City Competition for the Creative Class

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Abstract

This paper explores the conditions under which decentralization and fiscal competition lead to a policy of providing public amenities in order to attract highly productive labor. It provides a theoretical analysis which shows that the incentive to provide such amenities is particularly strong, if institutional restrictions prevent local governments from adjusting their tax structure. The empirical analysis considers the case of Germany, where public subsidies to local theaters are shown to exert a compensating earnings differential for highly educated labor. Taking account of the institutional setting, our empirical results suggest that local jurisdictions in Germany are subject to a substantial fiscal incentive to subsidize cultural activities.

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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 and scientists among others. In order to attract the creative class a city needs to offer amenities and 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 highly productive labor, the policy implications are not obvious. One option might be to provide public subsidies to local cultural activities in the expectation that this may pay off in terms of a higher productivity of the local work force, and that 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 follow the same approach. In addition, in order to raise the attractiveness for *highly productive labor*, it might be more effective to rely on revenue instruments, such as taxes.

In accordance with the view that public subsidies for the arts may be an instrument for 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 ranked highest among developed countries. International comparisons by the National Endowment for the

Arts (2000) and Canada Council for the Arts (2005) show that 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 governments 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 the conditions under which 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 amenity in a simple general equilibrium model that distinguishes immobile workers and highly productive mobile labor. The empirical contribution of the paper is to explore the effects of local subsidies to the arts on the attractiveness of local jurisdictions for highly educated employees and the fiscal incentive to provide those subsidies using German data.

In the theoretical analysis, the provision of a cultural amenity by the local government makes a city more attractive to mobile individuals who capture the rents from the production process. The cultural amenity is modeled as a common-pool resource good: consumption is rival and non-exclusionary, capturing the idea that due to public support access to cultural activities is open to everyone at low ticket prices but capacity is limited. We label the good as public good or public amenity. The model assumes that a city's policy is controlled by a majority of immobile residents

with basic skills (= non creative). Even if these residents 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 to adjust the tax burden for the highly skilled, 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 the first-best level. However, if the local governments are restricted and have no autonomy to decide about the tax burden of residents, but share the revenues from the tax, as is the case with German municipalities, the outcome is different. More specifically, we find that the equilibrium outcome in this case is characterized by inefficient overprovision. The key mechanism is the following: the provision of the public good attracts more creative people which raises the wage of immobile workers when factors are complements. At the same time, the rents earned by creative people tend to fall – a compensating earnings differential arises. The public good tends to be overprovided because each city ignores the fiscal externality that arises when it attracts creative people 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 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 rather low from the perspective of the individual jurisdiction.

Though the basic theoretical finding is derived in a setting with constant returns to scale, the paper also discusses the case of increasing returns. Focusing on a case where increasing returns are limited, over-provision still arises despite increasing returns. Of course, if increasing returns were overly large, an inflow of highly educated individuals would trigger a cumulative process and full concentration of highly educated individuals in one jurisdiction would result. We argue that this

might be a relevant setting only for a few selective professions – from the available data such a (trivial) spatial distribution of highly educated individuals is not generally found.

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 enables them to sell tickets at substantially reduced prices. 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. Our findings show that cultural subsidies paid to local theaters tend to give rise to a compensating earnings differential for highly educated labor: An increase in per capita spending on theaters and operas by 10 Euros would reduce earnings by about 0.6%. A compensating earnings differential is not found, however, for the majority of the workforce with basic education. Based on the empirical results and on the regional productivity effects of highly educated labor as estimated in the empirical literature (*e.g.*, Moretti, 2004), we provide a quantification of the fiscal incentive to provide subsidies to theaters in the institutional setting faced by the German jurisdictions. Our 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 25%. In other words, an increase in subsidies by 1 Euro would need only 75 cents of funding from the perspective of the individual jurisdiction. This effect is driven by both the rise in the attractiveness for employees with high education and by the implications for local productivity.

These findings suggest that the substantial amount of local subsidies to the arts in Germany can partly be explained by 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 highly productive labor. Instead, they expand 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 possible 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 educated individuals is positive but may be outside of the control of the local government.

Our analysis emphasizes effects of a skill complementarity between labor with low level of education and highly educated, creative individuals which has recently been used to explain spatial sorting among US cities (Eeckhout, Pinheiro and Schmidheiny, 2013). Our empirical finding that cultural subsidies tend to be associated with lower earnings of people with high education is related to the literature on the capitalization of local amenities into wages and rents (Rosen, 1974, Roback 1982, Bloomquist, Berger, and Hoehn, 1988, Clark and Kahn, 1988, and Albouy, 2009). Bakhshi, Lee, and Mateos-Garcia (2013) find a compensating earnings differential associated with the number of cultural institutions per capita in England. Evidence for the effects of subsidies is lacking, however. The negative earnings effect for the highly educated is consistent with the literature on the creative class, according to which urban success comes from being an attractive "consumer city" for high skilled people (Glaeser, 2005, Carlino and Saiz, 2008). However, in the light of the theoretical framework provided, 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 labor 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 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 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 individuals M. The production function $F(L, M)$ is identical across regions and features constant returns to scale. Later we will discuss the case of increasing and decreasing returns to scale. We assume positive but diminishing marginal products for each factor ($F_L, F_M > 0 > F_{LL}, F_{MM}$), and in addition that factors of production are complements ($F_{LM} > 0$).[1] The private consumption good is the numeraire, whose price is set equal to 1, and which can be used for production of a publicly provided private good g at a marginal rate of transformation of one. In abuse of terminology, we use the term "public good" for g even though in fact it is a rival and non-exclusionary good like a common pool resource good. 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

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

which will be equivalent to $b = F_M(L, M_i)$ with constant returns to scale.

[1] The latter assumption may be relaxed under increasing returns (see below).

Workers derive utility from a private consumption good and a public good that is supplied in the jurisdiction where they work and live.[2] 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. In the context of our application - theaters and opera houses in Germany - we can view g as a theater's seating capacity in proportion to the number of residents.

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 a 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

[2] In the following, we use a jurisdiction index only where necessary to avoid confusion.

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 rate on a creative indivdiual t_i^m and an immobile worker t_i^l might be negative (although not both at the same time), in which case government revenue is redistributed toward that group.

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 at least partially to the local jurisdiction. The government has some spending flexibility by using tax revenues either for the public good g or for a redistributive cash transfer $G^l \geq 0$ to immobile workers. We call this *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 the efficiency effects and distributional consequences from 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

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

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 $t_i^l = T^l - G_i^l$. The absence of cash transfers to creative individuals in the restricted instruments case seems broadly 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, reductions in fees for locally provided public services, *etc.*

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

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

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, a private good consumption level 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, $\sum_{i=1}^{N} M_i = N\overline{M}$. (8)

Recall our assumptions that the public good level g and the redistributive transfer G^l are nonnegative, and the exogenous tax rates T^l and T^m are positive.

