City Competition for the Creative Class

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May 2013

Abstract

Considering data for individual earnings from Germany we show that the local subsidization of cultural activities exerts effects on the wage distribution in the sense that these subsidies tend to reduce the wage gap between those with higher and less education. These findings motivate a theoretical analysis which explains the effects of subsidies in terms of a cross-sectional capitalization into the earnings of the immobile factor. In the theoretical model, the local government is focusing on improving the economic conditions faced by immobile residents. In this context, subsidization of cultural activities is discussed as a form of local public goods provision which makes a city more attractive to highly educated individuals who capture the rents from the production process. The theoretical analysis shows that inter-jurisdictional competition for the highly educated introduces a distortion of public goods provision, in the sense that uncoordinated policies lead to an inefficiently large supply of the public good. Our results suggest that a high level of support for public theatres may result in the presence of institutional restrictions which prevent local governments from adjusting their tax structure. In competing for residents with high education, then jurisdictions rather resort to extending the supply of cultural activities through public subsidization.

JEL-Classifications: H20, H41, R13

Keywords: *Fiscal competition, creative class, cultural ameneties, theatre subsidies, Perspektive Deutschland*

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1 Introduction

It is widely accepted that highly productive people are an important factor for the economic growth of cities. In a well known book, Florida (2002) has coined the term "creative class", which includes artists, self employed professionals, scientists among others, most of which tend to be highly educated. In order to attract the creative class a city needs to offer good and, perhaps, specific amenities as well as tolerance. Florida's thesis goes hand in hand with the wide spread perception that *soft location factors*, including a lively cultural scene are key for the economic success of cities.

Even if cultural activities tend to attract the creative class, the policy implications are not obvious. At first sight, the attractiveness for the creative class may seem to provide an argument for publicly subsidizing local cultural activities. In practice, however, public subsidization of cultural activities might come at the expense of individual donations (*e.g.*, Seaman, 1979). Moreover, even if a local jurisdiction could effectively raise its attractiveness for the creative class by subsidizing cultural activities, it is not clear how effective this policy will be if there is competition for the creative class and if other jurisdictions followed the same approach.

Against this background, this paper makes two contributions, one theoretical and one empirical. First, the paper provides empirical evidence about the role of cultural activities in generating amenities which attract highly educated people. More specifically, we show that cultural subsidies capitalize in the wages of workers, albeit differently by level of income. Second, building on assumptions consistent with the empirical findings the paper presents a theoretical model which allows us to consider the allocative consequences of local competition through public goods provision (such as publicly funded theatres and operas) for the creative class. Mobility of highly creative people induces inefficient (over) provision of public goods provision at the expense of redistributive expenditures for immobile low skilled workers. Equipped with the theoretical insights we put forward the hypothesis that heavy use of subsidies to certain local public goods might result in the presence of institutional restrictions which prevent local governments from adjusting their tax structure. In the absence of locally discretion in income taxation, competing for residents with high education, jurisdictions rather resort to subsidizing cultural activities.

Our empirical testing ground is the local government level in Germany. While local governments are active in supporting cultural activities such as theatres, philharmonics, and museums in many

developed countries, including the US (*e.g.*, Thompson, Berger, Blomquist, Allen, 2002), the German case is of particular interest, because public spending on arts and culture in Germany is continuously ranked highest among developed countries. While international comparisons are rare, studies including the National Endowment for the Arts (2000) and Canada Council for the Arts (2005) use data from the Arts Council of England, which put together data on public spending for arts and culture in 11 developed countries. Accordingly, direct public spending in the 1990s ranges from USD 6 per capita (lowest) for the US to USD 85 for Germany (second highest) and USD 91 for Finland (highest). Moreover, in Germany, public support for culture comes to a large extent from local governments (Schulze and Rose, 1998, Traub and Missong, 2005). At the same time, cultural activities do matter for location decisions within Germany. Using data from a 2004 survey of about half a million individuals in Germany we find that "Leisure and cultural offerings and an interesting cultural scene" ranks fourth among 15 reasons of why the current location has been chosen by highly educated individuals.

Combining data on local theatre subsidies with individual earnings data, we test wether the empirical evidence is consistent with the view that public subsidies to theatres create significant amenities for the highly educated. Our empirical results show that earnings of highly educated tend to be lower in cities where larger subsidies are paid to local theatres. The effect is economically large: An increase in per capita spending on theatres and operas of 100 Euros reduces earnings by about 6%. The mean level of subsidies in counties with a publc theatre is almost 79 Euros (with large variance). This suggests that subsidization of theatres serves as an instrument to attract highly educated workers. A compensating earnings differential is not found, however, for those with less education. Quite differently, the empirical results show that for those with basic education only, wages tend to be higher by 4% if subsidies increase by 100 Euros per resident.

Since the descriptive evidence is consistent with the view that subsidies to cultural activities are effective in attracting highly educated people, in Germany at least, and that paying those subsidies might actually be in the interest of residents with low education, our theoretical analysis addresses the consequences of local competition for the creative class. The theoretical model rationalizes the subsidization of cultural activities as a provision of a local public good in a simple general equilibrium model which includes immobile workers and a highly productive mobile creative class. The provision of public consumption goods by the local government makes a city more attractive to

mobile individuals who - because of their talents - capture the rents from the production process. The model assumes that a city's policy is controlled by a majority of unskilled (= non creative) immobile residents. This majority spends tax revenues on group specific transfers to itself and on a public consumption good that benefits both immobile workers and creative people. Building on the German case, the income tax schedule is assumed to be exogenous from the view of local governments (set at the federal level in Germany), but tax revenues are endogenously determined due to mobility of individuals. The key mechanism is the following: Providing public consumption goods capitalizes in the wages of unskilled workers. An increase in public goods at the expense of group specific transfers attracts more creative people which raises the wage of workers when factors are complements. At the same time, the rents to creative people tend to fall, which is consistent with our empirical evidence.

Comparing the outcome in a situation of a closed city (no mobility of creative individuals) with that of an open city (costless mobility of creative people) we discuss the role of mobility. We prove under weak assumptions on technology and preferences that the supply of public consumption goods is higher in the open city compared to the closed city situation. This result is in contrast to the classical literature on fiscal competition (such as Zodrow and Mieszkowski, 1986, and Wilson, 1986) where mobility of capital leads to less provision of public consumption goods compared to the closed economy and, hence, underprovision relative to the first best. In our case, competing cities reduce group-specific transfers to immobile residents to finance public goods that are attractive to both types of workers. As the number of creative individuals is exogenously fixed, the simultaneous attempts by all local governments to attract creative individuals are ineffective and immobile workers are worse off compared to the closed city even though public good provision has increased.

