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Abstract

This paper explores the conditions under which decentralization and fiscal competition lead to a policy of subsidizing cultural activities. A theoretical analysis discusses these subsidies as a form of local public good provision which makes a city more attractive to highly educated individuals. The analysis shows that the incentive to provide the public good is particularly strong, if institutional restrictions prevent local governments from adjusting their tax structure. An empirical analysis considering the case of public theaters in Germany supports the view that public subsidies attract highly educated individuals and capitalize in the earnings of workers with basic education. Given institutional restrictions, the empirical effects suggest that local jurisdictions face a substantial fiscal incentive to subsidize cultural activities.

JEL-Code: H200, H410, R130.

Keywords: fiscal competition, creative class, cultural amenities, theater subsidies, tax autonomy, capitalization, individual earnings.

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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. A larger creative class may pay off in terms of a higher-productivity of the local work force, and increases in tax revenues would alleviate the burden on the budget. 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 the 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. In addition, in order to raise the attractiveness for the creative class, it might be more effective to rely on revenue instruments, such as taxes.

However, consistent with the view that public subsidies for the arts may be an instrument of raising the attractiveness of a city, in many developed countries local governments are active in supporting activities such as theaters, philharmonics, and museums (*e.g.*, Thompson, Berger, Blomquist, Allen, 2002). The German case is of particular interest, where public spending on arts and culture is continuously ranked highest among developed countries. While international comparisons are rare, studies including National Endowment for the Arts (2000) and Canada Council for the Arts (2005) use data from the Arts Council of England 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). Interestingly, in Germany, public support for culture comes to a large extent from local governments (Schulze and Rose, 1998, Traub and Missong, 2005). Since local governments enjoy a substantial autonomy in the German system of fiscal federalism, at least on the expenditure side of the budget, public

support by local government is consistent with the view that providing cultural amenities might be an instrument of locational competition. However, other highly decentralized countries, most notably the US, do not show much local public subsidies for the arts.

Against this background this paper explores under which conditions a policy of subsidizing cultural activities emerges in a setting with decentralization and fiscal competition. The paper makes two contributions, one theoretical and one empirical. It provides a theoretical analysis that 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 empirical contribution of the paper is to explore the effects of local subsidies to the arts on workers and highly educated individuals and the incentive to provide those subsidies using German data.

In the theoretical analysis, the provision of the public consumption good by the local government makes a city more attractive to mobile individuals who 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. Even if the unskilled population did not generate utility from the public good, the mobility of highly creative people would induce local governments to provide this good in order to exploit the skill complementarity of factors of production. The equilibrium outcome critically hinges on the set of fiscal instruments available to the local governments. If there is local discretion in setting the tax burden for both unskilled and skilled residents, the local public good is funded through user fees that are independent of type. In this case the supply of the public good is equal to first-best. However, if the local governments are restricted and have no autonomy to decide about the tax burden of residents, as is the case with German municipalities, the outcome is different. More specifically, we find that the equilibrium outcome in this case is characterized with inefficient overprovision of public services. The key mechanism is the following: the provision of the public consumption good capitalizes in the wages of unskilled workers, *i.e.* the increase in the public good attracts more creative people which raises the wage of workers when factors are complements. At the same time, the rents earned by creative people tend to fall. The public goods tends to be overprovided because each city ignores the fiscal externality that arises when it attracts creative workers from other regions. This result is in contrast to the classical literature on capital tax competition (such as Zodrow and Mieszkowski, 1986, and Wilson, 1986)

where restrictions in revenue instruments leads to less provision of public consumption goods and underprovision relative to the first best. In our case, the public good provision is distorted since the marginal cost of funding the local public good is perceived to be too low from the perspective of the individual jurisdiction.

Our empirical analysis explores the incentive to provide subsidies to the arts in a decentralized setting where individual jurisdictions compete for the creative class. Our testing ground is the subsidization of Germany's public theaters, which receive substantial support through direct subsidies. According to the official statistics, revenues from ticket sales by the 744 public theaters in 2004 amounted to about EUR 0.385 Billion. On average, visitors paid EUR 20 per event. In comparison, total public subsidies to the theaters amounted to no less than EUR 2.1 Billion Euros. Put differently, each ticket sold was subsidized by about EUR 107, on average. Combining data on theater subsidies with individual earnings data, we test whether the empirical evidence is consistent with the view that public subsidies to theaters create significant amenities for the highly educated. More specifically, we show that cultural subsidies capitalize in the earnings, albeit differently by level of education. Earnings of highly educated tend to be lower in cities where larger subsidies are paid to local theaters. The effect is economically large: An increase in per capita spending on theaters and operas by 100 Euros reduces earnings by about 7%. 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 3% if subsidies increase by 100 Euros per resident.

Based on the empirical results, we provide a quantification of the fiscal incentive to provide subsidies to theaters in the institutional setting faced by the German jurisdictions. Abstracting from intergovernmental revenue, a baseline estimate of the mobility effect on the marginal cost of funding theaters as perceived by the individual jurisdiction suggests that the cost may be reduced by 37.5%. In other words, an increase in subsidies by four euros would need only two to three euros of funding from the perspective of the individual jurisdiction.

This suggests that a possible explanation for the substantial amount of local subsidies to the arts in Germany could be the specific institutional setting under which German local governments operate. While local jurisdictions in other countries with high degree of decentralization such as the

US provide little subsidies to the arts, local governments in Germany are prevented from adjusting the tax structure in order to attract the creative class. As a consequence, they resort to extending the supply of cultural activities through public subsidization.

Our theoretical contribution relates to a number of other works. As mentioned above, Zodrow and Mieszkowski (1986) or Wilson (1986) and the subsequent literature on tax competition for mobile capital finds underprovision of public consumption goods rather than overprovision. 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. 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 only efficient in the presence of interregional transfers. We differ in a number of ways by arguing that mobility costs differ by education and assume that optimal 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 work of Wellisch (2000) is close to our focus in that he also examines the role of the number of tax instruments in a decentralized economy with mobility. He considers two regimes: one where a tax on the mobile factor is available, and another where it is constrained to zero by assumption. By contrast, in our model a tax on highly skilled individuals is positive but may be outside of the control of the local government.

Our empirical finding that cultural subsidies tend to be associated with lower earnings of people with high education is in accordance with the Florida (2002) thesis that providing cultural amenities attracts the "creative class." The positive wage effect of subsidies for workers with low education, supports the empirical literature concerned with the local economic benefits of attracting the creative class (*e.g.*, Falck, Fritsch, Heblich, 2011). The positive wage effect is also consistent with the literature on human capital externalities (Moretti, 2004), which points to the benefit of low skilled workers from the local presence of highly educated labor. All this is consistent with the literature on the creative class, according to which urban success comes from being an attractive "consumer city" for high skill people (Glaeser, 2005). However, in the light of the theoretical framework pro-

vided, this conclusion needs to be qualified. In a decentralized setting, the presence of competing jurisdictions needs to be taken into account. If the overall supply of highly educated workers is fixed, the location policy of jurisdictions may be jointly ineffective, and under institutional restrictions even a welfare loss is obtained. Hence, policy recommendations for the individual jurisdiction and for the system of competing jurisdictions differ. The former would support local subsidization of cultural activities, the latter would point towards removing restrictions in the tax instruments.

