# Parents, Television and Cultural Change

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**Abstract**

We develop a model of cultural transmission where television plays a role in socialization. We study the coverage of different cultural traits by a profit maximizing TV industry and the resulting cultural dynamics. Our model predicts that cultural extinction is more likely in a competitive than in a monopolistic TV industry. A monopolist covers both traits but grants more coverage to the most profitable group. In a competitive TV industry each channel specializes on one trait. This might lead to cultural extinction but only for sufficiently large majorities so that all channels specialize on the same trait. The required majority size depends on the type of competitors: the presence of a pay-TV competitor reduces the probability of cultural extinction. Overall our model predicts that cultural extinction can only occur under very special circumstances suggesting that the fear voiced by policy makers seems exaggerated.

**Keywords**: television, socialization, cultural trait dynamics, media coverage.
**JEL classification**: Z1; D03; L82.

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# 1 Introduction

In recent years the study of cultural transmission of preferences has mushroomed.[1] In this literature cultural transmission is conceptualized as resulting from two forces: direct vertical socialization from parents to children and oblique and horizontal socialization by society at large. Although television has become the primary source of socialization in many modern societies (Gerbner et al., 2002) its role as an oblique socialization mechanism[2] has been ignored in the cultural transmission literature despite the existing evidence that television can change cultural traits and beliefs.[3]

In the political debate the idea that television can transform culture has been prominent. An unregulated television industry is sometimes perceived as a threat to cultural diversity. A common argument for maintaining public television is to ensure that diverse and high-quality programming is supplied that caters to the entire population, hence to all communities and cultures.[4] Politicians who care about local culture often feel that TV imports threaten local diversity and argue that TV programs should have the status of "cultural exceptions" and not be subject to free trade, a view that was approved in 2005 by the UNESCO in its Universal Declaration of Cultural Diversity. Protectionist measures have also been passed by the European Union in the 2007 Audiovisual Media Service Directive. Quotas for home productions are very common around the world. However, how real is the threat of cultural extinction? The argument that television can lead to a cultural change and hence might wipe some cultures off the map is too simplistic, since it overlooks that people who care about their culture will take this danger into account when deciding their TV demand. Moreover, an unregulated profit maximizing TV industry optimally chooses the program contents given people's demand. The cultural dynamics resulting from these strategic interactions might not be as simplistic as the political debate suggests.

[1]Bisin and Verdier (2010) provide a comprehensive review of the theoretical and empirical contributions to the literature.

[2]In the most standard approach (see e.g. Bisin and Verdier, 2001) the probability to acquire a cultural trait via oblique transmission equals its proportion in the population, hence the influence of a trait through society depends on its size. Saez-Marti and Sjögren (2008) have generalized the oblique cultural transmission function by formalizing merit-guided learning on part of the children by their peers. Patacchini and Zenou (forthcoming) look at neighborhood effects. Other papers have modelled education by schools as additional forms of oblique transmission (see e.g. Hauk and Saez-Marti, 2002) or have provided evidence about the empirical relevance of collective socialization mechanisms (see e.g. Aspachs-Bracons et al., 2008).

[3]This evidence will be discussed in Section 2.

[4]This argument was put forward by the pioneer in broadcasting economics, Peacock (Towse, 2005).

In the present paper we develop a model of cultural transmission where television plays the role of oblique socialization which allows us to study the coverage of different cultural traits by a profit maximizing TV industry and the resulting cultural dynamics. We look at a society with two cultural traits which differ in size, cultural intolerance and advertisement sensitivity. In our model parents dispose of one unit of free time which they have to split between socializing their child which is costly or watching TV. As in Bisin and Verdier (2001) time spent in socialization determines the probability that socialization is successful and hence the probability of direct socialization. However, and this is our main innovation, if direct socialization fails, the child is socialized by television. As in socialization analysis (Gerbner et al., 2002) we assume that the child is affected by the entire system of messages received by the television program. These messages consist of the amount of coverage of each cultural trait which determines the probability that the child will adopt this trait conditionally on being socialized by television. Hence, while watching television is entertaining, parents are aware that television might infect the child with the "wrong" cultural values. The television industry is not interested in the propagation of cultural values per se. Cultural coverage is chosen strategically to maximize profits since it influences the viewing time and thereby the advertisement revenue of a firm. We examine different industry structure: a monopolistic TV industry, competition between free-to-air firms, a pay TV-duopoly and a mixed duopoly with one pay-TV and one free-to-air firm. We study how the nature of competition affects the coverage of the different cultural traits, parents' optimal time allocation between socialization and TV time and the long run survival of the cultural traits. A monopolistic media industry captures more TV time from the most profitable group.[5] We show that the profitability of a group – and also its coverage – increases in its size, advertisement sensitivity and cultural intolerance. Since parental socialization and TV time are cultural substitutes (Bisin and Verdier, 2001), parents belonging to the less profitable group (which would coincide with the minority if groups were symmetric except for size) socialize more intensively their children. Therefore, cultural elimination will never occur under a monopolistic media industry.[6] In contrast, with a competitive media industry cultural extinction is possible. If there are various channels parents choose the one which gives them a higher utility, by for example granting more coverage

[5] Unless the entertainment value is very large relative to cultural intolerance in which case full TV coverage of both groups can be achieved.

[6] Unless TV does not provide any entertainment value.

to their cultural trait. This makes specialization by each channel on one single culture a dominant strategy. As a consequence when the profitability of one group is particularly large, the media industry will cover that group only, leading to less programming for the minority than in the monopoly case. The likelihood of cultural extinction is highest under duopoly. When all channels cover the more profitable trait, the incentives to deviate to cover the less profitable trait increase in the number of competing firms. Moreover, the presence of a pay-TV reduces the likelihood of cultural extinction. Pay-TV firms will charge a positive (indeed maximal) price, if they specialize on different traits and therefore have less incentives to cover the same trait. In terms of cultural survival, pure pay-TV competition dominates a mixed duopoly which dominates pure free-to-air competition. Overall our model predicts that cultural extinction can only occur under very special circumstances which suggests that the fear voiced by policy makers seems exaggerated.

The remainder of the paper is organized as follows. Section 2 motivates our main modelling assumptions. In Section 3 we present the basic model with symmetric traits except for size and we solve the model with a monopolistic free-to-air TV industry. Section 4 analyzes the different types of competitive TV industries and their effect on cultural survival. Section 5 is dedicated to robustness. We show that endogenizing the entertainment value, allowing entertainment to depend on cultural intolerance and coverage or introducing various asymmetries across traits does not alter our main results. We also discuss how important is our assumption that the TV industry is myopic and what would happen if cultural intolerance evolved over time. Finally, section 6 discusses existing evidence for the empirical predictions and concludes. All proofs not following immediately from the main text are relegated to the appendices.

## 2 Motivating evidence

Our model is based on three crucial assumptions: (i) television can lead to cultural change, (ii) the influence of TV is bigger the more time children spend watching TV (iii) parents are aware of this possibility and act accordingly. In what follows we provide some motivating evidence for these assumptions.

In recent years, economists have documented that the messages received by television may affect a large spectrum of beliefs and behaviors. Gentzkow and Shapiro (2004) find that being exposed to television programs in the Islamic world has an effect on the way people judge the west. Della Vigna and Kaplan (2007) show that Fox News Channel has an important role in explaining votes in the US. Other papers address the role of television on socioeconomic outcomes in developing countries. La Ferrara et al. (2008) study the effects of television on fertility choices in Brazil and find that women living in areas covered by the Globo signal have significantly lower fertility.[7] Chong and La Ferrara (2009) find that the share of women who are separated or divorced increases significantly after the Globo signal becomes available. Jensen and Oster (2009) using data on five Indian states show that the entry of cable TV led to increases in subjective measures of female autonomy and declines in pregnancy rates. Finally, Olken (2006) studies the effect of radio and television on social capital in Indonesia and finds that increased signal reception, which leads to more time watching television and listening to the radio, is associated with less participation in social organizations and with lower self-reported trust. Communication scientists (Shanahan and Morgan, 1999) have been studying how television affects culture long before economists. They labeled their field of studies "Cultivation Theory" because exposure to television over time cultivates viewers' perceptions of reality.[8] One of the central hypothesis in cultivation research coincides with our assumption (ii), namely that heavy TV viewers are more likely to be socialized by television than light viewers. This hypothesis was successfully tested by Gerbner already in 1968 within the US. Other studies provide evidence on the effect of TV imports. For the Philippines Tan et al. (1987) showed that heavy viewers of American television evidenced non-traditional values, more like those shown by the television programs than the traditional values of their Philippine homeland. Viewers in Australia had different views of Australian life if they watched more American television (Pingree and Hawkins, 1981). Tan and Suarchavarat (1988) provide evidence that the Thai people are becoming more vindictive and are abandoning the traditional forgiveness derived from Buddhism because of Chinese and Japanese television influences. The above evidence suggests that TV can lead to cultural change and that its influence is stronger for heavier viewers. But are parents aware of this? One of the most extreme examples of parents worrying that their culture might be endangered by television is found in Granzberg et al.'s (1977) study of the Cree culture: The most traditional people in Cree society refuse to have TV in their

[7] Globo is a network that had a virtual monopoly on telenovelas in Brazil.

[8] They argue that "Television is the source of the most broadly shared images and messages in history...Television cultivates from infancy the very predispositions and preferences that used to be acquired from other primary sources ... The repetitive pattern of television's mass-produced messages and images forms the mainstream of a common symbolic environment" (Gerbner et al. (1986) p. 17 – 18).

homes or feel it necessary to destroy a newly bought TV, or at least refuse to allow their children to watch scary programs.

## 3 The basic model

We consider a society with overlapping generations and an infinitely lived media industry. At any point in time, the society consists of old and young individuals with generation size 1. Individuals are born without any well-defined preferences and acquire one of two possible cultural traits when young. At the beginning of each period, the media industry chooses the coverage of the cultural traits in society (program contents). Each member of the old generation (adult) has a child (the new generation) and decides how much to invest in the direct socialization of the child. Time not spent in direct socialization is used for watching TV which has two functions: it provides entertainment and serves as the oblique socialization mechanism. Parental choices together with media coverage determine the transmission of cultural values and lead to the socialization of the young generation. Today's children become tomorrow's adults and replace the old generation that dies and the next period begins.

We start our analysis with the simplest model where cultural traits are symmetric except for group size. In particular, both cultural groups prefer their own cultural trait with value $V$ to the other cultural trait to which they attribute value $v$. Hence, $\Delta V = V - v$ measures the cultural intolerance in society. Without loss of generality we refer to trait 1 as the majority trait, i.e. it has size $n \geq \frac{1}{2}$. We analyze different media industry structures with one common choice variable, namely the coverage $q_i$ of trait $i$ with the restriction that $q_1 + q_2 = 1$. Parents make their time use decisions after observing this coverage. We normalize the individuals' amount of time to 1 and denote by $t_i$ the amount of time devoted by a parent of trait $i$ to the socialization of his child, $1 - t_i$, is dedicated to watching TV/let the child watch TV with a known entertainment value $\beta$.[9] While no effort is required to watch TV, we assume that educating one's child has a cost – beyond the missed entertainment value from watching TV – given by $c(t_i) = \frac{1}{2}ct_i^2$. The danger of watching television is that the child might get 'infected' by the cultural values transmitted by the

[9] For the time being we assume that this entertainment value is given and independent of cultural intolerance and coverage. We will relax this assumption in Section 5.2. We will also allow for the entertainment value to be chosen strategically by the media industry in Section 5.1.

television program. In other words, if direct socialization fails, the child is socialized by the TV. Hence, watching TV can lead to a trait change, the probability of which depends on the coverage of the different traits in TV: $(1-t_i)q_i$ is the probability that a child who has not been successfully educated by his parent still acquires his parent's trait by watching TV while $(1-t_i)(1-q_i)$ is the probability of a trait change.

