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Cultural Goods Production, Cultural Capital Formation and the Provision of Cultural Services

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Cultural Goods Production, Cultural Capital Formation and the Provision of Cultural Services*

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Abstract

Cultural capital is assumed to benefit all members of society. It is accumulated through the consumption of cultural services and is diminished through depreciation. Using the stock of cultural goods, cultural services are provided by the cultural services industry; the stock of cultural goods is enlarged by the flow of new cultural goods created by individuals who are both consumers and creators of culture and whose utility is positively affected by the cultural goods they created. In the no-policy market economy, individuals tend to ignore the positive external effects of their cultural services consumption and creation of cultural goods on other individuals via augmenting cultural capital and cultural-goods stock. Consequently, less cultural capital and cultural-goods stock will be accumulated. The efficient allocation can be restored by introducing an appropriate subsidy that stimulates the consumers' demand for cultural services, and the creation of new cultural goods, promotes the accumulation of cultural capital and cultural goods.

Jel-code: H2, H3, Z1

Keywords: cultural capital, cultural services, cultural goods

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* This paper is part of my dissertation.

1 Introduction

Unintendedly, social beneficial effects emerge from individuals' participation in cultural activities (e.g. when attending concerts to derive private pleasure): crime will be reduced, living-together in community will be more harmonious and creativity and innovative ability will be further developed.[1] Though economists have extensively discussed the concept of positive externality, they either claim an underprovision of culture without further specifying what the concrete link between culture and externality is like, (cf. e.g. Robbins (1963, p. 58) and Baumol and Bowen (1966, p. 382n.)), or they list various externalities and invoke them to justify public support for culture, (cf. e.g. Netzer (1978, p. 22n) and Fullerton (1992, p. 80)). 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. Though Ulibarri (2000) provides a dynamic framework to develop a theory of rational philanthropy in forming "cultural capital", he rather focuses on the interdependence between capital market opportunities and public funding for culture.

This paper first specifies culture in three aspects as cultural goods, cultural services and cultural capital in a dynamic stock-flow model; it then distinguishes and focuses on the relations between these different aspects of culture. Next it models the social components of the consumption of culture via a process of accumulation (and depreciation) of cultural capital (following Pethig and Cheng (2002)), the creation of new cultural goods to build up the stock of cultural goods, which in turn has an effect on the individuals' well-being. While the present paper doesn't aim at surveying and comparing various notions of culture and related terms applied in the literature, it is necessary to define the terms, cultural goods, cultural services and cultural capital specifically for the purpose of the subsequent analysis.

Cultural goods[2] are considered to consist of tangible or intangible items of cultural significance like heritage buildings, sites, locations, works of arts (e.g. paintings, sculptures), literature and music etc. 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. Following

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1 For empirical investigations see e.g. UNESCO (1998), Part one.

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. UNESCO (2000) describes cultural goods as follows: "Cultural goods…are the result of individual or collective creativity, include printed matter and literature, music, visual arts, cinema and photography, radio and television, games and sporting goods". In spirit this description is quite close to the term we use here.

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 we focus on consumptive cultural services, called *cultural services*[3]. Cultural services are considered to be all cultural performances provided by cultural institutions. These cultural services may take many widely differing forms such as visits to museums, attendances of concerts or reading books. Implicitly, the meaning and importance of cultural heritage for society is closely linked to the number and kinds of cultural services flowing from the stock of cultural goods. The magnitude and the structure of those flows depend, in turn, to a large extent on costs of providing 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, the stock of cultural goods *can* facilitate the provision of cultural services, but there is no automatism in the cultural heritage "giving rise to a flow of cultural services".

Our principal hypotheses are that the continuous consumption of cultural services over time leads to an accumulation of *cultural capital*[4], and the continuous creation of new cultural goods leads to an increase of the stock of cultural goods. Both stocks are positively valued by all members of society.

Following 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 author] is an important resource for individuals and can greatly affect their ability to act and their perceived quality of life."

Introducing cultural goods and cultural capital as outlined above in dynamic setups implies that the greater is the stock of cultural goods, the greater is the probability that the flow of cultural services is broad, even though the link between both is not rigid; the more cultural services are consumed the more cultural capital is likely to be generated, after depreciation is accounted for, and the greater will be the external benefits provided for society. Though con-

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[3] Some other authors combine the terms "cultural services" and "cultural goods" used here as "cultural goods". E.g. Towse (2003, p. 2) argues that "cultural goods are tangible objects, such as an artwork or a book; others are intangible services, like a musical performance or a visit to museum". Such a view totally ignores the productive effects of cultural goods on cultural services and therefore doesn't provide a solid basis for rigorous analysis, in our opinion.

[4] The stock of cultural goods as defined in the present study is denoted "cultural capital" by some other authors, e.g. Bourdieu (1983) and Throsby (1999). As will be clarified below we use the terms "cultural capital" here in an entirely different way.

sumers may account for their own benefits derived from increases in the stock of cultural goods/cultural capital brought about by their own creation of cultural goods and consumption of cultural services, they tend to ignore the beneficial impact which their own contribution to the generation of cultural goods or cultural capital has on their fellow citizens. This myopic individual behavior gives rise to external cultural benefits.

The basic idea to be developed in the present paper is hence the insight, aptly expressed by Heller and Starrett (1976, p. 10) that "one can think of externalities as nearly synonymous with non-existence of markets". In their view an externality "is a situation in which the private economy lacks sufficient incentives to create a potential market in some good and the non-existence of this market results in losses in Pareto efficiency". This paper aims at establishing a benchmark economy, in which an optimal intertemporal allocation is characterized by introducing Lindahl prices (1919) to eliminate the market failure. This set-up turns out to imply that under the condition that all agents reveal their willingness-to-pay for public goods truthfully, the market mechanism indeed implements the optimal intertemporal allocation. Lindahl markets are highly artificial since they are based on the problematic assumption that the agents truthfully reveal their willingness-to-pay for public goods. Yet agents have an incentive to underreport their willingness-to-pay and this is why Lindahl markets don't emerge in real market economies. The corresponding markets economies are shown to be allocative inefficient. The main conclusion in the present paper is that the market failure can be corrected by introducing an appropriate Pigouian tax/subsidy scheme, in which the cultural externalities can be internalized, such that consumer's demand for cultural services and her creation of new cultural goods will be stimulated, the accumulation of cultural capital and cultural-goods stock will be promoted.

The paper is organized as follows. In section 2 the general theoretical basis is modeled. Section 3 characterizes an efficient intertemporal allocation, which is decentralized in section 4 by Lindahl prices. Section 5 proceeds on the assumption that Lindahl markets do not exist and derives cultural policy recommendation to restore the allocation distortion caused by missing markets. Section 6 concludes.

2 The general model

Consider an economy in which a single composite resource serves as an input to produce three goods: a private consumer good, new cultural goods and cultural services. Society consists of n_c individuals who are not only consumers but also creators of new cultural goods and hence

are producers in that capacity. Therefore we will model individuals as consumer-artists[5]. The representative consumer-artist's utility function is

$$u = U\underset{+\ +\ +\ +\ +}{(g_c, k_c, s_c, v_c, y_c)}. \tag{1}$$

g_c and k_c represent the consumer-artist's demand for the stock of cultural goods and cultural capital which will be specified and interpreted further below. s_c is her consumption of cultural services, v_c is the amount of new cultural goods created by her, and y_c is her consumption of the consumer good.

