Can Cultural Education Crowd Out Arts Subsidization?

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Abstract

The debate about whether the arts should be supported or not is far from being recent, and most governments support the arts in one way or the other. The literature considers several arguments in favor of such interventions. Education may seem as an action which could, in the long run, lead to possible reductions of subsidies. Surveys show that those who have been exposed to the arts when young, participate more when adult. However, the “non-market” transmission from parents to children, generates an external effect, which has to be taken into account to reach first-best situations. We construct an overlapping generations model in which young consumers are exposed to both public education towards the arts and transmission of such a taste from their parents and show that the first-best can be reached only if there is both public cultural education and subsidization of arts consumption. Education can, therefore, not be considered as a substitute for subsidies to arts consumption though the situations that prevail in most European countries point to subsidizing education, while consumption, especially of the older generations, should be taxed rather than subsidized.

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1 Introduction

The debate about whether the arts should be supported or not is far from being recent, and though the problems and the approaches may vary across countries (and “cultures”), most governments are in favor of subsidizing the arts in one way or the other.

The United States are representative of the tradition in which the arts were mainly supported by noblemen, kings and popes, though, in modern times, these are rather industrialists turned into benefactors and maecenas. Public budgets are rather modest, but some congressmen even find these too large, and given away to politically incorrect or unjustified activities. Countries in continental Europe (France and Italy, among others) represent the other extreme of the spectrum, where most artistic activities are supported by the State. In France, the objective for culture is to reach a budget that amounts to one percent of government expenditure; this is almost the case in 1998, with $2.5 billion, representing 0.95% of the total budget. The United Kingdom stands in between, with a public budget of $1.4 billion, complemented by private donations and, more recently, by the National Lottery, which, not only, funds institutions, but even goes as far as commissioning art.

Though “top of the agenda for the ministers [of France, Italy and the United Kingdom] is to make the arts more accessible to all,” the policies followed can be very different. For instance, the French insist that museums should charge visitors—and they do so—, while free admission at the six British

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2In 1990, governmental assistance represents $900 million, while charitable contributions amount to $650 million. See James Heilbrun and Charles Gray (1993, p. 8). The sole Paul Mellon gave away some $600 million during the last fifty years. See The Art Newspaper, April 1999.

3On the debate about the funding by the National Endowment for the Arts, see Alice Marquis Goldfarb (1995).

4See The Art Newspaper, April 1999.

national museums—which used to charge—was achieved in January 2002.

The arguments used in the economics literature to justify subsidies are discussed in the last chapter of William Grampp’s (1989) book. The list is long: (a) art is a public good, which, unless it gets subsidized, is not produced in a sufficient amount; it must also be subsidized because (b) it yields positive externalities, (c) it is a merit good, (d) its demand depends on its supply, and if it were not available, consumers would not know its value, (e) for equity and efficiency reasons, it should be made available to everyone, and not only to those who can afford it, (f) the stock of art must be maintained, and maintaining is not a profitable activity, (g) producing art involves large fixed costs, and consumers should be charged only the marginal cost, to consume the available supply (the capacity of a museum or of a concert hall), and (h) art is labor intensive and productivity gains are hardly possible. Most of these arguments can be used for many commodities or sectors, and have been studied by economists in more general settings than here.

The last argument on the difficulty or impossibility to achieve productivity gains is more specific to the performing arts. It was put forward, more than thirty years ago, by William Baumol and William Bowen (1965, 1966), and came to be known, in the cultural economics literature, as the Baumol disease. It can be briefly stated as follows. Since wages escalate in sectors other than culture, they must also do so in the performing arts to make them attractive enough for artists to enter, but since no productivity gains are possible, wage increases have to be passed fully to prices. Therefore the relative price of the performing arts increases and, unless subsidized or supported by donors and private funds, the sector will shrink and eventually

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6Grampp discusses the arguments, but finds all of them unconvincing.
7See also Chapter 11 in James Heilbrun and Charles Gray (1993).
8It is worth quoting the (now) standard argument by Baumol and Bowen (1965): “The output per man-hour of the violinist playing a Schubert quartet...is relatively fixed, and it is fairly difficult to reduce the number of actors necessary for a performance of Henry IV, Part II.”
disappear.

The reasons for justifying public support are mainly based on the normative, but unverified, assumption that “art is useful,” and so are the arguments in favor of cultural education. Recently, the French Minister of education pointed out that, in this respect, “France is lagging behind” since only three percent of the children of school age are exposed to some form of artistic education. The departments of education and of culture will have to decide on joint initiatives geared to educating children.9

Education may indeed seem as an action which could, in the long run, lead to possible reductions of subsidies. Indeed, surveys show that arts education, both at school and in the family or close community, increases participation in the arts. Louis Bergonzi and Julia Smith (1996) even show that providing both has superadditive effects on participation.10 There are also dynamic effects which are at play, since parents will transmit the knowledge they were exposed to while young. Public education has therefore the usual direct effect on children, and the indirect effect through the transfer from parents to children. Therefore, one may think that arts education could, if sufficiently intensive, provide enough incentives for consumers to participate, so that the direct support of arts consumption could be reduced or even dispensed with. This would also leave to consumers, and not to government agencies, the choice of which activities to support.