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 rate of substitution for a worker and a creative person, where we omit the region index for notational convenience $MRS^l(c^l, g) = \frac{u_g^l(c^l,g)}{u_c^l(c^l,g)}$ and $MRS^m(c^m, g) = \frac{u_g^m(c^m,g)}{u_c^m(c^m,g)}$. In addition, we define population shares in region i for immobile workers and creative individuals $s_i^l = L/(L + M_i)$ and $s_i^m = M_i/(L + M_i)$, 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-like rule in the context of a publicly provided private good: the sum of the population share weighted marginal rate of substitution of an immobile worker and a creative individual equals the marginal costs for providing the good.

Condition (10b) states 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. It can be characterized as a locational efficiency condition ensuring that a reallocation of creative individuals does not create a net gain. In other words, the net social benefit of a creative person should be the same in all regions. Since the analysis focuses on a symmetric case $L_j = L$, this condition is usually fulfilled also in a decentralized setting, if preferences and production technology are identical across jurisdictions.

Condition (10a) 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 feasiblity (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 quasilinear of the form $u(c, g) = c + v(g), \quad \text{with } v' > 0 > v''$. In that case income effects are ruled out and the marginal rate of substitution is independent of the level of private consumption.

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 resident workers 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 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 a function of the region's policy instruments via mobility constraint (3). The optimization problem leads to two first order conditions

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

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

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

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

Taxes on creative people lower M, while a higher supply of the public good raises M. Combining the derivatives (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. The second condition, (13b), gives the financing rule. The public good is funded through user fees that are independent of type. Hence there is no redistribution and the locational equilibrium condition (10b) holds. When the equilibrium is symmetric, 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 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, this does not mean that tax rates are zero by assumption. In the German context, which is considered in the empirical analysis below, income tax rates are set at the federal level, but (portions of) the tax revenues accrue to local jurisdictions. We make the assumption that creative individuals earn more than immobile workers and thus pay higher taxes, *i.e.* $T^m > T^l$. In addition we assume that the tax rate on creative individuals T^m is constant across regions and greater than the level that is necessary to provide the first-best level of g^*, that is $T^m \geq g^*$. Each city government now controls the public good level g and the transfer

to immobile workers G^l.[3]

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 per worker, and the total net cost of public good funding for creative individuals divided by the population of immobile workers. The first order condition to the above problem reads

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

The supply of the public good has three 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 net contribution to the government budget $T^m - g_i$ coming along with an inflow of a creative individual. The supply of g_i is costly however, which represents the third effect. 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

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

[3]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 we work out a specific model and demonstrate the consistency of all assumptions.

A comparison of the first-best rule (10a) and condition (14b) indicates an inefficiency effect arising from the positive but exogenous tax on creative individuals T^m. The two conditions coincide if and only if $T^m = g^*$, where g^* is the first-best level of the public good. If this condition were to hold, the tax transfer system would resemble a pure fee financing mechanism for public good provision without redistribution: The government budget constraint (5) together with our assumption $G^l \geq 0$ requires then $T^l \geq T^m$. We assume, however, that mobile individuals pay more, thus proving the claim. Put differently, when a creative mobile individual pays more taxes than an immobile worker (absolutely, not necessarily relative to their income), the right-hand side of condition (14b) must be less than 1 because $T^m > g_i$.[4] It follows that the perceived marginal cost of providing the public good is reduced below the social cost. 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 net government 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 with constant returns to scale and complementarity between unskilled labor and creative individuals.

a) The allocation is efficient in the case of a full set of instruments (t_i^l, t_i^m, g_i), but inefficient when the set of instruments is restricted (g_i, G_i^l) and exogenous tax rates obey the condition $T^m > \max\{T^l, g^*\}$.

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

[4]The tax T^m is not only larger than first-best level g^*, but must also be larger than the equilibrium provision level of g, because $g > T^m > T^l$ would imply $G^l < 0$.

Proof: Part a) follows immediately by comparison of (10a), (13a) and (14b), and the above discussion. When preferences are quasilinear 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. 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 set of instruments is restricted, in which the fiscal effect is positive for $T^m > g$. Via the choice of g the government simultaneously tries to redistribute towards immobile workers and finances 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 individual are higher than the optimal level of g.[5] Note that the proposition holds regardless of whether the preferences of creative individuals are more or less in favor of the public good than those of immobile workers. What is required is, of course, that the public good matters and hence affects the location decisions of creative people - but it is not required that this population group has a particular strong preference for the public good.

[5]In a previous version of the paper we analyze the normative properties of the equilibrium with restricted instruments by comparing the equilibria with and without mobility of the creative class. Mobility makes creative individuals better off, while immobile workers are worse off, compared to no mobility. Interestingly, without mobility the public good is underprovided because immobile workers do not properly account for the utility derived from the public good by creative individuals. Detailed results are available upon request.

2.3 The Effects of Returns to Scale

In the base version of the model we assumed constant returns to scale in production, which serves as a benchmark and simplifies the algebra. Yet, in practice non constant returns to scale, in particular increasing returns to scale, are likely to play an important role. We now show that our main conclusion is reasonably robust to assuming moderate levels of decreasing returns and increasing returns to scale. Our analysis of increasing returns to scale is also an important input for our quantification exercise in section 4. Recall that the first best is characterized by conditions (10) regardless of technology. With restricted instruments, if we give up the constant returns to scale assumption, condition (14b) becomes

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

When $b > F_M$, reflecting decreasing returns to scale, the right-hand side becomes larger *ceteris paribus*, because both the numerator and denominator of the second term are negative. Public good provision tends to be reduced relative to the constant returns to scale case. There is still overprovision relative to the first best as long as the 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 $F_M - LF_{LM} < b$, the new effect showing up in (16) is negative and reinforces the tendency for oversupply of the public good. The first condition reflects the fact that with increasing returns an increase of highly educated individuals exerts a positive externality on local productivity. From eq. (2) the second condition is equivalent to the statement that the earnings of a creative individual fall if their number is increased. We make this assumption in the following, which implies that the degree of increasing returns to scale is not overly large. With stronger increasing returns, an inflow of highly educated

individuals would trigger a cumulative process and full concentration of highly educated individuals in one jurisdiction would result.[6] Note that with increasing returns to scale the assumption of complementarity can be relaxed. In fact, in this case the fiscal incentive is robust against some degree of substitutability (in the sense of $F_{LM} < 0$) when the second term on the right-hand side of eq. (16) is not too large compared to the third term (in absolute terms).

The effect associated with non-constant returns to scale is caused by the effect of the number of creative individuals on the incomes of immobile workers. We know from equation (2) that the earnings of a creative individual are determined by $b = \frac{F - LF_L}{M}$. By differentiation and using (1), we can determine the marginal effect of the number of creative individuals on immobile labor income

$$LF_{LM} = -\frac{\partial b}{\partial M} M\,(1 - z)\,, \text{ with: } z := (F_M - b)/(F_M - LF_{LM} - b).$$

Note that the sign and size of the new term on the right-hand side of (16) also depends on the term z. This term is zero with constant returns to scale. In this case, the increase in the incomes of immobile labor is corresponding to the decline in the incomes of creative individuals. However, in the case of increasing (decreasing) returns to scale, z is negative (positive). With increasing returns, the increase in the incomes of immobile labor exceeds the decline in earnings of the creative individuals in absolute terms. In this case, the right-hand side of (16) is further reduced and the public good tends to be even more oversupplied. By contrast, in the case of decreasing returns, the oversupply effect is reduced through the new term on the right-hand side of (16).