The plan of the paper is as follows. In section 2 we provide a theoretical analysis of competition for the creative class, where we show results for public provision of local public goods with and without institutional restrictions on the revenue instruments of local governments. The empirical analysis follows in section 3, where we provide evidence on the effects of theater subsidies in Germany on individual earnings. Section 4 uses the empirical results to quantify the fiscal incentive for providing public subsidies given the institutional framework in Germany. Section 5 concludes.

2 Theoretical Analysis of Competition by Public Good Provision

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 which can be used for production of the publicly provided good g at a marginal rate of transformation of one.[1] 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

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

[1] In abuse of terminology, we sometimes use the term "public good" for g even though in fact it is only a publicly provided private good.

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

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

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 a private consumption good and a public good that is supplied in the jurisdiction where they work and live. We use a jurisdiction index only where necessary. 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, which we discuss 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. Note that the public good g is uniformly supplied to all individuals (workers and creative individuals) in a jurisdiction. 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 utility level that creative individuals obtain in the rest of the economy. Each region takes u^* as given, but the value is determined in equilibrium.

Government

The government of a region uses tax revenues for spending on public good $g \geq 0$ and a transfer to immobile workers. The precise setup depends on the nature and number of fiscal instruments available. We consider two scenarios. First, we assume that the government has full control over type-specific taxes and transfers, called *full instruments*. For individuals only the net fiscal contribution matters, and therefore the government budget constraint can be stated as

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

The tax rates on creative individuals t_i^m and immobile workers t_i^l might be negative (although not both at the same time), in which case government revenue is redistributed toward that group. We assume that the good g is uniformly provided to all residents.[2]

In the second scenario we assume that type-specific tax rates $(T^l, T^m) > 0$ exist, but are outside of the control of the government. Taxes are set at a higher level of government, yet revenues accrue to the local jurisdiction. The government has spending flexibility by using tax revenues either for the public good g or for a redistributive transfer G^l to immobile workers. This is referred to as the setting with *restricted instruments*. While tax rates ares fixed exogenously, tax revenues in each region are endogenous because creative people are mobile between jurisdictions. This set up allows us to focus on efficiency effects and distributional consequences of competition through the expenditure side. The government budget constraint of region i maintains that the sum of tax revenues equals expenditures on transfers to workers and public good provision

$$T^m M_i + T^l L = (M_i + L) g_i + L G_i^l, \tag{5}$$

where we use capital letters T^m and T^l to denote exogenous and region-independent tax rates. Condition (5) assumes that the government does not have access to positive cash transfers to creative individuals. If it did, we would be back in the first scenario, where net tax rates could be written $t_i^m = T^m - G_i^m$ and $t_i^l = T^l - G_i^l$. Note that the absence of cash transfers to creative individuals is in line with the German situation. Creative individuals tend to be higher earning individuals who are not regularly eligible for cash transfers. Explicit or implicit cash transfers go to low income households in the form of housing assistance payments and reductions in fees for locally provided public services, among other items.

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

$$c_i^l = w_i - \begin{cases} t_i^l & \text{if goverment has full instruments} \\ T^l - G_i^l & \text{if government has restricted instruments,} \end{cases} \tag{6}$$

[2]In the context of our empirical application – public subsidies to theaters – we can view g as a theater's seating capacity, which is provided in proportion to the number of residents.

and that for a creative individual is

$$c_i^m = b_i - \begin{cases} t_i^m & \text{if goverment has full instruments} \\ T^m & \text{if government has restricted instruments.} \end{cases} \tag{7}$$

Economic Equilibrium

An economic equilibrium is a fiscal policy vector for each city, either $q_i = \{g_i, t_i^l, t_i^m\}_{i=1,\ldots,N}$ for the case with full instruments or $q_i = \{g_i, G_i^l\}_{i=1,\ldots,N}$ with exogenous tax rates T^m and T^l when instruments are restricted, private consumption levels for all workers and creative individuals, $\{c_i^l\}_{i=1,\ldots,N}$ and $\{c_i^m\}_{i=1,\ldots,N}$, and a distribution of creative people across cities such that

1. no creative individual can improve her utility by moving elsewhere, taking the fiscal policy vector of all cities as given,
2. each individual (worker and creative individual) is able to finance consumption out of net income given her residential choice and taking the fiscal policy in its region of residence as given,
3. each city's government budget, (4) or (5), is balanced given the distribution of creative people, and
4. the market for creative people is in equilibrium, that is,

$$\sum_{i=1}^{N} M_i = N\overline{M}. \tag{8}$$

2.1 First Best

Before analyzing the policy game let us consider the first-best outcome subject to a mobility constraint. The first best 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

$$u^l(c_i^l, g_i) = \overline{u}_i^l \text{ for all } i = 1, ..., N \tag{9a}$$

$$u^m(c_1^m, g_1) = u^m(c_j^m, g_j) \text{ for all } j \neq 1 \tag{9b}$$

$$\sum_{i=1}^{N} F(L, M_i) = \sum_{i=1}^{N} [(M_i + L)g_i + Lc_i^l + M_i c_i^m] \tag{9c}$$

and market clearing for creative people (8). 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 (9a) fixes a given utility level for each worker in every city, $\overline{u}_i^l$, the second condition (9b) reflects the mobility constraint of creative people and requires equal utilities everywhere, and the last condition (9c) is an aggregate feasibility constraint. To characterize the solution it is useful to define the marginal rates of substitution for a worker and a creative person, where we omit the region index for notational convenience:

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

In addition, we define population shares in region i for immobile workers $s_i^l = L/(L + M_i)$ and creative individuals $s_i^m = M_i/(L + M_i)$, respectively, so that $s_i^l + s_i^m = 1$.

Taking the first order conditions to the planner's problem, as shown in the appendix in more detail, and combining them yields the following two central conditions for all $i, j = 1, ..., N$

$$s_i^l \cdot MRS^l(c_i^l, g_i) + s_i^m \cdot MRS^m(c_i^m, g_i) = 1 \tag{10a}$$

$$F_M(L, M_i) - c_i^m - g_i = F_M(L, M_j) - c_j^m - g_j. \tag{10b}$$

Condition (10a) is a Samuelson rule in the context of a publicly provided private good: the population weighted average of the marginal rates of substitution of immobile workers and creative individuals equals the marginal cost of providing the good. The rule plays an important role further below 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 g in a given city i is pinned down uniquely for a given worker utility level $\overline{u}^l$ under weak assumptions. To see this, we solve (9a) 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 (10a) and aggregate feasibility (9c). Next, we solve (9c) for c^m as function of $(\overline{u}^l, g)$, which is then also substituted into (10a). The modified Samuelson rule is now only a function of the common public good level g, worker utility $\overline{u}^l$ and model 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 ($u_{cg} \geq 0$). Let us denote the public good level in the symmetric first best g^*.

One special case is noteworthy: The public good level is uniquely determined and independent of $\overline{u}^l$ (as long as constraints (9a) and (9b) are satisfied) when preferences are quasi-linear of the form $u(c, g) = c + v(g), \quad \text{with } v' > 0 > v''$. In that case the marginal rate of substitution is independent of the level of private consumption.

Condition (10b) is the locational efficiency condition (Wildasin, 1987), stating that in a first best allocation the net difference between the marginal product of a creative individual and her consumption of private and publicly provided goods should be equalized across cities. In other words, the net social benefit of a creative person should be the same in all regions.

We finally note that for the derivation of the first best rule (10) we have not required constant returns to scale.

2.2 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 utility level u^* 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 (even though u^* is endogenously determined in equilibrium). Creative people are mobile and thus the number of

creative people and factor prices w_i and b_i are endogenous.

