Mozart, and Vivaldi.

only emerge well after 1800 when after the so-called first Industrial Revolution an increasingly wealthy middle class began paying to attend concerts and demanding sheet music for home entertainment. In Scherer's data, this change in the music scene is reflected by a significant increase in freelance composing activity by composers born in the period 1800–1849.

These findings suggest that those theaters and opera houses built *before* the Industrial Revolution began making inroads into continental Europe in the middle of the 19th century were primarily built for reasons of prestige. They resulted form the cultural competition between kings, dukes, and princes in a time when strategic marriages and war alliances instead of endowments with economic factors determined regional prosperity. Of course, one might still argue that the necessary funds to build a prestigious theater or opera house did not appear by chance but somehow reflected economic wellbeing that might have indicated a region's future success. However, as outlined by Duchhardt (1992) and Vierhaus (1984), the rationale that you can only spend what you have did not apply to the autocratic rulers of this era. Indeed, many cases survived where the pomposity of the rulers caused large deficits and huge debts. Therefore, we regard the concentrations of bohemians around the sites of these theaters and opera houses as mostly independent of today's economic factors. By contrast, theaters and opera houses built *during* and *after* the so-called Industrial Revolution were most likely built to meet increased private demand for music, a demand chiefly driven by economic development that brought increasing wealth to some regions and their emerging bourgeoisie. Given that German regions have been and are still shaped by industrialization patterns, only today's concentration of bohemians that that can be explained by the existence of a opera that

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

Figure 1: Opera houses in Germany that were built before 1800



Notes: Map of the location of the 29 historic theaters and opera houses in Germany.

was built before 1800 can be viewed as being exogenous to today's regional performance.[9] Figure 1 maps the locations of the 29 historic theaters and opera houses.[10]

We thus assume that variation in today's concentration of bohemians can be exogenously explained by the existence of a historic theater or opera house:

$$b_i = f(oh_i, \cdot) \tag{9}$$

where *oh* is a dummy that equals unity if an historic theater or opera house exists in district *i*. In fact, regressing the average share of bohemians between 1998-2004 (Bohemians I) and between 2002-2004 (Bohemians II) on the opera house dummy, district type dummies and initial GDP per capita results in a highly significant and positive coefficient of the opera house dummy. For Bohemians, the coefficient is 0.002 (with a standard error of 0.0006). For Bohemians II, the coefficient is 0.003 (with a standard error of 0.0006).

Given these findings of regional spillover of cultural infrastructure, we then calculate pairwise geographic distances between the center of each district's core city and the 29 theaters or opera houses for all 403 German districts. For each district, we take the minimum distance out of the 29 distances and use this minimum distance as weight for the effect of the bohemians in district *j* (that has a historical opera house and that is at minimum distance to district *i*) on human capital in district *i*. Thus, in line with equation (8), we end up with the following equation:

$$h_i = f(md_{ij} \cdot b_{md(j)_i}, \cdot) \tag{10}$$

[9] We concentrate on musical composers and performers because private markets for paintings and sculptures, independent of court or church patronage, existed in economically prosperous places at an earlier time (cf. Cowen 1998, p. 32). It should be noted that industrialization did not reach continental Europe until the 1830s, whereas England had been undergoing the process for about 50 years already.

[10] Table A2 in the Appendix provides further information about the opera houses. From Table A2, one can immediately see, that the cutoff year 1800 is not interpreted sharply, i.e., we also include three opera houses that were built shortly after 1800. However, excluding these three opera houses does not qualitatively change our results.

Thereby, *md* is the distance of district *i* to the nearest location *j* with a historic opera house and $b_{md(j)i}$ is the share of bohemians in district *j* with a historic opera house that is closest to district *i*. We then insert equation (9) into (10) whereby *oh=1* and we further add the matrix of district type dummies (*D*) and the district *i* and *j*'s initial GDP per capita as control variables. We additionally consider district *j*'s initial GDP per capita as control because it turned out to have a significant effect when estimating equation 9. Together, this yields the "reduced form" first stage equation of our instrumental variable approach:

$$h_{it=0} = \alpha + \beta_1 md_{ij} + \beta_2 D + \beta_3 y_{it=0} + \beta_4 y_{jt=0} + \varepsilon_i \qquad (11)$$

The second stage equation is our basic cross country growth regression, whereby we additionally (in comparison to equation 6) control for initial GDP per capita in district *j*, which is the nearest location with a historical opera house:

$$\Delta \log y_i = \alpha + \beta_1 h_{it=0} + \beta_2 D + \beta_3 y_{it=0} + \beta_4 y_{jt=0} + \varepsilon_i \qquad (12)$$

Table 4 sets out the results of our IV regression. The first column shows the results when not controlling for initial GDP per capita in district *j*. The second column presents the results with this control variable. As expected, minimum distance is negative in the first-stage regression. The coefficient is highly significant and the F statistic of excluded instruments is well beyond the critical value of 10 in both specifications (Stock *et al.* 2002), thus demonstrating that our instrument is sufficiently strong.