This will however not be so if, as is assumed by Gary Becker and Nigel Tomes (1986), culture is “automatically transferred from parents to children.” Given its automatic character, this transmission cannot be internalized by parents and public intervention is needed for agents to consume the socially optimal level of culture. The (optimal) level of subsidies will depend on the (optimal) level of public education, but the former cannot be fully replaced by the latter. This is the issue that we study in our paper, without

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9See *Le Journal des Arts*, April 1999.
10See also Heilbrun and Gray (1993, p. 362).
questioning whether culture is important or not. We therefore assume that art consumption has a positive impact on consumers’ utility.

The dynamic nature of the problem, and the intergenerational transfer of knowledge, leads us to introduce (Section 2) an overlapping generations model in which agents live three periods. In period 0, they are exposed to arts education provided by schools, and inherit (at least, in part) the cultural capital of their parents. In period 1, they work and consume two goods: an aggregate commodity and art. In period 2, they retire, but still consume both goods.

In Section 3, we turn to the stationary state of this economy and study under which conditions this first-best can be decentralized to yield a competitive equilibrium. We show that though the government chooses the optimal level of public cultural education, subsidies on arts consumption can only be partly avoided: Support is needed for the consumption of the young, but can be cut back for retirees. Section 4 considers the results of a model whose parameters try to capture the situation that prevails in most continental European countries, where the current level of public expenditure devoted to the arts is well below the first-best level that is generated by the calibrated model. We show that if this is the case, the arts should be much less subsidized (and may even be taxed), while more should be devoted to arts education. Section 5 concludes the paper.

2 The Model

We assume that the economy consists of one sector, with overlapping generations of consumers and competitive firms producing a commodity that is both the usual consumption-investment good and “art.”

Population is constant. Each of the N identical consumers (households) lives three periods: childhood, young age, old age. As a child, a consumer makes no decision of his own, but is exposed to public cultural education,
the level of which is decided and financed by the government and, within
the household, to the culture transmitted from his parents. He works when
young, supplying the unit of labor he is endowed with. In period $t$, his
wage income $w_t$ is spent to consume $c_t$ units of the consumption good and
$a_t$ units of art, which may be taxed or subsidized at a rate $\theta^a_t$; he saves $s_t$
for his old age; he also pays (or receives) a lump-sum $T^1_t$ to finance public
education in culture, as well as possible subsidies. In period 2, he retires,
earns $s_t(1 + r_{t+1})$ from his savings in period 1 ($r_{t+1}$ is the interest rate),
spends $d_{t+1}$ on consumption, $b_{t+1}$ on art, possibly taxed or subsidized at rate
$\theta^b_{t+1}$ and pays (or receives) a lump-sum $T^2_{t+1}$.

The two-period utility function of the typical consumer $u(c_t, \lambda_t, d_{t+1}, \mu_{t+1})$
depends on the consumption good in both periods, $c_t$ and $d_{t+1}$, and on “cul-
tural capital stocks,” $\lambda_t$ and $\mu_{t+1}$, produced within the household à la Stigler
and Becker (1977). This process uses as inputs public arts education, the
cultural capital acquired from the family and through habit formation, and
arts consumption itself. We thus model art as a good that is addictive. More
specifically, we assume the following:

\[ \lambda_t = \phi(e_{t-1}, \lambda_{t-1}, a_t), \tag{1} \]

and

\[ \mu_{t+1} = \psi(\lambda_t, b_{t+1}). \tag{2} \]

In period 1, the cultural capital of the (young) consumer is influenced by his
past exposure to public education ($e_{t-1}$) and to family culture ($\lambda_{t-1}$) as a
child, as well as by the amount of art that he consumes ($a_t$). When old, the
consumer inherits from his past habits ($\lambda_t$) and can still increase his capital

\[ ^{11}\text{In terms of the Stigler and Becker model, this process could also be described in two}
\text{steps. “Taste for the arts” is produced by a function that depends on the consumption of}
\text{arts and on human capital produced within the household (say, through learning by doing)}
\text{by accumulating the effects of past tastes. To simplify presentation, we do not distinguish}
\text{the two steps.} \]
by consuming $b_{t+1}$ units of art. We assume that the functions appearing in (1) and (2) are differentiable, and that all the partial derivatives are positive: the stock of habits is increasing in education, in the past stock and in the consumption of art.

