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The economics of protection of cultural goods

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CHAPTER 1. GENERAL INTRODUCTION

1. Introduction

Many countries claim that foreign cultural goods threaten their national identities and culture and engage in protectionism. Protectionism takes various forms, beginning with direct involvement of the state in framing cultural policies and building cultural environment of the country, such as funding of specific cultural projects the regulator deems valuable (exhibitions, media forums, festivals, etc.), and ending with economic policies, such as tax-cum-subsidy policies and minimum quota on the proportion of domestic content. In this dissertation I focus on the latter,- I analyze the economics of trade protection in cultural services, concentrating on domestic cultural content protection in terrestrial television and radio broadcasting, and cultural tariffs in the movie industry.

Trade in media goods is a multi-billion dollar and one of the fastest-growing industries and policy restrictions may lead to large distortions in the flow of trade as well as have substantial impact on the ability of governments to maintain their budgets. There exist a large body of literature that discusses content protection policies in private goods but virtually no discussion of content protection of public goods,- media goods in particular. In this dissertation I fill this gap.

My first essay considers the impact of cultural quota imposed on radio stations in increasing consumption of domestic programs. Governments around the world believe that there exist domination of foreign music, American in particular, on the radio broadcasting. Such domination is viewed as a threat to national domestic interests, therefore, is believed to require government intervention. Radio broadcasting is a non-excludable public good therefore direct regulation of the consumption of broadcasting is not feasible. Due to this governments turn to broadcasters and require that they maintain a minimum fraction of the domestic music/programs in their broadcasting. The regulator believes that such requirement would induce higher consumption of the domestic music and bring, as it is in some countries, domestic music from the verge of extinction. I show that such simple understanding of the issue is naïve as it ignores the fact that there does not exist a clear mapping between *relative proportion* of the domestic programs in the total volume of broadcasting and the *absolute consumption* of domestic programs by the public. The answer very much depends on the preference structure of the society,- when people prefer foreign music to domestic music or have high opportunity cost of time then policy restriction may be counterproductive.

My second essay analyzes direct regulation of the proportion of the domestic programs in the total volume of broadcasting and tax-cum-subsidy policies on television. Television is considered to be one of the largest components of international trade in media goods. Turning on a TV set in any place in the world immediately demonstrates that the American and, to lesser extent, British media have undisputed domination over the TV market. American TV series, educational and science programs, and especially movies fill in peoples' screens all over the world. Such domination is considered to be a grave threat to national identity. Policymakers are afraid that access of domestic producers to domestic market is restricted and as a result, domestic culture is diluted. In order to correct this situation government turn to two main instruments. I find that marginal changes in content requirement increase (decrease) consumption of domestic shows when individuals are sensitive (insensitive) to the provided content. Tax-cum-subsidy polices have negative (no) effect on consumption of the domestic content when preferences of individuals of the country subject to regulation are highly sensitive (insensitive). Finally, I find that capping advertising increases consumption of domestic programs.

The last essay addresses the question of whether a cultural tariff is a proper policy to raise consumption of domestic movies, especially artistic ones, as opposed to foreign blockbuster movies. “Hollywood” blockbuster movies allegedly have low-cultural value yet command more than eighty percent of the world movie market. and cultural tariff intends to increase the average cultural level in the country implementing the policy. Starting from free trade, a small cultural tariff decreases the average blockbusterness of the domestic market as intended although the number of local producers willing to enter the blockbuster market increases and reduces the number of local producers specializing in the production of artistic movies. The cultural tariff introduces a distortion into the relative price of movies. Aggregate consumption of artistic movies that are locally made increases and so does the self-sufficiency ratio of local producers.

2. Thesis Organization

Thesis is organized in the following manner. Chapter 2 discusses domestic content protection on radio broadcasting. In the first section of the chapter I review literature and discuss issues raised by introduction of domestic content requirement. In the second section I build a model of international trade in radio broadcasting services and describe equilibrium before any content restrictions are imposed. In the third section I analyze the effects of domestic content requirement and in the fourth section I provide numerical simulations to assert analytical conclusions derived in the preceding section. Finally, in the fifth section I provide conclusions and directions for future research. Chapter concludes with the list of references and appendices.

Chapter 3 discusses issues pertaining to protectionism on television. I begin with a thorough literature review and discuss the current state of affairs in cultural protectionism. In the second section I build a theoretical framework for analysis, describe unconstrained equilibrium and its properties. In the following section, I consider marginal changes in the content requirement starting from just-binding level. I also consider the effects of tax-cum-subsidy policies and impact of regulation of advertising on consumption of domestic programs. In the fourth section I provide results of a numerical analysis to support analytical results derived earlier in the Chapter 3. Lastly, in the fifth section state main conclusions and policy recommendations. Paper concludes with references' list and appendices.

The final paper, presented in Chapter 4, I focus on impact of taxes on the structure of the movie production, in particular, whether taxes induce domestic firms to switch from production of auteur movies to production of blockbuster movies. In the first section I provide literature review and discuss, in general terms, the validity of regulator beliefs when imposing constraints on entry of foreign filmmakers. In the second section, I build a model used to demonstrate the main results and provide comparative statics for main parameters of the model. In the third section I investigate the impact of cultural tariff on consumption of domestic movies and production structure of local studios. In the fourth section I conclude and provide some policy recommendations. In addition, I provide directions for future research. Chapter ends with the list of references and with appendices.

CHAPTER 2. THE ECONOMICS OF DOMESTIC CULTURAL CONTENT PROTECTION IN RADIO BROADCASTING

A paper to be submitted to *The Canadian Journal of Economics*

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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

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reducing the overall aggregate consumption of broadcasting, and subsequently, the overall aggregate consumption of domestic programs.

1. Introduction

Despites its numerous benefits, globalization is alleged to be a serious threat to countries' national identities, especially by policymakers and mercantilist interests.[3] A perceived tradeoff between increasing economic integration and diminishing national identity is at the center of trade and cultural debates[4] 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.[5] 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.[6] Only a handful of countries, including the United States, have refrained from

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[3] For example, a large gathering this fall in Paris discussed a "Preliminary Draft Convention on the Protection of the Diversity of Cultural Contents and Artistic Expressions" for the 33rd UNESCO general convention.
[4] See Cowen (2002) for an excellent review of the cultural issues brought up by globalization as well as columns by Bernier (2003-2004).
[5] For example, articles XIV(a) of GATS and Annex on Communications to GATS 2(b).
[6] As an anecdote, Frenchman Gerard Depardieu is a vociferous and prominent opponent of U.S. blockbusters' dominance in France yet he does not mind casting in such or being exported to foreign markets.

adopting such policy. The European Union (EU) requires broadcasters in member states to reserve a majority proportion of their transmission time for EU work.[7] 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".[8] Similarly, Canadian regulation stipulates that each week at least 35% of popular musical selections by commercial stations are Canadian and 65% of the popular vocal music selections French-language stations broadcast are in French.[9] 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.[10] 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 language of the state, the Kazakh language, but the government requires that half of all programming to be done in Kazakh.[11]

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 the actual regulations is are a round-about instrument 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 daunting task involving

[7] Council Directive 89/552/EEC of 3 October 1989 adopted by the European Union, Chapter III, Article 4.1.
[8] Minister Toubon was nicknamed Mr. Allgood after he imposed his cultural policy (The Economist (1996)).
[9] Canadian Broadcasting Act, R.S.C., 1991, c. 11, Article 10.1.
[10] Article 71(1) of the Republic of South Korea's Broadcasting Act.
[11] The law of the Republic of Kazakhstan of 23 July 1999, #451-1 "About Means of Mass Information", article 3.2.

some arbitrary metric of culture. 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), and Shao (1995)). The first rationale applies primarily to the movie industry where domestic (non US) movie producers are marginalized by vertically integrated Hollywood studios.[12] 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), Beghin and Sumner (1992), and others). Our paper fills a 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

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[12] Francois and van Ypersele (2002)show that restrictions on trade in the movie industry may help resurrect

industries.[13] 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 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 countries or Canada but likely to fail in countries where language is the main obstacle for consumption of domestic programming. The latter might be some of

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.

[13] The few empirical analyzes of the effect of cultural content protection on welfare (e.g., Anderson, Swimmer and Suen (1997)) do not consider the public good nature (nonrivalness) of broadcasting.

the Baltic States and Central Asian 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.[14] 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 broadcaster 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 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.[15] For any broadcaster, we define the ratio of its domestic content to total cultural content as β. We use β to characterize genres[16] and assume that $\beta \sim U[0,1]$.

[14] 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. A mixture of any two genres constitutes a new genre and the number of stations is finite excluding two stations choosing a similar genre.

[15] 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.

[16] 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.

A representative consumer derives utility from consumption of broadcasting and leisure where the utility is quasi-linear with respect to leisure. Define the triplet of variables $\left(q_d(\beta), q_f(\beta), l\right)$ 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 $0 < \lambda < \frac{\sigma-1}{\sigma}$, 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 matrix that guarantee gross substitutability of the genres.[17]

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

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

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 (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 its 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 the virtual price faced by consumer.

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

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

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 an 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 un-bundle them.[18] 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

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

where $a(\beta)*1=(1-d(\beta)-f(\beta))*1$ 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:

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

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

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 $z^*(\beta)=\left(\gamma(\beta)\left(\frac{\sigma-1}{\sigma}\right)\right)^{-1}$.[19] 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

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

genres approaches infinity, the disparity between the two vanishes.

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

[19] 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 $\beta^{\beta}(1-\beta)^{1-\beta}$.

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,[20] instead of solving equations (6) and (7), now solves:

$$d(\beta) = \delta, \qquad (9),$$

and

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

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 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 a drop in prices. Other constrained stations with their genre 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[21] (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 other hand, stations that operate genres $\delta < \beta \leq \delta\left(\frac{\sigma}{\sigma - 1}\right)$ 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

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

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, $\frac{\gamma'(\beta)}{\gamma(\beta)} - \frac{1}{1+(\sigma-1)(1-\beta)} - \log\left[\frac{(\sigma-1)\beta(1-\delta)}{\delta(1+(\sigma-1)(1-\beta))}\right] \leq 0$.[22] 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 $\sigma \geq 2$. In the numerical analysis section, we relax this assumption and show that the results are robust under milder conditions.

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

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

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

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

$\bar{\beta} \equiv \left(\int_{\delta\left(\frac{\sigma}{\sigma-1}\right)}^{1} \beta z^{*}(\beta)^{1-\sigma} d\beta \right) \left(\int_{\delta\left(\frac{\sigma}{\sigma-1}\right)}^{1} z^{*}(\beta)^{1-\sigma} d\beta \right)^{-1}$. 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 $\delta \geq \underline{\beta}$[23] which implies that, on average, representative consumer is made worse off by the policy due to higher average virtual price of constrained stations. Parameter $\bar{\beta}$ 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-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

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

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

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

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

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, $-\dfrac{\hat{B}(1-\phi\mu)(\sigma-1)(\delta-\underline{\beta})}{1-\delta}$ (negative if $\sigma \geq 2$); and (iii) an increase in the aggregate consumption of broadcasting of unconstrained stations,

$\dfrac{\hat{B}\phi\overline{\beta}(1-\mu)(\sigma-1)(\delta-\underline{\beta})}{\delta(1-\delta)}$ (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 $\lim_{\delta\to 0}\underline{\beta}/\delta = 1$. Ultra-marginal 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* $\frac{\phi\bar{\beta}(1-\mu)(\sigma-1)(\delta-\underline{\beta})}{\delta(1-\delta)} \approx 0$ *(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* $\hat{D} = \left(\frac{\sigma-1}{\sigma}\right)^{\frac{1}{1-\lambda}} \left(\int_0^1 \left(\frac{\gamma(\beta)}{\beta^{\beta}(\sigma-\beta(\sigma-1))^{1-\beta}} \right)^{\sigma-1} d\beta \right)^{\frac{\lambda}{(1-\lambda)(\sigma-1)}}$

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* $\hat{D} \le D^*$ *we set* $\gamma(\beta) = 1/2$ *and set* $\sigma = 6$.

This yields $\hat{D} - D^* < 0$. *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 Far Eastern countries or 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 and Canada while EU member-countries and Oceania 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 Figure 1.1.

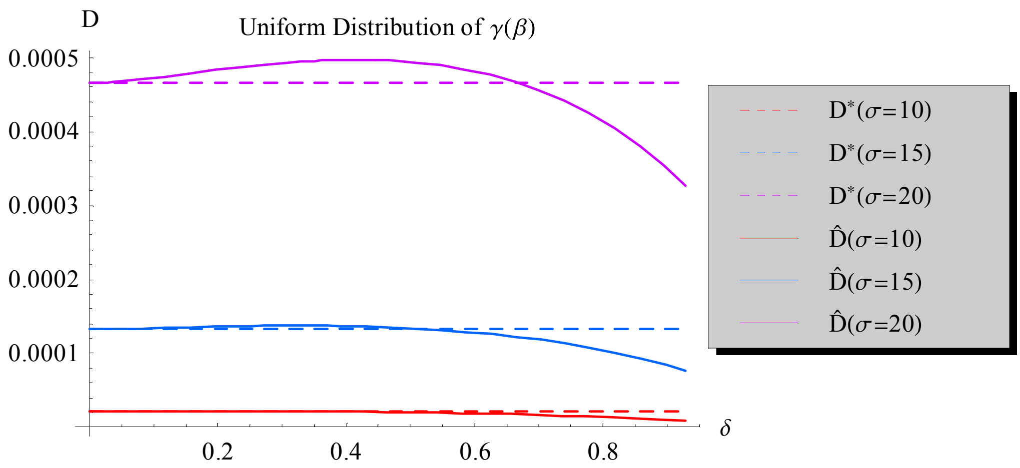

Figure 1.1: Aggregate consumption of domestic programming for different values of the elasticity parameter

As shown in Figure 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 (red 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 Figure 1.2.

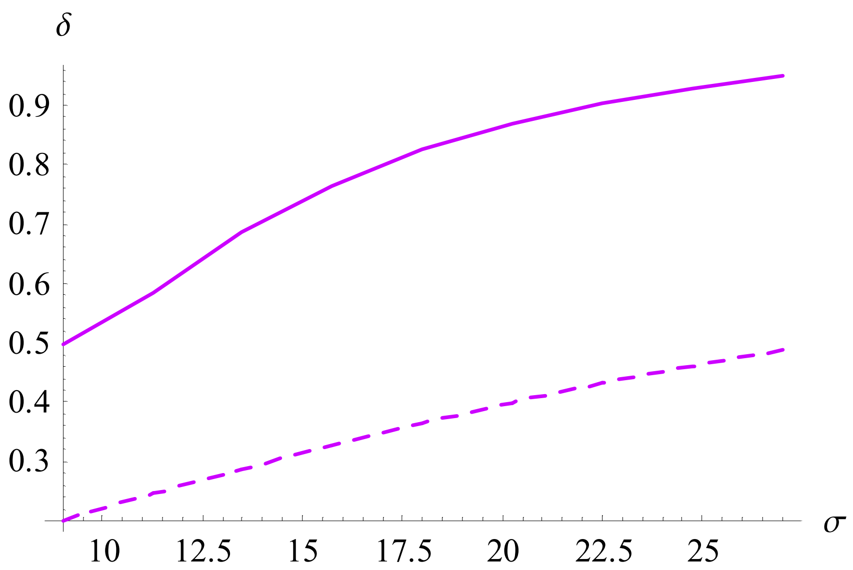

Figure 1.2: Critical points δ_0 and δ_1 as a function of σ. Note that δ_0 and δ_1 are indicated by the dashed and continuous line respectively.

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. Figures 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. Figure 1.3 shows the consumption of domestic programming as a function of the DCR policy.

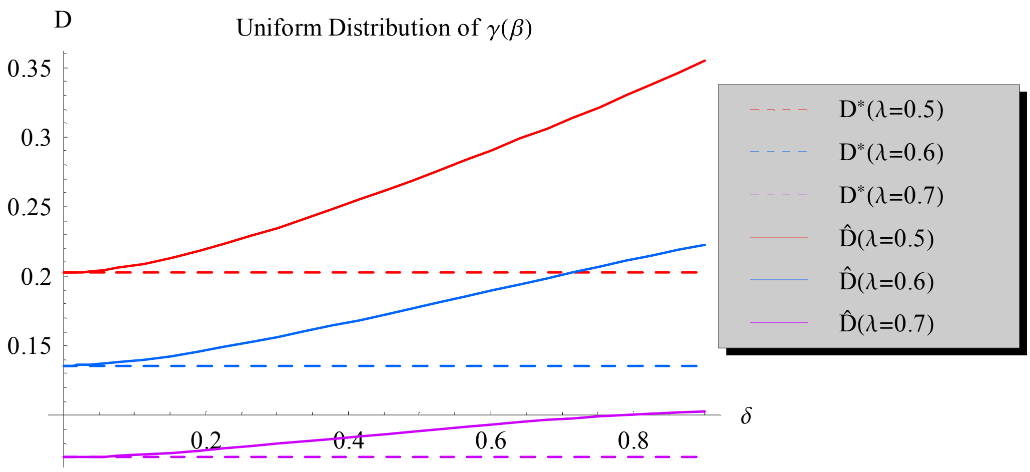

Figure 1.3: Aggregate consumption of domestic programming and DCR for different values of the concavity parameter

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. Figure 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. Figure 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. Figureically, 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.

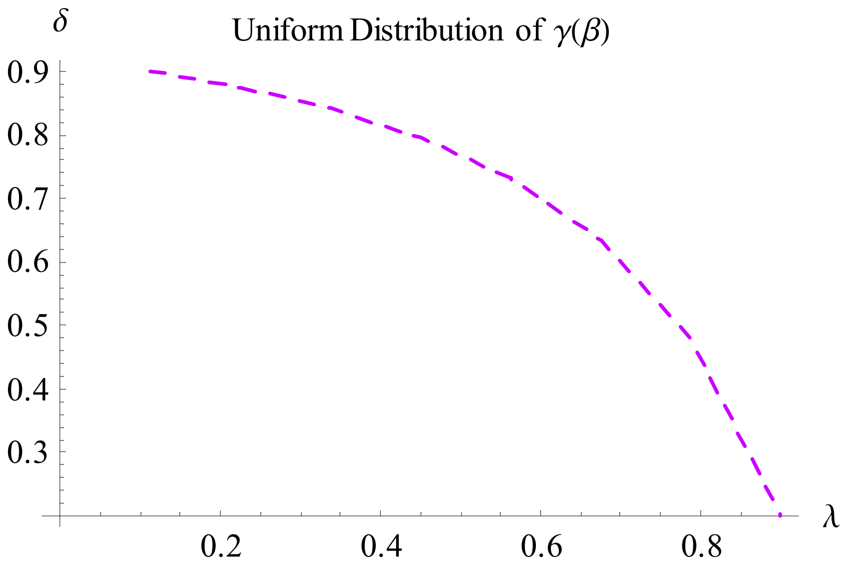

Figure 1.4: Critical consumption points and concavity parameter. Note that δ_0 is indicated by the dashed. Critical values of δ_1 do not exist.

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 $\lambda=0.9$. Figure 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. This is shown in Figure 2.2.

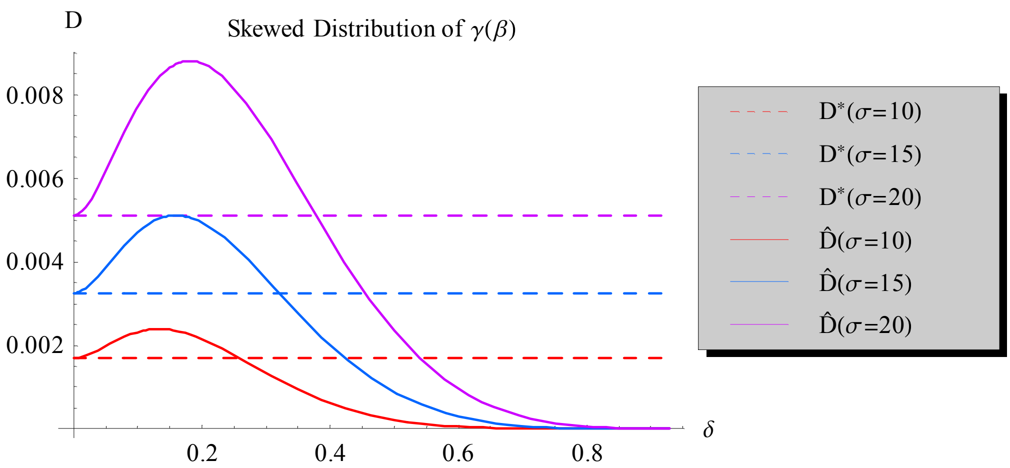

Figure 2.1: **Aggregate consumption of domestic programming for different values of the elasticity parameter.**

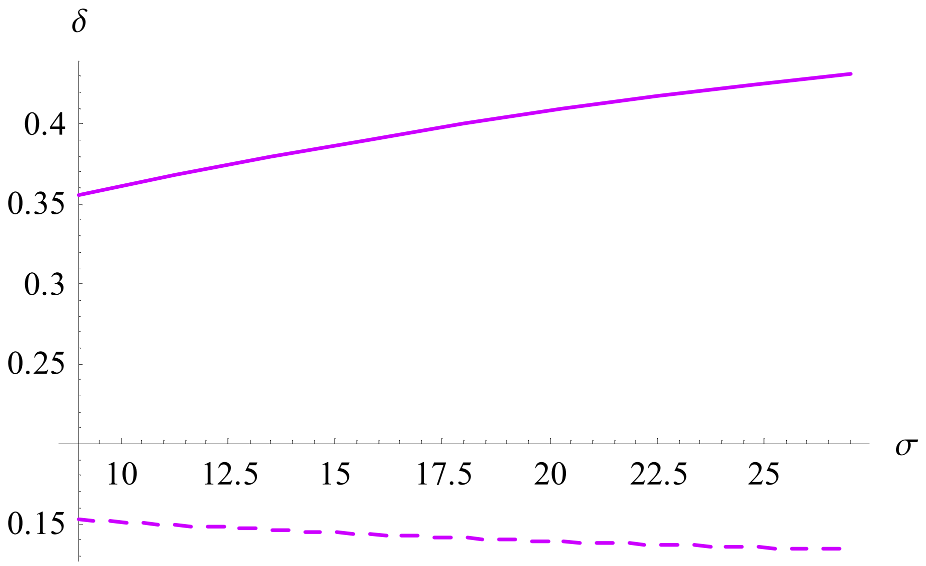

Figure 2.2: Critical consumption points under skewed distribution. Note that δ_0 and δ_1 are indicated by the dashed and continuous line respectively.

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. This implies that the indirect effect of falling consumption of broadcasting is large and overcomes the direct effect of increasing the share of domestic programs. In other words, when elasticity of substitution is high then people like blockbusters more or can tolerate higher prices caused by suboptimal content.

Therefore, the range of content requirement over which policy increases domestic content is higher.

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

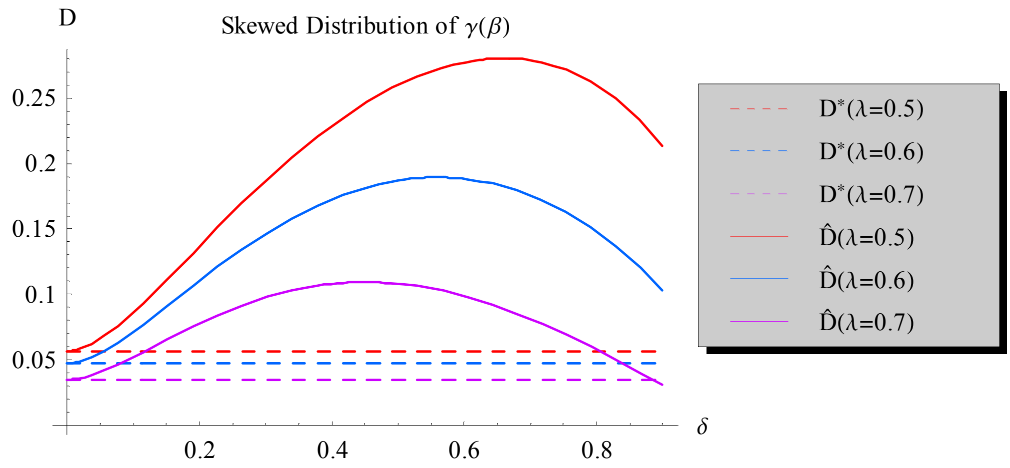

Figure 2.3: Aggregate consumption of domestic programming as a function of DCR for different values of the concavity parameter.

Again, from Figure 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 Figure 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 Figure 2.4.

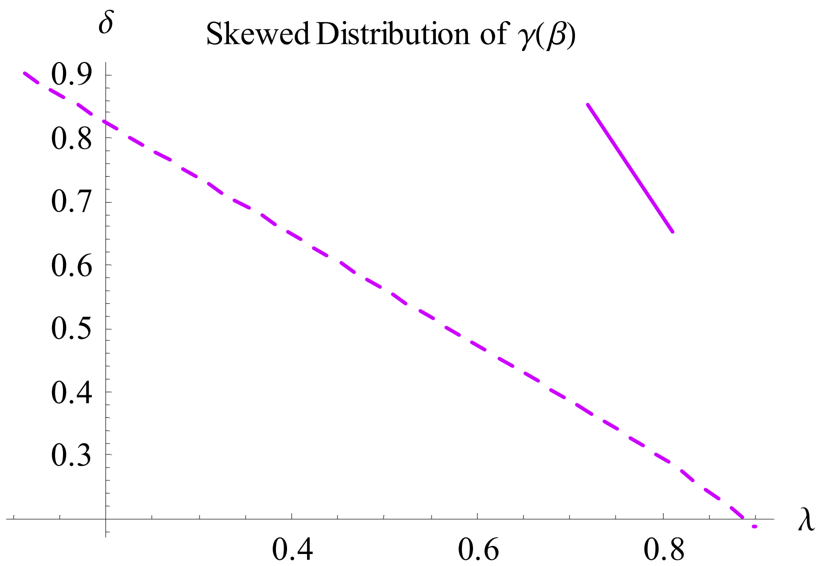

Figure 2.4: **Critical consumption points and concavity parameter. Note that δ_0 and δ_1 are indicated by the dashed and continuous line respectively.**

4.3. Dome-shaped distribution of preferences over genres

In this last case, we assume that distribution of genres is given by $\gamma(\beta)=(4/\pi)\sqrt{\beta}\sqrt{1-\beta}$. We further assume that $\lambda = 0.8$. Aggregate consumption of domestic programs is shown in Figure 3.1.

