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The Economics of Domestic Cultural Content Protection in Broadcasting

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The Economics of Domestic Cultural Content Protection in Broadcasting

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Abstract

Many countries claim foreign cultural goods threaten their national identities and engage in protectionism against foreign cultural goods with various policy interventions. We analyze the economics of domestic cultural content protection in terrestrial broadcasting, the most widespread policy instrument used in broadcasting. Using the love-of-variety approach, we model a representative consumer deriving utility from broadcasting services net of advertising, and allocating scarce time between consuming the various broadcasting services and leisure. Advertising is a nuisance; it costs time yet brings no utility. Broadcasting is a pure public good; broadcasters make profit in the monopolistic competition environment by bundling advertising with valuable cultural content. We impose a discrete domestic content requirement and then investigate the effects of its marginal changes on consumption of domestic broadcasting. Domestic content requirement may reduce (increase) consumption of domestic programs when consumer's demand is highly elastic (inelastic), the degree of preference for foreign content over domestic content is high (low) and opportunity cost of listening time is high (low). The reduction occurs because the consumer reshuffles her consumption bundle towards leisure away from high domestic-content stations thereby reducing the overall aggregate consumption of broadcasting, and subsequently, the overall aggregate consumption of domestic programs.

Keywords: domestic content, service trade, broadcasting, protection

JEL Code: F13, L82

I. Introduction

Despites its numerous benefits, globalization is alleged to be a serious threat to countries' national identities, especially by policymakers and mercantilist interests.[1] A perceived tradeoff between increasing economic integration and diminishing national identity is at the center of trade and cultural debates[2] as evidenced by the current negotiations on trade in services mandated by the General Agreement on Trade in Services (GATS) of the World Trade Organization (WTO). Trade in services has been expanding remarkably, especially in entertainment services, such as music and movie industries, exacerbating this controversy on the loss of cultural identity. Many countries use exemption clauses of GATS in order to cope with "cultural externality" of economic integration.[3] They engage in "cultural protectionism" favoring and implicitly subsidizing domestic producers of cultural goods over their foreign competitors.

Television broadcasting and movie industries have been particularly targeted. Decreasing domestic-programming content in the broadcasting industry and the increasing dominance of (American) blockbusters in the movie industry are example of the perceived threats. Only a handful of countries, including the United States, have refrained from adopting such policy. The European Union (EU) requires broadcasters in member states to reserve a majority proportion of their transmission time for EU work.[4] Within the EU, The most active proponent of content regulations is France where, for example, at least 40% of all songs played on the radio should be in French after the infamous "Loi Toubon".[5] Similarly, Canadian regulation stipulates that each week at least 35% of popular musical selections by commercial stations are Canadian and 65%

1 For example, a "Convention on the Protection of the Diversity of Cultural Contents and Artistic Expressions" was adopted at the 33rd UNESCO general convention in October 2005.
2 See Cowen (2002) and Bernier (2003-2004) for a review of the cultural issues brought up by globalization.
3 For example, articles XIV(a) of GATS and Annex on Communications to GATS 2(b).
4 Council Directive 89/552/EEC of 3 October 1989 adopted by the European Union, Chapter III, Article 4.1.
5 Minister Toubon was nicknamed Mr. Allgood after he imposed his cultural policy (The Economist (1996)).

of the popular vocal music selections French-language stations broadcast are in French.[6] For television, the Canadian requirement is stricter and requires that 60% of all programming be of a local origin. Even in states that are viewed as culturally conservative with little threat to domestic culture, like South Korea, legislators passed laws limiting foreign content.[7] The regulation takes an extreme form on some of the countries of the former Soviet Union. For example, in Kazakhstan, the Russian language vastly dominates the official Kazakh language, but the government requires that half of all programming to be done in Kazakh.[8]

However, despite the predominance of these regulations, it is unclear that they work as intended, as Acheson and Maule [2002] noted for the Canadian cultural protection initiatives. Two key stylized facts to note is that actual regulations are round-about instruments to increase the absolute consumption of domestic programs by imposing a relative restriction on production (broadcasting), and that broadcasted content is often a public good.

Quantifying cultural loss from trade in cultural goods is a difficult task involving some arbitrary metric of cultural externalities. We aim more realistically to look at the allocative implications of the predominant domestic cultural content policy used by governments to "protect" domestic culture. In the case of terrestrial broadcasting, policymakers typically choose linguistic erosion as an indicator of the cultural loss and regulate the domestic linguistic content of programming. Market failures are often used to motivate domestic cultural protection. The most prevalent alleged failure is abuses of market power by providers of entertainment (Francois and van Ypersele (2002), Farchy (1999), Sapir (1991), and Shao (1995)). The second one is the failure of consumers to endogenize the positive externalities generated by higher domestic cultural content (Cwi (1980), Globerman (1983), Sapir (1991), Richardson (2006), and Shao

6 Canadian Broadcasting Act, R.S.C., 1991, c. 11, Article 10.1.
7 Article 71(1) of the Republic of South Korea's Broadcasting Act.
8 The law of the Republic of Kazakhstan of 23 July 1999, #451-1 "About Means of Mass Information", article 3.2.

(1995)). The first rationale applies primarily to the movie industry where domestic (non US) movie producers are marginalized by vertically integrated Hollywood studios.[9] The second type of failure applies to radio and television broadcasting. The latter is usually non rival and lacks direct pricing. Our analysis addresses this second important case and looks at domestic cultural/linguistic content requirement in terrestrial broadcasting.

Our paper contributes to the literature on the economics of cultural policy in an open economy context hence to the international trade literature. The latter has elucidated the economics of domestic content protection of private goods in various contexts (Grossman (1981), Mussa (1984), Hollander (1987), Vousden (1987), Krishna and Itoh (1988), Richardson (1991), Beghin and Sumner (1992), and others). Our paper fills a near void in this content literature by analyzing the effects of a domestic content requirement (DCR) on public goods. We investigate the allocative effects of domestic cultural protection policies in terrestrial broadcasting industries.[10] The context of expanding trade in entertainment services re-enforces the pertinence of our analysis.

Using the love-of-variety approach, we model a representative consumer deriving utility from consuming broadcasting services net of advertising, and allocating scarce time between consuming the various broadcasting services and leisure. Advertising is a nuisance; it costs time yet brings no utility. Broadcasting is a pure public good; broadcasters make profit in the monopolistic competition environment by bundling advertising with valuable cultural content. Each broadcaster provides a unique mix of domestic and foreign contents. We impose a discrete DCR and then investigate the effects of its marginal changes on consumption of domestic

[9] Francois and van Ypersele (2002) show that restrictions on trade in the movie industry may help resurrect production of valuable cultural genres by both the exporter and importer and may increase welfare under increasing returns to scale technologies and discrete valuations of domestic and foreign movies by consumers.

[10] Richardson (2006) provides a related analysis using a duopoly model with a different treatment of consumer preferences and advertising. The few empirical analyses of the implications of cultural content protection on welfare (e.g., Anderson, Swimmer and Suen (1997)) do not consider the non-rivalness of broadcasting.

broadcasting.

We find that the effectiveness of DCR policies depends crucially on consumer preferences. A DCR may reduce (increase) consumption of domestic programs when consumer's demand is highly elastic (inelastic), the degree of preference for foreign content over domestic content is high (low), and opportunity cost of listening time is high (low). The reduction occurs because the consumer reshuffles her consumption bundle towards leisure away from high domestic-content stations thereby reducing the overall aggregate consumption of broadcasting, and subsequently, the overall aggregate consumption of domestic programs. The implication of this result is that a minimum DCR may be an effective policy is some EU and Latin American countries, French-speaking provinces of Canada, and Australia but likely to fail in countries where language is the main obstacle for consumption of domestic programming. The latter might be some of the Baltic and Central Asian states where consumers strictly prefer foreign music to domestic music.

2. **The Model**

We define consumer preferences over various radio broadcasting genres (e.g., rock, pop, rap, classical music or their combination) so that each genre is covered only by one station.[11] Each genre represents a unique mix of domestic and foreign content. Since the broadcasting industry is characterized by increasing returns to scale technology we assume that broadcasters face only fixed costs and derive revenue by selling air time to advertisers. Advertising is modeled as a nuisance - it brings zero utility but costs scarce time. However, broadcasters bundle advertising

[11] To avoid the problem of non-existence of equilibrium in the Bertrand games we require that each station serves its genre exclusively. This could be achieved two ways. Either, one assumes that the policymaker assigns each genre to each station through licensing of radio and television frequencies with large penalties for violation. Then, firms simultaneously choose their strategies. Or, each station is assumed to face fixed startup costs. Then, firms sequentially choose their strategies, and no firm enters the same market (genre) as stations before it. Therefore, each genre is served by a single station. We innocuously assume the former case.

with real content in fixed proportions, "forcing" the consumer to consume advertising whenever she consumes broadcasting services. This feature of our model allows us to derive the price of consumption of broadcasting in term of time units.[12] For any broadcaster, we define the ratio of its domestic content to total cultural content as β. We use β to characterize genres[13] and assume that $\beta \sim U[0,1]$.