In equation (1), $\lambda_{t-1}$ is taken as given by agents born in $t$, and represents the external effect of culture within the family. An alternative way of looking at this is to assume that $\lambda_{t-1}$ represents a social externality, the mean cultural capital of the previous generation.12 Since in our model, agents are identical, the two formulations lead to the same conclusions. More generally, $\lambda_{t-1}$ can be thought of as resulting from both a family and a community or social effect, which is consistent with the Bergonzi and Smith (1996) survey results alluded to in the introduction.

When making his decision, a consumer takes as given prices $w_t, r_{t+1}$, lump-sum transfers $T^1_t, T^2_{t+1}$, possibly nonzero tax (or subsidy) rates $\theta^a_t, \theta^b_{t+1}$, the level of public education $e_{t-1}$, as well as his parents’ cultural capital $\lambda_{t-1}$, and solves the following problem:

$$\max_{c_t, a_t, s_t, d_{t+1}, b_{t+1}} u(c_t, \lambda_t, d_{t+1}, \mu_{t+1})$$

subject to his budget constraints

$$c_t + (1 - \theta^a_t)a_t + s_t = w_t - T^1_t,$$  

and

$$d_{t+1} + (1 - \theta^b_{t+1})b_{t+1} = (1 + r_{t+1})s_t - T^2_{t+1},$$

where $\lambda_t$ and $\mu_{t+1}$ are defined by (1) and (2). The utility function defined in (3) is assumed strictly concave, increasing in all its arguments, and twice continuously differentiable.

12 As is the case for the external effects of human capital in e.g. Robert Lucas (1988) or Costas Azariadis and Allan Drazen (1990).
Production is carried out by identical perfectly competitive firms. Aggregate output $Y_t$ is given by

$$Y_t = F(K_t, L_t),$$  \hspace{1cm} (6)$$

where $K_t$ and $L_t$ represent aggregate capital and labor demand, and $F$ is homogeneous of degree one. The behavior of the representative firm is:

$$\max_{K_t, L_t} F(K_t, L_t) - (1 + r_t)K_t - w_tL_t,$$  \hspace{1cm} (7)$$

where we assume complete depreciation of the capital stock in every period.

The government collects (or redistributes) lump-sum transfers, finances education in the arts and may tax consumption. It has no optimizing behavior and simply seeks to satisfy its budget constraint

$$e_t + \theta^a_t a_t + \theta^b_t b_t = T^1_t + T^2_t,$$  \hspace{1cm} (8)$$

where $e_t, \theta^a_t, \theta^b_t$ and say, $T^1_t$ are given.

Market equilibrium on the goods market, the labor market and the capital market respectively, requires the three following conditions to hold:

$$N(c_t + d_t + a_t + b_t + e_t + s_t) = Y_t,$$  \hspace{1cm} (9)$$

$$L_t = N,$$  \hspace{1cm} (10)$$

$$K_t = Ns_{t-1}.$$  \hspace{1cm} (11)$$

An intertemporal overlapping generations equilibrium is defined by a sequence of consumptions $(c_t, a_t, d_{t+1}, b_{t+1})$, capital stocks $K_t$, labor demands $L_t$, public education $e_t$, lump-sum transfers $(T^1_t, T^2_t)$, tax rates $(\theta^a_t, \theta^b_t)$, supported by prices $(w_t, r_t)$, satisfying (1) to (11) for $t = 0, 1, ...$

Along the perfect foresight equilibrium path, and assuming interior solutions, the following first-order conditions will hold for the consumer optimization problem:

$$u'_c = (1 + r_{t+1})u'_d,$$  \hspace{1cm} (12)$$
\[(1 - \theta^a_t)u'_c = [u'_\lambda + u'_\mu \psi'_\lambda] \phi'_a, \quad (13)\]

and
\[(1 - \theta^b_{t+1})u'_d = u'_\mu \psi'_b. \quad (14)\]

In all these expressions, \(u'_x\) denotes the partial derivative of \(u(\cdot)\) with respect to argument \(x\), evaluated in equilibrium \((c_t, \lambda_t, d_{t+1}, \mu_{t+1})\); likewise, \(\psi'_x\) and \(\phi'_x\) are derivatives of \(\psi(\cdot)\) and \(\phi(\cdot)\) with respect to \(x\), evaluated in equilibrium.

Equation (12) is the usual Euler condition describing the arbitrage between first and second period consumptions, \(c_t\) and \(d_{t+1}\). Equations (13) and (14) represent the tradeoff between consumption of the commodity and of art in period 1 \((c_t \text{ and } a_t)\) and in period 2 \((d_{t+1} \text{ and } b_{t+1})\), respectively. Equation (13) shows that for the young consumer, the loss of utility when he foregoes one unit of the consumption good should, in equilibrium, be equal to the marginal utility of one additional unit of art that accrues over the two periods of his life \(((1 - \theta^a_t)^{-1}u'_\lambda \phi'_a \text{ when young and } (1 - \theta^a_t)^{-1}u'_\mu \phi'_\lambda \phi'_a \text{ when old})\). Equation (14) can be interpreted in a similar way for the retired consumer.