As an artist, she possesses cultural and technical skills to produce new cultural goods using the production function

$$v_c = V\underset{+\ +}{(r_v, k_c)}, \tag{2}$$

where r_v is the resource input to produce the amount v_c of new cultural goods, given the input k_c of cultural capital. The stock of cultural capital, k_c, as an argument of the production function (2) expresses the hypothesis that a diffusing creativity-stimulating atmosphere in society induces the artists to create more artworks.

New cultural goods, v_c, constitute investments in the stock of cultural goods, *g*. This stock changes over time according to the investment function

$$\dot{g} = n_c v_c - a_g g\ . \tag{3}$$

The state variable, *g*, is the stock of cultural goods created by all artists and known to exist at time *t*. We refer to *g* as the stock of cultural goods supplied at time *t*. It is inherited from the past (cultural heritage), and there is an ongoing process of degradation at an exogenous positive rate of depreciation a_g, reflecting the observation that some fraction of cultural goods gets lost over time either physically or in the memory of the artists and society at large. Examples are the destruction of the historical statues of the Bamiyan Buddhas in Afghanistan under the Taliban regime. As shown in (3), the depreciation of the stock of cultural goods, $a_g g$, is countervailed by adding the newly created cultural goods to it, $n_c v_c$, such that the net increment of the stock of cultural goods may be positive or negative.

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[5] The notion of "artist" is used here as a synonym for "creator of new cultural goods".

As expressed in (1), consumers are affected by the stock of cultural goods (or by parts of it) in two different ways:

(i) The mere existence of cultural goods may give satisfaction to people, it may make them happy and/or proud. This existence value or passive-use value of cultural goods is captured in (1) through $U_{g_c} > 0$.

(ii) Individuals make use of cultural goods actively through consuming cultural services: The Mona Lisa painting is enjoyed by visiting the Louvre in Paris or by looking at one of its photos, prints or replicas; Beethoven's 9th is consumed by attending a live concert or by listening to a radio broadcast or the CD-player. The benefit derived from consuming cultural services is captured in (1) through $U_{s_c} > 0$.

To further illustrate the important distinction between passive use (*g*) and active use (*s*) consider the Chinese terracotta army hidden underground for some 2500 years. Before it was (re)discovered in the 1970s it did not belong to the stock of (known) cultural goods, *g*. It was then added to that stock through reports in the media. But beyond basic information about its existence people were eager to learn more about it, and this demand was satisfied through restoration and the supply of various cultural services ranging from art books, replicas and access to the site.

In our model, cultural services are produced by n_s identical firms with the help of the production functions

$$s_s = \underset{+\ +}{S}(r_s, g_s), \tag{4}$$

where s_s are cultural services produced by the cultural-services firm with resource input r_s and cultural-goods input g_s. An art gallery exhibiting Leonardo da Vinci's Mona Lisa needs to possess that painting as an input. If Beethoven's 9th symphony is performed in a concert hall, the musicians need to have the scores of that symphony etc.

The specification of the production functions (2) and (4) appears to be quite plausible although it may be argued, for example, that in addition to the inputs r_v and k_c in (2), g_s may also be a factor stimulating the individuals' creativity in generating new cultural goods, $V_{g_c} > 0$, and likewise, $S_k > 0$. Yet in what follows we will stick to the production functions (2) and (4) to avoid unreasonable analytical complexity.

Cultural capital is conceived of as an intangible and depreciable asset that is built up by consuming cultural services. Similar to (3) the formation of cultural capital, *k*, is modeled as a dynamic process:

$$\dot{k} = n_c s_c - a_k k\,, \tag{5}$$

where a_k is an exogenous positive rate of depreciation accounting for the observation that some fraction of the stock of cultural capital gets lost over time. For example, the Chinese Cultural Revolution during the 1960s greatly diminished the Chinese society's cultural capital implying that, on the one hand, the external benefits provided by cultural capital declined and that, on the other hand, the Chinese culture became less and less valued by the Chinese society.

The distinction between, and separate consideration of, the stock of cultural goods and the stock of cultural capital in the model and as arguments in the consumer's utility function is motivated by the observation that the existence of cultural goods per se is not an appropriate indicator of a society's intensity of cultural life and its cultural atmosphere. The stock of cultural goods needs to be "activated" to create a cultural atmosphere or - as we call it - cultural capital. That is achieved through the supply and consumption of cultural services which, in turn, are based on cultural goods as an essential input. Therefore the stock of cultural goods has an impact on the accumulation of cultural capital, (5), only indirectly through (4). In other words, the (aggregate) amount of cultural services consumed is related to but is not unambiguously determined by the size of the (aggregate) stock of cultural goods: Societies with a rather small cultural heritage (low *g*) may be culturally very active (high *s*) and vice versa. Hence it is not the stock of cultural goods per se that determines the cultural atmosphere or cultural climate in society but primarily the volume and richness of cultural services through which the existing stock of cultural goods is used by the members of society. Our principal hypothesis is that the continuous consumption of cultural services leads to an accumulation of cultural capital which, in turn, is positively valued by all members of society.

It remains to introduce the production of a private consumer good that is produced by a single (aggregate) firm using the technology

$$y = \underset{+}{Y}\left(r_y\right), \tag{6}$$

where *y* is the amount of the consumer goods produced by the resource input r_y.

The description of our model will now be completed by listing all supply constraints:

$$y > n_c y_c \,, \tag{7}$$

$$n_c \bar{r}_c \geq r_y + n_s r_s + n_c r_v \,, \tag{8}$$

$$k \geq k_c \,, \tag{9}$$

$$g \geq g_c \,, \tag{10}$$

$$g \geq g_s \,, \tag{11}$$

$$n_s s_s \geq s_c \,. \tag{12}$$

The constraints (9) - (12) characterized cultural capital, the stock of cultural-goods and cultural services, respectively, as public goods. The structure of the model is summed up in a non-technical way in Table 1.