A representative consumer derives utility from consumption of broadcasting and leisure where the utility is quasilinear with respect to leisure. Define the triplet of variables $(q_d(\beta), q_f(\beta), l)$ as the consumption of domestic programs of genre β, foreign programs of genre β and leisure, respectively. Then, the utility function takes the following form:

$$U \equiv \frac{1}{\lambda}\left(\int_0^1 \left(\frac{\gamma(\beta) q_d(\beta)^{\beta} q_f(\beta)^{1-\beta}}{\beta^{\beta}(1-\beta)^{1-\beta}}\right)^{\frac{\sigma-1}{\sigma}} d\beta\right)^{\frac{\sigma}{\sigma-1}\lambda} + l, \qquad (1)$$

where $\sigma > 1$ is the elasticity of substitution between genres and λ is the concavity parameter that regulates the aggregate expenditure on consumption of broadcasting. Function $\gamma(\beta)$ is the weight of each genre. We assume that preferences over foreign and domestic content for each genre follow Cobb-Douglas specification. We further assume that $0 < \lambda \leq \frac{\sigma-1}{\sigma}$, which guarantees that this utility function satisfies all the regularity conditions (increasing utility, and negative semi-definite Hessian matrix of the second-order derivatives of the utility function with respect to choice variables). We also impose negative off-diagonal elements of the Hessian

[12] The original formulation of broadcasting industries in continuous setups is found in Berry and Waldfogel (1999) and Anderson and Coate (2003). In the latter, private companies derive revenues from pure public goods despite absence of direct pricing of the good.

[13] For the case of radio broadcasting, one may assume that there exist two types of music,- popular music (high in foreign content) and folklore (low in foreign content). Then, the ratio of folklore music to the sum of folklore and popular music defines a genre. A positive monotonic mapping between proportion of folklore in the total music content and proportion of domestic content in the total cultural content leads to β as a genre parameter.

matrix that guarantee gross substitutability of the genres.[14]

A key feature of the above utility function is that a representative consumer derives utility from consumption of only foreign and domestic content. However, because stations bundle advertising with broadcasting the former costs time and advertising is a nuisance. This specification allows us to "price" broadcasting and generate revenues for broadcasters.

The consumer maximizes her utility function subject to the constraint that the total time spent on consumption of broadcasting and leisure does not exceed her time endowment, which we normalized to unity. Denote $b(\beta)$ as the consumption of broadcasting that consists of domestic content, foreign content, and advertising, and $\left(d(\beta), f(\beta), a(\beta)\right)$ as their respective shares in total volume of broadcasting for genre β. Further, define consumption of advertising of genre β as $q_a(\beta)$. Then, we have the following identities: $q_d(\beta)+q_f(\beta)+q_a(\beta)\equiv b(\beta)$, and $d(\beta)+f(\beta)+a(\beta)\equiv 1$. Hence, the utility function can be restated as follows:

$$U=\frac{1}{\lambda}\left(\int_0^1\left[\frac{b(\beta)\gamma(\beta)d^{\beta}(\beta)f(\beta)^{1-\beta}}{\beta^{\beta}(1-\beta)^{1-\beta}}\right]^{\frac{\sigma-1}{\sigma}}d\beta\right)^{\frac{\sigma}{\sigma-1}\lambda}+l. \qquad (2)$$

Inspection of utility function given by equation (2) reveals that each broadcasting demand is weighted by genre-specific function $\frac{\gamma(\beta)d^{\beta}(\beta)f(\beta)^{1-\beta}}{\beta^{\beta}(1-\beta)^{1-\beta}}$. It is convenient to define its inverse as $z(\beta)\equiv\left(\frac{\gamma(\beta)d^{\beta}(\beta)f(\beta)^{1-\beta}}{\beta^{\beta}(1-\beta)^{1-\beta}}\right)^{-1}$ to which hereunder we refer as virtual price. The higher the proportions of both foreign and domestic content are (or lower proportion of the advertising) and the higher the weight of a genre in the utility function compared to other genres is, the lower is

[14] This utility specification can be generalized to heterogeneous consumers as long as heterogeneity comes from different valuation of subutility from broadcasting to allow tractable aggregation of individual demands.

the virtual price faced by consumer.

Substituting $z(\beta)$ into (2) leads to the utility maximization problem expressed as:

$$\max_{b} \frac{1}{\lambda}\left(\int_0^1\left[\frac{b(\beta)}{z(\beta)}\right]^{\frac{\sigma-1}{\sigma}} d\beta\right)^{\frac{\sigma}{\sigma-1}\lambda} + l \; s.t. \int_0^1 b(\beta)d\beta + l = 1. \tag{3}$$

For brevity define $\phi \equiv 1-\left(\frac{\lambda}{1-\lambda}\right)\frac{1}{\sigma-1}$. Restrictions on the concavity parameter λ guarantee that $0 \le \phi \le 1$. Solving the utility maximization problem yields broadcasting demands

$$b(\beta) = z(\beta)^{1-\sigma} V^{-\phi}, \tag{4}$$

where $V \equiv \int_0^1 z(\beta)^{1-\sigma} d\beta$ is the aggregate virtual price index. Even though the aggregate price index is independent of each individual virtual price, it does depend on the aggregate level of prices. This implies that marginal shocks in prices have no marginal effect on the aggregate price level, however, discrete fluctuations in prices lead to changes in the aggregate price index.

We assume that all stations (or firms) have identical cost structure, namely, given the public nature of broadcasting, each firm face the same fixed cost. Without loss of generality we normalize fixed costs at zero. Combined with the assumption that each station has exclusive rights to its genre, the market has the attributes of monopolistic competition. Stations derive their revenues by bundling together "real" content and advertising and consumers cannot unbundle them.[15] The price of advertising, $p(.)$, is assumed to be linearly increasing in the firm's share of the broadcasting market, or $p(b) \equiv \frac{b(\beta)}{B}$, where $B \equiv \int_0^1 b(\beta)d\beta$ is the aggregate demand for broadcasting. The broadcaster's problem is

[15] We abstract from cases where consumers can suppress advertising, such as when using recording devices like TiVo.

$$\max_{d(\beta),f(\beta)} \pi(\beta) \equiv p\big(B(\beta)\big)a(\beta)*1, s.t.\ \pi(\beta) \geq 0, \tag{5}$$

where $a(\beta)*1 = \big(1-d(\beta)-f(\beta)\big)*1$ is the total amount of advertising during the time period, in minutes. Broadcasters behave strategically and the industry reaches best-reply equilibrium. For simplicity, we assume that each station broadcast all the time. This assumption is motivated by zero variable cost and because broadcasters my not know exactly when the consumer will tune in.

Then, the first-order conditions for an interior solution for profit maximization for station serving genre β are:

$$\frac{\partial \pi(\beta)}{\partial d(\beta)} \propto (\sigma-1)\beta\left(\frac{1-d(\beta)-f(\beta)}{d(\beta)}\right)-1=0, \text{ and} \tag{6}$$

$$\frac{\partial \pi(\beta)}{\partial f(\beta)} \propto (\sigma-1)(1-\beta)\left(\frac{1-d(\beta)-f(\beta)}{f(\beta)}\right)-1=0. \tag{7}$$

Solving equations (6) and (7) yields optimum $d^*(\beta)=\beta\left(\frac{\sigma-1}{\sigma}\right)$ and $f^*(\beta)=(1-\beta)\left(\frac{\sigma-1}{\sigma}\right)$, where the asterisk denotes the unconstrained equilibrium levels. Thus, the virtual prices are given by $z^*(\beta)=\left(\gamma(\beta)\left(\frac{\sigma-1}{\sigma}\right)\right)^{-1}$.[16] Parameters β and $(1-\beta)$ are respectively the most-preferred by consumer proportions of domestic and foreign programs in the total provided broadcasting bundle. However, broadcasting is provided only when it brings profits to a station, in our case, by means of advertising. Therefore, provided content is always worse than the most-desirable content. As elasticity of substitution between genres approaches infinity, the disparity between the two vanishes.

