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Cultural Capital and the Consumption of Cultural Services*

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Abstract

Cultural capital is assumed to benefit all members of society. It is built up by the aggregate consumption of cultural services and is diminished through depreciation. Cultural goods (e.g. cultural heritage, works of arts, literature and music) turn out to give rise to a flow of cultural services. In the no-policy market economy, consumers tend to ignore the beneficial external effects of their cultural service consumption on the other consumers (and on themselves) through augmenting cultural capital. Cultural Services will be less consumed and, as a result, cultural capital will be underprovided. The efficient allocation is shown to be restored by an appropriate subsidy on cultural services that stimulates the consumers demand for cultural services and thus promotes the accumulation of cultural capital.

Zusammenfassung

In diesem Papier wird angenommen, dass Kulturkapital allen Mitgliedern einer Gesellschaft nützt. Es wird durch Konsum von Kulturdienstleistungen akkumuliert and verringert sich durch Abschreibung. Der Bestand an Kulturgütern (z. B. Kulturerbe, Kunstwerke, Literatur und Musik) wird durch Bereitstellung von Kulturdienstleistungen genutzt. In einer Laissez-Faire-Marktwirtschaft neigen die Konsumenten dazu, den durch Erhöhung des Kulturkapitals entstehenden positive externen Effekt ihres Konsums an Kulturdienstleistungen auf andere Mitbürger (und auf sich selbst) zu ignorieren. Der Konsum von Kulturdienstleistungen ist deshalb zu gering mit der Folge Unterversorgung an Kulturkapital. Es wird gezeigt, dass Allokationseffizienz durch eine geeignete Subventionierung von Kulturdienstleistungen wieder hergestellt werden kann, welche die Nachfrage nach Kulturdienstleistungen stimuliert und somit das Kulturkapital erhöht.

JEL classification: H 2, H 3, Z 1

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1. Introduction

Consumption of culture has a major social component. We share the widespread presumption or conviction that the consumption of culture yields positive effects for society: creativity will be further developed, tolerance for others (race and gender) will be enhanced, criminality will be reduced, people's sense of identity will be strengthened.[1] Though economists have extensively discussed the concept of positive externality, they either claim an undersupply of culture without further specifying what the concrete link between culture and externality may be like, or they enumerate various externalities and invoke them to justify public support for culture. Those arguments are not stringent, and none is demonstrated analytically, to our knowledge.

For example Robbins (1963, p. 58) argues that "... the positive effects of the fostering of art and learning and the preservation of culture are not restricted to those immediately prepared to pay cash but diffuse themselves to the benefit of much wider sections of the community in much the same way as the benefits of the apparatus of public hygiene or of a well-planned urban landscape". In their pioneering contribution to cultural economics Baumol and Bowen (1966, p. 382n.) pay much attention to four types of general benefit (national prestige, advantages cultural activity confer on business in its vicinity, benefit for future generations, contribution to education) which flow from the arts. They also point out that "... performing arts confer direct benefits on those who attend a performance but which also offer benefits to the community as a whole ...". Peacock (1969, p. 328n.) invokes also intertemporal spillovers of culture and argues that even "... those who do not understand and appreciate music and drama may be glad to contribute towards making available their fruits to those who do, and to those whose tastes are not yet formed. Present generations may derive positive satisfaction from preserving live performance safe in the knowledge that they do not risk being accused of narrowing the range of choice of cultural activities for future generations through allowing Arts to die". Netzer (1978, p. 22n) extends the list of external benefits by adding that the interdependence of art forms tends to support one another, and that inovation is fostered through artistic undertakings and business advantage through culture and arts. Fullerton (1992, p. 80) offers a new twist on the externality argument and justifies public support of the arts as follows: If there are enough persons (external beneficiaries) who want others to attend art events and hence "... are willing to pay to see subsidized arts, and if similar individuals can 'free ride' by enjoying others' donation, then none of them has sufficient in-

[1] See e.g. "The First World Culture Report (1998) of UNESCO, Part one".

centive to give to the arts. It is possible for government, potentially, to make everybody better off by taxing those individuals who do value others' attendance, and then using the funds to subsidize the arts."

While all these positive externality arguments have some appeal in the cultural context, they are not made precise in formal intertemporal analysis and they do not explicitly account for the distinctive characteristics of culture. The present paper aims at capturing the specificities of culture in a dynamic stock-flow model by distinguishing – and focusing on the relations – between cultural goods, cultural services and cultural capital. It then models the social component of the consumption of culture via a process of accumulation (and depreciation) of cultural capital which in turn affects the individuals' well-being.

The notions of culture and related terms are applied in the literature in various often incompatible ways. We refrain from presenting a comprehensive survey and comparison of major concepts. Instead, we define how we will use the terms culture, cultural goods, services and capital in the present paper and content ourselves with a few remarks about other connotations and terms suggested in the literature.

For the purpose of the present paper, it suffices to think of *culture* "... as being represented by the 'cultural sector' of the economy" (Throsby 1995, p. 202). *Cultural goods*[2] are considered to be all items of cultural significance like heritage buildings, sites, locations, works of arts (e.g. paintings, sculptures), literature and music.[3] There is a stock of cultural goods inherited from the past, and there is an ongoing process of creating new cultural goods which are then added to the stock. Although the production of new cultural goods is of great importance (Throsby (1999), Ulibarri (2000)), we restrict our subsequent analysis to the inherited, constant stock of cultural goods to avoid overloading our model with a complex analysis of the supply side.

Following Throsby (1999, p. 7) we assume the cultural heritage to "... give rise to a flow of services that may be consumed as private and / or public goods entering final consumption immediately, and / or they may contribute to the production of future goods and services, including new cultural goods". Suppressing the role of these services as productive factors (see

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[2] The notion of cultural goods as introduced here is closely related to what is termed 'cultural capital' by Throsby (1999), except that we do not link cultural goods with Thorsby's 'cultural value'. The latter is considered by Throsby (1999, p. 6) as "... different from, though not unrelated to economic value", but Throsby does not specify how this value emerges.

[3] Cultural goods are durable. They may be further differentiated according to whether they are tangible or intangible or whether they are private or public goods. These distinctions are not relevant in the context of our model and are hence omitted.

above) we focus on consumptive cultural services, called *cultural services,* for short.