From the producer optimization problem, and since \(L_t = N\), it follows that
\[F'_K(K_t, N) = (1 + r_t), \quad (15)\]

and
\[F'_L(K_t, N) = w_t, \quad (16)\]

where \(F'_K(\cdot)\) and \(F'_L(\cdot)\) are the derivatives of the production function with respect to labor and capital.

### 3 The Long-run First-best Solution and its Decentralization

We now show that even when, after an infinite number of periods, the steady state is reached, it is optimal to subsidize the cultural consumption of young
consumers. In the steady state, the first-best is obtained as a solution of the following centralized program:

$$\max_{c,a,d,b,k,e} N u(c, \lambda, d, \mu)$$

subject to

$$\lambda = \phi(e, \lambda, a)$$
$$\mu = \psi(\lambda, b)$$
$$K + N(c + a + d + b + e) = F(K, N)$$

for given $N$.

This solution achieves the highest welfare. The question to which we turn now is to determine under which conditions this optimum can be decentralized as a steady state equilibrium. The main result is stated in Proposition 1.

**Proposition 1** The first-best steady state is an equilibrium steady state if the following conditions are satisfied:

(a) public cultural education $e$ is set at its optimal level;
(b) art consumption by the young is subsidized at a rate $\theta^a = \phi'_\lambda$;
(c) art consumption by the old should not be subsidized or taxed: $\theta^b = 0$.
(d) transfers $T^1$ and $T^2$ lead to the golden-rule capital stock.

The proposition shows that to achieve a first-best, art consumption of the young should be subsidized, even if the level of public cultural education to which children are exposed is chosen optimally. The rate at which this consumption should be supported is equal to the marginal influence the cultural capital of parents has on the cultural capital of children.\textsuperscript{14} More-

\textsuperscript{13}See Appendix, Sections 1-3 for detailed calculations.
\textsuperscript{14}No subsidy is needed only if $\phi'_\lambda = 0$. This will be so in a population in which the
over, if $\phi_{\lambda,e}'' > 0$ (which will be the case if, as shown by Bergonzi and Smith (1996), the effects of education and transmission from parents are superadditive), then a marginal increase in public education will even strengthen the positive consequences of the transmission from parents to children.

Note that, even if public education is a perfect substitute for the one provided by the family, i.e. if $\phi(e, \lambda, a) = \phi_0(e + \lambda, a)$, it would be optimal to subsidize arts consumption of the young. This is so since the external effect of this consumption on the next generation’s welfare is positive and has no cost.

Since we assume that the educational effect of grand-parents on their grand-children can be neglected (it is set to zero in the model), arts consumption of the old generation should not be subsidized. This is at variance with observed situations in which the arts consumption of retirees is often more subsidized than that of the young generations.

4 Second-best Analysis

We now consider the second-best problem, in which $T$, the government budget (for the arts) is fixed, at a smaller than the first-best steady state budget, $T^*$, and seek to maximize consumers’ utility.

4.1 The Second-best Problem

We choose the golden rule capital level $k^*$ for which $f'(k^*) = 1$ and $f(k^*) - k^* = w^*$. Given $T$, it is always possible to decentralize the equilibrium for any policy $(\theta^a, \theta^b, e)$, as long as there is no restriction on the intergenerational distribution $(T^1, T^2)$. Once $T$ is given, one can compute $w^* - T$, the lifecycle budget of consumers who take as given $w^* - T, \theta^a, \theta^b, e$ as well as their cultural level of the family has no action on the level of cultural appreciation of the young, i.e. if $\lambda_t = \phi(e_{t-1}, a_t)$ instead of the formulation suggested in equation (1), or if there is satiation in $\lambda$ at the optimal level of education, or before this level is reached.
parents cultural capital $\bar{X}$ and maximize $u(c, \lambda, d, \mu)$ subject to their budget constraint $w^* - T = c + (1 - \theta^a)a + d + (1 - \theta^b)b$, while $\lambda$ and $\mu$ must satisfy $\lambda = \phi(e, \bar{X}, a)$ and $\mu = \psi(\lambda, b)$.

This maximization leads to decisions $c(\cdot), a(\cdot), d(\cdot), b(\cdot), \lambda(\cdot), \mu(\cdot)$ and indirect utility $v(\cdot)$ that depend on $w^* - T, \theta^a, \theta^b, e$ and $\bar{X}$.