[16] When the consumer values genres equally, the model yields equal virtual prices, and all genres yield the same utility. It is why we have normalized the weight parameter $\gamma(\beta)$ by $\beta^{\beta}(1-\beta)^{1-\beta}$.

The second-order conditions of profit maximization require the Hessian of the second-order derivatives of the profit function with respect to the choice variables to be negative semi-definite. Since $\frac{\partial \pi^2(\beta)}{\partial d(\beta)^2} = -(\sigma-1)\beta\frac{1-f(\beta)}{d(\beta)^2} \le 0$, $\frac{\partial \pi^2(\beta)}{\partial f(\beta)^2} = -(\sigma-1)(1-\beta)\frac{1-d(\beta)}{f(\beta)^2} \le 0$, and $\frac{\partial \pi^2(\beta)}{\partial d(\beta)^2}\frac{\partial \pi^2(\beta)}{\partial f(\beta)^2} - \left(\frac{\partial \pi^2(\beta)}{\partial d(\beta)\partial f(\beta)}\right) = \frac{(\sigma-1)^2\beta(1-\beta)(1-d(\beta)-f(\beta))}{d(\beta)f(\beta)} \ge 0$, these second-order conditions hold.

By aggregating over all broadcasting firms, the aggregate market consumption of domestic programming in unconstrained equilibrium is given by

$$D^* = \left(\int_0^1 \beta\left(\frac{\sigma-1}{\sigma}\right)\left(\gamma(\beta)\left(\frac{\sigma-1}{\sigma}\right)\right)^{\sigma-1} d\beta\right) * \left(\int_0^1 \left(\gamma(\beta)\left(\frac{\sigma-1}{\sigma}\right)\right)^{\sigma-1} d\beta\right)^{-\phi}. \quad (8)$$

3. Effects of the Domestic Content Requirement

As broadcasting is a public good that lacks direct pricing, the policymaker attempts to reach his cultural consumption objective by imposing the cultural policy on broadcasters. We assume the policymaker forces producers to incorporate higher shares of domestic programming in their broadcastings by imposing a minimum level on the share of domestic content in total broadcasting time. Presumably, the consumer will increase her consumption of domestic broadcasted culture as well. We now assess the validity of this conjecture that imposing a cultural DCR on broadcasters leads to higher consumption of domestic programming. To account for feedback effects between stations to changes in DCR we first impose a discrete DCR and then derive the effects of marginal changes in DCR around its initial level on the aggregate consumption of domestic programming as in Mussa (1984). The most common form of DCR in broadcasting is to require that domestic programming constitutes a minimum fraction of

aggregate broadcasting. Formally, defining a policy instrument as δ we have DCR requiring $\delta \geq d(\beta)$.

When the policy maker imposes the DCR policy, the constraint binds for all stations with genres β such that $d^*(\beta) \leq \delta$, i.e. for all $\beta \leq \delta\left(\frac{\sigma}{\sigma-1}\right)$. Therefore, each of these stations,[17] instead of solving equations (6) and (7), now solves:

$$d(\beta) = \delta, \tag{9}$$

and

$$(\sigma-1)(1-\beta)\left(\frac{1-d(\beta)-f(\beta)}{f(\beta)}\right)-1=0. \tag{10}$$

The solution is $\hat{d}(\beta)=\delta$ and $\hat{f}(\beta)=\frac{(\sigma-1)(1-\beta)(1-\delta)}{1+(\sigma-1)(1-\beta)}$. We denote constrained solutions and their functions with over-hats. Combining solutions yields constrained virtual price $\hat{z}(\beta)=\left(\left(\frac{(\sigma-1)(1-\beta)}{1+(\sigma-1)(1-\beta)}\right)^{1-\beta}\gamma(\beta)\left(\frac{\delta}{\beta}\right)^{\beta}\left(\frac{1-\delta}{1-\beta}\right)^{1-\beta}\right)^{-1}$. We see that $\frac{\partial\hat{z}(\beta)/\partial\delta}{\hat{z}(\beta)}=\frac{\delta-\beta}{\delta(1-\delta)}$. The proportional change in the virtual price to changes in the DCR has an ambiguous sign because only the stations serving genres $\beta \leq \delta$ experience drop in prices. Other constrained stations with their genre located on the proportion-of-the-domestic-content scale such that $\delta < \beta \leq \delta\left(\frac{\sigma}{\sigma-1}\right)$ actually increase their prices when the DCR policy is imposed. This happens because for firms that find themselves strictly constrained ($\beta \leq \delta$), the attractiveness of the genre decreases ("content effect"). The fall in the advertising level[18] (and lower virtual price) is not sufficient to offset the fall in the attractiveness caused by the provision of the sub-optimal content. On the

[17] We assume that the penalty for non-compliance with the DCR is prohibitive..

[18] $\hat{a}=1-\delta-(1-\delta)\left(u(1-\beta)/\left(1+u(1-\beta)\right)\right) \Rightarrow \partial\hat{a}/\partial\delta \leq 0$.

other hand, stations that operate genres $\delta < \beta \le \delta\left(\frac{\sigma}{\sigma-1}\right)$ experience a net drop in virtual prices because the lower advertising level ("advertising effect") dominates the effect caused by provision of sub-optimal content. As the elasticity of substitution between genres goes up, the range of stations that raise prices in response to the policy shrinks. This is attributed to the fact that, *ceteris paribus*, the consumer values the composition of desirable content higher than the nuisance caused by advertising. The constraint becomes binding for all stations once δ increases passed $\left(\frac{\sigma}{\sigma-1}\right)$. We do not, however, consider such cases in our analysis due to lack of their appeal in the real world.

The interaction of the "content effect" and "advertising effect" introduces ambiguity to the effect of DCR on the consumption of domestic content. Since the focus of our paper is the distortion of the consumption of domestic programs brought about by the DCR, we assume, for analytical tractability, that the representative consumer always values low-domestic-content genres higher than high-domestic-content ones so that virtual prices of the low-domestic-content stations remain higher than high-domestic-content stations even after a DCR is imposed. It is tantamount to $\gamma(\beta)$ falling sufficiently fast in β, or mathematically, $\frac{\gamma'(\beta)}{\gamma(\beta)} - \frac{1}{1+(\sigma-1)(1-\beta)} - \log\left[\frac{(\sigma-1)\beta(1-\delta)}{\delta(1+(\sigma-1)(1-\beta))}\right] \le 0$.[19] By imposing this restriction we mitigate the "advertising effect" in favor of the "content effect". We concentrate on sufficient conditions therefore further restrict our attention on cases where $\sigma \ge 2$. In the numerical analysis section, we relax this assumption and show that the results are robust under milder conditions.

[19] The derivative of $\hat{z}(\beta)$ with respect to β is proportional to the given expression.

We define an aggregate price index for all stations as $\hat{V}+V^*$ where $\hat{V}\equiv\int_0^{\delta\left(\frac{\sigma-1}{\sigma}\right)}\hat{z}(\beta)^{1-\sigma}d\beta$ and $V^*\equiv\int_{\delta\left(\frac{\sigma-1}{\sigma}\right)}^{1}z^*(\beta)^{1-\sigma}d\beta$. When the DCR constraint is binding, the aggregate demand is given by $\hat{B}+B^*$, where $\hat{B}\equiv\int_0^{\delta\left(\frac{\sigma-1}{\sigma}\right)}\hat{b}(\beta)d\beta$ and $B^*\equiv\int_{\delta\left(\frac{\sigma-1}{\sigma}\right)}^{1}b^*(\beta)d\beta$. Having defined the aggregate broadcasting demand, the aggregate consumption of domestic programming is given by

$$\hat{D}=\int_0^{\delta\left(\frac{\sigma}{\sigma-1}\right)}\hat{d}(\beta)\hat{b}(\beta)d\beta+\int_{\delta\left(\frac{\sigma}{\sigma-1}\right)}^{1}d^*(\beta)b^*(\beta)d\beta. \tag{11}$$