Relative to the first best, both open and closed city settings do not provide optimal results. In the closed city economy, public goods tend to be underprovided because immobile workers ignore the utility obtained by creative individuals from public goods provision. By contrast, in the open economy, public goods tend to be overprovided as a city ignores the fiscal externality that arises when it attracts more creative workers and thus steals tax revenues from other regions. A further result is obtained when we compare the outcome across situations with a different set of fiscal instruments. Our base model assumes that the local government generates tax revenues from a head tax, where the tax rate is exogenous. This mirrors the German situation, where local jurisdictions

receive revenue sharing grants without the autonomy to tailor the tax burden of residents according to own considerations. Introducing a local income tax in our model changes the conclusion under mobility of creative individuals. Instead of overprovision of public goods, the supply of goods is efficient, and the tax on creative individuals is not used in equilibrium. We argue that this outcome is consistent with both little use of local income taxes and low public spending on cultural amenities in the US.

Our theoretical contribution relates to a number of other works. In one branch of the literature on fiscal competition the focus has been on capital mobility and fiscal spending. As mentioned above, classic papers like Zodrow and Mieszkowski (1986) or Wilson (1986) find that source taxation of capital leads to underprovision of public consumption goods. Keen and Marchand (1997) show that in a noncooperative equilibrium the composition of government expenditures is distorted towards public inputs (such as infrastructure) at the expense of too little public consumption goods. This is opposite to our findings. In a different branch of the literature, researchers have looked at the provision of public goods in the presence of mobile households. Mansoorian and Myers (1993) argue that the allocation of households is efficient even in the presence of mobility costs when regions make interregional transfers. We differ in a number of ways by arguing that mobility costs are correlated with education and assume that interregional transfers are not feasible. Borck (2005) considers the consequences of interregional mobility of high skilled labor on the composition of public spending if preferences for public services differ with the level of skills. While our analysis also allows for differences in preferences, we focus on the provision of a single public good in a more general setting where preferences are not necessarily different.

The plan of the paper is as follows. In section 2 we use survey data from Germany to document the role of culture for mobility decisions of those with high levels of education. We also provide empirical evidence on the scale of local government subsidies in Germany and their impact on individual earnings. The theoretical analysis follows in section 3, where we show results for public provision of local public goods with and without mobility of creative individuals. The case with exogenous and endogenous taxation by cities, and its application to Germany and the US, is discussed in section 4. Section 5 concludes.

2 Cultural Activities as Amenities for Highly Educated

A large literature on location choice and property prices has established the importance of various amenities for household location decisions. While the list of amenities discussed in this literature is typically rather large, ranging from climate and environmental attributes to educational services (see Blomquist *et al.*, 1988), cultural activities have not been the focus of much interest. However, a prominent hypothesis by Florida (2002) is that cultural activities are particularly relevant for attracting creative, and highly-educated population. A stylized fact of mobility and job search is that mobility differs across different groups of population, and a large literature indicates that mobility increases with the level of education (Dustmann and Glitz, 2011). But whether cultural activities also matter for location choice, and in particular for individuals with higher education, does not seem so obvious.

Table 1 provides some empirical evidence derived from German survey data. The "Perspektive Deutschland" (PD) survey taken among more than half a million German households[1] asked respondents that have moved into the current region during the last 10 years about their key motives for choosing the current location.

Consistent with Florida's (2002) hypotheses, this survey supports the view that cultural activities matter for location choice. 12.39 % of the about 150 thousand respondents, that relocated in the last ten years, answered that "leisure and cultural offerings and an interesting cultural scene" has been one of the key location characteristics that were of relevance to their decision. Taking account of the population weight of the respondents, the figure is lower (8.66 %). However, the survey data also enables us to test whether highly educated professionals are more, rather than less sensitive to "leisure and cultural offerings and an interesting cultural scene."Columns (3) and (4) of Table 1 report figures for the sub-sample of respondents with higher education (comprising senior high-school exams and/or a university degree) and which are working at full-time. Accordingly, cultural offerings was among the four most important reasons to come to the region.

The empirical evidence provided so far supports the view that cultural activities matter for location choice and, in particular, for the location choice of those with higher education. While this suggests

[1]The study was initiated in 2001 by McKinsey corporation and carried out over several waves. For an overview of the project see Fassbender and Kluge (2006).

Table 1: Survey Responses on Location Choice in %

Reasons, why current region was chosen	Group of respondents			
	all		working with high educ.	
	(1)	(2)	(3)	(4)
Labor market, professional reasons	44.67	38.02	61.47	57.29
Personal relationship (friends, family, ...)	35.77	41.18	32.26	34.86
Natural amenities, scenic landscape	17.69	24.93	16.48	18.04
Leisure and cultural offerings and interesting cultural scene	12.39	8.66	12.55	12.68
Social environment, local mentality	12.17	12.93	11.60	11.97
Availability of housing	11.59	14.82	10.60	10.29
Access, public transport	10.22	9.76	9.46	9.44
Attractivess of city, nice city environment, parks	8.93	9.24	8.07	8.39
Low cost of living	8.82	9.70	7.23	6.85
Schooling and education opportunities	14.61	6.38	6.23	5.86
Shopping opportunities, local services	6.53	7.16	5.43	5.47
Positive attitude to children and families	4.53	6.14	4.29	4.14
Low crime	5.25	8.06	3.41	3.69
Openness to migrants	3.25	3.68	2.55	2.58
Quality of life for seniors/elderly	1.85	3.78	0.93	1.19
Other reasons	20.86	22.84	14.92	16.28

Source: Fourth wave of PD survey. 150816 (out of 511256) respondents that relocated in the current region in the last 10 years were asked about the four main reasons for their choice of the current region, where region is defined by the city or county (identified by the leading letters on the license plate of local cars). Columns (1) and (2): 150816 respondents. Columns (3) and (4): 48508 respondents full time working with higher education (senior high-school exams and/or university degree). Columns (1) and (3) raw figures, columns (2) and (4) population weighted.

that jurisdictions with rich cultural offerings are more attractive for highly educated people, the role of local government subsidies in this context is not obvious, as cultural activities may form endogenously without public intervention. However, as noted in the introduction, cultural activities in Germany receive substantial public subsidies, supporting cultural activities such as theatres, philharmonics, and museums more than most other developed countries. Moreover, subsidization is mainly done at a local level. According to the Federal Statistical Office (Destatis, 2008), in Germany, state and local governments together spend about 84 Euro per capita for cultural activities in 2006, the federal government spends only 12 Euro per capita. In the more narrow budget category of "Music and Theatre" the official statistics report public spending in an amount of 42 Euro per capita in 2006. The lion's share (about 61%) comes from municipal governments.