Full Set of Instruments

The government of city i maximizes the utility of a representative worker with respect to both tax rates and the public good level. By making use of the government budget constraint (4) a city's optimization problem can be stated as

$$\max_{g_i, t_i^m} \; u^l(w_i - t_i^l, g_i) = u^l\left(w_i - \frac{[(M_i + L)g_i - t_i^m M_i]}{L}, g_i\right)$$

through choice of g_i and t_i^m. The government recognizes that the number of creative people M_i and the wage $w_i = F_L(L, M_i)$ are functions of the region's policy instruments via mobility constraint (3). The optimization problem leads to two first order conditions

$$u_c^l \cdot \left[\left(F_{LM} + \frac{t_i^m - g_i}{L}\right)\frac{dM_i}{dg_i} - \frac{(M_i + L)}{L}\right] + u_g^l = 0 \tag{11a}$$

$$u_c^l \cdot \left[\left(F_{LM} + \frac{t_i^m - g_i}{L}\right)\frac{dM_i}{dt_i^m} + \frac{M_i}{L}\right] = 0 \tag{11b}$$

Differentiating the mobility constraint (3) we also find (holding the other policy instruments constant)

$$\frac{dM_i}{dt_i^m} = \frac{1}{F_{MM}} < 0 \text{ and } \frac{dM_i}{dg_i} = -MRS^m \cdot \frac{dM_i}{dt_i^m} > 0. \tag{12}$$

A tax on creative individuals lowers M_i, while a higher supply of the public good g_i raises M_i. Combining the derivative (12) with the first-order conditions (11) it is straightforward to prove that in equilibrium the following conditions hold for all i (see the appendix for derivation)

$$s_i^l \cdot MRS^l(c_i^l, g_i) + s_i^m \cdot MRS^m(c_i^m, g_i) = 1 \tag{13a}$$

$$t_i^m = t_i^l = g_i. \tag{13b}$$

Condition (13a) shows that under full instruments the allocation is first best efficient, as it mirrors conditions (10a). The second condition (13b) gives the financing rule. The publicly provided private good is funded through user fees that are independent of type. Hence there is no redistribution.

When the equilibrium is symmetric, there is no mobility of creative people in equilibrium and factor payments are given by $w = F_L(L, \overline{M})$ and $b = F_M(L, \overline{M})$. Existence of a symmetric equilibrium is proved in the appendix.

The spirit of the above result is in line with the existing literature. For example, Wellisch (2000, ch. 3) shows in a similar but different model with (impure) public goods, endogenous distribution of firms, and land as immobile fixed factor, that under a complete set of fiscal instruments the allocation is efficiently chosen by local governments who each maximize their local net land rent.

Restricted Instruments

We now turn to the case with restricted instruments. Tax rates T^m and T^l are exogenous from the viewpoint of each city. Unlike earlier literature, tax rates are not constrained to zero (as in Wellisch, 2000). We assume that the tax rate on creative workers T^m is positive and constant across regions.[3] Moreover, it is assumed to be greater than the level which is necessary to provide the first best level of g^*. Each city government now controls the public good level g and the transfer to immobile workers G^l. We assume that the exogenous tax rates are sufficiently high so that the transfer G^l is non-negative and the wages of both types of individuals are high enough to pay the exogenous tax. In the appendix A3 we work out a specific model and demonstrate the consistency of all assumptions.

Solving the government budget constraint for G^l and inserting into the objective function the government of city i solves

$$\max_{g_i} u^l \left(w_i - g_i + \frac{(T^m - g_i)M_i}{L}, g_i \right)$$

through choice of g_i alone. Private consumption equals the wage minus the cost of provision of the public good, and the total net contribution of creative individuals to the budget divided by the population of immobile workers. The first order condition to the above problem reads

$$u_c^l \left[\left(F_{LM} + \frac{T^m}{L} \right) \frac{dM_i}{dg_i} - \frac{(M_i + L)}{L} \right] + u_g^l = 0. \tag{14a}$$

[3]This is consistent with the German case, where income tax rates are set at the federal level, but some portion of the tax revenue accrues to the local jurisdiction, see below.

The supply of the public good has two positive effects for immobile workers on top of the direct utility gain from consuming g. By increasing the number of creative individuals the wage of immobile workers is boosted through the complementarity of production factors $F_{LM} > 0$. The second effect is the tax payment T^m coming along with an inflow a creative person. The supply of g_i is costly however. The per capita cost of providing g equals the total cost of providing g to $M_i + L$ individuals divided by L.

We rewrite the first order condition by making use of (12) and the condition $F_{LM}F_{MM}^{-1} + M_i L^{-1} = 0$ (due to constant returns to scale) and obtain

$$s_i^l \cdot MRS^l(c_i^l, g_i) + s_i^m \cdot MRS^m(c_i^m, g_i) = 1 - \frac{T^m}{L + M_i}\frac{dM_i}{dg_i} < 1. \tag{14b}$$

Comparison of the first best rule (10a) and condition (14b) demonstrates the fiscal incentive arising from the positive but exogenous tax on creative individuals T^m. The perceived marginal cost of providing the public good is reduced. There now exists a tendency for overprovision of the public good relative to the first best due to a negative fiscal externality. Attracting creative people from other cities lowers tax revenues elsewhere which is ignored by the city that benefits from the inflow of creative individuals. We now state:

Proposition 1. Consider a symmetric first best allocation and a symmetric Nash equilibrium in the open city economy.

a) The allocation in the symmetric Nash equilibrium is efficient in the case of a full set of instruments (t_i^l, t_i^m, g_i)*, but inefficient when instruments are restricted* (g_i, G_i^l)*.*

b) In the situation with restricted instruments the supply of the publicly provided private good g *is inefficiently high when preferences are quasi-linear.*

Proof: Part a) follows immediately by comparison of (10a), (13a) and (14b). When preferences are quasi linear of the form $u(c, g) = c + v(g)$, with $v'(g) > 0 > v''(g)$, the marginal rate of substitution for both types depends only on g. Lower marginal cost of supplying the public good in the case of restricted instruments (the right-hand side of (14b) is smaller than 1) must imply a higher level of g due to strict concavity of $v(g)$. This proves part b).

Attracting mobile individuals has a positive wage effect and a fiscal effect whose sign depends on the level of public good provision. The fiscal effect is positive for $T^m > g$. When the government controls the full set of instruments the fiscal effect can be dealt with separately by charging a user fee, which is efficient. This is no longer the case when the instruments are restricted. In this case, through the choice of g the government simultaneously tries to redistribute towards the immobile workers and to finance the cost of supplying g. With restricted instruments offering the public good beyond the efficient level is beneficial from the viewpoint of a single region because the tax revenues per creative worker are higher than the optimal level of g. This is the core result of the theoretical model.