Next, define $\underline{\beta}\equiv\left(\int_0^{\delta\left(\frac{\sigma}{\sigma-1}\right)}\beta\hat{z}(\beta)^{1-\sigma}d\beta\right)\left(\int_0^{\delta\left(\frac{\sigma}{\sigma-1}\right)}\hat{z}(\beta)^{1-\sigma}d\beta\right)^{-1}$ and $\overline{\beta}\equiv\left(\int_{\delta\left(\frac{\sigma}{\sigma-1}\right)}^{1}\beta z^*(\beta)^{1-\sigma}d\beta\right)\left(\int_{\delta\left(\frac{\sigma}{\sigma-1}\right)}^{1}z^*(\beta)^{1-\sigma}d\beta\right)^{-1}$. The former is the expected value of β over interval $\left[0,\delta\left(\frac{\sigma}{\sigma-1}\right)\right]$ and probability density function $\frac{\hat{z}(\beta)^{1-\sigma}}{\hat{V}}$. The assumptions of $\gamma(\beta)$ falling sufficiently fast and $\sigma\geq 2$ were required for $\delta\geq\underline{\beta}$[20] which implies that, on average, representative consumer is made worse off by the policy due to higher average virtual price of constrained stations. Parameter $\overline{\beta}$ is the expected value of β over interval $\left[\delta\left(\frac{\sigma}{\sigma-1}\right),1\right]$ and probability density function $\frac{z^*(\beta)^{1-\sigma}}{V^*}$. Similarly, it represents the weighted-average most-

[20] $\partial\hat{z}(\beta)/\partial\beta\geq 0\Rightarrow\partial\hat{z}(\beta)^{1-\sigma}/\partial\beta\leq 0\Rightarrow\underline{\beta}\leq(1/2)\delta\left(\sigma/(\sigma-1)\right)\leq\delta\ \forall\sigma\geq 2$

preferred proportion of domestic content over unconstrained stations. Further, define $\mu \equiv \frac{\hat{B}}{\hat{B}+B^{*}}$ as the share of the constrained aggregate demand in the total aggregate demand for broadcasting services. Then, the marginal effect of tightening the DCR on aggregate consumption of domestic broadcasting is given by

$$\frac{\partial \hat{D}}{\partial \delta} = \hat{\mathrm{B}}\left[1 - \frac{(1-\phi\mu)(\sigma-1)\left(\delta-\underline{\beta}\right)}{1-\delta} + \frac{\phi\overline{\beta}(1-\mu)(\sigma-1)\left(\delta-\underline{\beta}\right)}{\delta(1-\delta)}\right]. \qquad (12)$$

We are now able to state our analytical results:

Proposition 1

Under the assumptions of Sections 2 and 3, the effect of marginal changes in the DCR around an initially binding level on consumption of domestic programs consists of three effects: (i) a direct increase in the share of domestic programs in the total volume of broadcasting, $\hat{B}$*; (ii) a reduction in the consumption of broadcasting of constrained stations,* $-\frac{\hat{B}(1-\phi\mu)(\sigma-1)\left(\delta-\underline{\beta}\right)}{1-\delta}$ *(negative if* $\sigma \geq 2$*); and (iii) an increase in the aggregate consumption of broadcasting of unconstrained stations,* $\frac{\hat{B}\phi\overline{\beta}(1-\mu)(\sigma-1)\left(\delta-\underline{\beta}\right)}{\delta(1-\delta)}$ *(positive for* $\sigma \geq 2$*). The sum of these effects has an ambiguous sign.*

Proposition 2

Under the assumptions of Sections 2 and 3, there exists a non empty set of parameters ((σ,λ) *and functional forms of genres distribution function* $\gamma(\beta)$ *leading to positive and negative effects of the DCR policy on aggregate consumption of domestic programs. There exist parameter values and functional forms of* $\gamma(\beta)$ *under which consumption of domestic programming can be maximized with respect to the DCR, and for which levels of constrained*

consumption of domestic programs is lower than the unregulated consumption (overshooting).

Proof of propositions. The fact that the direct effect is always positive is trivial. The signs of indirect effects depend on the sign of $\delta-\beta$ through our assumption on the curvature of the weight function $\gamma(\beta)$ and $\sigma \geq 2$. Both guarantee that $\delta-\beta \geq 0$. By inspecting equation (12) we observe that for just binding policy, $\delta=0$, marginal changes in DCR have no effect on the consumption of the domestic programming because $\hat{B}=0$ by construction and $\lim_{\delta \to 0} \underline{\beta}/\delta=1$. Ultramarginal increases in δ increase $\hat{B}$ making the direct effect strictly positive. At small values of DCR $\mu \approx 0$ and $\delta-\underline{\beta} \approx 0$ so that indirect effects, $\frac{(1-\phi\mu)(\sigma-1)(\delta-\underline{\beta})}{1-\delta} \approx 0$ and $\frac{\phi\overline{\beta}(1-\mu)(\sigma-1)(\delta-\underline{\beta})}{\delta(1-\delta)} \approx 0$ (again, we've used $\lim_{\delta \to 0} \underline{\beta}/\delta=1$). Hence, for small values of δ, $\frac{\partial \hat{D}}{\partial \delta}>0$. Further, $\hat{D}$ evaluated at a DCR at which it is binding for all stations, $\delta=\left(\frac{\sigma-1}{\sigma}\right)$, yields $\hat{D}=\left(\frac{\sigma-1}{\sigma}\right)^{\frac{1}{1-\lambda}}\left(\int_0^1\left(\frac{\gamma(\beta)}{\beta^{\beta}\left(\sigma-\beta(\sigma-1)\right)^{1-\beta}}\right)^{\sigma-1} d\beta\right)^{\frac{\lambda}{(1-\lambda)(\sigma-1)}}$ while $D^*=\left(\frac{\sigma-1}{\sigma}\right)^{\frac{1}{1-\lambda}}\left(\int_0^1 \beta\gamma(\beta)^{\sigma-1} d\beta\right)^{\frac{\lambda}{(1-\lambda)(\sigma-1)}}$. To show that there exist parameter values of (σ,λ) and functional forms of $\gamma(\beta)$ such that $\hat{D} \leq D^*$ we set $\gamma(\beta)=1/2$ and $\sigma=6$. These value yield $\hat{D}-D^*<0$. Therefore, given that the set of δ is compact and that function $\hat{D}$ is continuous in δ, there exist at least one maximum and at least one point where constrained and unconstrained consumptions of domestic programs are equal. Given that the set of δ is compact and convex, there exist a range of values of δ where (i) the discrete DCR policy increase (decreases) consumption of domestic programming and/or (ii) DCR policy yields consumption of domestic

programs higher (lower) than in the unconstrained economy■

The effect of DCR on aggregate consumption of domestic programming consists of three effects. The first effect, $\hat{B}$, is a direct effect, the second effect, $-\frac{\hat{B}(1-\phi\mu)(\sigma-1)(\delta-\underline{\beta})}{1-\delta}$, is the indirect effect of change in consumption of domestic programs of constrained stations, and the third effect, $\frac{\hat{B}\phi\bar{\beta}(1-\mu)(\sigma-1)(\delta-\underline{\beta})}{\delta(1-\delta)}$, is the indirect effect of change in consumption of domestic programs of unconstrained stations. Assume we have the set of parameters that guarantee $\underline{\beta} \le \delta$ and $\hat{D}$ reaches a unique global maximum. When the initial δ is small, the positive change in consumption of unconstrained stations is the dominating effect because this is where most of the consumption of broadcasting is concentrated prior to the policy change. However, as policy δ increases further, its rate of increase slows down and at the same time the negative effect of change in consumption of constrained stations becomes noticeable. Share parameter μ is large (closer to 1) for strictly binding levels of DCR by the assumption that the consumer favors low-domestic-content stations to high-domestic-content stations. Therefore, an important requirement for the second effect having an impact on the overall sign of the equation (12) is ϕ being small. The latter is achieved at either small values of elasticity of substitution between genres or/and large value of the concavity parameter. In a sense, in societies with poor substitution among various genres, consumers do not change they consumption habits despite unfavorable virtual prices brought about by DCR policy. High value of the concavity parameter implies that the policy pushes the consumer to switch away from broadcasting altogether rather than switch to stations that offer different mix of foreign and domestic content. As the policymaker sets the DCR subsequently at higher larger levels, at some point, the indirect effect of decreased

consumption of constrained stations overcomes both the positive direct effect and positive indirect effect of change in consumption of unconstrained stations. This is the point where consumption of domestic programs reaches its maximum. Denote this point as $\delta_0 \equiv \left\{\delta \middle| \left(\partial \hat{D} / \partial \delta\right) = 0\right\}$. Any increase in δ past this point lowers the consumption of domestic programs below its maximum. At such level of DCR, the share of constrained demand in total demand for broadcasting is substantial which makes the impact of the indirect, third effect pale in comparison with the indirect, second effect. If the policymaker chooses a DCR larger than δ_0 (overshooting), the indirect effect of decrease in consumption of constrained stations may become so severe that the amount of consumption of domestic programs attained under such policy may be no larger than the amount where policy is not in place. We denote such point as $\delta_1 \equiv \left\{\delta \middle| \hat{D} = D^*\right\}$. Any DCR policy setting δ beyond δ_1 is then totally counterproductive in inducing an increase in domestic-program consumption above its unconstrained level *D**.