An interesting feature of theatre subsidies is that the German public theatres have a long history which has been shown to still matter for today's location of the creative class (Falck, Fritsch, Heblich, 2011). Hence, theatres partly constitute *historic amenities* in the sense of Brueckner, Thisse, and Zenou (1999). Of course, current funds are still needed in order to provide cultural activities at those place, and, in Germany, the public sector is heavily involved. Some insights in the support for theatres is provided by Table 2. It reports summary statistics on public theatres among the German cities (=urban counties) and counties. Population size ranges from about 36 Thousand to 3.4 Million (Berlin). About a quarter of these jurisdictions (114) contains one or more public theatres, which often includes also an opera house or a ballet. The lower part of the table focuses on the 114 counties where at least one public theatre or opera house is located. Most of these are urban counties made up by a single city. In the other cases the theatre is usually located in the county capital. Own revenues basically captures ticket sales, subsidies refers to public support sometimes from state but mostly from local governments. Note that public support (almost 79 Euros) easily outweighs own revenues (about 12 Euros), pointing at a substantial rate of subsidization.

It is tempting to explore, whether the heavy involvement of municipal governments in subsidizing cultural activities exerts any noticeable effects on location decisions which are economically significant. A potentially powerful test is obtained by an empirical analysis of individual earnings. If cultural subsidies really matter for location choice, they should give rise to a compensating earnings differential for highly educated people. For less educated, rather immobile workers, however,

Table 2: Summary Statistics on Public Theatres in Germany

Variable	Mean	Std. Dev.	Min	Max
all urban and rural counties				
Population (in 1000)	188.1	219.0	35.5	3,388
Public theatre exists (binary)	.260	.439	0	1
counties with public theatres only				
Own revenues (in 1000 Euro)	3,373	6,789	68	54,763
Subsidies (in 1000 Euro)	18,465	24,383	377	162,689
Own revenues (Euro per capita)	11.93	8.26	0.28	42.56
Subsidies (Euro per capita)	78.69	58.06	2.11	294.8

Descriptive statistics for 438 (114) urban and rural counties in 2004.

wages should not be lowered. To test for the effect of theatre subsidies on individual earnings, we combine the data on public spending for theatres in German cities with data on individual earnings from a 1% random sample of the social security accounts (IABS). The dataset contains information on individual earnings for all German counties including all urban counties and, hence, enables us to exploit the cross-sectional variation of subsidies. In addition to earnings, the data includes information about individual characteristics such as education, age and gender. This is important since we need to separate the highly educated individuals from workers with just basic education.

A problem with the data is that earnings data are censored from above at the social security threshold. If the earnings are above this uniform threshold the actual level of earnings is not reported. This is a potentially serious problem since in particular highly educated individuals might well have earnings above the threshold. To obtain unbiased estimates, we take resort to censored quantile regression techniques (e.g., Chamberlain, 1994). More specifically, we group our data into cells of individuals with same level of education, the same gender, and which are working in the same county or city. For each of the cells we determine empirical cell quantiles and then regress all uncensored cell quantiles on cell characteristics which include inter-alia also the subsidies paid to local theatres.

Using the information on education and qualification in the IABS data we form three groups:

1. High-level education such as technical college or university degrees (*Hochschul- oder Fachhochschulabschluss*) (41302 observations)

2. Medium-level education including high school degrees with or without professional education (*Abitur mit und ohne Berufsausbildung*) (22799 observations)

3. Basic-level education (*Volks-, Haupt-,Realschule mit Berufsausbildung*) which is the largest group (244936 observations).

The first group consists of people with high-level schooling which also have obtained university or technical colleges degrees. This group is referred to as highly educated in the analysis below. The second group refers to medium level schooling with or without vocational training. The third group is the main group in the data, comprising workers and employees with only basic education but vocational training, which reflects the importance of the "dual system" of vocational education and training in Germany. This group constitutes the basic education level in the analysis below.[2]

Table 3 provides descriptive statistics. The upper part provides statistics on individual characteristics by education group. Note that the number of uncensored observations is relatively large for individuals with basic-level education but relatively small for those with high-level education. The bottom part refers to regional characteristics. We include public subsidies – both in terms of total grants and regarding grants received only from upper level governments – as well as basic variables such as population size and density. In addition, we provide information about the local rate of unemployment and of the land-price for newly developed land.[3]

Columns (1) to (3) in Table 4 provide results for the earnings of those with high-level education. This includes individuals with a degree from a university or from a technical college. The explanatory variables include age, and age squared and dummies for individuals with a university degree, for gender, and for employment in east Germany, where productivity still lacks behind. To control for endogenous amenities associated with the market size of jurisdictions and the degree of urbanization, the local characteristics include population density. Note that the population density points at a significant urban wage premium (Glaeser and Mare, 2001), which has also been

[2]We exclude workers without vocational training from the group with basic level of education as this is a rather heterogenous group of individuals including a large number of foreign born people where the above education classification is not applicable.

[3]In the case of city states Hamburg and Berlin state-level subsidies are treated as local subsidies.

Table 3: Descriptive Statistics

Variable	High-Level		Medium-Level		Basic-Level	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Gross compensation < threshold	116.3	33.95	93.30	36.03	81.06	31.68
Observations/uncensored only	41302/27412		22799/20118		244936/235854	
Age	41.13	9.04	36.2	9.58	40.4	10.7
Univ.degree	.627	.484				
Vocational training			.830	.376	1	0
Female	0.29	0.456	.465	.499	.363	.481
East	0.161	0.367	.108	.310	.192	.394

Statistics on individual characteristics by education group

Variable	Mean	Std. Dev.	Min	Max
Subsidy per capita (€ 1000)	0.015	0.037	0	0.242
State and federal grants, only	0.006	0.018	0	0.118
Publicly funded theatre exists (binary)	0.211	0.408	0	1
Land price per sq.meter	96.6	93.5	0	707.6
Unemployment rate	11.62	5.52	4.4	27.7
Population	220082	237448	51564	3387545
Density	517.9	704.1	40.0	4010

Descriptive statistics for 343 counties. Missing values for land prices.

confirmed for Germany (Lehmer and Moeller, 2010). In the basic specification (1) per-capita subsidy for theatres exert a significant effect on the wage elevel. The point estimate indicatesthat an increase in subsidies by EUR 10 per resident is associated with a decline in earnings by about 6%.