In the remainder of this section we offer two additional insights. First, it is instructive to compare the open economy with a closed economy equilibrium, both with restricted instruments, in order to describe the efficiency and distributional effects arising from mobility. In a closed city creative people are not mobile by assumption, and thus (3) no longer applies and instead $M_i = \overline{M}$ holds for all i. The representative government's optimization problem is to maximize $u^l(w - g + (T^m - g)\overline{M}/L, g)$ by choice of g, where we made use of the government budget constraint (4) and dropped the region/city index for expositional reasons. This leads to the optimality rule

$$s^l \cdot MRS^l(c^l, g) = 1. \tag{15}$$

In words, for the closed city the the marginal rate of substitution of immobile workers multiplied with their population share equals the marginal rate of transformation. In contrast to the first-best rule (10a) the public good tends to be underprovided. While the first-best rule requires the weighted average of workers' and creative individuals' MRS to be equal to 1, the comparison with (15) is not trivial as private consumption and public good levels may differ across (10a) and (15). In one situation, however, we are sure to have underprovision in the closed economy, namely when preferences of all individuals are quasi-linear. In this case $MRS = v'(g)$ and thus (10a) becomes $s^l \cdot MRS^l(g) + s^m \cdot MRS^m(g) = 1$, which differs from (15).

The overprovision is welfare worsening from the perspective of immobile workers. Mobility of creative workers entails equilibrium redistribution away from immobile residents to creative people. To see this, note that the number of creative individuals in equilibrium is the same under mobility

and no mobility. Thus the wage is the same in the two settings. For given wage w, tax rate T^m, and equilibrium numbers of individuals $\overline{M}$ and L, a worker's utility $u^l(w - g + (T^m - g)\overline{M}/L, g)$ is maximized when the public good level is first best, that is, condition (15) holds. Hence mobility of creative individuals makes workers worse off. Creative individuals are better off, because private consumption $c^m = F_M(L, \overline{M}) - T^m$ is unchanged across mobility regimes, while g is higher under the assumption of full mobility of creative individuals.

We like to end this section by noting that our main conclusion is robust to a different assumption regarding the production technology. Recall that the first best is characterized by conditions (10) regardless of technology. With restricted instruments, workers must take into account how changes in public goods provision affect the incomes of creative workers, which depends on technology, and thus on the responsiveness of M with respect to g. Condition (14b) becomes

$$s_i^l \cdot MRS^l(c_i^l, g_i) + s_i^m \cdot MRS^m(c_i^m, g_i) = 1 + \frac{s^m(F_M - b)MRS^m}{F_M - LF_{LM} - b} - \frac{T^m}{L + M_i}\frac{dM_i}{dg_i} < 1. \qquad (16)$$

When $b > F_M$, reflecting decreasing returns to scale, the right-hand side becomes larger ceteris paribus, and hence public good provision is reduced relative to the constant returns to scale case. There is still overprovision relative to the first best as long as the sum of the last two terms is negative, which means that a moderate degree of decreasing returns to scale is admissible.

If, by contrast, production exhibits increasing returns to scale, $b < F_M$, and in addition $F_M - LF_{LM} < b$, then the new effect showing up in (15) is negative and reinforces the tendency for oversupply of the public good. Our main result is therefore robust to assuming moderate levels of decreasing or increasing returns to scale.

3 Subsidizing Culture as Location Policy: Empirical Evidence

A large literature on location choice and land or property prices has established the importance of various amenities for household location decisions. While the list of amenities discussed in this literature is rather large, ranging from climate and environmental attributes to educational services (see Blomquist, Berger, and Hoehn, 1988), cultural activities have not been the focus of

much interest. Yet cultural activities may be particularly relevant for attracting creative, and highly-educated population (Florida, 2002). 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 those with high education is not obvious. We focus on the case of public theaters in Germany, which receive substantial subsidies from local governments, as we noted above.

3.1 Survey Evidence

Table 1 provides empirical evidence on location decisions derived from German survey data. The "Perspektive Deutschland" (PD) survey taken among more than half a million German households[4] 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. 8.66 % of 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. 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 (2) of Table 1 report figures for the sub sample of respondents with higher education (comprising senior high-school exams and/or a university degree) who work full-time. For this group the share is 12.68%, and leisure and cultural offerings is among the four most important reasons for coming to the region.

3.2 Capitalization of Theater Subsidies

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

[4]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 (1)	Group of respondents: working and high educ. (2)
Labor market, professional reasons	38.02	57.29
Personal relationship (friends, family, ...)	41.18	34.86
Natural amenities, scenic landscape	24.93	18.04
Leisure and cultural offerings and interesting cultural scene	8.66	12.68
Social environment, local mentality	12.93	11.97
Availability of housing	14.82	10.29
Access, public transport	9.76	9.44
Attractiveness of city, nice city environment, parks	9.24	8.39
Low cost of living	9.70	6.85
Schooling and education opportunities	6.38	5.86
Shopping opportunities, local services	7.16	5.47
Positive attitude to children and families	6.14	4.14
Low crime	8.06	3.69
Openness to migrants	3.68	2.58
Quality of life for seniors/elderly	3.78	1.19
Other reasons	22.84	16.28

Population weighted means. 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). Column (1): 150816 respondents. Columns (2): 48508 respondents full time working with higher education (senior high-school exams and/or university degree).

Table 2: Summary Statistics on Public Theaters 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 theater exists (binary)	.260	.439	0	1
counties with public theaters 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. Per capita figures refer to resident population.

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. German theaters have a long history which has been shown to still matter for today's location of the creative class (Falck, Fritsch, Heblich, 2011). Hence, theaters partly constitute *historic amenities* in the sense of Brueckner, Thisse, and Zenou (1999), which are largely exogenous as they result from past eras. But, of course, current funds are still needed in order to provide cultural activities at those places, and, as noted in the introduction, the local public sector in Germany provides substantial subsidies.

Some insights in the support for theaters is provided by Table 2. It reports summary statistics on public theaters among the German counties in 2004, including urban 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 theaters, 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 theater or opera house is located. Own revenues basically captures ticket sales, subsidies refers to public support. Note that public support (almost 79 Euros per resident) easily outweighs own revenues (about 12 Euros per resident), pointing at a substantial rate of subsidization.

The heavy involvement of municipal governments in subsidizing cultural activities raises the question as to whether the subsidies exert any noticeable and economically significant effects on location

decisions. A potentially powerful test is obtained by an empirical analysis of individual earnings. If cultural subsidies provided by a jurisdiction 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, wages should not be lowered. In fact, the above theory suggests that with complementarity these wages might increase. To test for the effect of theater subsidies on individual earnings, we combine the data on public spending for theaters in German cities with data on individual earnings from a 1% random sample of the social security accounts (IABS). This dataset contains information on individual earnings for 343 German regions 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 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 (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 region. 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 theaters in the region.

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 level of schooling without university or technical college degree with or without professional education (*Abitur mit und ohne Berufsausbildung*) (22799 observations)

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

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	41301/27412		22799/20118		244936/235854	
Age	41.13	9.04	36.2	9.58	40.4	10.7
Univ.degree	0.627	0.483				
Vocational training			0.830	0.376	1	0
Female	0.295	0.456	0.466	.499	0.363	0.481

Statistics on individual characteristics (age, univ.degree, vocational training, female) for non-censored cells.

Variable	Mean	Std. Dev.	Min	Max
Subsidy per capita (€ 1000)	0.020	0.039	0	0.242
State and federal subsidies, only	0.009	0.021	0	0.118
Publicly funded theater exists (binary)	0.327	0.469	0	1
East Germany	0.222	0.416	0	1
Land price per sq.meter*	98.5	92.8	6.68	707.6
Population	240528	232716	97751	3387545
Density	1995.7	1002.6	631.8	5652.3
Share of highly educated employees	0.092	0.045	0.021	0.302

Descriptive statistics for 343 districts. * Due to missing values statistics for land prices are based on 324 districts. Density measured as population size per square kilometer of the settlement area of the district.