4. Numerical Analysis

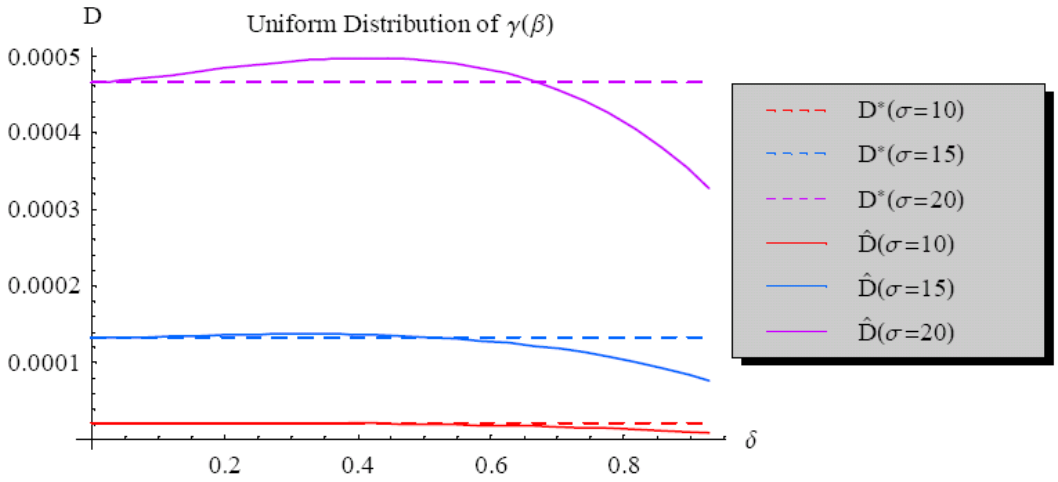
We use numerical analysis to overcome the analytical intractability of the two second-order effects in equation (12), to investigate the effect of different parameters on the effectiveness of the DCR policy. We consider three hallmark cases of the distribution of preferences over stations (parameter ($\gamma(\beta)$): (1) the case where individual preferences over genres are uniformly distributed, (2) the case where individuals preferences are skewed towards stations with low domestic content (say popular music); and (3) the case where individual preferences over genres are concentrated in the middle, which we denote as "balanced." Case (1) is indicative of countries where there is no language barrier to consumption of domestic program and people are more "liberal" in terms of accepting foreign cultures and traditions. That, for example, could be

the case of Australia, some parts of Canada and Latin American countries. On the other hand, case (2) is assumed to characterize countries with strong language barrier while case (3) can be attributed to countries where people prefer balanced programming, in terms of foreign and domestic contents. Countries that fit the second case are former Soviet republics while EU member-countries may fit the third case. We choose distribution of function $\gamma(\beta)$ such that it integrates to $1/2$ over β over the unit interval.

4.1. Uniform distribution of preferences over genres

We set $\gamma(\beta)=1/2$ for all β and assume that $\lambda=0.9$. Then, aggregate consumption of domestic programming as a function of DCR δ is depicted in Graph 1.1.

Graph 1.1: Aggregate consumption of domestic programming for different values of the elasticity parameter

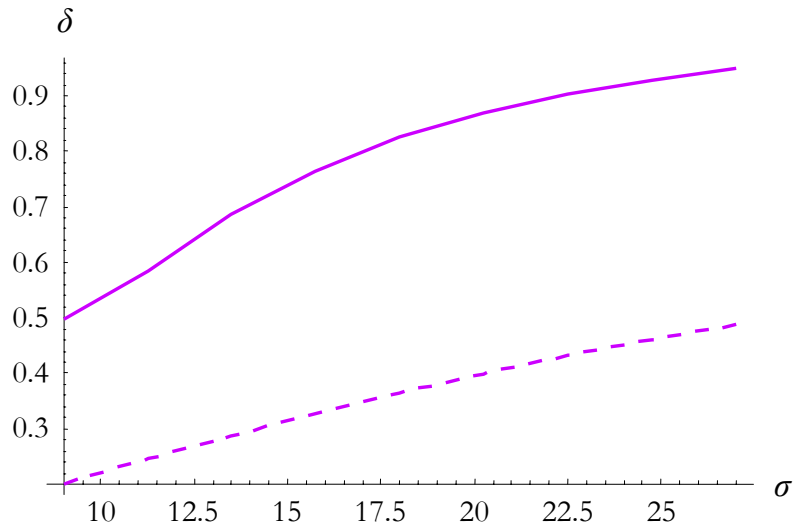


As shown in Graph 1.1, under uniformly-distributed preferences, the higher is the elasticity of substitution between genres, the more effective the DCR policy is to increase the domestic-program consumption beyond its unconstrained level (dashes). Constrained stations become less competitive by offering a less attractive mix of foreign and domestic content. A higher elasticity of substitution eases switching towards stations that are not restricted by the policy and which offer a more attractive content mix (better "priced"). Since the latter stations

also provide relatively higher domestic content ratio, the overall consumption of domestic programs increases. Consumption only starts to fall at very large policy levels of DCR when the lion's share of consumption is directed towards leisure.

By solving for two critical points of interest δ_0 and δ_1 as a function of the elasticity of substitution between stations we obtain Graph 1.2.

Graph 1.2: Critical points δ_0 and δ_1 as a function of σ

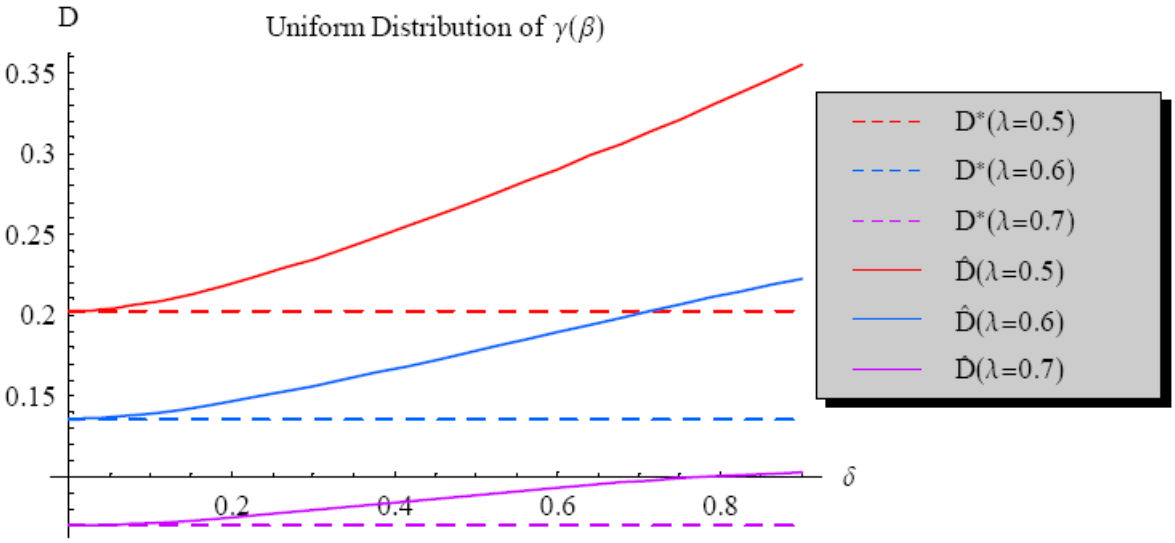


Note: δ_0 and δ_1 are indicated by the dashed and continuous line respectively.

Since critical points (δ_0, δ_1) are unique, they provide the following intuition. If the goal of the policymaker is to achieve the maximum consumption of domestic shows/music then the range of the size of the DCR policy that leads to overshooting is wider the larger is the elasticity of substitution between genres. Therefore, it may pay to reduce an initially large DCR policy as in "cultural" Laffer curve. Graphs 1.1 and 1.2 together lead to further policy implications. If the goal of a policymaker is to increase consumption of domestic programs over unconstrained level then the DCR policy is more likely to succeed in societies where stations are close substitutes. Even if the policy overshoots it still may increase consumption above its unconstrained level as the elasticity of substitution gets larger.

Next, we assume $\sigma = 10$ and let λ, the concavity parameter between aggregate expenditure and leisure, vary. Graph 1.3 shows the consumption of domestic programming as a function of the DCR policy.