Table 1: General structure of the model

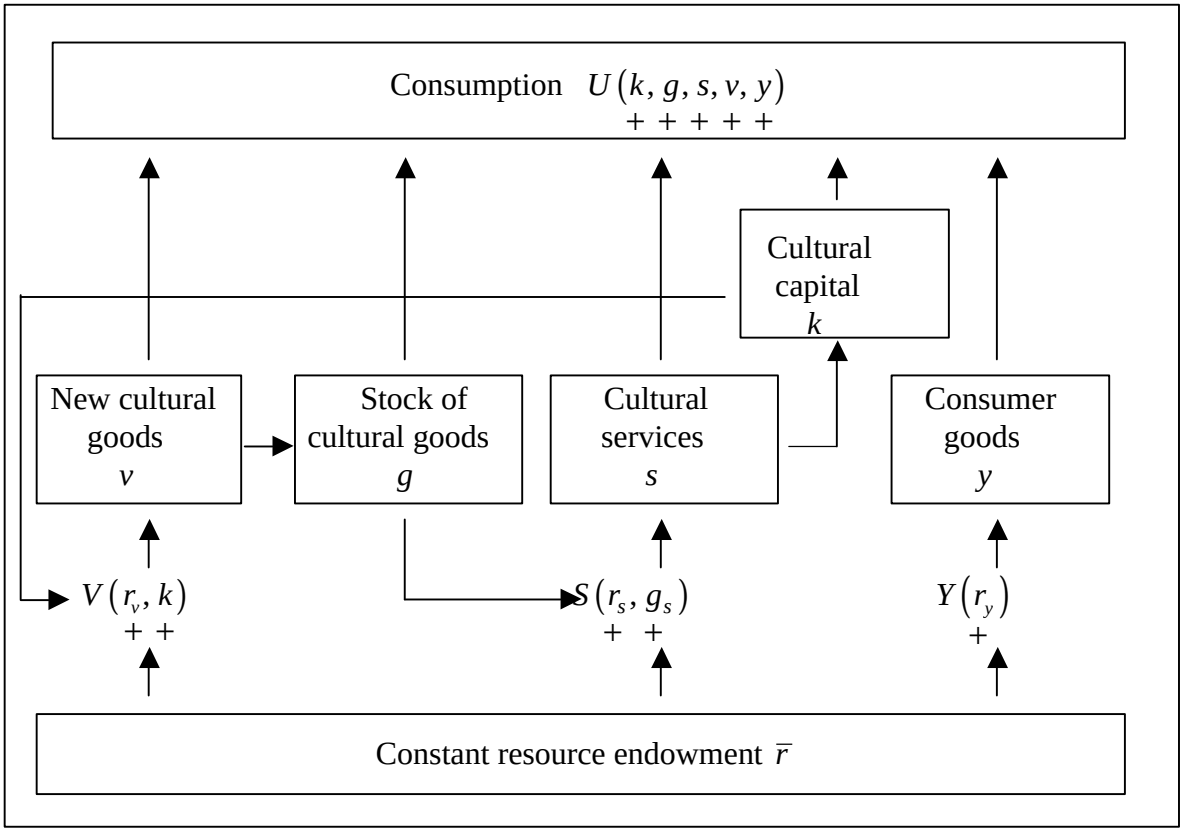

Table 1 shows that the economy's given resource endowment is used to produce three different types of goods: an ordinary (private) consumer goods, *y*, new cultural goods, *v*, and cultural services, *s*. While consumer goods are produced with resources as the only input, extant cultural goods are an essential additional input in the process of producing cultural services. Regarding the creation of new cultural goods it is assumed that cultural capital has a produc-

tivity enhancing effect. All three kinds of goods produced are demanded by consumers. In addition, consumers derive satisfaction from both cultural capital and the prevailing stock of cultural goods. These two stocks are not "produced" in a technical sense but they accumulate (or deplete) over time according to some specific stock-flow relationships modeled in (3) and (5), respectively. The driving force for the accumulation of cultural goods is the creation of new cultural goods by all consumer-artists, while the accumulation of cultural capital is derived by the aggregate consumption of cultural services.

3 Allocative efficiency

The social planner aims at maximizing the Utilitarian welfare function

$$n_c \int_0^{\infty} e^{-dt} U\left(g_c, k_c, s_c, v_c, y_c\right) dt\,, \quad \text{subject to (2) - (12),} \tag{13}$$

where d is a positive and constant social discount rate. Hence the planner has to solve a problem of optimal control where the time path of the state variables *g* and *k* is guided by the control variables $g_c, g_s, k_c, s_c, s_s, v_c, r_s, r_v, r_y, y_c$ and y. To characterize the socially optimal intertemporal allocation, consider the following Hamiltonian associated to the social planner's optimization problem:

$$\begin{aligned} H = {} & n_c U\left(g_c, k_c, s_c, v_c, y_c\right) + \mu_g\left(n_c v_c - \alpha_g g\right) + \mu_k\left(n_c s_c - \alpha_k k\right) + \lambda_y\left[Y\left(r_y\right) - y\right] \\ & + n_s \lambda_s\left[S\left(r_s, g_s\right) - s_s\right] + n_c \lambda_v\left[V\left(r_v, k_c\right) - v_c\right] + \lambda_r\left(n_c \bar{r}_c - r_y - n_s r_s - n_c r_v\right) \\ & + \lambda_c\left(y - n_c y_c\right) + n_c \lambda_{sc}\left(n_s s_s - s_c\right) + n_c \lambda_{gc}\left(g - g_c\right) + n_s \lambda_{gs}\left(g - g_s\right) + n_c \lambda_k\left(k - k_c\right), \end{aligned} \tag{14}$$

where μ_g and μ_k are co-state variables and λ's denote Lagrangean multipliers. The associated marginal conditions are enumerated in the first column of Table 2. The characteristics of the optimal time path for cultural goods are spelled out after some rearrangement of these pertinent marginal conditions as follows:

$$\frac{\mu_g}{U_y Y_r} = \frac{1}{V_r} - \frac{U_v}{U_y Y_r}, \tag{15}$$

Table 2: Comparison of rules governing a socially optimal allocation and an equilibrium in the market economy

	GM	BM	BL
	1	2	3
1	$U_{k_c} = l_k - l_r\left(V_k / V_r\right)$	$U_{k_c} = b_c p_{kc} - b_c p_r\left(V_k / V_r\right)$	-
2	$U_{g_c} = l_{gc}$	$U_{g_c} = b_c p_{gc}$	$U_g = b_c t_g / n_c$
3	$U_v V_r = l_r - m_g V_r$	$U_v V_r = b_c p_r - b_c p_v V_r$	$U_v V_r = b_c p_r - b_c p_v V_r$
4	$U_s = l_{sc} - m_k$	$U_s = b_c p_{sc} - b_c p_{sK}$	$U_s = b_c p_{sc} + b_c t_{sc}$
5	$l_r = n_c l_{sc} S_r$	$p_r = p_s S_r$	$p_r = p_s S_r$
6	$l_{gs} = n_c l_{sc} S_g$	$p_{gs} = p_s S_g$	$p_{gs} = p_s S_g$
7	$\dot{m}_g = \left(d + a_g\right) m_g - n_c l_{gc} - n_s l_{gs}$	$\dot{p}_g = \left(d + a_g\right) p_v - p_g$	$\dot{p}_g = \left(d + a_g\right) p_v - t_g - p_g$
8	$\dot{m}_k = \left(d + a_k\right) m_k - n_c l_k$	$\dot{p}_k = \left(d + a_k\right) p_{sK} - p_k$	-
9	$l_r = l_y Y_r$	$p_r = p_y Y_r$	$p_r = p_y Y_r$

$$\frac{\dot{m}_g}{(d+a_g)U_rY_r} = -\left\{\left[\frac{n_c\frac{U_g}{U_yY_r}}{(d+a_g)} + \frac{n_s\frac{S_g}{S_r}}{(d+a_g)}\right] - \left(\frac{1}{V_r} - \frac{U_v}{U_yY_r}\right)\right\}. \tag{16}$$