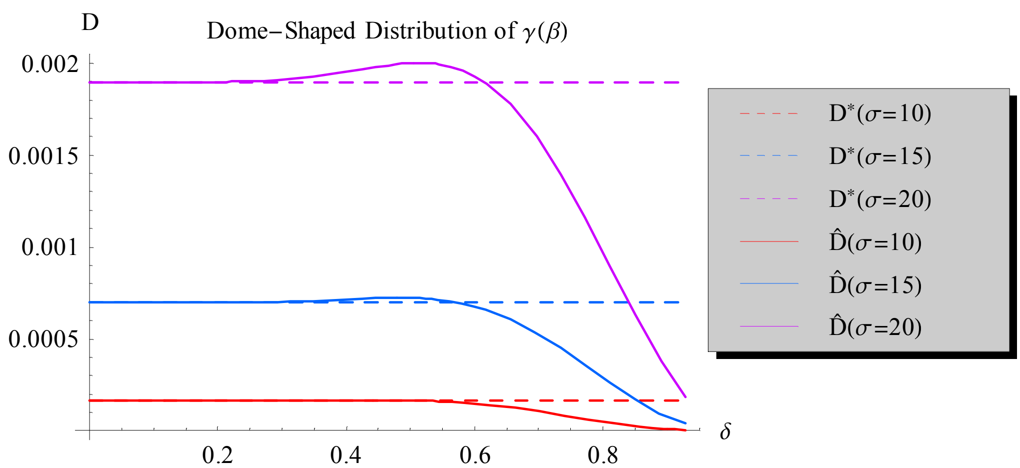

Figure 3.1: **Aggregate consumption of domestic programming for different values of the elasticity parameter.**

Figure 3.1 shows that at 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 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.

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

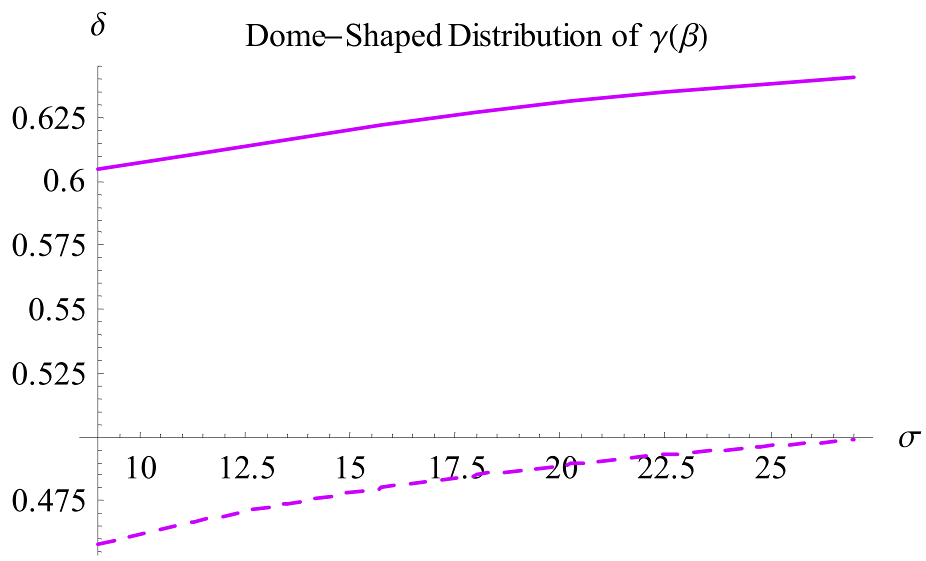

Figure 3.2: Critical points (δ_0, δ_1) as a function of σ. Note that δ_0 and δ_1 are indicated by the dashed and continuous line respectively.

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 Figure 3.3.

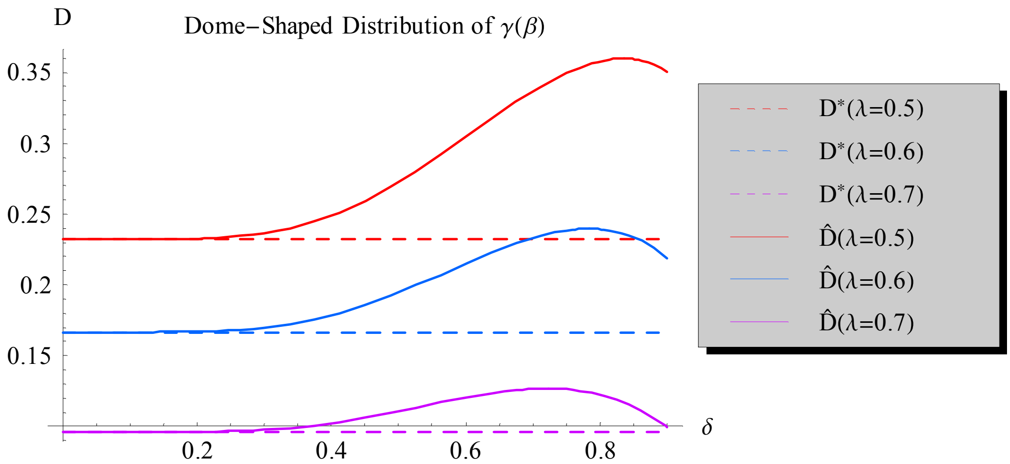

Figure 3.3: Aggregate consumption of domestic programming as a function of DCR for different values of the concavity parameter. Note that concavity parameter values are (0.1125,0.45,and 0.7875); The lower values shift the plot higher.

Figure 3.3 retains some properties of Figure 3.1 in which the elasticity of substitution varied. Namely, 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. Figure 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 Figure 3.4

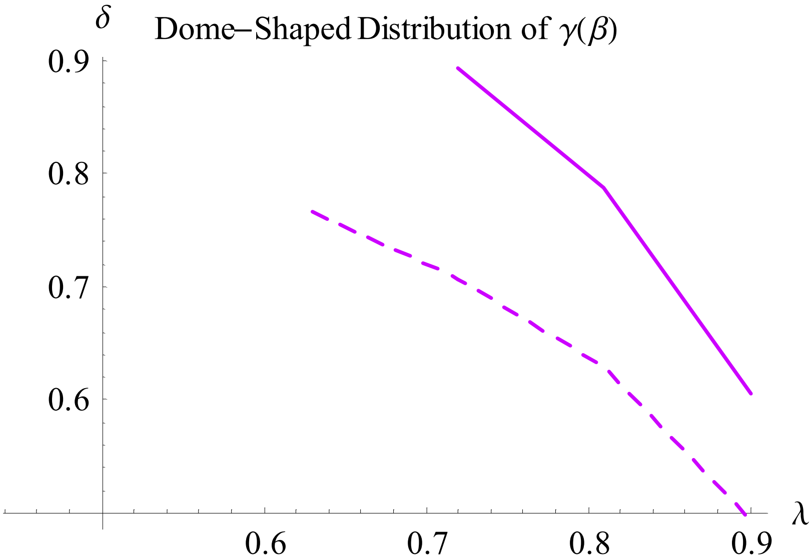

Figure 3.4: **Critical consumption points and concavity parameter. Note that δ_0 and δ_1 are indicated by the dashed and continuous line respectively.**

5. Conclusions and extensions

We have established that a marginal DCR increment in the neighborhood of an initially strictly binding policy increases proportions of domestic content across all markets in which firms are constrained. However, by the nature of being constrained, it also increases average virtual prices over constrained stations. This leads to a decrease in consumption of constrained stations' output and increase in unconstrained stations output. The increment in 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 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.

Using numerical analysis, we have shown 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 relatively less attractive (low concavity parameter λ). Therefore, a policymaker is likely to 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, however. 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. In this case it is important that a policymaker exercises caution in his choice of 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. The level of the DCR in the neighborhood of the most-preferred "balanced" genres (ranges of β with the largest density of $\gamma(\beta)$ function) increases consumption of domestic programs. A slight DCR overshooting however, leads to fall in consumption of domestic programming below its maximum attainable level or even below its unconstrained level.

The irony of the DCR policy is that it is normally imposed on societies that have small unconstrained consumption of domestic programming either due to high language barrier or high opportunity cost of time. We have shown that the policy might not work in exactly the economies that are characterized by these two factors. Countries that fall into the first category are some of the countries of the former USSR (countries that are dominated by the Russian language), Canada (there are Canadians that do not speak French), and New

Zealand (support of Maori language). The latter might be developed countries where leisure opportunities abound, like Australia and European Union. 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 implies that policies in these countries are the most effective yet, apparently, government intervention is least required 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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CHAPTER 3. CULTURAL PROTECTION POLICIES IN TERRESTRIAL TELEVISION BROADCASTING IN GENERALIZED HORIZONTAL PRODUCT DIFFERENTIATION FRAMEWORK

A paper to be submitted to *The Journal of Cultural Economics*

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Abstract

Many countries around the world view trade in cultural goods,- terrestrial broadcasting, movie industry, cable television - to undermine their national identity as such use various tools to protect the national cultural heritage. In this paper we analyze the two most widely tools,- direct regulation of the proportion of the domestic programs in the total volume of broadcasting and tax-cum-subsidy policies,- policies where government taxes stations with low domestic content and uses the proceeds to subsidize high-domestic content stations. We find that marginal changes in content requirement increase consumption of the domestic content when individuals are sensitive to the provided content. When individuals are nearly indifferent then marginal content requirement may have an adverse effect on consumption of the domestic content. Further, tax-cum-subsidy polices have negative effect on consumption of the domestic content when preferences of individuals of the country subject to regulation are highly sensitive to domestic content and have virtually no impact when individuals are insensitive to domestic content. Finally, we find that putting a cap on proportion of advertising in the total volume of broadcasting always increases consumption of domestic programs.

1. Introduction

Regulation of broadcasting industry is a sensitive issue because there exist essentially two polar views regarding the role of terrestrial broadcasting,- a commercial view in which broadcasting is just an ordinary business activity as such should be left to its own devices[24] and a cultural view in which the key role of broadcasting is to preserve the cultural heritage. Proponents of the former, especially the United States, have long argued that all services bear some social function, as such, excluding audiovisual services from free trade may jeopardize the whole General Agreement on Trade in Services. On the other hand, the proponents of the cultural view, especially France, argue that the regulation is necessary to preserve cultural identity and cultural diversity as well as to keep open an avenue for expression of opinions by all layers of society,- a quintessential element for survival of democracies[25]. Both camps provide valid points, however, precisely because it is impossible to put an objective monetary metric on cultural heritage, trade negotiations with respect to the status of cultural goods have stalled. In light of the aforementioned we do not attempt to validate the points of each side

[24] It appears that the US focus in the WTO has shifted to seeking standstill commitments in audiovisual services, i.e. an agreement to keep existing cultural measures without any ability to alter these in the future. Many countries, however, oppose this position and desire to keep their ability to change the level of cultural protection depending on the condition of the domestic audiovisual sector.

[25] Canada's former Prime Minister Kim Campbell noted that "For Americans, cultural industries are industries like any others. For Canadians, cultural industries are industries that, aside from their economic impact, create products that are fundamental to the survival of Canada as a society. The globalization of the world economy and communications has been a vehicle for the Americanization of the globe. For Canada and other countries, globalization has been a phenomenon within which their distinct, non-American cultures must struggle to survive."

but rather focus on the analysis of effectiveness of the cultural protection policies on preserving the cultural identity[26] in the case of terrestrial TV broadcasting.

The arsenal of tools available to regulators in regulating terrestrial broadcasting is quite large and ranges from setting quotas on foreign content, to subsidizing production of domestic content to financing public stations broadcasting domestic content by either taxing commercial stations directly or through levying license duties.

The most popular tool used to battle the "invasion" of foreign content is direct regulation of the proportion of domestic content as a fraction of total broadcasting, or simply a quota on the proportion of the foreign content. This tool is so common that perhaps only a handful of countries, including the United States, have not passed a legislation limiting foreign content. For example, Council Directive 89/552/EEC of 3 October 1989 adopted by the European Union, Chapter III, Article 4.1 says that "Member States shall ensure…that broadcasters reserve for European works…a majority proportion of their transmission time…". Similarly, Canadian Broadcasting Act, R.S.C., 1991, c. 11, Article 10.1 says that "The Commission [Canadian broadcasting authority] may make regulations respecting the proportion of time that shall be devoted to the broadcasting of Canadian programs". Presently, such commission requires that 60% of all programming be of a Canadian origin. In the more culturally conservative states, like South Korea, Article 71(1) of Broadcasting Act says that "A broadcasting business operator shall program, among the total programs of the relevant channel, domestically produced broadcast programs in excess of a specified ratio … prescribed by Presidential Decree". The regulation takes an extreme form on some of the

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[26] There exist an empirical work on the effect of content protection on welfare by Anderson, Swimmer and Suen

countries of the former Soviet Union like Baltic and Central Asian states. For example, in Kazakhstan, a country in which the Russian language dominates the official language of the state, the Kazakh language, the government requires, by the law of the RK of 23 July 1999, #451-1 "About Means of Mass Information", article 3.2, that "The volume of broadcasting on television and radio channels… on the language of the state, in terms of time, exceeds that of all other languages combined".

The key to the analysis of content protection is the recognition of the fact that government content regulation is an attempt to increase the *absolute consumption* of domestic programming (which we use as a proxy for the cultural identity) by imposing a *relative* restriction on *production* (broadcasting) of its content, where content is a public good. In our analysis we use the generalized model of horizontal product differentiation developed by Lancaster (1979) in which two stations compete on a single genre (for example, news for TV stations) over viewers who are uniformly distributed over their most-preferred domestic content ratio. Since by assumption the broadcasting industry is characterized by increasing returns to scale technology all individuals are not provided with their most preferred domestic content. Therefore, the consumption by individuals depends on the magnitude of the mismatch between available and the most-preferable domestic content and the degree of sensitivity of preferences to such a mismatch, to which we hereon refer as simply sensitivity.

We show that the success of domestic content protection policies depends on consumer preferences and the form of regulation. When preferences are highly sensitive to

(1997), however, it does not provide a sufficient theoretical framework for analysis of various content protection initiatives.

domestic programs then a quota on proportion of foreign programs have small positive effect on aggregate consumption of domestic content. This situation is typical for countries in which the main obstacle for consumption of domestic programs is the language barrier, for example, for countries that promote minority languages. When, however, preferences are not very sensitive to domestic programs (that is the case of Europe or Australia for example) then domestic content protection may have negative effect on aggregate consumption of domestic programs. Moreover, when stations operate under strictly binding regulation of advertising, marginal domestic content requirement always raises consumption of domestic programs.

In addition, many countries have minority language regulation in which governments put levies on commercial stations (in our case we assume that commercial stations provide low domestic programming content) and use the proceeds to subsidize stations that have a smaller audience (for example, a minority) or target a specific market (in our model they correspond to high domestic content stations). For example, in New Zealand the government taxes all commercial broadcasters and uses the proceeds to subsidize stations broadcasting in Maori language. The results of our analysis indicate that marginal taxes and subsidies have very little effect on the consumption of domestic content in societies with low sensitivity of preferences to domestic content ratio while substantial undesired effect in societies in which sensitivity to domestic content is large.

Finally, advertising is often subject to regulations[27] and represents the main source of revenue for commercial terrestrial broadcasters. Even though governments regulate

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[27] Usually there exists a ceiling on the proportion of advertising, for example, Chapter 4, Article 18 of Council Directive 89/552/EEC of 3 October 1989 of EU says that Article 18 "The amount of advertising shall not exceed 15 % of the daily transmission time… the amount of spot advertising within a given one-hour period shall not exceed 20 %".

advertising to promote the "quality" of broadcasting rather than to increase consumption of domestic content, we also consider it effects as an alternative instrument of domestic content protection. We show that instituting a marginal restriction of advertising always raises consumption of domestic programs, and the larger is the sensitivity of preferences to domestic content ratio the smaller is the effect of advertising on consumption of the domestic programs.

This chapter might be viewed as an extension of the first chapter in the sense that it is built around the same motivation,- investigating the economics of cultural protectionist policies. However, the key point of departure is that this paper primarily concerns television terrestrial broadcasting[28] where domestic content requirement takes the form of a minimum fraction of domestic programs in the net-of-advertising broadcasting as opposed to radio broadcasting where domestic content requirement is often imposed on domestic programs as a fraction of advertising-inclusive broadcasting. For this reason, it is more convenient to model it in the generalized horizontal product differentiation framework. Further, in this paper we assume that two stations operate in a single genre and individuals view stations are perfect substitutes, whereas in the first essay we have many genres and in the eyes of consumers, programming provided by stations have varying degrees of substitutability. Lastly, we do an analysis of regulation of advertising and tax-cum-subsidies on the consumption of domestic programming.

[28] It may apply to radio terrestrial broadcasting of countries where regulation takes the form of a fraction of net broadcasting rather than gross broadcasting we have investigated in chapter 1.

The limitations of some of our results hinges upon the fact that we use marginal content protection policies. Furthermore, we have employed a duopolistic setup. Changing either of these assumptions breaks the symmetry and renders analytical analysis unfeasible.

2. The model

We assume that the real world has only one genre and two stations compete on this genre. Individuals derive utility by either tuning to a particular station or by doing something else. Thus, each consumer has preferences given by $U \equiv \frac{\varepsilon+1}{\varepsilon}\left(\sum_{i=1}^{2}\breve{q}_i\right)^{\frac{\varepsilon}{\varepsilon+1}}+l$ where $\breve{q}_i$ is the consumption of the most-preferred programming of domestic content provided by station, l is leisure and ε is a preference parameter greater than one. The additive preference specification tells us that programming of different stations are perfect substitutes and that a consumer tunes to only one station within his time constraint. We also assume that broadcasting technology is characterized by increasing returns to scale[29] which automatically implies that not all consumers will be provided with their most-preferred content. In order to have consumers consume broadcasting that does not match their most-preferred domestic content specification we introduce, a la Lancaster (1979), a compensation function $h(v_i,\zeta)$ where $v_i \equiv \left|\Delta_i - \breve{\delta}\right|$ is the distance between the most-preferred and available content ($\breve{\delta} \equiv \frac{\breve{d}_i}{\breve{f}_i+\breve{d}_i}$ refers to most-preferred domestic content and $\Delta_i \equiv \frac{d_i}{f_i+d_i}$ refers to available domestic content, where (f_i,d_i) stand for foreign and domestic content in units of time) and

ζ is some curvature parameter of the compensation function (or what we refer to as sensitivity parameter). This compensation function must satisfy the following properties:

$h(v_i,\zeta)>1$, $h^{v_i}(v_i,\zeta)>0$, $h^{v_iv_i}(v_i,\zeta)>0$, when $v_i>0,\zeta>0$,

$h(0,\zeta)=1$, $h^{v_i}(0,\zeta)=0$, $h^{v_iv_i}(0,\zeta)>0$ when $\zeta>0$.

This set of properties is taken directly from Lancaster's model. Further we assume that $\frac{\partial}{\partial v_i}\left(\frac{h^{\zeta}(v_i,\zeta)}{h(v_i,\zeta)}\right)\ge 0$ and $\lim_{\zeta\to 0}\frac{\partial}{\partial v_i}\left(\frac{h(v_i,\zeta)^{\zeta}}{h(v_i,\zeta)}\right)\left(\frac{h(v_i,\zeta)}{h(v_i,\zeta)^{v_i}}\right)=\infty$. Define $r(v_i,\zeta)\equiv\frac{h^{v_iv_i}(v_i,\zeta)h(v_i,\zeta)}{h^{v_i}(v_i,\zeta)^2}$, then, we assume that $\lim_{\zeta\to 0}r(v_i,\zeta)=\infty$, $\lim_{\zeta\to\infty}r(v_i,\zeta)=1$.

Examples of functions that satisfy the above properties are

(i) polynomial of the form

$$h(v,\zeta)=\begin{cases}1+\sum_{j=0}^{J}\left((\zeta+j)v\right)^{\sigma(\zeta+j)} & \zeta\ge\bar{\zeta},J\ge 1,\bar{\zeta}>1,\sigma>0\\ 1+\sum_{j=1}^{J}v^{\sigma\left(\frac{1}{\zeta}+j\right)} & 0\le\zeta\le\underline{\zeta},J\ge 1,\underline{\zeta}<1,\sigma>0\end{cases} \quad (13),$$

or

$$h(v,\zeta)=1+\sum_{j=2}^{J}(\zeta v)^{\sigma j},J\ge 2,\sigma\ge 0 \quad (14),$$

(ii) exponential form:

$$h(v,\zeta)=\exp\left\{\sum_{j=1}^{J}(\zeta v)^{\sigma j}\right\}-\sum_{j=1}^{J}(\zeta v)^{\sigma j},0\le\zeta\le 1,J\ge 1,\sigma>0 \quad (15),$$

$$h(v,\zeta)=\exp\left\{\sum_{j=0}^{J}\left((\zeta+j)v\right)\right\}-\sum_{j=0}^{J}\left((\zeta+j)v\right),0\le\zeta\le 1,J\ge 1 \quad (16).$$

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[29] Given the public nature of broadcasting we observe in the real world that fixed costs represent a lion's share

Each individual spends his entire time endowment on either leisure or watching television, therefore, normalizing his time endowment to one the budget constraint can be written as $\sum_{i=1}^{2}(q_i + a_i) + l = 1$, where q_i refers to available programs and a_i to advertising (in absolute units, say hours). The fact that we show $(q_i + a_i)$ together reflects the fact that stations bundle advertising and real content together and that consumers cannot separate the two.

Therefore, the utility maximization problem of each individual is

$$\max_{q_i, l} \frac{\varepsilon+1}{\varepsilon}\left(\sum_{i=1}^{2}\frac{q_i}{h_i}\right)^{\frac{\varepsilon}{\varepsilon+1}} + l, \text{s.t.} \sum_{i=1}^{2}(q_i + a_i) + l = 1 \qquad (17).$$

The fact that advertising does not show up in the utility function reflects our assumption that advertising is a nuisance[30] and does not provide any utility to individuals. Then, by defining b_i to be the total consumption of broadcasting of station i in hours, we can rewrite consumer's problem as

$$\max_{b_i, l} \frac{\varepsilon+1}{\varepsilon}\left(\sum_{i=1}^{2}\frac{b_i - a_i}{h_i}\right)^{\frac{\varepsilon}{\varepsilon+1}} + l, \text{s.t.} \sum_{i=1}^{2} b_i + l = 1 \qquad (18).$$

Let us define $\tilde{\alpha}_i \equiv \frac{a_i}{b_i}$ to be the fraction of broadcasting devoted to advertising, $\tilde{\alpha}_i \in [0,1]$. Then if we define $\hat{\alpha}_i \equiv \frac{h_i}{1-\tilde{\alpha}_i}$ and $\hat{b}_i \equiv \frac{b_i}{\hat{\alpha}_i}$ to be, correspondingly, normalized price and normalized demand for broadcasting we can restate the consumer's utility maximization problem as

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of costs.

$$\max_{b_i,l}\frac{\varepsilon+1}{\varepsilon}\left(\sum_{i=1}^{I}\hat{b}_i\right)^{\frac{\varepsilon}{\varepsilon+1}}+l,\text{s.t.}\sum_{i=1}^{2}\hat{\alpha}_i\hat{b}_i+l=1 \quad (19).$$

This is a standard utility maximization problem that gives us normalized demands $\hat{b}_i$ as function of normalized price $\hat{\alpha}_i$ to which causally refer as price of broadcasting. There are two sources that negatively affect consumption of broadcasting,- advertising and provision of sub-optimal programming in terms of domestic content. Our setup allows us to incorporate both of these factors into a single term, $\hat{\alpha}_i$, our normalized price. This normalized price is a relative price that consumer effectively has to pay in order to consume a unit of normalized broadcasting rather than leisure.

By solving this problem we get $b_i=\hat{\alpha}_i^{-\varepsilon}$ where ε is the elasticity of broadcasting demand with respect to normalized price. In the analysis of the equilibrium and its properties we have a situation where the existence of the equilibrium depends on the properties of the elasticity of demand ε.

Given that terrestrial broadcasting is a public good, advertising is the sole source of revenue for commercial broadcasters and the larger is the audience the higher is the price they are able to charge to advertisers. In our model the size of audience depends on proportion of advertising and proportion of domestic programming in the total volume of programming. We assume that individuals are distributed uniformly over their most-preferred domestic content ratio on the unit interval. Let us denote $p(B_i)$, $p^{B_i}(B_i)\geq 0$ [31], the price of advertising

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[30] Tirole (1997) gives a summary of arguments why advertising can be considered a nuisance.
[31] Hereafter we denote partial derivatives as superscripts.

per unit of time[32], in monetary units, where $B_i \equiv \int_{\underset{\cdot}{\delta}_i}^{\dot{\delta}_i} b_i(\delta)\,d\delta$ is the aggregate consumption of broadcasting of station i over its market: $\left(\underset{\cdot}{\delta}_i, \dot{\delta}_i\right)$ refers lower and upper boundary of the market of station i. Then, by assuming that stations have only fixed costs c_i[33], the stations' problem can be stated as follows:

$$\max_{\Delta_i, \tilde{\alpha}_i} \pi_i \equiv \left(p\left(B_i\right) + t_i\right)\tilde{\alpha}_i - c_i, \pi_i \geq 0, i = 1,2 \qquad (20),$$

where t_i refers to tax or subsidy given to station i[34].