In order to test for possible endogeneity effects which arise when local government subsidies respond to the local labor market conditions, column (2) reports instrumental variables estimates. Our identification strategy here relies on the volume of grants received only from state and federal governments. While local government support to the performing arts might well be correlated with the characteristics of the individual labor market, state-level or federal programs are usually less sensitive to local conditions. As state level support can only be received if a publicly funded theatre exists, we add a binary variable to the set of instruments which reflects the presence of a publicly sponsored theatre. To include this binary indicator is supported by the historic nature of these amenities (see above). The overidentification test indicates that the instruments statisfy orthogonality assumptions and the instruments also turn out to have high explanatory power (see appendix for the first-stage regression results). The empirical effect of public subsidies turn out to be slightly stronger, and the other results prove robust.

In columns (3) we report results obtained while controlling for the local unemployment rate and for land prices. Including those variables enables us to make sure that the empirical relationship between subsidies and wages is not driven by omitted local characteristics. More specifically, the inclusion of the local unemployment rate allows us to check whether the empirical effect of subsidies stems from some correlation with regional productivity differences. Depressed regions, for instance, might display lower subsidies. Controlling for the price for land available for construction allows us to check whether the empirical effect is driven by some correlation between wages and land-prices. In all specifications, however, the per-capita subsidy for theatres exerts rather similar effects. The point estimate indicates a marginal effect such that an increase in subsidies by EUR 10 per resident, is associated with a decline in earnings by about 6%.

Columns (4) to (6) provide results for the earnings of those with medium-level education, obtained in high-school. To control for the differences within this group, we include an indicator for additional professional education. The specifications do not indicate any significant effect of theatre subsidies even if instrumental variables are used to identify the empirical effect of public subsidies. Columns (7) to (9) provide results for the earnings of those with basic education without high-school, college,

Table 4: Wage Effects of Theatre Subsidies

	High-level education			Medium-level education			Basic education		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Age	0.086 **	0.086 **	0.080 **	0.098 **	0.098 **	0.095 **	0.114	0.113	0.006
	(0.027)	(0.027)	(0.028)	(0.018)	(0.018)	(0.018)	(0.073)	(0.074)	(0.068)
Age^2	-0.001 **	-0.001 **	-0.001 **	-0.001 **	-0.001 **	-0.001 **	-0.001	-0.001	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Univ.Degree	0.118 **	0.119 **	0.122 **						
	(0.016)	(0.016)	(0.016)						
Voc.Training				0.161 **	0.161 **	0.164 **			
				(0.024)	(0.024)	(0.025)			
Gender	-0.294 **	-0.294 **	-0.289 **	-0.220 **	-0.220 **	-0.224 **	-0.193 **	-0.194 **	-0.185 **
	(0.021)	(0.021)	(0.022)	(0.021)	(0.021)	(0.022)	(0.008)	(0.008)	(0.008)
East	-0.229 **	-0.228 **	-0.153 **	-0.276 **	-0.274 **	-0.150 **	-0.369 **	-0.367 **	-0.266 **
	(0.030)	(0.030)	(0.033)	(0.030)	(0.030)	(0.022)	(0.008)	(0.012)	(0.008)
log Density	0.044 **	0.046 **	0.022	0.041 **	0.042	0.026	0.041 **	0.043 **	0.016 **
	(0.013)	(0.014)	(0.016)	(0.013)	(0.013)	(0.022)	(0.005)	(0.006)	(0.008)
Subsidy	-0.602 **	-0.680 **	-0.568 *	-0.039	-0.106	-0.170	0.390 **	0.328 **	0.444 **
	(0.281)	(0.305)	(0.297)	(0.302)	(0.347)	(0.375)	(0.123)	(0.146)	(0.137)
Unemployment			-0.003			-0.006			-0.006 **
			(0.003)			(0.005)			(0.002)
log Land price			0.046 **			0.056 **			0.054 **
			(0.016)			(0.024)			(0.008)
Constant	3.121 **	3.112 **	3.171 **	2.368 **	2.360 **	2.328 **	1.750	1.769	3.698 **
	(0.546)	(0.544)	(0.560)	(0.323)	(0.322)	(0.331)	(1.452)	(1.448)	(1.326)
Uncensored	1222	1222	1150	1261	1261	1179	686	686	644
No. of Cells	1357	1357	1274	1266	1266	1266	686	686	644
R-squared	0.3432			0.3763			0.8509		
Overid.Test		1.04(.31)	.231(.63)		0.00(0.99)	0.54(0.46)		.751(0.39)	2.2(0.14)
Weak Id.Test		5023	4945		4925	4810		2652	2603

Dependent variable: log wage rat Robust standard errors allowing for county-level cluster effects in parentheses. An asterisk indicates significance at 10% level, two asterisks at 5% level. (3), (6) and (9) instrumental variable estimates using grants from upper level governments as instruments. Overidentification test refers to the Hansen-J statistic, p-value in parentheses, the test for weak instruments reports the Cragg-Donald F statistic.

or university degrees. The specifications all point at a significant positive effect of theatre subsidies. Here, the point estimate indicates that wages tend to be higher by 3 to 4% if subsidies are increased by EUR 10 per resident.

Our empirical results, thus, are consistent with the view that providing public subsidies generates amenities which attract highly educated individuals. At the same time, interestingly, we find that subsidization of theatres actually exerts positive effects on the wage rate at a basic level of education. Since workers with less education tend to be immobile, this is in accordance with the view that those subsidies exert beneficial effects on less-educated individuals possibly due to some complementarity between highly-educated and less educated workers. The complementarity of high and low skilled workers is also found by Eeckhout, Pinheiro and Schmidheiny (2013), who argue that this type of extreme skill complementarity is consistent with the observation that in the US large cities attract overproportionately many low and high skilled workers. However, note that we control for differences in population density and hence focus on the complementary at given level of urbanization. Taken together, the differential empirical effects of subsidies on cultural activities point at some effect on the wage distribution, in the sense that these subsidies tend to reduce the wage gap between those with higher and less education. This finding complements Diamond (2012), who considers the consequence of productivity shocks on the college - high school graduate wage gap and finds that endogenous amenities tend to raise differences in the well-being between those groups.[4] Our results suggest that public subsidization of amenities may work in the opposite direction and reduce differences in the well-being between those groups. Regarding the quantitative magnitude of the effects we should stress we have just picked one observable type of subsidization which might well be correlated with the subsidization of other cultural activities, such as concerts or museums.

We now turn to our theoretical analysis. Consistent with our empirical findings we allow local governments provision of public goods (=subsidies) to be effective, but assume that many governments compete for the same set of creative individuals. The analysis in section 3 focuses on the role of mobility of highly creative individuals, while section 4 considers the consequences of local tax autonomy given a high degree of mobility.