$$[1] = -\{([2]+[3]) - ([4]-[5])\}.$$

m_g / U_yY_r is the shadow price of cultural goods produced by consumer-artists in terms of the resource. According to (15) the shadow price of cultural goods equals the difference between the individual's marginal cost of producing new cultural goods (i.e. her marginal investment cost) and her marginal benefit from creating new cultural goods. Ceteris paribus, the shadow price goes up when the investment is successively increased and vice versa. In (16), [*1*] is the present value of the change in time of the shadow price of cultural goods (in terms of the resource). [*2*] is the present value of the consumers' aggregate marginal passive-use benefits from cultural goods. [*3*] is the present value of the aggregate marginal productivity effect of cultural goods in the production of cultural services. ([*4*] - [*5*]) is the marginal social cost of cultural goods while ([*2*] + [*3*]) is their marginal social benefit. Closer inspection of (16) yields

$$\dot{m}_g \begin{Bmatrix} > \\ = \\ < \end{Bmatrix} 0 \quad \Leftrightarrow \quad ([2]+[3]) \begin{Bmatrix} < \\ = \\ > \end{Bmatrix} ([4]-[5]) \quad \Leftrightarrow \quad ([2]+[3]+[5]) \begin{Bmatrix} < \\ = \\ > \end{Bmatrix} [4],$$

which indicates that if the marginal social benefit of cultural goods is smaller than (equal to, greater than) the marginal social cost of cultural goods, the shadow price of cultural goods declines (keeps unchanged, increases) over time.

After having investigated the optimal time path for cultural goods, we now turn to the characteristics of the optimal path for cultural capital that are elicited from the marginal conditions as

$$\frac{m_k}{U_yY_r} = \frac{1}{n_c}\left(\frac{1}{S_r} - n_c\frac{U_s}{U_yY_r}\right), \tag{17}$$

$$\frac{\dot{m}_k}{(d+a_k)U_yY_r} = -\left\{\left[\frac{n_c\frac{U_k}{U_yY_r}}{(d+a_k)} + \frac{n_c\frac{V_k}{V_r}}{(d+a_k)}\right] - \frac{1}{n_c}\left(\frac{1}{S_r} - n_c\frac{U_s}{U_yY_r}\right)\right\}. \tag{18}$$

$$[6] = -\{([7] + [8]) - \frac{1}{n_c}([9] - [10])\}.$$

The shadow price of cultural capital (in terms of the resource) has a similar structure as that of cultural goods. It is the $1/n_c$ *th* part of the difference between the marginal resource cost of production and the consumers' aggregate marginal willingness-to-pay for cultural services. From the viewpoint of cultural-capital formation, the marginal benefits of cultural services accruing to consumers ($U_s > 0$) constitute a positive externality. Hence the aggregate marginal willingness-to-pay for cultural services reduces the marginal social costs of cultural capital. In (18), [*6*] is the present value of the change in time of the shadow price of cultural capital. [*7*] is the present value of the consumers' aggregate marginal benefits from cultural capital. [*8*] is the present value of the aggregate marginal productivity effect of cultural capital in the production of new cultural goods. ([*9*] - [*10*]) is the $1/n_c$ *th* part of the marginal social cost of cultural capital while ([*7*] + [*8*]) is their marginal social benefit. (18) implies

$$\dot{m}_k \begin{Bmatrix} > \\ = \\ < \end{Bmatrix} 0 \quad \Leftrightarrow \quad ([7]+[8]) \begin{Bmatrix} < \\ = \\ > \end{Bmatrix} \frac{1}{n_c}([9]-[10]) \quad \Leftrightarrow \quad \left([7]+[8]+\frac{1}{n_c}[10]\right) \begin{Bmatrix} < \\ = \\ > \end{Bmatrix} \frac{1}{n_c}[9],$$

which says that if the marginal social benefit of cultural capital is smaller than (equal to, greater than) the marginal social cost of cultural capital, the shadow price of cultural capital declines (keeps unchanged, increases) over time.

A steady state of the socially optimal time path is defined by $\dot{k} = 0, \dot{m}_k = 0$ and $\dot{g} = 0, \dot{m}_g = 0$. In view of (3), (5), (16) and (18) it is straightforward to characterize such a steady state by

$$n_c v_c = a_g g\,, \tag{19}$$

$$n_c s_c = a_k k\,, \tag{20}$$

$$[2]+[3]+[5]=[4] \qquad \text{or} \qquad \frac{n_c \dfrac{U_g}{U_y Y_r}}{(d + a_g)} + \frac{n_s \dfrac{S_g}{S_r}}{(d + a_g)} + \frac{U_v}{U_y Y_r} = \frac{1}{V_r}\,, \tag{21}$$

$$[7]+[8]+\frac{1}{n_c}[10] = \frac{1}{n_c}[9] \quad \text{or} \quad \frac{n_c \dfrac{U_k}{U_y Y_r}}{(d + a_k)} + \frac{n_c \dfrac{V_k}{V_r}}{(d + a_k)} + \frac{U_s}{U_y Y_r} = \frac{1}{n_c S_r}\,. \tag{22}$$

According to (19) and (20), new cultural goods constituting the investments in the stock of cultural goods must equal the depreciation of that stock, and the accumulated cultural capital through the consumption of cultural services must equal the loss of cultural capital through

depreciation in the steady state. The interpretation of (21) and (22) is obvious: The marginal production costs of new cultural goods and cultural services, respectively, on the right side of these equations are exactly matched by the respective marginal benefits of these goods. (21) and (22) are the modified version of the famous summation condition of Samuelson (1954, p. 387-389) for the optimal allocation of public goods.

4 The Lindahl economy as a benchmark

Now we explore how the market mechanism performs in the context of cultural economics as modeled here and, in particular, under which conditions it is possible to implement the optimal allocation through the market mechanism. To answer these questions, we make use of standard welfare economic methodology to study how the optimal intertemporal allocation can be "decentralized by prices. The personalized prices a la Lindahl (1919) derived here serve as a benchmark (denoted as BM) for later reference. The market economy we envisage in the present section exhibits a complete set of perfectly competitive markets, some of which will turn out to be purely virtual or fictitious. The market economy is made up of five different types of agents. All of them are price takers and we characterize them by their market transactions and the optimization problems they solve.

? The representative consumer-artist carries out the following transactions:

- She sells her resource endowment $\bar{r}_c$ at price p_r and buys back her own demand for the resource, r_v, at the same price, to create new cultural goods.
- She sells her newly created cultural goods, v_c, to firm G (to be specified below) at price p_v.
- She buys the amount g_c of cultural goods from firm G at price p_{gc}.
- She buys the amount s_c of cultural services for own consumption at price p_{sc}, and sells the amount s_{cK} of cultural services consumed to the firm K at price p_{sK}.
- She buys the amount k_c of cultural capital from firm K at the price p_{kc}; like g_c (see above) k_c is treated here as the consumer-artist's endogenous decision variable.
- She buys private consumer goods, y_c, at price p_y.