The first group consists of people with high level of schooling which in addition 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 education. It comprises individuals with high level of schooling without university or technical college degrees with or without vocational training. The third group is the main group in the data, comprising workers and employees with only standard-level of schooling but with some 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.[5]

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

[5]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. For similar reasons we exclude blue collar workers from the group with high level of education.

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 all subsidies and subsidies received only from upper level governments.[6] We also include population density to control for an urban wage premium, and a dummy for eastern Germany. In order to test whether other characteristics might cause some spurious correlation between theater subsidies and wages, we also include the land-price for newly developed land.

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 results show significant effects of the standard explanatory variables including age, and age squared and the 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 confirmed for Germany (Lehmer and Moeller, 2010). In the basic specification (1), subsidies to theaters exert a significant effect on earnings. The point estimate indicates that an increase in subsidies by EUR 100 per resident is associated with a decline in earnings by almost 7%.

In order to test for possible endogeneity effects which arise when local government subsidies respond to the local labor market conditions for those with high education, column (2) reports instrumental variables (iv) estimates. Our identification strategy here relies on the subsidies received only from state and federal governments. While local government support to the performing arts might well be correlated with the local labor market conditions, state or federal programs are usually less sensitive to local conditions.[7] We add a binary variable to the set of instruments which reflects the presence of a public theater. To include this binary indicator is supported by the historic nature of these amenities (see above). The overidentification test indicates that the instruments satisfy

[6] In the case of city states, such as Berlin, state-level subsidies are treated as local subsidies.

[7] While details differ, most state constitutions emphasize the state's responsibility to promote and support the arts, the cultural heritage as well as an educational responsibility of the state. The constitutional mandate is usually operationalized in terms of the responsibility to ensure that state residents have access to a basic cultural infrastructure For a discussion, and further details see the final report of the Enquete Commission "Culture in Germany" of the German Parliament (Bundestag, 2007, Drucksache 16/7000).

Table 4: Wage Effects of Theater Subsidies

	High-level education			Medium-level education			Basic education		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Age	0.091 **	0.091 **	0.086 **	0.109 **	0.109 **	0.106 **	0.104 **	0.104 **	0.127 **
	(0.027)	(0.027)	(0.028)	(0.020)	(0.020)	(0.020)	(0.025)	(0.025)	(0.024)
Age^2	-0.001 **	-0.001 **	-0.001 **	-0.000 **	-0.001 **	-0.001 **	-0.001 **	-0.001 **	-0.001 **
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Univ.Degree	0.121 **	0.121 **	0.124 **						
	(0.016)	(0.016)	(0.017)						
Voc.Training				0.176 **	0.176 **	0.179 **			
				(0.023)	(0.023)	(0.025)			
Female	-0.300 **	-0.300 **	-0.297 **	-0.219 **	-0.210 **	-0.223 **	-0.190 **	-0.190 **	-0.185 **
	(0.021)	(0.021)	(0.022)	(0.021)	(0.021)	(0.022)	(0.008)	(0.008)	(0.008)
East	-0.226 **	-0.223 **	-0.182 **	-0.261 **	-0.259 **	-0.181 **	-0.384 **	-0.381 **	-0.317 **
	(0.031)	(0.031)	(0.029)	(0.032)	(0.033)	(0.042)	(0.012)	(0.012)	(0.010)
log Density	0.121 **	0.126 **	0.072	0.121 **	0.123 **	0.034	0.104 **	0.109 **	0.018
	(0.027)	(0.027)	(0.035)	(0.026)	(0.026)	(0.044)	(0.010)	(0.011)	(0.013)
Subsidy	-0.691 **	-0.796 **	-0.749 **	-0.071	-0.114	-0.133	0.342 **	0.235 *	0.301 **
	(0.243)	(0.256)	(0.249)	(0.396)	(0.314)	(0.327)	(0.113)	(0.137)	(0.122)
log Land price			0.046 **			0.084 **			0.076 **
			(0.018)			(0.024)			(0.007)
Constant	2.405 **	2.237 **	2.653 **	1.535 **	1.520 **	1.875 **	1.603	1.561	1.417 **
	(0.583)	(0.578)	(0.634)	(0.396)	(0.404)	(0.447)	(0.440)	(0.444)	(0.443)
Uncensored	1223	1223	1158	1261	1261	1187	686	686	648
No. of cells	1357	1357	1282	1266	1266	1191	686	686	648
R-squared	0.3560			0.3843			0.8577		
Overid.Test		1.81(.18)	1.81(.18)		0.01(0.94)	0.20(0.66)		0.36(0.55)	0.16(0.69)
Weak Id.Test		2320	2233		2293	2166		1267	1209

Dependent variable: log wage rate. Robust standard errors allowing for county-level cluster effects in parentheses. An asterisk indicates significance at 10% level, two asterisks at 5% level. (2), (3), (5), (6), (8) and (9) instrumental variable estimates using subsidies 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.

orthogonality assumptions and the instruments also turn out to have high explanatory power. As the first-stage regression shows (see appendix), the level of state and federal subsidies as well as the existence of a public theater exert strong positive effect on total subsidies. Consistent with the "zoo effect" (Oates, 1989), according to which larger cities provide more services, also population density shows strong positive effects on subsidies. In the second-stage regression, the empirical effect of total subsidies turns out to be slightly stronger, and the other results prove robust.

In column (3) we report iv-results obtained while controlling for land prices. Including this variable enables us to provide some first test that the empirical relationship between subsidies and wages is not driven by omitted local characteristics. More specifically, the inclusion of the local land price allows us to check whether the empirical effect of subsidies stems from some correlation with regional conditions which would give rise to price differences at given level of density. Depressed regions or regions with other amenities, for instance, might display lower subsidies. In all specifications, however, the per-capita subsidy to theaters exerts rather similar effects. The point estimate indicates that an increase in subsidies by EUR 100 per resident is associated with a decline in earnings by about 7%.

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. While all other variables show similar effects, the specifications do not indicate any significant effect of theater subsidies even if instrumental variables are used to identify the empirical effect of the subsidies.

Columns (7) to (9) provide results for the earnings of those with basic education without high-school, college, or university degrees. Qualitatively, the results show similar effects regarding age, gender, location in the east, and density. In difference to the above results, all specifications point to positive effects of theater subsidies. The point estimate indicates that wages tend to be higher by about 3% if subsidies are increased by EUR 100 per resident.

Our empirical results, thus, are consistent with the view that providing public subsidies generates amenities which attract highly educated individuals. As a caveat, we should note that we have just picked one observable type of subsidization which might well be correlated with the subsidization of other cultural activities, such as museums and exhibitions. At the same time, we find that

subsidization of theaters actually exerts positive effects on the wage rate at a basic level of education. Since workers with basic-level education tend to be immobile relative to highly educated,[8] 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. In order to test this interpretation, we may include some indicator for the number of highly educated employees in the region. More specifically, if the positive sign of the subsidies is, in fact, driven by the attraction of high skilled workers, we should not find this effect when conditioning on the actual share of highly educated employees. Inclusion of this variable in the earnings regression for highly-educated, we should expect to still find a negative effect of subsidies. In fact, if the concentration of those with high education tends to reduce their rents, we might even find a stronger effect of subsidies.