These cultural services take many widely differing forms. Examples of (first-order) cultural services are (guided) tours to cultural sites, visits to museums, attendance of concerts or of opera and drama performances, reading books. Other cultural services (of second or higher order) are e.g. reading books about medieval paintings, about the Chinese terracotta army, or about the cultural treasures of Paris; watching broadcasted reports about these cultural goods, watching broadcasted opera performances or concerts; listening to broadcasted or recorded music; enjoying sculptures, replica paintings, or replica heritage buildings; watching a photo of the London parliament building in the show window of a travel agency, enjoying (own) photos or videos taken during tours to cultural sites.

This rather selective list of cultural services strongly suggests that the meaning and importance of cultural heritage for society is closely linked to the amounts and kinds of cultural services flowing from the stock of cultural goods.[4] The magnitude and the structure of those flows depends, in turn, to a large extent on costs to provide them and on income and relative prices to consume them. Public cultural policies, intervention and regulation may have a great impact on these economic determinants. Consequently, there is no automatism in the cultural heritage 'giving rise to a flow of cultural services'.

Leaving the supply, demand and the pricing of cultural services to markets (laissez-faire) would be highly recommendable, if the consumption of cultural services were comparable to services like e.g. hair-cutting which do not appear to have a major social component. Our principal hypothesis is that the continuous consumption of cultural services over time leads to an accumulation of *cultural capital* which, in turn, is positively valued by all members of society. Like Becker (1998, p. 12n.) we conceive of cultural capital as an intangible and depreciable asset that is a form of social capital in the sense of Coleman (1990) who argues (ibidem, p. 317) that "... social capital [and hence cultural capital, as presently defined; the authors] is an important resource for individuals and can greatly affect their ability to act and their perceived quality of life." He also maintains that "although it is a resource that has value in use, it cannot be easily exchanged. As an attribute of the social structure in which a person is embedded, social capital is not the private property of any of the persons who benefit from it" (ibidem, p. 315). According to Becker (1998) cultural changes over time may be

[4] This is most clearly seen by considering the fictitious polar case in which not any cultural service flows from the cultural heritage. This would be a situation as if there exists no cultural heritage at all.

slower than changes of other kinds of social capital but he rightly rejects the view "... that culture so dominates behavior that little room is left for choice" (ibidem, p. 16n.).

Introducing cultural capital as outlined above in a dynamic setup implies that the more cultural services are consumed the more cultural capital is generated (after depreciation is accounted for) and the greater will be the external benefits provided for society. Though consumers may realize their own benefit from an increase in the stock of cultural capital brought about by their own consumption of cultural services, they tend to ignore the beneficial impact which their own contribution to the generation of cultural capital has on their fellow citizens. When the number of consumers is very large, they may even neglect that their own utility is enhanced through an increase in cultural capital induced by their own (negligibly small) consumption of cultural services. This myopic individual behavior gives rise to external cultural benefits.

Related to the concept of cultural capital as perceived in the present paper is the theory of human capital inspired by Becker (1964) and elaborated over the last decades in the context of endogenous growth theory surveyed, e.g., by Aghion and Howitt (1998, chapter 10). Human capital is accumulated by and 'within' the individual consumer / worker either through education or through learning by doing. On an aggregate level, the stock of human capital enhances productivity and is therefore considered the driving force for economic growth. In the model to be analysed here, no individual consumer is supposed to build up her own 'stock of cultural capital' in analogy to human capital. Consumers rather contribute to the accumulation of cultural capital (which is not the private property of any of the persons who benefit from it, as observed above) and thus enjoy not only a secondary benefit from their own investment in cultural capital but also a purely external benefit from the other consumers' investment in cultural capital. The individual's investment in cultural capital is not at all or not primarily her intention when consuming cultural services. In contrast, when consuming education the individual's main objective is the accumulation of human capital to improve her own market value. Human capital formation through learning-by-doing is closer, in spirit, to the process of cultural capital accumulation, but both are definitively different concepts. Society benefits from the stocks of human capital built up by all individuals through the enhancement of productivity. In this sense the presence of external benefits is common to both approaches.

Consider now – as we will do below – all those (first order) cultural services that are price excludable and suppose that price exclusion is applied. Owing to the consumers' failure to internalize the external benefits of their

consumption of cultural services, cultural capital will be underprovided in the laissez-faire economy, even if the cultural services under consideration are private rather than public goods.[5] As an immediate consequence this paper provides a justification for subsidies on cultural services that serve to internalize the external benefits of cultural service consumption. Although the basic argument has a strong common sense intuition, it has not yet been developed and demonstrated to our knowledge, in a dynamic theoretical framework modeling the distinctive characteristics of culture.

Positive externalities of the consumption of cultural services are introduced in a dynamic setting and different regimes are studied and compared. As a benchmark, the efficient allocation is characterized (as e.g. implemented by a omniscient benevolent social planner). Then the focus is on the inefficiency of unfettered competitive markets providing a rationale for subsidies on cultural services. Section 2 develops the model of consumption of cultural services. Section 3 sets out the first-order conditions for welfare maximization under full consideration of its dynamics and characterizes the efficient intertemporal allocation. Section 4 presents the underprovision of cultural capital in the laissez-faire economy with two alternative assumptions about consumer behavior. Section 5 compares the results from sections 3 and 4. Section 6 discusses the options for restoring efficiency by appropriately designed tax / subsidy schemes. Section 7 concludes.

2. The Model

Consider a simple economy in which two consumption goods X and Y are produced. Denote by X_t^s and Y_t^s respectively, the quantities produced (and supplied) of these goods by means of the linear technologies

$$R_t^D = C_D D_t^s \,, \tag{1}$$

for $D = X,\ Y$ and for $t \geq 0$, where R_t^D is the input of a generic resource and where C_X, C_Y are positive time-invariant input-output coefficients. Y is a standard (composite) good and X is a *cultural service* based on a given (inherited) stock of *cultural goods*. For example, X^s is the supply of visits to a museum or the supply of attendances of art performances, dramas, operas etc. The given stock of cultural goods is clearly the origin of these services

[5] If the cultural service is a public consumption good, e.g. a television broadcast of an opera performance, another allocative distortion is added to that involved in cultural capital formation. In the present paper cultural services are treated as private goods to isolate the allocative displacement caused by cultural capital in the laissez-faire economy.