The profit is a product of the (i) sum of price of advertising and tax/subsidy and (ii) the total amount of advertising during the time period[35], $\tilde{\alpha}_i$, where we set the time constraint of each station equal to that of individual, or 1,- this makes the total amount of advertising and the fraction of advertising during the time period coincide. It is convenient to work with increasing monotonic transformation of proportion of advertising, $\alpha_i \equiv \left(1-\tilde{\alpha}_i\right)^{-1}$ where $\alpha_i \in (1,\infty)$ rather than the proportion of advertising. Then, the normalized price can be stated as a product of advertising and monotonic transformation of compensation function, $\hat{\alpha}_i = \alpha_i h_i$. Assuming that $p\left(B_i\right) \equiv B_i^{\beta}$ is a constant elasticity function, $\beta > 0$, stations' objective function can be restated as

[32] There exist an argument which says that price should be concave in aggregate demand partially because the more consumers watch television or listen to radio the less time, presumably, they spend working, as such, the less income they have, therefore, the less they worth to advertisers. A more precise relationship between price of advertising and aggregate demand can be derived by explicitly modeling advertisers, however, curvature of the price function does not bear on the results.

[33] It can be argued that fixed costs represent the lion's share of costs faced by broadcasters as such the broadcasting industry is characterized by the increasing returns to scale technologies. Therefore, we assume that stations have strictly positive fixed costs yet small enough not to give rise to discontinuities of the best reply functions.

34 Please note that in our model small ad valorem taxes and subsidies have not effect.

$$\max_{\Delta_i,\alpha_i} \pi_i = \left(p\left(B_i\right)+t_i\right)\left(1-\frac{1}{\alpha_i}\right)-c_i, \pi_i \geq 0, i=1,2 \qquad (21).$$

To have a symmetric and tractable solution we concentrate on a duopoly case. We assume, as it often observed in the real world, that the government regulates entry into broadcasting market by issuing a limited number of licenses. This could allow stations to make positive profits in equilibrium. Without loss of generality we assume that station 1 locates to the left of station 2 on the unit domestic content ratio interval. Given uniform distribution of consumers we can rewrite the aggregate demand for broadcasting as $B_i \equiv \int_0^{\underline{u}_i} b(v)\,dv + \int_0^{\bar{u}_i} b(v)\,dv$ where $\underline{u}_i \equiv \Delta_i - \delta$, $\underline{u}_i \equiv \delta - \Delta_i$ are the distances to the lower and upper boundaries of market i, $i=1,2$.

Lemma 1: When $\underline{u}_1 = \bar{u}_2$ ***then (a)*** $\underline{u}_1$ ***is linearly increasing in*** Δ_1 ***at the rate of one and is independent of*** $(\Delta_2,\alpha_1,\alpha_2)$***, (b)*** $\bar{u}_1$ ***is linearly decreasing in*** Δ_1 ***and linearly increasing in*** Δ_2 ***at the rates of one-half, and is decreasing and convex in*** α_1 ***and is increasing in*** α_2***, (c)*** $\underline{u}_2$ ***is linearly decreasing in*** Δ_1 ***and linearly increasing in*** Δ_2 ***at the rates of one-half, and is increasing in*** α_1 ***and is decreasing and convex in*** α_2***, (d)*** $\bar{u}_2$ ***is linearly decreasing in*** Δ_1 ***at the rate of one and is independent of*** $(\Delta_1,\alpha_1,\alpha_2)$***. Further,*** $\frac{\partial^2 \bar{u}_1}{\partial\alpha_1\partial\alpha_2} = \frac{\partial^2 \underline{u}_2}{\partial\alpha_2\partial\alpha_1} = 0$ ***and***

$$\lim_{\zeta\to 0} -\frac{(r-1+\varepsilon)^2}{\eta^2\psi} = 0 \Rightarrow \lim_{\zeta\to 0}\frac{d\alpha_1}{d\Delta_1} = \lim_{\zeta\to 0}\frac{d\alpha_2}{d\Delta_1} = 0.$$

Proof: *See Appendix 1*■

[35] We assume that stations broadcast all the time and listeners randomly tune in during that time.

Our assumption of quasi-linear preferences allows us to write aggregate broadcasting demand as $B_i = \alpha_i^{-\varepsilon} H_i$, where $H(\underline{u}_i, \overline{u}_i, \zeta) \equiv \int_0^{\underline{u}_i} h(v)^{-\varepsilon} dv + \int_0^{\overline{u}_i} h(v)^{-\varepsilon} dv$ can be viewed as a proxy for aggregate satisfaction; small (large) H_i be the case where consumers, on average, are not very satisfied (very satisfied) with provided domestic content ratio.

Substituting for explicit expression of aggregate demands into profit function the objective function of each station is given by

$$\max_{\Delta_i, \alpha_i} \pi_i = \left(p\left(\alpha_i^{-\varepsilon} H_i\right) + t_i\right)\left(1 - \frac{1}{\alpha_i}\right) - c_i, \text{s.t.} \pi_i \geq 0, i = 1,2 \tag{22}$$

The first order-conditions for an interior solution are given by:

$$\pi_i^{\Delta_i} = p'\left(1 - \frac{1}{\alpha_i}\right)\alpha_i^{-\varepsilon} H_i^{\Delta_i} = 0, i = 1,2 \tag{23}$$

$$\pi_i^{\alpha_i} = \frac{p_i}{\alpha_i^2}\left(1 - \beta(\alpha_i - 1)(\varepsilon + \eta_i) + \frac{t_i}{p_i}\right) = 0, i = 1,2 \tag{24}$$

where $\eta_i \equiv -\frac{\alpha_i H_i^{\alpha_i}}{H_i} \geq 0$ [36] is the elasticity of aggregate satisfaction with respect to advertising. Taking derivative of H_i with respect to Δ_i yields $H_i^{\Delta_i} = \frac{\partial \underline{u}_i}{\partial \Delta_i} h(\underline{u}_i)^{-\varepsilon} + \frac{\partial \overline{u}_i}{\partial \Delta_i} h(\overline{u}_i)^{-\varepsilon}$, which for firm 1 reduces to $H_1^{\Delta_1} = h(\underline{u}_1)^{-\varepsilon} - \frac{1}{2} h(\overline{u}_1)^{-\varepsilon}$ and for firm 2 to $H_2^{\Delta_2} = \frac{1}{2} h(\underline{u}_2)^{-\varepsilon} - h(\overline{u}_2)^{-\varepsilon}$ [37]. By solving simultaneously the set of first-order conditions (23) and (24) we find a Nash equilibrium $(\Delta_1, \Delta_2, \alpha_1, \alpha_2)$.

[36] Properties of aggregate satisfaction function and its elasticity are given in Appendix 2.
[37] Derivation of properties of market boundaries are given in Appendix 1.

Lemma 2: In symmetric equilibrium the aggregate compensation function has the following derivative properties: $H_1^{\Delta_1} = H_2^{\Delta_2} = 0$, $H_1^{\Delta_1\Delta_1} = H_2^{\Delta_2\Delta_2} \le 0$, $H_1^{\Delta_2} = -H_2^{\Delta_1} = 2^{-1}h^{-\varepsilon}$,

$H_1^{\alpha_1} = H_2^{\alpha_2} = -H_2^{\alpha_1} = -H_1^{\alpha_2} = -h^{1-\varepsilon}\left(2\alpha h'\right)^{-1}$, $H_1^{\Delta_1\Delta_2} = H_2^{\Delta_2\Delta_2} = 4^{-1}\varepsilon h^{-\varepsilon-1}h'$,

$H_1^{\alpha_1\alpha_1} = H_2^{\alpha_2\alpha_2} = -h^{-\varepsilon-1}\left(\varepsilon-2\right)\left(4\alpha^2 h'\right)^{-1}$, $-H_1^{\Delta_1\alpha_1} = H_1^{\Delta_1\alpha_2} = -H_2^{\Delta_2\alpha_1} = H_2^{\Delta_2\alpha_2} = h^{-\varepsilon}\left(r-1+\varepsilon\right)\left(4\alpha\right)^{-1}$.

Proof: *See Appendix 2*■

Given that equilibrium advertising levels are the same, each station maximizes aggregate satisfaction of its market. In the neighborhood of equilibrium aggregate compensation function is decreasing in own advertising level at the increasing rate and increasing in the advertising level of the competitor. Other properties of compensation function are not so obvious however are extensively used in the analysis that follows.

Since both firms have identical costs structure then the equilibrium is symmetric. In such an equilibrium an indifferent consumer is located in the middle of the unit line. We focus on the first-order conditions of the first firm. In symmetric equilibrium results for the second firm are identical.

The first-order conditions of the first firm can be restated as $h\left(\Delta_1\right)^{-\varepsilon} - 1/2\,h\left(1/2-\Delta_1\right)^{-\varepsilon} = 0$. It is more convenient to work with the degree of content differentiation $m \equiv \Delta_2 - \Delta_1$. We can write the first-order condition as $\xi\left(m\right) = 2^{1/\varepsilon}$ where $\xi\left(m\right) \equiv h\left(1/2\left(1-m\right)\right)/h\left(1/2\,m\right)$. By inspecting this equation we observe that $0 \le m \le 1/2$ so that each station positions itself closer to the middle of the unit interval. Intuitively, consumers in the interior markets have a choice between tuning to station 1 or station 2. Consumers on the corner markets however have the ability to switch only to leisure. Therefore, consumers in the interior markets are more picky that those in the corner market. In this situation firms find it beneficial to cater the needs of the former group by locating closer to the middle of the market.

Lemma 3: $\xi(m)$ ***is decreasing and convex in*** m ***with*** $\lim_{m\to 0}\xi(m)=h(1/2)$***, and*** $\lim_{m\to 1/2}\xi(m)=1$ **.**

Proof: *See Appendix 3*■

To show that the equilibrium exists we need to show that for any pair of parameters (ζ,ε) there exist m that satisfies equation $\xi(m)=2^{1/\varepsilon}$. Since $\xi(m)$ is decreasing in m until $\xi(m)$ reaches its minimum at 1 while $2^{1/\varepsilon}\in(1,2)$ because $\varepsilon\in(2,\infty)$, the sufficient and necessary condition for the symmetric equilibrium to exist is to have $h(1/2)\geq 2^{1/\varepsilon}$. Given the set of parameters (ζ,ε) this condition can easily be satisfied. Further, by virtue of the fact that $\xi(m)$ is monotonic in m the symmetric equilibrium is unique.

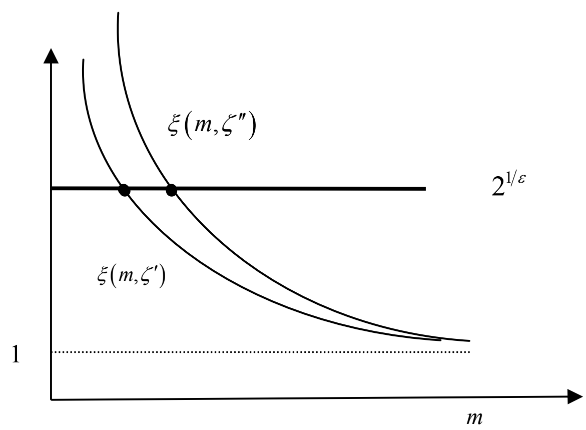

Figure 1: Equilibrium in location where $\zeta'<\zeta''$.

Having solved for the equilibrium locations we solve for equilibrium advertising levels. In the symmetric case firms choose different locations on the domestic content unit interval because choosing the same location reduces this game into a Bertrand game with increasing returns to scale technologies, where advertising levels plays the role of prices, and such a game does not have an equilibrium in pure strategies[38].

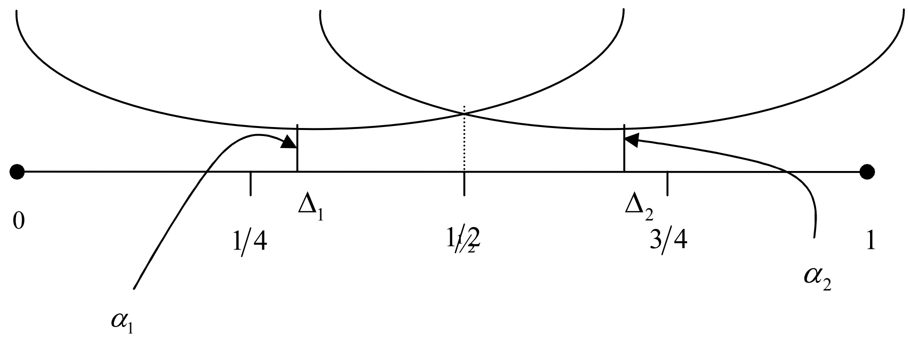

Figure 2: Symmetric equilibrium of the game.

In Figure 2 we show the effective price paid by individuals whose most-preferred content coincides with the available content. The height of the leg corresponds to the advertising rate (or mill price as described in Hoteling model of product differentiation) while the U-shaped curve corresponds to convex compensation function. The indifferent consumer locates at the intersection of such U-shaped curves, which in symmetric setup is equal to $1/2$.

Lemma 4: The elasticity of aggregate satisfaction with respect to advertising is increasing in its own advertising level, decreasing in the advertising level of the competitor. Moreover, it increases when own domestic content ratio and decreases when competitor's domestic content ratio approach the middle of the market.

Proof: *See Appendix 4*■

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[38] The equilibrium may have a mixed strategy equilibrium (Dasgupta and Maskin (1986)).

Intuitively, as the own price increases then listeners that belong to the own market become more sensitive to advertising and are more prone to switch to competitor. However, when the competitor increases its advertising then the own market grows more attached to the own station therefore elasticity of aggregate satisfaction falls. Further, when own location shifts towards the competitor, the average satisfaction of the own audience falls, therefore, consumers become more sensitivity to advertising. Hence, elasticity of aggregate satisfaction with respect to advertising increases. The exact opposite happens when the competitor moves towards the middle of the market in an attempt to capture more consumers.

Derivatives of the first-order conditions with respect to endogenous variables form a stability matrix of the system, S given by

$$S \equiv \begin{bmatrix} \pi_1^{\Delta_1\Delta_1} & \pi_1^{\Delta_1\Delta_2} & \pi_1^{\Delta_1\alpha_1} & \pi_1^{\Delta_1\alpha_2} \\ \pi_2^{\Delta_2\Delta_1} & \pi_2^{\Delta_2\Delta_2} & \pi_2^{\Delta_2\alpha_1} & \pi_2^{\Delta_2\alpha_2} \\ \pi_1^{\alpha_1\Delta_1} & \pi_1^{\alpha_1\Delta_2} & \pi_1^{\alpha_1\alpha_1} & \pi_1^{\alpha_1\alpha_2} \\ \pi_2^{\alpha_2\Delta_1} & \pi_2^{\alpha_2\Delta_2} & \pi_2^{\alpha_2\alpha_1} & \pi_2^{\alpha_2\alpha_2} \end{bmatrix} \qquad (25).$$

Lemma 5: The Stability matrix has negative trace and positive determinant.

Proof: *See Appendix 5*■

The system is stable if eigenroots of stability matrix have negative real parts. A sufficient condition for this are negative trace and positive determinant which is true by lemma 5[39].

For the second-order conditions we need $\pi_i^{\Delta_i\Delta_i} \leq 0$, $\pi_i^{\alpha_i\alpha_i} \leq 0$, which are shown to be true in Appendix 4, and the determinant of Hessian, $\pi_i^{\Delta_i\Delta_i}\pi_i^{\alpha_i\alpha_i} - \left(\pi_i^{\Delta_i\alpha_i}\right)^2 \geq 0$. Evaluating the latter at equilibrium we have

[39] See Dixit (1986) for detailed discussion of stability conditions.

$$\pi_i^{\Delta_i\Delta_i}\pi_i^{\alpha_i\alpha_i}-\left(\pi_i^{\Delta_i\alpha_i}\right)^2 \propto \varepsilon\left(1+2\left(\frac{h_c'/h_c}{h'/h}\right)\right)\left(\frac{1}{r-1+\varepsilon}\right)^2\left(\frac{2(\varepsilon+\eta)(1+\beta(\varepsilon+\eta))}{\eta}+\varepsilon+2\eta\right)-1 \quad (26).$$

Generally, the sign of determinant is ambiguous. For infinitely large sensitivity to domestic content, $\zeta\to\infty$, we have $\lim_{\zeta\to\infty} r(v,\zeta)=1$, by assumption, therefore, the determinant of Hessian is positive. On the other hand, when individuals exhibit low sensitivity to domestic content ratio then the answer depends on the interaction between ζ and ε. Assuming that elasticity of demand parameter, ε, dominates derivative functions of compensation function that are driven by the sensitivity parameter, ζ, equation (26) is positive. Therefore, the second-order conditions hold.

The system has three exogenous parameters, (i) sensitivity parameter ζ, (ii) elasticity of demand ε, and (iii) elasticity of price of advertising with respect to audience's size β. Comparative statics can then be summarized in the following lemmas.

Lemma 6. In symmetric equilibrium content differentiation and advertising levels increase with ζ***. Further, (i)*** $\lim_{\zeta\to\infty}(\Delta_2-\Delta_1)=1/2$ ***and*** $\lim_{\zeta\to\infty}\alpha_1=\lim_{\zeta\to\infty}\alpha_2=1+(\beta\varepsilon)^{-1}$ ***and (ii)*** $\lim_{\zeta\to 0}(\Delta_2-\Delta_1)=0$ ***and*** $\lim_{\zeta\to 0}\alpha_1=\lim_{\zeta\to 0}\alpha_2=1$**.**

Proof. *See Appendix 6*■

In equilibrium the firm finds a location where it balances the average compensation that needs to be provided to individuals located in the corner market against average compensation for individuals located in the interior market while also taking into account the ability of consumer(s) located on the boundary between station 1 and 2 to switch between firms. When sensitivity to content rises, the compensation to individuals located in the corner market increases faster than compensation that needs to be given to individuals located in the interior of the market. This happens because the compensation function is convex. Therefore, firm moves towards the corner of the market to equalize the value of average compensation between its two markets. In the limit as $\zeta \to \infty$, compensation that needs to be given to the indifferent consumer explodes to infinity and since no such compensation exists consumption by the indifferent consumer drops to zero. In this case each firm positions itself in the middle of its market. In the polar case where $\zeta \to 0$, consumption of individuals becomes independent of the distance between the available and the most-preferred domestic content, therefore, competition between stations in terms of locations reduces to capturing the indifferent consumer. Since such consumer locates in the middle of unit interval both stations locates as close to the middle of interval as possible[40].

Recall that the price facing a consumer is a product of the advertising and the degree of mismatch between available and the most-preferred domestic content. The latter is expressed in terms of the compensation function. Therefore, increase in ζ puts more weight on compensation function component of the actual price paid by consumer than on advertising, giving stations ability to raise prices. When ζ falls to zero the content differentiation vanishes and the game converges to "cutthroat" competition in advertising[41]. On the other hand, when $\zeta \to \infty$ we have H becoming arbitrarily small, say H_0, and

[40] In the analysis that follows we use an assumption that both stations choose to locate arbitrarily close the middle of the interval. As stated before, to have an equilibrium in the case where preferences are insensitive requires an arbitrary large value of elasticity of demand, however, it is shown in lemma 7 that rising elasticity forces firms to move away from each other. The final result is determined by the interplay of these two parameters and specific form of compensation function.

[41] Since fixed costs are strictly positive then advertising level are strictly greater than one. However, for the easy of analysis we assume that fixed costs are small enough as to allow us to approximate the advertising levels to be unity.

essentially irresponsive to changes in advertising. In this case the problem converges to $\max_{\alpha_i} \pi_i \equiv p\left(\alpha_i^{-\varepsilon} H_0\right)\left(1-\alpha_i^{-1}\right)$ s.t. $\pi_i \geq 0$ and the solution converges to $\alpha = 1+\beta^{-1}\varepsilon^{-1}$.

Lemma 7. In symmetric equilibrium content differentiation, m***, rises with*** ε ***while its effects on advertising are ambiguous.***

Proof. *See Appendix 7*■

As broadcasting demand becomes more elastic, individuals become more sensitive to the effective price they face, or become more selective in their consumption, therefore, firms move towards the middle of their respective markets to balance compensation that needs to be provide to individuals in the corner market against compensation for individuals located in the interior market. The effect of elasticity of demand on equilibrium advertising levels can not be asserted with a general form of compensation function. However, we expects that rise of elasticity triggers a fall of advertising levels because individuals become sensitive to broadcasting and more prone to switch to leisure.

Lemma 8. In symmetric equilibrium, content differentiation, m***, is independent of*** β***. Advertising levels fall in*** β***.***

Proof. *See Appendix 8*■

The intuition for lemma 8 is straightforward,- in symmetric equilibrium firms choose the same advertising levels therefore the indifferent consumer always locates in the middle of the interval. Therefore, the size of the market of each station for any value of parameter β is the same, - one half. In other words, the equilibrium content differentiation is independent of β. However, advertising levels do depend on parameter β. Recall that advertising enters firm's profit function in two ways, (a) directly and (b) indirectly through broadcasting pricing function where broadcasting demand is a function of advertising itself. Parameter β essentially plays the role of an amplifier or dampener of the effects of advertising on aggregate broadcasting demand. When $\beta > 1$ then negative effects of advertising on aggregate broadcasting are further amplified by the pricing function, thus, firms have smaller ability to "charge" consumers high advertising rates . In the opposite case, when $\beta < 1$, the negative effects that advertising has on aggregate broadcasting are debilitated which gives firms ability to bundle higher advertising proportions in their broadcastings.

3. Policies of the domestic content protection

We assume that the rationale behind government imposing a content restriction is to increase the aggregate consumption of domestic programs. The two most popular instruments are minimum quota on the proportion of domestic content (or domestic content requirement) and tax-cum-subsidy policies. Often however minimum quotas on domestic content go hand in hand with quota on the proportion of advertising, therefore, we also analyze the effects of regulation of advertising on consumption of domestic programs even though, we believe that governments do not intentionally use such regulations it as to stimulate consumption of thereof.

3.1. Domestic content requirement on the proportion of domestic content

The central question of this section is the effect marginal domestic content restriction has on consumption of the domestic content. Given that station 1 is the one with the low domestic content we assume that policy maker imposes a just-binding domestic content restriction of $\bar{\delta} = \Delta_1$, therefore, infinitesimal changes in $\bar{\delta}$ are equivalent to infinitesimal changes in Δ_1. Imposing marginal content requirement allows us to rip the benefits of the symmetric setup without sacrificing the essence of impact the domestic content requirement has on consumption of domestic programming.

The aggregate consumption of the domestic content is given by $\sum_{j=1}^{2} D_j = \sum_{j=1}^{2}\left(\Delta_j B_j / \alpha_j\right)$. By inspecting this expression we expect to see that changes in domestic content requirement have a direct effect on the aggregate consumption of the domestic programs and indirect effect though best-responses of the remaining variables of the system of equations (23) and (24). By differentiating aggregate consumption of domestic content with respect to Δ_1 we can write the proportional change in aggregate consumption of domestic programs as follows

$$\frac{\partial\left(\sum_{j=1}^{2} D_j\right) \Big/ \partial \Delta_1}{\sum_{j=1}^{2} D_j} = \frac{\sum_{j=1}^{2}\left(\frac{B_j}{\alpha_j}\frac{\partial \Delta_j}{\partial \Delta_1} - \frac{\Delta_j B_j}{\alpha_j^2}\frac{\partial \alpha_j}{\partial \Delta_1} + \frac{\Delta_j}{\alpha_j}\sum_{i=1}^{2}\left(\frac{\partial B_j}{\partial \Delta_i}\frac{\partial \Delta_i}{\partial \Delta_1} + \frac{\partial B_j}{\partial \alpha_i}\frac{\partial \alpha_i}{\partial \Delta_1}\right)\right)}{\sum_{j=1}^{2}\left(\frac{\Delta_j B_j}{\alpha_j}\right)} \qquad (27).$$

By imposing symmetry,- $B_1^{\alpha_1} = B_2^{\alpha_2} \le 0$, $B_1^{\alpha_2} = B_2^{\alpha_1} \ge 0$, $B_1^{\Delta_2} = -B_2^{\Delta_1} \ge 0$,- invoking the first-order conditions and noting that $\Delta_1 + \Delta_2 = 1$, (27) is written as

$$\begin{aligned} \frac{\partial\left(\sum_{j=1}^{2} D_j\right) \Big/ \partial \Delta_1}{\sum_{j=1}^{2} D_j} &= \left[1 - \omega + \chi_{\Delta_2}\left(\omega + \frac{\Delta_2}{\Delta_1}\right)\right] \\ &+ \left[\chi_{\alpha_1}\left(-(\eta + \varepsilon + 1) + \frac{\Delta_2}{\Delta_1}\eta\right) + \chi_{\alpha_2}\left(-\frac{\Delta_2}{\Delta_1}(\eta + \varepsilon + 1) + \eta\right)\right] \end{aligned} \qquad (28),$$

where we denote best-response elasticities of endogenous variables as $\chi_{\Delta_2} \equiv \frac{\Delta_1}{\Delta_2}\frac{\partial \Delta_2}{\partial \Delta_1}$, $\chi_{\alpha_1} \equiv \frac{\Delta_1}{\alpha_1}\frac{\partial \alpha_1}{\partial \Delta_1}$, and $\chi_{\alpha_2} \equiv \frac{\Delta_1}{\alpha_2}\frac{\partial \alpha_2}{\partial \Delta_1}$. Parameter $\omega \equiv \Delta_2 B_1^{\Delta_2} / B_1 \in (0, 1/2)$ refers to elasticity of aggregate demand of station i with respect to location of station j, $i \neq j$, $0 \leq \omega < 1$. We refer to the first term of equation (28) as the "location effect", Σ_{Δ}, and to the second term as the "advertising effect", Σ_{α}.