The two cases can be illustrated for the case of a generalized Cobb-Douglas production function $F(L, M) = L^{\alpha} M^{\beta}$, where $1 > \alpha, \beta > 0$. In this particular case z becomes $z = (\alpha + \beta -$

[6] Full concentration might be a relevant setting for a few selective professions, yet as shown below from the available data for Germany such a (trivial) spatial distribution of highly educated individuals is not generally found. Also US data do not suggest that increasing returns are overly large.

$1)/\left((\beta-1)(1-\alpha)\right)$. With increasing returns to scale $\alpha+\beta>1$ and z is negative.[7] By contrast, when $\alpha+\beta<1$, z is positive. However z is small when decreasing returns to scale are not too large. For example, when $\alpha=\beta$ we obtain $z=(1-2\alpha)/(1-\alpha)^2$, which converges to zero for α approaching 0.5.

3 Subsidizing Culture as Location Policy: Empirical Evidence

The theoretical analysis has explored the role of mobility of creative individuals for the public provision of an amenity good. It has shown that if jurisdictions are restricted and have no discretion in setting the tax burden on residents, a fiscal incentive to provide this good emerges. Due to the attraction of the creative class, the marginal cost of public funds as perceived by the local government is reduced relative to the marginal cost of funds in the first-best allocation, chosen by a benevolent federal planner. Directly testing for "over-subsidization" of the arts due to mobile skilled workers would require to define some benchmark level of subsidization and to check whether the actual subsidization under mobility exceeds this level. To do so, one might think of comparing subsidization by restricted jurisdictions that are differently exposed to mobility. In the context of international competition for capital, for instance, openness operationalized by the lack of capital controls has often been used to identify differences in mobility (*e.g.*, Slemrod, 2004). However, international comparisons on subsidies to the arts are scarce, and it would be difficult to control for institutional differences which also matter as the theory emphasizes. With regard to jurisdictions within countries, where institutions are more similar, however, it seems difficult to establish differences in mobility. Facing a lack of opportunity to identify differences in mobility empirically,

[7] We also assume that both α and β are less than one each, which is in line with our assumption above that increasing returns to scale are not too strong.

the empirical section does not directly test the equilibrium prediction of the theoretical model, but rather checks whether the key mechanism underlying the theoretical results is consistent with the empirical evidence in a country with inter-jurisdictional competition and restricted tax instruments. More specifically, the theory argues that, if increasing returns are not too large, public spending tends to attract creative individuals such that in the equilibrium their earnings tend to be lower in places that spend more on the amenity good. In this section we explore whether this hypothesis can be validated by an empirical analysis of public subsidies to arts and culture. Our empirical testing ground is the financial support of public theaters in Germany. This is promising for an empirical analysis since the institutional setting fits into the case of restricted jurisdictions: while German municipalities have a large degree of autonomy on the expenditure side of the budget, they cannot adjust the income tax burden on residents.

A large literature on location choice 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 (*e.g.*, Blomquist, Berger, and Hoehn, 1988), cultural activities have not been the focus of much interest. An exception is Clark and Kahn (1988), who use a hedonic wage approach to test for cultural amenities. In a recent study, Bakhshi, Lee, and Mateos-Garcia (2013) find a compensating earnings differential associated with the number of cultural institutions per capita in England. 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). Also for Germany, empirical research supports the assumption that low-skilled workers are less mobile. Arntz (2011) argues that the mobility of unemployed workers with low

skills is lower than for unemployed with higher skills. This effect is attributed to the design of federal unemployment and welfare benefits in Germany. Table A-1 in the appendix provides some empirical evidence on revealed mobility and intended mobility based on German survey data. More specifically, the table reports results from the "Perspektive Deutschland" (PD) survey taken online among more than half a million German households (see Fassbender and Kluge, 2006). Controlling for age, age squared, income, and gender we find that the probability that someone has actually relocated is increasing with education level. It is about 20% higher if this person has a university degree as compared to an unskilled worker (which is the omitted category). A similar pattern is found when focusing on intended mobility, *i.e.* on those respondents that have answered "yes", or, "perhaps" on the question of whether they would be willing to relocate to a different place with at least 100 kilometers of distance.

While evidence supports higher mobility of individuals with high education levels, whether cultural activities also matter for location choice and in particular for those with higher education is not obvious.

3.1 Survey Evidence on Culture as Location Factor

Table 1 provides an overview of motives behind location decisions derived from German survey data. The "Perspektive Deutschland" (PD) survey also asked respondents that have moved into the current region during the last 10 years about their key motives for choosing the current location (see Fassbender and Kluge, 2006).

Consistent with our key hypothesis, 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,

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

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." Column (2) of Table 1 reports figures for the subsample 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 higher (12.68%), and leisure and cultural offerings is among the four most important reasons for coming to the region.[8]

3.2 Public Theaters and Subsidies in Germany

While the survey evidence suggests that jurisdictions with rich cultural offerings are more attractive for highly educated people, given multiple location factors it is not clear how strong the effect on actual location decisions is. Moreover, the role of local government subsidies in this context is not obvious, as cultural activities may form endogenously – without public intervention.

Some insights in the public support for theaters is provided by Table 2. It reports summary statistics on public theaters among the German counties in 2004, including urban counties, aggregated into 343 regions. Population size ranges from about 240 Thousand to 3.4 Million (Berlin). About a third of these regions (113) contains one or more public theaters, which often includes also an opera house and a ballet.

The lower part of the table focuses on the 113 regions where at least one public theater is located. Own revenues basically captures ticket sales, subsidies refers to public support. Note that public

[8]Comparing group means, the share of respondents that count "leisure and cultural offerings *etc.*" among the most important location factors, is significantly higher by 5 percentage points among the group of full-time working respondents with higher education than among other respondents that also relocated within the last ten years.