Parents have imperfect empathy[10], i.e. they evaluate their child's utility as if it was their own. This implies that parents judge the costs and benefits of their child watching TV with their own preferences and decide the child's TV time based on the program content and their socialization cost. Hence, for our model to work, we do not need to assume that parents and children watch TV together or watch the same programs.[11] The parent's maximization problem is therefore given by

$$\max_{t_i}(1-t_i)\beta + t_iV + (1-t_i)q_iV + (1-t_i)(1-q_i)v - \frac{1}{2}ct_i^2 \tag{1}$$

leading to the parental optimal choice[12]

$$t_i^* = \begin{cases} \frac{\Delta V(1-q_i)-\beta}{c} \text{ if } q_i < \widehat{q} = 1 - \frac{\beta}{\Delta V} \\ 0 \text{ if } q_i \geq \widehat{q}. \end{cases} \tag{2}$$

Equation (2) tells us that parents substitute from the relatively less beneficial to the relatively more beneficial activities: TV time $1-t_i^*$ is decreasing in cultural intolerance $\Delta V$ and increasing both in the entertainment value, $\beta$ and in the cost of socialization, $c$. The expressions also illustrate that socialization and TV coverage are *cultural substitutes* and parents therefore free-ride on trait transmission by television. TV time increases in the coverage of one's own trait. A high coverage of one's own trait, increasing the probability of keeping the trait, implies zero socialization effort. We assume that

**Assumption 1** $c \geq \Delta V - \beta \geq 0$

[10]While we embrace the imperfect empathy assumption, there is also an ample literature which investigates cultural transmission without it. See e.g. Corneo and Jeanne (2009) and Dessi (2008).

[11]However it seems that parental TV time is similar to child TV time and that this activity is often synchronized within the household. Indeed, Cardoso et al. (2010) reveal the widespread influence of parental time use on the child's time use: in the three countries analyzed (France, Germany and Italy) both the mother's and the father's share of time spent watching TV has a positive impact on the share of time the youngster allocates to that activity.

[12]It is immediate to see that the second-order condition for a maximum is satisfied.

which insures that parental socialization effort is always smaller or equal to 1 and is not zero for all possible $q_i$. The case $c < \Delta V - \beta$ is less interesting from a theoretical point of view since it implies no TV time for any $q \neq 1$ and hence no trait change but also no TV coverage.

Equation (2) gives us the optimal parental choice no matter how media coverage is determined in the media industry. Next we analyze both monopolistic and competitive media industries starting with a monopolistic free-to-air TV.

## 3.1 Monopolistic free-to-air media industry

A monopolistic free to air media industry decides the coverage of each cultural trait to maximize its revenue from advertisement which is given by

$$\pi = \max_{q_i} \gamma \left[ n \left(1 - t_1^*\right) + (1-n)\left(1 - t_2^*\right)\right] \tag{3}$$

where $n$ is the group size of trait 1 and $\gamma$ is the advertisement revenue of the media industry per unit of time spent watching television which we will refer to as people's advertisement sensitivity.[13] From (2) we know that for a parent of trait $i$ TV time is 1 if the coverage is larger than $\widehat{q} = 1 - \frac{\beta}{\Delta V}$. Observe that $\widehat{q}$ larger than $\frac{1}{2}$ is equivalent to $\Delta V > 2\beta$. Hence for $\Delta V \leq 2\beta$, the monopolistic media industry can get full TV time from both traits by setting $q_1 \geq \widehat{q}$ and $q_2 \geq \widehat{q}$ since $2\widehat{q} < 1$. The media industry can choose an optimal cultural coverage mix that totally satisfies both groups, since the entertainment value of watching TV is large relative to cultural intolerance. If instead $\Delta V > 2\beta$, the entertainment value is relatively small compared to cultural intolerance. Increasing the time one group watches TV implies decreasing the time the other group watches TV. Therefore, the media industry chooses to capture more TV time from the more profitable group, which in this context coincides with the bigger group as shown in the following proposition.

**Proposition 1 (Media coverage and profits)** *The TV coverage and the corresponding profits are as follows:*

1. *If $\Delta V \leq 2\beta$, then any $1 - \frac{\beta}{\Delta V} \leq q_i \leq \frac{\beta}{\Delta V}$ is optimal. Both traits watch TV all the time and $\pi = \gamma$.*

[13] The effect of heterogeneity in advertisement sensitivity and cultural intolerance will be described in Section 5.3.

2. *If $\Delta V > 2\beta$, then only the smaller group invests in socialization $t_2^* = \frac{\Delta V - 2\beta}{c}$ while the bigger group watches TV all the time $t_1^* = 0$. The optimal coverages are $q_1^* = 1 - \frac{\beta}{\Delta V}$, $q_2^* = \frac{\beta}{\Delta V}$ and profits are*

$$\pi = \gamma \left[ n + (1-n) \left( \frac{c + 2\beta - \Delta V}{c} \right) \right]. \tag{4}$$

**Proof.** See Appendix A.1 ■

Notice that while group size determines the TV coverage chosen by the media industry, the size of the coverage itself and therefore also the socialization efforts by parents (equation (2)) are independent of group size. This simplifies the dynamic analysis which we undertake next.

## 3.2 Dynamics

Group 1 is initially a majority, i.e. $n_0 \geq \frac{1}{2}$. At date $t+1$ its group size $n_{t+1}$ is given by

$$n_{t+1} = n_t \left( t_1 + (1 - t_1) q_1 \right) + (1 - n_t)(1 - t_2) q_1 \tag{5}$$

Trait 1 parents will have a trait 1 child if socialization is successful (with probability $t_1$) or if socialization fails (with probability $1 - t_1$) and their child is successfully socialized by television (with probability $q_1$). Moreover, some trait 1 individuals of the next generation will stem from those trait 2 parents $(1 - n_t)$ who were unsuccessful at socialization and whose children were socialized by TV to trait 1 (with probability $(1 - t_2)q_1$).

If parents do not socialize their children, which happens if the entertainment value of TV is large relative to cultural intolerance $\Delta V \leq 2\beta$, media coverage fully determines group size. However, if some socialization occurs, the long run steady state results from an interplay between direct and oblique socialization. Bisin and Verdier (2001) distinguish between social environments that act as substitutes or complements to parental socialization. They show that cultural heterogeneity obtains whenever direct vertical socialization is a substitute to oblique/horizontal socialization. This condition, essentially, requires that parents socialize more intensively children when their cultural trait is minoritarian. The driving force in our dynamics (equation 5) is also cultural substitution. If a trait is minoritarian the media coverage is biased against this trait (Proposition 1) which causes parents to reduce TV time and intensify direct socialization (equation 2). This insight allows us to conclude that while for $q_1 = 0$ the steady state converges to $n = 0$ and for

$q_1 = 1$ the steady state converges to $n = 1$, only the interior steady state $n^*$ is stable where

$$n^* = \frac{(1 - t_2^*) q_1^*}{1 - (t_1^* + (t_2^* - t_1^*) q_1^*)} \tag{6}$$

and since $n_0 > \frac{1}{2}$ the system will converge to

$$n_b^* = 1 - \frac{c\beta}{c\Delta V - (\Delta V - 2\beta)(\Delta V - \beta)} \tag{7}$$

obtained by substituting in (6) the optimal media coverage $q_1^*$ and the corresponding socialization efforts derived in Proposition 1.[14] With symmetric cultural traits group size uniquely determines the optimal media coverage. The group which is initially a minority, will stay a minority, will get less coverage and exert some socialization effort, while the initial majority group will entirely rely on trait transmission by the TV.

The following proposition summarizes our findings:

**Proposition 2 (Steady states)** *Let $n_o \geq \frac{1}{2}$. Then the stable steady states are as follows:*

1. *If $\Delta V \leq 2\beta$, media coverage fully determines group size since parents do not socialize: $n^* = q_1^*$ with $1 - \frac{\beta}{\Delta V} \leq q_1^* \leq \frac{\beta}{\Delta V}$.*

2. *If $\Delta V > 2\beta$, then the system converges to $n_b^*$ defined by (7) where only minority parents socialize and majority parents fully rely on socialization by the media industry.*

Since only the interior steady state is stable, we can conclude that a monopolistic free-to-air TV industry preserves cultural diversity. Cultural diversity is maximized if $\Delta V = 2\beta$. In this case, the monopolistic TV industry can capture full TV time of both traits by giving them equal coverage, hence $n^* = \frac{1}{2}$.[15] If $\Delta V > 2\beta$ the initially bigger group will stay a majority in the long run. Its final size will be bigger, the higher are parental socialization costs $c$ (equation 7). Increasing $\Delta V$ has two effects: (i) the media industry needs to increase the coverage of trait 1 to ensure full TV time, (ii) trait 2 reduces TV time (Proposition 1). For all parameter values satisfying Assumption 1 the size of the majority trait increases in steady state as long as the minority trait

[14] Observe that by Assumption 1 $n_b^* \geq \frac{1}{2}$.

[15] This equilibrium can be sustained if the entertainment value of TV increases, however, a continuum of possible equilibria arises and we cannot predict the exact outcome. Since media coverage uniquely determines the steady state, there is no path dependence on initial size and the initial majority group might not be the majority in the long run.

is willing to watch some TV (equation 7). Reducing $\beta$ has the same effects. In the limit when $\beta = 0$ TV no longer provides entertainment and its role is reduced to oblique socialization. Parents will still let their children watch TV, because direct socialization is costly. Since TV time is now only a substitute for direct socialization, the majority parents will require full coverage not to invest in direct socialization, hence by Proposition 1 the optimal coverage is $q_1 = 1$ leading to the extinction of the minority trait. To preserve some degree of cultural diversity under a monopolistic TV industry, a sufficiently high entertainment value is required since it serves as a counter-balance to cultural dislike.

# 4 Competitive media industry

We now modify the previous model to allow for a competitive media industry. We first consider free-to-air competition (Section 4.1). Next, we study a pay-TV duopolist where each TV firm has two instruments to maximize profits: the coverage of cultural traits and the fee charged to viewers (Section 4.2). Finally, we analyze competition when there is a mixed duopoly with one free-to-air and one pay-TV firm (Section 4.3).

## 4.1 Free-to-air competition

With a duopolistic media industry individuals will decide both which channel to watch and for how long.[16] Let $q_i^j$ denote the coverage of trait $i$ by channel $j$ where $j = I, II$. Parents will choose the channel that gives a higher coverage to their own trait. If both channels give the same coverage, we assume that they are chosen with equal probability. The time devoted to socialization by an individual with trait $i$ who is watching channel $j$ is equal to

$$t_i^j = \max\left\{0, \left[\Delta V\left(1 - q_i^j\right) - \beta\right]/c\right\}. \tag{8}$$

Both channels simultaneously decide the coverage of each cultural trait. Each channel $j$, taking as given the choice of the other channel $-j$, decides the coverages $q_1^j$ and $q_2^j$ (with $q_2^j = 1 - q_1^j$) to

[16] This setup is similar to Richardson (2006) where two radio channels have to decide the amount of local and foreign content. However, in Richardson (2006) consumers are heterogeneous in terms of their taste over the mixture between local and foreign content. In our model each parent prefers the channel that transmits its cultural trait.

maximize its revenue from advertisement given by

$$\gamma\left[n\left(1-t_1^j\right)1_{q_1^j>q_1^{-j}}+(1-n)\left(1-t_2^j\right)1_{q_2^j<q_2^{-j}}+\left(\left(n\left(1-t_1^j\right)+(1-n)\left(1-t_2^*\right)\right)/2\right)1_{q_i^j=q_i^{-j}}\right]. \quad (9)$$

where $1_A$ is the indicator function which takes the value 1 if $A$ is true and zero otherwise. Notice that if both channels cover both groups equally ($q_i^j = q_i^{-j}$), they will split the audience. We now describe the coverage of each cultural trait by the media industry.