(Shakespeare's Summer night Dream, Beethoven's 9th Symphony) but the total amount of cultural services supplied and demanded is not determined by that stock of capital goods, as e.g. in Ulibarri (2000).

For all t, there is a constant number $n_t = n$ of identical consumers. Denoting by X_t and Y_t the representative individual's consumption of the cultural service and of good Y, respectively, her utility is, at each point in time,

$$u_t = U(X_t, Y_t, Z_t) \,, \tag{2}$$

where $U_D > 0, U_{DD} < 0$ for $D = X, Y, Z$ and $U_{XY} = U_{YX} \geq 0$. (The variable Z will be specified further below). To simplify the exposition and the analysis, we assume that the utility function (2) is additively separable and well-behaved[6]

$$U(X_t, Y_t, Z_t) = U^1(X_t, Y_t) + U^2(Z_t) \,. \tag{2'}$$

The 'consumption good' Z from (2) is a non-excludable public good called *cultural capital,* which we motivated and discussed in the introduction.[7] By hypothesis, cultural capital is created through all individuals' consumption of cultural services and it declines through depreciation. Following Becker (1998, especially footnote 2 on p. 12) we formalize this concept by assuming that the change in time of cultural capital is

$$\dot{Z}_t = nX_t - \alpha Z_t, \quad \text{where} \quad \dot{Z}_t := \frac{dZ_t}{dt}, \alpha \in \,]0,1[, \quad Z_t \geq 0 \quad \text{for} \quad t \geq 0 \,. \tag{3}$$

In (3) the aggregate consumption of cultural services represents the gross investment in cultural capital; α is the depreciation rate.

The model is completed by specifying the supply conditions. nR is assumed to be the economy's aggregate resource endowment available at each

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[6] U is well-behaved in the sense that $\lim_{D \to 0} U_D = \infty$ for $D = X, Y, Z$. As an implication, consumption bundles (X_t, Y_t, Z_t) with $D_t = 0$ for $D = X, Y, Z$, $t \geq 0$, will be ruled out along the optimal path to be derived below. The additivity of $U^1(\cdot)$ and $U^2(\cdot)$ is unnecessarily restrictive for some results. However, without the separability assumption it would be impossible to characterize the dynamics by means of phase diagrams in the subsequent sections.

[7] The hypothesis in (2) is that "culture" enhances each consumer's utility not only by her consumption of cultural services, X, but also by the "prevailing" cultural capital, Z, irrespective of who contributed how much to its accumulation. This specification clearly distinguishes our model from the human capital cum endogenous growth approach where each individual only benefits from the human capital she accumulated herself. In addition, human capital is typically modeled as productivity improving while in the model of the present paper, cultural capital does not affect production technologies.

point in time. Since Y is a *private* consumption good, the associated supply constraint is $Y_t^s \geq nY_t$. One can find relevant types of cultural services that are either private or public goods. More importantly, most public cultural services are excludable, and in the real world, price exclusion is often applied.[8] Here we will restrict our attention to good X being a *private* cultural service, i.e. we assume $X_t^s \geq nX_t$. Considering the supply constraints $X_t^s \geq nX_t$ and $Y_t^s \geq nY_t$ as equalities and invoking (1) yields the linear production possibility constraint

$$nR = C_X nX_t + C_Y nY_t \quad (\text{for all } t \geq 0) \,. \tag{4}$$

The allocative problem to be solved is how consumption X_t and Y_t develop (or should develop) over time and how the consumption of cultural services, X_t, impacts on cultural capital, Z_t.

3. Allocative Efficiency

The social planner maximizes the present value of the consumers' aggregate utilities over an infinite time horizon and with a constant rate of time preference, δ:

$$\max_{\{X_t, Y_t\}} \int_0^\infty nU(X_t, Y_t, Z_t) e^{-\delta t} dt \,, \tag{5}$$

subject to (3) and (4). In this optimal control problem (3) – (5), X_t and Y_t are the control variables and Z_t is a state variable. This problem is solved by applying the current-value Hamiltonian

$$H = nU(X_t, Y_t, Z_t) + V(nX_t - \alpha Z_t) + W(nR - nC_X X_t - nC_Y Y_t) \,. \tag{6}$$

The costate variable V is the shadow price of cultural capital measuring the value the social planner attaches to an increment of cultural capital. In other words, V measures the additional utility in the future which today's consumption X_t creates by raising the cultural capital. Hence it measures the value of the positive externality for future periods of today's consumption X_t. W is the Lagrange multiplier attached to equation (4). The FOCs for a solution to (5) are:

[8] Fullerton (1992, p. 73) observes correctly that "... art can be bought and sold, and admission to art events can be charged. The primary benefits of art and its viewing are excludable."

$$\frac{\partial H}{\partial X} = nU_X + nV - nWC_X = 0 \,, \tag{7}$$

$$\frac{\partial H}{\partial Y} = nU_Y - nWC_Y = 0 \,, \tag{8}$$

$$\dot{V} = \delta V - \frac{\partial H}{\partial Z} = (\alpha + \delta)V - nU_Z \,. \tag{9}$$

By combining the equations (7) and (8) we get

$$\frac{U_X + V}{U_Y} = \frac{C_X}{C_Y} \,, \tag{10}$$

and therefore $\frac{U_X}{U_Y} > \frac{C_X}{C_Y} \Leftrightarrow V > 0$. Hence the rate at which the agent is willing to give up the consumption good Y to acquire the cultural service X depends on the shadow price of cultural capital V. The agent is willing to give up the more of consumption good Y to acquire an additional unit of cultural service X the greater is V.

Before we further characterize the optimal time path, it is convenient first to investigate the properties and the optimality of the steady states.

3.1. Steady states

A steady state of the economy is defined by a situation $\dot{Z}_t = \dot{X}_t = \dot{Y}_t = 0$ that prevails for all t following some point in time, $t_0 \geq 0$. Obviously, such a state is given at the value of cultural capital, denoted Z_E in Figure 1; it is derived in the Appendix A. In the following we refer to (V_E, Z_E, X_E, Y_E) as the (unique) *interior* steady state.