All these transactions listed above are subject to the budget constraint

$$p_{sK}s_{cK} + p_v v_c + p_r \bar{r}_c + p_c \geq p_{gc}g_c + p_{kc}k_c + p_r r_v + p_{sc}s_c + p_y y_c, \tag{23}$$

where p_c is consumer-artist's share of profits, taken as constant by her. The consumer-artist aims at maximizing the present value of her utility

$$\underset{(g_c, k_c, r_c, s_c, s_{cK}, v_c, y_c)}{Max} \int_0^\infty U(g_c, k_c, s_c, v_c, y_c) e^{-dt} dt,$$

$$\text{subject to} \quad v_c = V(r_v, k_c), \quad s_{cK} \leq s_c \quad \text{and} \quad (23). \tag{24}$$

The pertinent Hamiltonian reads

$$H^C = U(g_c, k_c, s_c, v_c, y_c) + b_{vc}\left[V(r_v, k_c) - v_c\right] + b_S(s_c - s_{cK})$$
$$+ b_c\left[p_{sK}s_{cK} + p_v v_c + p_r \bar{r}_c + p_c - p_{gc}g_c - p_{kc}k_c - p_r r_v - p_{sc}s_c - p_y y_c\right]. \tag{25}$$

? Firm Y buys the resource, r_y, at price p_r, produces the consumer goods *y*, and sells them to the consumer-artists at price p_y. Firm Y hence maximizes the present value of its profit:

$$\underset{(y, r_y)}{Max} \int_0^\infty \left(p_y y - p_r r_y\right) e^{-dt} dt, \quad \text{subject to (6).} \tag{26}$$

Firm Y's optimization calculus is to solve the Hamiltonian:

$$H^Y = p_y y - p_r r_y + b_y\left[Y(r_y) - y\right]. \tag{27}$$

? The representative cultural-cervices firm produces cultural services, s_s. It buys the resource input, r_s, at price p_r, and cultural-goods input (taken from the stock of cultural goods), g_s, at the price p_{gs}. The demand price of cultural services, as introduced above, is p_{sc}. Hence the cultural-services producer's revenue from selling one and the same unit of its output to all demanders is $n_c p_{sc}$. In what follows it is analytically convenient to assume that the cultural-services firm's supply of cultural services, s_s, is (intended to be) sold to all n_c consumer-artists at some (aggregate) supply price p_s. As will be shown further below, a necessary equilibrium condition will then turn out to be $p_s = n_c p_{sc}$. The cultural-services firm maximizes the present value of its profit:

$$\underset{(g_s, r_s, s_s)}{Max} \int_0^\infty \left(p_s s_s - p_r r_s - p_{gs} g_s\right) e^{-dt} dt, \text{ subject to (4).} \tag{28}$$

The pertaining optimal production is attained by solving the Hamiltonian:

$$H^S = p_s s_s - p_r r_s - p_{gs} g_s + b_{sj}\left[S\left(g_s, r_s\right) - s_s\right]. \tag{29}$$

? Firm G purchases *new* cultural goods, v_G, at price p_v from the consumer-artists and sells cultural goods, g_G, from the stock of cultural goods, *g*, to all cultural-service firms and to all consumer-artists, where g_G is now firm G's decision variable and *g* is the state variable. (In equilibrium the condition $g_G = g$ needs to be satisfied). Recall that p_{gs} is the price the cultural-services firm pays for each unit of cultural goods purchased. Hence firm G accrues the revenue $n_s p_{gs}$ per unit of cultural goods sold to all cultural-service firms. Likewise, the consumer-artist buys a unit of cultural goods from firm G at price, p_{gc}. It follows then that firm G obtains the revenue $n_c p_{gc}$ per unit of cultural goods sold to all consumer-artists. Hence if firm G sells a unit of cultural goods to each and every cultural-services firm and to each and every consumer-artist, its total revenue is $\left(n_s p_{gs} + n_c p_{gc}\right) g_G$. Obviously the argument is essentially like that applied above for the market of cultural services. It suffices, therefore, to introduce an aggregate supply price, p_g, for firm G (which will need to satisfy $p_g = n_s p_{gs} + n_c p_{gc}$ in equilibrium). With this set-up, firm G maximizes the present value of its profit:

$$\underset{(g_G, v_G)}{Max} \int_0^\infty \left[p_g g_G - p_v v_G\right] e^{-dt} dt, \quad \text{subject to} \quad \dot{g} = v_G - a_g g \quad \text{and} \quad g_G \le g. \tag{30}$$

The associated Hamiltonian reads:

$$H^G = p_g g_G - p_v v_G + j_g\left(v_G - a_g g\right) + b_G\left(g - g_G\right), \tag{31}$$

where j_g is the co-state variable associated to the state variable *g*.

? Firm K is a fictitious agent, who buys cultural services consumed by the consumer-artists, s_K, at price p_{sK} and sells the cultural capital, k_K from the stock of cultural capital, *k*, at the aggregate supply price p_k. The supply price needs to satisfy the condition $p_k = n_c p_{kc}$ in equilibrium. Firm K maximizes the present value of its profits,

$$\underset{(k_K, s_K)}{Max} \int_0^\infty \left[p_k k_K - p_{sK} s_K\right] e^{-dt} dt, \quad \text{subject to} \quad \dot{k} = s_K - a_k k \quad \text{and} \quad k_K \le k. \tag{32}$$

Technically speaking, k_K belongs to firm K's control variables whereas *k* is cultural capital as a state variable. Note also that the condition $k_K = k$ needs to be satisfied in equilibrium. Firm K sells k_K to the consumer-artists. In view of (32), firm K can be interpreted as a public enterprise maximizing the present value of the intangible asset "cultural capital" k_K. The pertinent Hamiltonian is

$$H^K = \left[p_k k_K - p_{sK} s_K \right] + j_k \left(s_K - a_k k \right) + b_K \left(k - k_K \right), \tag{33}$$

where j_k is the co-state variable associated to the state variable *k*.

The marginal conditions derived from solving (25), (27), (29), (31) and (33) are listed in the second column of Table 2. We now investigate how this hybrid market equilibrium fares in terms of allocative efficiency[6] by following the standard procedure of comparing the marginal conditions of the efficient regime in section 3 with the marginal conditions derived above. The result is summarized in

Proposition 1

Set $p_y = l_y \equiv 1$, $p_{gc} = \dfrac{U_g}{U_y}$, $p_{gs} = l_{gs}$, $p_{kc} = \dfrac{U_k}{U_y} + \dfrac{l_r V_k}{V_r}$, $p_s = l_s$, $p_{sc} = l_{sc}$, $p_{sK} = m_k$,

$p_v = m_g$, $p_r = l_r$, $p_g = n_c \dfrac{U_g}{U_y} + n_s \dfrac{l_{gs}}{l_y}$ *and* $p_k = n_c \left(\dfrac{U_k}{U_y} + \dfrac{l_v V_k}{l_y} \right)$, *where all terms on the right side of the equations are evaluated at the solution of maximizing* (13) *subject to* (2) - (12). *Then at each point in time a general competitive equilibrium is attained in economy BM and the associated allocation is efficient.*

Proposition 1 will be proved with the help of Table 2. Observe first that in column 1 of Table 2 the optimality conditions are listed with the implicit information $U_y = l_y$. To avoid clutter we slightly abuse the notation by writing

$$\frac{l_r}{l_y} = l_r, \ \frac{U_k}{U_y} = U_k \text{ and } \frac{m_g}{l_y} = m_g \text{ etc.}$$

The second column lists all marginal conditions in the benchmark market economy BM, while $U_y = b_c p_y$ is implicitly considered. Similar to our treatment of the first column, we divide by

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[6] It would also be important, in the first place, to secure the existence of such an equilibrium. We conjecture that an equilibrium can be shown to exist but a rigorous existence proof is beyond the scope of the present study.