To obtain $\left(\chi_{\Delta_2}, \chi_{\alpha_1}, \chi_{\alpha_2}\right)$ we totally differentiate the set of first order conditions and evaluate the result at equilibrium. Therefore, we have: $\frac{d\Delta_2}{d\Delta_1} = -\frac{\lambda_5 - \lambda_2\left(\lambda_3 + \lambda_4\right)}{\lambda_5 + \lambda_1\left(\lambda_3 + \lambda_4\right)}$,

$\frac{d\alpha_1}{d\Delta_1} = -\frac{\lambda_5\left(2+\lambda_5\right) - \lambda_2\left(\left(1+\lambda_5\right)\lambda_3 + \lambda_4\right) + \lambda_1\left(\lambda_3 + \left(1+\lambda_5\right)\lambda_4\right)}{\left(\lambda_5 + \lambda_1\left(\lambda_3 + \lambda_4\right)\right)\left(\lambda_3 - \lambda_4\right)}$, and

$\frac{d\alpha_2}{d\Delta_1} = -\frac{\lambda_5\left(2+\lambda_5\right) + \lambda_1\left(\left(1+\lambda_5\right)\lambda_3 + \lambda_4\right) - \lambda_2\left(\lambda_3 + \left(1+\lambda_5\right)\lambda_4\right)}{\left(\lambda_5 + \lambda_1\left(\lambda_3 + \lambda_4\right)\right)\left(\lambda_3 - \lambda_4\right)}$, where λ_j, $j = 1,2,3,4,5$, are defined in Appendix 4.

In the analysis below we consider two polar cases, (i) the case where individuals have high sensitivity to domestic content ratio, $\zeta \to \infty$, and (ii) the case where individuals are nearly insensitive to domestic content ratio, $\zeta \to 0$.

When preferences are sensitive to domestic content then we have $\lim_{\zeta \to \infty} \Delta_1 = 1/4$, as shown in Lemma 6. Therefore, using the fact that in symmetric equilibrium the indifferent consumer locates in the middle of the domestic content ratio unit interval we have $\lim_{\zeta \to \infty}\left(\frac{h\left(1/2 - \Delta_1, \zeta\right)}{h^{v}\left(1/2 - \Delta_1, \zeta\right)}\right) = 0$, $\lim_{\zeta \to \infty}\left(\frac{h\left(1/2 - \Delta_1, \zeta\right)^{-\varepsilon}}{2H\left(\Delta_1, 1/2 - \Delta_1, \zeta\right)}\right) = 0$, hence, $\lim_{\zeta \to \infty} \eta\left(\Delta_1, 1/2 - \Delta_1, \zeta\right) = 0$.

Intuitively, $\zeta \to \infty$ implies that the importance of the provided content in the choice of consumption of individuals is very high relative to importance of advertising, therefore, the aggregate satisfaction, H, becomes insensitive to changes in advertising yet highly sensitive to changes in location.

In the opposite case where consumers are insensitive to domestic content ratio we have locations of each firm converging towards the indifferent consumer located in the middle of the unit interval, or $\lim_{\zeta\to 0}\Delta_1 = 1/2$. Therefore, $\lim_{\zeta\to 0}\left(\frac{h(1/2-\Delta_1,\zeta)}{h^v(1/2-\Delta_1,\zeta)}\right)=\infty$ and $\lim_{\zeta\to 0}\left(\frac{h(1/2-\Delta_1,\zeta)^{-\varepsilon}}{2H(\Delta_1,1/2-\Delta_1,\zeta)}\right)=1$ imply that $\lim_{\zeta\to 0}\eta(\Delta_1,1/2-\Delta_1,\zeta)=\infty$. The intuition for this result is the following,- once domestic content ratio is irrelevant the only factor capable of affecting broadcasting demand (and the level of satisfaction with domestic content) is advertising. Essentially, as sensitivity to content drops to zero stations become perfect substitutes (in terms of domestic content ratio), as such, the game converges to a Bertrand game where advertising levels play the role of prices. Undercutting competitor in advertising level means gaining the whole market, thus, infinitesimal changes in the level of advertising bring about all-or-nothing levels of satisfaction provided by station which undertakes the change.

Lemma 9. In symmetric equilibrium the effect of quota on foreign content on the location of firm with high domestic content depends on the compensation function. When compensation function is very sensitive to domestic content ratio, $\zeta\to\infty$***, the elasticity of best-response function of location of station with high domestic content ratio,*** χ_{Δ_2}***, approaches*** $1/9$***. When compensation function is insensitive to domestic content ratio,*** $\zeta\to 0$***, the elasticity of best-response function of location of station with high domestic content ratio approaches*** -1***.***

Further, the elasticity of advertising with respect to domestic content requirement of a firm with low domestic programming content is generally ambiguous; the elasticity of a firm with high domestic content is negative. In the limiting cases where preferences are either extremely sensitive to domestic content or totally insensitive to domestic content both elasticities of advertising approach zero. Moreover, the absolute value of elasticity of advertising with respect to the quota of a firm with high domestic content is always larger than the absolute value of the elasticity with respect to the quota of the firm with low domestic content.

Proof. *See Appendix 9*■

The intuition for the above result is as follows,- for any given advertising level the optimal domestic content differentiation is the one that maximizes H. It can be shown that such differentiation requires $\Delta_1 = 1/4$ and $\Delta_2 = 3/4$. Since content protection policy reduces the distance between two stations on the domestic content ratio scale then an average price faced by individuals raises (or H falls), therefore, stations need to compensate individuals for such an increase of price. The only way to do that is to lower the average level of advertising for the market.

The response of the station with high domestic content ratio to increase in content ratio of station with low domestic content ratio is composed of two effects,- firstly, when station 2 moves away from station 1 it loses an indifferent consumer, however, without this consumer station 2 no longer optimizes its location since the average compensation to the right of its location is larger than the average compensation to the left of its location, therefore, by moving towards individuals located to the right it equalizes the average compensation. Secondly, by decreasing its advertising level, firm 2 may capture back the indifferent consumer and therefore reduce or eliminate altogether the need to adjust its location. Mathematically, $\chi_{\Delta_2} = \frac{\alpha}{\Delta_2 \lambda_1}\left[\frac{\Delta_1 \lambda_2}{\alpha} + \left(\chi_{\alpha_2} - \chi_{\alpha_1}\right)\right]$. $\chi_{\alpha_2} - \chi_{\alpha_1} \propto -\lambda_5\left(\lambda_1 + \lambda_2\right)\left(\lambda_3 - \lambda_4\right) \leq 0$, therefore, the sign of χ_{Δ_2} is determined by the interaction of the two terms in the square brackets. When

$\Delta_1 \uparrow \Rightarrow \underline{u}_2 \downarrow \big| d\Delta_2 = 0 \Rightarrow h\left(\underline{u}_2\right) \downarrow \Rightarrow h\left(\underline{u}_2\right)^{-\varepsilon} \uparrow \Rightarrow \left(\frac{1}{2} h\left(\underline{u}_2\left(\Delta_2, \alpha_2\right)\right)^{-\varepsilon} - h\left(\bar{u}_2\left(\Delta_2, \alpha_2\right)\right)^{-\varepsilon}\right) \uparrow$. In the equilibrium the last expression is given by $\left(\frac{1}{2} h\left(\underline{u}_2\left(\Delta_2, \alpha_2\right)\right)^{-\varepsilon} - h\left(\frac{1}{2} - \underline{u}_2\left(\Delta_2, \alpha_2\right)\right)^{-\varepsilon}\right)$. Since this expression comes from unconstrained profit maximization of station 2, station 2 changes its location and advertising levels as to rebalance this equation. First of all, for a given advertising level, the only way to rebalance it is to shift Δ_2 up. Alternatively, for fixed Δ_2 station 2 may rebalance this equation by lowering its advertising level ($\chi_{\alpha_2} - \chi_{\alpha_1} \leq 0$ implies that response of station 1 to capture back the indifferent consumer by lowering its advertising level is smaller than the response of station 2) which leads to recapture of the indifferent consumer and return of status quo to the first-order condition with respect to location. There two effects move in opposite direction and that is what makes the sign of $\partial\Delta_2/\partial\Delta_1$ ambiguous.

With the rise of sensitivity, the importance of the indifferent consumer in relation to the density of consumers who belong to station's 2 market falls, therefore, we observe that the elasticity approaches $1/9$. On the other hand, when sensitivity of preferences to domestic content is very small then competition becomes all about the indifferent consumer. In this case a movement by station 1 towards the indifferent consumer makes such a consumer switch to station 1, therefore, to prevent this from happening station 2 moves towards station 1 by the exactly the same amount. For all intermediate values of ζ the sign of elasticity of location is generally ambiguous. In the simulation section it is shown that the effect is negative for small values of ζ and raises with the rise of ζ.

Lemma 10. The sign of location effect depends on the sensitivity of preferences to domestic content ratio. When preferences are highly sensitive to content then the location effect converges to $4/3$***, when preferences are insensitive to content the location effect converges to*** -1**.**

Proof. *See Appendix 10*■

The location effect can be decomposed into a direct effect, which is proportional to 1, and indirect effect, which is proportional to $-\omega+\chi_{\Delta_2}\left(1+\Delta_2/\Delta_1\right)$. With uniform preferences and perfect substitutability of normalized broadcasting demands the interaction between stations goes through indifferent consumer and advertising. When preferences are highly sensitive to domestic content ratio then the value of the indifferent consumer becomes negligible since his/her consumption is virtually zero, therefore, the indirect effect becomes small. This is what is reflected in both ω and χ_{Δ_2} being small. Therefore, the positive direct effect is the dominating one, as such, the location effect is positive. On the contrary, when preferences are insensitive to domestic content then the competition becomes all about the indifferent consumer. In this case the absolute value of the impact of location on indifferent consumer becomes very large which makes location effect negative. Intuitively, if policy forces station 1 to move its location closer to the indifferent consumer then the only way for station 2 to keep such a consumer indifferent is to move towards him by the exactly the same amount.

Lemma 11. The sign of the advertising effect is positive. When preferences are either highly sensitive to domestic content ratio or insensitive to domestic content ratio then the effect vanishes.

Proof. *See Appendix 11*■

Since content protection policy reduces domestic content differentiation further away from the optimal content differentiation, consumers demand higher compensation. The only way for firms to compensate consumers is to lower their advertising levels. Lower advertising raises the aggregate broadcasting demand, therefore, the fraction of the demand that corresponds to domestic programs. When sensitivity of preference is large then advertising has little effect because H essentially becomes independent of advertising. When sensitivity to domestic content is extremely small then location does not matter anymore since consumers are willing to buy from any station that charges lower advertising rates. Then, advertising levels become insensitive to location and the advertising effect converges to zero.

When preferences are infinitely sensitive to domestic content ratio then, from advertising point of view, the markets of station 1 and 2 become independent of each other. In such case any change in location has no impact on optimal choice of advertising. However, when preferences are insensitive to content then the overall effect of content depends on the interplay of two factors,- (i) low sensitivity to content forces stations to locate as close as possible. Locating as close as possible converges the game into a Bertrand game in prices and intensifies competition in advertising. Thus, advertising becomes extremely sensitive to content. On the other hand, (ii) when stations locate right next to the indifferent consumer then location stops playing any role in the choice of advertising, therefore, advertising becomes independent of location. These two effects move in opposite directions and it has been shown that in the limit the second effect dominates the first effect.

The sum of location and advertising effects gives total effect. Therefore, the effect of minimum quota on the proportion of domestic content can be summarized in the following proposition.

Proposition 1. The effect of marginal content protection policies on consumption of domestic programs depend on the sensitivity of preferences to domestic content ratio. When sensitivity is large then policy has a positive effect on the consumption of domestic programs. Further, when sensitivity is low then the policy has an adverse effect on the consumption of domestic programs. For intermediate values of sensitivity to content the effect is ambiguous.

Proof of Proposition 1. The *proof follows directly from lemmas 10 and 11*■

When sensitivity to content is extreme then the equilibrium converges to the case where markets of each stations are essentially independent of each other, therefore, the effect of domestic content requirement of station 2 is zero. Further, since the weight of advertising in the price faced by consumer is virtually nil as opposed to the weight of loss due to mismatch of specification, the effect of content requirement on advertising is zero as well.

Hence, the overall effect of content requirement is equivalent to the direct effect of content requirement which is always positive[42].

On the contrary, when consumers are basically indifferent to domestic content then competition between stations boils down to capturing the indifferent consumer. In this case firm 2 changes its location as to exactly offset any changes in location by station 1. Further, since the location and advertising choices become independent of each other, the advertising effect converges to zero. In this case, the overall effect of content protection policies leads to the reduction in consumption of aggregate domestic programs.

This bears direct link to the content protection policies of some of the European and former Soviet Union countries,- marginal content protection policies in countries where population considers low domestic content not to be an issue, such as some western European countries, domestic content requirement reduces product differentiation in the broadcasting market and reduce the overall satisfaction with broadcasting programming. For marginal changes in domestic content requirement this translates into lower consumption of the domestic programs. On the other hand, in countries with significant language barrier marginal content protection policies essentially becomes ineffective since individuals whose preferences slightly differ from available content consume virtually no broadcasting, as such, policy has an impact only on individuals with most-preferred domestic content ratio in the vicinity of available content. Since the density of such consumers is very small then the effect of domestic content requirement is negligible. In the elasticity terms, however, the effect of such policies is positive, i.e. an infinitesimal change in consumption of the domestic

[42] The absolute value of the change in the consumption of domestic programs is zero because the only consumer

programs is large if one is to weigh it against an equally infinitesimal original consumption of domestic programs. Summarizing, if individuals consume very little of broadcasting demand due to high sensitivity to domestic content ratio then imposing a content requirement certainly increases consumption of domestic content but by very small amount that such policy may not worth the effort. On the other hand, when individuals' consumption of broadcasting is sizable because such individuals are nearly insensitive to the ratio of domestic programs in the total volume of broadcasting then content protection policy may have a significant counterproductive effect on the aggregate consumption of domestic programs.

One important aspect of the above analysis is the absence of exit strategies. If one is to assume that one station has a certain cost advantage over the other station then content restriction may lead to negative profits by less efficient station and subsequent exit from the market. In this situation the overall domestic content falls dramatically because the survivor positions itself at either the middle of market or content restriction limit, whichever is greater. This leads to increase in the aggregate compensation which is equivalent to a drop in broadcasting demand, thus, a drop in the consumption of the domestic content. This effect is further amplified by the increase in advertising levels due to monopolistic position of the station and further fall in the broadcasting demand.

3.2. The effect of subsidies and taxes on consumption of domestic programming

An alternative vehicle used by governments around the world to resist the offensive of foreign programs into domestic market is to employ tax-cum-subsidy policies in which stations with low domestic content are taxed and proceeds are distributed to high domestic

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that matters for each station is the one whose most-preferred content coincides with the available content. Such consumer, however, has zero mass as such the aggregate demand is essentially non-existent.

content stations. This regulation often takes the form where (i) commercial stations (often low domestic content stations) pay the fraction of their license fees to a special fund which supports public stations (often high domestic content stations) or (ii) where government imposes a direct tax on the price of advertising of commercial and redistributed the proceeds to high domestic content stations. The former corresponds to increases in fixed costs while the latter corresponds to increases in the price of advertising. In this paper we focus on the latter because in our model costs have no impact on decisions of stations with respect to either location or advertising.

Often in the real world stations that get subsidized are public stations rather than commercial stations. Commercial advertising for these stations is not the main source of financing. We, however, can still fit them inside the framework of our model by thinking about the time spent thanking sponsors and contributors as a proxy for advertising.

We assume that stations and the government operate in a general equilibrium framework in the sense that all tax/license proceeds collected from the low domestic content ratio station are distributed to the high domestic content ratio station. In a symmetric equilibrium the government budget constraint reduces to station 2 receiving subsidy exactly equal to the tax levied upon station 1. We assume that the government issues license to station 1 to provide low domestic content television and to station 2 to provide high domestic content station in an omnipotent manner.

To obtain the effects of marginal taxes on the consumption of domestic programs we differentiate aggregate consumption of domestic programming with respect to t and evaluate at small tax. Thus, we have

$$\frac{\partial\left(\sum_{j=1}^{2} D_j\right)\Big/\partial t}{\sum_{j=1}^{2} D_j} = \left(2-(\Delta_2-\Delta_1)\left(\frac{B_1^{\Delta_2}}{B_1}\right)\right)y_\Delta - (\Delta_2-\Delta_1)\left(\frac{1-\eta}{\alpha}\right)y_\alpha, \text{ where } y_\Delta \equiv \frac{\partial\Delta_1}{\partial t} = \frac{\partial\Delta_2}{\partial t},$$

$y_\alpha \equiv -\frac{\partial\alpha_1}{\partial t} = \frac{\partial\alpha_2}{\partial t}$ and $\left(\frac{B_1^{\Delta_2}}{B_1}\right) = \frac{h^{-\varepsilon}}{2H} \leq 1$. To obtain comparative statics we differentiate the set of first -order conditions with respect to t:

$$\begin{bmatrix} \pi_1^{\Delta_1 t} \\ \pi_2^{\Delta_2 t} \\ \pi_1^{\alpha_1 t} \\ \pi_2^{\alpha_2 t} \end{bmatrix} + \begin{bmatrix} \pi_1^{\Delta_1\Delta_1} & \pi_1^{\Delta_1\Delta_2} & \pi_1^{\Delta_1\alpha_1} & \pi_1^{\Delta_1\alpha_2} \\ \pi_2^{\Delta_2\Delta_1} & \pi_2^{\Delta_2\Delta_2} & \pi_2^{\Delta_2\alpha_1} & \pi_2^{\Delta_2\alpha_2} \\ \pi_1^{\alpha_1\Delta_1} & \pi_1^{\alpha_1\Delta_2} & \pi_1^{\alpha_1\alpha_1} & \pi_1^{\alpha_1\alpha_2} \\ \pi_2^{\alpha_2\Delta_1} & \pi_2^{\alpha_2\Delta_2} & \pi_2^{\alpha_2\alpha_1} & \pi_2^{\alpha_2\alpha_2} \end{bmatrix} \begin{bmatrix} d\Delta_1/dt \\ d\Delta_2/dt \\ d\alpha_1/dt \\ d\alpha_2/dt \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} \qquad (29).$$

Since, in order to preserve symmetry, we evaluate comparative statics at small tax, $t = 0$, the only new terms added to the analysis from the previous section are $\pi_1^{\Delta_1 t} = \pi_2^{\Delta_2 t} = 0$ and $\pi_1^{\alpha_1 t} = -\pi_2^{\alpha_2 t} = -\frac{1}{\alpha^2}$.

The solution to (29) is $y_\Delta \equiv \frac{\partial\Delta_1}{\partial t} = \frac{\partial\Delta_2}{\partial t} = \frac{2\lambda_6}{(\lambda_1-\lambda_2)(\lambda_3+\lambda_4)+2\lambda_5}$,

$y_\alpha \equiv -\frac{\partial\alpha_1}{\partial t} = \frac{\partial\alpha_2}{\partial t} = \frac{(\lambda_1-\lambda_2)\lambda_6}{(\lambda_1-\lambda_2)(\lambda_4+\lambda_3)+2\lambda_5}$, where $\lambda_6 \equiv \frac{4H}{\beta ph^{-\varepsilon}(\alpha-1)(r-1+\varepsilon)}$. By expanding y_Δ and y_α we have $y_\Delta = \frac{2H(\varepsilon+\eta)}{ph^{-\varepsilon}}\left\{\frac{\varepsilon(\psi-1)}{r-1+\varepsilon}\left(\frac{(\varepsilon+\eta)(1+\beta(\varepsilon+\eta))}{\eta}+\varepsilon+2\eta\right)+\eta\right\}^{-1}$, and

$y_\alpha = \frac{(\varepsilon+\eta)}{p\eta}\frac{(\psi-1)}{2}\frac{\varepsilon\alpha}{r-1+\varepsilon}\left\{\frac{\varepsilon(\psi-1)}{r-1+\varepsilon}\left(\frac{(\varepsilon+\eta)(1+\beta(\varepsilon+\eta))}{\eta}+\varepsilon+2\eta\right)+\eta\right\}^{-1}$, where we have imposed our assumption that $t = 0$.

Lemma 12. Marginal taxes/subsidies raise domestic content ratio of each station. For high sensitivity to content the effect of taxes/subsidies on equilibrium locations is

high. On the other hand, when sensitivity to content is low the effect of taxes/subsidies is minimal.

Proof. *See Appendix 12*■

Lemma 13. Marginal taxes/subsidies reduce advertising levels of the taxed station and increase advertising levels of the subsidized station. For high sensitivity to content the effect of taxes/subsidies on equilibrium advertising levels goes to infinity. On the other hand, when sensitivity to content is infinitesimally small then the effect of taxes/subsidies converges to zero.

Proof. *See Appendix 13*■

The intuition for this result is convoluted. On the one hand, by taxing station 1 government puts pressure on its advertising rates, therefore, to compensate for the loss of revenue station 1 moves towards station 2 in order to capture an indifferent consumer. On the other hand, station 2 receives a subsidy and can afford to "charge" its customers higher advertising levels. Further, it alleviates the pressure on competition by moving away from firm 1.

By putting lemma 12 and 13 together we have the following proposition.

Proposition 2. In symmetric equilibrium the effect of tax-cum-subsidy policies on consumption of domestic content depends on the sensitivity of preferences to domestic content ratio. When sensitivity is high then a tax-cum-subsidy policy has large negative effect on consumption of the domestic content. When sensitivity is low domestic consumption remains unchanged following the introduction of a policy.

Proof. *See Appendix 14*■

Similarly to results of a quota on broadcasting of foreign content, the effects of tax-cum-subsidy policies on consumption of domestic programs depends on the sensitivity of preferences to domestic content ratio. For societies in which there exist a significant language barrier such policies may be counterproductive because the fall of the aggregate demand can not be compensated by the increase in relative proportion of domestic content due to high sensitivity to content ratio. For societies in which the language by itself does not preclude consumption of domestic programs the effects of subsidies is minuscule because locations and advertising levels remain unchanged as people are indifferent to domestic content ratio.

3.3. The effect of regulation of advertising on consumption of domestic programs

Governments often limit competition in broadcasting market by issuing a limited number of broadcasting licenses. This is especially true for terrestrial television. Limited competition normally leads to increase in both the price of advertising and proportion of advertising in the total volume of broadcasting. Given that advertising is more likely to be viewed as a nuisance, one way to deal with it is to impose a ceiling on the proportion of advertising. In this section we consider the effect of such regulation on the consumption of domestic programs, even though, we believe, that governments do not impose advertising ceilings to regulate consumption of domestic programming. To do so we differentiate the aggregate consumption of the domestic programs

$$\frac{\partial\left(\sum_{j=1}^{2} D_j\right)\Big/\partial\alpha}{\sum_{j=1}^{2} D_j} = \frac{\sum_{j=1}^{2}\alpha_j^{-1}\left(-\Delta_j B_j/\alpha + \left(\partial\Delta_j/\partial\alpha\right)B_j + \Delta_j\sum_{i=1}^{2}\left(B_j^{\Delta_i}\left(\partial\Delta_i/\partial\alpha\right) + B_j^{\alpha_i}\right)\right)}{\sum_{j=1}^{2}\left(\Delta_j B_j/\alpha_j\right)} \quad (30).$$

By imposing the first-order conditions and symmetry (30) can be restated as

$$\frac{\partial\left(\sum_{j=1}^{2} D_j\right)\Big/\partial\alpha}{\sum_{j=1}^{2} D_j} = \sum_{j=1}^{2}\left(-\Delta_j/\alpha + \left(\partial\Delta_j/\partial\alpha\right)\left(1+\frac{\Delta_j B_j^{\Delta_i}}{B_j}\right) + \Delta_j \sum_{i=1}^{2}\frac{B_j^{\alpha_i}}{B_j}\right) \qquad (31).$$

Proposition 3. Marginal quotas on proportion of advertising increase consumption of domestic programs.

Proof. *See Appendix 15*■

This result should not come as a surprise,- any reduction in advertising raises demand for broadcasting, and therefore, consumption of domestic programs.

3.4. The effects of domestic content requirement in the presence of binding regulation of advertising

Regulation of advertising and domestic content requirement often go hand in hand. In fact, many firms find themselves twice constrained by the regulation of advertising and by quota on proportion of foreign content. In this section we investigate the effect of domestic content requirement in the presence of the binding advertising regulation.

We start by deriving the effect of domestic content requirement on the choice of domestic content ratio of the second firm. By differentiation the first-order condition of location choice of firm two with respect to location of the first firm we have

$\chi_{\Delta_2} \equiv \frac{\Delta_1}{\Delta_2}\frac{\partial\Delta_2}{\partial\Delta_1} = \frac{\Delta_1}{\Delta_2}\left(\frac{\pi_2^{\Delta_2\Delta_1}}{-\pi_2^{\Delta_2\Delta_2}}\right) \geq 0$. In the absence of interaction through advertising, the only option station 2 has to respond to change in location of station 1 is to move up on the domestic content ratio scale.

Proposition 4. A quota on proportion of foreign content in the presence of binding advertising constraint increases the aggregate consumption of domestic programs.