Table 4: Results—Instrumented Human Capital and Regional Growth

	(1) Average yearly growth of GDP per capita 1999–2004	(2) Average yearly growth of GDP per capita 1999–2004
Human capital	0.39***	0.37***
	(0.099)	(0.105)
Initial GDP per capita in district *i*	-0.17***	-0.13**
	(0.050)	(0.065)
Initial GDP per capita in district *j*		-0.039
		(0.028)
District-type dummies	Yes***	Yes***
F statistic	4.31***	6.51***
R^2	0.28	0.29
First stage		
Minimum distance to the closest historic	-0.0002***	-0.0002***
theater or opera house	(0.000)	(0.000)
F statistic (excluded instrument)	18.48***	16.13***
Number of observations	403	403

Notes: The table presents the 2SLS for the impact of exogenous concentrations of bohemians represented by the existence of a historic theater or opera house on average yearly growth of GDP per capita. At this,the index i refers to the district we analyze and the index j refers to the closest district with a historic theater or opera house. The first stage measures the impact of a historic concentration of bohemians on today's concentration of human capital and the second stage measures the indirect impact of the historic concentration of bohemians on average yearly growth of GDP per capita via human capital. Initial GDP per capita is measured in 1998. Robust standard errors are reported in parentheses.
**** statistically significant at the 1% level, ** statistically significant at the 5% level, * statistically significant at the 1% level.*

In the second-stage regression, the human capital coefficient is significantly positive and the size of the coefficient holds when additionally controlling for GDP per capita in location *j*. Interestingly, the coefficient is larger than the one estimated in the OLS model in Section 2. The coefficient signifies that a one standard deviation increase in the share of employees with a tertiary degree increases GDP per capita growth by about 1.5 to 1.6 percentage points. The smaller effect in the OLS model could be due to the fact that we use the total variation in the districts' share of employees with a tertiary degree. Accordingly, we calculate an average effect over all highly qualified people in the OLS model. In the instrumental variable approach, we fall back on only those highly qualified individuals who are attracted by the geographic proximity of bohemians. Our results suggest that it is exactly this group of highly qualified people that is more growth enhancing than the rest of the highly qualified people, a result supportive of Florida's argument.

Robustness Checks

Our identification strategy relies on the assumption that historic concentrations of bohemians influence today's concentrations of highly skilled individuals in only one way, i.e. the persistence of a cultural environment. So we assume that there are no other omitted variables that influence both, the existence of historic concentrations of bohemians and today's concentration of highly skilled people. This assumption might be influenced by two coincidences which we address now.

Those who have read Thomas Mann's famous novel about the *Buddenbrooks* that describes the rise and the downfall of trader's family in the hanseatic city of Luebeck might argue that theaters and opera houses in hanseatic cities were not built as a result of competition between courts but to meet increased demand of citizens for music, chiefly driven by prosperous economic development. Even though, theaters and opera houses in the hanseatic cities Brunswick, Bremen, Hamburg, Luebeck and Rostock were built after the heyday of the Hanseatic League between 1250 and 1400, we also ran separate regressions where we omit these hanseatic cities in the calculation of the minimum distance to a historic opera house. As reported in Column 1 of Table 5, the results remain robust to this modification.

Table 5: Robustness Checks

	(1) Hanseatic cities excluded		(2) Cities with a historic university excluded		(3) Cities with a baroque university excluded	
Human capital	0.55***	0.55***	0.45***	0.45***	0.46***	0.46***
	(0.076)	(0.067)	(0.086)	(0.095)	(0.082)	(0.088)
Initial GDP per capita in district *i*	-0.21***	-0.21***	-0.19***	-0.19***	-0.19***	-0.19***
	(0.053)	(0.059)	(0.049)	(0.065)	(0.050)	(0.066)
Initial GDP per capita in district *j*		-0.00		0.00		0.01
		(0.021)		(0.035)		(0.031)
District-type dummies	Yes***	Yes***	Yes***	Yes***	Yes***	Yes***
R^2	0.13	0.13	0.23	0.23	0.22	0.22
F statistic	7.76***	9.23***	5.51***	7.54***	5.93***	7.88***
First stage						
Minimum distance to the closest historic theater or opera house	-0.0002***	-0.0002***	-0.0002***	-0.0002***	-0.0002***	-0.0002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
F statistic (excluded instrument)	69.34***	94.27***	39.50***	35.34***	43.23***	41.14***
Number of observations	403	403	403	403	403	403