Now, given $T$, the government’s second-best problem is to choose $e, \theta^a, \theta^b$ and $\lambda$ which maximize indirect utility $v(w^* - T; \theta^a, \theta^b, e, \bar{X})$, subject to

$$T = e + \theta^a a(\cdot) + \theta^b b(\cdot)$$

and

$$\phi(e, \bar{X}, a) = \bar{X}.$$

### 4.2 A Cobb-Douglas Example

We consider the formulation of the model in which both habit formation equations (1) and (2), and the utility function (3) are linear in logarithms, so that

$$\log \lambda = \rho \log e + \delta_1 \log \bar{X} + \eta_1 \log a,$$

$$\log \mu = \delta_2 \log \lambda + \eta_2 \log b,$$

and

$$u(c, \lambda, d, \mu) = \log c + \alpha \log \lambda + \beta (\log d + \alpha \log \mu).$$

All parameters are positive and $\delta_1$, the inherited effect of cultural accumulation, is smaller than one.

The second-best solution is derived in the appendix, and gives the values of the subsidy rates $\theta^a, \theta^b$ and of arts education $e$ as functions of the total cultural budget $T$ and of the other given parameters. The following proposition holds:\textsuperscript{15}

\textsuperscript{15}See Appendix, Section 4 for the proof
**Proposition 2** For any total budget $T < T^*$, the second-best solution is such that:

(a) the subsidy rate on art consumption by the old is negative (i.e. the old are taxed); $\theta^a$, the subsidy rate on art consumption by the young is larger than $\theta^b$;

(b) both rates, as well as the level of public education $e$ are increasing in $T$.

The Cobb-Douglas example points to the possibility that the young may also be taxed if some conditions on the parameters are satisfied, and for low values of $T$.\(^\text{16}\)

4.3 Calibration and Simulation Results

The coefficients of the Cobb-Douglas economy are chosen so that the resulting consumptions of the young and of the old, both for the good and the arts, reproduce some stylized facts observed in France, which can be thought of being representative of continental European countries. Details on this calibration can be found in the Appendix, Section 5.

Table 1 displays the first-best values\(^\text{17}\) of $T/w^*$ and $e/w^*$ generated by the model for various choices of $\alpha$, the relative preference for arts consumption in the utility function, and $\rho = (1 - \delta_1)$ ($\rho$ and $\delta_1$ represent the effects of public and household arts education).

Stylized facts suggest that public expenditure for the arts (as a share of wage income, $T/w^*$) is not larger than 5%, a figure that will be used in drawing our conclusions.\(^\text{18}\) Simulations show that first-best budgets are well above this 5% threshold for all reasonable choices of $\alpha$ and $\rho$. The observed

\(^{16}\)See Appendix, Section 4.

\(^{17}\)The theoretical results presented in Section 4 of the Appendix can also be expressed in terms of ratios $T/w^*$ and $e/w^*$. This makes the calibration exercise easier to deal with.

\(^{18}\)It is difficult to estimate the value of $T/w^*$ with more accuracy, since arts are supported at different levels (central or federal, state, local, etc.), and no global accounts are available.
equilibrium is thus obviously not a first-best. Moreover, since one observes that the arts consumption of the old generations are often more heavily subsidized than the consumption of the younger ones, we are not even in a second-best equilibrium. Cultural budgets should therefore be fully devoted to arts education, until they become larger.

In Figure 1, we illustrate the $e/w$, $\theta_a$ and $\theta_a$ curves as functions of $T/w^*$, for our best guess of the parameters $\alpha = 0.10$ and $\rho = \delta = 0.5$. As can be checked, for $T/w^*$ values smaller than 5% (which is probably an upper bound in most European countries), arts consumption should not be subsidized. Arts consumption of the old generations should even be taxed, which is of course just the reverse of what is practiced, since usually, elderly people get larger discounts than other adults.

5 Conclusions

Our model suggests that even if the level of public cultural education is optimal, the first-best obtains if and only if the consumption of art by the young generation is subsidized. This result is due to the social external effect resulting from the “automatic” transmission of culture from parents to children, as stressed by Becker and Tomes (1986), for whom “both biology and culture are transmitted from parents to children, one encoded in DNA and the other in a family’s culture.”

Several issues need to be discussed, however. The first is concerned with altruism. With altruistic agents, the external effect generated by families transmitting culture to their posterity would disappear, and no public intervention would be needed anymore. Pure altruism is however conflicting with the automatic character of the transmission of culture, which has been underlined above.\footnote{Parents buy books that they want to read, and do not necessarily think of their childrens’ utility when choosing. The books are of course also available for their children.}
There may also exist social externalities, acquired either from the close community of friends and schoolmates, or from the general cultural level of the population. These externalities can be represented by the mean value of the individual $\lambda_{t-1}$ appearing in the $\phi(.)$ functions, and again, subsidies will be needed to reach the first-best, even if consumers are altruistic. Thus, in the more realistic case where both family and social externalities are at play, but only family externalities can be internalized if consumers are altruistic, public intervention is useful.