Proof of Proposition 4. *The effect of quota under constrained advertising levels is equal to location effect, however, now* $\chi_{\Delta_2} \geq 0$. *Given that* $\omega \leq 1/2$ *the location effect is positive*■

The location effect is decomposed into a direct effect and indirect effect. The direct effect is given by change aggregate consumption of domestic programs for fixed broadcasting demand. The indirect effect is associated with the change in the broadcasting demand. However, the magnitude of the indirect effect is small relative to the direct effect, which causes the overall effect to be positive. The implications of this result is that in countries where stations find the advertising constraint to be binding, marginal increases in content requirement do indeed lead to higher consumption of domestic programming.

4. Simulation results

In order to assert the main qualitative results of this paper for intermediate values of parameters of the model we perform simulation analysis using the compensation function of the form $h(v,\zeta) = \begin{cases} 1 + \sum_{j=0}^{J}\left(\left(\zeta + j\right)v\right)^{\zeta + j} & \zeta \geq 1, J \geq 1 \\ 1 + \sum_{j=1}^{J} v^{\frac{1}{\zeta}+j} & 0 \leq \zeta \leq 1, J \geq 1 \end{cases}$. This compensation function is flexible in the sense that it allows us to consider cases where individuals' sensitivity to content ranges from insensitive ($\zeta = 0$) to infinitely sensitive ($\zeta = \infty$). We set parameter values of $\beta = 0.01$

and $J=1$ since they do not bear on any qualitative results. We consider three cases: (i) $\varepsilon=2$, (ii) $\varepsilon=16$ and (ii) $\varepsilon=32$. We consider cases (ii) and (iii) in order to have a sensible comparison of cases with large and small ζ [43].

4.1. Domestic content requirement on the proportion of domestic content in the total volume of broadcasting

(i) $\varepsilon=2$

ζ	$\Delta_2-\Delta_1$	α	χ_{Δ_2}	χ_{α_1}	χ_{α_2}	Σ_Δ	Σ_α	$\Sigma_\Delta+\Sigma_\alpha$
0.2	NE[44]	NE	NE	NE	NE	NE	NE	NE
0.3	NE	NE	NE	NE	NE	NE	NE	NE
0.4	NE	NE	NE	NE	NE	NE	NE	NE
0.5	NE	NE	NE	NE	NE	NE	NE	NE
0.6	NE	NE	NE	NE	NE	NE	NE	NE
0.7	NE	NE	NE	NE	NE	NE	NE	NE
0.8	0.1606	3.6006	0.0381	-0.4309	-0.5001	0.9489	3.4163	4.3651
0.9	0.1820	3.8990	0.1310	-0.2245	-0.3053	1.0829	2.0490	3.1319
1	0.1944	4.0836	0.1687	-0.1365	-0.2215	1.1417	1.4458	2.5876
1	0.3249	4.7163	0.1435	-0.1280	-0.1931	1.1073	1.5643	2.6715
2	0.4173	5.3438	0.1298	-0.1186	-0.1540	1.1148	1.4944	2.6093
3	0.4600	5.8115	0.1228	-0.0551	-0.0618	1.2027	0.6673	1.8700
4	0.4772	5.9712	0.1179	-0.0129	-0.0132	1.2963	0.1505	1.4468
5	0.4840	5.9975	0.1159	-0.0015	-0.0015	1.3287	0.0173	1.3460
6	0.4871	5.9999	0.1150	-0.0001	-0.0001	1.3330	0.0012	1.3342
7	0.4889	6.0000	0.1144	0.0000	0.0000	1.3333	0.0001	1.3334
8	0.4902	6.0000	0.1140	0.0000	0.0000	1.3333	0.0000	1.3333
9	0.4912	6.0000	0.1137	0.0000	0.0000	1.3333	0.0000	1.3333
10	0.4920	6.0000	0.1135	0.0000	0.0000	1.3333	0.0000	1.3333

Table 1: The effects of domestic content requirement on the consumption of the domestic programs in the case of small elasticity of demand.

(ii) $\varepsilon=16$

[43] Recall that due to uniform distribution of preferences over the most-preferred domestic content ratio for small values of ζ the equilibrium exists only for large enough ε.

[44] NE refers to No Equilibrium.

ζ	$\Delta_2-\Delta_1$	α	χ_{Δ_2}	χ_{α_1}	χ_{α_2}	Σ_Δ	Σ_α	$\Sigma_\Delta+\Sigma_\alpha$
0.2	0.0106	1.0000	-0.9789	0.0000	0.0000	-0.0117	0.0005	-0.0112
0.3	0.2766	1.1937	-0.4054	-0.6918	-0.6933	0.0155	32.6035	32.6190
0.4	0.3941	1.4773	0.0810	-0.1271	-0.1396	0.9411	7.6998	8.6409
0.5	0.4321	1.5591	0.1209	-0.0515	-0.0597	1.1111	3.4577	4.5688
0.6	0.4474	1.5913	0.1244	-0.0284	-0.0321	1.1906	1.9166	3.1072
0.7	0.4548	1.6062	0.1240	-0.0171	-0.0187	1.2404	1.1415	2.3818
0.8	0.4587	1.6136	0.1234	-0.0110	-0.0116	1.2712	0.7198	1.9910
0.9	0.4609	1.6176	0.1229	-0.0074	-0.0077	1.2903	0.4799	1.7702
1	0.4621	1.6198	0.1226	-0.0052	-0.0054	1.3022	0.3374	1.6396
1	0.4783	1.6246	0.1176	-0.0007	-0.0007	1.3288	0.0484	1.3772
2	0.4897	1.6250	0.1142	-0.0001	-0.0001	1.3329	0.0049	1.3378
3	0.4950	1.6250	0.1126	-8.7437	-8.7437	1.3333	0.0000	1.3333
4	0.4972	1.6250	0.1120	-13.3496	-13.3496	1.3333	0.0000	1.3333
5	0.4980	1.6250	0.1117	-22.4199	-22.4199	1.3333	0.0000	1.3333
6	0.4984	1.6250	0.1116	-34.7612	-34.7612	1.3333	0.0000	1.3333
7	0.4986	1.6250	0.1115	-45.5408	-45.5408	1.3333	0.0000	1.3333
8	0.4988	1.6250	0.1115	-57.5439	-57.5439	1.3333	0.0000	1.3333
9	0.4989	1.6250	0.1114	-72.9405	-72.9405	1.3333	0.0000	1.3333
10	0.4990	1.6250	0.1114	-81.0229	-81.0229	1.3333	0.0000	1.3333

Table 2: **The effect of domestic content requirement on consumption of domestic programs in the case of medium elasticity of demand.**

(iii) $\varepsilon = 32$

ζ	$\Delta_2-\Delta_1$	α	χ_{Δ_2}	χ_{α_1}	χ_{α_2}	Σ_Δ	Σ_α	$\Sigma_\Delta+\Sigma_\alpha$
0.2	0.1333	1.0009	-0.7643	-0.0239	-0.0239	-0.1405	1.8181	1.6775
0.3	0.3786	1.2029	-0.0233	-0.1663	-0.1715	0.6636	18.1544	18.8180
0.4	0.4468	1.2865	0.1185	-0.0321	-0.0359	1.1170	4.1776	5.2947
0.5	0.4660	1.3055	0.1207	-0.0109	-0.0116	1.2432	1.4105	2.6537
0.6	0.4737	1.3105	0.1190	-0.0037	-0.0038	1.3000	0.4689	1.7689
0.7	0.4774	1.3119	0.1179	-0.0013	-0.0013	1.3213	0.1593	1.4807
0.8	0.4794	1.3123	0.1173	-0.0005	-0.0005	1.3288	0.0580	1.3868
0.9	0.4805	1.3124	0.1170	-0.0002	-0.0002	1.3315	0.0231	1.3546
1	0.4810	1.3125	0.1168	-0.0001	-0.0001	1.3325	0.0102	1.3427
1	0.4892	1.3125	0.1143	0.0000	0.0000	1.3333	0.0002	1.3335
2	0.4949	1.3125	0.1126	0.0000	0.0000	1.3333	0.0000	1.3333
3	0.4975	1.3125	0.1119	0.0000	0.0000	1.3333	0.0000	1.3333
4	0.4986	1.3125	0.1115	0.0000	0.0000	1.3333	0.0000	1.3333
5	0.4990	1.3125	0.1114	0.0000	0.0000	1.3333	0.0000	1.3333
6	0.4992	1.3125	0.1114	0.0000	0.0000	1.3333	0.0000	1.3333
7	0.4993	1.3125	0.1113	0.0000	0.0000	1.3333	0.0000	1.3333
8	0.4994	1.3125	0.1113	0.0000	0.0000	1.3333	0.0000	1.3333
9	0.4995	1.3125	0.1113	0.0000	0.0000	1.3333	0.0000	1.3333
10	0.4995	1.3125	0.1113	0.0000	0.0000	1.3333	0.0000	1.3333

Table 3: The effects of domestic content requirement on the consumption of the domestic programs in the case of high elasticity of demand.

Simulations support our model's prediction that an increase in sensitivity of demand causes stations to locate as far as possible and decreases advertising levels. Further, we observe that the elasticity of location of firm 2 with respect to location of firm 1 is negative for small values of ζ and positive for large values of ζ. We also notice that for all intermediate values of ζ there exist a positive monotonic relationship between the elasticity of location and the sensitivity to domestic content ratio. Further, as expected the sign of elasticity of advertising of firm 2 with respect to location of firm 1 is always negative and the elasticity of advertising with respect to location of firm 2 is large, in absolute value, than the elasticity of advertising with respect to location of firm 1. We also observe that elasticities of advertising approach zero in both cases, when sensitivity raises or sensitivity falls.

Finally, location effect is monotonically increasing in sensitivity and has its minimum, a negative value, at the lowest level of sensitivity to domestic content. At the same time, advertising effect is not monotonic,- for small values of sensitivity parameter advertising effects is increasing in sensitivity. However, after some point the advertising effect goes down and approaches zero. The most important result is that for small values of sensitivity parameter and moderate elasticity of demand the total effect of content protection polices may have negative effect on consumption of domestic programs. For intermediate and large values of the sensitivity parameter domestic content protection is effective.

Comparison of tables 1,2, and 3 supports our assertion given in lemma 6 that increase in elasticity of demand increases product differentiation. It further supports our intuition that increase in elasticity drives the equilibrium advertising levels down, something we could not prove analytically.

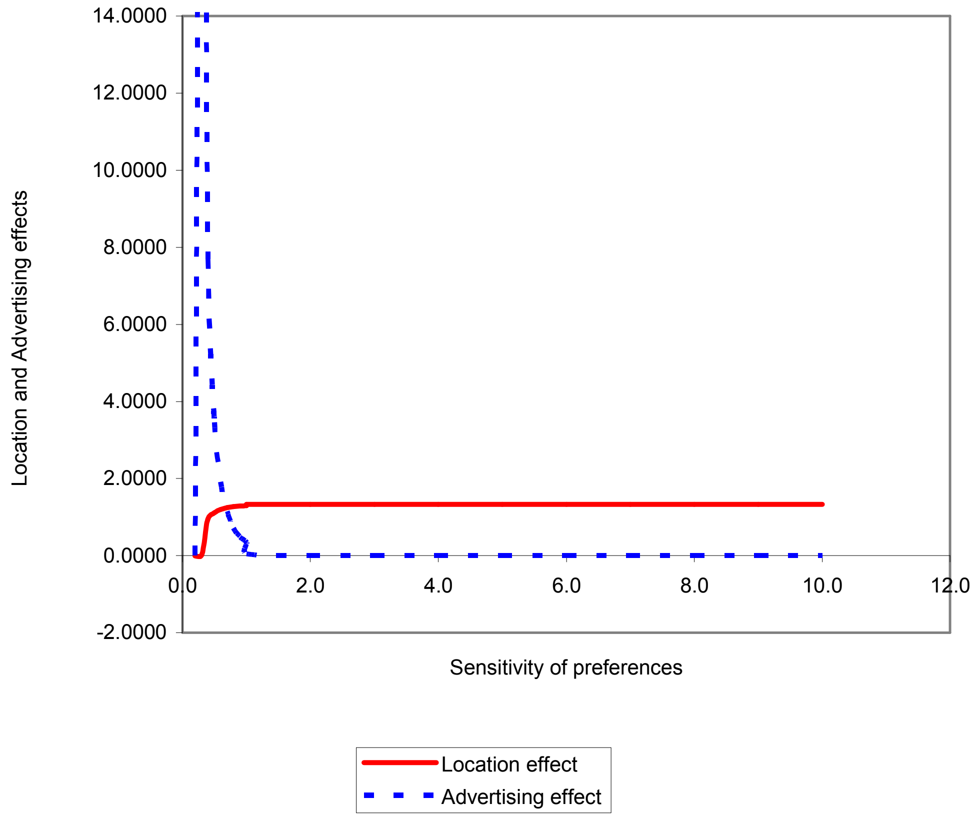

Figure 3: Location and advertising effects for $\varepsilon = 16$.

By inspecting Figure 3 we see that advertising is virtually zero at very small values of ζ, and is dominated by negative location effect which makes the overall effect negative. However, as ζ rises, advertising effect shoots up and then reduces back to zero again while location effect remains positive and essentially unchanged. Therefore, the total effect becomes positive.

4.2. The effect of subsidies and taxes on consumption of domestic programming

ζ	$\varepsilon = 2$			$\varepsilon = 16$			$\varepsilon = 32$		
	y_Δ	y_α	$\frac{\partial\left(\sum_{j=1}^{2} D_j\right)/\partial}{\sum_{j=1}^{2} D_j}$	y_Δ	y_α	$\frac{\partial\left(\sum_{j=1}^{2} D_j\right)/\partial}{\sum_{j=1}^{2} D_j}$	y_Δ	y_α	$\frac{\partial\left(\sum_{j=1}^{2} D_j\right)/\partial}{\sum_{j=1}^{2} D_j}$
0.20	NE	NE	NE	9.02E-01	3.14E-19	1.79E+00	8.39E-01	5.01E-09	1.54E+00
0.30	NE	NE	NE	1.28E+00	1.99E-03	2.08E+00	1.95E+00	3.40E-02	2.99E+00
0.40	NE	NE	NE	1.63E+00	2.25E-01	2.63E+00	1.53E+00	3.92E-01	2.65E+00
0.50	NE	NE	NE	1.27E+00	6.68E-01	2.14E+00	1.22E+00	7.48E-01	2.12E+00
0.60	NE	NE	NE	1.12E+00	1.05E+00	1.86E+00	1.07E+00	9.89E-01	1.78E+00
0.70	NE	NE	NE	1.05E+00	1.34E+00	1.70E+00	1.02E+00	1.18E+00	1.62E+00
0.80	8.99E-01	6.34E-01	1.63E+00	1.03E+00	1.57E+00	1.60E+00	1.04E+00	1.36E+00	1.58E+00
0.90	6.28E-01	1.12E+00	1.13E+00	1.03E+00	1.75E+00	1.56E+00	1.08E+00	1.54E+00	1.60E+00
1.00	4.38E-01	1.51E+00	7.79E-01	1.04E+00	1.90E+00	1.55E+00	1.15E+00	1.72E+00	1.68E+00
1.00	4.80E-01	2.81E+00	7.05E-01	7.94E-01	2.50E+00	8.51E-01	1.02E+00	2.64E+00	1.06E+00
2.00	4.01E-01	4.90E+00	3.49E-01	4.60E-01	2.99E+00	1.98E-02	6.92E-01	3.73E+00	-2.40E-02
3.00	1.90E-01	7.38E+00	-2.13E-01	3.92E-01	5.41E+00	-8.63E-01	1.08E+00	1.22E+01	-2.47E+00
4.00	1.06E-01	9.40E+00	-5.40E-01	7.07E-01	1.75E+01	-3.95E+00	6.42E+00	1.28E+02	-3.60E+01
5.00	8.57E-02	1.19E+01	-7.91E-01	2.95E+00	1.05E+02	-2.62E+01	1.61E+02	4.59E+03	-1.42E+03
6.00	8.99E-02	1.58E+01	-1.10E+00	2.23E+01	9.85E+02	-2.57E+02	1.15E+04	4.05E+05	-1.31E+05
7.00	1.07E-01	2.17E+01	-1.56E+00	2.44E+02	1.25E+04	-3.36E+03	1.59E+06	6.57E+07	-2.18E+07
8.00	1.34E-01	3.07E+01	-2.24E+00	3.45E+03	2.00E+05	-5.45E+04	3.58E+08	1.67E+10	-5.65E+09
9.00	1.75E-01	4.44E+01	-3.29E+00	5.95E+04	3.85E+06	-1.06E+06	1.19E+11	6.20E+12	-2.12E+12
10.0	2.36E-01	6.57E+01	-4.91E+00	1.23E+06	8.74E+07	-2.44E+07	5.57E+13	3.20E+15	-1.10E+15

Table 4: The effects of taxes/subsidies on the consumption of the domestic programs.

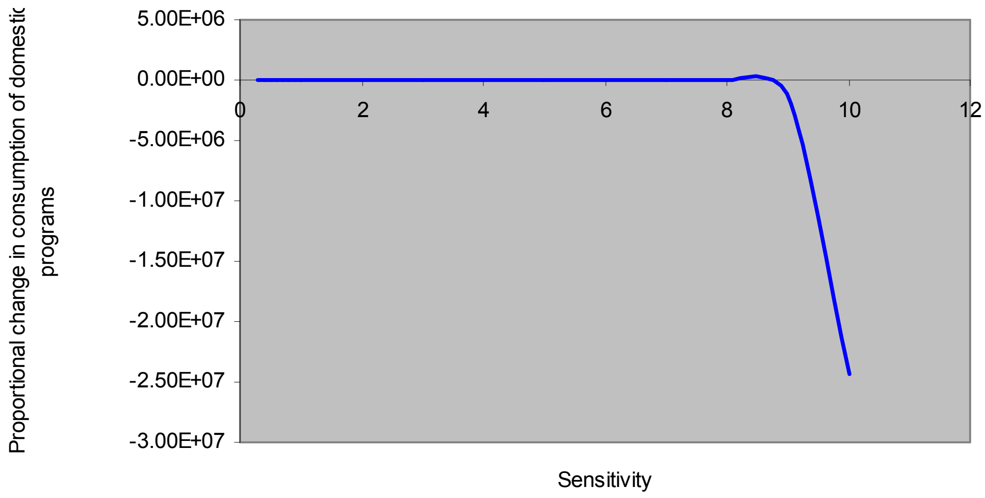

Figure 4: **Effect of tax-cum-subsidy policy on consumption of domestic programs for** $\varepsilon = 16$.

As predicted by Proposition 2, the effects of tax-cum-subsidy policies have positive impact on the consumption of the domestic content for societies with low sensitivity to domestic content ratio and negative impact in societies with high sensitivity to domestic content ratio.

4.3. The effect of regulation of advertising on consumption of domestic programs

	$\varepsilon = 2$	$\varepsilon = 16$	$\varepsilon = 32$
ζ	$\dfrac{\partial\left(\sum_{j=1}^{2} D_j\right) \Big/ \partial\alpha}{\left(\sum_{j=1}^{2} D_j\right)}$	$\dfrac{\partial\left(\sum_{j=1}^{2} D_j\right) \Big/ \partial\alpha}{\left(\sum_{j=1}^{2} D_j\right)}$	$\dfrac{\partial\left(\sum_{j=1}^{2} D_j\right) \Big/ \partial\alpha}{\left(\sum_{j=1}^{2} D_j\right)}$
0.20	NE	-17.0000	-32.9707
0.30	NE	-14.2414	-27.4337
0.40	NE	-11.5077	-25.6518
0.50	NE	-10.9036	-25.2773
0.60	NE	-10.6829	-25.1803
0.70	NE	-10.5842	-25.1542
0.80	-0.8332	-10.5355	-25.1467
0.90	-0.7694	-10.5097	-25.1443
1.00	-0.7347	-10.4951	-25.1435
1.00	-0.7347	-10.4951	-25.1435
2.00	-0.6657	-10.4695	-25.1429
3.00	-0.6608	-10.4703	-25.1429
4.00	-0.6581	-10.4749	-25.1429
5.00	-0.6537	-10.4826	-25.1429
6.00	-0.6473	-10.4932	-25.1429
7.00	-0.6395	-10.5061	-25.1429
8.00	-0.6305	-10.5206	-25.1430
9.00	-0.6207	-10.5358	-25.1432
10.00	-0.6104	-10.5512	-25.1435

Table 5: The effects of regulation of advertising on the consumption of the domestic programs.

By inspecting Table 5 we notice that the effect of regulation of advertising on the consumption of the domestic content is always negative and is monotonically decreasing in absolute value as sensitivity to content rises. This supports analytical results of proposition 3.

5. Conclusion

We have analyzed three policy instruments used by governments to increase consumption of the domestic content, - direct quota on proportion of foreign content under unconstrained and constrained choice of advertising, tax-cum-subsidy schemes, and regulation of proportion of advertising. We show that the effectiveness of marginal content restrictions depends on sensitivity of the public to domestic programs. In societies in which public is very sensitive to domestic content the effectiveness of quotas on foreign content has very small impact on the overall consumption of domestic content. On the other hand, in societies in which the public is not very sensitive to proportion of domestic content that is devoted to domestic or foreign programs government policies may even become counterproductive. However, the latter result holds only under extreme parameters,- moderate to large elasticity of demand and small sensitivity to domestic content ratio. It can be argued that developed countries have high opportunity cost of time (not explicitly modeled here) as such we expect to observe high elasticity of demand. On the other hand, many of these countries do not have high language barrier, as such, likely to have low sensitivity to domestic content ratio. An example of such counties is western European countries where population is highly educated and is fluent in several languages. There we might have a situation where domestic content requirement has an adverse effect on consumption of domestic content. In other developed countries which have high opportunity cost (as expressed in our model in high elasticity of demand) yet with significant language barrier, such as French-speaking provinces of Canada or aboriginal parts of Australia, marginal domestic content requirement has positive effect, yet small in absolute value, on the consumption of the domestic content. In developing countries with small opportunity costs of time, domestic content protection might be an effective policy instrument for both countries with and without the language barrier. Moreover, when station find themselves constrained in terms of the choice of advertising level, marginal domestic content requirement always raises the consumption of domestic programs.

The above result is in stark contrast to findings in the 1st essay where it is shown that marginal domestic content requirement policies in radio broadcasting have positive effects in European Union, Australia and France, and negative effect where in countries with significant language barrier, such as countries of former USSR. Those results were driven by both the sensitivity of demand and distribution of preferences over genres. This implies that the choice of market structure and the choice of preferences are paramount to the analysis of domestic content requirement policies.

The effect of tax-cum-subsidy policies also depends on the sensitivity of preferences to the domestic content ratio. When sensitivity is high such a policy may have an adverse effect on the consumption of domestic programs. When sensitivity is low such a policy may have little, if any, effect on consumption of domestic content.

Advertising, being a nuisance, always increases consumption of both foreign and domestic programs, and the larger the sensitivity to content the smaller is the effect of advertising on the consumption of domestic programs.

The cornerstone of the analysis was the finding that, (i) given the public good nature of consumption of broadcasting, production of broadcasting is not tantamount to its consumption, and that (ii) relative proportion of domestic programs is not equivalent to the absolute value of domestic programs. Therefore, the policy of achieving the goal of increasing *absolute value of consumption* of domestic programs through regulation of *production* via imposing domestic content requirement on the *proportion* of domestic programs in the total volume of broadcasting may be not necessarily be effective. The importance of the above finding is that some devices used to protect domestic cultural goods around the world may be inappropriate, if not counterproductive. To make a judgment about the effectiveness of certain polices of cultural protection government has to have a good picture of the sensitivity of individuals to domestic content.

Although, while have not explicitly discussed, domestic content restriction reduces product differentiation between stations, and therefore, reduces the aggregate satisfaction with broadcasting. Since there exist one to one mapping between welfare and the aggregate satisfaction, domestic content policies also reduces welfare of individuals.

The limitation of the above analysis is in the use of marginal content requirement. We might expect that discrete domestic content restrictions have negative effects even for societies with high sensitivity to domestic content, however, current setup does not allow us to address this question. This is because any large content restriction leads to a breakdown of symmetry assumption of already complicated model. The limitation in the analysis of the tax-cum-subsidy policies is the assumption that both stations generate revenues by selling advertising. In the real world, however, stations that broadcast high domestic content are often public ones and raise money through donations or subsidies.