Notes: The table presents 2SLS regressions as in Table 4 where average yearly growth of GDP per capita 1999–2004 is the dependent variable but excludes some historic locations of theaters and opera houses that might suffer from endogeneity. Robust standard errors are reported in parentheses.
**** statistically significant at the 1% level; ** statistically significant at the 5% level; * statistically significant at the 1% level.*

Another argument one could think of is that rulers who supported bohemians and the evolution of musical art were not just patrons of the arts but also of science. If this was true, one could argue that these rulers supported bohemians and also founded universities that lead to an early concentration of bohemians and highly skilled people that last until today. However, when looking at Table A2 on can see that only seven out of 29 cities with a historic opera house possessed a university before 1800. The separate regressions where we omitted these seven cities in the calculation of the minimum distance to a historic opera house are reported in Column 2 of Table 4. Moreover, only two universities, Muenster and Brunswick, were founded in the Baroque era that is of especial importance for our analyses. The results where we omit these two cities in the calculation of the minimum distance to a historic opera house are reported in Column 3 of Table 4. Both specifications show that the results did not change. Therefore, we are confident that our identification strategy is not biased by these omitted variables.

5. Conclusions

This paper makes an important contribution to the literature on the geography of bohemia, which contains prominent examples of prosperous cities in which bohemians and human capital are co-located. These cities raise the question of whether political action aimed at enhancing cultural amenities could lead to overall regional growth. To answer this question, we need to find out whether there is a causal relationship between bohemians and human capital. Solving this problem empirically requires an exogenous instrument for the concentration of bohemians. Our quest for such an instrument embodied in a quasi-natural experiment led us back in time. During the Baroque era, what we know as Germany today was comprised of approximately 300 sovereign states in which prestige was measured by the presence of theaters or opera houses and the occurrence of musical performances. Accordingly, concentrations of bohemians today in these areas of former cultural competition can be regarded as mostly independent of today's economic factors.

In exploiting this natural experiment, we use only the part of the variation in districts' share of highly qualified employees that can be explained by the minimum distance to a historic theater or opera house, estimating what Imbens and Angrist (1994) call a local average treatment effect (LATE). In simple terms, we estimate the mean impact on those highly qualified people who are attracted by a district due to its closeness to a historic theater or opera house. Our empirical analysis supports Florida's (2002) idea that bohemians attract human capital. We find that those highly qualified individuals who are attracted by the nearness of bohemians are the very ones most relevant to economic development. Of course, other factors no doubt play a role in the regional distribution of highly qualified people, and thus there is much room for further study.

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Table A1: Historic locations of Opera houses that were built before and just around 1800 and founding year of Universities in these cities

Location	Year of Construction	Description	University
Aachen	1751	Aachen's first public opera house opened its doors in 1751. Aachen's town master builder Johann Joseph Couven rebuilt a bathhouse into an opera house. It was located at the *Katschhof*.	1870
Augsburg	1776	Augsburg's first opera house, the *Städtische Schauspielhaus*, was built on a large scale, offering the capacity to host prestigious ensembles and orchestras. Among others, Mozart visited the opera house in October 1777 and his opera, *Don Giovanni,* was staged in 1787, the year of its world premiere.	1970
Bautzen	1796	Bautzen's opera house was established in the inner part of the city wall, located between *Lauengraben* and *Kornmarkt*. Among others, Mozart's *Zauberflöte* became soon after its world premiere in 1791 part of the program.	1827
Bayreuth	1748	The opera house bears witness to the margrave's wife Wilhelmine, princess of Prussia and Fredrick the Great's sister, artistic deposition. Its outer parts were built by Joseph Saint-Pierre, the inner parts were built by Giuseppe and Carlo Galli-Bibiena.	1975
Berlin	1742	Fredrick the Great engaged Georg Wenzeslaus von Knobelsdorff to build the opera house. Construction work started in July 1741. The impatient ruler demanded its inauguration on December 7th, ten months before the actual completion, with Carl Heinrich Graun's opera *Cleopatra e Cesare*.	1948
Brunswick	1690	The opera house in was built on behalf of duke Anton Ulrich von Braunschweig-Lüneburg. It was located at the Hagenmarkt. Besides operas, the house hosted the premiere of Gotthold Ephraim Lessing's play Emilia Galotti in 1772.	1745
Bremen	1792	Bremen's first opera house called *Altes Schauspielhaus* was built by Carl Ludwig Murtfeldt on the *Junkernbastion* in proximity to the *Ostertor*. It was inaugurated with Joseph Marius von Babo's play *Bürgerglück* which points to the fact that it hosted plays but also operas. Among the most popular composers performed in Bremen were Paisiello, Mozart, and Ditters von Dittersdorf.	1971