Table 2: Summary Statistics on Public Theaters in Germany

Variable	Mean	Std. Dev.	Min	Max
all regions				
Population (in 1000)	240.5	232.9	97.75	3,388
Public theater exists (binary)	.329	.471	0	1
Public theater existed in 1936 (binary)	.292	.455	0	1
regions with public theaters only				
Population (in 1000)	317.5	374.6	99.31	3,388
Theater existed in 1936 (binary)	.850	.359	0	1
Own revenues (in 1000 Euro)	3,406	6811	68	54,763
Subsidies (in 1000 Euro)	18,631	24,424	377	162,689
Subsidies from state & fed.gvmts. (in 1000 Euro)	7528	12,421	0	99,562
Own revenues (Euro per capita)	9.536	6.928	.284	42.45
Subsidies (Euro per capita)	62.48	44.90	.930	241.7
Subsidies from state & fed.gvmts. (Euro per capita)	33.85	28.60	0	123.6

Descriptive statistics for 343 regions defined by the IABS emploment sample (see below). If not noted otherwise figures refer to 2004. Per capita figures refer to resident population. Own calculations. Sources include the statistical yearbook for German municipalities 2006 and 1938 as well as the official population figures for rural and urban counties in 2004 from the federal statistical office.

support (almost 62 Euros per resident) easily outweighs own revenues (about 10 Euros per resident), pointing at a substantial rate of subsidization. The subsidization comes from local as well as from upper level governmments, *i.e.* from state and federal governments. However, more than half of all subsidies are provided by the municipalities. A specific feature of public theaters in Germany is the long tradition in the public support. This is highlighted by the fact that 85% of the regions that host a public theater in 2004 have already hosted a public theater 70 years ago.

3.3 Testing for Compensating Earnings Differentials

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 of highly productive labor. A potentially powerful test is obtained by an empirical analysis of individual earnings. If full concentration of highly productive labor can be excluded and if cultural subsidies provided by a jurisdiction really matter for location choice, they should give rise to a compensating earnings differential.

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 in 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 gender, age and education. The latter is important since we want to focus on highly educated individuals.

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 employ censored quantile regression techniques (Chamberlain, 1994). More specifically, we group our data into cells of individuals with same level of education and the same gender, and which are working in the same region. For each of the cells we determine the median wage rate and then regress all uncensored observations on cell characteristics using weighted least squares. The list of cell characteristics includes the subsidies paid to local theaters in the region.

Using the information on education and qualification in the IABS data we define highly educated individuals as employees with high-level education such as technical college or university degrees. Focusing on the spells with highest earnings there are 41342 observations. We also form a comparison group of individuals with basic education but without university or technical college degrees. This group comprises 244919 individuals with some standard level of schooling (*Volks-, Haupt-,Realschule mit Berufsausbildung*) and vocational training.

The upper part of Table 3 provides descriptive statistics on individual characteristics by education group. Note that the share of uncensored observations is relatively large for individuals with basic-level education but lower for those with high-level education.

3.4 Identification of Subsidy Effects

A potential problem with testing for compensating earnings effects of subsidies among highly educated labor is that local government support to the performing arts might be endogenous. To identify effects of government subsidies the analysis below rests on the tradition of public theaters as well as on the support by state and federal governments. In places with a long-tradition of

Table 3: Descriptive Statistics

Variable	High-level education		Basic-level education	
	Mean	Std. Dev.	Mean	Std. Dev.
Gross compensation of uncensored earnings spells[1]	116.3	33.95	81.06	31.68
Age	41.13	9.04	40.4	10.7
Univ.degree	0.627	0.483		
Female	0.294	0.456	0.363	0.481
Observations/uncensored only	41342/27423		244919/235860	

Own calculations based on IABS, a 2 % random sample from German social security accounts (IABS). Descriptive statistics refer to 2004. [1] The gross compensation refers to remuneration per day. The median is uncensored and has a value of Euro 142.

Variable	Mean	Std. Dev.	Min	Max
Regional variables				
Subsidy per capita (€ 1000)	0.021	0.039	0	0.242
State and federal subsidies, only*	0.009	0.021	0	0.118
Publicly funded theater exists (binary)	0.329	0.470	0	1
Publicly funded theater existed in 1936 (binary)	0.292	0.455	0	1
East Germany	0.222	0.416	0	1
Population	240528	232716	97751	3387545
Density	1995.7	1002.6	631.8	5652.3
GDP per capita (€ 1000)	25.01	9.56	12.94	85.37
Land price per sq.meter*	98.5	92.8	6.68	707.6
Amenity variables				
Sunshine (100 hours)	16.13	1.191	10.47	18.79
Emissions (tons per sq.km)	6.060	9.970	0.061	80.2
Forest area (%)	27.56	14.41	1.5	64.8
Water area (%)	2.368	2.627	0.2	28.2
Tourism (stays per 1000 residents)	4.167	4.927	0.2	40.4
Metropolitan (bin)	0.379	0.485	0	1
Peripherality (min)	99.85	35.35	33	220.0
Poverty (welf.recip. per 1000 residents)	28.68	15.46	4.2	118.5
Leisure facilities	0.214	0.067	0.043	0.387
Crime	0.189	0.072	0.032	0.480
Accessibility	0.283	0.115	0.055	0.632
Education	0.308	0.060	0.155	0.519

Descriptive statistics for 343 districts. * Due to missing values statistics for land prices are based on 324 regions and state and federal subsidies are based on 341 regions. Density measured as population size per square kilometer of the settlement area of the district. For definitions of amenity variables, see appendix.

public theaters the willingness to use public funds in order to sponsor cultural activities might be particularly large and also the incrementalism in public budgeting may result in a stronger support of established institutions (Krebs and Pommerehne, 1995). To capture the local tradition of public theaters, we employ a binary variable which reflects the presence of a public theater before World War II.[9] Despite the severe economic and political shocks that have affected the regions in Germany since then, statistical sources indicate that most of the public theaters can be traced back to pre-war times. The likelihood to observe a public theater in 2004, if a public theater existed in 1936, is high in both parts of Germany. In the western part, 86% of the regions hosting a public theater in 2004, have already done so in 1936. In the eastern part (excluding Berlin) this share is only slightly smaller with 83%.[10]

The set of instruments also includes subsidies received only from state and federal governments. While current subsidies to the performing arts by local government might respond to the earnings of the highly educated, state or federal programs are less sensitive to local conditions.[11] Given the constitutional requirement to support the cultural infrastructure,[12] the state and federal support of local theaters is fixed in specific chapters in the federal or state budget laws. Hence, the exact amount and mostly also the detailed purpose of the funding in terms of personal, maintenance, investment *etc.* is specified for each theater that receives support. Hence, in contrast to matching

[9]Focusing on opera houses, that have been founded in the baroque era, Falck, Fritsch, Heblich (2011) exploit the historic tradition in arts and culture in order to identify the effect of highly educated on regional economic growth.

[10]Note that the local tradition of public theaters is not simply reflecting the presence of historical amenities in the sense of Brueckner, Thisse, and Zenou (1999). With its location in the city centers many of the public theater buildings were destroyed in the second world war. The statistical yearbook for municipalities in 1949 reports results from a survey among theaters in the western part of Germany and noted that due to destruction only in 11 out of 48 cities the original buildings were still used for performances after the war.

[11]In the IV estimates we exclude the city states of Berlin and Hamburg, where state grants can not be distinguished from city funds.

[12]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).

grants the support is predetermined and does not vary by the amount of local subsidies paid by the individual municipality.