**Proposition 3 (Competitive free-to-air)** *For a sufficiently large majority $n \geq \overline{n}$ where*

$$\overline{n} = \frac{c + \Delta V - \beta}{2c + \Delta V - \beta} \quad (10)$$

*only the majority trait will be covered $q_1^I = q_1^{II} = 1$. Otherwise firms will specialize on different traits, ($q_1^I = 0, q_1^{II} = 1$ or $q_1^I = 1, q_1^{II} = 0$).*[17]

**Proof.** See Appendix A.2. ■

Proposition 3 says that it is always optimal for TV firms to cover only one trait. In a duopoly, given that channel $I$ has specialized in covering one of the two cultures, there is no benefit for channel $II$ from partially broadcasting that culture's trait because anyone from that culture will strictly prefer to watch channel $I$ and have their children only exposed to their own culture. Similarly, if the first duopolist is not specializing, the second channel can capture the entire market for the biggest (most profitable) of the two cultures. In other words, specialization is a dominant strategy. As a consequence, when group sizes are sufficiently similar the two channels diversify on covering one cultural trait each,[18] while only the majority trait is covered for a sufficiently large majority($n > \overline{n}$). Specialization on one cultural group is more likely for lower values of cultural intolerance $\Delta V$, higher entertainment value $\beta$ and higher cost of socialization $c$.[19] The intuition is simple. Those changes in parameters make socialization more costly or less desirable and therefore increase the TV watching by the minority which is not covered, increasing the incentive to concentrate on the bigger group even if the difference in size is not too big.

We now show that the dynamics is rather simple. First, notice that if the majority is sufficiently large ($n_o > \overline{n}$), both firms specialize on this trait, hence the minority trait will disappear in the

[17] In the proof we show that there also exists a mixed strategy equilibrium for these parameters.

[18] Since the channel covering the majority trait makes larger profits, there also exists a mixed strategy equilibrium for this parameter range where both channels cover the majority trait with the same probability.

[19] For the formal argument see the proof of Proposition 3 in Appendix A.2.

long run.[20] If, however, $\frac{1}{2} \leqslant n_0 \leqslant \overline{n}$ and firms play a pure strategy equilibrium, i.e. they diversify on covering different traits, then group sizes remain constant.[21] These insights are summarized in the following proposition.

**Proposition 4** *For a sufficiently big majority $n_0 > \overline{n}$, the system converges to $n = 1$. For a smaller majority $1/2 \leqslant n_0 \leqslant \overline{n}$ the system converges to $n = n_0$.*

In other words, only minority groups that are sufficiently big so that one of the competing firms is willing to cover the minority trait can survive in the long-run.

In line with the intuition, it is simple to show that as the number of channels competing in the media market increases, the result that both cultural groups receive full coverage is more and more likely. Consider for instance three channels, then $q_1^I = q_1^{II} = q_1^{III} = 1$ is an equilibrium if $\gamma \left[n + (1-n)(1-t_2^*)\right]/3 \geqslant \gamma (1-n)$ that is if $n \geqslant (2c + \Delta V - \beta)/(3c + \Delta V - \beta)$ which is clearly bigger than $\overline{n}$. In other words, as the number of channels increases, the probability of cultural concentration tends to zero. Our model therefore predicts that

**Corollary 1** *Cultural extinction is more likely in a competitive media industry than in a monopolistic market. Moreover, a duopolistic market is the worst case scenario for cultural survival.*

However, a duopolistic TV industry does not always do worse than a monopoly in preserving cultural diversity. Indeed, as we argued in the previous section, if TV has no entertainment role, then a monopolistic free-to-air industry automatically leads to cultural extinction. In this case the only hope for cultural survival is competition. Therefore,

**Corollary 2** *If the media provides little entertainment value a competitive market is likely to lead to a larger minority group than a monopolistic one.*[22]

[20] At $\overline{n}$ both the concentration equilibrium ($q_1^I = q_2^{II} = 1$) and the diversification equilibria ($q_1^I = 0$, $q_2^{II} = 1$) or ($q_1^I = 1$, $q_2^{II} = 0$) exist. However, the diversification equilibria are Pareto superior, so we concentrate on them.

[21] It is easy to show using standard martingale theory that the mixed strategy equilibrium would lead to cultural extinction of either the minority or the majority group. Over time the group size will almost surely fall outside the bounds for which the mixed strategy equilibrium is defined ($1 - \overline{n} \leq n \leq \overline{n}$) leading to full coverage of the group which is the majority when the bounds are threshpassed. While we present this result for completeness, from now on we will concentrate on pure strategies only in the dynamics.

[22] Competition will lead to a larger minority size in the long run whenever the initial majority group size $n_0$ is such that $\frac{1}{2} \leq n_0 \leq \min\left[\overline{n}, n_b^*\right]$ where $n_b^*$ is the steady state majority group size under monopoly (equation 7).Notice that this is always the case for $\beta = 0$ and likely to be satisfied for positive but small $\beta$.

## 4.2 Pay-TV duopoly

In this section we study competition between two pay-TV firms. As in Peitz and Valletti (2008), we model this as a two-stage game. In the first stage both TV firms determine the coverage of each cultural trait.[23] In the second stage they set the fee $s^j$ a viewer has to pay. The rest of the model is unchanged. The parent's maximization problem is now given by

$$\max_{t_i^j} U^i(q_i^j, s^j) = (1 - t_i^j)\beta + t_i^j V + (1 - t_i^j) q_i^j V + (1 - t_i^j)(1 - q_i^j) v - \frac{1}{2} c t_i^{j2} - s^j.$$

The time devoted to socialization is unchanged and equal to (8). Parents now trade off coverage and fee and will choose the channel that offers the largest utility, that is, $U_j^i = \max_{j \in \{I,II\}} U^i(q_i^j, s^j)$. We assume that if both TV firms provide viewers with the same utility and the same coverage, they are chosen with equal probability. However, if the utility is the same but coverage differs, the tie is broken in favor of the firm providing more coverage. The following two fee levels will be crucial in the analysis. Let $s^{\max} = \beta + V$ be the maximum fee that a cultural group that receives full coverage is willing to pay defined by $U_j^i(1, s^{\max}) = 0$. Second, let $\widehat{s} = \Delta V - (\Delta V - \beta)^2 / 2c$ be the maximum fee that a cultural group that receives no TV coverage is willing to pay, defined by $U_j^i(0, \widehat{s}) = 0$. The next proposition describes the coverage of each cultural trait and the fee chosen in equilibrium for a sufficiently low advertisement sensitivity.[24]

**Proposition 5 (Competitive pay-TV)** *Let $\gamma < s^{\max} - \widehat{s}$. For a sufficiently big majority group $n \geq \overline{n}(s^{\max})$ where*

$$\overline{n}(s^{\max}) = \frac{2cs^{\max} + \gamma (c + \Delta V - \beta)}{2cs^{\max} + \gamma (2c + \Delta V - \beta)} \tag{11}$$

*both firms will charge no fees ($s^I = s^{II} = 0$) and concentrate on covering the majority ($q_1^I = q_1^{II} = 1$) leading to the long-run elimination of the minority. Otherwise both firms will charge the maximum fee $s^I = s^{II} = s^{\max}$ and will specialize on different traits ($q_1^I = 0, q_1^{II} = 1$ or $q_1^I = 1, q_1^{II} = 0$ ), so that group sizes remain constant.*[25]

[23] We stick to our simple model of advertisement revenue unlike Peitz and Valletti (2008) and Armstrong and Weeds (2007) who provide an explicit model of the advertisement market.

[24] If the advertisment sensitivity was too high ($\gamma > s^{\max} - \widehat{s}$) the pure strategy equilibria with specialization would be destroyed by the incentive to cover the highly profitable – because of the revenues from advertisement – majority group.

[25] There also exists a mixed strategy equilibrium in this case which is characterized in the proof of the proposition.

**Proof.** See Appendix A.2. ■

The only difference compared to the case with two free-to-air TV firms is that competition between two pay-TV increases the area where the TV firms diversify their coverage ($\overline{n}(s^{\max}) > \overline{n}$) and hence survival of the minority group is more likely. This happens because diversification under pay TV allows firms to charge $s^{\max}$ making deviations to specializing on the majority trait less attractive than under free-to-air competition. Moreover, $\overline{n}(s^{\max})$ increases in $s^{\max} = \beta + V$, hence the higher the entertainment value (or the value given to one's own trait), the more $\overline{n}(s^{\max})$and $\overline{n}$ drift apart.[26] Hence a higher entertainment value increases the chances of cultural survival of the minority.

## 4.3 Mixed duopoly

We now analyze competition with one free-to-air and one pay-TV firm. Without loss of generality let firm $I$ be the pay-TV. Then

**Proposition 6 (Competitive mixed)** *For a sufficiently big majority group $n \geq \overline{n}(\widehat{s})$ where*

$$\overline{n}(\widehat{s}) = \frac{2c\widehat{s} + \gamma\left(c + \Delta V - \beta\right)}{2c\widehat{s} + \gamma\left(2c + \Delta V - \beta\right)} \tag{12}$$

*the pay TV will charge no fees ($s^I = 0$) and both firms will concentrate on covering the majority ($q_1^I = q_1^{II} = 1$) leading to the long-run elimination of the minority. Otherwise firms will diversify on covering one trait each and firm $I$ will charge $s^I = \widehat{s}$ leading to no changes in group sizes. Specifically, while for sufficiently small majorities $1/2 \leq n \leq \overline{n}$ (where $\overline{n}$ is defined by (10)) either firm might cover the majority trait*[27] *($q_1^I = 0, q_1^{II} = 1$ or $q_1^I = 1, q_1^{II} = 0$), for intermediate majority sizes, $\overline{n} \leq n \leq \overline{n}(\widehat{s})$ there exists just one diversification equilibrium in which the free-to-air firm covers the majority group ($q_1^I = 0, q_1^{II} = 1$).*

**Proof.** See Appendix A.2. ■

Notice that the diversification equilibrium where the pay-TV firm covers the minority is more likely to exist. The pay-TV firm charges $s^I = \widehat{s}$ under diversification of coverages and therefore has less incentives to deviate to covering the majority group (losing the fee) than a free-to-air firm.

[26] Indeed, the survival of the minority group under pay-TV-competition becomes more likely for higher entertainment values $\frac{\partial \overline{n}(s^{\max})}{\partial \beta} > 0$ which stands in sharp contrast to free-to-air competition where $\frac{\partial \overline{n}}{\partial \beta} < 0$.

[27] There also exists a mixed equilibrium in this case as described in the proof of the proposition.

This explains why the existence of a pay-TV firm increases the likelihood to have a pure strategy equilibrium with diversification. Consequently, the area where the TV firms diversify their coverage is largest for competition between two pay-TV, intermediate when there is a mixed duopoly with one free-to-air and one pay-TV firm, and smallest with two free-to-air firms ($\overline{n}(s^{\max}) > \overline{n}(\widehat{s}) > \overline{n}$). Comparing the different market structures we can therefore conclude that

**Corollary 3** *The presence of pay-TV firms decrease the probability of cultural extinction. This probability is smallest if all competing firms are pay-TV firms. Moreover, higher entertainment values amplify the advantage for cultural survival of pay-TV relative to free-to-air competition.*

# 5 Robustness

To check for the robustness of our results we introduce variations in our basic model (free-to-air media industry). We endogenize the entertainment value in two ways (i) it is strategically chosen by firms (Section 5.1) and (ii) it depends on cultural coverage and cultural intolerance (Section 5.2). In Section 5.3 we introduce various asymmetries across traits such as different advertisement sensitivities and cultural intolerance. Finally we discuss the importance of some remaining modeling assumptions.

## 5.1 Endogenous entertainment

Since entertainment attracts audience and is costly to produce, it is reasonable to assume that firms might also choose the entertainment value. To illustrate how this affects our results, we will work with a very simple setup: the entertainment value is low $\beta_L$ unless the TV firms pay the cost $k > 0$ to produce a high entertainment value $\beta_H$, and we define $\Delta\beta = \beta_H - \beta_L > 0$. In the rest of the analysis we assume that $\Delta V > 2\beta_H$, that group 1 is the majority $n > 1/2$, and that coverage is chosen before the entertainment value.