Coburg	1684	Coburg was the ducal seat of the dukes of Saxony-Coburg. In the Baroque era, duke Albrecht opened Coburg's first court theater in 1684. After his death performances stopped until duke Ernst Friedrich rebuilt the former ball house at the *Schlossarkaden* into an opera house and theater. Performances then included operas by Mozart and plays by Schiller and Iffland.	1812
Darmstadt	1711	Darmstadt's first theater was built on behalf of the landgrave's wife Elisabeth Dorothea. The previous riding arena at *Herrengarten* was rebuilt into an opera house by Louis Remy de La Fosse. It was inaugurated with Christoph Graupners opera *Telemach*.	1877
Dessau	1800	In 1798, prince Leopold Friedrich Franz engaged Friedrich Wilhelm von Erdmannsdorff to build and opera house. It was inaugurated with the opera *Bathmendi* by the newly hired artistic director Freiherr Carl August Ludwig von Lichtenstein.	1919
Dresden	1718	At the beginning of the 17th century, Dresden's *Kursächsische Staatskapelle*, which served as an opera house, became too small and was replaced by the first dedicated opera house, built by J.A. Haase. It opened its doors in 1718. In 1755, a second opera house opened its doors. It was called *Kleines Hoftheater* (little court theater) in order to distinguish it from the existing opera house.	1828
Frankfurt	1782	Frankfurt's theater and opera house was designed and built by town master builder Johann Andreas Liebhardt. The desire to posses a theater was probably stimulated by the establishment of Mannheim's theater and opera house in 1777. The theater was inaugurated with the play *Hanno, Fürst in Norden*. However, operas were also popular, especially the ones by Mozart.	1914
Hamburg	1678	The opera house in Hamburg built by Girolamo Sartorio was located at the *Gänsemarkt*. It was inaugurated with the musical comedy *Adam und Eva oder Der Erschaffene, Gefallene und Aufgerichtete Mensch* by Johann Theile.	1919
Koblenz	1787	Koblenz's opera house was built on behalf of Trier's archbishop Clemens Wenzeslaus of Saxony. It was built by the architect Peter Sachsen in the part of town called *Neustadt*. The opera house was inaugurated with Mozart's opera *Die Entführung aus dem Serail*.	1970

Leipzig	1693	Leipzig's first opera house, built in 1693, was located at the Brühl, partly on ground of the previous *Bernhardinerkolleg*s, a college. Since the opera house did not have its own orchestra, there has traditionally been a close cooperation with the *Gewandhausorchster,* the orchestra of the nearby *Gewandhaus* theater. The cooperation probably dates back to the year 1766 when the musical comedy *Der Teufel ist los oder Die verwandelten Weiber* by Johann Adam Hiller was performed.	1409
Luebeck	1752	Luebeck's theater and opera tradition dates back to the carpenter Hermann Hinrich Schröder who frequently invited actors to his house in *Königsstraße*. In 1751, Schröder was granted the official permission to perform plays in his house. The first opera performance in Luebeck dates back to the year 1746 when an Italian group of actors at the head of Pietro Mingotti presented the opera *Ipermestra.* To perform an opera in Schröder's house, they had to rebuild the house. With increasing success, Schröder had to look for a larger place and finally found the vacant *Lüneburger Hof* located in the *Beckergrube.* The theater was later renamed into *Ebbesches Theater.* From 1799 on, Luebeck's theater and opera house possessed a permanent ensemble.	1964
Mannheim	1777	Mannheim's opera house was established on behalf of elector Karl Theodor, who initiated to rebuild the arsenal into an opera house. Builder Lorenzo Quaglio did this job and enlarged and beautified the house. Karl Theodor hired Johann Stamitz as instrumental-music director and instructed him to reform and enlarge the court orchestra. Moreover, Karl Theodor also supported the further development of a formerly unknown instrumental style that became known as the *Mannheimer Schule.* Finally, Karl Theodor also supported the renewal of the prevailing understanding of the opera. In doing so, he argued in support of German-language operas as alternative to the Italian operas.	1907
Munich	1679	Elector Ferdinand Maria and his wife Gattin Henriette Adelaide founded Munich's first independent ensemble. Initially, it performed in their residence until the Venetian builder Francesco Santurini was hired to construct Munich's first opera house at *Salvatorplatz* in 1657. A second opera house was built in the period 1751-1753 by François de Cuvilliés, architect to the court.	1472
Muenster	1774	Elector Franz Freiherr von Fürstenberg established Münster's theater and opera tradition when he instructed mason Wilhelm Ferdinand Lipper to rebuild the slaughterhouse located at the *Roggenmarkt* into Münster's first theater and opera house, the so called *Komödienhaus*. Performances included musical comedies and operas.	1771