[4]Diamond (2012) models amenities by means of local monopolistic competition where consumers have love-of-variety preferences.

3 Cities Competing Through Public Good Provision - A Theoretical Analysis

An economy consists of N identical cities indexed by $i = 1, ..., N$, and each one of them is inhabited by L immobile workers and $\overline{M}$ potentially mobile creative individuals. A private consumption good is produced with labor and mobile creative workers M. The production function $F(L, M)$ is identical across regions and features constant returns to scale. We assume positive but diminishing marginal products for each factor ($F_L, F_M > 0 > F_{LL}, F_{MM}$), and assume that factors of production are complements ($F_{LM} > 0$). The private consumption good is the numeraire, whose price is set equal to 1, and can be used for production of a pure, local public good g at a marginal rate of transformation of one. All workers and creative individuals inelastically supply one unit of labor and creative individual services respectively. All markets are perfectly competitive. The wage of a worker in region i equals the marginal product of labor

$$w_i = F_L(L, M_i), \tag{1}$$

and a creative person obtains the remaining output after paying workers, called b, where

$$b_i = \frac{F(L, M_i) - F_L(L, M_i)L}{M_i} = F_M(L, M_i), \tag{2}$$

where the latter equality follows from the constant returns to scale assumption. Later we will briefly discuss the case of non constant returns to scale.

Workers derive utility from the private consumption good and the local public good that is supplied in the jurisdiction where they work and live. We use a jurisdiction index only where necessary to avoid confusion. The utility function $u^l(c^l, g)$ has standard properties and superscript l refers to the worker. Private consumption of a worker is financed out of labor income net of taxes and government transfers, where the latter is discussed in more detail below.

Creative people have possibly but not necessarily different preferences over the same two goods $u^m(c^m, g)$ and their income differs. As explained in (2), the gross income of a creative individual is the remainder of output after paying workers. In an open economy setup creative people are mobile at no cost between all regions. In equilibrium their utility must be equalized across all regions i

$$u^m(c_i^m, g_i) = u^*, \tag{3}$$

where u^* is the creative individual's utility level in the rest of the economy. Each region takes u^* as given, but the value is determined in equilibrium.

Government

The government of region i can use tax revenues for spending on a local public good g_i and a transfer to immobile workers G_i^l. Revenues are generated from an exogenous head tax T, which is assumed to be the same across all regions. A progressive tax schedule would not change our results qualitatively as long as the tax schedule is same across cities. Our set of assumptions captures an important element of the German situation: The income tax schedule is set at the federal level, and revenues are distributed basically by residence of individuals. We explore the role of endogenous taxation in section 4.

While the tax rate is fixed exogenously, tax revenues in each region are endogenous when creative people are mobile between jurisdictions, as revenues depend on the number of creative people. This set up allows us to focus on the distributional consequences from competition through the expenditure side. The government budget constraint of region i maintains that the sum of head tax revenues equals expenditures on transfers to workers and public good provision

$$(L + M_i)T = g_i + LG_i^l. \tag{4}$$

While the tax T is uniform, the transfer G_i^l is group and region specific. In essence, the combination of tax and transfer instruments allows the regional policymaker to implement a progressive tax-transfer system.

We are now in a position to specify individual consumption. The budget constraint of a representative worker in region i reads

$$c_i^l = w_i - T + G_i^l, \tag{5}$$

and that for a creative individual is

$$c_i^m = b_i - T. \tag{6}$$

Economic Equilibrium

Consider the economic equilibrium in a *closed city economy*. The mobility constraint (3) is not relevant and by assumption $M_i = \overline{M}$ for all i. Since workers are immobile and supply one unit of

labor inelastically, total regional supply of labor of each type is also given. Hence the wage rate and the compensation of a creative individual are determined by (1) and (2). For any level of g_i the transfer G_i^l follows from the government budget constraint (4), and vice versa.

An economic equilibrium in the *open city economy* is a fiscal policy vector for each city $q_i = \{g_i, G_i^l\}_{i=1,...,N}$, a consumption level for each worker and creative individual in each city, $\{c_i^l\}_{i=1,...,N}$ and $\{c_i^m\}_{i=1,...,N}$, and a distribution of creative people across cities such that i) no creative individual can improve his or her utility by moving elsewhere, taking the fiscal policy vector of all other cities as given, ii) each individual (worker and creative individual) is able to finance consumption out of net income taking fiscal policies everywhere as given, iii) the government budget (4) in each city is balanced given the distribution of creative people, and iv) the market for creative people is in equilibrium, that is,

$$\sum_{i=1}^{N} M_i = N\overline{M}. \tag{7}$$

First Best

Before analyzing the policy game in the closed and open city economy let us first consider the first-best outcome subject to a mobility constraint. This can be found by maximizing the utility of a creative individual residing in region 1, $u^m(c_1^m, g_1)$, subject to the following constraints

$$u^l(c_i^l, g_i) = \overline{u}_i^l \text{ for all } i = 1, ..., N$$

$$u^m(c_1^m, g_1) = u^m(c_j^m, g_j) \text{ for all } j \neq 1$$

$$\sum_{i=1}^{N} F(L, M_i) = \sum_{i=1}^{N} (g_i + Lc_i^l + M_i c_i^m) \tag{8c}$$

and market clearing for creative people (7). A social planner solves this problem by choosing a private consumption value for each individual in society $\{c_i^l, c_i^m\}_{i=1,...,N}$, a distribution of creative people across cities $\{M_i\}_{i=1,...,N}$, and a public good level for each city $\{g_i\}_{i=1,...,N}$. The first constraint (8a) fixes a given utility level for each worker in every city, $\overline{u}_i^l$, the second condition (8b) reflects the mobility constraint of creative people and requires equal utilities everywhere, and the last condition (8c) is an aggregate feasibility constraint.