**Monopoly**: A monopolistic media industry will prefer the high entertainment value whenever it leads to higher profit.

**Proposition 7 (Monopoly entertainment)** *If $k < \gamma\Delta\beta/c$ the monopolist chooses $\beta_H$ if the majority is not too big, i.e. $n < 1 - (ck/2\gamma\Delta\beta)$ and $\beta_L$ otherwise. For $k \geq \gamma\Delta\beta/c$ high quality is never chosen.*

**Proof.** See Appendix A.3 ■

Notice that the likelihood of choosing high quality programs depends positively on people's advertisement sensitivity, on the size of the minority group whose decision of how much time to watch TV is dependent on quality, on the increase in quality due to the investment; while the same decision depends negatively on the cost of increasing programs' quality and socializing the child. High quality will only be chosen if its cost is not too high and the majority is not too big. The dynamics is exactly as in the baseline model and high quality is chosen in the long-run if and only if $n_b^*(\beta_H) \leq 1 - (ck/2\gamma\Delta\beta)$ where $n_b^*(\beta_H)$ is obtained by substituting $\beta_H$ in (7).

**Free-to-air competition**: Let us study what happens when there are two free to air firms that choose programs' quality. With respect to the baseline model we assume that both channels simultaneously decide the coverage of each cultural trait and only after observing the coverage they simultaneously choose the quality $\beta_l^j$ where $l = L, H$. The rest of the model is unchanged. The parent's maximization problem is now given by

$$\max_{t_i} U^i(q_i^j, \beta_l^j) = (1-t_i)\beta_l^j + t_i V + (1-t_i)q_i^j V + (1-t_i)(1-q_i^j)v - \frac{1}{2}ct_i^2$$

Since there is no heterogeneity within groups all the individuals of a group choose the same TV time and the same channel. Moreover, people watch the channel that offers the largest utility, that is, $U_j^i = \max_{j\in\{I,II\}} U^i(q_i^j, \beta_l^j)$. If both channels offer the same utility, they get half the audience. This can only happen if both firms cover the same trait, since $U_j^i(1, \beta_L^j) = \beta_L^j + V$ and $U_j^i(0, \beta_H^j) = \Delta V - \frac{\left(\Delta V - \beta_H^j\right)^2}{2c}$, so that it is always true that $U_j^i(1, \beta_L^j) > U_j^i(0, \beta_H^j)$. Proposition 8 describes the pure strategy equilibrium outcome of the game for a sufficiently low cost of providing highly entertaining programs.[28]

**Proposition 8 (Competitive entertainment)** *Let $k \leq \left[\gamma\left(c - (\Delta V - \beta_L) + 2\beta_H\right)\right]/2c$. For a sufficiently big majority group $n \geq \overline{n_k}$ where*

$$\overline{n_k} = \frac{\gamma\left(c + \Delta V - \beta_H\right) + 2ck}{\gamma\left(2c + \Delta V - \beta_H\right)} \tag{13}$$

*both firms will choose $\beta_H$ and concentrate on covering the majority ($q_1^I = q_1^{II} = 1$) leading to the long-run elimination of the minority. Otherwise firms will provide $\beta_L$ and will specialize on different traits, so that group sizes remain constant.*

[28]This assumption on $k$ avoids multiple pure strategy equilibria in the second stage of the game and hence guarantees a unique solution.

**Proof.** See Appendix A.3 ■

Similar to the case of two pay-TV firms, the two-dimensional nature of competition benefits the minority group by increasing the attractiveness of diversification in coverage. If both firms cover the same trait, the competition in quality is very tough. This makes deviating to covering the other trait more profitable because it reduces the competition in quality ($\overline{n_k} > \overline{n}$). Smaller minorities are now able to survive in the long run, but the price is a lower entertainment value for everybody.

## 5.2 Entertainment depends on cultural coverage and intolerance

Our basic model assumes a constant entertainment value. While this is a reasonable starting point, it is more realistic to assume that the entertainment value might depend on the trait covered by the TV and on the parent's degree of cultural intolerance. People tend to particularly enjoy programs that positively represent their own culture. Black audiences prefer soap operas with mainly black actors except for the "baddies" while white audiences prefer the opposite (Poindexter and Stroman, 1981).[29] One way to cover a culture is to give the message of its cultural superiority in the stories told by television. These assumptions can be captured by the following functional form

$$\beta_i(q_i, \Delta V) = \beta - \zeta(1 - q_i)\Delta V + \theta q_i \Delta V$$

with $\beta, \zeta$ and $\theta$ all positive. The first term represents a pure entertainment effect, the second is a negative effect from watching programs covering the other trait, and the third is a positive effect from watching programs covering one's trait. The last two effects are both weighted with the degree of cultural intolerance. Let $\vartheta = \theta + \zeta$. Then we can redefine the entertainment function as

$$\beta_i(q_i, \Delta V) = \beta - \zeta\Delta V + \vartheta q_i \Delta V.$$

It is immediate to see that the total entertainment from watching TV is always increasing in the coverage of one's trait $q_i$. Moreover, $\beta_i(q_i, \Delta V)$ can be both increasing or decreasing in cultural intolerance and the sign of the derivative depends on the coverage of one's trait $q_i$. Specifically, total entertainment from watching TV is increasing in cultural intolerance if and only if the

[29] Atkin (1992) analyzes US television series with minority-lead characters and finds that the observed increase in Black-lead characters is due to commercial purposes: Back-lead characters attract the Black audience that has become a highly sought after target by advertisers.

coverage of one's trait is sufficiently large, that is $q_i > \zeta/\vartheta$. Finally, the cross derivative coverage and intolerance is always positive: the more intolerant you are, the more you enjoy your trait being covered by TV. It is easy to see that none of our qualitative results are affected by these changes. Following the same steps as in the previous analysis it can be shown that the time devoted to watch television, is $t_i^* = \max\{0, [\Delta V(1-q_i) - \beta_i(q_i, \Delta V)]/c\}$ and that the condition $\Delta V \gtreqless 2\beta$ now becomes $\Delta V(1+2\zeta-\vartheta) = \Delta V(1+\zeta-\theta) \gtreqless 2\beta$. A monopolistic media industry with $\Delta V(1+\zeta-\theta) > 2\beta$ will choose coverage $q_1^* = \frac{\Delta V(1+\zeta)-\beta}{\Delta V(1+\vartheta)} = \frac{\Delta V(1+\zeta)-\beta}{\Delta V(1+\theta+\zeta)}$ and both traits will survive in the long run. Similarly, the qualitative results under competition remain the same. Hence, our analysis is robust to these changes.[30]

### 5.3 Heterogeneous cultural groups

In this subsection we introduce two additional sources of heterogeneity: advertisement sensitivity and the degree of cultural intolerance. Let $\gamma_1 = \gamma$ and $\gamma_2 = \alpha\gamma$ with $\alpha > 0$ where $\alpha$ describes the relative advertisement profitability of a member of group 2 relative to a member of group 1. Let $\Delta V_1 = \Delta V$ and $\Delta V_2 = \theta\Delta V$, where the parameter $\theta$ measures the relative cultural intolerance of group 2 with respect to group 1. Observe that the profitability of a group now depends on the size of the group, on the relative advertisement sensitivity of the group and the group's relative cultural intolerance and we therefore can no longer present results in terms of the majority group. Without loss of generality we assume $\theta \leq 1$, i.e. group 1 is culturally more intolerant.[31] We will focus on $\Delta V > 2\beta$ so that the media industry cannot capture full TV time by both cultural traits. These assumptions result in the following restriction on $\theta$.

$$\theta_{\min} = \beta/(\Delta V - \beta) \leq \theta \leq \theta_{\max} = 1. \tag{14}$$

Under this characterization a monopolistic media industry maximizes

$$\pi = \max_{q_i} \gamma\left[n(1-t_1^*) + \alpha(1-n)(1-t_2^*)\right]. \tag{15}$$

[30] The above formulation can also capture the case where the entertainment value depends only on cultural coverage. In this setup $\Delta V = 1$, $\theta = 0$ and $\beta = \zeta$. In this world the parameter area where a monopolistic TV industry can capture full TV time of both audiences disappears and the interval for which both groups are covered by a competitive media industry is now larger, reducing the danger of cultural extinction.

[31] Now Assumption 1 boils down to $c \geq \Delta V - \beta \geq \theta\Delta V - \beta \geq 0$.

Following the same steps as in Proposition 1 it is easy to show that a monopolistic TV industry will give more coverage to the more profitable group to capture its entire TV time. More formally, for $n \leq \widetilde{n}$ (where $n$ is the size of group 1) the optimal coverage is $q_1^a = 1 - q_2^a = q^a = \beta/\theta\Delta V$ and only trait 1 invests in education while for $n > \widetilde{n}$ the optimal coverage is $q_1^b = q^b = 1 - \beta/\Delta V$ and only trait 2 invests in education where

$$\widetilde{n} = \frac{\theta\alpha}{1+\theta\alpha} = 1 - \frac{1}{1+\theta\alpha}. \tag{16}$$

Since higher $\alpha$ and $\theta$ increase group 2's profitability, the threshold $\widetilde{n}$ is increasing in $\alpha$ and $\theta$. Therefore, for given group sizes, an increase in the relative advertisement sensitivity of one group with respect to the other and/or an increase in its relative cultural intolerance increases the probability that this group gets more coverage.

The dynamics of the cultural trait 1 is still driven by equation (5) but now - since we have two possible coverages - we have two steady state candidates, namely

$$n_a^* = \frac{\frac{c\beta}{\theta\Delta V}}{c - \Delta V\left(1 - \frac{\beta}{\theta\Delta V}\right)^2 + \beta\left(1 - \frac{\beta}{\theta\Delta V}\right)} \tag{17}$$

and

$$n_b^* = 1 - \frac{\frac{c\beta}{\Delta V}}{c - \theta\Delta V\left(1 - \frac{\beta}{\Delta V}\right)^2 + \beta\left(1 - \frac{\beta}{\Delta V}\right)}. \tag{18}$$

Notice that these potential steady states are always interior.[32] Also, they are independent of the advertisement sensitivity $\alpha$ because neither coverage nor optimal TV time depend on $\alpha$. Also $n_a^* \leq n_b^*$,[33] however the threshold $\widetilde{n}$ defined by (16) which determines whether the TV industry chooses $q^a$ or $q^b$ is not guaranteed to fall in between the two steady states candidates. On the one hand, a low (high) advertisement sensitivity might push $\widetilde{n}$ below $n_a^*$ (above $n_b^*$) which is unaffected by changes in $\alpha$. On the other hand, changes in the group's relative cultural intolerance affect both $\widetilde{n}$ and the steady state candidates. Specifically, while a decrease in $\theta$ leads to a lower $\widetilde{n}$, both $n_a^*$ and $n_b^*$ increase,[34] meaning that group 1 gets larger in the steady state candidates because group 2 becomes relatively less intolerant. This gives rise to three cases: (i) if $n_a^* \leq \widetilde{n} \leq n_b^*$, initial group size determines which steady state is reached : $n_a^*$ is reached if the initial size is smaller than $\widetilde{n}$,

[32] For $0 < n_a^* < 1$ we need $c > \frac{\theta\Delta V - \beta - \theta\beta}{\theta} = \Delta V - \beta - \frac{\beta}{\theta}$ while for $0 < n_b^* < 1$ we need $c > \theta\Delta V - \beta - \theta\beta$. Both conditions are guaranteed by Assumption 1.

[33] See Lemma 1 in Appendix B.

[34] Simple calculations show that $\frac{\partial n_a^*}{\partial\theta} < 0$ and $\frac{\partial n_b^*}{\partial\theta} < 0$.

while $n_b^*$ is reached otherwise. (ii) If $\widetilde{n} > n_b^*$ the system always converges to $n_a^*$. (iii) If $\widetilde{n} < n_a^*$ the system always converges to $n_b^*$. Hence in cases (ii) and (iii) there is a unique steady state.[35] The steady states are illustrated in Figure 1.[36] The picture shows that $n_b^*$ can only be an equilibrium if group 2 is not too sensitive to advertisement (there is an upper bound on $\alpha$). Moreover, if group 2 becomes more culturally intolerant (higher $\theta$), this change must be accompanied by a lower advertisement sensitivity and vice versa. This happens because higher $\alpha$ and $\theta$ make group 2 more valuable for the media industry relative to group 1. Hence, if these values become too high the media industry would like to capture group 2's entire TV time resulting in $n_a^*$.