The lower part of Table 3 provides descriptive statistics for regional characteristics. We include public subsidies – both in terms of all subsidies and subsidies received only from upper level governments. We also include population density to control for an urban wage premium, GDP per capita as an indicator of average productivity, and a dummy for eastern Germany. In order to test whether other characteristics might cause some spurious correlation between theater subsidies and wages, we include an indicator of the local land price or a list of amenity indicators that have been used to predict land-price differences across regions in Germany (Buettner and Ebertz, 2008). This list includes hours of sunshine, industry emissions, shares of land covered by forests and water, tourism, metropolitan status, travel time to next agglomeration, poverty, and survey indicators of leisure facilities, crime, accessibility and education.

3.5 Empirical Effects of Theater Subsidies

Columns (1) to (6) in Table 4 provide results for the earnings of those with high-level education. 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. All specifications also include a full set of employment shares for the available 2-digit industry classification (18 industries) for each region.

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 specification (1), subsidies to theaters exert a significant effect on earnings. The specification in column (2) adds regional GDP per capita to control for average differences in regional productivity. While this control exerts a significant positive effect, the subsidy effect proves robust. Since the subsidy variable is scaled in terms of 1000 Euro per capita, the point estimate indicates that an increase in subsidies by 10 Euro per resident is associated with a decline in earnings by about 0.8%.

In order to test for possible endogeneity effects, column (3) reports instrumental variables (IV) estimates using subsidies from state and federal governments as well as the existence of a public theater in 1936 as instrumental variables. The overidentification test indicates that the instruments satisfy 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 in 1936 exert strong positive effects on total subsidies. Note also that the coefficient of federal and state grants on total subsidies is not significantly different from unity. This suggests that there is a 1:1 relationship between subsidies received from the state or the federal government and total subsidies: local subsidies are not increased when receiving more state and federal grants, as would be the case with matching grants. Consistent with the "zoo effect" (Oates, 1989), according to which larger cities provide more services, also population density shows strong positive effects on subsidies. The first stage regression also shows that subsidies tend to increase with higher GDP per capita. In the second-stage regression, the empirical effect of total subsidies is confirmed. The point estimate indicates that an increase in subsidies by EUR 10 per resident is associated with a decline in earnings by about 0.8%.

The two-step approach employed in order to study the determinants of the median wage rate rests on the assumption that the cells of observations with the same region, gender and education are

Table 4: Earnings Effects of Theater Subsidies

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age	0.076 **	0.076 **	0.075 **	0.164 **	0.071 **	0.075 **	0.114 **	0.120 **
	(0.021)	(0.021)	(0.021)	(0.033)	(0.021)	(0.020)	(0.019)	(0.019)
Age^2	-0.001 **	-0.001 **	-0.001 **	-0.002 **	-0.001 **	-0.001 **	-0.001 **	-0.001 **
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Univ.Degree	0.133 **	0.133 **	0.133 **	0.101 **	0.135 **	0.132 **		
	(0.013)	(0.013)	(0.013)	(0.015)	(0.014)	(0.013)		
Female	-0.293 **	-0.294 **	-0.294 **	-0.210 **	-0.291 **	-0.296 **	-0.182 **	-0.181 **
	(0.017)	(0.017)	(0.017)	(0.019)	(0.017)	(0.017)	(0.007)	(0.007)
East	-0.194 **	-0.174 **	-0.176 **	-0.223 **	-0.139 **	-0.158 **	-0.314 **	-0.344 **
	(0.035)	(0.033)	(0.032)	(0.042)	(0.032)	(0.036)	(0.013)	(0.016)
log Density	0.091 **	0.096 **	0.098 **	0.102 **	0.063 **	0.113 *	-0.016	0.064 **
	(0.028)	(0.027)	(0.028)	(0.038)	(0.028)	(0.062)	(0.011)	(0.018)
log GDP p.c.		0.105 **	0.103 **	0.064 *	0.076 **	0.091 *	0.086 **	0.130 **
		(0.035)	(0.036)	(0.036)	(0.037)	(0.049)	(0.015)	(0.017)
log Land price					0.048 **		0.056 **	
					(0.017)		(0.005)	
Subsidy	-0.549 **	-0.800 **	-0.810 **	-0.802 **	-0.563 **	-0.601 **	-0.078	-0.042
	(0.243)	(0.248)	(0.258)	(0.322)	(0.251)	(0.275)	(0.150)	(0.157)
Constant	3.074 **	2.651 **	2.637 **	0.783	2.873 **	2.675 **	1.841 **	1.186 **
	(0.470)	(0.456)	(0.448)	(0.815)	(0.469)	(0.669)	(0.385)	(0.426)
Industry controls	yes	yes	yes	yes	yes	yes	yes	yes
Amenity controls	no	no	no	no	no	yes	no	yes
Instrumental variables	no	no	yes	yes	yes	yes	yes	yes
N. of all cells	1357	1357	1349	491	1274	1345	648	680
N. of uncensored cells	1222	1222	1214	411	1149	1210	648	680
R-squared	0.361	0.401						
Overid.Test			0.15(.69)	2.16(.14)	0.60(.44)	0.77(.38)	0.05(.82)	0.02(.88)
Weak Id.Test			135.4	68.93	118.5	92.38	114.7	89.7

Dependent variable: log earnings for highly educated employees in columns (1) to (6), and for employees with basic education in columns (7) and (8). Weighted least squares regression results for the median earnings using weights reflecting the inverse probability of censoring. Cells are defined for region, gender and university education if applicable. All regressions include a full set of regional employment shares for 18 industries. Manufacturing is chosen as the reference category. Specifications reported in columns (6) and (8) include controls for differences in sunshine, industry emissions, shares of land covered by forests and water, tourism, metropolitan status, travel time to next agglomeration, poverty, and survey indicators of leisure facilities, crime, accessibility and education. Columns (1) and (2) display weighted least squares estimates. Columns (3) to (8) report weighted instrumental variable estimates using subsidies from upper level governments and a presence of a public theater in 1936 as instruments. Column (4) reports estimates including only those empirical cell quantiles with minimum cell size of 20 observations. Heteroscedasticity robust standard errors allowing for region-level cluster effects in parentheses. An asterisk indicates significance at 10% level, two asterisks at 5% level. Overidentification test refers to the Hansen-J statistic, p-value in parentheses, the test for weak instruments reports the Kleibergen-Paap F statistic.

large enough to provide reasonably precise estimates of the median wage. To check whether the results are robust against exclusion of cells with few observations, the specification in column (4) discards all cells with less than 20 uncensored observations. Although this has a substantial effect on the number of observations the empirical results are qualitatively similar and also the point estimate for grants proves robust.