Results are provided in table 5, which includes the share of highly educated among all employees in our sample. While the share shows no significant effect on earnings, the inclusion tends to be associated with stronger effects of subsidies in columns (1) to (3) which are concerned with the earnings of the highly educated. In columns (4) to (6), which deal with basic-level of education, the share of highly educated proves highly significant. And, in fact, theater subsidies turn out insignificant. This supports the above view that the attraction of highly educated is driving the positive wage effect for those with basic education. At the same time, the positive effect of the share of the highly educated is in line with the literature on social returns to education (*e.g.*, Moretti, 2004), which points at the complementarity of high and low skilled workers. Since we distinguish three levels of education our findings are also in line with Eeckhout, Pinheiro and Schmidheiny (2013), who argue an extreme skill complementarity is consistent with the observation that in the US large cities attract in particular low and high skilled workers.

Taken together, subsidies exert an effect on the earnings distribution, in the sense that these subsidies tend to reduce the earnings 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, provided through

[8]This stylized fact also holds in the German context. Based on the Perspektive Deutschland survey the share of people that states to be open for relocating elsewhere is about twice as large among those with university or technical college degrees as compared to respondents with basic-level of education.

Table 5: Wage Effects, Controlling for Share of Highly Educated

	High-level education			Basic education		
	(1)	(2)	(3)	(4)	(5)	(6)
Age	0.090 **	0.090 **	0.086 **	0.108 **	0.108 **	0.126 **
	(0.027)	(0.027)	(0.028)	(0.023)	(0.023)	(0.023)
Age^2	-0.001 **	-0.001 **	-0.001 **	-0.001 **	-0.001 **	-0.001 **
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Univ.Degree	0.122 **	0.122 **	0.124 **			
	(0.016)	(0.016)	(0.017)			
Female	-0.300 **	-0.300 **	-0.296 **	-0.190 **	-0.190 **	-0.186 **
	(0.021)	(0.021)	(0.022)	(0.008)	(0.008)	(0.008)
East	-0.233 **	-0.232 **	-0.185 **	-0.401 **	-0.399 **	-0.343 **
	(0.034)	(0.034)	(0.035)	(0.011)	(0.011)	(0.011)
log Density	0.105 **	0.108 **	0.070 *	0.053 **	0.055 **	0.003
	(0.035)	(0.035)	(0.039)	(0.010)	(0.010)	(0.013)
Subsidy	-0.801 **	-0.901 **	-0.771 **	0.049	-0.025	0.116
	(0.217)	(0.233)	(0.229)	(0.121)	(0.132)	(0.136)
High education	0.341	0.374	0.077	0.982 **	1.001 **	0.654 **
	(0.307)	(0.303)	(0.340)	(0.112)	(.115)	(0.117)
log Land price			0.044 **			0.059 **
			(0.018)			(0.007)
Constant	2.507 **	2.485 **	2.668 **	1.837 **	1.816 **	1.600 **
	(0.633)	(0.630)	(0.664)	(0.408)	(0.409)	(0.421)
Uncensored	1223	1223	1158	686	686	648
No. of cells	1357	1357	1282	686	686	648
R-squared	0.3569			0.8781		
Overid.Test		1.78(.18)	1.86(.17)		.114(0.74)	0.11(0.74)
Weak Id.Test		2155	2011		1197	1108

Dependent variable: log wage rate. Robust standard errors allowing for county-level cluster effects in parentheses. An asterisk indicates significance at 10% level, two asterisks at 5% level. (2), (3), (5) and (6) instrumental variable estimates using subsidies 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.

the market, tend to raise differences in the well-being between those groups.[9] Our results suggest that public provision of amenities may work in the opposite direction and reduce differences in the well-being.

4 Quantification of Mobility Induced Incentive

In the theoretical section, we have explored the role of mobility of creative individuals for public goods provision. We have found that if jurisdictions are restricted and have no discretion in setting the tax burden on residents, a fiscal incentive to provide the local public good emerges. Due to the attraction of the creative class, the marginal cost of public funds as perceived by the individual jurisdiction is reduced relative to the marginal cost of funds in the first best allocation, chosen by the benevolent federal planner.

Comparing the first-order condition for public service provision under revenue restriction and constant returns to scale (14b) with the first-order condition under first best (10a), we find that the marginal cost of public funds perceived by the individual jurisdiction is reduced by

$$\Delta = -\frac{T^m}{L+M}\frac{dM}{dg}.$$

This term depends on the marginal effect of public goods provision on the number of creative individuals. The above empirical analysis has provided an estimate of the capitalization of public spending in local wages. This effect can be decomposed into the effect of a creative individual on wages and the effect of public spending on the local size of the creative class. Formally,

$$\frac{dw}{dg} = \frac{dw}{dM}\frac{dM}{dg}.$$

Therefore, we can express Δ as a function of the wage effect

$$\Delta = -\frac{T^m}{L+M}\left(\frac{dw}{dg}\Big/\frac{dw}{dM}\right).$$

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

In order to quantify this term, we need not only an empirical estimate of the wage effect ($\frac{dw}{dg}$), but also an estimate of the effect of creative individuals on local wages, which arises from the complementarity of the production factors.

Moretti (2004) provides empirical evidence pointing at a wage increase of 1.6% if the local share of college graduates increases by 1 percentage point. Noting that the average share of college graduates in the estimation sample of Moretti (2004) is 0.25, we have $\frac{1}{w}\frac{dw}{dM} = 1.2\,(L+M)$, where 1.2 is the point estimate for the wage effect of raising the number of college graduates scaled by the size of the work force.[10] To apply this figure in our setting seems somewhat bold. Even if the production function and education standards would be similar in the US and in Germany, the definition of high education in our analysis applies to smaller fraction of the workforce. Therefore, in our case, it seems reasonable to use a figure of 0.6 instead of 1.2.[11] Inserting our point estimate of the wage effect of increasing subsidies by EUR 1000 per capita $\frac{dw}{dg} = 0.3$, we arrive at

$$\Delta = -T^m 0.0003/0.6.$$

In the theoretical model, T^m is the lump-sum tax levied on a creative individual. In the institutional context of Germany, this corresponds to the municipal share of the income tax. Based on 2004 figures the local revenue increase associated with a high income tax earner can be approximated

[10] In our notation, Moretti (2004) provides a point estimate

$$\frac{1}{w}\frac{dw}{d\left(\frac{M}{M+L}\right)} = 1.6.$$

Since $d\left(\frac{M}{M+L}\right) = \frac{dM}{M+L}\left(1-\frac{M}{L+M}\right)$, we have $\frac{1}{w}\frac{dw}{\frac{dM}{L+M}} = 1.6\left(1-\frac{M}{L+M}\right)$. The expression in the text is obtained after inserting the share of college graduates $\frac{M}{L+M} = 0.25$, and rearranging terms.

[11] According to the above findings, an increase in the share of highly-educated raises local wages by 0.654% (see column 6) in table 5. Noting that the average share of highly-educated workers is 0.09, we have $\frac{1}{w}\frac{dw}{\frac{dM}{L+M}} = 0.654\left(1-\frac{M}{L+M}\right) = 0.654\,(1-0.09) \approx 0.6$.

with EUR 750.[12] This would suggest that a reasonable estimate in the German setting is

$$\Delta = -0.375.$$

Accordingly, the perceived marginal cost of public funds is below the true cost by between one and two quarters. In other words, an increase in subsidies by four Euros would need only between two to three Euros of funding.