[Include Figure 1 around here]

The figure nicely illustrates that for any fixed $\theta > \theta_{\min}$ – as $\alpha$ increases – the steady state will change from $n_b^*$ to a region where convergence depends on the initial size of the groups and finally to $n_a^*$.

We can therefore derive the following empirical predictions. Increasing the relative advertisement sensitivity of one group with respect to the other and/or its relative cultural intolerance, increases the probability of moving to a steady state in which this group is larger.

If we allow for a competitive media industry, the analysis of the problem is similar to the symmetric case except that now we have to look at all possible group sizes since being the majority is no longer equivalent to being the most profitable group. Again for intermediate group sizes now defined by

$$\underline{n}^h = \frac{\alpha c}{\alpha c + c + \Delta V - \beta} \leq n \leq \overline{n}^h = \frac{\alpha \left(c + \theta \Delta V - \beta\right)}{\alpha \left(c + \theta \Delta V - \beta\right) + c} \tag{19}$$

the media industry specializes on different traits while outside this parameter range only the most profitable group is covered. It is instructive to study when both groups are covered. First, notice that only $\overline{n}^h$ is affected by $\theta$ and it is increasing in $\theta$, making specialization on different traits most likely for $\theta = 1$ when both groups are equally intolerant. Moreover, the size of the interval for which both traits are covered $(\overline{n}^h - \underline{n}^h)$ is increasing for $\alpha < \widehat{\alpha}$, decreasing for $\alpha > \widehat{\alpha}$ and largest

[35] Notice that this does not mean that there is a unique coverage during the process of convergence. To see this assume $\widetilde{n} > n_b^*$ and let the initial group size lie above $\widetilde{n}$. Then TV coverage $q^b$ is implemented temporarily leading to a shrinking in group size until $n_t < \widetilde{n}$ in some period $t$ and the media industry switches to the steady state policy $q^a$.

[36] For a formal analysis see Appenix B.

for $\alpha = \widehat{\alpha}$, where $\widehat{\alpha} = \sqrt{(c-\beta+V\Delta)(c-\beta+V\theta\Delta)}/(c-\beta+V\theta\Delta)$.[37] Notice that for $\theta = 1$ we have that $\widehat{\alpha} = 1$ as well. Indeed, this analysis uncovers that the thresholds on $n$ drift apart, the more 'equal' the groups are. If $\theta < 1$ – meaning that group 1 is more radical than group 2 – than this must be countervailed by a higher sensitivity to advertisement ($\widehat{\alpha} > 1$) for group 2.

The previous discussion adds a couple of new empirical predictions: A decrease in the size of a group, its advertisement sensitivity or its degree of cultural intolerance will decrease the probability that the media industry will concentrate to cover that group. Finally, the comparison between monopolistic and competitive media industry is unaffected: competition is still more likely to lead to cultural extinction.[38]

## 5.4 Discussion of further assumptions

### 5.4.1 Non-myopic monopolist

Our agents are short-sighted: parents only care about their children and the TV industry only cares about their present profits. The assumption on parents is consistent with the entire literature on cultural transmission. But especially a monopolistic TV industry want to manipulate the cultural dynamics of the groups, if it care about future profits. This manipulation is most attractive if the entertainment value is low compared to cultural intolerance, so that the monopolist can never capture full TV time of both cultural groups. But if one group got eliminated, future profits are maximized and this will happen sooner, the lower the coverage of this group in the present. Therefore, the monopolist faces a trade-off, losing some of the present profits for higher future profits. The outcome depends on how much the monopolist discounts the future. While a very patient monopolist will manipulate the dynamics and drive one group to extinction, a sufficiently impatient monopolist will behave as the myopic agent in our model.

### 5.4.2 Evolving cultural intolerance

In our model the degree of cultural intolerance of each group is held constant. In a complex dynamic model $\Delta V^i_{t+1}$ might depend on $\Delta V^i_t$, on what people watch in TV ($q^i_t$), and how long

[37] For details on this derivation see Appendix B.

[38] Poor minorities could have a higher cost of socializing their children being therefore obliged to rely more on TV time. This can be captured by our model assuming different parental costs of socialization $c_i$. However, the idea that a culture will not disappear when the TV market is monopolistic is robust to this extension.

they watch it $(1 - t_t^i)$. Since nothing can be said for a general functional form, we will postulate a specific simple form.[39] Assume that the evolution of cultural intolerance depends only on the program content, in particular, let $\Delta V_{t+1}^i = \Delta V_t^i + \varepsilon$ where $\varepsilon$ is positive for $q_t^i \geq \overline{q}$ where $\overline{q}$ is some constant level of coverage and negative otherwise. We start by discussing what happens for $\overline{q} = \frac{1}{2}$ with initially symmetric groups except for group size and a free-to-air monopolist.[40] Assume also $\Delta V_0 = \Delta V > 2\beta$. The majority who gets more coverage in $t = 0$, becomes culturally more intolerant while the minority becomes more tolerant. Hence it becomes harder / easier to induce the majority / minority to watch TV. Nevertheless, the monopolist still induces full TV time from the majority: the cutoff for optimality of this strategy even shrinks to $n_1 > (\Delta V - \varepsilon)/2\Delta V$. As time passes this cutoff shrinks further to $(\Delta V - t\varepsilon)/2\Delta V$ where $t$ is the current time period. The initial majority keeps radicalizing, growing and getting more coverage while the initial minority keeps shrinking and becomes more tolerant every period, namely $(\Delta V - t\varepsilon)$ where $t$ is the current time period. It might even become so tolerant that full TV time can be captured from both traits. Nevertheless it disappears in the long run, since the majority requires more coverage every period. For $\overline{q} > \frac{1}{2}$ the dynamics is similar if the majority is sufficiently big so that $q_1^*(t = 0) > \overline{q}$. Otherwise both groups become culturally more tolerant next period, and the majority requires less coverage to forego socialization. Over time both groups will become sufficiently tolerant that the monopolist can capture full TV time of both groups. Hence the group size is totally determined by the TV coverage with long run survival of both traits.[41] Similar results hold, if the change in cultural intolerance was weighted by TV time only that the (de)radicalization of the majority would happen at a higher speed than the deradicalization of the minority.

# 6 Discussion and Conclusion

Television does not only provide entertainment but is also an important source of oblique socialization. To keep the model tractable, we have abstracted from other forms of socializations like

[39] It is an empirical question which form is most reasonable.

[40] Notice that this is the interesting case, since under competition either both groups get full coverage and the group sizes stay constant or only one group gets covered leading to elimiation of the other group: this would also happen under the present assumptions.

[41] If cultural intolerance remains constant for intermediate levels of coverage, i.e. $\varepsilon = 0$ for $1 - \overline{q} \leq q \leq \overline{q}$, $\varepsilon < 0$ for $q < 1 - \overline{q}$ and $\varepsilon > 0$ for $q > \overline{q}$, then our baseline model applies if $1 - \overline{q_1} \leq q_1^b \leq \overline{q_1}$. Otherwise the majority becomes more intolerant every period, while the minority becomes more tolerant and will be eliminated in the long-run.

influence by peers or by the school. This simplification is appropriate since we study socialization at a very young age, due to our assumption that parents decide their children's TV viewing. Therefore, our model cannot be used to talk more generally about the possible impact of new communication technologies such as internet and social networking website on cultural diversity and evolution of preferences. To study the impact of new communication technology we would need to enrich our model to allow for socialization to occur partly through role model effects and random social interactions outside the home which is left for future research. In the present paper we have chosen to develop an industrial organization view of cultural transmission and preference evolution instead studying both the demand and supply side of television and its resulting influence on cultural change. The model derives three sets of predictions concerning: (i) TV demand, (ii) TV supply and (iii) the cultural dynamics and resulting steady states.

On the **demand side** the model mainly predicts that TV time is increasing in cultural coverage and decreasing in cultural intolerance. The communication literature provides some indirect evidence for this prediction: people prefer home produced TV products even if worse in quality. In other words, people watch more television if the coverage of their cultural traits is larger. In the same vain, cultural proximity has been shown to be a key factor for TV success.[42] Imported programs that are produced in a culture which is close in terms of language, dress, ethnic types, body language, definitions of humor, ideas about story pacing, music traditions, religious elements etc...tend to be more successful: Brazilian telenovelas dubbed into Spanish are more popular in Latin America than any American Soap, while Japanese and Chinese television are more successful in Asia than American imports, to mention a few examples.

Israel is an ideal country to study different cultural groups' viewing behaviors. In their case study Cohen (2005) and Cohen and Tukachinsky (2007) show that viewing patterns differ among groups and each group watches the channel that covers their culture better. They also look at the **supply side** and illustrate how the Israelian TV market has responded to demand by creating different niches for different cultures. In this market, all traits are covered except for the ultra orthodox Jews who do not watch TV. This is in accordance with our model: in Israel cultural groups are of similar sizes (profitability) so that a competitive TV industry finds it convenient to

[42] See Trepete, (2003), Straubhaar (1991, 2008), La Pastina and Straubhaar (2005), Straubhaar et al. (2003), de Bens and Schmaele (2001)

cover all of them except for the ultra orthodox Jews who are very insensitive to advertisement.[43] Other empirical studies[44] look at different measures of channel diversity based on program type and check how increased competition affects diversity without getting a clear answer: diversity measures can vary considerably across markets with similar number of channels. According to our model, the effect of competition on diversity depends on the relative profitability of the different cultural groups. Therefore, controlling for cultural aspects of programs and not only for program type, for group size, advertisement sensitivity and socialization costs of different cultures can serve as an empirical strategy to disentangle this mixed evidence.[45] All our other predictions concerning the supply side of television simply say that the relatively more profitable cultural group gets more coverage.[46] Observe that profitability depends on cultural intolerance: more intolerant groups should get more coverage. The empirical test of this prediction requires data on the relative cultural dislike of one cultural trait towards the others and is left for future research.

The third set of predictions of our model concerns the **cultural dynamics**. While we are not aware of any studies testing our predictions directly,[47] some efforts have been made to study cultural change over time. Inglehart and Baker (2000) use the World Value Surveys to show both massive cultural change and the persistence of distinctive cultural values. Especially the broad heritage of a society in terms of religion is shown to leave a deep imprint on values that endure modernization. The role of the mass media is ignored in the study. However, in a recent book Norris and Inglehart (2009) take a first look at the role of the media for cultural change again using the World Value Survey and conclude that the risks to national diversity due to mass media

[43]Cultural groups in Israel consist of around 12% Ultra-Orthodox Jews, 18% Arabs, 20% immigrants from the former Soviet Union while the remaining 50% is split among tradional-Mizrahi, secular-Ashkenazi and national religious groups (Cohen, 2005).

[44]see e.g. Signorielli (1986), De Jong and Bates (1991), Lin, (1995), Li and Chiang (2001), Van der Wurff (2004, 2005).

[45]A possibility alluded to in Van der Wurff (2005) who suggests that the different channel diversity might be due to "differences in audience demand for minority programmes, country-specific (cultural-historical) differences in channel programming or a combination of these factors" (p.267).

[46]A parallel argument could be made for commercial radios concentrating on the most profitable groups. Siegelman and Waldfogel (2001) provide empirical evidence that US commercial radio mainly covers white audiences and underprovides minority listeners (blacks and hispanics) who have a very distinctive taste.