In column (5) we report IV-results where the set of explanatory variables includes an indicator of the local land price. Including this variable enables us to provide some further test whether the empirical relationship between subsidies and wages is 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. Regions with natural amenities, for instance, might provide lower subsidies while still displaying lower earnings of those with higher education. However, since the land price is not available for all jurisdictions, the estimation sample is reduced. Nevertheless, the per-capita subsidy to theaters is found to exert significant effects. The point estimate indicates that an increase in subsidies by EUR 10 per resident is associated with a decline in earnings by about 0.6%. Column (6) provides IV results obtained after inclusion of a list of standard amenity variables that have been used in the literature to predict land-price differences across regions in Germany (Buettner and Ebertz, 2008). The specification uses 12 indicators, capturing differences in sunshine, industry emissions, shares of land covered by forests and water, tourism, metropolitan status, travel time to next agglomeration, poverty, and survey indicators of leisure facilities, crime, accessibility and education. However, the results are not much affected. The point estimate for grants is quite similar to the result reported in column (5).

Columns (7) and (8) use the same estimation technique to test whether theater subsidies also exert

significant effects on the wage rate of employees with basic education. Regardless of whether the land price or a vector of amenities is included no such effects are found. Since workers with basic-level education tend to be less mobile relative to highly educated employees,[13] subsidies should be expected to cause compensating earnings effects only for the latter. Given that the estimation controls for the productivity differences by means of industry employment shares and GDP per capita, the insignificant effect does not contradict positive capitalization effects on the wages of workers with basic education that would emerge under complementarities.

Our empirical results, thus, are consistent with the view that providing public subsidies generates amenities which attract highly educated individuals. The point estimates obtained from the IV approach suggest that an increase in subsidies by EUR 10 per resident is associated with a decline in earnings by about 0.6% or more, depending on the specification. Based on the median of the earnings distribution of employees with high-level education, the implied decrease in net income amounts to some 115 Euro per year.[14] Though this is sizeable effect it is not unreasonably high. It should also be noted that this figure refers to the small group of highly educated employees, which has a population share of about 3% only, and, thus, does not reflect the average willingness to pay. 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 publicly sponsored cultural activities, such as museums and exhibitions. However, note that the amenity list includes an indicator of leisure facilities. Hence, our finding can not be explained by a correlation with government support for other types of leisure such as sports and recreation.

[13]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.

[14] With a median of gross earnings of Euro 142 per day (see table 3), with 253 labor days in 2004, and applying standard taxes and social security contributions, the associated decrease in net incomes earnings of those with high-level education is about 115 Euro per year.

Note that in the light of the theory, the empirical finding that higher subsidies contribute to lower earnings of highly educated individuals does not directly imply that the individual jurisdictions would have an incentive to expand subsidization. Though an expansion of subsidies would attract more high-skilled workers, with restricted tax instruments higher subsidies show up in a lower direct transfer to immobile labor G^l, which results in less consumption of the private good. In the resulting equilibrium, the government refrains from expanding the subsidies, as it takes account of the associated cost for immobile labor.

4 Quantification of the Fiscal Incentive to Provide Subsidies

In the light of the empirical evidence this section explores the implications of the empirical effect of theater subsidies on the earnings of highly educated and quantifies the fiscal incentive to provide such subsidies.

Comparing the first-order condition in the case with restricted instruments 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 equal to

$$1 - \Delta \text{ , with } \Delta = (T^m - g) \frac{M}{L+M} \left(\frac{1}{M} \frac{dM}{dg} \right).$$

Δ depends on the marginal effect of public good provision on the number of creative individuals. The above empirical analysis has shown that public good provision has a compensating earnings effect for those with higher education. This effect can be decomposed into the attraction of creative

individuals due to amenities and the effect of the number of these individuals on their remuneration

$$\frac{db}{dg} = \frac{\partial b}{\partial M}\frac{dM}{dg}.$$

Inserting and rearranging terms,

$$\Delta = (T^m - g)\, s^m \left(\frac{\partial b}{\partial M}\frac{M}{b}\right)^{-1} \left(\frac{1}{b}\frac{db}{dg}\right),$$

where $s^m = \frac{M}{L+M}$ denotes the population share of those with higher education, as above. With a generalized Cobb-Douglas production function $\frac{\partial b}{\partial M}\frac{M}{b}$ depends on the production elasticity of creative individuals β, and we have

$$\Delta = (T^m - g)\, s^m \left(\frac{1}{\beta - 1}\right) \left(\frac{1}{b}\frac{db}{dg}\right).$$

With increasing returns to scale, we know from equation (16) that we have a further effect which depends on the marginal rate of substitution. Assuming the marginal rates of substitution for creative individuals and immobile labor are equal, $MRS^m = MRS^l = MRS$, we can rewrite condition (16) in the form

$$MRS = \frac{1}{1 - s^m z}\,(1 - \Delta), \tag{17}$$

where z is negative under increasing returns to scale. The right-hand side represents the marginal cost of public funds. As we have noted above, with a generalized Cobb-Douglas production function z depends on the production elasticities $z = (\alpha + \beta - 1)/\left((\beta - 1)(1 - \alpha)\right)$.

To quantify the effect on the marginal cost of funds, we need not only an estimate of the compensating earnings effect but also empirical estimates of the local production elasticities of creative

individuals and immobile labor. Using US matched employer-firm data, Moretti (2004) has obtained empirical estimates for college graduates as a higher education group, referred to as skilled workers, and other labor, referred to as unskilled workers. As a caveat, we should note, however, that type and quality of education might differ substantially between the US and Germany. However, though the definitions differ we consider these to be the best available estimates for our case.[15] Moretti (2004) distinguishes two effects of skilled workers. There is a direct effect of the skilled workers among the employees of each firm with a point estimate of the production elasticity of 0.382. And, there is also an indirect effect from college graduates employed by other firms in the region. Combining the two effects, at an average share of college graduates in the local economy the total production elasticity of skilled workers is about 0.513. The point estimate of the production elasticity of unskilled workers is estimated with 0.47, and the production elasticity of capital is estimated with 0.178. If capital is mobile such that the return on capital is uniform across jurisdictions, the relevant production elasticities in our setting would be the production elasticities relative to 1 minus the production elasticity of capital, *i.e.* 0.624 ($= \frac{0.513}{1-0.178}$) for those with higher education and 0.572 ($= \frac{0.47}{1-0.178}$) for other labor.[16,17]

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 with EUR 750.[18] g can be approximated by the average amount of local theater subsidies – excluding

[15]Note that the share of employees with higher education in our data (16.9%) is similar to the share of mean hours worked by college graduates (17.5%) in Moretti (2004).

[16]Note that the results by Moretti (2004) are in accordance with complementarity at the regional level in the US. A more recent paper supporting skill complementarity specifically with regard to high-level education in the US is Eeckhout, Pinheiro and Schmidheiny (2013).

[17]Note also that the production elasticity of high skilled workers is smaller than unity, which is consistent with the case of limited increasing returns in a setting with a generalized log-linear production functions as discussed in the theoretical section.