$b_c p_y$ (or U_y) both sides of the equations contained in the lines 4 through 7 in the second column. This operation has two effects: First, U_w in these lines really represents the marginal rate of substitution $\left(U_w / U_y\right)$ for $w = g_c, k_c, s_c$ and v_c. Moreover, b_c vanishes or, equivalently, is set equal to one.

With these explanatory comments on Table 2 the proof of *Proposition 1* is now straightforward. It suffices to replace in the second column of Table 2 all prices by the Lagrange multipliers or co-state variables that have been assigned to those prices in *Proposition 1*. Obviously, this operation makes the second column of Table 2 coincide with the first column, line by line. As a consequence, the market allocation is an equilibrium allocation and it is Pareto efficient. This completes the proof of *Proposition 1*.

Proposition 1 provides two important pieces of information. First, it shows that our benchmark market economy is capable to support an efficient allocation and second, it demonstrates how prices guide the allocation efficiently. All prices are positive (in case of an interior solution).

It is worth recalling how the equilibrium Lindahl's prices are fixed. Conceptually the personalized price must be set equal to the agent's willingness-to-pay for the last unit of the public good under consideration

$$p_{gs} = p_s S_g = \frac{p_r S_g}{S_r}.$$

The far right side of this equation is the cultural-services firm's cost savings from a marginal substitution of the resource by cultural goods which leaves the output unchanged. This cost savings exactly equals the firm's willingness-to-pay for the last unit of cultural goods.

The equation

$$p_{gc} = \frac{p_y U_g}{U_y},$$

is straightforward, too. The price consumer-artist pays for her passive use of the stock of cultural goods equals her marginal willingness-to-pay.

The RHS of the equation

$$p_{kc} = \frac{p_y U_k}{U_y} + \frac{p_r V_k}{V_r},$$

indicates that the consumer-artist's (total) marginal willingness-to-pay for cultural capital is the sum of her marginal willingness-to-pay as a consumer $\left(p_y U_k / U_y\right)$ and as a producer $\left(p_r V_k / V_r\right)$.

In equilibrium, the consumer-artist's personalized price for cultural services is given by

$$p_{sc} = \frac{p_y U_s}{U_y} + p_{sK} > \frac{p_y U_s}{U_y}.$$

In other words, the price, the consumer-artist pays for consuming cultural services exceeds her marginal willingness-to-pay for these services implying, under standard concavity conditions, that she consumes more cultural services than she would do when following the $p_{sc} = p_y\left(U_s / U_y\right)$ rule. The deviation from this rule is easily explained. After the consumer-artist has purchased and consumed cultural services she resells them to firm K. The revenue from this sale amounts to an effective reimbursement, in part, of her upfront expenditures for cultural services. Hence $p_{sc} - p_{sK}$ is the net price she really pays for her consumption of cultural goods, and that net price is in fact equal to the marginal willingness-to-pay, U_s / U_y.

A final remark relates to the assignments $p_v = m_g$ and $p_{sK} = m_k$. In the optimal-control program of the social planner, m_g and m_k are co-state variables, i. e. the shadow prices of the stock of cultural goods $\left(m_g\right)$ and the stock of cultural capital $\left(m_k\right)$ in economic interpretation. In the benchmark market economy BM these stocks are not directly priced. But new cultural goods serve as an investment into the stock of cultural goods. Hence $p_v = m_g$ means that the stock of cultural goods is valued through the price of its investment good. The same observation applies to the assignment $p_{sK} = m_k$.

5 Missing markets and efficiency-restoring cultural tax-subsidy policy

In section 4 we showed that the optimal intertemporal allocation of the general model (GM) can be "decentralized by prices" by means of market systems with competitive markets for all commodities which include, in particular, Lindahl markets for cultural goods, cultural services and cultural capital. However, under the realistic assumption that information on preferences and technology is private, Lindahl markets cannot function smoothly unless one implicitly assumes that all agents reveal their characteristics (preferences and/or technologies) truthfully.

Therefore, the important question to ask is whether truthful revelation is in the demanders' self-interest. Unfortunately the answer is no, since all agents have an incentive to misrepresent their characteristics.

In a nutshell, Lindahl markets for public goods cannot be observed in reality. To move towards a more realistic setting we therefore modify the market economy of section 4 by assuming that there are no Lindahl markets while all other competitive markets are still active and function smoothly. More specifically, we will employ the assumption that the Lindahl markets for the consumer-artists' (passive) use of cultural goods and cultural capital are absent. These models will be marked by BL (**B**reakdown of **L**indahl markets). Since the Lindahl markets for the consumer-artists' (passive) use of cultural goods and cultural capital do not exist, in terms of the formal model, we set

$$p_k = p_{kc} = p_{gc} \equiv 0 \,. \tag{34}$$

The model BL differs from the model BM only in the condition (34). Observe, that in BL there are still Lindahl markets, namely the Lindahl market for cultural goods (as production inputs) traded between firm G and the cultural-services firms and the Lindahl market for cultural services traded between cultural-services firms and consumer-artists.[7]

Before we explore the allocative displacement caused by (34) in more detail and analyze the options to restore efficiency by appropriate tax-subsidy schemes, it is useful to investigate the impact of (34) on firm K. Consider firm K's optimal-control problem

$$\underset{(k_K, s_K)}{Max} \int_0^\infty \left[t_k k_K - \left(p_{sK} + t_{sK} \right) s_K \right] e^{-dt} dt \,, \quad \text{subject to} \quad \dot{k} = s_K - a_k k \quad \text{and} \quad k_K \le k \,, \tag{35}$$

where t_k and t_{sK} are tax rates that are unconstrained in sign[8]. Suppose first, $t_k = t_{sK} = 0$. In this case firm K doesn't receive any revenue (subsidy) from selling its cultural capital. Since firm K's objective is to maximize the present value of its profits, any additional unit of cultural capital "produced" implies negative profit. As a result, firm K's best strategy is to cease producing altogether. In terms of the formal model, firm K chooses $s_K = 0$, whenever $p_{sK} > 0$. But if $p_{sK} > 0$, consumer-artists will choose $s_{cK} = s_c$, which is positive, in general. Therefore the market for cultural services between firm K and consumer-artists is in excess

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7 One may cast into doubt the realism of the remaining Lindahl markets. Yet we defend our procedure on the grounds that in order not to blur the analysis by trying to deal with too many complex allocation problems simultaneously, we have to reduce complexity.

8 $t_k > 0$ is a sales subsidy and $t_{sK} < 0$ [$t_{sK} > 0$] is a subsidy [tax] on the purchase of cultural services.

supply, and it follows that $p_{sK} = 0$ is a necessary equilibrium condition. With $p_{sK} = 0$ (and $t_k = t_{sK} = 0$) firm K has neither revenues nor costs and consumer-artists are indifferent in their choice of any $s_{cK} \in [0, s_c]$. If $t_k = t_{sK} = 0$, it is therefore not restrictive to set $s_{cK} = s_c$ and $s_K = n_c s_c$ such that firm K's activity is completely reduced to the differential equation $\dot{k} = s_K - a_k k$, as known from (5).