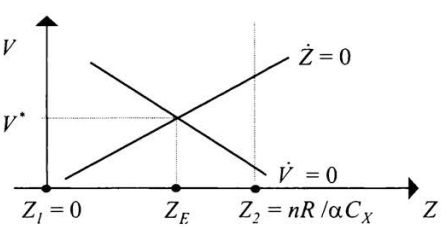

Figure 1: The steady states of the economy

To see that the differential equations (3) and (9) also involve further steady states at the boundary, consider the state (V_2, Z_2, X_2, Y_2) satisfying $\dot{V}_2 > 0, V_2 > 0, X_2 := \alpha Z/n = R/C_X$ and hence $Y_2 = 0$. Increasing V creates a pressure via (10) to increase X_2 which would violate (4), however (so that (10) does not hold as an equality anymore). Hence $\dot{X} = 0$ and $\dot{Z} = 0$. Using similar arguments we identify another boundary state, say (V_1, Z_1, X_1, Y_1), satisfying $\dot{V}_1 < 0, V_1 < 0, X_1 = Z_1 = 0$ and $Y_1 = R/C_Y$. For convenience of later reference we denote these boundary steady states by *S1* and *S2*, respectively.

3.2. Characterization of the optimal time path

To investigate the transitional dynamics of cultural capital and its shadow price, we now develop a phase diagram. The $\dot{V} = 0$ line and the $\dot{Z} = 0$ line divide the space in Figure 2 in four regions. Using standard arguments, one determines for each point how the variables V and Z change in time. Figure 2 illustrates these dynamics for selected points by means of dotted lines with arrows.

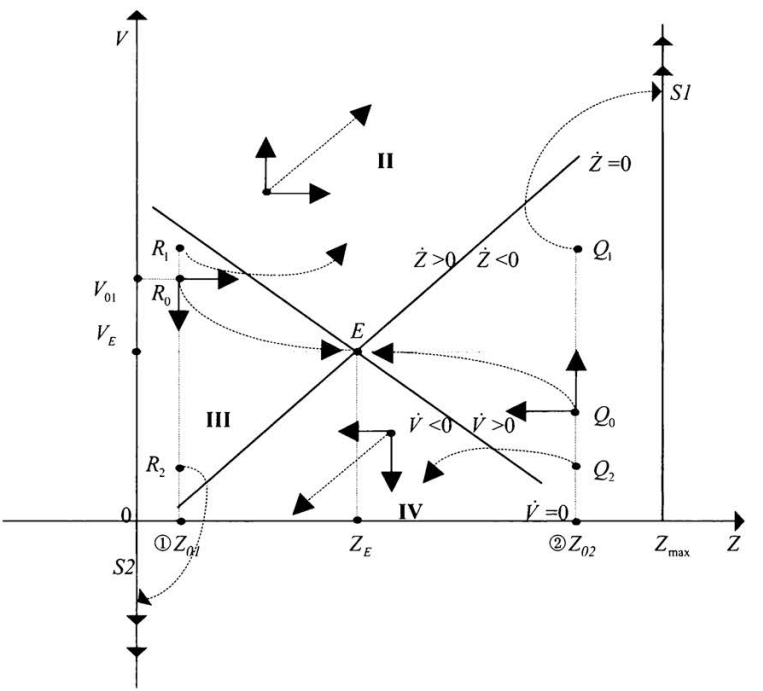

Figure 2: Phase diagram

In region I of Figure 2 the direction of motion is northwest. There exists a path starting e.g. from Q_0 in this region, which leads right into E. If a starting point is chosen above or below the point Q_0, e.g. at point Q_1 or Q_2, the system will never reach the steady state E. The trajectory starting at Q_1 is not optimal, since it implies a growing accumulation of cultural capital until, eventually, the boundary steady state *S2* (as defined above) is reached. Since this state implies $Y = 0$, it is suboptimal owing to the assumption $\lim_{Y \to 0} U_Y = \infty$. The trajectory starting at Q_2 is not optimal either, since it tends toward the boundary steady state *S1,* implying that the cultural capital is eventually driven down to zero. In region II the arrows point northeast. All trajectories starting in this region will fail to reach the point E, and hence are both unstable and suboptimal. Region III is analogous to region I. Here the arrows point southeast and therefore there exists an optimal (and stable) path leading to the steady state E. In region IV the arrows point southwest, so that all trajectories starting there lead to the suboptimal boundary steady state *S2*. Regions I and III are the typical saddle-path cases. The trajectories passing through these regions either reach the optimal steady state E or suboptimal boundary steady states depending on the choice of the starting point.

Since V_E is positive as shown in Appendix A, (9) implies that along the optimal path $V_t > 0$ needs to hold for all t. An important implication of that observation is contained in (10). Since $V > 0$ yields $\frac{U_X}{U_Y} > \frac{C_X}{C_Y}$, the optimal consumption bundle (X_t, Y_t) is such that the agent consumes more of the cultural service and less of good Y than she would have chosen in a world where the consumption of cultural services does not affect the generation of cultural capital (or, alternatively, in a world where all agents ignore the built-up of cultural capital through the consumption of cultural services).

3.3. The impact of the initial endowment of cultural capital on the optimal path

We now investigate in more detail the time pattern of optimal cultural services consumption, cultural capital and its shadow price focusing in particular, on how that time pattern depends on the economy's initial endowment of cultural capital. For that purpose observe that the total derivative of function V (from equation (A4) as shown in Appendix A) with respect to time yields sign $\dot{X} =$ sign $\dot{V}$. Moreover, the total derivative of equation (5) with respect to time gives $C_Y \dot{Y} = -C_X \dot{X}$. Hence sign $\dot{Y} =$ sign $\dot{X}$. We also make use of the information from equation (3) that $\dot{Z} = X - \alpha Z$, and from equation (9) by the assumption of additively separability: $\dot{V} = (\alpha + \beta)V - nU_Z^2(Z)$.