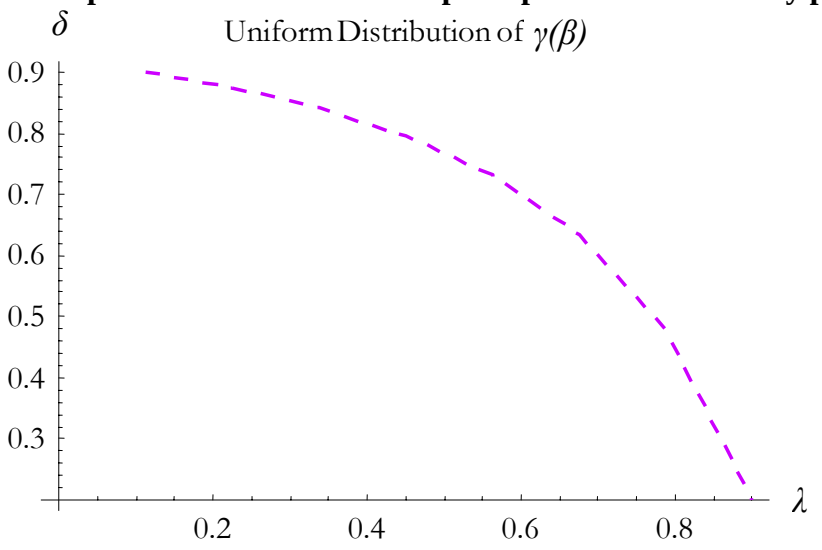
Graph 1.3: Aggregate consumption of domestic programming and DCR for different values of the concavity parameter



The concavity parameter regulates the ease of substitution between consumption of broadcasting and consumption of leisure. The larger is the concavity parameter the more eager is the consumer to switch between broadcasting and leisure. When concavity parameter approaches one then broadcasting and leisure become perfect substitutes. Therefore, one may deem the concavity parameter as a proxy for the opportunity cost of time consuming broadcasting. Graph 1.3 shows that for small concavity parameter values, the consumer reshuffles her portfolio away from broadcasting slower than the proportion of domestic programming increases. Therefore, consumption of domestic programs is monotonically increasing in the DCR conditioned on small values of λ. At higher concavity parameter values, the consumer consumes less of (domestic) broadcasting and as the DCR increases, it eventually overshoots as the consumer switches away from radio listening to leisure and the effectiveness of the DCR falls. Graph 1.4 shows how

critical value δ_0 evolves with changes in concavity parameter λ. When the concavity parameter increases, the DCR is more likely to overshoot the optimal level of the DCR because δ_0 falls. The intuition remains the same. As λ increases, leisure becomes a better substitute for broadcasting and the consumer is less reluctant to tolerate suboptimal mix of domestic and foreign content. Graphically, the higher is the concavity parameter the faster the constrained consumption of domestic programs curve bends down. Therefore, both, the critical point where the constrained consumption of domestic programs is maximized, δ_0, and the point where DCR overshoots the unconstrained level, δ_1 (if such point exists), are reached sooner.

Graph 1.4: Critical consumption points and concavity parameter



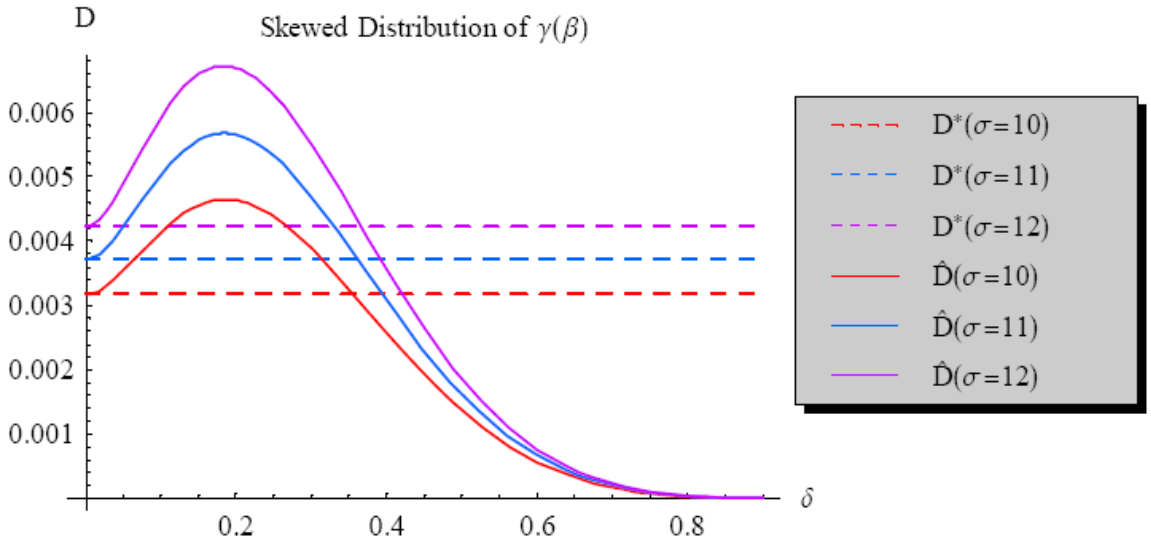
Note: δ_0 is indicated by the dashed. Critical values of δ_1 do not exist.

4.2. Distribution of preferences skewed towards low-domestic-content genres.

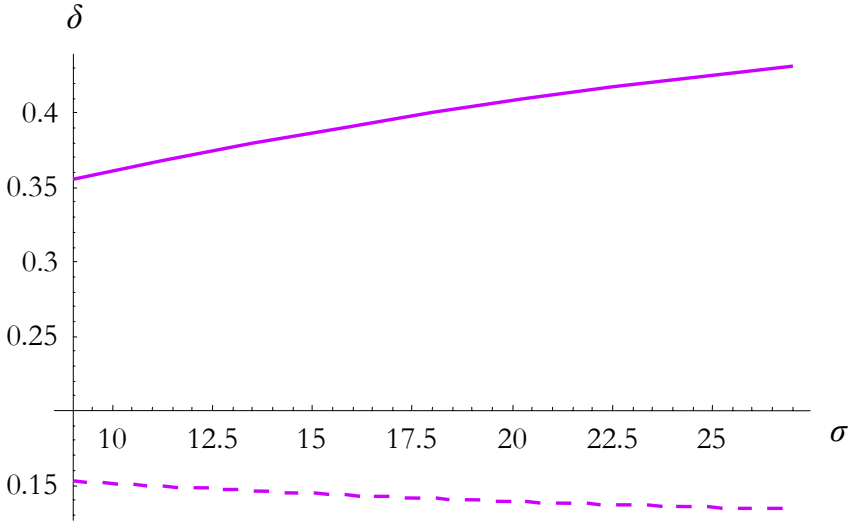
In this second case the distribution of genres takes a very simple form $\gamma(\beta) = 1 - \beta$. We further assume that $\lambda = 0.9$. Graph 2.1 shows the aggregate consumption of domestic program as a function of the DCR for different values of the elasticity of substitution between genres. In contrast to the case of uniform distribution of preferences, the difference between constrained

and unconstrained consumptions of domestic content is more pronounced. Furthermore, the two critical points (δ_0, δ_1) are reached at smaller values of DCR policies under the skewed distribution of genres in comparison to the case with uniform distribution of genres. The range of policy for which overshooting still leads to an increase in consumption relative to the unconstrained level gets larger as the elasticity of substitution increases as shown in Graph 2.2.

Graph 2.1: Aggregate consumption of domestic programming for different values of the elasticity parameter



Graph 2.2: Critical consumption points under skewed distribution

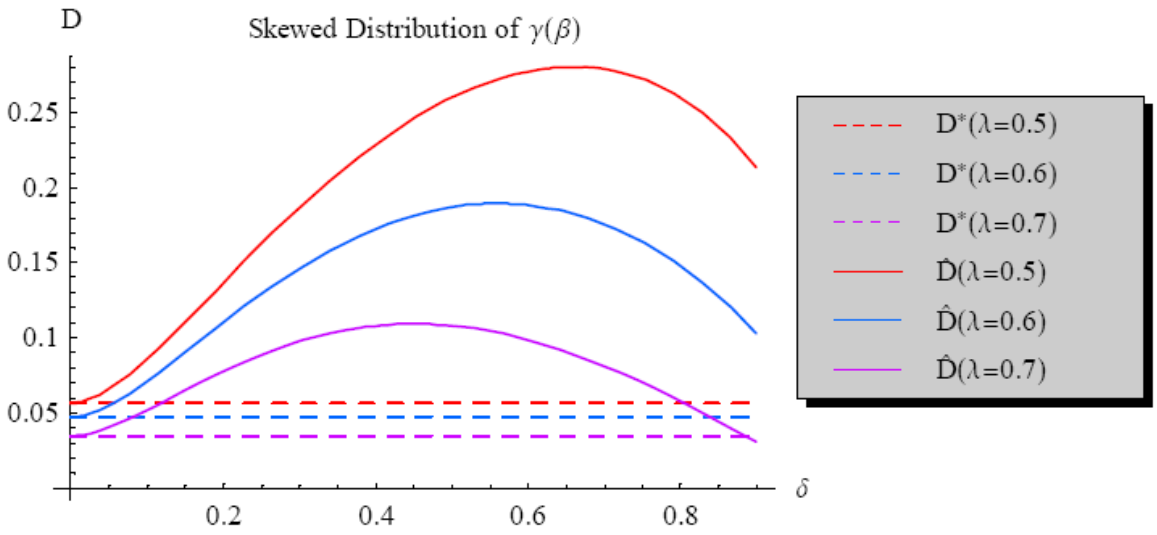


Note: δ_0 and δ_1 are indicated by the dashed and continuous line respectively.