[47]The closest attempt might be due to Morgan (1986) who investigated the effect of watching TV on regional diversity in the US between 1975 and 1983 examining the General Social Surveys conducted by the National Opinion Research Centre and discovered that heavy viewers had less regional diversity than light or moderate viewers.

is exaggerated.[48] Cultural extinction can occur in our model but only under special circumstances. Parental concern about the survival of cultural traits acts as a firewall against cultural convergence. If parents care about their culture, their children will only be allowed to watch television that gives a sufficient coverage to their cultural trait. It is this aspect of the demand side that acts as an insurance towards cultural survival and can make protectionist policies superfluous.[49] A serious conclusion concerning cultural convergence versus non-convergence due to mass media can only be given by an empirical test of our dynamic predictions.[50]

This paper has provided a framework that allows for the discussion of media market structure and competitive and cultural policy in the media sector. According to our model TV programs should not be classified as "cultural exceptions" and public broad-casting is rarely justifiable on cultural grounds. Indeed, cultural extinction can only occur if the differences in the groups' overall advertisement profitability is very big and the media industry is competitive with a small number of firms. The more competitors there are, the less likely is cultural extinction. Moreover, the presence of pay-TV firms decrease the probability of cultural extinction and this probability is smallest if all competing firms are pay-TV firms.[51] Recent developments in the TV industry suggest that we live in such a world.

[48] Disdier et al. (2010) reach the same conclusion. In their paper they offer systematic evidence of the influence of foreign media on one particular cultural trait, namely naming patterns in France. Names given to babies are seen as "emblematic characteristics of national cultural traditions" and hence "expressions of cultural identity". Disdier et al. (2010) show that despite the existence of many examples of non-traditional names in France the aggregate impact of foreign media is modest and has changed less than 5% of the names.

[49] For instance, studying the Israeli TV market where all channels have quotas on Israeli productions, Cohen (2005) discovered all commercial channels voluntarily surpassed these quotas because that was what consumers demanded.

[50] In order to do so, one would need a long panel with data on people's time use and values, together with data on TV contents that allow for cultural differentiation between channels. This very demanding task is left for future research.

[51] Another interesting extension is to allow for firms to broadcast multiple channels and offer bundles. Crawford and Cullen (2007) show in numerical welfare simulations that consumers would benefit if cable television networks were offered à la carte. If cultural survival is a concern, this is likely to reinforce their conclusion.

# A Appendix: Symmetric Groups

## A.1 Monopolistic firm

**Proof of Proposition 1.** The result for $\Delta V \leq 2\beta$ follows immediately from the main text and the observation that for any $1-\frac{\beta}{\Delta V} \leq q_i \leq \frac{\beta}{\Delta V}$, the coverage of each cultural we lies above $\widehat{q_1} = \widehat{q_2}$. If $\Delta V > 2\beta$, we proceed in the following way: we divide the possible coverage into three subintervals depending on whether the TV industry can capture full TV time of one of the traits. We then determine the optimal coverage in each of them and compare the level of profits in each subinterval to find the overall optimal coverage. The first subinterval is given by all levels of media coverage that guarantee full TV time from trait 2 and partial TV time from trait 1, namely $q_1 \leq \frac{\beta}{\Delta V}$. It is easy to see that $q_1^a = \frac{\beta}{\Delta V}$ is optimal, since $(1-t_1^*)$ is increasing in $q$ while $(1-t_2^*)$ is constant and equal to 1. Using (3), (2) and $q_1^a = \frac{\beta}{\Delta V}$, profits are easily shown to be equal to $\pi^a = \gamma \left[ (1-n) + n \left( \frac{c+2\beta-\Delta V}{c} \right) \right]$ .We now solve for the last subinterval where only trait 2 socializes and trait 2 watches TV all the time, namely $q_1 \geq 1-\frac{\beta}{\Delta V}$. Given that $(1-t_1^*)$ is constant and equal to 1, while $(1-t_2^*)$ is decreasing in $q$ the optimal coverage mix is $q^b = 1-\frac{\beta}{\Delta V}$ and profits are equal to $\pi^b$ defined by (4). Finally, in the subinterval where both traits socialize, namely $\frac{\beta}{\Delta V} \leq q_i \leq 1-\frac{\beta}{\Delta V}$ the firm has to maximize

$$\max_{\frac{\beta}{\Delta V} \leq q_i \leq 1-\frac{\beta}{\Delta V}} \gamma \left\{ n \left( \frac{c+\beta-\Delta V(1-q_i)}{c} \right) + (1-n) \left( \frac{c+\beta-\Delta V q_i}{c} \right) \right\}.$$

Since the problem is linear, we get a corner solution leading either to $q_1^a$ and $\pi^a$ or to $q_1^b$ and $\pi^b$. It is easy to show that $\pi^a \leq \pi^b$ whenever $n \geq \widetilde{n} = \frac{1}{2}$. ■

## A.2 Competitive media industries

**Proof of Proposition 3.** We first show that $(q_1^I = 0, q_1^{II} = 1)$ and $(q_1^I = 1, q_1^{II} = 0)$ are two pure strategy Nash equilibria for all $1/2 \leqslant n \leqslant \overline{n}$. In those equilibria the channel (no matter which) covering group 2 gets profits $\gamma(1-n)$ while the only profitable deviation is to cover group 1 only which would give profits $\gamma \Delta_1 = \gamma \left[ n + (1-n)(1-t_2^*) \right]/2$ where $t_2^* = (\Delta V - \beta)/c$, hence

$$\Delta_1 = \left[ c - (1-n)(\Delta V - \beta) \right]/2c \tag{20}$$

which is not profitable for $n \leq \overline{n}$. For the channel covering group 1, instead, profits are equal to $\gamma n$, while deviating to cover group 2 would give the profits $\gamma \Delta_2 = \gamma \left[ n(1-t_1^*) + (1-n) \right]/2$ where

$t_1^* = (\Delta V - \beta)/c$, hence

$$\Delta_2 = [c - n(\Delta V - \beta)]/2c \tag{21}$$

and this is not profitable for $n \geq c/(2c + \Delta V - \beta)$ which is smaller than 1/2.

There also exists a mixed strategy equilibrium with $p^I = p^{II} = \frac{c+\Delta V-\beta-n(2c+\Delta V-\beta)}{\Delta V-\beta}$ for all $1/2 \leq n \leq \overline{n}$ where $p^j$ is the probability to specialize on the minority trait. The probability $p^{II}$ must make firm $I$ indifferent between playing $q_1^I = 0$ or $q_1^I = 1$ i.e., $\Pi^I\left(q_1^I = 0\right) = \Pi^I\left(q_1^I = 1\right)$ where $\Pi^I\left(q_1^I = 0\right) = \gamma\left[p^{II}\Delta_2 + \left(1 - p^{II}\right)(1-n)\right]$ and $\Pi^I\left(q_1^I = 1\right) = \gamma\left[p^{II}n + \left(1 - p^{II}\right)\Delta_1\right]$. At the same time the probability $p^I$ must make firm $II$ indifferent between playing $q_1^{II} = 0$ or $q_1^{II} = 1$ i.e., $\Pi^{II}\left(q_1^{II} = 0\right) = \Pi^{II}\left(q_1^{II} = 1\right)$ where $\Pi^{II}\left(q_1^{II} = 0\right)$ and $\Pi^{II}\left(q_1^{II} = 1\right)$ are identical to $\Pi^I\left(q_1^I = 0\right)$ and $\Pi^I\left(q_1^I = 1\right)$ with $p^I$ in place of $p^{II}$. After some algebra the equilibrium probabilities immediately follow. Finally, the bounds are found by checking the conditions $0 \leq p^I = p^{II} \leq 1$ and recalling that $n > 1/2$ by assumption. Next, we show that for $n \geq \overline{n}$, $q_1^I = q_1^{II} = 1$ is an equilibrium. Indeed, for $q_1^I = q_1^{II} = 1$ the only possible deviations are for $q < 1$ which would at most guarantee profits $\gamma(1-n)$ to the deviating channel. Then, $q_1^I = q_1^{II} = 1$ is an equilibrium if $\gamma\Delta_2 \geqslant \gamma(1-n)$, that is if $n \geq \overline{n}$. Instead $q_1^I = q_1^{II} = 0$ would be an equilibrium if $\gamma\Delta_2 \geqslant \gamma n$, that is if $n \leq \frac{c}{2c+\Delta V-\beta} = 1 - \overline{n}$ but since $n > 1/2$ by assumption this is never the case. We now show that there are no other pure strategy Nash equilibria. Assume there exist an equilibrium with $q_1^I > q_1^{II}$ (different from $(q_1^I = 1, q_1^{II} = 0)$) then channel $I$ would get profits $\gamma n(1 - t_1^*)$ and channel $II$ would get profits $\gamma(1-n)(1-t_2^*)$. This is never an equilibrium for $(1 - t_1^*)$ and/or $(1 - t_2^*)$ smaller than 1. In that case $I$ and/or $II$ could deviate and get a larger audience by increasing $q_1^I$ and/or decreasing $q_1^{II}$. This is always true since $t_1^*$ is non-increasing in $q$ while $t_2^*$ is non-decreasing in $q$ and there are some $q$ such that $t_1^* = t_2^* = 0$. If instead, $(1 - t_1^*)$ and $(1 - t_2^*)$ both equal 1, again this cannot be an equilibrium. Indeed, since $n > \frac{1}{2}$ channel $II$, would profit from deviating to a $q_1^I < q_1^{II}$ because this deviation would get $\gamma n$ which is more than the candidate equilibrium payoff $\gamma(1-n)$. Notice that this reasoning does not work if $q_1^I$ is already equal to 1 as in $(q_1^I = 1, q_1^{II} = 0)$. A similar reasoning shows that there is never an equilibrium for $q_1^I < q_1^{II}$. Assume now that there exist an equilibrium with $q_1^I = q_1^{II}$ (different from $q_1^I = q_1^{II} = 1$) then both channels would get profits $\gamma[n(1-t_1^*) + (1-n)(1-t_2^*)]/2$. In this case the best possible deviation would be to satisfy completely $(1 - t_i^* = 1)$ the most profitable group. Therefore, since $n > \frac{1}{2}$, (that is group 1 is the more profitable group), a deviation to a $q > q_1^I = q_1^{II}$ would give to the deviating channel a profit of $\gamma n$. Then, $q_1^I = q_1^{II}$ will be an equilibrium if $\gamma[n(1-t_1^*) + (1-n)(1-t_2^*)]/2 \geqslant \gamma n$ and this is not possible for $n > \frac{1}{2}$ even if $(1 - t_1^*) = (1 - t_2^*) = 1$.