In principle, firm K could be revitalized by introducing non-zero tax rates. In fact, one could simply set $t_k > 0$ and $t_{sK} > 0$ to replace the missing market price p_k and p_{sK}, respectively. We will refrain from pursuing this line of analysis in what follows, however, because such a tax-subsidy scheme applied to firm K is an institutional design (of a public agency or public enterprise) that doesn't appear to be in the realm of relevance for practical cultural policy. In other words, we assume in what follows that there is no market anymore for the exchange of cultural services between consumer-artists and firm K implying that firm K is no player anymore in our subsequent models. More precisely, the only "reminder" of firm K will be the differential equation (5). The challenge will be to find tax-subsidy schemes, not relying on (non-zero) t_k and t_{sK}, to correct for possible misallocations caused by the missing Lindahl markets (cf. (34)).

But before we address this policy issue, some other points also need to be clarified. Up to now we haven't specified the response to the missing markets of all those agents who were formerly involved in transactions on those markets.

(a) Consider first the markets for cultural services traded between consumer-artists and firm K. In the economy BM the consumer-artist spends the amount of money $p_{sc} s_c$ and $p_s s_c$, respectively, on cultural services and receives the "reimbursement" $p_{sK} s_{cK}$. Since $s_{cK} = s_c$ is an equilibrium condition, the consumer-artist's net expenditure on cultural services amounts to $(p_{sc} - p_{sK}) s_c$ in BM. As argued above, in case of (34) firm K doesn't exist anymore in the economy BL, implying $p_{sK} = 0$ (among other things). Yet it will turn out to be important for our subsequent analysis to allow fees for cultural services to deviate from market prices. Therefore we introduce a tax t_s and assume the consumer's expenditures for cultural services to be $(p_{sc} + t_{sc}) s_c$.

(b)In the absence of a Lindahl market for cultural capital traded between firm K and the consumer-artists and with firm K's disappearance, all consumer-artists enjoy the "prevailing level

of cultural capital" but they fail to understand and hence don't take into account the process of cultural-capital formation. In particular, they totally ignore the impact of their own contributions through consumption of cultural services to the formation of cultural capital. Quite obviously, the larger is the number of consumer-artists, the smaller is a consumer-artist's contribution to the formation of cultural capital and hence the more realistic it is for the consumer-artists to adopt the behavioral pattern of ignorance (cf. Pethig and Cheng, 2002).

(c) In the economy BM firm G sells cultural goods to two distinct groups of demanders: to the cultural-services firms and to the consumer-artists. As outlined in (34) the market between firm G and consumer-artists breaks down. In the absence of the Lindahl market for cultural goods between firm G and consumer-artists, we assume again that consumer-artists are ignorant towards the dynamics of the stock of cultural goods, i.e. all consumer-artists take the prevailing stock of cultural goods as given and enjoy its passive use for free.

Due to the absence of the Lindahl market for cultural goods traded between firm G and consumer-artists, the market is reduced to firm G selling cultural goods to the cultural-services firms only. To compensate firm G for the sales revenues foregone, $n_c p_{gc} g_G$, we will consider a subsidy t_g for consumer-artists on the price at which they purchase cultural-goods stock from firm G.

In their optimization calculus, ignorant consumer-artists take as given the "prevailing" stock *k*, implying that k_c and s_{cK} are no longer in the set of their decision variables. The variable s_{cK} is dropped completely and k_c is replaced by *k*. On the other hand, consumer-artists now get for free their use of cultural capital and their passive use of the stock of cultural goods which they had to pay for in the economy BM. Consequently firm K will not be paid anymore for providing cultural capital to the consumer-artists. In fact, as argued above, firm K can now be safely ignored.

Our subsequent analysis has two focal points: First we wish to demonstrate that in the absence of corrective cultural policies the breakdown of markets causes allocative inefficiency and we aim to characterize the misallocation, as far as possible. We call that situation the no-policy or *laissez-faire* scenario. After that, the natural question is to ask whether and how efficiency can be restored by suitable tax-subsidy schemes. The no-policy scenario is then the special case where all these tax rates are set equal to zero.

5.1 The allocation in economy BL with and without corrective subsidy/taxes

The optimization program (28) of the cultural-services firms carries over from economy BM, but the decision problems of firm G and consumer-artists need to be modified as follows:

? Firm G:

$$\underset{(g_G, v_G)}{Max} \int_0^{\infty} \left[\left(p_g + t_g \right) g_G - p_v v_G \right] e^{-dt} dt ,$$

$$\text{subject to} \quad \dot{g} = v_G - a_g g \quad \text{and} \quad g_G \le g , \tag{36}$$

where $p_g = n_s p_{gs}$. The associated Hamiltonian reads:

$$H^G = \left[\left(p_g + t_g \right) g_G - p_v v_G \right] + j_g \left(v_G - a_g g \right) + b_G \left(g - g_G \right), \tag{37}$$

where j_g is the co-state variable in economy BL. This specification of firm G's decision problem differs from that in section 4 in (30) only through the subsidy rate t_g on firm G's sales of cultural goods to the consumer-artists.

? Consumer-artist:

$$\underset{(r_v, s_c, v_c, y_c)}{Max} \int_0^{\infty} U\left(g, k, s_c, v_c, y_c\right) e^{-dt} dt , \quad \text{subject to}$$

$$v_c = V\left(r_v, k\right) \quad \text{and} \quad p_v v_c + p_r \bar{r}_c + p_c \ge t_g g / n_c + p_r r_v + \left(p_{sc} + t_{sc} \right) s_c + p_y y_c . \tag{38}$$

Note that consumer-artist's optimization calculus in (38) differs from that in (24) in some components: The decision variables g_c and k_c in (24) are substituted by the state variables g and k in (38), implying that the ignorant consumer-artist now takes as given the prevailing stock of cultural goods and cultural capital, she receives the subsidy $t_g g / n_c$ on the price at which she buys the cultural-goods stock (as passive-use). The associated Hamiltonian reads:

$$H^C = U\left(g, k, s_c, v_c, y_c\right) + b_{vc} \left[V\left(r_v, k\right) - v_c \right]$$

$$+ b_c \left[p_v v_c + p_r \bar{r}_c + p_c - t_g g / n_c - p_r r_v - \left(p_{sc} + t_{sc} \right) s_c - p_y y_c \right]. \tag{39}$$

For reference and comparison, the marginal conditions derived above are enumerated in the third column of Table 2.