Situation ①: The initial endowment of cultural capital is relatively small

Suppose the initial stock Z_{01} of cultural capital in Figure 2 is smaller than the steady state stock Z_E. Then the optimal trajectory towards the steady state E is characterized by $\dot{X}_t < 0, \dot{Y}_t > 0, \dot{Z}_t > 0$ and $\dot{V}_t < 0$ for all $t \geq 0$. Through the consumption of cultural services, cultural capital will be accumulated. With the relatively low initial stock of cultural capital, Z_{01}, the socially optimal policy is to set the initial shadow price of cultural capital at $V_{01} > 0$ well above its steady state level V_E, because the trajectory starting from point R_0 with coordinates (Z_{01}, V_{01}) leads to the steady state E. Before the steady state E is reached, the optimal X_t is greater than the steady state value $X_E = F^{-1}(V_E)$ and X_E, in turn, is greater than the consumption of cultural services, X_M, that would be utility maximizing in an economy in which the consumption of the cultural service that does not affect the generation of cultural capital.

Situation ②: The initial endowment of cultural capital is relatively large

Suppose the initial value Z_{02} of cultural capital is greater than the steady state value Z_E. Then for all $t \geq 0$ the optimal trajectory towards the steady state is characterized by $\dot{X}_t > 0, \dot{Y}_t < 0, \dot{Z}_t < 0$ and $\dot{V}_t > 0$ for all $t \geq 0$. Since we showed above that $V_t > 0$ for all t along the optimal path, it is obviously true that $V_t > 0$ for $t = 0$. This observation is quite remarkable since it proves wrong the plausible intuition that in case of a *very* large initial capital stock Z_{02}, it might be optimal to reduce consumption of cultural services below X_M in an initial phase (implying $V < 0$) to speed up the reduction of cultural capital towards its steady state level.

A final remark on the optimal shadow price of cultural capital, V_t, is in order. As observed already, this shadow price reflects the social value of cultural capital and, through the intermediation of cultural services, it ultimately represents the social value of the stock of inherited cultural goods. To maximize the value of its cultural heritage, society needs to optimize the flow of cultural services derived from that heritage. This interpretation suggests that the optimal shadow price of cultural capital as established in our formal model is closely related to Thorsby's (1999, p. 6) notion of 'cultural value'. However, while our concept of shadow price is rigorously derived, Thorsby's 'cultural value' appears to be introduced ad hoc without an analytical foundation.

4. Underprovision of Cultural Capital in the Laissez-faire Economy

We now study the intertemporal allocation of cultural services and cultural capital in the laissez-faire competitive economy. The results will turn out to depend on our assumption about the consumers' behavior. First we assume that all consumers maximize utility, taking as given the prevailing stock of cultural capital (and hence ignoring the effect of the consumption of cultural services on cultural capital altogether). This assumption appears to be realistic in case of very large numbers of consumers, n. As an alternative we will assume Cournot-Nash behavior that is particularly plausible if n is not too large. A Cournot-Nash consumer maximizes her utility taking as given the other agents' consumption of the cultural service and accounting for the impact of her own cultural service consumption on the change in the stock of cultural capital. In what follows we investigate both models successively focusing on open loop strategies.

4.1. Cournot-Nash consumers

Consumer h solves the optimization problem[9]:

$$\max_{\{X_t, Y_t\}} \int_0^\infty U(X_t, Y_t, Z_t) e^{-\delta t} dt \,, \tag{11}$$

subject to

$$\dot{Z}_t = X_t + \bar{X}_t - \alpha Z_t \,, \tag{12}$$

and

$$R \geq P_X X_t + P_Y Y_t \,. \tag{13}$$

In (12) $\bar{X}_t = \sum_{j \neq h} X_{jt}$ is considered constant by consumer h, and in (13) we set $P_X = C_X, P_Y = C_Y$ and $P_R \equiv 1$. The optimal control problem (11) – (13) is solved by applying the current-value Hamiltonian:

$$H = U(X_t, Y_t, Z_t) + \mu(X_t + \bar{X} - \alpha Z_t) + \lambda(R - P_X X_t - P_Y Y_t) \,, \tag{14}$$

where μ is the shadow price of cultural capital and λ is the Lagrange multiplier valuing the resource. It is shown in Appendix B that the time path of

[9] Subscript h is suppressed to avoid clutter.

the Cournot-Nash equilibrium tends towards an (interior) steady state characterized by the stock of cultural capital, $Z_{CN} > 0$, that is illustrated in Figure 3. If the initial endowment of cultural capital happens to be $Z_0 > Z_{CN}$, Z will successively shrink until Z_{CN} is eventually reached. Conversely, if $Z_0 < Z_{CN}$, cultural capital accumulates until the steady state Z_{CN} is attained. The comparison between the Cournot-Nash time path and the optimal path is postponed to section 5.

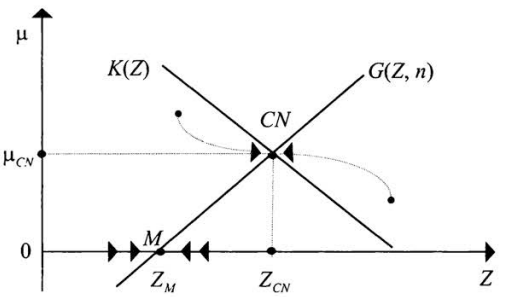

Figure 3: Cultural capital in the laissez-faire economy

4.2. Ignorant consumers

Suppose now consumers ignore the positive impact which their cultural service consumption has (through its contribution to the accumulation of cultural capital) on both their own and all other agents' utilities. In formal terms, now the representative consumer maximizes (11) with regard to X_t and Y_t subject to (12) taking the "prevailing" level of cultural capital as given. The law of motion of the stock of cultural capital is still determined by (3) but disregarded by all consumers. In other words, the time path of cultural capital $\{Z_t\}$ depends on the time path $\{X_t\}$ of cultural service consumption, as before, but that relation does not play a role in the individual optimization problems. Translated into our formal analysis this behavioral assumption is expressed by setting the shadow price μ equal to zero. As a consequence, the Hamiltonian (14) degenerates to:

$$H = U(X_t, Y_t, Z_t) + \lambda(R - P_X X_t - P_Y Y_t) \,. \tag{15}$$

The FOCs then yield:

$$\frac{U_X}{U_Y} = \frac{P_X}{P_Y} \,. \tag{16}$$

According to equation (16) each consumer's *MRS* between the cultural service and good Y equals the price ratio at each point in time along the equilibrium path. Denote by (X_M, Y_M) the unique solution to (16) subject to $R = P_X X_t - P_Y Y_t$. Then we obviously have[10] $(X_t, Y_t) = (X_M, Y_M)$ for all t.