To characterize the solution it is useful to define the marginal rate of substitution for a worker and

a creative person:

$$MRS^l(c_j^l, g_j) = \frac{u_g^l(c_j^l, g_j)}{u_c^l(c_j^l, g_j)} \quad \text{and} \quad MRS^m(c_j^m, g_j) = \frac{u_g^m(c_j^m, g_j)}{u_c^m(c_j^m, g_j)}.$$

Taking first order conditions and combining them yields the following two central conditions for all $j = 1, ..., N$

$$L \cdot MRS^l(c_j^l, g_j) + M_j \cdot MRS^m(c_j^m, g_j) = 1$$

$$F_M(L, M_i) - c_i^m = F_M(L, M_j) - c_j^m. \tag{9b}$$

Condition (9a) is a Samuelson rule: the sum of the marginal rates of substitution of all individuals in a region equals the marginal rate of transformation. The rule plays an important role and thus it is useful to elaborate. Assuming that the first best allocation features perfect city symmetry ($\overline{u}_i^l = \overline{u}^l$ for all i, and thus $M_i = \overline{M}, c_i^m = c^m$) the public good level in a given city j is pinned down uniquely for a given worker utility level $\overline{u}^l$ under weak assumptions. To see this, we solve (8a) for private consumption of a worker as function of a given worker utility and public good level $c^l(\overline{u}^l, g)$. This expression is substituted into (9a) and aggregate feasiblity (8c). Next, we solve (8c) for c^m as function of $(\overline{u}^l, g)$, which is then also substituted into (9a). The Samuelson rule is now only a function of the common public good level g, worker utility $\overline{u}^l$ and other parameters. It is straightforward to show that the level of the public good is then uniquely determined if the utility function is strictly concave in each of the two goods ($u_{cc}, u_{gg} < 0$) and the two goods are (weak) complements ($u_{cg} \geq 0$). One special case is noteworthy: The public good level is uniquely determined and independent of $\overline{u}^l$ (as long as constraints (8a) and (8b) are satisfied) when preferences are quasilinear (and linear in private consumption c), as then the marginal rate of substitution is independent of the level of private consumption.

Condition (9b) states that in a first best the net difference between the marginal product of a creative individual and his or her consumption net of taxes should be equalized across cities. Becauses taxes are exogenously given and the same across cities, condition (9b) is equivalent to stating that the difference between the marginal product of a creative individual and his or her wage should be the same across cities. This condition will hold in a market equilibrium under constant returns to scale, as individuals are paid their marginal product.

Equilibrium Provision of Public Goods

In the following we assume that each city government maximizes the utility of a representative worker of its city, taking the fiscal policy in all other cities as given. This assumption makes the model a positive one and can be justified on political economy grounds when immobile residents have the political majority. In addition, maximizing a convex combination of the utility of a resident worker and creative individuals gives the same result since each city takes u^* as given. We compare the closed and open city economy allocation. Recall that the tax rate $T > 0$ is exogenously given and the same in all cities (perhaps as the result of federal legislation that specifies the tax and leaves the proceeds to the local level).

In the *closed city economy* creative people are not mobile by assumption. The representative government's optimization problem is to maximize

$$u^l(w - T + G^l, g) = \ u^l\left(w + \frac{(TM - g)}{L}, g\right)$$

by choice of g, where we made use of the government budget (4). This leads to the optimality rule

$$L \cdot MRS^l(c^l, g) = 1. \tag{10}$$

In words, the sum of the regional workers' marginal rate of substitution between the public and the private good equals the marginal rate of transformation. In contrast to the first-best rule (9a) the public good tends to be underprovided. While the first best rule requires the sum of workers' and creative people' MRS to be equal 1, the comparison is not trivial as private consumption and public good levels may differ across (9a) and (10). In one situation, however, we are sure to have underprovision in the closed economy, namely when preferences of all individuals are quasi-linear of the form $u(c, g) = c + h(g)$, where $h'(g) > 0 > h''(g)$. In this case $MRS = h'(g)$ and thus (9a) becomes $L \cdot MRS^l(g) + \overline{M} \cdot MRS^m(g) = 1$, while (10) reads $L \cdot MRS^l(g) = 1$

Optimality rule (10) is a Samuelson rule as well, but differs from the first best rule because the utility of a creative individual does not enter directly. Each government is concerned only with its immobile workers. Creative people contribute to the financing of the government budget though, and the optimality rule reflects this indirect effect in the definition of the private consumption level $c^l = w + (TM - g)/L$. The latter expression plus condition (10) show how the government trades off the benefit of public good provision that directly benefits workers (*and* creative people), and private consumption possibilities of workers, as provision of g reduces the transfer G^l.

In the *open city economy* creative people are mobile and thus the number of creative people and factor prices are endogenous. The government of city i maximizes $u^l\left(w_i + \frac{(TM_i - g_i)}{L}, g_i\right)$ through choice of g, but now recognizes that the wage and the number of creative people are directly or indirectly a function of the region's public good supply. Solving the government's optimization problem leads to the following condition

$$L \cdot MRS^l(c_i^l, g_i) = 1 - L \cdot \frac{dw_i}{dM_i}\frac{dM_i}{dg_i} - T \cdot \frac{dM_i}{dg_i}. \tag{11}$$

We now anticipate a symmetric equilibrium and therefore drop the subscript i. Whether public good provision in the open economy compared to the closed economy is higher or not depends on i) the capitalization effect of public good provision on local wages dw/dg, ii) the tax revenue effect of creative individual mobility $T \cdot dM/dg$, and iii) on the level of private consumption c^l in both situations. Regarding the latter, note that the private consumption level of a worker in the closed and open city economy, $c^l = w + (TM - g)/L$, differ *only* in g because the symmetry of the open city economy equilibrium implies that $M_i = \overline{M}$ for all i. Thus, the wage rate w (and the level of compensation for creative persons b) in the open and closed economy are the same as well!

Turning to the incidence of public good supply on wages, the effect can be derived by differentiating (1),(2), and (3). We obtain

$$\frac{dw}{dg} = F_{LM}\frac{dM}{dg} > 0, \qquad \frac{dM}{dg} = -\frac{MRS^m}{A} > 0, \tag{12}$$

where $A := -LF_{LM}/M < 0$ under the assumption of complementarity of factors of production. Using (12) the Samuelson rule (11) can be rewritten to read in a symmetric equilibrium

$$L \cdot MRS^l(c^l, g) + \overline{M} \cdot MRS^m(c^m, g) = 1 + \frac{T \cdot MRS^m(c^m, g)}{A} < 1. \tag{13}$$

There now exists a tendency for overprovision of the public good relative to the first best due to a negative fiscal externality when the tax rate T is positive (which we assume). Attracting creative people from other cities lowers their tax revenues which is ignored by the city that benefits from the inflow of creative individuals. We summarize our finding as follows:

Proposition 1. Let the tax rate $T > 0$ be exogenously given and the same in all cities. Consider a symmetric Nash equilibrium in the open city economy.

a) The open city economy leads to more provision of the public consumption good g than the closed city

b) Workers in the open economy are worse off compared to the closed city even though the supply of the public consumption good increases. Creative people are better off.

c) The equilibrium in the closed city and the open economy are inefficient. When preferences are quasilinear the closed city is characterized by underprovision of public consumption goods compared to the first best, while the open city economy leads to excessive public consumption good supply.

Proof: See appendix.