Neustrelitz	1769	The theater and opera house in Neustrelitz was built in French-style in the period 1755-1758. In 1769, it was rebuilt by builder Martin Seydel and from 1775 on, it existed as permanent court theater.	--
Passau	1783	The opera house was built on behalf of prince-bishop Leopold Wilhelm von Österreich in 1664 and initially served as dance hall for the popular Spanish balls. About 100 years later around 1773, prince-bishop Ernst Leopold Kardinal Graf von Firmian tuned the ball house into a court theater and opera house and finally, prince-bishop Joseph Kardinal Graf von Auersperg opened its doors to the public in 1783. The public opera house was inaugurated in 1783 with Anton Schweiter's opera *Alceste*.	1978
Potsdam	1795	The theater and opera house was initiated by king Friedrich Wilhelm II and is located along the cannel. Because of its location, it is also known as *Kanaloper,* the *"channel opera house"*	1991
Regensburg	1804	The theater and opera house in Regensburg is located at the *Bismarkplatz*. The construction plan stems from Emanuel Herigoyen and it was built at elector, archbishop and imperial chancellor Carl Theodor von Dalberg's suggestion. Previously, a theater was already located within the dance hall in the period from 1760 to 1804.	1962
Rostock	1786	Until 1786, travelling groups of artist performed in Rostock at different locations like the *Ballhaus* or the *Comödienhaus*. From then on, performances took place in the newly built theater and opera house.	1419
Stralsund	1765	In 1765, a building that already served as theater was rebuilt and turned into Stralsund's theater and opera house, located in *Mönchstrasse*. Previously, the building was an orphanage. The theater and opera house was inaugurated with a masquerade ball.	1991
Trier	1802	Even though a place for music and theater performances since the electoral times in the 17th century, Trier did not possess a permanent theater and opera house until the beginning of the 18th century. Then, in 1802, a contract between the French prefect and the proprietor Schaak, Jr laid the ground for the first permanent theater and opera house in the former Capuchin monastery.	1473
Ulm	1641	In 1641, town master mason Joseph Furttenbach rebuilt the former granary at the *Binderhof* close by the Dominicans' monastery into an early version of a theater. It already possessed common items like curtain and orchestra and it was equipped with the latest Italian technology, i.e. rotatable scenery. The theater attracted artists from all over Europe who performed together with the permanent actors.	1967

Weimar	1779	Duke Ernst August II. Konstantin von Sachsen-Weimar-Eisenach's wife, Anna Amalia always supported German musical comedy, French plays and operas. There were a variety of stages spread across the city where performances took place regularly. Then, in 1779 a theater was built and in 1791, Duke Carl August turned this theater into Weimar's court theater in 1791. Goethe became the director of the theater that was inaugurated with Iffland's play *Die Jäger*.	1860
Wuerzburg	1804	Julius Earl Soden is the founder of Würzburg's theater and opera house. The theater was located in the Adligen *Damenstift Heilige Anna* that was rebuilt into a theater and opera house. It was inaugurated with the play *Stille Wasser sind tief*.	1582

Notes: Columns 1-3 provide information about the location and the year of construction of the 29 historic theaters or opera houses. Column 4 provides additional information on whether the city possessed a university. We use this information in our robustness checks.
Sources: Forsyth, M. (1985), Kazig & Schweitzer (2008), Zöchling (1983) and own research.

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