We now show what happens to the size of the interval for which specialization on different cultural traits occurs

$$\overline{n} - 1/2 = \frac{c + \Delta V - \beta}{2c + \Delta V - \beta} - 1/2.$$

It is immediate to see that the size of the interval decreases with respect to $c$ and $\beta$ and increases with respect to $\Delta V$. ■

**Proof of Proposition 5.** Competition is now a two stage game which we solve by backward induction. In the second stage TV firms simultaneously choose their optimal fees after observing the coverages chosen in the first stage. Notice that price competition in the second stage does not alter the fact that specialization is a dominant strategy in the first stage, hence we will only consider $q_1^j = 0$ or $q_1^j = 1$ as possible coverages. By usual reasoning firms will choose $s = 0$ in the second stage if they concentrate on the same trait. Otherwise, firms will be able to set positive prices. The maximum price $s^{\max}$ is an equilibrium if the firm covering the minority group (say firm $j$) does not want to deviate to a lower $\widehat{s} - \varepsilon$ where $\widehat{s}$ is the price that would make the majority group indifferent between the two channels, i.e. $U_j^1(0, \widehat{s}) = U_{-j}^1(1, s^{\max}) = 0$. This requires that $(1 - n)(\gamma + s^{\max}) > 2\Delta_1\gamma + (\widehat{s} - \varepsilon)$ where $\Delta_1$ is defined by (20) or equivalently when $\varepsilon \longrightarrow 0$ that

$$n < n_s = \frac{c\left[s^{\max} - \widehat{s}\right] + \gamma\left(\Delta V - \beta\right)}{\gamma\left(c + \Delta V - \beta\right)}$$

Since by assumption $\gamma < \left[s^{\max} - \widehat{s}\right]$ this deviation is never profitable. Hence if coverages are different, firms always choose $s^{\max}$. We therefore can write the normal form of the first stage as follows where $\Delta_1$ and $\Delta_2$ are defined by (20) and (21) respectively

| | **Firm II** | | |
|---|---|---|---|
| | | $q_1^I = 0$ | $q_1^I = 1$ |
| **Firm I** | $q_1^{II} = 0$ | $\gamma\Delta_2, \gamma\Delta_2$ | $(1-n)(\gamma + s^{\max}), n(\gamma + s^{\max})$ |
| | $q_1^{II} = 1$ | $n(\gamma + s^{\max}), (1-n)(\gamma + s^{\max})$ | $\gamma\Delta_1, \gamma\Delta_1$ |

From this payoff matrix and following the same steps as in the proof of Proposition 3 it is easy to show that: first, $q_1^j = 0$, $q_1^{-j} = 1$ with $s^j = s^{-j} = s^{\max}$ are two pure Nash equilibria for all $\frac{1}{2} \leq n \leq \overline{n}(s^{\max})$, (most profitable deviation is avoided if $(1-n)(\gamma + s^{\max}) > \gamma\Delta_1$); second, $q_1^I = q_1^{II} = 1$ with $s^I = s^{II} = 0$ is a pure strategy Nash equilibrium for all $n \geq \overline{n}(s^{\max})$; third, for all $1/2 \leqslant n \leqslant \overline{n}(s^{\max})$, there is also a mixed strategy equilibrium with $p^I = p^{II} = \frac{\gamma(c-(1-n)(\Delta V-\beta))-2c(1-n)(\gamma+s^{\max})}{\gamma(2c-\Delta V+\beta)-2c(\gamma+s^{\max})}$ where $p^j$ is the probability with which the minority group is covered by firm $j$. Finally, simple algebra shows that $\overline{n}(s^{\max}) = \frac{2cs^{\max}+\gamma(c+\Delta V-\beta)}{2cs^{\max}+\gamma(2c+\Delta V-\beta)} > \frac{c+\Delta V-\beta}{2c+\Delta V-\beta} = \overline{n}$. The resulting dynamics are trivial. ■

**Proof of Proposition 6.** Competition is a two stage game, where in the second stage only firm $I$ chooses its fee and firm $II$ chooses $s = 0$. By standard arguments firm $I$ will set $s = 0$ if $q_1^I = q_2^{II}$. If $q_1^I \neq q_2^{II}$, firm 1 sets a positive fee $\widehat{s}$ which leaves the trait that gets more coverage by firm 1 indifferent between watching firm I's channel or firm II's channel which is free. By the same arguments as in the proof of Proposition 3, the only possible first period outcomes are either $q_1^j = 0$ or $q_1^j = 1$. Hence if firms specialize on different traits $\widehat{s}$ is determined by $U_I^i(1, \widehat{s}) = U_{II}^i(0, 0)$. We can then write the game played in the first stage as follows where $\Delta_1$ and $\Delta_2$ are defined by (20) and (21) respectively

| | **Firm II** | | |
|---|---|---|---|
| | | $q_1^I = 0$ | $q_1^I = 1$ |
| **Firm I** | $q_1^{II} = 0$ | $\gamma\Delta_2, \gamma\Delta_2$ | $(1-n)(\gamma + \widehat{s}), n\gamma$ |
| | $q_1^{II} = 1$ | $n(\gamma + \widehat{s}), (1-n)\gamma$ | $\gamma\Delta_1, \gamma\Delta_1$ |

From this payoff matrix and following the same steps as in the proof of Propositions 3 and 5 it is simple to show that: first, $q_1^I = 1, q_1^{II} = 0$ with $s^I = \widehat{s}$ is a pure strategy Nash equilibrium for all $1/2 \leqslant n \leqslant \overline{n}$; second, for all $1/2 \leq n \leq \overline{n}(\widehat{s})$, there is a pure strategy Nash equilibrium $q_1^I = 0, q_1^{II} = 1$ and $s^I = \widehat{s}$; third, $q_1^I = q_1^{II} = 1$ with $s^I = s^{II} = 0$ is a pure strategy Nash equilibrium for all $n \geq \overline{n}(\widehat{s})$; fourth, for $\frac{1}{2} \leqslant n \leqslant \overline{n}$, there is also a mixed strategy equilibrium with $p^I = \frac{(1-n)(\Delta V - \beta + 2c) - c}{\Delta V - \beta}$ and $p^{II} = \frac{2c(1-n)(\gamma + \widehat{s}) - \gamma(c - (1-n)(\Delta V - \beta))}{\gamma(\Delta V - \beta) + 2c\widehat{s}}$ where $p^j$ is the probability with which the minority group is covered by firm $j$. Finally, to show that $\overline{n}(s^{\max}) > \overline{n}(\widehat{s}) > \overline{n}$ it is sufficient to notice that $\overline{n}(s) = \frac{2cs + \gamma(c + \Delta V - \beta)}{2cs + \gamma(2c + \Delta V - \beta)}$ is increasing in $s$, that $\overline{n}(s)$ tends to $\overline{n}$ when $s$ goes to zero and that $s^{\max} > \widehat{s}$. The resulting dynamics are trivial. ■

## A.3 Endogenous entertainment

**Proof of Proposition 7.** Following the same steps as in our baseline model it is easy to show that he two possible level of profit are $\Pi_H = \gamma\left[n + (1-n)\left(1 - \frac{\Delta V - 2\beta_H}{c}\right)\right] - k$ and $\Pi_L = \gamma\left[n + (1-n)\left(1 - \frac{\Delta V - 2\beta_L}{c}\right)\right]$. The media firm will prefer the high entertainment level if and only if $\Pi_H \geq \Pi_L$ which is equivalent to $n \leq \widehat{n} = 1 - \frac{ck}{2\gamma\Delta\beta}$. High quality can only be an equilibrium outcome if $\widehat{n} > \frac{1}{2} \Leftrightarrow k < \frac{\gamma\Delta\beta}{2}$. ■

**Proof of Proposition 8.** The possibility to choose entertainment in the second stage does not alter the fact that covering only one trait is a dominant strategy in the first stage, hence we will only consider $q_1^j = 0$ or $q_1^j = 1$ as possible coverages. We start by looking at the second stage. If $q_1^I = q_1^{II}$ then there is always an equilibrium in which both firms choose $\beta_H$. There might also be an equilibrium in which both firms choose $\beta_L$. In particular, $q_1^I = q_1^{II} = 1$ and $\beta_L$ is an equilibrium if $\gamma\Delta_1^L >$

$2\gamma\Delta_1^H - k \Leftrightarrow n < 1 - \frac{c(\gamma-2k)}{\gamma(\Delta V-2\beta_H+\beta_L)} = n_k$. Similarly, $q_1^I = q_1^{II} = 0$ and $\beta_L$ is an equilibrium if $\gamma\Delta_2^L > 2\gamma\Delta_2^H - k \Leftrightarrow n > \frac{c(\gamma-2k)}{\gamma(\Delta V-2\beta_H+\beta_L)} = 1 - n_k$, where $\Delta_1^l$ and $\Delta_2^l$ for $l = L, H$ are obtained by (20) and (21) substituting $\beta_l$ to $\beta$. However, these equilibria do not exist if $\frac{c(\gamma-2k)}{\gamma(\Delta V-2\beta_H+\beta_L)} > 1$, or if $k < \frac{\gamma(c-(\Delta V-\beta_L)+2\beta_H)}{2c}$. If $q_1^I \neq q_1^{II}$ then both firms will choose $\beta_L$ since they are not able to capture any additional demand by deviating to $\beta_H$. Hence we get the following first stage payoffs taking the second stage reactions into account.

| | | | |
|---|---|---|---|
| | **Firm II** | | |
| | | $q_1^I = 0$ | $q_1^I = 1$ |
| **Firm I** | $q_1^{II} = 0$ | $\gamma\Delta_2^H - k, \gamma\Delta_2^H - k$ | $(1-n)\gamma, n\gamma$ |
| | $q_1^{II} = 1$ | $n\gamma, (1-n)\gamma$ | $\gamma\Delta_1^H - k, \gamma\Delta_1^H - k$ |

From this payoff matrix and following the same steps as in the proof of Propositions 3 it is easy to show that $q_1^I = q_1^{II} = 1$ and $\beta_H$ is an equilibrium if $\gamma\Delta_1^H - k > (1-n)\gamma \Leftrightarrow n > \overline{n_k} = \frac{\gamma(c+\Delta V-\beta_H)+2ck}{\gamma(2c+\Delta V-\beta_H)}$ while for $\frac{1}{2} < n < \overline{n_k}$ firms diversify their coverage. The resulting dynamics is trivial. ■

# B Appendix: Heterogeneous cultural groups

## B.1 Dynamics with a monopolistic TV industry

As explained in the main text, with heterogeneous cultural groups and a monopolistic TV industry there are two candidate steady states in equilibrium: $n_a^*$ defined by (22) and $n_b^*$ defined by (23). To understand which of the two candidates steady states is an equilibrium we check if for $n_a^*$ and $n_b^*$ the TV industry chooses $q^a$ and $q^b$ respectively. Hence, we check the location of $n_a^*$ and $n_b^*$ with respect to the threshold $\widetilde{n}$ defined by (16). We first show that $n_a^* \leq n_b^*$.

**Lemma 1** $n_a^* \leq n_b^*$

**Proof.** Recall that $\theta_{\min} = \frac{\beta}{\Delta V-\beta} \leq \theta \leq \theta_{\max} = 1$. Simple algebra reveals that $n_a^* = n_b^*$ at $\theta_{\min}$ while $n_a^* < n_b^*$ at $\theta_{\max}$ since $n_a^*(\theta_{\max}) < n_b^*(\theta_{\max}) \Leftrightarrow (\Delta V - 2\beta)\,c > (\Delta V - 2\beta)(\Delta V - \beta)$ which is always true by assumption 1. Also both $n_a^*$ and $n_b^*$ strictly decrease in $\theta$. Therefore if we can show that $\left|\frac{\partial n_a^*}{\partial\theta}_{|\theta_{\min}}\right| > \left|\frac{\partial n_b^*}{\partial\theta}_{|\theta_{\min}}\right|$ we have established that $n_a^* \leq n_b^*$. Simple algebra reveals that $\left|\frac{\partial n_a^*}{\partial\theta}_{|\theta_{\min}}\right| > \left|\frac{\partial n_b^*}{\partial\theta}_{|\theta_{\min}}\right| \Leftrightarrow (\Delta V - \beta)^2 (\beta(3\Delta V - 4\beta) + \Delta V c) > 0$ which is always true since we are in the parameter area where $\Delta V > 2\beta$. ■

This leaves three possible scenarios:

1. For $n_a^* \leq \widetilde{n} \leq n_b^*$ both $n_a^*$ and $n_b^*$ are stable. The dynamics converges to $n_a^*$ if the initial $n_0 < \widetilde{n}$ and to $n_b^*$ otherwise. Our benchmark case (symmetric cultural traits) falls into this scenario.

2. For $n_a^* \leq n_b^* < \widetilde{n}$ the system converges to $n_a^*$.

3. For $\widetilde{n} < n_a^* \leq n_b^*$ the system converges to $n_b^*$.

Proposition 9 derives the parameter conditions on $\alpha$ and $\theta$ for which cases 1, 2 and 3 occur.