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7. Appendices

<u>Appendix 1</u>

Proof of Lemma 1: Our assumption on preferences imply that the market is always covered. Therefore, for corner market a movement away from the boundary increases the distance to the boundary by the exactly same amount. Therefore, we have $\underline{u}_1^{\Delta_1} = -\bar{u}_2^{\Delta_2} = 1$. For the interior markets, the size of the market for each station is determined by the distance from the choice of domestic content ratio to the indifferent consumer. The indifference condition is given by $\hat{\alpha}_1 = \hat{\alpha}_2$ so that person is indifferent whenever he faces the same normalized prices. By defining $m \equiv \Delta_2 - \Delta_1 = \bar{u}_1 + \underline{u}_2$ to be the distance between the domestic content ratios of station 1 and station 2 (hereunder referred to as degree of product differentiation) it can be rewritten as $\alpha_1 h(\bar{u}_1) = \alpha_2 h(m - \bar{u}_1)$ or $\alpha_1 h(m - \underline{u}_2) = \alpha_2 h(\underline{u}_2)$. Properties of m are $m^{\alpha_1} = m^{\alpha_2} = 0$ and $m^{\Delta_1} = -m^{\Delta_2} = -1$. For brevity we refer to the first and the second derivative of compensation function with respect to the distance between the available and the most-preferred content as prime and double prime respectively. By differentiating indifference condition with respect to its arguments we obtain:

$$-\bar{u}_1^{\Delta_1} = \bar{u}_1^{\Delta_2} = \alpha_2 h'(\underline{u}_2)\left(\alpha_1 h'(\bar{u}_1) + \alpha_2 h'(\underline{u}_2)\right)^{-1} \quad (32),$$

$$\underline{u}_2^{\Delta_2} = -\underline{u}_1^{\Delta_2} = \alpha_1 h'(\bar{u}_1)\left(\alpha_1 h'(\bar{u}_1) + \alpha_2 h'(\underline{u}_2)\right)^{-1} \quad (33),$$

$$\bar{u}_1^{\alpha_1} = -\underline{u}_2^{\alpha_1} = -h'(\bar{u}_1)\left(\alpha_1 h'(\bar{u}_1) + \alpha_2 h'(\underline{u}_2)\right)^{-1} \quad (34),$$

$$\bar{u}_1^{\alpha_2} = -\underline{u}_2^{\alpha_2} = h'(\underline{u}_2)\left(\alpha_1 h'(\bar{u}_1) + \alpha_2 h'(\underline{u}_2)\right)^{-1} \quad (35),$$

$$\bar{u}_1^{\Delta_1\Delta_1} = \frac{\alpha_2 h''(\underline{u}_2)\left(\underline{u}_2^{\Delta_1}\right)^2 - \alpha_1 h''(\bar{u}_1)\left(\bar{u}_1^{\Delta_1}\right)^2}{\alpha_1 h'(\bar{u}_1) + \alpha_2 h'(\underline{u}_2)} \quad (36),$$

$$\underline{u}_2^{\Delta_2\Delta_2} = \frac{\alpha_1 h''(\bar{u}_1)\left(\bar{u}_1^{\Delta_2}\right)^2 - \alpha_2 h''(\underline{u}_2)\left(\underline{u}_2^{\Delta_2}\right)^2}{\alpha_1 h'(\bar{u}_1) + \alpha_2 h'(\underline{u}_2)} \quad (37),$$

$$\bar{u}_1^{\alpha_1\alpha_1} = \frac{\alpha_2 h''(\underline{u}_2)\left(\underline{u}_2^{\alpha_1}\right)^2 - \alpha_1 h''(\bar{u}_1)\left(\bar{u}_1^{\alpha_1}\right)^2 - 2h'(\bar{u}_1)\left(\bar{u}_1^{\alpha_1}\right)}{\alpha_1 h'(\bar{u}_1) + \alpha_2 h'(\underline{u}_2)} \quad (38),$$

$$\underline{u}_2^{\alpha_2\alpha_2} = \frac{\alpha_1 h''(\bar{u}_1)\left(\bar{u}_1^{\alpha_2}\right)^2 - \alpha_2 h''(\underline{u}_2)\left(\underline{u}_2^{\alpha_2}\right)^2 - 2h'(\underline{u}_2)\left(\underline{u}_2^{\alpha_2}\right)}{\alpha_1 h'(\bar{u}_1) + \alpha_2 h'(\underline{u}_2)} \quad (39),$$

$$\bar{u}_1^{\Delta_1\Delta_2} = -\underline{u}_2^{\Delta_1\Delta_2} = \frac{\alpha_2 h''(\underline{u}_2)\underline{u}_2^{\Delta_1}\underline{u}_2^{\Delta_2} - \alpha_1 h''(\bar{u}_1)\bar{u}_1^{\Delta_1}\bar{u}_1^{\Delta_2}}{\alpha_1 h'(\bar{u}_1) + \alpha_2 h'(\underline{u}_2)} \quad (40),$$

$$\bar{u}_1^{\Delta_1\alpha_1} = \frac{\alpha_2 h''(\underline{u}_2)\underline{u}_2^{\Delta_1}\underline{u}_2^{\alpha_1} - \alpha_1 h''(\bar{u}_1)\bar{u}_1^{\Delta_1}\bar{u}_1^{\alpha_1} - h'(\bar{u}_1)\bar{u}_1^{\alpha_1}}{\alpha_1 h'(\bar{u}_1) + \alpha_2 h'(\underline{u}_2)} \quad (41),$$

$$\underline{u}_2^{\Delta_2\alpha_2} = \frac{\alpha_1 h''(\bar{u}_1)\bar{u}_1^{\Delta_2}\bar{u}_1^{\alpha_2} - \alpha_2 h''(\underline{u}_2)\underline{u}_2^{\Delta_2}\underline{u}_2^{\alpha_2} - h'(\underline{u}_2)\underline{u}_2^{\Delta_2}}{\alpha_1 h'(\bar{u}_1) + \alpha_2 h'(\underline{u}_2)} \quad (42),$$

$$\bar{u}_1^{\Delta_2\alpha_1} = -\underline{u}_2^{\Delta_2\alpha_1} = \frac{\alpha_2 h''(\underline{u}_2)\underline{u}_2^{\Delta_2}\underline{u}_2^{\alpha_1} - \alpha_1 h''(\bar{u}_1)\bar{u}_1^{\Delta_2}\bar{u}_1^{\alpha_1} - h'(\bar{u}_1)\bar{u}_1^{\Delta_2}}{\alpha_1 h'(\bar{u}_1) + \alpha_2 h'(\underline{u}_2)} \quad (43),$$

$$\bar{u}_1^{\Delta_1\alpha_2} = -\underline{u}_2^{\Delta_1\alpha_2} = \frac{\alpha_2 h''(\underline{u}_2)\underline{u}_2^{\Delta_1}\underline{u}_2^{\alpha_2} - \alpha_1 h''(\bar{u}_1)\bar{u}_1^{\Delta_1}\bar{u}_1^{\alpha_2} + h'(\underline{u}_2)\underline{u}_2^{\Delta_1}}{\alpha_1 h'(\bar{u}_1) + \alpha_2 h'(\underline{u}_2)} \quad (44),$$

$$\bar{u}_1^{\alpha_1\alpha_2} = -\underline{u}_2^{\alpha_1\alpha_2} = \frac{\alpha_2 h''(\underline{u}_2)\underline{u}_2^{\alpha_1}\underline{u}_2^{\alpha_2} - \alpha_1 h''(\bar{u}_1)\bar{u}_1^{\alpha_1}\bar{u}_1^{\alpha_2} + h'(\underline{u}_2)\underline{u}_2^{\alpha_1} - h'(\bar{u}_1)\bar{u}_1^{\alpha_2}}{\alpha_1 h'(\bar{u}_1) + \alpha_2 h'(\underline{u}_2)} \qquad (45).$$

When $\bar{u}_1 = \underline{u}_2$ then we have $\alpha_1 = \alpha_2$, then, the above equations reduce to

$-\bar{u}_1^{\Delta_1} = -\underline{u}_1^{\Delta_1} = \bar{u}_1^{\Delta_2} = \underline{u}_1^{\Delta_2} = 1/2$, $\bar{u}_1^{\alpha_1} = -\underline{u}_2^{\alpha_1} = -\bar{u}_1^{\alpha_2} = \underline{u}_2^{\alpha_2} = -h(2\alpha h')^{-1} \le 0$, $\bar{u}_1^{\Delta_1\Delta_1} = \underline{u}_2^{\Delta_2\Delta_2} = 0$,

$\bar{u}_1^{\alpha_1\alpha_1} = \underline{u}_2^{\alpha_2\alpha_2} = h(2\alpha^2 h')^{-1} \ge 0$, $\bar{u}_1^{\alpha_1\alpha_2} = \underline{u}_2^{\alpha_1\alpha_2} = \bar{u}_1^{\Delta_1\Delta_2} = \underline{u}_2^{\Delta_1\Delta_2} = 0$,

$-\bar{u}_1^{\Delta_1\alpha_1} = \underline{u}_2^{\Delta_2\alpha_2} = \bar{u}_1^{\Delta_2\alpha_1} = -\underline{u}_2^{\Delta_2\alpha_1} = \bar{u}_1^{\Delta_1\alpha_2} = -\underline{u}_2^{\Delta_1\alpha_2} = (r-1)(4\alpha)^{-1} \ge 0$ ■

Appendix 2

Proof of Lemma 2: We concentrate on firm 1. When $\bar{u}_1 = \underline{u}_2$, firm's 2 functions are mirror-symmetric. Aggregate satisfaction is given by $H_i \equiv \int_0^{\underline{u}_i} h(v)^{-\varepsilon}\,dv + \int_0^{\bar{u}_i} h(v)^{-\varepsilon}\,dv$, therefore, $H_i^{\Delta_i} = \underline{u}_i^{\Delta_i} h(\underline{u}_i)^{-\varepsilon} + \bar{u}_i^{\Delta_i} h(\bar{u}_i)^{-\varepsilon}$. Differentiating with respect to its arguments and imposing symmetry:

$$H_1^{\Delta_1\Delta_1} = -\varepsilon\left(h(\underline{u}_1)^{1-\varepsilon} h'(\underline{u}_1) + 4^{-1} h(\bar{u}_1)^{1-\varepsilon} h'(\bar{u}_1)\right) \le 0 \qquad (46),$$

$$H_2^{\Delta_2\Delta_2} = -\varepsilon\left(4^{-1} h(\underline{u}_1)^{1-\varepsilon} h'(\underline{u}_2) + h(\bar{u}_2)^{1-\varepsilon} h'(\bar{u}_2)\right) \le 0 \qquad (47).$$

Since corner markets depend only on own choice of domestic content ration we focus on a symmetric case where both stations enjoy equal interior markets. Therefore, differentiating and using lemma 1 yields:

$$H_1^{\Delta_2} = \bar{u}_1^{\Delta_2} h(\bar{u}_1)^{-\varepsilon} = 2^{-1} h^{-\varepsilon} \ge 0 \qquad (48),$$

$$H_2^{\Delta_1} = \underline{u}_2^{\Delta_1} h(\underline{u}_2)^{-\varepsilon} = -2^{-1} h^{-\varepsilon} \le 0 \qquad (49),$$

$$H_1^{\alpha_1} = \bar{u}_1^{\alpha_1} h(\bar{u}_1)^{-\varepsilon} = -h^{1-\varepsilon}(2\alpha h')^{-1} \le 0 \qquad (50),$$

$$H_1^{\alpha_2} = \bar{u}_1^{\alpha_2} h(\bar{u}_1)^{-\varepsilon} = h^{1-\varepsilon}(2\alpha h')^{-1} \ge 0 \qquad (51),$$

$$H_2^{\alpha_2} = \underline{u}_2^{\alpha_2} h(\underline{u}_2)^{-\varepsilon} = -h^{1-\varepsilon}(2\alpha h')^{-1} \le 0 \qquad (52),$$

$$H_2^{\alpha_1} = \underline{u}_2^{\alpha_1} h(\underline{u}_2)^{-\varepsilon} = h^{1-\varepsilon}(2\alpha h')^{-1} \ge 0 \qquad (53).$$

Since $\overline{u}_1 = \underline{u}_2$ and arguments of compensating function of all the second derivatives of H_i below are in terms of interior market sizes we suppress arguments of the compensating function.

$$H_1^{\Delta_1\Delta_2} = \overline{u}_1^{\Delta_1\Delta_2} h^{-\varepsilon} + \overline{u}_1^{\Delta_1}(-\varepsilon) h^{-\varepsilon-1} h' u_1^{\Delta_2} = \frac{1}{4}\varepsilon h^{-\varepsilon-1} h' \qquad (54),$$

$$H_2^{\Delta_2\Delta_1} = \underline{u}_2^{\Delta_1\Delta_2} h^{-\varepsilon} + \underline{u}_2^{\Delta_1}(-\varepsilon) h^{-\varepsilon-1} h' \underline{u}_2^{\Delta_2} = \frac{1}{4}\varepsilon h^{-\varepsilon-1} h' \qquad (55),$$

$$H_1^{\Delta_1\alpha_1} = -\varepsilon h^{-\varepsilon-1} h' \overline{u}_1^{\alpha_1} \overline{u}_1^{\Delta_1} + \overline{u}_1^{\alpha_1\Delta_1} h^{-\varepsilon} = -h^{-\varepsilon}(r-1+\varepsilon)(4\alpha)^{-1} \le 0 \qquad (56),$$

$$H_1^{\Delta_1\alpha_2} = -\varepsilon h^{-\varepsilon-1} h' \overline{u}_1^{\Delta_1} \overline{u}_1^{\alpha_2} + \overline{u}_1^{\Delta_1\alpha_2} h^{-\varepsilon} = h^{-\varepsilon}(r-1+\varepsilon)(4\alpha)^{-1} \ge 0 \qquad (57),$$

$$H_1^{\alpha_1\alpha_1} = -\varepsilon h^{-\varepsilon-1} h' \left(\overline{u}_1^{\alpha_1}\right)^2 + \overline{u}_1^{\alpha_1\alpha_1} h^{-\varepsilon} = -h^{-\varepsilon-1}(\varepsilon-2)(4\alpha^2 h')^{-1} \le 0 \qquad (58),$$

$$H_1^{\alpha_1\Delta_2} = -\varepsilon h^{-\varepsilon-1} h' \overline{u}_1^{\alpha_1} \overline{u}_1^{\Delta_2} + \overline{u}_1^{\alpha_1\Delta_2} h^{-\varepsilon} = h^{-\varepsilon}(r-1+\varepsilon)(4\alpha)^{-1} \ge 0 \qquad (59),$$

$$H_2^{\Delta_2\alpha_1} = -\varepsilon h^{-\varepsilon-1} h' \underline{u}_2^{\alpha_1} \underline{u}_2^{\Delta_2} + \underline{u}_2^{\Delta_2\alpha_1} h^{-\varepsilon} = -h^{-\varepsilon}(r-1+\varepsilon)(4\alpha)^{-1} \le 0 \qquad (60),$$

$$H_2^{\Delta_2\alpha_2} = -\varepsilon h^{-\varepsilon-1} h' \underline{u}_2^{\alpha_2} \underline{u}_2^{\Delta_2} + \underline{u}_2^{\Delta_2\alpha_2} h^{-\varepsilon} = h^{-\varepsilon}(r-1+\varepsilon)(4\alpha)^{-1} \ge 0 \qquad (61),$$

$$H_2^{\alpha_2\Delta_1} = -\varepsilon h^{-\varepsilon-1} h' \underline{u}_2^{\alpha_2} \underline{u}_2^{\Delta_1} + \underline{u}_2^{\Delta_1\alpha_2} h^{-\varepsilon} = -h^{-\varepsilon}(r-1+\varepsilon)(4\alpha)^{-1} \le 0 \qquad (62),$$

$$H_2^{\alpha_2\alpha_2} = -\varepsilon h^{-\varepsilon-1} h' \left(\underline{u}_2^{\alpha_2}\right)^2 + \underline{u}_2^{\alpha_2\alpha_2} h^{-\varepsilon} = -h^{-\varepsilon-1}(\varepsilon-2)(4\alpha^2 h')^{-1} \le 0 \qquad (63).$$

Therefore, in symmetric equilibrium we have $H_1^{\Delta_1} = H_2^{\Delta_2} = 0$, $H_1^{\Delta_1\Delta_1} = H_2^{\Delta_2\Delta_2} \le 0$, $H_1^{\Delta_2} = -H_2^{\Delta_1} = 2^{-1} h^{-\varepsilon}$, $H_1^{\alpha_1} = H_2^{\alpha_2} = -H_2^{\alpha_1} = -H_1^{\alpha_2} = -h^{1-\varepsilon}(2\alpha h')^{-1}$, $H_1^{\Delta_1\Delta_2} = H_2^{\Delta_2\Delta_2} = 4^{-1}\varepsilon h^{-\varepsilon-1} h'$, $H_1^{\alpha_1\alpha_1} = H_2^{\alpha_2\alpha_2} = -h^{-\varepsilon-1}(\varepsilon-2)(4\alpha^2 h')^{-1}, -H_1^{\Delta_1\alpha_1} = H_1^{\Delta_1\alpha_2} = -H_2^{\Delta_2\alpha_1} = H_2^{\Delta_2\alpha_2} = h^{-\varepsilon}(r-1+\varepsilon)(4\alpha)^{-1}$ ■

Appendix 3

Proof of Lemma 3: Differentiating $\xi(m)$ with respect to m gives

$$\frac{\partial\xi(m)}{\partial m}=-\xi(m)\left[\frac{h'(1/2(1-m))}{h(1/2(1-m))}+\frac{h'(1/2m)}{h(1/2m)}\right]\leq 0 \text{ and}$$

$$\begin{aligned}\frac{\partial^2\xi(m)}{\partial m^2}=&-\xi'(m)\left[\frac{h'(1/2(1-m))}{h(1/2(1-m))}+\frac{h'(1/2m)}{h(1/2m)}\right]\\&+\xi(m)\left[\frac{h'(1/2(1-m))^2\left(r(1/2(1-m))-1\right)}{h(1/2(1-m))^2}+\frac{h'(1/2m)^2\left(r(1/2m)-1\right)}{h(1/2m)^2}\right]\\&\geq 0\end{aligned}$$

Further, taking limits yields $\lim_{m\to 0}\xi(m)=h(1/2)$, and $\lim_{m\to 1/2}\xi(m)=1$ because $h(0)=1$ ■

Appendix 4

Proof of Lemma 4: The elasticity of the aggregate satisfaction with respect to advertising is defined as $\eta_i\equiv-\alpha_i H_i^{\alpha_i}H_i^{-1}\geq 0$. Straight differentiation and imposition of symmetry yields

$$\begin{aligned}\eta_1^{\alpha_1}&=-H_1^{-1}\left(\alpha H_1^{\alpha_1\alpha_1}+(1+\eta)H_1^{\alpha_1}\right)\\&=-H_1^{-1}\left(\frac{h^{1-\varepsilon}(\varepsilon-2)}{4\alpha h'}+(1+\eta)\left(-\frac{h^{1-\varepsilon}}{2\alpha h'}\right)\right)\\&=\frac{h^{1-\varepsilon}(\varepsilon+2\eta)}{4\alpha Hh'}\geq 0\end{aligned} \qquad (64),$$

$$\begin{aligned}\eta_1^{\alpha_2}&=-H_1^{-1}\left(\alpha H_1^{\alpha_1\alpha_2}+\eta H_1^{\alpha_2}\right)\\&=-\frac{1}{H}\left(\frac{\varepsilon h^{1-\varepsilon}}{4\alpha h'}+\eta\frac{h^{1-\varepsilon}}{2\alpha h'}\right)\\&=-\frac{h^{1-\varepsilon}(\varepsilon+2\eta)}{4\alpha Hh'}\leq 0\end{aligned} \qquad (65),$$

$$\begin{aligned}\eta_1^{\Delta_1}&=-H_1^{-1}\left(\alpha H_1^{\alpha_1\Delta_1}+\eta H_1^{\Delta_1}\right)\\&=\frac{h^{-\varepsilon}(r-1+\varepsilon)}{4H}\geq 0\end{aligned} \qquad (66),$$

$$\begin{aligned}\eta_1^{\Delta_2} &= -H_1^{-1}\left(\alpha H_1^{\alpha_1\Delta_2} + \eta H_1^{\Delta_2}\right)\\ &= -\frac{1}{H}\left(\frac{h^{-\varepsilon}\left(r-1+\varepsilon\right)}{4} + \eta\frac{h^{-\varepsilon}}{2}\right)\\ &= -\frac{h^{-\varepsilon}}{4H}\left(r-1+\varepsilon+2\eta\right) \le 0\end{aligned} \quad (67),$$

$$\begin{aligned}\eta_2^{\alpha_2} &= -H_2^{-1}\left(\alpha H_2^{\alpha_2\alpha_2} + \left(1+\eta\right)H_2^{\alpha_2}\right)\\ &= -H_2^{-1}\left(\frac{h^{1-\varepsilon}\left(\varepsilon-2\right)}{4\alpha h'} + \left(1+\eta\right)\left(-\frac{h^{1-\varepsilon}}{2\alpha h'}\right)\right)\\ &= \frac{h^{1-\varepsilon}\left(\varepsilon+2\eta\right)}{4\alpha Hh'} \ge 0\end{aligned} \quad (68),$$

$$\begin{aligned}\eta_2^{\alpha_1} &= -H_2^{-1}\left(\alpha H_2^{\alpha_1\alpha_2} + \eta H_2^{\alpha_1}\right)\\ &= -\frac{1}{H}\left(\frac{\varepsilon h^{1-\varepsilon}}{4\alpha h'} + \eta\frac{h^{1-\varepsilon}}{2\alpha h'}\right)\\ &= -\frac{h^{1-\varepsilon}\left(\varepsilon+2\eta\right)}{4\alpha Hh'} \le 0\end{aligned} \quad (69),$$

$$\begin{aligned}\eta_2^{\Delta_2} &= -H_2^{-1}\left(\alpha H_2^{\alpha_2\Delta_2} + \eta_2 H_2^{\Delta_2}\right)\\ &= -\frac{h^{-\varepsilon}\left(r-1+\varepsilon\right)}{4H} \le 0\end{aligned} \quad (70),$$

$$\begin{aligned}\eta_2^{\Delta_1} &= -H_2^{-1}\left(\alpha H_2^{\alpha_2\Delta_1} + \eta_2 H_2^{\Delta_1}\right)\\ &= \frac{1}{H}\left(\frac{h^{-\varepsilon}\left(r-1+\varepsilon\right)}{4} + \eta\frac{h^{-\varepsilon}}{2}\right)\\ &= \frac{h^{-\varepsilon}}{4H}\left(r-1+\varepsilon+2\eta\right) \ge 0\end{aligned} \quad (71).$$

Therefore, $\eta_1^{\alpha_1} = -\eta_1^{\alpha_2} = \eta_2^{\alpha_2} = -\eta_2^{\alpha_1} = h^{1-\varepsilon}\left(\varepsilon+2\eta\right)\left(4\alpha Hh'\right)^{-1}$, $\eta_1^{\alpha_1} = -\eta_2^{\alpha_2} = h^{-\varepsilon}\left(r-1+\varepsilon\right)\left(4H\right)^{-1}$, and $\eta_1^{\Delta_2} = -\eta_2^{\Delta_1} = -h^{-\varepsilon}\left(4H\right)^{-1}\left(r-1+\varepsilon+2\eta\right)$.