A comprehensive calculation would include also the effect of attracting highly educated residents on state (and not only municipal) revenues which feed back to local governments through intergovernmental revenue sharing. This is an issue in the German context, since the constitution mandates states to share some part of their own revenues with the municipalities. Consequently, intergovernmental revenue is equally important in the budget of municipalities as the municipal share of the income tax. The additional funds would tend to further contribute to a reduction in the marginal cost of public funds. But this additional effect will be generally less strong, due to the redistributive nature of the grant allocation scheme.[13]

5 Conclusion

A common view in the debate about local economic development is that public support of cultural activities may help to attract high skilled and well educated people, and, thus, contributes to the economic performance of jurisdictions. In fact, local governments are sometimes quite active in subsidizing cultural activities. An interesting case is the support of theaters by German municipalities, where according to official data for 2004, the average subsidy to public theaters was about EUR 107 per ticket sold. Yet the few existing international comparative studies suggest that local public subsidies for other decentralized countries are much lower. Against this background this

[12] In our base year 2004, the municipal share of the income tax is 15% of the total state and federal income tax revenues collected in the respective state. The distribution of funds among municipalities considers only taxes payable on the first EUR 30000 (EUR 60000) of taxable income of a single household (married couple). In 2004, a single household (married couple) with income of EUR 30.000 (EUR 60.000) would have to pay income taxes in the amount of approximately EUR 5.000, of which 15% or EUR 750 would be the municipal share.

[13] For details on the local revenue sharing system in Germany see Buettner (2006).

paper has discussed under which conditions a policy of subsidizing cultural activities emerges in a setting with decentralization and fiscal competition.

We have provided a theoretical analysis that rationalizes the subsidization of cultural activities in a setting where jurisdictions compete for a highly productive mobile creative class. Subsidization of cultural activities is discussed as a form of local public goods provision which makes a city more attractive to individuals who 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 analysis shows that even if public provision of amenities is effective from the viewpoint of the individual jurisdiction, the effectiveness 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. With restrictions of tax instruments, the mobility of the creative class introduces a fiscal incentive to provide the public good. This tends to distort public good provision, in the sense that uncoordinated policies lead to an inefficiently large supply of the public good.

In order to provide empirical evidence, we have explored the German case, where local jurisdictions have a large degree of autonomy on the expenditure side of the budget, but cannot adjust the income tax burden on residents. We have provided empirical evidence supporting 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 suggests also that the local subsidization of cultural activities in Germany is effective in attracting highly educated people. We also find that the subsidies are associated with higher earnings of workers with basic education.

Based on the empirical findings, we have provided a quantification of the fiscal incentive to provide public support to cultural activities. Abstracting from intergovernmental revenue, our baseline estimate of the mobility effect on the perceived marginal cost of funding theaters suggests that the cost of funding is reduced by about 37.5%. In other words, an increase in subsidies by four Euros would need only two to three Euros of funding. The normative implications of our results for the individual jurisdictions and the federation as a whole are different. For the individual jurisdiction, our results suggest that subsidizing culture actually improves the working conditions of those with

basic education. For the federation, our theoretical analysis suggests that the individual attempts to raise the attractiveness would mainly result in inefficient expansion of cultural subsidies. This will come to the benefit of those with higher education and reduce the utility of workers with basic-level of education. Of course, the expansion of cultural subsidies would also be welcomed by those who consider arts and culture as some form of merit good.

With regard to positive implications, our results point at a link between decentralization and mobility and the subsidization of the performing arts. Our theoretical analysis has shown, however, that public support tends to be large, 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. The explanation which emerges from our analysis is that, in order to attract those with higher education, local governments resort to extending the supply of cultural activities through public subsidization as they are prevented from adjusting their tax structure.

Appendix

Table A-1: First-Stage-Regression Results

	High-level		Medium-level		Basic	
	(2)	(3)	(5)	(6)	(8)	(9)
Age	-0.000	-0.000	0.001 *	0.001	0.002	0.002
	(0.001)	(0.001)	(0.000)	(0.000)	(0.004)	(0.004)
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	0.001 **	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	-0.001	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
East	0.002	0.004	0.003	0.004	0.003	0.004
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
log Density	0.017 **	0.016 **	0.016 **	0.016 **	0.016 **	0.016 **
	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)	(0.004)
log Land price		0.001		0.000		0.000
		(0.002)		(0.002)		(0.002)
State&Fed.Subsidy	1.226 **	1.237 **	1.223 **	1.227 **	1.217 **	1.223 **
	(0.114)	(0.121)	(0.115)	(0.122)	(0.114)	(0.120)
Public theater exists	0.019 **	0.017 **	0.021 **	0.019 **	0.020 **	0.018 **
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
Constant	-0.119 **	-0.116 **	-0.134 **	-0.130 **	-0.145 **	-0.142
	(0.021)	(0.023)	(0.018)	(0.021)	(0.068)	(0.069)
R-squared	0.8973	0.8976	0.8939	0.8944	0.8930	0.8935
No. of cells	1223	1158	1261	1187	686	648
F-Stat.	292.16	282.36	281.69	267.89	295.80	283.00

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

A-1 Derivation of First Best

The Lagrange approach can be stated as follows

$$\begin{aligned}\max, u^m(c_1^m, g_1) + \sum_i \lambda_i[u^l(c_i^l, g_i) - \overline{u}_i^l] + \sum_i \mu_i[u^m(c_1^m, g_1) - u^m(c_i^m, g_i)] \\ + \sigma\left[\sum_{i=1}^N F(L, M_i) - \sum_{i=1}^N [(M_i + L)g_i + Lc_i^l + M_i c_i^m]\right].\end{aligned}$$

The first order conditions for c_i^l, c_i^m, g_i, and M_i are

$$\begin{aligned}\lambda_i u_{c_i}^l - \sigma L &= 0 \\ -\mu_i u_{c_i}^m - \sigma M_i &= 0 \\ \lambda_i u_{g_i}^l - \mu_i u_{g_i}^m - \sigma(L + M_i) &= 0 \\ \sigma(F_M^i - g_i - c_i^m) &= 0.\end{aligned}$$

The last condition must hold for all cities and thus leads to (10b). We solve the second condition for σ which is inserted in the first and third conditions. Next we then solve the first condition for

$$\lambda_i = -\frac{\mu_i u_{c_i}^m L}{M u_{c_i}^l},$$

which is inserted in the modified third one to obtain

$$-\frac{\mu_i u_{c_i}^m L}{M_i u_{c_i}^l} u_{g_i}^l - \mu_i u_{g_i}^m + \mu_i \frac{u_{c_i}^m}{M_i}(L + M_i) = 0.$$

After canceling the common factor and rearranging we obtain (10a).

A-2 Full Set of Instruments: Derivation and Existence of Equilibrium

We start with an element from condition (11b) and make use of (12) to show

$$F_{LM}\frac{dM_i}{dt_i^m}+\frac{M_i}{L}=\frac{F_{LM}}{F_{MM}}+\frac{M_i}{L}=0, \tag{A1}$$

where the last equality is due to the constant returns to scale assumption.[14] Therefore the first order condition (11b) reduces to

$$\frac{dU_i^l}{dt_i^m}=u_c^l\frac{(t_i^m-g_i)}{L}\frac{dM_i}{dt_i^m}. \tag{A2}$$

Recall that $dM_i/dt_i<0$. Utility is increasing (decreasing) in the tax rate when t_i^m is smaller (greater) than g_i regardless of u^*. A necessary condition for utility maximization is therefore $t_i^m=g_i$. From the government budget constraint (4) follows $t_i^l=g_i$, and thus the financing rule (13b) is established.