We show that retirees should not be subsidized. This is so because, in our model, they do not transmit culture to their grand-children. Should this be the case—it is often said that grand-parents take their grand-children to museums or to concerts—, then the art consumption of the old would also need to be subsidized, at a rate that corresponds to their influence, and which may be different from that of the young. This (as well as the results of the model according to which old generations should not be subsidized at all) raises the question of whether it is possible to discriminate between generations. This is obviously the case for many cultural activities where presence is required, such as concerts, movies, theater plays, etc. But there are also many activities where this is impossible to implement: Books and records can be bought by the young for the old, television can be watched without any control as to who watches, etc.

Heterogeneous agents, some of whom are better exposed to art than others, possibly because they finance education within their own group, would also lead to interesting questions, since different subsidy rates would be needed to decentralize the first best. This would be implementable only if some characteristics related to the agents’ heterogeneity can be observed, such as income, or the level of schooling.

However, the use of numerical simulations to study the consequences of to read, but this is considered as paternalism, and not as altruism, and leads to external effects.
second-best situations shows that for plausible parameter values, and since
the government budget for the arts is smaller than what is required in a
first-best and in a second-best, art consumption of “old” consumers should
be taxed, arts consumption of the young should not be subsidized, and all
the proceeds of arts public expenditure should be devoted to arts education.

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Table 1
First-best total budget for the arts \((T^*/w^*)\)
and budget for artistic education \((e^*/w^*)\)

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<th>(\rho)</th>
<th>0.875</th>
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<td>(T^<em>/w^</em>)</td>
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7 Appendix

1. First-order Conditions of the Welfare Optimum

After some simple algebra and given that $F(K, N)$ is homogeneous, the centralized program of Section 3 can also be written, in per capita terms, as

$$\max_{c, a, d, b, k, e} u(c, \lambda, d, \psi(\lambda, b))$$
subject to

$$\lambda = \phi(e, \lambda, a)$$
$$k + c + a + d + b + e = f(k),$$

where $k = K/N$ and $f(k) = F(K/N, 1)$.

An interior solution satisfies the following first-order conditions, where $q^*$ and $p^*$ are the multipliers associated with the first and the second constraints of the program:

$$f'(k^*) = 1 \quad (A1)$$
$$u'_c = p^* \quad (A2)$$
$$u'_d = p^* \quad (A3)$$
$$q^* \phi'_a = p^* \quad (A4)$$
$$u'_\mu \psi'_b = p^* \quad (A5)$$
$$q^* \phi'_e = p^* \quad (A6)$$
$$u'_\lambda + u'_\mu \psi'_\lambda = (1 - \phi'_\lambda) q^*. \quad (A7)$$

In all these expressions, the derivatives are taken in the optimum and the constraints
\[ \lambda^* = \phi(e^*, \lambda^*, a^*) \quad (A8) \]
\[ k^* + c^* + a^* + d^* + b^* + e^* = f(k^*) \quad (A9) \]

are satisfied.

From (A2) and (A3)
\[ u'_c = u'_d = p^*. \quad (A10) \]

Combining (A4) and (A10), one sees that \( q^* = u'_c/\phi'_a \). Replacing \( q^* \) by this expression in (A7), one obtains
\[ (u'_\lambda + u'_\mu \psi'_\lambda)\phi'_a = (1 - \theta^a)u'_c. \quad (A11) \]

Finally, from (A5) and (A10)
\[ u'_\mu \psi'_b = u'_d. \quad (A12) \]

2. Steady State Conditions for Consumers’ Equilibrium

In the steady state, the following first-order conditions hold (for an interior solution):
\[ u'_c = (1 + r)u'_d \quad (A13) \]
\[ (u'_\lambda + u'_\mu \psi'_\lambda)\phi'_a = (1 - \theta^a)u'_c \quad (A14) \]
\[ u'_\mu \psi'_b = (1 - \theta^b)u'_d \quad (A15) \]

and the budget constraints
\[ c = w - T^1 - (1 - \theta^a)a - s \quad (A16) \]
\[ d = (1 + r)s - T^2 - (1 - \theta^b)b \quad (A17) \]
3. Decentralizing the Welfare Optimum

We now check whether and how the first best can be decentralized as a steady state equilibrium solution. The steady state resource constraints of the centralized problem are obviously satisfied in every equilibrium. With competitive producers, lump-sum transfers to consumers make it possible to reach the optimal capital stock for which, by (A1), \( f'(k^*) = 1 \). Therefore, it is sufficient (a) to verify that the first best satisfies the steady state first-order conditions (A13)-(A15) of the consumers’ problem, (b) to compute the necessary lump-sum transfers in order to satisfy the consumers’ budget constraints (A16)-(A17) and (c) to verify whether the government’s budget is in equilibrium.

(a) By (A1), \( r^* = 0 \), and (A13) coincides with (A10). So do (A14) and (A11) iff \( \theta^a = \phi'_a \). Finally, (A15) coincides with (A12) iff \( \theta^b = 0 \).