[18]In our base year 2004, the municipal share of the income tax is 15% of the total state and federal income tax

state and federal support. Following the summary statistics for German theaters, we use a figure of EUR 40. With an average share of highly educated in jurisdictions with theaters of $s^m = 0.12$ and inserting the average point estimate obtained above, which suggests that the earnings effect of increasing subsidies by EUR 10 per capita is about $\frac{1}{b}\frac{db}{dg} = 0.006$, these figures suggest that

$$\Delta = 0.14 \simeq (750 - 40)\, 0.12 \frac{1}{1 - 0.624} 0.006/10.$$

This estimate for Δ would indicate that the perceived cost of spending an additional Euro of subsidies is only 86 cents. Yet, as noted above, if the sum of the production elasticities for high skilled and other labor is larger than unity, z will be negative and contribute to a further decline in the marginal cost of funds (*cf.* equation 17). Using the parameter estimates for the relative production elasticities of high-skilled and unskilled labor implied by the empirical results of Moretti we have z equal to $-1.22 = (\frac{0.624+0.572-1}{(0.624-1)(1-0.572)})$. Hence, we can calculate the marginal cost of funding in equation (17) to obtain

$$MRS = 0.754 \simeq \left(\frac{1}{1 + 1.22 \times 0.12}\right)(1 - 0.14)\,.$$

Accordingly, the perceived cost of spending an additional Euro of subsidies is only 75 cents.

A comprehensive assessment would include also the effect of attracting highly educated residents on intergovernmental revenue from state-level governments. This is an issue in the German context, where transfers from the state are 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

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.

marginal cost of public funds, in particular, since funds are distributed according to population size. Any new resident will, therefore, imply an increase in grants. While funds are large, the strength of this effect will be limited, however, due to the redistributive nature of the grant allocation scheme.[19]

5 Conclusions

A common view in the debate about local economic development is that public provision of cultural amenities 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 public theaters by German municipalities, where according to official data for 2004, the average subsidy to public theaters was about EUR 107 per ticket sold, with more than half of the subsidies coming from the local municipality. The few existing international comparative studies suggest that local public subsidies for other decentralized countries are much lower. Against this background this 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 creative individuals. Typically (but depending on the technology) an increase in public goods at the expense of group specific transfers attracts more creative individuals which raises the wage of workers when factors are complements. At the same time, the rents to creative individuals

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

tend to fall.

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 analysis shows that the mobility of the creative class introduces a fiscal incentive to provide the amenity good. This tends to distort the provision of this good, in the sense that uncoordinated policies lead to a larger supply of the amenity good.

In order to provide empirical evidence, we have explored the German case, where local jurisdictions enjoy 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 highly educated labor. Considering data for individual earnings our empirical analysis indicates that subsidies to local theaters exert a compensating earnings differential for highly educated employees. This suggests that the local subsidization of cultural activities in Germany is effective in attracting highly educated labor. Based on the empirical findings, we have provided a quantification of the fiscal incentive to provide public support to cultural activities. 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 25%. In other words, an increase in subsidies by 1 Euro would need only about 75 cents of funding. This effect is driven by both the rise in the attractiveness for highly educated labor due to public subsidies and by the strong effects of highly educated labor on local productivity.

The normative implications of our results for the individual jurisdiction and the federation as a whole are different. With regard to the individual jurisdiction our results suggest that subsidizing

culture actually improves the working conditions of those with basic education. Given restrictions in the set of tax instruments, some part of the cost of financing the subsidies may also pay off in terms of higher tax returns. From the perspective of 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 that public support tends to be large, when the local governments do not have access to a sufficient set of group-specific revenue instruments. It is tempting to relate this finding with the fact that in Germany, where income tax rates are set at the central level, 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 the US-German difference may potentially be explained by the different sets of fiscal instruments available to local governments. In order to attract those with higher education, local governments in Germany resort to extending the supply of cultural activities through public subsidization as they are prevented from adjusting their tax structure. In contrast to German municipalities, local governments in the US experience discretion with regard to local income taxation. As the theoretical analysis shows, if there is discretion in adjusting local income taxes a fiscal incentive to subsidize culture does not arise. However, there is also substantial private spending on the arts in the US (possibly related to the tax deductibility), the exploration of which is beyond the scope of our paper.

Appendix

A-1 Derivation of first best

The Lagrange approach can be stated as follows

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

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). Next, 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 condition 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 cancelling the common factor and rearranging we obtain (10a).

A-2 Full 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 constant returns to scale.[20] Therefore the first order condition (11b) reduces to

$$\frac{dU_i^l}{dt_i^m} = u_c^l \frac{(t_i^m - g_i)}{L}\frac{dM_i}{dt_i^m} = 0. \tag{A2}$$

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 the financing rule in the other first order condition (11a), we obtain after using (12) and (A1)

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

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

We next turn to the proof of existence for a class of utility functions. When preferences are quasilinear (*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 the 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

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

all cities follow the same strategy must then be an equilibrium because no deviation by a single city is profitable.

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 quasilinear with logarithmic subutility, $u(c,g) = c + \ln g$, and a 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 mobility response of creative individuals becomes $dM_i/dg_i = L/(2\gamma g_i)$.

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

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

which is positive for all $g_i \leq 1$ regardless of u^* when $T^m \geq 1$. 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

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

or

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

which is greater than 1 and less than T^m if the tax on creative individuals is sufficiently large, namely $T^m > 1$ (otherwise $\widehat{g} = T^m$).

Given the specific functional form assumptions the second order condition to utility maximization

becomes:

$$\begin{aligned}\frac{d^2U_i^l}{dg_i^2} = & \quad F_{LMM}\left(\frac{dM_i}{dg_i}\right)^2 - \frac{2}{L}\frac{dM_i}{dg_{i_i}} + \left(\frac{T^m - g_i}{L} + F_{LM}\right)\frac{d^2M_i}{dg_i^2} + v'' \\ = & \quad \frac{1-T^m}{2\gamma g_i^2} - \frac{1}{2\gamma g_i} - \frac{M}{Lg_i^2} - \frac{1}{g_i^2}, \end{aligned} \tag{A6}$$

which again is negative when the tax on creative households is larger than 1 (we made use of $dM_i/dg_i = (2\gamma g)^{-1}L$) . 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 (A5) we can state the transfer to immobile workers to be

$$G^l = \frac{\overline{M}T^m + LT^l - (\overline{M} + L)\widehat{g}}{L}. \tag{A7}$$

This is nonnegative when the tax rates and γ are sufficiently large. For very large values of γ the public good level becomes close to 1 (the first best, see A5) and the numerator in the transfer expression (A7) becomes $\overline{M}(T^m - 1) + L(T^l - 1)$. This equals total transfers LG^l in the first best case, which we assume to be nonnegative. Hence being sufficiently close to the first best, via choice of γ, leads to a nonnegative transfer.

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 choice 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 $\alpha, \beta, \gamma, \overline{M}, L$ 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.

Highly educated individuals are defined as employees with high-level education such as technical college or university degrees. The comparison group of individuals with basic education includes employees as well as workers with some standard level of schooling (*Volks-*, *Haupt-*, *Realschule mit Berufsausbildung*) and vocational training.

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.

Female 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.

GDP per capita: Regional GDP in 2004 in current prices is obtained the states' statistical offices and related to population size in 2004.