Using (13b) in the other first order condition (11a), and using (12) and (A1), we obtain

$$\begin{aligned}\frac{dU_i^l}{dg_i}&= u_c^l\left[-\frac{F_{LM}}{F_{MM}}MRS_i^m-\frac{(M_i+L)}{L}\right]+u_g^l\\ &= \frac{u_c^l}{L}\left[M_i(MRS_i^m-1)+L(MRS_i^l-1)\right].\\ &= \frac{u_c^l}{L(L+M)}\left[s_i^m\cdot MRS_i^m+s_i^l\cdot MRS^l-1\right]\end{aligned} \tag{A3}$$

Utility maximization requires (A3) to equal zero, which proves (13a).

We next turn to the proof of existence for a particular class of utility functions. When preferences are quasi-linear and identical (*i.e.*, $u(c,g)=c+v(g)$) the marginal rate of substitution is the same for creative individuals and immobile workers. Utility of an immobile worker is then increasing (decreasing) in g_i when the MRS is above (below) 1, again regardless of the level of u^*. We conclude that he optimal government choice requires to set the public good level consistent with the rule $MRS(g)=1$. This determines uniquely the level of g due to strict concavity of $v(g)$. A symmetric equilibrium in which all cities follow the same strategy must then be an equilibrium because no deviation by a single city is profitable.

[14] This can be shown by differentiating $F(L,M)=LF_L(L,M)+MF_M(L,M)$ with respect to M.

A-3 Restricted Instruments: Existence of Equilibrium

We prove existence of a symmetric equilibrium for a particular specification of the model, namely when preferences are quasi-linear with logarithmic sub-utility, $u(c,g) = c + \ln g$, and quadratic constant returns to scale technology $F(L,M) = \alpha L + \beta M - \gamma M^2/L$, with $\alpha, \beta, \gamma > 0$. We assume that α and β are sufficiently large so that T^m and T^l can be paid out of labor income, $w = F_L = \alpha + \gamma(ML^{-1})^2$ and $b = F_M = \beta - 2\gamma ML^{-1}$, regardless of the distribution of creative individuals across cities. Note that the (symmetric) first best requires for the above specification $g^* = 1$, as $MRS^l = MRS^m = g^{-1}$.

The first order condition (14a) for optimization of a single city in the noncooperative game becomes

$$\begin{aligned} \frac{dU_i^l}{dg_i} &= \left(F_{LM} + \frac{T^m}{L}\right)\frac{dM_i}{dg_i} - 1 - \frac{M_i}{L} + \frac{1}{g_i} \\ &= (g^{-1} - 1)\left(\frac{M_i}{L} + 1\right) + \frac{T^m}{2\gamma g_i}, \end{aligned} \tag{A4}$$

which is positive for all $g_i \leq 1$ regardless of u^*. We now assume that a symmetric equilibrium with $g > 1$ exists. Setting the first order condition equal to zero, using symmetry and making use of the properties of the production function, the candidate for equilibrium is

$$\widehat{g} = 1 + \frac{T^m L}{2\gamma(\overline{M} + L)} > 1, \tag{A5}$$

which is greater than 1 and less than T^m if T^m is sufficiently large (otherwise $\widehat{g} = T^m$).

Given the specific functional form assumptions the second-order condition for utility maximization is negative for $g > 1$:

$$\frac{d^2U_i^l}{dg_i^2} = F_{LMM}\left(\frac{dM_i}{dg_i}\right)^2 - \frac{1}{L}\frac{dM_i}{dg_i} + \left(\frac{T^m}{L} + F_{LM}\right)\frac{d^2M_i}{dg_i^2} + v''. \tag{A6}$$

The last two terms are negative under the assumptions on preferences and technology, because $dM_i/dg_i = (2\gamma g)^{-1}L$ and thus $d^2M_i/dg_i^2 < 0$. The sum of the first two terms can be written as $(1 - g_i)(2\gamma g_i^2)^{-1}$, which is negative for $g_i > 1$. Therefore at the public good level $\widehat{g}$ identified in (A5) the second order condition is satisfied, and thus a local maximum is obtained. Moreover, the

objective function is strictly concave for all $g_i > 1$, increasing in g_i for $g_i < 1$, and continuous at $g_i = 1$. Hence $\widehat{g}$ is a best response when all other cities choose $\widehat{g}$, and thus $u^* = u^m(F_M(L, \overline{M}) - T^m, \widehat{g})$. The argument applies to all cities due to symmetry, and thus proves existence.

From the government budget constraint (5) and condition (A5) we can state the transfer to immobile workers to be

$$G^l = \frac{MT^m + LT^l - (\overline{M} + L)\widehat{g}}{L} = (T^m - 1) + T^l - 1 - \frac{T^m}{2\gamma}.$$

This is nonnegative when the tax rates and the parameter γ are sufficiently high. At the same time we need to satisfy the conditions $F_M > T^m > \widehat{g}$ in equilibrium. The first inequality can be guaranteed by choosing a sufficiently high level of β. The latter requires T^m to be sufficiently large and thus works in the same direction as the nonnegativity constraint on transfers to workers. There are enough degrees of freedom through parameter values β, γ, M, L to satisfy these constraints simultaneously.

A-4 Data Sources and Definitions used in Earnings Regressions

Individual Earnings Data: The earnings data are taken from the regional file of the IABS ("IAB–Beschäftigtenstichprobe"), a 2 % random sample from German social security accounts made available by the research institute of the Federal Employment Service (IAB) in Nuremberg. Detailed information is available from the institute's website.

The basic information in the IABS consists of social security insurance spells comprising the starting point and the end of an employment spell, the daily gross wage (excluding employers' contributions) and socioeconomic characteristics. We restrict the analysis to full–time working employees. For individuals with multiple spells we focus on the spell with highest income.

The IABS-REG dataset contains information for 343 regions. Most of these regions are identical with one of the 439 counties (rural and urban counties) in Germany. For reasons of confidentiality, adjacent counties in more sparsely settled regions are aggregated into larger regions. In these cases, the empirical analysis computes the regional control variables, such as the land price, as population weighted averages. From 343 regions, 261 regions are identical with a single county, 69 regions include two counties, 12 regions include three counties, and 1 region consists of 4 counties.

We focus on earnings in 2004.

Individual Characteristics: The IABS-REG data also provides us with a list of individual characteristics. This includes:

Age in years. Data reports age in the range between 17 and 61 years.

Gender is a binary variable with unit value for female employees.

University degree is a binary variable.

Vocational training (completed) is a binary variable.

Level of education (for the definition of high-level education, medium-level education, and basic education see above).

Regional variables: Besides individual-level variables, the analysis employs various regional characteristics.

Density: Total resident population in 2004 in relation to the settlement area in square kilometers both taken from the federal statistical office.

East Germany: Binary variable for regions located in former GDR. Berlin is treated as non GDR.

Land price obtained from the total sales of construction land in 2004 divided by the lot size, in EUR per square meter, taken from the federal statistical office.

Subsidy: Subsidies to theaters are taken from the statistical yearbook of the cities published by the German league of cities (*Deutscher Staedtetag*). The data covers all 744 public theaters in Germany located in 122 municipalities in the theater season 2003/2004. For the empirical analysis, the data is aggregated at district level. Per capita figures are obtained using total resident population in 1000 from the federal statistical office.

Share of employees with high-education: Number of employees with high-level education relative to all employees in a region in 2004. Own computation using IABS.

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