**Proposition 9 (Steady states)** *There exist thresholds $\alpha_a$, $\alpha_b$, $\alpha_c$, $\theta_a$ and $\theta_b$, (all given in the proof) such that the steady states are as follows:*

1. *for $\alpha < \alpha_a$ the system converges to $n_b^*$;*

2. *for $\alpha_a \leq \alpha \leq \alpha_b$ the system converges to $n_b^*$ for $\theta_{\min} \leq \theta < \theta_a$ while for $\theta_a \leq \theta \leq \theta_{\max}$ the system converges to $n_a^*$ whenever the initial $n_0 < \widetilde{n}$ and converges to $n_b^*$ otherwise;*

3. *for $\alpha_b < \alpha \leq \alpha_c$ we get the following subcases:*

   *(a) for $\theta_{\min} \leq \theta < \theta_a$ the system converges to $n_b^*$;*

   *(b) for $\theta_a \leq \theta \leq \theta_b$ the system converges to $n_a^*$ whenever the initial $n_0 < \widetilde{n}$ and converges to $n_b^*$ otherwise;*

   *(c) for $\theta_b < \theta \leq \theta_{\max}$ the system converges to $n_a^*$.*

4. *for $\alpha > \alpha_c$ the system converges to $n_a^*$.*

*In steady state $n_a^*$ the media industry chooses coverage $q^a$ and only trait 1 invest in education. In steady state $n_b^*$ the media industry chooses coverage $q^b$ and only trait 2 parents invest in education.*

**Proof of Proposition 9.** The dynamics give us the conditions for stability: $n_a^*$ is stable whenever $n_a^* \leq \widetilde{n}$, while $n_b^*$ is stable whenever $\widetilde{n} \leq n_b^*$. We first translate these conditions into restrictions on the parameter $\theta$. Since both $n_a^*$ and $n_b^*$ are decreasing while $\widetilde{n}$ is increasing in $\theta$, simple algebra delivers that $n_a^* \leq \widetilde{n}$ whenever $\theta \geq \theta_a$ where

$$\theta_a = \frac{-\alpha\left(2\Delta V - c - \beta\right)\beta + \sqrt{\alpha^2\left(2\Delta V - c - \beta\right)^2\beta^2 + 4\beta(\alpha\beta + c)\alpha\Delta V\left(c + \beta - \Delta V\right)}}{2\alpha\Delta V\left(c + \beta - \Delta V\right)} \tag{22}$$

while $\widetilde{n} \leq n_b^*$ whenever $\theta \leq \theta_b$ where

$$\theta_b = \frac{(\Delta V - \beta)(c + \beta)}{(\Delta V - \beta)^2 + \alpha\beta c}. \tag{23}$$

Moreover both $\theta_a$ and $\theta_b$ are decreasing in $\alpha$. We then compare these thresholds with the permitted range of $\theta$ as defined by $\theta_{\min} = \frac{\beta}{\Delta V - \beta} \leq \theta \leq \theta_{\max} = 1$ and translate this into restrictions on $\alpha$. Simple algebra gives us the following results:

- $n_a^*$ is always unstable if $\max[\theta_a, \theta_{\max}] = \theta_a$ or equivalently if $\alpha < \alpha_a$ with

$$\alpha_a = \frac{c\beta}{(\Delta V - \beta)(c + 2\beta - \Delta V)} \tag{24}$$

- $n_b^*$ is always stable if $\max[\theta_b, \theta_{\max}] = \theta_b$ or equivalently if $\alpha \leq \alpha_b$ with

$$\alpha_b = \frac{(\Delta V - \beta)(c + 2\beta - \Delta V)}{c\beta}. \tag{25}$$

- $n_a^*$ is always stable if $\min[\theta_a, \theta_{\min}] = \theta_a$ and $n_b^*$ is always unstable if $\min[\theta_b, \theta_{\min}] = \theta_b$, or equivalently if $\alpha > \alpha_c$ where

$$\alpha_c = \frac{(\Delta V - \beta)^2}{\beta^2}. \tag{26}$$

Since the condition for complete instability for $n_b^*$ and for complete stability for $n_a^*$ coincide at $\alpha > \alpha_c$ defined by (26) whenever $n_b^*$ is completely unstable for all permitted $\theta$, $n_a^*$ is completely stable: we are in case 2. The conditions for complete instability of $n_a^*$, namely $\alpha < \alpha_a$ defined by (24) and complete stability of $n_b^*$, namely $\alpha < \alpha_b$ defined by (25) do not coincide, however it can be shown by simple algebra that $\alpha_a < \alpha_b$, so complete instability of $n_a^*$ (namely $\alpha < \alpha_a$) implies complete stability of $n_b^*$ for all possible $\theta$: we are in case 3. For $\alpha_a \leq \alpha \leq \alpha_b$ we are also in case 3 for $\theta_{\min} < \theta < \theta_a$ and in case 1 for $\theta_a < \theta < \theta_{\max}$. Lemma 2 establishes that $\theta_a \leq \theta_b$ for $\alpha_b \leq \alpha \leq \alpha_c$, hence we are in case 1 for $\theta_a \leq \theta \leq \theta_b$, in case 2 for $\theta_b < \theta \leq \theta_{\max}$ and in case 3 for $\theta_{\min} \leq \theta < \theta_a$.

**Lemma 2** *For $\alpha_b < \alpha \leq \alpha_c$ it is always the case that $\theta_a < \theta_b$.*

**Proof.** We know that for $\alpha_b < \alpha < \alpha_c$ both $\theta_a$ and $\theta_b$ are interior with respect to $\theta_{\min}$ and $\theta_{\max}$. We first compare $\theta_a$ and $\theta_b$ in general and then show that if they lie between $\theta_{\min}$ and $\theta_{\max}$ it must be the case that $\theta_b > \theta_a$. After some reformulation $\theta_a \lesseqqgtr \theta_b$ is equivalent to

$$4Vc\Delta\alpha\,(c + \beta - \Delta V)\left(\Delta V^2 + \beta^2 - \alpha\beta^2 - 2\Delta V\beta\right) \times$$
$$\left(\left(\Delta V^2 + \beta^2(1 - \alpha) - 2\beta\Delta V\right)(c\alpha + \beta) + \Delta V\alpha\left(\beta^2 - c^2\right)\right) \lesseqqgtr 0.$$

By Assumption 1 the first bracket is positive, hence we have to look at the second and third bracket only

$$\left(\Delta V^2+\beta^2-\alpha\beta^2-2\Delta V\beta\right)\left(\left(\Delta V^2+\beta^2\left(1-\alpha\right)-2\beta\Delta V\right)\left(c\alpha+\beta\right)+\Delta V\alpha\left(\beta^2-c^2\right)\right)\lesseqgtr 0. \quad (27)$$

Equation (27) tells us that there are two values of $\alpha$, say $\alpha_1$ and $\alpha_2$, for which $\theta_a=\theta_b$. Those values of $\alpha$ can be calculated equating (27) to zero: The zero of the first bracket of (27) gives $\alpha_2$ which happens to coincide with $\alpha_c$ while the zero of the second bracket gives us $\alpha_1$. The first bracket is positive $\left(\Delta V^2+\beta^2-\alpha\beta^2-2\Delta V\beta\right)>0$ for $\alpha<\alpha_c$ defined by (26) which is the condition that both $\theta_b>\theta_{\min}$ and $\theta_a>\theta_{\min}$. Hence we only need to sign

$$\begin{aligned}&\left(\Delta V^2+\beta^2\left(1-\alpha\right)-2\beta\Delta V\right)\left(c\alpha+\beta\right)+\Delta V\alpha\left(\beta^2-c^2\right)\\ =\;&\left(\left(\Delta V-\beta\right)^2-\beta^2\alpha\right)\left(c\alpha+\beta\right)+\Delta V\alpha\left(\beta^2-c^2\right) &(28)\\ =\;&\left(\Delta V-\beta\right)^2\beta+\alpha\left(c\left(\Delta V-\beta\right)^2+\left(\beta^2-c^2\right)\Delta V-\beta^3\right)-\beta^2 c\alpha^2. &(29)\end{aligned}$$

If we could prove that the sign is negative for $\theta_b<\theta_{\max}$ and $\theta_a<\theta_{\max}$, we would have shown that $\theta_b>\theta_a$. It is clear from (29) that the sign becomes negative for high $\alpha$. From the argument leading to (25) we know that $\theta_b<\theta_{\max}$ requires $\alpha>\alpha_b=\frac{(\Delta V-\beta)(c+2\beta-\Delta V)}{c\beta}>1>\frac{c\beta}{(\Delta V-\beta)(c+2\beta-\Delta V)}=\alpha_a$. But the value of (28) at $\alpha=1$ is given by $-\Delta V\left(c+\beta\right)\left(c+\beta-\Delta V\right)<0$ always. Hence, we can conclude that $\theta_b>\theta_a$. In general, the proof shows that $\theta_a<\theta_b$ if and only if $\alpha_1<\alpha<\alpha_2$. ■

The lemma implies that in this last area ($\alpha_b<\alpha\leq\alpha_c$) $n_b^*$ is the only stable steady state for $\theta<\theta_a$, while $n_a^*$ is the only stable steady state for $\theta>\theta_b$. In the middle region ($\theta_a\leq\theta\leq\theta_b$) the initial $n_0$ determines which state is reached. ■

## B.2 Competitive free-to-air media industry

We now turn to the analysis of a competitive media industry. It is trivial to extend the proof of Proposition 3 to get the generalized thresholds $\overline{n}^h$ and $\underline{n}^h$ given by (19). Now the size of the interval for which specialization on different cultural traits occurs is

$$\overline{n}^h-\underline{n}^h=\frac{\alpha\left(\beta^2-2c\beta+c\Delta V+\theta\Delta V^2-\Delta V\beta+c\theta\Delta V-\theta\Delta V\beta\right)}{\left(c+c\alpha-\alpha\beta+\theta\Delta V\alpha\right)\left(c-\beta+\Delta V+c\alpha\right)}.$$

The term in brackets at the numerator can be rewritten as $(c+\Delta V-\beta)\left(\theta\Delta V-\beta\right)+c(\Delta V-\beta)$ and is positive (Assumption 1). Hence, the sign of the derivative with respect to the advertisement sensitivity $\alpha$ is equal to the sign of the following expression: $c\left(c-\beta+\Delta V-c\alpha^2+\alpha^2\beta-\theta\Delta V\alpha^2\right)$ which is zero for $\alpha=\widehat{\alpha}=\frac{\sqrt{(c-\beta+V\Delta)(c-\beta+V\theta\Delta)}}{c-\beta+V\theta\Delta}$, implying that $\overline{n}^h-\underline{n}^h$ is increasing for $\alpha<\widehat{\alpha}$, decreasing for $\alpha>\widehat{\alpha}$ and largest for $\alpha=\widehat{\alpha}$.

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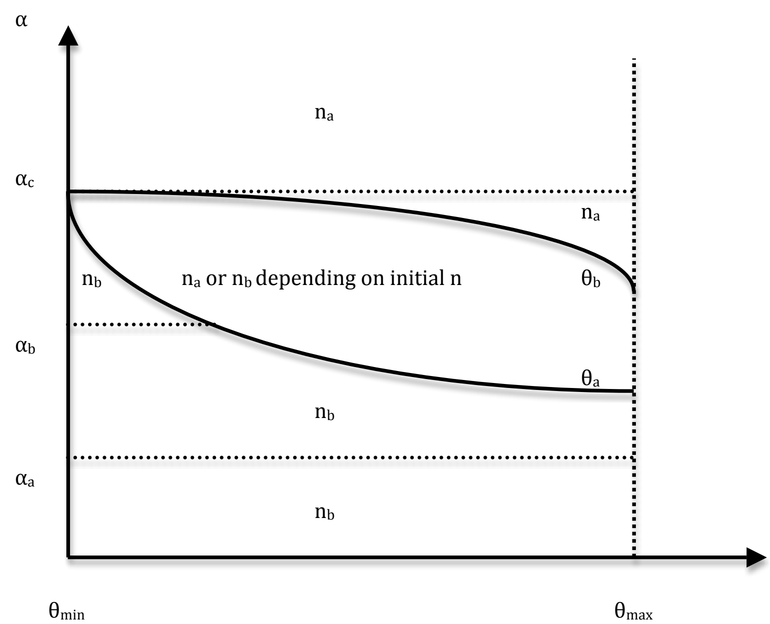


Figure 1: Convergence to steady states with a monopolistic TV industry