In contrast to the case of uniform distribution of preferences over genres, when the consumer prefers low-domestic-content genres to high-domestic-content stations, the larger is the elasticity of substitution the smaller is the optimum δ. The intuition for this result is the following. With skewed distribution at hand the consumer finds low-domestic-content stations more attractive than high-domestic-content stations. Skewed distribution of genres yields different prices, therefore, the higher elasticity of substitution between genres leads to higher desirability of leisure for any given concavity parameter. Therefore, when DCR is imposed, the relative lack of desirability of high-domestic-content stations is lessened, yet people are more prone to switch to leisure, and the larger is the elasticity of substitution between genres the larger is the keenness to do that. Hence, the indirect effect of falling consumption of broadcasting is large and overcomes the direct effect of increasing the share of domestic programs. Therefore, consumption of domestic programming falls.

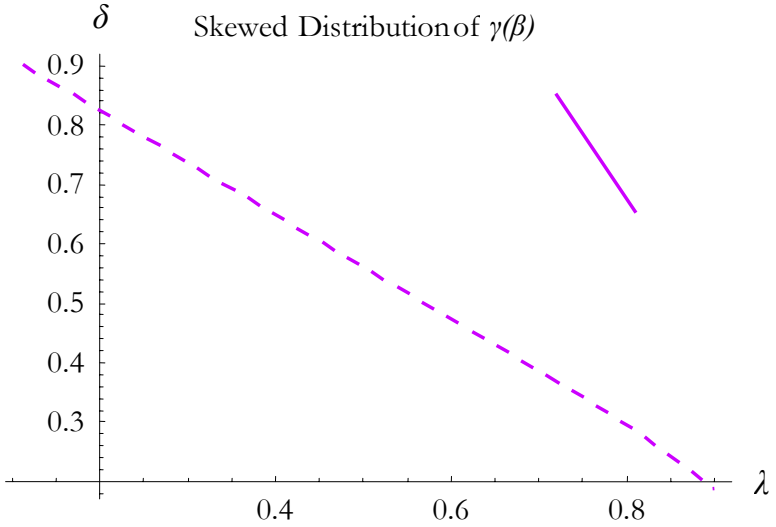
To plot consumption of domestic programs as a function of the concavity parameter we fix $\sigma = 10$. This is shown in Graph 2.3.

Graph 2.3: Aggregate consumption of domestic programming as a function of DCR for different values of the concavity parameter



Again, from Graph 2.3 we observe that the higher is the concavity parameter the more concave the constrained consumption of domestic programming becomes. As opposed to the uniform case, the constrained consumption of domestic programming folds back down and for large value of the concavity parameter it falls below the unconstrained level. Further, by inspecting Graph 2.3 we notice that the larger is the concavity parameter the smaller are the critical points (δ_0, δ_1), if they exist. This information is summarized in the Graph 2.4.

Graph 2.4: Critical consumption points and concavity parameter



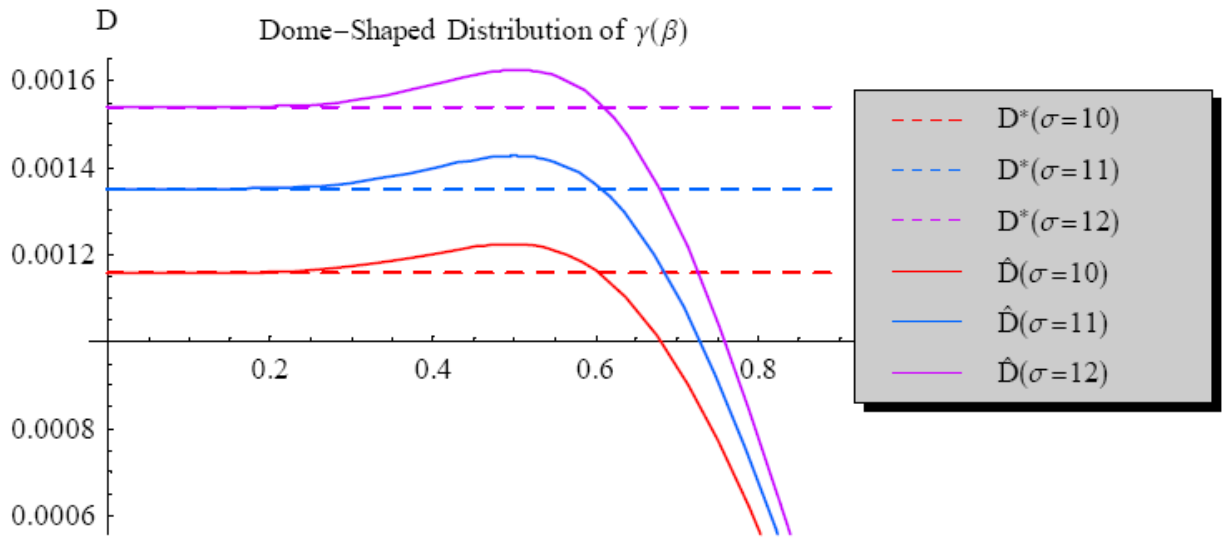
Note: δ_0 and δ_1 are indicated by the dashed and continuous line respectively.

4.3.Dome-shaped distribution of preferences over genres

Last, we assume that distribution of genres is given by $\gamma(\beta) = (4/\pi)\sqrt{\beta}\sqrt{1-\beta}$. We further assume that $\lambda = 0.9$. Aggregate consumption of domestic programs is shown in Graph 3.1. **A**t small values of DCR the policy has essentially no effect on the consumption of domestic programming. Once the level of DCR approaches the "balanced" genres preferred by the consumer, constrained consumption starts to pick up. This, however, does not last for long since further increases in DCR lead to a sharp drop in consumption of domestic programs as the policy seriously constrains stations with the formerly most attractive content. The policy drives the

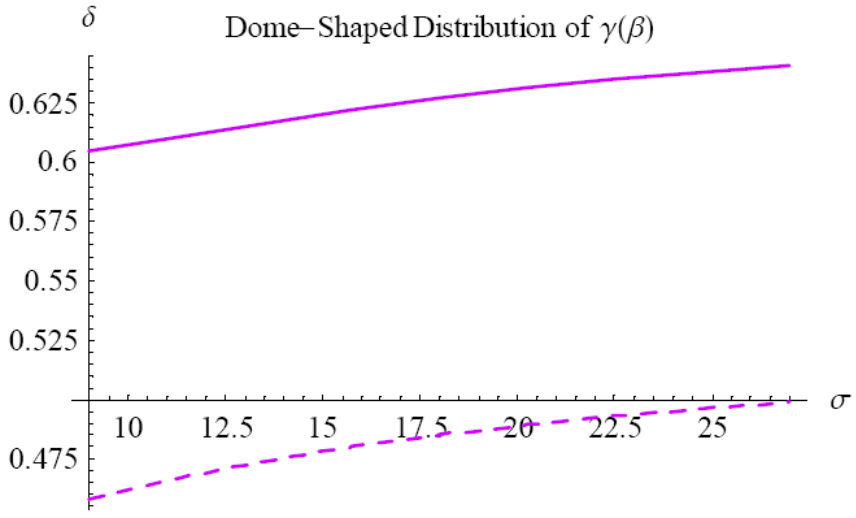
wedge between the most preferred and available bundle of programming wider. Given that consumption of genres on the extreme is not desirable the consumer prefers to switch away from broadcasting to leisure.

Graph 3.1: Aggregate consumption of domestic programming for different values of the elasticity parameter



Plotting critical points (δ_0, δ_1) as a function of the elasticity of substitution between genres yields Graph 3.2.