Since $\mu_t \equiv 0$ for all t by assumption (implying $\dot{\mu}_t = 0$ for all t) the steady state is now fully characterized by $\dot{Z} = 0$. In terms of Figure 3 the entire $\dot{Z} = 0$ locus collapses into the point Z_M. Since each consumer chooses $X_t = X_M$ for all t, $Z_M := nX_M/\alpha$ is clearly the steady state value of cultural capital. Hence the phase diagram of Figure 3 degenerates to changes in the stock of cultural capital along the abscissa (Z-axis). If the initial endowment of cultural capital happens to be $Z_0 > Z_M$, cultural capital Z will gradually shrink until Z_M is eventually reached. Conversely, if $Z_0 < Z_M$ cultural capital accumulates until the steady state Z_M is attained.

5. Inefficiency of the Laissez-faire Market Economy

We now compare the cultural capital formation for the regimes:

E: Centralized economy with an omniscient benevolent social planner

CN: Market economy with Cournot-Nash consumers

M: Market economy with ignorant consumers

Table I

Steady states of different regimes

	Steady state values	*Characterization of steady state*
E	V_E, Z_E, X_E	$\dot{V} = 0, \dot{Z} = 0, \dot{X} = 0; V_E, Z_E$ and X_E satisfy $V_E = nK(Z_E), V = G(Z_E, n)$ and $X_E = \alpha Z_E/n$
CN	μ_{CN}, Z_{CN}, X_{CN}	$\dot{\mu} = 0, \dot{Z} = 0, \dot{X} = 0; \mu_{CN}, Z_{CN}$ and X_{CN} satisfy $\mu_{CN} = K(Z_{CN}, \mu = G(Z_{CN}, n)$ and $X_{CN} = \alpha Z_{CN}/n$
M	$\mu_M \equiv 0, Z_M, X_M$	$\dot{\mu} = 0, \dot{Z} = 0, \dot{X} = 0; Z_M$ and X_M satisfy $G(Z_M, n) = 0$ and $X_M = \alpha Z_M/n$

The characteristics of the pertinent steady states are summarized in Table I in which the functions G and K are used as defined in the Appendix A. To see how the steady state values of the three regimes are related to each other,

[10] The additive separability assumption on function U from (2') is unnecessarily strong for this result to hold. Weak separability of U between X and Y on the one hand and Z on the other hand would do the job.

observe that the steady state capital stock associated to the regime $j = E, CN, M$, respectively, is determined by the equation

$$m_j K(Z) = G(Z, n) \,, \tag{17}$$

if and only if $m_E = n \geq 2, m_{CN} = 1$ and $m_M = 0$. Since $K(Z) > 0$ for all $Z > 0$, $K_Z < 0$ and $G_Z > 0$, it is straightforward that $Z_M < Z_{CN} < Z_E$. Using the steady state condition $X = nZ\ /\alpha$ these inequalities yield immediately $X_M < X_{CN} < X_E$, and (4) gives us $Y_M > Y_{CN} > Y_E$.

We conclude, therefore, that in the steady state of the laissez-faire market economy both cultural services and cultural capital are underprovided and that the underprovision is greater in case of ignorant than in case of Cournot-Nash consumers.

Table II

The impact of the numbers of consumers on the steady state value of cultural capital

	E	CN	M
$\frac{dZ}{dn}$	$-\frac{G_n - K(Z)}{G_Z - nK_Z}$	$-\frac{G_n}{G_Z - K_Z}$	$-\frac{G_n}{G_Z}$

To determine the impact of exogenous changes in the number of consumers, n, on the respective steady states we totally differentiate the steady state condition (17) and obtain the results listed in Table II. We find that the steady state value of cultural capital increases in all regimes as the number of consumers gets larger. Unfortunately, comparisons across regimes are not feasible, in general, since the partial derivatives in the terms listed in Table II are taken at different values of $Z(Z_M < Z_{CN} < Z_E)$. Suppose, however, the functions G and K happen to have constant partial derivatives (approximately, at least). The Table II implies

$$\left(\frac{dZ}{dn}\right)_E > \left(\frac{dZ}{dn}\right)_{CN} > \left(\frac{dZ}{dn}\right)_M \,. \tag{18}$$

In that case, the underprovision of cultural capital in the market economy would be the more pronounced the larger is the society under consideration, and the market economy with ignorant consumers fares worse than the economy with Cournot-Nash consumers.

6. Pigouvian Subsidies on the Consumption of Cultural Services

We showed in the previous section that in the absence of cultural policy the market economy provides cultural services and cultural capital at inefficiently low levels. It is therefore natural to think about subsidizing cultural services as a means to stimulate demand. In formal terms a subsidy turns the consumer's budget constraint (13) into

$$R \geq T + (P_X - S_X)X_t + P_Y Y_t \,. \tag{19}$$

Where S_X is the subsidy rate and T is a lump-sum tax taken as given by the consumers and set by the government such as to finance the total subsidy on cultural services. In section 5 the extent of market failure was shown to depend on consumers behavior. Hence the rate of the corrective subsidy must take the consumers' actual behavior into account. It is therefore necessary to investigate the appropriate subsidies for each type of market economies starting with Cournot-Nash behavior of consumers.