5.2 The efficiency-restoring cultural tax-subsidy policies

To explore how the market equilibrium fares in terms of allocative efficiency we compare the marginal conditions of the efficient allocation with the marginal conditions derived in section 5.1 and report the results in

Proposition 2

(i) *Set* $p_y = l_y$, $p_r = l_r$, $p_{sc} = l_{sc}$, $p_v = m_g$, $p_s = n_c l_{sc}$, $p_{gc} = l_{gc}$, $p_{gs} = l_{gs}$, $p_g = n_s l_{gs} + t_g$, $t_g = n_c l_{gc}$ *and* $t_{sc} = -m_k$, *where* $m_g, m_k, l_{gc}, l_{gs}, l_r, l_{sc}$ *and* l_y *are the values attained by the respective variables in the solution of* (13) *in section 3. Then at each point in time there exists a general competitive equilibrium in economy BL and the associated allocation is efficient.*

(ii) *If* $t_g = t_{sc} \equiv 0$ *the general competitive equilibrium is inefficient.*

Proposition 2 is verified by applying the same procedure as in the proof of *Proposition 1*. Column 3 of Table 2 summarizes the first-order conditions characterizing the solutions of (26), (28), (36) and (38). Similar to the treatment of column 1 and 2 in sections 3 and 4, we divide by $b_c p_y$ $(=U_y)$ both sides of the equations contained in the lines 4 through 7 in the third column. With the assignment of prices and tax rates as shown in *Proposition 2*, column 3 of Table 2 is made to coincide with column 1. This match is straightforward for all rows except for the rows 1 and 8.

Consider first the process of cultural-capital accumulation (row 8). To see that the subsidy $t_{sc} = -m_k$ renders the accumulation of cultural capital efficient, we carry out the following thought experiment. Suppose, contrary to our setup, firm K is still active and with it the market for cultural services between firm K and the consumer-artists. Let firm K solve (35) assuming $p_{sK} = 0$ (as argued above) but $t_k = n_c l_k$ and $t_{sK} = m_k$. Hence the tax rates (t_k, t_{sK}) exactly replace the missing prices (p_k, p_{sK}). In this scenario the net price the consumer-artist needs to pay for her consumption of cultural services is $p_{sc} - p_{sK} = l_s - m_k$ (see above). In economy BL where firm K is absent the consumer-artist's net price for cultural services is $p_{sc} + t_{sc}$ and due to *Proposition 2* we have $p_{sc} + t_{sc} = l_s - m_k$. Hence the net price of cultural services is the same in both cases. Next we consider the accumulation process of cultural-goods stock (row 7). Now let firm G solve (36) assuming the subsidy rate $t_g = n_c l_{gc} > 0$, the

subsidy hence replaces the missing price $n_c p_{gc}$, the consumer-artist needs to pay for her consumption of cultural-goods stock is $p_{gc} = t_g / n_c$, such subsidy then renders the accumulation of cultural-goods stock efficient. This observation implies that the efficient accumulation of the cultural capital and the cultural-goods stock in economy BL is secured.

We now turn to the row 1 of Table 2 and observe that there is entry in column 1, 2 but no entry in column 3. The reason is, of course, the breakdown of the pertaining Lindahl markets in the economy BL ($p_{kc} = p_{gc} \equiv 0$). In BL the intertemporal allocation of cultural capital and the stock of cultural goods are not guided by demand-side signals anymore. Note, however, that efficiency of the accumulation processes $\dot{k} = n_c s_c - a_k k$ and $\dot{g} = n_c v_c - a_g g$ is achieved as long as the variables s_c and v_c take on their efficient values for all consumer-artists at each point in time. This is secured by the assignment of those prices and subsidy rates that are listed in *Proposition 2*.

The proof of *Proposition 2 (ii)* is simple. Modify the first sentence of *Proposition 2 (i)* by setting $t_g = t_{sc} \equiv 0$, then consider the modified assignments of prices and subsidy rates in the third column of Table 2, and finally juxtapose column 3, modified in this way, to column 1 of Table 2 for comparing all rows pairwise. The entries in the rows 4 and 7 turn out not to match anymore proving that the equilibrium allocation in economy BL is bound to deviate from the Pareto-efficient allocation characterized by the marginal conditions of the first column of Table 2. Hence the equilibrium allocation of economy BL is inefficient.

The central message of *Proposition 2* is that the (equilibrium) allocation of the *laissez-faire* economy is inefficient. The inefficiency of the *laissez-faire* economy, can be restored, however, by means of subsidizing (i) the consumer-artists' creation of cultural goods at the rate $t_g (= n_c l_{gc})$, and (ii) the consumer's consumption of cultural services at the rate $t_{sc} (= -m_k)$. Though the empirical determination of the optimal levels of t_g and t_{sc} is difficult, *Proposition 2* still provides some conceptual basis for the design of an efficient cultural policy: this policy should stimulate the consumer-artists' creation of new cultural goods and consumption of cultural services. The implementation of such efficient cultural policy *can be*, e.g. (i) the active patronage of the government to the consumer-artists' creation of cultural goods, and thus the creational conditions become financially easier/more attractive, such that their creative activities can be encouraged; (ii) the governmental financial support on consumer-artists' participation in cultural activities, therefore, the costs of the visits to museums and the atten-

dances of concert become less, such that the cultural activities can become more intensive. The problem of underprovision of the cultural capital and the cultural-goods stock can be remedied through the efficient cultural policy that stimulates consumer-artists' cultural activities.

6 Concluding remarks

This study provides a theoretical framework of cultural economics to help us to better understand the real world. In our descriptive analysis, we first established a reference market model in which the economy is endowed with a full set of perfectly competitive (Lindahl) markets whose equilibrium is Pareto efficient. However, acknowledging that Lindahl markets don't emerge in the real world for reasons well understood by economists, we found that the *laissez-faire* market allocation without Lindahl markets becomes inefficient. To correct such misallocation and internalize the positive externalities governmental intervention in the agents' cultural activities is called for. We hence explored cultural policies in form of appropriate subsidy/tax schemes that are capable to restore Pareto efficiency. In other words, the provision of cultural capital and cultural goods in the policy-supported market economy coincides with their efficient provision in the benchmark model. The principal findings of our study are summarized in the following three theses.

Thesis 1: In the *laissez-faire* market economy, consumers tend to ignore the beneficial external effects of their cultural-services consumption on the other consumers through accumulating cultural capital. The result is an underprovision of cultural capital.

Thesis 2: In the *laissez-faire* market economy, consumers tend to ignore the beneficial external effects of their creations of cultural goods on the other consumers through augmenting the stock of cultural goods. The result is a suboptimally small stock of cultural goods.

Thesis 3: Allocative efficiency can be restored by appropriate subsidies on the consumption of cultural services and on the creation of cultural goods. These subsidies stimulate the consumers' demand for cultural services and the supply of cultural goods which promotes the accumulation of both cultural capital and cultural goods.

Essentially, these theses were driven by our basic hypotheses that the consumption of cultural services and the creations of cultural goods are not only beneficial for the individual consumers but also contribute to form a "better" or a "more cultivated" society that is valued by all members of society irrespective of their own cultural-services consumption and cultural-goods

creations. Therefore, the empirical relevance of our approach depends heavily on the concepts of “cultural capital” and “cultural-goods stock”, and their measurability. Similarly, as with the related notion of “social capital” or “human capital”, empirical measurement turns out to be difficult. We are therefore left without straightforward evidence for the hypotheses that members of society appreciate the accumulation of cultural capital and are proud of the cultural goods created by themselves and their ancestors. Though the hypotheses may seem trivial, they present demanding challenges for future research.

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