Appendix 5

Proof of Lemma 5: Since in our model all important effects take place around indifferent consumer, then in symmetric equilibrium we denote compensation function for an interior market without subscript while for corner market with subscript c. Differentiating the set of first-order conditions, imposing symmetry and evaluating at $t=0$ yields:

$$\begin{aligned}\pi_1^{\Delta_1\Delta_1} &= p'\left(1-\frac{1}{\alpha}\right)\alpha^{-\varepsilon}H_1^{\Delta_1\Delta_1}\\ &= -\frac{1}{4}p'\left(1-\frac{1}{\alpha}\right)\alpha^{-\varepsilon}\varepsilon h^{-\varepsilon}\left(\frac{h'}{h}\right)\left(1+2\left(\frac{h_c'/h_c}{h'/h}\right)\right)\\ &= -\frac{\beta p h^{-\varepsilon}}{4H}\left(1-\frac{1}{\alpha}\right)\varepsilon\left(\frac{h'}{h}\right)\left(1+2\left(\frac{h_c'/h_c}{h'/h}\right)\right)\leq 0\end{aligned} \tag{72),}$$

$$\begin{aligned}\pi_1^{\Delta_1\Delta_2} &= p'\left(1-\frac{1}{\alpha}\right)\alpha^{-\varepsilon}H_1^{\Delta_1\Delta_2}\\ &= \frac{1}{4}p'\left(1-\frac{1}{\alpha}\right)\alpha^{-\varepsilon}\varepsilon h^{-\varepsilon}\left(\frac{h'}{h}\right)\\ &= \frac{\beta p h^{-\varepsilon}}{4H}\left(1-\frac{1}{\alpha}\right)\varepsilon\left(\frac{h'}{h}\right)\geq 0\end{aligned} \tag{73),}$$

$$\begin{aligned}\pi_1^{\Delta_1\alpha_1} &= p'\left(1-\frac{1}{\alpha}\right)\alpha^{-\varepsilon}H_1^{\Delta_1\alpha_1}\\ &= -\frac{1}{4}p'\left(1-\frac{1}{\alpha}\right)\alpha^{-\varepsilon-1}h^{-\varepsilon}\left(r-1+\varepsilon\right)\\ &= -\frac{\beta p h^{-\varepsilon}}{4H}\left(1-\frac{1}{\alpha}\right)\left(\frac{1}{\alpha}\right)\left(r-1+\varepsilon\right)\leq 0\end{aligned} \tag{74),}$$

$$\begin{aligned}\pi_1^{\Delta_1\alpha_2} &= p'\left(1-\frac{1}{\alpha}\right)\alpha^{-\varepsilon}H_1^{\Delta_1\alpha_2}\\ &= \frac{1}{4}p'\left(1-\frac{1}{\alpha}\right)\alpha^{-\varepsilon-1}h^{-\varepsilon}\left(r-1+\varepsilon\right)\\ &= \frac{\beta p h^{-\varepsilon}}{4H}\left(1-\frac{1}{\alpha}\right)\left(\frac{1}{\alpha}\right)\left(r-1+\varepsilon\right)\geq 0\end{aligned} \tag{75),}$$

$$\begin{aligned}\pi_1^{\alpha_1\alpha_1} &= -\frac{p\beta}{\alpha^2}\left(\varepsilon+\eta+(\alpha-1)\eta_1^{\alpha_1}\right)\\ &= -\frac{p\beta}{\alpha^2}\left(\varepsilon+\eta+\frac{h^{-\varepsilon}}{4H}\left(1-\frac{1}{\alpha}\right)\left(\frac{h}{h'}\right)(\varepsilon+2\eta)\right)\\ &= -\frac{\beta p h^{-\varepsilon}}{4H}\left(1-\frac{1}{\alpha}\right)\left(\frac{h}{h'}\right)\left(\frac{1}{\alpha^2}\right)\left(\frac{4H(\varepsilon+\eta)\alpha}{h^{-\varepsilon}(\alpha-1)}\left(\frac{h'}{h}\right)+\varepsilon+2\eta\right)\\ &= -\frac{\beta p h^{-\varepsilon}}{4H}\left(1-\frac{1}{\alpha}\right)\left(\frac{h}{h'}\right)\left(\frac{1}{\alpha^2}\right)\left(\frac{2(\varepsilon+\eta)\alpha}{\eta(\alpha-1)}+\varepsilon+2\eta\right)\leq 0\end{aligned} \tag{76),}$$

$$\begin{aligned}\pi_1^{\alpha_1\alpha_2} &= -\frac{p\beta(\alpha-1)}{\alpha^2}\eta_1^{\alpha_2} \\ &= \frac{p\beta h^{-\varepsilon}}{4H}\left(1-\frac{1}{\alpha}\right)\left(\frac{1}{\alpha^2}\right)\left(\frac{h}{h'}\right)(\varepsilon+2\eta)\geq 0\end{aligned} \qquad (77),$$

$$\begin{aligned}\pi_1^{\alpha_1\Delta_1} &= -\frac{p\beta(\alpha-1)}{\alpha^2}\eta_1^{\Delta_1} \\ &= -\frac{p\beta h^{-\varepsilon}(r-1+\varepsilon)}{4H\alpha}\left(1-\frac{1}{\alpha}\right)\leq 0\end{aligned} \qquad (78),$$

$$\begin{aligned}\pi_1^{\alpha_1\Delta_2} &= -\frac{p\beta(\alpha-1)}{\alpha^2}\eta_1^{\Delta_2} \\ &= \frac{p\beta h^{-\varepsilon}}{4H}\left(1-\frac{1}{\alpha}\right)\left(\frac{r-1+\varepsilon+2\eta}{\alpha}\right)\geq 0\end{aligned} \qquad (79),$$

$$\begin{aligned}\pi_2^{\Delta_2\Delta_2} &= p'\left(1-\frac{1}{\alpha}\right)\alpha^{-\varepsilon}H_2^{\Delta_2\Delta_2} \\ &= -\frac{1}{4}p'\left(1-\frac{1}{\alpha}\right)\alpha^{-\varepsilon}\varepsilon h^{-\varepsilon}\left(\frac{h'}{h}\right)\left(1+2\left(\frac{h_c'/h_c}{h'/h}\right)\right) \\ &= -\frac{\beta p h^{-\varepsilon}}{4H}\left(1-\frac{1}{\alpha}\right)\varepsilon\left(\frac{h'}{h}\right)\left(1+2\left(\frac{h_c'/h_c}{h'/h}\right)\right)\leq 0\end{aligned} \qquad (80),$$

$$\begin{aligned}\pi_2^{\Delta_1\Delta_2} &= p'\left(1-\frac{1}{\alpha}\right)\alpha^{-\varepsilon}H_2^{\Delta_1\Delta_2} \\ &= \frac{1}{4}p'\left(1-\frac{1}{\alpha}\right)\alpha^{-\varepsilon}\varepsilon h^{-\varepsilon}\left(\frac{h'}{h}\right) \\ &= \frac{\beta p h^{-\varepsilon}}{4H}\left(1-\frac{1}{\alpha}\right)\varepsilon\left(\frac{h'}{h}\right)\geq 0\end{aligned} \qquad (81),$$

$$\begin{aligned}\pi_2^{\Delta_2\alpha_2} &= p'\left(1-\frac{1}{\alpha}\right)\alpha^{-\varepsilon}H_2^{\Delta_2\alpha_2} \\ &= \frac{1}{4}p'\left(1-\frac{1}{\alpha}\right)\alpha^{-\varepsilon-1}h^{-\varepsilon}(r-1+\varepsilon) \\ &= \frac{\beta p h^{-\varepsilon}}{4H}\left(1-\frac{1}{\alpha}\right)\left(\frac{1}{\alpha}\right)(r-1+\varepsilon)\geq 0\end{aligned} \qquad (82),$$

$$\begin{aligned}\pi_1^{\Delta_1\alpha_2} &= p'\left(1-\frac{1}{\alpha}\right)\alpha^{-\varepsilon}H_1^{\Delta_1\alpha_2} \\ &= \frac{1}{4}p'\left(1-\frac{1}{\alpha}\right)\alpha^{-\varepsilon-1}h^{-\varepsilon}\left(r-1+\varepsilon\right) \\ &= \frac{\beta ph^{-\varepsilon}}{4H}\left(1-\frac{1}{\alpha}\right)\left(\frac{1}{\alpha}\right)\left(r-1+\varepsilon\right)\geq 0\end{aligned} \tag{83),}$$

$$\begin{aligned}\pi_1^{\alpha_1\alpha_1} &= -\frac{p\beta}{\alpha^2}\left(\varepsilon+\eta+(\alpha-1)\eta_2^{\alpha_2}\right) \\ &= -\frac{p\beta}{\alpha^2}\left(\varepsilon+\eta+\frac{h^{-\varepsilon}}{4H}\left(1-\frac{1}{\alpha}\right)\left(\frac{h}{h'}\right)(\varepsilon+2\eta)\right) \\ &= -\frac{\beta ph^{-\varepsilon}}{4H}\left(1-\frac{1}{\alpha}\right)\left(\frac{h}{h'}\right)\left(\frac{1}{\alpha^2}\right)\left(\frac{4H(\varepsilon+\eta)\alpha}{h^{-\varepsilon}(\alpha-1)}\left(\frac{h'}{h}\right)+\varepsilon+2\eta\right) \\ &= -\frac{\beta ph^{-\varepsilon}}{4H}\left(1-\frac{1}{\alpha}\right)\left(\frac{h}{h'}\right)\left(\frac{1}{\alpha^2}\right)\left(\frac{2(\varepsilon+\eta)\alpha}{\eta(\alpha-1)}+\varepsilon+2\eta\right)\leq 0\end{aligned} \tag{84),}$$

$$\begin{aligned}\pi_2^{\alpha_1\alpha_2} &= -\frac{p\beta(\alpha-1)}{\alpha^2}\eta_2^{\alpha_1} \\ &= \frac{p\beta h^{-\varepsilon}}{4H}\left(1-\frac{1}{\alpha}\right)\left(\frac{1}{\alpha^2}\right)\left(\frac{h}{h'}\right)(\varepsilon+2\eta)\geq 0\end{aligned} \tag{85),}$$

$$\begin{aligned}\pi_2^{\alpha_2\Delta_2} &= -\frac{p\beta(\alpha-1)}{\alpha^2}\eta_2^{\Delta_2} \\ &= \frac{p\beta h^{-\varepsilon}(r-1+\varepsilon)}{4H\alpha}\left(1-\frac{1}{\alpha}\right)\geq 0\end{aligned} \tag{86),}$$

$$\begin{aligned}\pi_2^{\alpha_2\Delta_1} &= -\frac{p\beta(\alpha-1)}{\alpha^2}\eta_2^{\Delta_1} \\ &= -\frac{p\beta h^{-\varepsilon}}{4H}\left(1-\frac{1}{\alpha}\right)\left(\frac{r-1+\varepsilon+2\eta}{\alpha}\right)\leq 0\end{aligned} \tag{87).}$$

Define $\lambda_0 \equiv \frac{p\beta h^{-\varepsilon}}{4H}\left(1-\frac{1}{\alpha}\right)\left(\frac{r-1+\varepsilon}{\alpha}\right)\geq 0$, $\lambda_1 \equiv \left(\frac{h'}{h}\right)\left(1+2\left(\frac{h'_c/h_c}{h'/h}\right)\right)\frac{\varepsilon\alpha}{r-1+\varepsilon}\geq 0$, $\lambda_2 \equiv \left(\frac{h'}{h}\right)\frac{\varepsilon\alpha}{r-1+\varepsilon}\geq 0$, $\lambda_3 \equiv \left(\frac{h}{h'}\right)\left(\frac{1}{\alpha}\right)\left(\frac{2(\varepsilon+\eta)\alpha}{\eta(\alpha-1)}+\varepsilon+2\eta\right)\frac{1}{r-1+\varepsilon}\geq 0$, $\lambda_4 \equiv \left(\frac{1}{\alpha}\right)\left(\frac{h}{h'}\right)\frac{\varepsilon+2\eta}{r-1+\varepsilon}\geq 0$, $\lambda_5 \equiv \frac{2\eta}{r-1+\varepsilon}\geq 0$. We then can write the stability matrix as

$$S=\lambda_0\begin{bmatrix}-\lambda_1 & \lambda_2 & -1 & 1\\ \lambda_2 & -\lambda_1 & -1 & 1\\ -1 & 1+\lambda_5 & -\lambda_3 & \lambda_4\\ -1-\lambda_5 & 1 & \lambda_4 & -\lambda_3\end{bmatrix} \qquad (88).$$

The stability condition requires that eigenroots of S have negative real parts for which the sufficient condition is negative trace and positive determinant. Trace is negative because each diagonal element is non-positive. Determinant of S is given by $\lambda_0^4(\lambda_1+\lambda_2)(\lambda_3-\lambda_4)((\lambda_1-\lambda_2)(\lambda_3+\lambda_4)+2\lambda_5)$. $(\lambda_3\geq\lambda_4,\lambda_1\geq\lambda_2)$ imply that S is positive■

Appendix 6

Proof of Lemma 6: Differentiation of the first-order conditions with respect to ζ and evaluating at $t=0$ yields

$$\begin{aligned}\pi_1^{\Delta_1\zeta}+\pi_1^{\Delta_1\Delta_1}\Delta_1^{\zeta}+\pi_1^{\Delta_1\Delta_2}\Delta_2^{\zeta}+\pi_1^{\Delta_1\alpha_1}\alpha_1^{\zeta}+\pi_1^{\Delta_1\alpha_2}\alpha_2^{\zeta}&=0\\ \pi_1^{\alpha_1\zeta}+\pi_1^{\alpha_1\Delta_1}\Delta_1^{\zeta}+\pi_1^{\alpha_1\Delta_2}\Delta_2^{\zeta}+\pi_1^{\alpha_1\alpha_1}\alpha_1^{\zeta}+\pi_1^{\alpha_1\alpha_2}\alpha_2^{\zeta}&=0\end{aligned} \qquad (89).$$

In the symmetric equilibrium we have $\Delta_1^{\zeta}=-\Delta_2^{\zeta}$ and $\alpha_1^{\zeta}=\alpha_2^{\zeta}\equiv\alpha^{\zeta}$. Define $\lambda_\Delta\equiv\lambda_0^{-1}p'(1-\alpha^{-1})\alpha^{-\varepsilon}H^{\Delta\zeta}$ and $\lambda_\alpha=-\lambda_0^{-1}p\,\beta(\alpha-1)\alpha^{-2}\eta^{\zeta}$. Then, the solution to (89) is $m^{\zeta}=-2\lambda_\Delta(\lambda_1+\lambda_2)^{-1}$ and $\alpha^{\zeta}=(\lambda_\alpha(\lambda_1+\lambda_2)-\lambda_\Delta(2+\lambda_5))((\lambda_3-\lambda_4)(\lambda_1+\lambda_2))^{-1}$ where we used $m=\Delta_2-\Delta_1$. $H^{\Delta\zeta}=-2^{-1}\varepsilon h^{-\varepsilon}(h_c^{\zeta}/h_c-h^{\zeta}/h)$. Since $h(v)^{\zeta}/h(v)$ is increasing in v by assumption on the properties of the compensation function, $\underline{u}_1\geq\bar{u}_1\Rightarrow H^{\Delta\zeta}\leq0\Rightarrow\lambda^{\Delta}\leq0\Rightarrow(\partial m/\partial\zeta)\geq0$. A sufficient condition for $\alpha^{\zeta}\geq0$ is $\eta^{\zeta}\leq0$. $Sign(\lambda_\alpha)\propto-Sign(\eta^{\zeta})$.

$$\eta^{\zeta}=-\frac{\varepsilon h(\bar{u},\zeta)^{-\varepsilon}\left(\frac{h(\bar{u},\zeta)^{\zeta}}{h(\bar{u},\zeta)}H-\int_0^{\underline{u}}h(v,\zeta)^{-\varepsilon}\frac{h(v,\zeta)^{\zeta}}{h(v,\zeta)}dv-\int_0^{\bar{u}}h(v,\zeta)^{-\varepsilon}\frac{h(v,\zeta)^{\zeta}}{h(v,\zeta)}dv\right)\left(\frac{h(\bar{u},\zeta)}{h(\bar{u},\zeta)^{v}}\right)}{2H^2}+\frac{h(\bar{u},\zeta)^{-\varepsilon}}{2H}\frac{\partial}{\partial\zeta}\left(\frac{h(\bar{u},\zeta)}{h(\bar{u},\zeta)^{v}}\right) \qquad (90).$$

Applying the mean value theorem for integrals we get

$$\eta^{\zeta}=\frac{\left(\frac{h(\underset{.}{u},\zeta)^{\zeta}}{h(\underset{.}{u},\zeta)}-\frac{h(\bar{u},\zeta)^{\zeta}}{h(\bar{u},\zeta)}\right)\left(\int_{0}^{\underline{u}}h(v,\zeta)^{-\varepsilon}\,dv\right)+\left(\frac{h(\dot{u},\zeta)^{\zeta}}{h(\dot{u},\zeta)}-\frac{h(\bar{u},\zeta)^{\zeta}}{h(\bar{u},\zeta)}\right)\left(\int_{0}^{\bar{u}}h(v,\zeta)^{-\varepsilon}\,dv\right)}{\frac{2H^{2}}{\varepsilon h(\bar{u},\zeta)^{-\varepsilon}}\frac{h(\bar{u},\zeta)^{\nu}}{h(\bar{u},\zeta)}} + \frac{h(\bar{u},\zeta)^{-\varepsilon}}{2H}\frac{\partial}{\partial\zeta}\left(\frac{h(\bar{u},\zeta)}{h(\bar{u},\zeta)^{\nu}}\right) \quad (91),$$

where $0\le\dot{u}\le\bar{u}$ and $0\le\underset{.}{u}\le\underline{u}$. The first term is negative because $\int_{0}^{\underline{u}}h(v,\zeta)^{-\varepsilon}\,dv\ge\int_{0}^{\bar{u}}h(v,\zeta)^{-\varepsilon}\,dv$ and $\frac{h(\dot{u},\zeta)^{\zeta}}{h(\dot{u},\zeta)}\le\frac{h(\underset{.}{u},\zeta)^{\zeta}}{h(\underset{.}{u},\zeta)}$. The second term $\frac{\partial}{\partial\zeta}\left(\frac{h(\bar{u},\zeta)}{h(\bar{u},\zeta)^{\nu}}\right)=-\frac{\partial}{\partial v}\left(\frac{h(\bar{u},\zeta)^{\zeta}}{h(\bar{u},\zeta)}\right)\left(\frac{h(\bar{u},\zeta)}{h(\bar{u},\zeta)^{\nu}}\right)^{2}\le 0$ by assumption. Therefore, $\eta^{\zeta}\le 0\Rightarrow\alpha^{\zeta}\ge 0$. Both $(\partial m/\partial\zeta)\ge 0$ and $(\partial\alpha/\partial\zeta)\ge 0$ sound reasonable,- for large sensitivity to content a movement away from the center of the market means the fall of aggregate demand for all people in the interior market and the loss of indifferent consumer. However, the first decrease in aggregate demand is exactly offset by the increase in demand by individuals at the distance u_i^{interior} towards the end of the market while the latter term is overwhelmingly smaller than increase in demand at the distance $u_i^{corner}-u_i^{\text{interior}}\ge 0$ from the end of the market. Similarly, rising sensitivity to content gives the ability to stations to raise advertising rates because the propensity of the indifferent consumer to switch to another station is fall.

<u>Appendix 7</u>

Proof of Lemma 7: By differentiating the first-order conditions with respect to ε and evaluating at $t=0$ we have

$$\begin{aligned}\pi_1^{\Delta_1\varepsilon}+\pi_1^{\Delta_1\Delta_1}\Delta_1^{\varepsilon}+\pi_1^{\Delta_1\Delta_2}\Delta_2^{\varepsilon}+\pi_1^{\Delta_1\alpha_1}\alpha_1^{\varepsilon}+\pi_1^{\Delta_1\alpha_2}\alpha_2^{\varepsilon}=0\\ \pi_1^{\alpha_1\varepsilon}+\pi_1^{\alpha_1\Delta_1}\Delta_1^{\varepsilon}+\pi_1^{\alpha_1\Delta_2}\Delta_2^{\varepsilon}+\pi_1^{\alpha_1\alpha_1}\alpha_1^{\varepsilon}+\pi_1^{\alpha_1\alpha_2}\alpha_2^{\varepsilon}=0\end{aligned} \quad (92).$$

In the symmetric equilibrium we have $\Delta_1^{\varepsilon}=-\Delta_2^{\varepsilon}$ *and* $\alpha_1^{\varepsilon}=\alpha_2^{\varepsilon}\equiv\alpha^{\varepsilon}$. *Define* $\kappa_{\Delta}\equiv\left(\frac{1}{\lambda_0}\right)p'\left(1-\frac{1}{\alpha}\right)\alpha^{-\varepsilon}H^{\Delta\varepsilon}$ *and* $\kappa_{\alpha}=-\left(\frac{1}{\lambda_0}\right)\frac{p\,\beta(\alpha-1)}{\alpha^2}\left(1+\eta^{\varepsilon}\right)$. *Then the solution to the system of equations (92) is* $m^{\varepsilon}=-2\kappa_{\Delta}\left(\lambda_1+\lambda_2\right)^{-1}$ *and* $\alpha^{\varepsilon}=\left(\kappa_{\alpha}\left(\lambda_1+\lambda_2\right)-\kappa_{\Delta}\left(2+\lambda_5\right)\right)\left(\left(\lambda_3-\lambda_4\right)\left(\lambda_1+\lambda_2\right)\right)^{-1}$ *where we've used* $m=\Delta_2-\Delta_1$. $H^{\Delta\varepsilon}=-\varepsilon\left(\underline{h}^{-\varepsilon-1}-1/2\,\overline{h}^{-\varepsilon-1}\right)=-(1/2)\varepsilon\overline{h}^{-\varepsilon}\left(\underline{h}-1/2\,\overline{h}\right)$. $\underline{u}\geq\overline{u}\Rightarrow H^{\Delta\varepsilon}\leq 0\Rightarrow\kappa_{\Delta}\leq 0$. *The sign of* κ_{α} *is ambiguous as is the sign of* α^{ε}

<u>Appendix 8</u>

Proof of Lemma 8: The first-order conditions with respect to location is independent of β therefore the equilibrium locations is independent of advertising pricing parameter. Further, since, by assumption, β is constant then $\partial\alpha_1/\partial\beta=\partial\alpha_2/\partial\beta=-\alpha^2(\alpha-1)p^{-1}\beta^{-1}\leq 0$ ■

<u>Appendix 9</u>

Proof of Lemma 9: We have $\lambda_1\geq\lambda_2\geq 0$, $\lambda_3\geq\lambda_4\geq 0$ and $\lambda_5\geq 0$, however, $(1+\lambda_5)\lambda_3+\lambda_4\geq\lambda_3+(1+\lambda_5)\lambda_4$ which implies that the sign of $-\lambda_2\left((1+\lambda_5)\lambda_3+\lambda_4\right)+\lambda_1\left(\lambda_3+(1+\lambda_5)\lambda_4\right)$, hence, the sign of χ_{α_1} are ambiguous. Similarly, $\lambda_1\geq\lambda_2\geq 0$, $\lambda_3\geq\lambda_4\geq 0$, $\lambda_5\geq 0$ imply that $(1+\lambda_5)\lambda_3+\lambda_4\geq\lambda_3+(1+\lambda_5)\lambda_4$, hence, $\chi_{\alpha_2}\leq 0$. $\chi_{\alpha_1}+\chi_{\alpha_2}\propto-\frac{(2+\lambda_5)\left(2\lambda_5+(\lambda_1-\lambda_2)(\lambda_3+\lambda_4)\right)}{\left(\lambda_5+\lambda_1(\lambda_3+\lambda_4)\right)(\lambda_3-\lambda_4)}\leq 0$.

Turning to limiting cases, we know that as ζ increases stations move away from each other as far as possible. In the limit we have $\lim_{\zeta\to\infty}\Delta_1=1/4$. Therefore, we will have $\lim_{\zeta\to\infty}\left(\frac{h(1/2-\Delta_1,\zeta)}{h^{v}(1/2-\Delta_1,\zeta)}\right)=0$, $\lim_{\zeta\to\infty}\left(\frac{h(1/2-\Delta_1,\zeta)^{-\varepsilon}}{2H(\Delta_1,1/2-\Delta_1,\zeta)}\right)=0$, hence, $\lim_{\zeta\to\infty}\eta(\Delta_1,1/2-\Delta_1,\zeta)=0$. By using the fact that $\lim_{\zeta\to\infty}\left(1+2\left(\frac{h'(1/2-\Delta_1,\zeta)/h(1/2-\Delta_1,\zeta)}{h'(\Delta_1,\zeta)/h(\Delta_1,\zeta)}\right)\right)=3$ we can simplify λ_j, $j=1,2,3,4,5,6$ as

follows: $\lambda_1=\frac{3}{\eta}\left(\frac{1+\beta\varepsilon}{\beta\varepsilon}\right)$, $\lim_{\zeta\to\infty}\eta(\Delta_1,1/2-\Delta_1,\zeta)=0\Rightarrow\lim_{\zeta\to\infty}\lambda_1=\infty$, $\lambda_2=\frac{1}{\eta}\left(\frac{1+\beta\varepsilon}{\beta\varepsilon}\right)$,

$\lim_{\zeta\to\infty}\eta(\Delta_1,1/2-\Delta_1,\zeta)=0\Rightarrow\lim_{\zeta\to\infty}\lambda_2=\infty$,

$\lambda_3=\frac{2\beta(\varepsilon+\eta)\eta^2(1+\beta)}{\varepsilon(1+\beta(\varepsilon+\eta))}+\frac{\eta\beta(\varepsilon+\eta)(2(1+2\varepsilon\beta)+\varepsilon)}{\varepsilon(1+\beta(\varepsilon+\eta))}+\frac{2\beta(1+\beta\varepsilon)(\varepsilon+\eta)}{(1+\beta(\varepsilon+\eta))}$, where we used the fact that

$\lim_{\zeta\to\infty}r=1$ and $\lim_{\zeta\to\infty}(h/h')=\eta$. Now, $\lim_{\zeta\to\infty}\eta(\Delta_1,1/2-\Delta_1,\zeta)=0\Rightarrow\lim_{\zeta\to\infty}\lambda_3=2\beta\varepsilon$.

$\lambda_4=\frac{\beta(\varepsilon+\eta)\eta(\varepsilon+2\eta)}{\varepsilon(1+\beta(\varepsilon+\eta))}$. $\lim_{\zeta\to\infty}\eta(\Delta_1,1/2-\Delta_1,\zeta)=0\Rightarrow\lim_{\zeta\to\infty}\lambda_4=0$. $\lambda_5=\frac{2\eta}{\varepsilon}$.

$\lim_{\zeta\to\infty}\eta(\Delta_1,1/2-\Delta_1,\zeta)=0\Rightarrow\lim_{\zeta\to\infty}\lambda_5=0$.

The elasticities of best-responses contain the following expressions.

$$\lambda_5-\lambda_2(\lambda_3+\lambda_4)=\frac{2\eta}{\varepsilon}-\frac{1}{\eta}\left(\frac{1+\beta\varepsilon}{\beta\varepsilon}\right)\left(\frac{2\beta(\varepsilon+\eta)\eta^2}{\varepsilon(1+\beta(\varepsilon+\eta))}+\frac{2\beta(\varepsilon+\eta)(1+2\varepsilon\beta+\varepsilon+\eta)\eta}{\varepsilon(1+\beta(\varepsilon+\eta))}+\frac{2\beta(1+\beta\varepsilon)(\varepsilon+\eta)}{(1+\beta(\varepsilon+\eta))}\right)$$

.