The first main point of our result is that the supply of the public consumption good increases when creative individuals become mobile. The intuitive reason is straightforward: Workers do not care about the utility of a creative individual *per se*, but since creative people value public consumption goods, increasing public good supply at the expense of group specific transfers allows a city to pay lower compensation b while attracting more creative people M. This is the capitalization effect of public goods into factor prices, which we documented for the case of public subsidies to theatres in our empirical analysis for Germany. As a result, the wage rate for unskilled workers rises since the marginal product depends positively on the other factor, which in turn implies that the sum of the workers' marginal rate of substitutions is less than 1. In addition, creative people contribute to the funding of the public good. In equilibrium, however, each city obtains the same number of creative people as in the closed city and thus the attempt to attract more creative people is unsuccessful. This explains why the public good is overprovided relative to the closed city. Our result is in contrast to the literature on capital tax competition such as Zodrow and Mieszkowski (1986) and Wilson (1986), where competition leads to underprovision of public consumption goods. Labor and capital mobility are different.

The second main contribution is found in part b). The overprovision is welfare worsening from the perspective of the workers and thus mobility of creative workers entails equilibrium redistribution away from immobile residents to creative people. Finally, statement c) shows that typically neither the open economy nor the closed city reach the first best. In the closed city the positive effect on the utility of creative individuals is ignored by immobile workers, while in the open city economy

the detrimental fiscal effects on other cities is not properly taken into account. Under quasi-linear preferences the two regimes lead to under- and overprovision, respectively.

We like to end this section by noting that our main conclusion is robust to different assumptions regarding the production technology. In the base model with constant returns to scale creative workers receive the marginal product as wage (see (2)). Under increasing or decreasing returns to scale the public provision rule in the closed economy is still governed by condition (10). The wage of immobile workers is competitively set regardless of the technology, and is predetermined by the given number of creative individuals. By contrast, in the open economy the outcome changes. Workers now must take into account how changes in public goods provision affect the incomes of creative workers, which depends on technology. Condition (13) becomes

$$L \cdot MRS^l(c^l, g) = 1 + \left(\frac{LF_{LM} + T}{A}\right) \cdot MRS^m(c^m, g), \tag{14}$$

where $A = (F_M - b - LF_{LM})/M$. Condition (14) simplifies to (13) when $F_M = b$ (constant returns to scale). Proposition 1 continues to hold as long as $A < 0$, as then the right hand side of (14) is less than one. For $A < 0$ it is sufficient, but not necessary, that $b \geq F_M$, which means that our main result is reasonably robust to assuming decreasing or moderately increasing returns to scale.

4 Why do German Cities Provide so much Public Support on Culture?

In the previous section we explored the role of mobility of creative individuals for public goods provision. We now turn to a comparison of public good spending in different institutional settings for a given *high* level of mobility. We do so in order to understand better the differences in cross-country spending on cultural amenities. As noted in the introduction, German cities spend relatively large amounts per capita on theatres and operas. US cities, by contrast, spend fairly little. To some extent these differences can be explained by the different mix in public and private financing. US cultural institutions depend much more heavily on donations from (rich) individuals, and thereby enjoy the advantage of tax deductibility (*e.g.*, Brooks, 2004) and, thus, little public spending does not necessarily imply little spending on culture overall.

The different public private spending mix, however, is not the only difference in a cross country

comparison. An important institutional feature of fiscal policy at the local level in Germany is that cities have no own taxing power for personal income. Instead, localities finance themselves mainly by a source based local business tax (Gewerbesteuer), a land tax (Grundsteuer), local fees and various grants, including revenue sharing grants associated with the federal income tax (*e.g.*, Buettner, 2001). The income tax schedule, however, is defined uniformly at the federal level, and states and localities participate on a formula basis mainly driven by residency of citizens. While also the statutory tax rate for the local land tax is set by the individual jurisdictions, the adherence to the assessed values of 1964, or 1935 in some parts of the country, makes it difficult for local governments to rely on this revenues source. Thus, local taxation is mainly associated with the business tax and competition for highly skilled individuals must materialize through other means. The expenditure side of the local budget is a likely candidate.

This institutional setup differs from those countries which have significant taxing power at the local level. For example, in the US, localities are engaged in a substantial taxation of residential property. In addition, they are often allowed to make use of a local personal income tax. While the definition of taxable income is set at the state (and federal level), local jurisdictions can determine the local tax rate. Henchman and Sapia (taxfoundations.org 2011) report that local income taxes are levied in about 17 states in the US, covering about 23 million individuals, which is less than a tenth of the entire population. Moreover tax rates have been declining recently and are now on average about 1.55 %. The relatively high mobility of households in the US may be considered a driving force behind these low and declining rates as discussed below.

We now want to explore the role of local taxation of residents in our theoretical framework. More specifically, we compare two countries which both are characterized by full mobility of creative individuals between cities, but which differ in taxing power at the local level. Local taxing power can be either modelled by type-specific transfer payments G^l and G^m for a given income tax rate T, or equivalently via type-specific income tax rates t^l and t^m. We follow the latter and assume that a government controls these type-specific tax rates, of which one could become negative, in addition to the public good level. The government budget constraint can be written as

$$Lt_i^l + M_i t_i^m = g_i, \tag{15}$$

where t_i^l and t_i^m are (net) taxes in region i. The consumption of a worker is then $c_i^l = w_i - t_i^l$, and

$c_i^m = b_i - t_i^m$ for a creative worker.[5]

In the *open economy* with mobile (creative) individuals we can rely on the production efficiency theorem of Diamond and Mirrlees (1971) to argue that the effective tax on creative workers t^m must be zero in a city's optimum (under the assumption of constant returns to scale in production and utility taking behaviour of cities, that is u^* in (3) is given from the viewpoint of a single city). Any deviation would distort production choices and is less efficient than raising revenues directly from the tax on immobile workers t^l (a tax on creative individuals affects wages negatively via the induced outflow of creative workers). With $t^m = 0$, the positive tax revenue effect of attracting creative individuals, which was identified in (11), vanishes.

The optimization problem from the viewpoint of an immobile worker in region i then reduces to maximize $u^l(w_i - t_i^l, g_i) = u^l(F_L(L, M_i) - g_i/L, g_i)$, where the latter expression was derived by making use of the government budget constraint and competitive labor market conditions. The first order condition for g_i can be written as $L \cdot MRS^l = 1 - LF_{LM}\frac{dM}{dg}$, assuming a symmetric equilibrium. The positive tax revenue effect from attracting creative individuals, which we found in (11) disappears, and thus the public goods provision rule is now first best in a symmetric Nash equilibrium:

$$L \cdot MRS^l(c^l, g) + \overline{M} \cdot MRS^m(c^m, g) = 1. \tag{17}$$

In our simple model governments have access to a lump sum tax and therefore we conclude that the public good provision in the open economy is always efficient.