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.

Public theater presence in 1936: The statistical yearbook for German municipalities started as a series in the 1930s. Detailed statistics on public theaters and subsidies have been provided in the 1938 issue referring to 1936. Since this statistic employs a population size threshold of 50,000 inhabitants, information about the presence of at least one public theater in regions hosting cities between 20,000 and 50,000 inhabitants has been taken from the cities' official websites.

Industry employment shares: Using the IABS data (see above) we count the number of full–time spells of employees by industry for each county and calculate shares. The IABS industry classification (W03) identifies 18 industries:

1 Agriculture, energy, mining
2 Food and luxury food industry
3 Textile and clothing, wood, paper, publishing industry
4 Primary production, recycling, other consumer goods
5 Mechanical engineering, vehicle construction, precision mechanics
6 Construction industry
7 Automobile trade
8 Wholesale trade, trade negotiations
9 Retail industry
10 Hospitality industry
11 Transport and communication
12 Credit and insurance industry, estate service, letting
13 Economic services, R&D, data processing
14 Public administration, public services
15 Education
16 Health, veterinary and social services
17 Religious association, culture, sports
18 Other services, household services

Amenity variables: A vector of amenity variables, that has proved successful in predicting land-prices, is taken from a study by Buettner and Ebertz (2008). The indicators are measured at the level of counties and aggregated into 343 regions. Excluding labor market indicators, which are likely to be endogenous, the following 12 indicators are used:

1 Sunshine: average yearly duration of sunshine in 100 Hrs., measured at, at least, one meteorological office in each county. For counties with missing information the value of the closest neighboring county is used. Taken from "Deutscher Wetterdienst" (2004).

2 Emissions: aggregate emission of CH4, NOx and SO2 particles of 27 industry branches in tons per sqkm. Calculations based on average emissions per worker of each industry branch and regional occupation figures of the sectors. Data taken from the states' statistical offices (2004).

3 Share of forest: forest area as a share of the total surface area in percent. Taken from the states' statistical offices (2000).

4 Share of water: water area as a share of the total surface area in percent. Taken from the states' statistical offices (2000).

5 Tourism: number of overnight stays per inhabitant. Taken from the Federal Statistical Office and States' statistical offices (2003).

6 Metropolitan area: dummy variable that takes the value unity if a region belongs to a metropolitan area according to the classification of the "Bundesamt für Bauwesen und Raumordnung". Taken from the "Perspektive Deutschland" study 2004.

7 Peripherality: average travel time in minutes to the next three agglomeration centers by public transport. Source: "Bundesamt für Bauwesen und Raumordnung."

8 Poverty: number of welfare recipients ("Sozialhilfeempfänger") per 1,000 inhabitants. Taken from the Federal Statistical Office and States' statistical offices (2003).

Using survey data from the "Perspektive Deutschland" study 2004 Buettner and Ebertz (2008) coded answers to the question "which is the issue to be improved most urgently in your region?" into local indicators. The original variable takes the value unity if the aspect in question is considered one of the four most urgent problems in the region. The average assessment of each aspect in each county is recoded, such that regressors take values between 0 and 1, where a higher value indicates a better situation or less need for improvement (except for crime, where a higher value indicates a worse situation). Four variables are added to the list of amenities.

9 Leisure facilities: local cultural and leisure facilities are considered as satisfactory.

10 Crime: crime is considered to be one of the four most urgent problems in the region.

11 Accessibility: local traffic system/connection to other regions is considered as satisfactory.

12 Education: local schooling/education facilities are considered as satisfactory.

Table A-1: Revealed and Intended Mobility among Labor Market Particants

	Has moved in last 10 years (1)	Is willing to move (2)
Educ= 1 (No Completed School Degree)	.020	.001
	(.020)	(.026)
Educ= 3 (Intermediate Secondary School)	.022	.043**
	(.005)	(.006)
Educ= 4 (Upper Secondary School)	.049**	.102**
	(.008)	(.009)
Educ= 5 (Grammar School)	.095**	.113**
	(.007)	(.009)
Educ= 6 (Univ. Degree)	.202**	.192**
	(.006)	(.007)
Age	.003**	-.009**
	(.001)	(.001)
Age^2	.1E-3**	.7E-4**
	(.1E-4)	(.2E-4)
Income	-.005**	-.005**
	(.001)	(.001)
Female	-.040**	-.011**
	(.004)	(.005)
Constant	.341**	.791**
	(.019)	(.021)
N.obs	255469	255463

Regression results based on the fourth wave of PD survey. Dependent variable in column (1) is a binary variable with unit value if the respondent has relocated in the current region in the last ten years. Dependent variable in column (2) is a binary variable with unit value if the respondent states that he/she is willing to move. All regressions condition on respondents with active labor market status. Note that the pool of respondents differs from that used by Table 1 above. Residual education category is secondary general school. Regressions employ population weights. A star (two stars) denotes significance at the 10% (5%) level.

Table A-2: First-Stage-Regression Results

	(3)	(4)	(5)	(6)	(7)	(8)
Age	-0.000	0.005	0.000	-0.000	0.001	0.001
	(0.001)	(0.003)	(0.000)	(0.001)	(0.003)	(0.003)
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 *		
	(0.000)	(0.001)	(0.000)	(0.000)		
Female	-0.001 **	-0.006 **	-0.001 **	-0.000 **	-0.001	-0.001
	(0.000)	(0.002)	(0.000)	(0.000)	(0.001)	(0.001)
East	0.006	0.009	0.005	0.011	0.006	0.011 **
	(0.003)	(0.007)	(0.004)	(0.005)	(0.004)	(0.005)
log Density	0.007 **	0.017 **	0.009 **	-0.006	0.010 **	-0.005
	(0.002)	(0.006)	(0.003)	(0.004)	(0.003)	(0.005)
log GDP p.c.	0.027 **	0.035 **	0.025 **	0.014 **	0.023 **	0.014 **
	(0.006)	(0.010)	(0.005)	(0.006)	(0.005)	(0.006)
log Land price			-0.002		-0.002	
			(0.002)		(0.002)	
State&Fed.Subsidy	1.093 **	0.965 **	1.091 **	1.049 **	1.082 **	0.011 **
	(0.102)	(0.116)	(0.110)	(0.103)	(0.113)	(0.003)
Public theater exists	0.013 **	0.016 **	0.011 **	0.009 **	0.012 **	1.054 **
	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.106)
Constant	-0.160 **	-0.359 **	-0.157 **	-0.025	-0.145 **	-0.049
	(0.032)	(0.094)	(0.032)	(0.047)	(0.068)	(0.074)
Industry controls	yes	yes	yes	yes	yes	yes
Amenity controls	no	no	no	yes	no	yes
R-squared	0.9062	0.9465	0.9282	0.9339	0.9255	0.9301
No. of cells	1214	411	1149	1210	644	644
F-Stat.	135.40	68.93	118.5	92.38	114.71	89.73

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

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