Graph 3.2: Critical points (δ_0, δ_1) as a function of σ



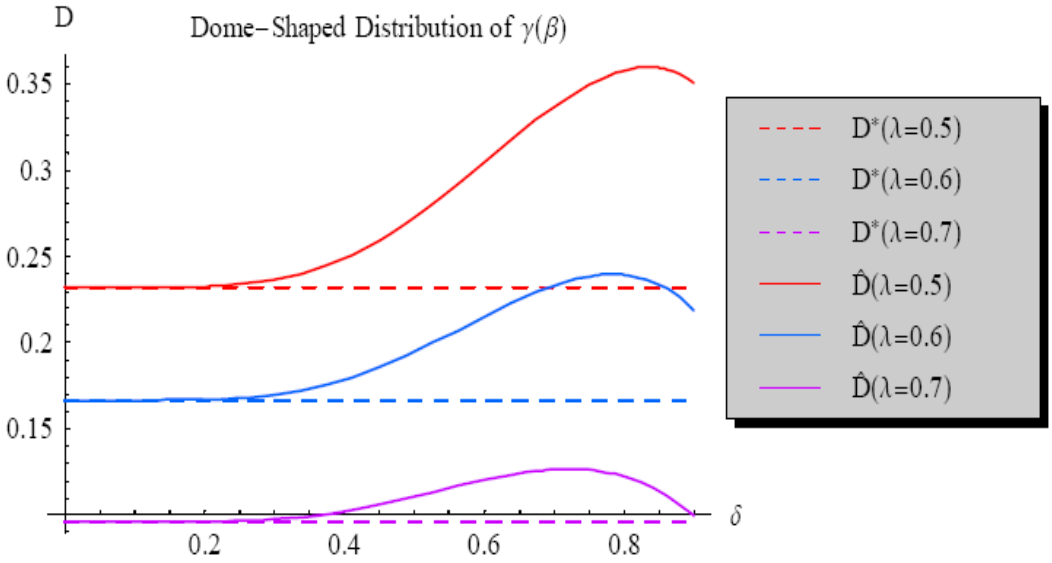
Note: δ_0 and δ_1 are indicated by the dashed and continuous line respectively.

Both critical points increase in the elasticity of substitution, which means that the margin

for error is larger for societies characterized by high degree of substitution between genres for increasing consumption of domestic program over unconstrained level and for reaching the maximum domestic programs' consumption.

Fixing elasticity of substitution at ten we then plot the consumption of domestic programs as a function of the concavity parameter. This is shown in Graph 3.3.

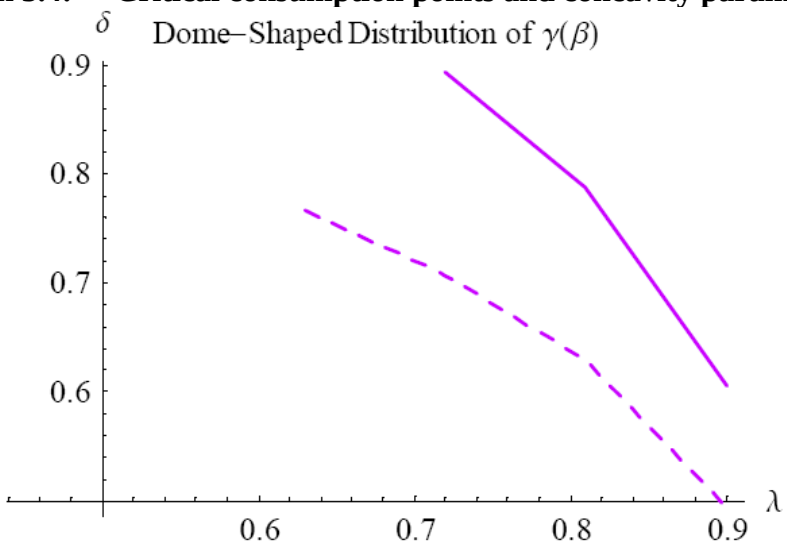
Graph 3.3: Aggregate consumption of domestic programming as a function of DCR for different values of the concavity parameter



Note: Concavity parameter values are (0.1125,0.45,and 0.7875); the lower values shift the plot higher.

Graph 3.3 retains some properties of Graph 3.1 in which the elasticity of substitution varied. At small values of the DCR, the policy has almost no effect. Once the DCR reaches the level of the stations most preferred by the consumer, consumption of domestic programs increases. For small values of the concavity parameter, domestic-program consumption increases steadily while for large concavity parameter it eventually falls down once policy goes far past the most-popular "balanced" genres. Graph 3.3 also shows that the larger is the concavity parameter the smaller are the critical points (δ_0, δ_1), if they exist at all. We combine this information in the Graph 3.4

Graph 3.4: Critical consumption points and concavity parameter



Note: δ_0 and δ_1 are indicated by the dashed and continuous line respectively.

5. Conclusions and Extensions

We showed that a marginal DCR increment in an initially binding policy increases the proportion of domestic content of stations which were initially constrained. Because of its constraining nature, the increment also increases average virtual prices over constrained stations and leads to a decrease in consumption of constrained stations' output and an increase in the consumption of unconstrained stations output. The increment in the strictly binding DCR may lead to an average decline in the consumption of broadcasting services when preferences are such that the consumer tends to substitute leisure for less-desirable radio consumption rather than other stations because of high opportunity-cost of time (better leisure opportunities) or large linguistic barriers. This, in turn, may lead to decline in the aggregate consumption for domestic programs despite the increase in their relative share of total radio listening. In contrast Richardson's (2006) finds that tigthening the local cultural content always increases the amount (proportion) of local music heard as consumers always devote a given time to radio listening. In his duopoly model,

tightening a local-music quota increases the local content in the music mix played by both stations. This mix-effect outweighs the audience-shifting effect –more listeners for the station specialized into foreign music.

Our numerical analysis showed that, for uniform distribution of genre preferences, the consumption of domestic programs peaks at large values of DCR when leisure alternatives to radio-listening are good. The consumption of domestic program may not peak if leisure alternatives are less attractive (low concavity parameter λ). A policymaker could achieve an objective of increasing consumption of domestic programs above the unconstrained level in such situation (uniform taste across genres). Finding the maximum level may be an elusive pursuit. When consumer preferences are skewed toward stations with low-domestic content, then critical values (δ_0, δ_1) are reached at relatively small values of the DCR suggesting that policymaker consider exercise caution when choosing a DCR level. Finally, when people prefer balanced consumption of domestic and foreign content then small values of DCR have virtually no effect on consumption of domestic programming. A DCR set in the neighborhood of the most-preferred "balanced" genres increases consumption of domestic programs. Beyond that level, a slight DCR overshooting could reduce domestic programming consumption below its maximum attainable level or even below its unconstrained level.

DCR policies are often imposed on societies that have small unconstrained consumption of local content either due to high-language barrier or high-opportunity cost of time. We show that the policy might not work in exactly the economies characterized by these two factors. Countries that fall into the first category are some of the countries of the former USSR dominated by the Russian language. The latter might be developed countries where leisure opportunities abound, like Australia and the EU. The uniform distribution case is more

identifiable with Latin-American countries in which demand for both foreign and domestic programs is strong without intervention. In fact, there are some countries where enforcement of the DCR policy is triggered only when the estimates of the past domestic content consumptions falls below certain threshold, and such thresholds have not been breached. Our numerical analysis suggests that policy in the latter countries is more effective yet, the case for government intervention is least compelling in these very countries.

For uniform and balanced distributions of preferences for genres, we have shown that as the elasticity of the substitution between genres increases and the concavity parameter decreases, the range of values increases for which the DCR boosts aggregate consumption of domestic programs above its unconstrained level. Similarly, reaching the maximum consumption of domestic programming, is more likely to succeed the higher the elasticity of substitution between genres and the smaller is the concavity parameter for the cases of uniform and balanced distribution of genres. However, for the case of preferences skewed toward stations with low-domestic content, reaching the maximum consumption level is more likely to succeed for societies with both low elasticity of substitution between genres and concavity parameter.

Our analysis understates the potentially negative effects of a DCR policy as firms do not leave the market. When fixed costs of production are high then severely constrained stations may be forced out of the market. This will aggravate the counterproductive results of DCR policy. A promising extension of our model would be solving the social planner's problem and finding a tax-cum-subsidy arrangement that replicates the objective of increasing consumption of domestic programs under less distortionary instruments. Another potential extension would be to consider the effects of the DCR in a general equilibrium setup. We have taken the price of advertising as given, however, it is possible to build a model where preferences of individuals reflect both the

time and income constraint and derive price of advertising by modeling explicitly the behavior of advertisers.

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