6.1 Cournot-Nash consumers

Taking (19) into account, the Hamiltonian (14) is modified to read

$$H = U(X_t, Y_t, Z_t) + \mu(X_t + \bar{X} - \alpha Z_t) + \lambda[R - T - (P_X - S_X)X_t - P_Y Y_t] \,. \tag{20}$$

The FOCs can be written as:

$$\frac{U_X}{U_Y} = \frac{P_X - S_X}{P_Y} - \frac{\mu}{U_Y} \,. \tag{21}$$

Denote by S_X^{CN} that particular subsidy rate that internalizes the cultural externality. It is implicitly defined by setting equal (10) and (21):

$$\frac{U_X}{U_Y} = \frac{P_X - S_X^{CN}}{P_Y} - \frac{\mu}{U_Y} = \frac{P_X}{P_Y} - \frac{V}{U_Y} \,. \tag{22}$$

Solving (22) for S_X^{CN} yields:

$$S_X^{CN} = \frac{P_Y(V - \mu)}{U_Y} \,. \tag{23}$$

In view of (23) S_X^{CN} is essentially the difference between the social value of cultural capital, V, and its private value, μ, where P_Y/U_Y is used to turn the

dimension 'utility' into the dimension 'money'. As shown in the Appendix (cf. (A2) and (B9)), equation (23) can be transformed into

$$S_X^{CN} = \frac{P_Y U_Z}{U_Y} \frac{(n-1)}{\alpha+\delta} . \tag{24}$$

According to (24) the subsidy rate S_X^{CN} depends on the number of consumers, n, the depreciation rate of cultural capital, α, the time preference, δ, and on the marginal willingness-to-pay for cultural capital, (U_Z/U_Y). The greater is n, the higher is the efficient subsidy rate, ceteris paribus. The faster the cultural capital depreciates, the lower is the efficient subsidy rate. The higher the agents' preference for present consumption, the lower is the efficient subsidy rate.

(24) has another interesting interpretation: Suppose through her consumption of the cultural service, consumer h increases the cultural capital at the margin. Since h is a Cournot-Nash consumer, she takes the beneficial effect of this change on her own well-being into account and evaluates that effect at $\mu = U_Z/(\alpha+\delta)$. Owing to symmetry the same beneficial effect accrues to all other consumers. But since no market transaction is involved, h does not receive any remuneration for her contribution to the other consumers' well-being and therefore ignores these (external) benefits in her own utility maximization calculus. The subsidy rate S_X^{CN} from (24) is designed to pay consumer h exactly the value of her (previously external) benefits to the $(n-1)$ other consumers. Thus the cultural externality is internalized.

6.2 Ignorant consumers

Using (19), the Hamiltonian from equation (15) is now:

$$H = U(X_t, Y_t, Z_t) + \lambda[R - T - (P_X - S_X)X_t - P_Y Y_t] . \tag{25}$$

The FOCs are:

$$\frac{U_X}{U_Y} = \frac{P_X - S_X}{P_Y} . \tag{26}$$

Denote by S_X^M the efficient subsidy rate which is characterized, in view of (10), (24), and (26), as

$$S_X^M = \frac{P_Y V}{U_Y} = \frac{P_Y U_Z}{U_Y} \frac{n}{\alpha+\delta} = S_X^{CN} + \frac{P_Y U_Z}{U_Y(\alpha+\delta)} . \tag{27}$$

Comparing (27), and (24), S_X^M and S_X^{CN} turn out to be quite similar. Since the terms $\frac{P_Y U_Z}{U_Y}$ and $\frac{1}{\alpha+\delta}$ are the same in both cases, it follows that $S_X^M > S_X^{CN}$.

It is straightforward to interpret this observation: The ignorant consumer disregards the beneficial effect of an increase in cultural capital, induced by herself, on all other consumers. In this respect she behaves like the Cournot-Nash consumer, and to internalize that externality she needs to be subsidized by the rate S_X^{CN}. But in contrast to the Cournot-Nash consumer the ignorant consumer also ignores in her consumption plan the benefits she offers to herself through an increase in cultural capital induced by her own cultural service consumption. The value of this benefit is $\mu = U_Z/(\alpha + \delta)$, in terms of utility, or, $P_Y U_Z/[U_Y(\alpha + \delta)]$, in terms of money. This amount of money must be added to the subsidy rate S_X^{CN} to achieve a complete internalization of the cultural externality in a market economy with ignorant consumers.

A final remark is in order regarding the comparison of S_X^M and S_X^{CN} when the number of consumers becomes very large. With increasing n, the difference $S_X^M - S_X^{CN}$ remains positive but tends to zero. The greater is n the smaller is the impact of each individual Cournot-Nash consumer on the formation of cultural capital and the less significant becomes the difference between Cournot-Nash behavior and ignorant behavior. In that sense ignorant behavior may be considered a fairly good approximation for Cournot-Nash behavior in sufficiently large societies.

7. Concluding Remarks

The justifications for government support of cultural services discussed in the cultural economics literature are mostly confined to static analysis. The present paper demonstrated that the consideration of dynamic aspects of positive externalities associated to the consumption of cultural services makes a strong, and in our view, more convincing case for government subsidization. The preceding analysis builds on a simple game theoretic model and finds that, in the absence of government intervention, both cultural services and cultural capital are underprovided and that this allocative inefficiency can be eliminated by an appropriate subsidy on the consumption of cultural services.

Essentially, this conclusion is driven by the basic hypothesis that the consumption of cultural services is not only beneficial for the individual consumer but contributes to form a "better" or a "more civilized" society which is enjoyed by all its members irrespective of (and in addition to) their own cultural service consumption. Therefore, the empirical relevance of that ap-

proach depends heavily on our concept of cultural capital and its measurability. Similar as with the related notion "social capital" or even "human capital", empirical measurement turns out to be difficult which, unfortunately, leaves us without clear-cut evidence for the hypothesis that citizens appreciate the accumulation of cultural capital.

While this ambiguity is clearly unsatisfactory, it is not convincing to argue, on the other hand, that a concept is rendered elusive and (hence) useless whenever it is difficult to measure. Consider, as a case in point, the notion of merit goods that was introduced some fifty years ago and is heavily disputed since then. The present model may be interpreted as a rationalization of the issues involved in the allocation of a good which some people use to call a merit good. One could argue that our modeling of the cultural service as a merit good is as unsatisfactory as the ad hoc merit good approach because the "black box" merit good is merely substituted by a new "black box" called cultural capital. We maintain, however, that our model focuses on a well-defined externality issue and draws our attention on a specific hypothesis about cultural capital, its development and effects. In our view it offers better guidance in tackling merit-good type of problems than the traditional paternalistic merit-good approach.