(b) Setting \( s = k^* \), \( r = 0 \), \( w = f(k^*) - k^* f'(k^*) = f(k^*) - k^* \), equilibrium values for the transfers can be computed as:

\[
T^1 = f(k^*) - k^* - (c^* + (1 - \theta^a)a^* + k^*) \tag{A18}
\]

\[
T^2 = k^* - (d^* + b^*) \tag{A19}
\]

using (A16)-(A17).

(c) Finally, adding (A18) and (A19) and using (A9), it is straightforward to check that:

\[
T^* = T^1 + T^2 = e^* + \theta^a a^*,
\]

which shows that the government budget (8) is also in equilibrium.
4. The Second-best in the Cobb-Douglas Example

We consider the following Cobb-Douglas economy:

\[ u(c, \lambda, d, \mu) = \log c + \alpha \log \lambda + \beta (\log d + \alpha \log \mu), \quad (A20) \]

\[ \log \lambda = \rho \log e + \delta_1 \log \bar{X} + \eta_1 \log a, \quad (A21) \]

\[ \log \mu = \delta_2 \log \lambda + \eta_2 \log b. \quad (A22) \]

By substitution, we obtain

\[ u = \log c + \beta \log d + \alpha_1 \log a + \alpha_2 \log b + \alpha_3 \log e + \alpha_4 \log \bar{X}, \]

where

\[ \alpha_1 = \alpha \eta_1 (1 + \beta \delta_2), \alpha_2 = \beta \alpha \eta_2, \alpha_3 = \alpha \rho (1 + \beta \delta_2), \alpha_4 = \alpha \delta_1 (1 + \beta \delta_2). \quad (A23) \]

The maximum of utility subject to the life-cycle budget constraint leads to decisions \(c, d, a, b\) such that \(c, d, (1 - \theta^a)a, (1 - \theta^b)b\) are proportional to \(w^* - T\), with factors \(\gamma, \beta \gamma, \alpha_1 \gamma, \alpha_2 \gamma\) with \(\gamma = 1/(1 + \beta + \alpha_1 + \alpha_2)\). Thus we have:

\[ c/w^* = \gamma (1 - T/w^*) , \quad d/w^* = \beta \gamma (1 - T/w^*), \quad (A24) \]

\[ (1 - \theta_a)a/w^* = \alpha_1 \gamma (1 - T/w^*), \quad (1 - \theta_b)b/w^* = \alpha_2 \gamma (1 - T/w^*). \quad (A25) \]

From there, it is easy to compute the indirect utility function as

\[ v = \gamma^{-1} \log(w^* - T) - \alpha_1 \log(1 - \theta^a) - \alpha_2 \log(1 - \theta^b) + \alpha_3 \log e + \alpha_4 \log \bar{X} + \text{const}. \]

In the fixed point \(\lambda = \bar{X}\). Using (A21), we have \(\alpha_3 \log e + \alpha_4 \log \bar{X} = \beta_1 \log a + \beta_2 \log e\), where \(\beta_1 = \alpha_4 \eta_1 /(1 - \delta_1)\) and \(\beta_2 = \alpha_3 + \alpha_4 \rho /(1 - \delta_1)\).

Using (A25), the government budget constraint implies:

\[ e = T - \theta^a a - \theta^b b = T - [\theta^a \alpha_1 /(1 - \theta^a) + \theta^b \alpha_2 /(1 - \theta^b)] \gamma (w^* - T) \quad (A26), \]

\[ e = T + (\alpha_1 x^a + \alpha_2 x^b) \gamma (w^* - T), \quad (A27) \]
where \( x^a = -\theta^a / (1 - \theta^a) \) and \( x^b = -\theta^b / (1 - \theta^b) \).

Substituting \((1 - \theta^a) = 1 / (1 - x^a)\), \((1 - \theta^b) = 1 / (1 - x^b)\) and \( e \), we obtain indirect utility as a function of \( x^a, x^b \) and \((w^* - T)\):

\[
V(x^a, x^b, w^* - T) = \frac{1}{\gamma + \beta_1} \log(w^* - T) + (\alpha_1 + \beta_1) \log(1 - x^a) + \alpha_2 \log(1 - x^b) + \beta_2 \log[T + (\alpha_1 x^a + \alpha_2 x^b)\gamma(w^* - T)].
\]

For given \( T \geq 0, T < w^* \), \( V \) is a concave function of \( x^a \) and \( x^b \), defined on the set \( x^a < 1, x^b < 1 \) and \( T + (\alpha_1 x^a + \alpha_2 x^b)\gamma(w^* - T) > 0 \). This corresponds to the values \( \theta^a < 1, \theta^b < 1 \) such that the corresponding value of \( e \) given by (A26) is positive.