The central insight from this section now follows easily by comparison with the case where governments have no discretion in adjusting the income tax, as stated in Prop. 1. With no local taxing power public goods tend to be overprovided (which happens for sure with quasilinear preferences), while public good provision is efficient when such taxing power exists. This result is consistent with the observation from the US, where the personal income tax at the local level is either absent or at low levels. Our model thus provides a simple explanation for the differences in cultural spending across countries like the US and Germany.

[5]To see the equivalence to a situation where the government controls the public good level g and type-specific transfers G^l and G^m, in addition to the poll tax set at the national level T, consider the government budget constraint which reads then $(L + M_i)T = LG_i^l + M_iG_i^m + g_i$. This can be transformed to (15) by factoring out L amd M_i, and redifining net contributions to government finances.

5 Conclusion

The empirical evidence provided in this paper supports the view that cultural activities matter for location decisions, in particular for the location of the highly-educated people. Considering data for individual earnings the empirical evidence also suggests that the local subsidization of cultural activities in Germany is effective in attracting highly educated people. Moreover, the results indicate that the German theatre subsidies exert effects on the wage distribution in the sense that these subsidies tend to reduce the wage gap between those with higher and less education.

These findings motivate a theoretical analysis which explains the effects of subsidies in terms of a cross-sectional capitalization into the earnings of the immobile factor. In the theoretical model, the local government is focusing on improving the economic conditions faced by immobile residents. In this context, subsidization of cultural activities is discussed as a form of local public goods provision which makes a city more attractive to individuals who - because of their talents - capture the rents from the production process. Typically (but depending on the technology) an increase in public goods at the expense of group specific transfers attracts more creative people which raises the wage of workers when factors are complements. At the same time, the rents to creative people tend to fall.

The theoretical analysis shows that the effectiveness of public provision of amenities needs to be qualified in a competitive setting, where the simultaneous provision of amenities by competing local jurisdictions tends to offset each others' location advantages. Under certain conditions, notably with restrictions in the set of available tax instruments, the competition for the creative class introduces a distortion of public goods provision, in the sense that uncoordinated policies lead to an inefficiently large supply of the public good.

Besides normative implications, we should note on positive grounds, that our results point at a link between decentralization and mobility and the subsidization the performing arts. Our theoretical analysis has shown, however, that this result holds in particular, when the local government has no access to a sufficient set of group-specific revenue instruments. It is tempting to relate this finding with the fact that in Germany, where individual income taxes are centralized, local jurisdictions are much more active in subsidizing the performing arts than in other decentralized countries such as the US. A possible explanation which emerges from our analysis is that since local governments

are prevented from adjusting their tax structure in order to attract those with higher education, they resort to extending the supply of cultural activities through public subsidization.

6 Appendix: First-Stage-Regression Results

	High-level		Medium-level		Basic	
	(2)	(3)	(5)	(6)	(8)	(9)
Age	0.000	0.000	-0.000	-0.000	-0.007	-0.010
	(0.004)	(0.001)	(0.000)	(0.000)	(0.007)	(0.008)
Age^2	-0.000	-0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Univ.Degree	0.000	0.000				
	(0.000)	(0.000)				
Voc.Training			-0.000	-0.000		
			(0.000)	(0.000)		
Gender	-0.000 *	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
East	0.002	0.003	0.002	0.003	0.002	0.003
	(0.002)	(0.004)	(0.002)	(0.005)	(0.002)	(0.004)
log Density	0.000	0.000	0.000	-0.000	0.000	-0.000
	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Unemployment		-0.000		-0.000		-0.000
		(0.000)		(0.000)		(0.000)
log Land price		0.001		0.001		0.001
		(0.001)		(0.001)		(0.001)
State&Fed.Subsidy	1.137 **	1.080 **	1.123 **	1.063 **	1.129 **	1.071 **
	(0.133)	(0.152)	(0.133)	(0.150)	(0.133)	(0.149)
Public theatre exists	0.051	0.054	0.051 **	0.054 **	0.051 **	0.054 **
	(0.005) **	(0.006) **	(0.005)	(0.006)	(0.005)	(0.006)
Constant	0.002	- 0.000	0.000	0.002	0.146	0.194
	(0.009)	(0.010)	(0.005)	(0.006)	(0.151)	(0.150)
R-squared	0.9435	0.9471	0.9392	0.9435	0.9397	0.9439
F-Stat.	496.04	418.59	460.87	401.83	457.10	396.09

First-stage regression results for the IV estimates in Table 4. The columns are numbered according to the specification presented above. Dependent variable: local theatre subsidies per capita. An asterisk indicates significance at 10% level, two asterisks at 5% level.

7 Appendix: Proof of Proposition 1

a) From the Samuelson rules for the closed city (10) and open city economies (13) follows that

$$MRS^l_{open} < MRS^l_{closed},$$

where the subscript refers to the two situations. Due to symmetry of the Nash equilibrium wages and number of creative people in each region are the same in the closed and open economy, that is, $w_{closed} = w_{open}$ and $M_{closed} = M_{open} = \overline{M}$. From a worker's budget constraint $c^l = w + (T\overline{M} - g)/L$ follows then that private consumption in the open city is larger than in the closed city ($c^l_{open} > c^l_{closed}$) if and only if the public good level is smaller in the former ($g_{open} < g_{closed}$). The proof now is done by contradiction. Assume that in the closed economy more of the public good is provided. Then its private consumption level must be smaller. Since the MRS is falling in g and rising in c (assuming $u_{cc}, u_{gg} < 0, u_{cg} \geq 0$), the MRS in the open economy should be larger than the MRS in the closed economy. This contradicts the premise however.

b) Holding M at $\overline{M}$ fixed and thus wages constant, worker utility $u^l(w + (T\overline{M} - g)/L, g)$ is a function of g only. This utility is maximized when $MRS^l = 1/L$, which is equivalent to the closed city Samuelson rule (10). Since the open city Samuelson rule (13) differs, utility of a worker must be lower. Creative people gain due to the increased public good supply, while their income $b - T$ is unchanged.

c) The inefficiency follows from the difference in Samuelson rules when compared to the first best. The ordering of public good levels in the first best, the closed and open city economies follows now immediately when the marginal rate of substitution depends only on the public good level:

$$L \cdot MRS^l(g_{FB}) + \overline{M} \cdot MRS^m(g_{FB}) = 1 = L \cdot MRS^l(g_{closed}) > L \cdot MRS^l(g_{open}) + \overline{M} \cdot MRS^m(g_{open}).$$

This completes the proof.

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