In concluding, recall that we did not incorporate into our model the process of creating new cultural goods. Conceptually, it is clear how the present model must be extended to accommodate for investments to augment the stock of goods. First, this stock would need to be explicitly introduced as a state variable in addition to cultural capital and, second we would need a production function for new cultural goods that are interpreted as investments in the stock of cultural goods. It is plausible that, among other inputs, cultural capital should enter that production function as a production factor creating a feedback effect that makes the dynamics of cultural growth or decline both more realistic and very complex. Tackling these additional aspects in a rigorous analysis is a highly relevant and rewarding item on the agenda for future research, since such an approach would promise to give new insights into an issue which was clearly beyond the scope of the model in the present paper: the rationale of supply-side subsidies to stimulate the production of new cultural goods.

Appendix A

Derivation of the Steady State

In view of (2′) we have $U_Z(X,Y,Z) = U_Z^2(Z)$. Hence equation (9) reads

$$\dot{V} = (\alpha + \beta)V - nU_Z^2(Z) \; . \tag{A1}$$

For $\dot{V} = 0$, equation (A1) yields

$$V = \frac{nU_Z^2(Z)}{\alpha+\delta} =: nK(Z) \; . \tag{A2}$$

Since $U_{ZZ} < 0$ by assumption, the $\dot{V} = 0$ locus implied by equation (A2) is negatively sloped.

Using equation (10), V can be rewritten as

$$V = \frac{C_X}{C_Y} U_Y^1(X,Y) - U_X^1(X,Y) \; . \tag{A3}$$

Substituting $Y = \frac{R}{C_Y} - \frac{C_X}{C_Y} X$ from (4) into equation (A3) we get

$$V = \frac{C_X}{C_Y} U_Y^1[X, (\frac{R}{C_Y} - \frac{C_X}{C_Y} X)] - U_X^1[X, (\frac{R}{C_Y} - \frac{C_X}{C_Y} X)] =: F(X) \; . \tag{A4}$$

The derivative of function F is:

$$F_X = 2\frac{C_X}{C_Y} \underset{+}{U_{XY}} - \left(\frac{C_X}{C_Y}\right)^2 \underset{-}{U_{YY}} - \underset{-}{U_{XX}} \; . \tag{A5}$$

Owing to the assumptions on U introduced in equation (2), F_X is positive.

For $\dot{Z} = 0$, equation (3) yields $X = \frac{\alpha Z}{n}$. We insert this equation in function F from (A4) to obtain the $\dot{Z} = 0$ locus in the (V, Z) space.

$$V = F\left(\frac{\alpha Z}{n}\right) = \underset{+}{G}(Z, \underset{-}{n}) \tag{A6}$$

Hence along the $\dot{Z} = 0$ locus V is strictly increasing in Z. Note that the steady state value Z_E is then obtained by solving the equations (A2) and (A6) simultaneously: $nK(Z) = G(Z, n)$. Since U is assumed well-behaved (cf. footnote 6) the solution Z_E to this equation is unique and satisfies $Z_E > 0$, because $G_Z > 0$ and $G(Z, n) > 0$ for large values of Z and because $K_Z < 0$ and

$K(Z) > 0$ for all $Z > 0$. As a consequence, $V_E = G(Z_E, n) > 0$ and $X_E := \alpha Z_E / n > 0$. We also conclude that $Y_E > 0$ since $F(X)$ is not defined for $X = X_{\max} = R/C_X$.

Appendix B

Derivation of the Cournot-Nash Equilibrium

The optimal control problem (11) – (13) is solved by applying the current-value Hamiltonian:

$$H = U(X_t, Y_t, Z_t) + \mu(X_t + \bar{X} - \alpha Z_t) + \lambda(R - P_X X_t - P_Y Y_t) \,. \tag{14}$$

The FOCs for a solution to (11) are:

$$\frac{\partial H}{\partial X} = U_X + \mu - \lambda P_X = 0 \,, \tag{B1}$$

$$\frac{\partial H}{\partial Y} = U_Y - \lambda P_Y \,, \tag{B2}$$

$$\dot{\mu} = \delta\mu - \frac{\partial H}{\partial Z} = (\alpha + \delta)\mu - U_Z \,. \tag{B3}$$

Combining equations (B1) and (B2) we obtain

$$\frac{U_X}{U_Y} = \frac{P_X}{P_Y} - \frac{\mu}{U_Y} \,. \tag{B4}$$

Similar as (10), equation (B4) shows that each consumer's *MRS* between X and Y must equal the price ratio minus the ratio of the shadow price of cultural capital and the marginal utility with respect to Y. Combining equations (B3) and (B4) and substituting $\frac{R}{P_Y} - \frac{P_X}{P_Y} X$ from (13) μ can be rewritten as

$$\mu = \frac{P_X}{P_Y} U_Y[X, (\frac{R}{P_Y} - \frac{P_X}{P_Y} X)] - U_X[X, (\frac{R}{P_Y} - \frac{P_X}{P_Y} X)] \; =: F(X) \,. \tag{B5}$$

Since all consumers are assumed to be identical, it is appropriate to restrict the equilibrium analysis to a symmetric Cournot-Nash equilibrium. Hence for every agent there exists an individually optimal time path

$\{X_t\}, \{Y_t\}, \{Z_t\}$ for any given $\bar{X}$. The associated necessary equilibrium condition is then $X_i = X_j = X$ for all $i, j = 1, \ldots, n$. It follows that

(B6) $$\sum_{j \neq h} X_j = (n-1)X \, .$$

As before, the change in the stock of cultural capital is given by

(B7) $$\dot{Z} = nX - \alpha Z \, .$$

The equations (12), and (B7) are not contradictory since (12) is the individual consumer's perception whereas (B7) reflects the actual intertemporal changes of cultural capital under the (necessary) equilibrium condition $X_j = X_h = X$ for all $j, h = 1, \ldots, n$. We combine (B7) and (B5) to obtain the $\dot{Z} = 0$ locus in the (μ, Z) space:

(B8) $$\mu = F(X) = F\left(\frac{\alpha Z}{n}\right) =: G(Z, n) \, .$$

For $\dot{\mu} = 0$ equation (B3) yields

(B9) $$\mu = \frac{U_Z(Z)}{\alpha + \delta} =: K(Z) \, .$$

The Cournot-Nash equilibrium of cultural capital Z_{CN} is then implicitly defined through the equation $G(Z, n) = K(Z)$. We also know that $\mu_{CN} := G(Z_{CN}) > 0$ and hence the equilibrium dynamics are qualitatively the same as in case of the optimal time path discussed in section 3.2.

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