The maximum of \( V \) is characterized by the following first-order conditions:

\[
\frac{\partial V}{\partial x^a} = -\frac{(\alpha_1 + \beta_1)}{(1 - x^a)} + (\alpha_1 \beta_2 / e)\gamma(w^* - T) = 0,
\]

\[
\frac{\partial V}{\partial x^b} = -\frac{\alpha_2}{(1 - x^b)} + (\alpha_2 \beta_2 / e)\gamma(w^* - T) = 0.
\]

By substituting \( x^a \) and \( x^b \) in (A27), one obtains

\[
e/w^* = \beta_2 / (\alpha_1 + \beta_1 + \alpha_2 + \beta_2)[T/w^* + \gamma(\alpha_1 + \alpha_2)(1 - T/w^*)],
\]

which shows that \( e/w^* \) is increasing in \( T/w^* \), since \( \gamma(\alpha_1 + \alpha_2) < 1 \).

We also have:

\[
(1 - \theta^a) = 1 / (1 - x^a) = \beta_2 \gamma \alpha_1 (1 - T/w^*) / [(\alpha_1 + \beta_1)e/w^*],
\]

\[
(1 - \theta^b) = 1 / (1 - x^b) = (\alpha_1 + \beta_1)(1 - \theta^a) / \alpha_1.
\]

It is now easy to show why the results of Proposition 2 hold. The last relation implies \((1 - \theta^b) > (1 - \theta^a)\) and thus \( \theta^a > \theta^b \). Since \( \gamma(\alpha_1 + \alpha_2) < 1 \), \( e \) is increasing in \( T \). Therefore, \((e/w^*) / (1 - T/w^*)\) is also increasing in \( T \). This implies that \((1 - \theta^a)\) and \((1 - \theta^b)\) are decreasing in \( T \). Since \( \theta^b \) is increasing.
in $T$ and equal to zero in the first best, we necessarily have $\theta^b < 0$ in the second-best. The condition $\theta^a > 0$ is equivalent to $(\alpha_1 \beta_2 - \beta_1 \alpha_2) \gamma (w^* - T) < (\alpha_1 + \beta_1) T$. There are thus two possibilities. Either $\alpha_1 \beta_2 - \beta_1 \alpha_2 \leq 0$ so that $\theta^a > 0$ for all $T > 0$. Or $\alpha_1 \beta_2 - \beta_1 \alpha_2 > 0$ and then $\theta^a < 0$ for small $T$, i.e. for $T$ such that $T/w^* < \gamma (\alpha_1 \beta_2 - \beta_1 \alpha_2)/[\alpha_1 + \beta_1 + \gamma (\alpha_1 \beta_2 - \beta_1 \alpha_2)]$.

The first-best is the maximal value of the utility, obtained by substituting $\lambda$ and $\mu$, with $\overline{\lambda} = \lambda$:

$$u^* = \log c + \beta \log d + (\alpha_1 + \beta_1) \log a + \alpha_2 \log b + \beta_2 \log e.$$  

The maximum of $u^*$ subject to the government’s budget constraint leads to

$$c^*/w^* = \beta_2/(1 + \beta + \alpha_1 + \beta_1 + \alpha_2 + \beta_2),$$

$$a^* = (\alpha_1 + \beta_1)/(1 + \beta + \alpha_1 + \beta_1 + \alpha_2 + \beta_2).$$

Using the fact that the optimal subsidy rate $\theta^a = \delta_1$, we obtain $T^* = c^* + \delta_1 a^*$, and $T^*/w^* = [\beta_2 + \delta_1 (\alpha_1 + \beta_1)]/(1 + \beta + \alpha_1 + \beta_1 + \alpha_2 + \beta_2)$.

5. Calibrating the Cobb-Douglas Economy

Using French national accounts, as well as the results of a survey on cultural expenditures of French households carried out in 1995, one finds that the (inclusive taxes and subsidies) expenditure shares (see A24-A25) for the consumption good are $\gamma = 0.654$ (young generations) and $\beta \gamma = 0.330$ (old generations). For arts consumption, these shares are respectively $\alpha_1 \gamma = 0.012$ (for the young) and $\alpha_2 \gamma = 0.004$ (for the old). Therefore, it is easy to check that $\beta = 0.5$. Since $\alpha_2 = \alpha \beta \eta_2$ (see A23), one can derive $\eta_2$ once $\alpha$ is known. We parametrize $\alpha$ for values ranging from 0.05 to 0.2. Next, we set $\eta_1 = \eta_2$, (the effect of consuming the arts on the cultural stock is the same when young and old). From $\alpha_1 = \alpha \eta_1 (1 + \beta \delta_2)$ (see A23), we obtain $\delta_2 = 1$. This

\[^{20}\text{See Maresca and Pouquet (2000).}\]
merely means that “nothing is lost” in the transmission of cultural capital to oneself (when “switching” from young to old). We also parametrize for $\delta_1$ between 0.125 and 0.50 and we assume that the effect of education ($\rho$) on the stock of culture of the young is equal to $(1 - \delta_1)$, to represent in a parametric way, the relative effects of education and family transmission.