Since $\lim_{\zeta\to\infty}\eta=0$ the first term in the second brackets drops out while the second term

can be written as $\frac{2\beta(1+2\varepsilon\beta+\varepsilon)\eta}{(1+\beta\varepsilon)}$. Therefore,

$$\lambda_5-\lambda_2(\lambda_3+\lambda_4)=-\left(\frac{1+\beta\varepsilon}{\beta\varepsilon}\right)\left(\frac{2\beta(1+2\varepsilon\beta+\varepsilon)}{(1+\beta\varepsilon)}+\frac{2\beta(1+\beta\varepsilon)(\varepsilon+\eta)}{(1+\beta(\varepsilon+\eta))\eta}\right).$$

$$\lambda_5+\lambda_1(\lambda_3+\lambda_4)=3\left(\frac{1+\beta\varepsilon}{\beta\varepsilon}\right)\left(\frac{2\beta(1+2\varepsilon\beta+\varepsilon)}{(1+\beta\varepsilon)}+\frac{2\beta(1+\beta\varepsilon)(\varepsilon+\eta)}{(1+\beta(\varepsilon+\eta))\eta}\right).\ (1+\lambda_5)\lambda_3+\lambda_4=2\beta\varepsilon.$$

$\lambda_3 + (1+\lambda_5)\lambda_4 = 2\beta\varepsilon$. Therefore, we obtain

$$-\lambda_2\left((1+\lambda_5)\lambda_3+\lambda_4\right)+\lambda_1\left(\lambda_3+(1+\lambda_5)\lambda_4\right)=\frac{4(1+\beta\varepsilon)}{\eta},$$

$\left(\lambda_5+\lambda_1(\lambda_3+\lambda_4)\right)(\lambda_3-\lambda_4)=\frac{6}{\eta}\left(\frac{1+\beta\varepsilon}{\beta\varepsilon}\right)^2\left(\frac{2\beta(1+2\varepsilon\beta+\varepsilon)}{(1+\beta\varepsilon)}+\frac{2\beta(1+\beta\varepsilon)(\varepsilon+\eta)}{(1+\beta(\varepsilon+\eta))\eta}\right)$. Combining expressions yields $\lim\limits_{\zeta\to\infty}\frac{d\Delta_2}{d\Delta_1}=\frac{1}{3}$ and $\frac{d\alpha_1}{d\Delta_1}=\left(\frac{3(1+\beta\varepsilon)}{\beta\varepsilon^2}\left(\frac{(1+2\varepsilon\beta+\varepsilon)}{(1+\beta\varepsilon)}+\frac{(1+\beta\varepsilon)(\varepsilon+\eta)}{(1+\beta(\varepsilon+\eta))\eta}\right)\right)^{-1}$. Since $\lim\limits_{\zeta\to\infty}\frac{(1+\beta\varepsilon)(\varepsilon+\eta)}{(1+\beta(\varepsilon+\eta))}=\varepsilon$ and $\lim\limits_{\zeta\to\infty}\frac{1}{\eta}=\infty$, $\lim\limits_{\zeta\to\infty}\frac{d\alpha_1}{d\Delta_1}=0$. Similarly,

$\frac{d\alpha_2}{d\Delta_1}=-\left(\frac{3(1+\beta\varepsilon)}{\beta\varepsilon^2}\left(\frac{(1+2\varepsilon\beta+\varepsilon)}{(1+\beta\varepsilon)}+\frac{(1+\beta\varepsilon)(\varepsilon+\eta)}{(1+\beta(\varepsilon+\eta))\eta}\right)\right)^{-1}$ and $\lim\limits_{\zeta\to\infty}\frac{d\alpha_2}{d\Delta_1}=0$. When ζ falls to zero then $\lim\limits_{\zeta\to 0}\Delta_1=1/2$, therefore, $\lim\limits_{\zeta\to 0}\left(\frac{h(1/2-\Delta_1,\zeta)}{h^v(1/2-\Delta_1,\zeta)}\right)=\infty$, $\lim\limits_{\zeta\to 0}\left(\frac{h(1/2-\Delta_1,\zeta)^{-\varepsilon}}{2H(\Delta_1,1/2-\Delta_1,\zeta)}\right)=1$ and $\lim\limits_{\zeta\to 0}\eta(\Delta_1,1/2-\Delta_1,\zeta)=\infty$. Since $\lim\limits_{\zeta\to 0}\left(\frac{h(1/2-\Delta_1,\zeta)^{-\varepsilon}}{2H(\Delta_1,1/2-\Delta_1,\zeta)}\right)=1$ at $\lim\limits_{\zeta\to 0}\alpha=1$ then as $\zeta\to 0$ we have $\left(\frac{h}{h'}\right)\to\eta$, therefore we can write λ_j, $j=1,2,3,4,5$ as: $\lambda_1=\frac{\varepsilon\psi}{\eta(r-1+\varepsilon)}$, where $\psi\equiv 1+2\left(\frac{h'/h}{h'/h}\right)$ with $\lim\limits_{\zeta\to 0}\psi=\infty$ (please note that $\lim\limits_{\zeta\to 0}(\psi/\eta)=1$ while $\lim\limits_{\zeta\to 0}(\psi/r)=0$; we also have $\lim\limits_{\zeta\to 0}\eta=\infty$, $\lim\limits_{\zeta\to 0}r=\infty$, $\lim\limits_{\zeta\to 0}(\eta/r)=0$ and $\lim\limits_{\zeta\to 0}(\eta^2/r)=\infty$), $\lambda_2=\frac{\varepsilon}{\eta(r-1+\varepsilon)}$ ($\lim\limits_{\zeta\to 0}\eta=\infty\Rightarrow\lim\limits_{\zeta\to 0}\lambda_2=0$),

$\lambda_3=\frac{2(\varepsilon+\eta)}{r-1+\varepsilon}+\frac{2\beta(\varepsilon+\eta)^2}{r-1+\varepsilon}+\frac{\eta(\varepsilon+2\eta)}{r-1+\varepsilon}$ (generally, the limit of this expression as $\zeta\to 0$ is ambiguous and depends on the functional form of the compensation function; for functional form of compensation function $h(v,\zeta)=1+\sum_{j=1}^{J}v^{\frac{1}{\zeta}+j},0\le\zeta\le 1,J\ge 1$ we have $\lim\limits_{\zeta\to 0}(\eta^2-r)=\infty$,

$\lim_{\zeta\to 0}(\eta - r) = -\infty$ in which case $\lim_{\zeta\to 0}\frac{2(\varepsilon+\eta)}{r-1+\varepsilon} = 0$, $\lim_{\zeta\to 0}\frac{2\beta(\varepsilon+\eta)^2}{r-1+\varepsilon} = \infty$, $\lim_{\zeta\to 0}\frac{\eta(\varepsilon+2\eta)}{r-1+\varepsilon} = \infty$; on the other hand, when $r \le 1$ and is a constant then all the terms of go to infinity, thus, $\lim_{\zeta\to 0}\lambda_3 = \infty$),

$\lambda_4 \equiv \frac{\eta(\varepsilon+2\eta)}{r-1+\varepsilon}$ (again, for examples of functional forms mentioned above we have $\lim_{\zeta\to 0}\lambda_4 = \infty$),

$\lambda_5 = \frac{2\eta}{r-1+\varepsilon}$ (when r is a finite constant then the limit of λ_5 as $\zeta \to 0$ is ambiguous; however, when $r\to\infty$ then $\lim_{\zeta\to 0}\lambda_5 = 0$). In order to sign elasticities of best response functions we need to sign the following expressions:

$$\lambda_5 - \lambda_2(\lambda_3+\lambda_4) = \frac{2\left(\eta^2(r-1+\varepsilon) - \varepsilon\left(\varepsilon+\eta+\beta(\varepsilon+\eta)^2+\eta(\varepsilon+2\eta)\right)\right)}{\eta(r-1+\varepsilon)^2}$$

, which, in the limiting case where $\zeta\to 0$, is dominated by the term $\eta/(r-1+\varepsilon)$,

$$\lambda_5 + \lambda_1(\lambda_3+\lambda_4) = \frac{2\left(\eta^2(r-1+\varepsilon) + \varepsilon\psi\left(\varepsilon+\eta+\beta(\varepsilon+\eta)^2+\eta(\varepsilon+2\eta)\right)\right)}{\eta(r-1+\varepsilon)^2}$$

, that is dominated by the term $\varepsilon\psi\eta/(r-1+\varepsilon)^2$,

$$\lambda_1((1+\lambda_5)\lambda_3+\lambda_4) = \frac{\varepsilon\psi\eta(\varepsilon+2\eta)(r-1+\varepsilon)+\varepsilon\psi(2\eta+r-1+\varepsilon)\left(2(\varepsilon+\eta)+2\beta(\varepsilon+\eta)^2+\eta(\varepsilon+2\eta)\right)}{\eta(r-1+\varepsilon)^3},$$

which is dominated by the term $\psi\eta/(r-1+\varepsilon)^2$,

$$\lambda_2((1+\lambda_5)\lambda_3+\lambda_4) = \frac{\varepsilon\eta(\varepsilon+2\eta)(r-1+\varepsilon)+\varepsilon(2\eta+r-1+\varepsilon)\left(2(\varepsilon+\eta)+2\beta(\varepsilon+\eta)^2+\eta(\varepsilon+2\eta)\right)}{\eta(r-1+\varepsilon)^3},$$

which can be approximated $\eta/(r-1+\varepsilon)^2$,

$$\lambda_1\left(\lambda_3+\left(1+\lambda_5\right)\lambda_4\right)=\frac{\varepsilon\psi\left(2\left(\varepsilon+\eta\right)+2\beta\left(\varepsilon+\eta\right)^2+\eta\left(\varepsilon+2\eta\right)\right)\left(r-1+\varepsilon\right)+\varepsilon\psi\eta\left(\varepsilon+2\eta\right)\left(2\eta+r-1+\varepsilon\right)}{\eta\left(r-1+\varepsilon\right)^3},$$

which is dominated by $\psi\eta/\left(r-1+\varepsilon\right)^2$,

$\lambda_2\left(\lambda_3+\left(1+\lambda_5\right)\lambda_4\right)=\dfrac{\varepsilon\left(2\left(\varepsilon+\eta\right)+2\beta\left(\varepsilon+\eta\right)^2+\eta\left(\varepsilon+2\eta\right)\right)\left(r-1+\varepsilon\right)+\varepsilon\eta\left(\varepsilon+2\eta\right)\left(2\eta+r-1+\varepsilon\right)}{\eta\left(r-1+\varepsilon\right)^3}$, which is approximated by $\eta/\left(r-1+\varepsilon\right)^2$, and $\lambda_5\left(2+\lambda_5\right)=\dfrac{2\eta\left(2\eta+r-1+\varepsilon\right)}{\left(r-1+\varepsilon\right)^2}$, which can be approximated by $\eta/\left(r-1+\varepsilon\right)+\eta^2/\left(r-1+\varepsilon\right)^2$.

Then $\dfrac{d\Delta_2}{d\Delta_1}=-\dfrac{\dfrac{2\eta}{r-1+\varepsilon}-\dfrac{2\varepsilon}{\eta\left(r-1+\varepsilon\right)^2}\left(\varepsilon+\eta+\beta\left(\varepsilon+\eta\right)^2+\eta\left(\varepsilon+2\eta\right)\right)}{\dfrac{2\eta}{r-1+\varepsilon}+\dfrac{2\psi\varepsilon}{\eta\left(r-1+\varepsilon\right)^2}\left(\varepsilon+\eta+\beta\left(\varepsilon+\eta\right)^2+\eta\left(\varepsilon+2\eta\right)\right)}$. In order to find the limit of this expression as ζ approaches zero we need to know whether $\lambda_5-\lambda_2\left(\lambda_3+\lambda_4\right)$ is smaller or greater than zero.

$$\frac{2\eta}{r-1+\varepsilon}-\frac{2\varepsilon}{\eta\left(r-1+\varepsilon\right)^2}\left(\varepsilon+\eta+\beta\left(\varepsilon+\eta\right)^2+\eta\left(\varepsilon+2\eta\right)\right)\propto 1-\frac{\varepsilon}{\eta^2\left(r-1+\varepsilon\right)}\left(\varepsilon+\eta+\beta\left(\varepsilon+\eta\right)^2+\eta\left(\varepsilon+2\eta\right)\right)$$

. Since $\lim\limits_{\zeta\to 0}\left(\eta^2/r\right)=\infty$, $\lim\limits_{\zeta\to 0}\left(\eta/r\right)=0$ we can observe that $\lim\limits_{\zeta\to 0}\dfrac{\varepsilon\left(\varepsilon+\eta+\beta\left(\varepsilon+\eta\right)^2+\eta\left(\varepsilon+2\eta\right)\right)}{\eta^2\left(r-1+\varepsilon\right)}=0$, thus, we have $\lim\limits_{\zeta\to 0}\dfrac{d\Delta_2}{d\Delta_1}=-1$. Similarly, $\dfrac{d\alpha_1}{d\Delta_1}$, in the limiting case of $\zeta\to 0$, can be approximated by $\dfrac{d\alpha_1}{d\Delta_1}\xrightarrow{\zeta\to 0}-\dfrac{\dfrac{\eta}{r-1+\varepsilon}+\left(\dfrac{\eta}{r-1+\varepsilon}\right)^2-\dfrac{\eta}{\left(r-1+\varepsilon\right)^2}+\dfrac{\psi\eta}{\left(r-1+\varepsilon\right)^2}}{\dfrac{\eta^3\psi}{\left(r-1+\varepsilon\right)^3}}$. Since $\lim\limits_{\zeta\to 0}\left(\eta/r-1+\varepsilon\right)=0$ and $\lim\limits_{\zeta\to 0}\left(\psi/r-1+\varepsilon\right)=0$ then the last three terms in the numerator approaches zero faster than the first, as such, can be dropped out. Therefore, it can be restated as

$\frac{d\alpha_1}{d\Delta_1} = -\frac{(r-1+\varepsilon)^2}{\eta^2\psi}$. Similarly, it can be shown that $\frac{d\alpha_2}{d\Delta_1} = -\frac{(r-1+\varepsilon)^2}{\eta^2\psi}$. These two limits depends on the form of the compensation function. For compensating function

$$h(v,\zeta) = \begin{cases} 1+\sum_{j=0}^{J}\left((\zeta+j)v\right)^{\sigma(\zeta+j)} & \zeta \ge \overline{\zeta}, J \ge 1, \overline{\zeta} > 1, \sigma > 0 \\ 1+\sum_{j=1}^{J} v^{\sigma\left(\frac{1}{\zeta}+j\right)} & 0 \le \zeta \le \underline{\zeta}, J \ge 1, \underline{\zeta} < 1, \sigma > 0 \end{cases} \quad \lim_{\zeta\to 0} -\frac{(r-1+\varepsilon)^2}{\eta^2\psi} = 0 \Rightarrow \lim_{\zeta\to 0}\frac{d\alpha_1}{d\Delta_1} = \lim_{\zeta\to 0}\frac{d\alpha_2}{d\Delta_1} = 0.$$

For compensation functions of the form $h(v,\zeta) = 1+\sum_{j=2}^{J}(\zeta v)^{\sigma j}, J \ge 2, \sigma \ge 0$ or

$h(v,\zeta) = \exp\left\{\sum_{j=1}^{J}(\zeta v)^{\sigma j}\right\} - \sum_{j=1}^{J}(\zeta v)^{\sigma j}$ for $0 \le \zeta \le 1, J \ge 1, \sigma > 0$

$$\lim_{\zeta\to 0} -\frac{(r-1+\varepsilon)^2}{\eta^2\psi} = -\infty \Rightarrow \lim_{\zeta\to 0}\frac{d\alpha_1}{d\Delta_1} = \lim_{\zeta\to 0}\frac{d\alpha_2}{d\Delta_1} = -\infty.$$

$$\frac{d\Delta_2}{d\Delta_1} \propto -\frac{\eta^2(r-1+\varepsilon) - \varepsilon\left(\left((\varepsilon+\eta)(1+\beta(\varepsilon+\eta))+\eta(\varepsilon+2\eta)\right)\right)}{\eta^2(r-1+\varepsilon)+\varepsilon\psi\left(\left((\varepsilon+\eta)(1+\beta(\varepsilon+\eta))+\eta(\varepsilon+2\eta)\right)\right)}$$ where $\psi \equiv \left(1+2\left(\frac{h'/h}{h'/h}\right)\right)$. The sign of this expression is ambiguous, however, more light can be shed on it by considering two limiting cases: (i) $\zeta \to \infty$, where sensitivity of compensation function to content is very large and (ii) $\zeta \to 0$, where individuals are essentially indifferent to domestic content.

(i) $\zeta \to \infty$

By lemma 1 increase in sensitivity to content induces stations to locate as far as possible. Since the first-order conditions with respect to location require that the inner market of each station be smaller than the outer market, in the limit, we have $\lim_{\zeta\to\infty}\Delta_1 = 1/4$ and $\lim_{\zeta\to\infty}\Delta_2 = 3/4$. Further, we showed above that $\lim_{\zeta\to\infty}(d\Delta_2/d\Delta_1) = 1/3$.

Therefore, $\lim_{\zeta\to\infty}(\Delta_1/\Delta_2)/(d\Delta_2/d\Delta_1) = 1/9$.

(ii) $\zeta \to 0$

By lemma 1 $\lim_{\zeta\to 0}\Delta_1 = \lim_{\zeta\to 0}\Delta_2 = 1/2$. In Appendix 5 we show that $\lim_{\zeta\to\infty}\left(d\Delta_2/d\Delta_1\right) = -1$, therefore, $\lim_{\zeta\to\infty}\left(\Delta_1/\Delta_2\right)/\left(d\Delta_2/d\Delta_1\right) = -1$ ■

Appendix 10

Proof of Lemma 10: We showed in Appendix 9 that $\lim_{\zeta\to\infty}\Delta_1 = 1/4$. By symmetry the indifferent consumer locates in the middle of the unit domestic content ratio interval, therefore, we have $\lim_{\zeta\to\infty}\left(h(1/2-\Delta_1,\zeta)/2H(\Delta_1,1/2-\Delta_1,\zeta)\right) = 0$. This implies that $\lim_{\zeta\to\infty}\omega = 0$. Applying lemma 9 yields $\lim_{\zeta\to\infty}\Sigma_\Delta = 1-0+\frac{1}{9}(0+3) = \frac{4}{3}$. When $\zeta \to 0$ then $\lim_{\zeta\to 0}\left(h(1/2-\Delta_1,\zeta)^{-\varepsilon}/2H(\Delta_1,1/2-\Delta_1,\zeta)\right) = 1$ which implies that $\lim_{\zeta\to 0}\omega = 1/2$ and $\lim_{\zeta\to 0}\left(\Delta_2/\Delta_1\right) = 1$. Applying lemma 9 yields $\lim_{\zeta\to 0}\Sigma_\Delta = 1-\frac{1}{2}+(-1)\left(\frac{1}{2}+1\right) = -1$ ■

Appendix 11

Proof of Lemma 11: $\Sigma_\alpha = \chi_{\alpha_1}\left(-(\eta+\varepsilon+1)+\frac{\Delta_2}{\Delta_1}\eta\right)+\chi_{\alpha_2}\left(-\frac{\Delta_2}{\Delta_1}(\eta+\varepsilon+1)+\eta\right)$. We know that $\left|\chi_{\alpha_1}\right| \le \left|\chi_{\alpha_2}\right|$ and that $\chi_{\alpha_2} \le 0$. Further, we know that these two inequalities $\left|-(\eta+\varepsilon+1)+\frac{\Delta_2}{\Delta_1}\eta\right| \le \left|-\frac{\Delta_2}{\Delta_1}(\eta+\varepsilon+1)+\eta\right|$ and $-\frac{\Delta_2}{\Delta_1}(\eta+\varepsilon+1)+\eta \le 0$ always hold. Therefore, we always have $\Sigma_\alpha \ge 0$. Further, when preference are highly sensitive to domestic content ratio then, by lemma 9, both χ_{α_1} and χ_{α_2} converges to zero, therefore, Σ_α converges to zero as well. When preferences are insensitive to domestic content ratio then, by lemma 2, both χ_{α_1} and χ_{α_2} become zero. Moreover, we know that that $\lim_{\zeta\to 0}\left(\Delta_2/\Delta_1\right) = 1$ therefore we have

$\lim_{\zeta\to 0}\left(-(\eta+\varepsilon+1)+\frac{\Delta_2}{\Delta_1}\eta\right)=\lim_{\zeta\to 0}\left(-\frac{\Delta_2}{\Delta_1}(\eta+\varepsilon+1)+\eta\right)=\lim_{\zeta\to 0}(-1-\varepsilon)=-\infty$. However, since both χ_{α_1} and χ_{α_2} converge to zero much faster than ε approaches infinity we have Σ_α converge to zero ■

Appendix 12

Proof of Lemma 12: $\lambda_1 \geq \lambda_2$ and $\lambda_j \geq 0$, $j=1,2,3,4,5,6$, the result directly follows. When sensitivity to domestic content ratio approaches infinity then we have $\lim_{\zeta\to\infty} r=1$, $\lim_{\zeta\to\infty}(h/h')=\eta$ and $\lim_{\zeta\to\infty}\psi=3$. Substituting these expressions into # yields $y_\Delta=\frac{2H(\varepsilon+\eta)}{ph^{-\varepsilon}}\left\{2\left(\frac{(\varepsilon+\eta)(1+\beta(\varepsilon+\eta))}{\eta}+\varepsilon+2\eta\right)+\eta\right\}^{-1}$, therefore, $\lim_{\zeta\to\infty}\eta=0$ and $\lim_{\zeta\to\infty}2Hh^{\varepsilon}=\infty\Rightarrow\lim_{\zeta\to\infty}y_\Delta=\infty$. When sensitivity to domestic content ratio approaches zero then we have $\lim_{\zeta\to 0}(h/h')=\eta$, both $\lim_{\zeta\to 0}r=\infty$ and $\lim_{\zeta\to 0}\eta=\infty$ but $\lim_{\zeta\to 0}(\eta^2-r)=\infty$, $\lim_{\zeta\to 0}(\eta-r)=-\infty$. Then, using the fact that $\lim_{\zeta\to 0}\alpha=1$ we can write # as $y_\Delta=\frac{\varepsilon+\eta}{p}\left\{\left[\frac{\varepsilon(\psi-1)}{r-1+\varepsilon}\left(\frac{(\varepsilon+\eta)(1+\beta(\varepsilon+\eta))}{\eta}+\varepsilon+2\eta\right)\right]+\eta\right\}^{-1}$.

Again, we have $\lim_{\zeta\to 0}(\psi\eta/r)=\infty$ while $\lim_{\zeta\to 0}(\eta/r)=0$. Since price of advertising is monotonic function of broadcasting demand then $\lim_{\zeta\to\infty}B=0\Rightarrow\lim_{\zeta\to\infty}p(B)=0$. Therefore we have $\lim_{\zeta\to 0}y_\Delta=1$ ■

Appendix 13

Proof of Lemma 13: Since $\lambda_1 \geq \lambda_2$ and $\lambda_j \geq 0$, $j=1,2,3,4,5,6$, the result directly follows. Similarly to the proof of lemma 8 it can be shown for high sensitivity to content $\lim_{\zeta\to\infty}\eta=0\Rightarrow\lim_{\zeta\to\infty}y_\alpha=(2p\beta\varepsilon)^{-1}$. When sensitivity to domestic content ratio approaches zero then $\lim_{\zeta\to 0}\eta=\infty\Rightarrow$

$$
\begin{aligned}
\lim_{\zeta\to 0} y_\alpha &= \lim_{\zeta\to 0}\frac{(\varepsilon+\eta)}{p\eta}\frac{(\psi-1)}{2}\frac{\varepsilon\alpha}{r-1+\varepsilon}\left\{\frac{\varepsilon(\psi-1)}{r-1+\varepsilon}\left(\frac{(\varepsilon+\eta)(1+\beta(\varepsilon+\eta))}{\eta}+\varepsilon+2\eta\right)+\eta\right\}^{-1}\\
&= \lim_{\zeta\to 0} y_\Delta * \lim_{\zeta\to 0}\frac{(\psi-1)\varepsilon\alpha}{2\eta(r-1+\varepsilon)} \qquad \blacksquare\\
&= 0*0\\
&= 0
\end{aligned}
$$

<u>Appendix 14</u>

Proof of Proposition 2: As $\zeta\to\infty$ we have $\lim_{\zeta\to\infty}\eta=0$, therefore,

$$
\begin{aligned}
\lim_{\zeta\to\infty}\frac{\partial\left(\sum_{j=1}^{2}D_j\right)\Big/\partial t}{\sum_{j=1}^{2}D_j} &= 2y_\Delta-\frac{1}{2\alpha}y_\alpha\\
&= \frac{(\varepsilon+\eta)}{p}\left\{\frac{4H}{h^{-\varepsilon}}-\frac{(\psi-1)}{4\eta}\right\}\left\{(\psi-1)\left(\frac{(\varepsilon+\eta)(1+\beta(\varepsilon+\eta))}{\eta}+\varepsilon+2\eta\right)+\eta\right\}^{-1}\\
&= \frac{2(\varepsilon+\eta)\left(\frac{h}{h'}-1\right)}{p\eta\left[2\left(\frac{(\varepsilon+\eta)(1+\beta(\varepsilon+\eta))}{\eta}+\varepsilon+2\eta\right)+\eta\right]}\\
&= -\frac{1}{p(1+\beta(\varepsilon))}\\
&= -\infty
\end{aligned}
$$

We used the fact that $\lim_{\zeta\to\infty}B=0\Rightarrow\lim_{\zeta\to\infty}p(B)=0$. When $\zeta\to 0$ then

$$
\begin{aligned}
\lim_{\zeta\to 0}\frac{\partial\left(\sum_{j=1}^{2}D_j\right)\Big/\partial t}{\sum_{j=1}^{2}D_j} &= \lim_{\zeta\to 0}(\Delta_2-\Delta_1)\lim_{\zeta\to 0}(1-\eta)\,y_\alpha\\
&= \lim_{\zeta\to 0}(\Delta_2-\Delta_1)\lim_{\zeta\to 0}y_\Delta\lim_{\zeta\to 0}\frac{(\psi-1)(1-\eta)\varepsilon\alpha}{2\eta(r-1+\varepsilon)} \qquad \blacksquare\\
&= 0*0*0\\
&= 0
\end{aligned}
$$

<u>Appendix 15</u>

Proof of Proposition 3: Setting $\alpha_1 = \alpha_2 = \alpha$ and differentiating the set of first-order conditions yields $\partial\Delta_1/\partial\alpha = \partial\Delta_2/\partial\alpha = 0$. Substituting this into *(31)* and rearranging gives

$$\frac{\partial\left(\sum_{j=1}^{2} D_j\right)\Big/\partial\alpha}{\sum_{j=1}^{2} D_j} = -\frac{(\varepsilon+1)}{\alpha} < 0 \ \blacksquare$$

CHAPTER 4. THE EFFECT OF CULTURAL TARIFF ON TRADE IN MOVIES

A paper to be submitted to *The Journal of Cultural Economics*

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Abstract

Despite the fact that Hollywood dominates worldwide box offices (likely for the reason that moviegoers actually like its movies), some foreign governments view Hollywood movies as void of any artistic value. As a result, governments engage in various protectionist policies to mitigate Hollywood's negative influence on domestic culture. We build a two-country (the US and France) monopolistic competition model with two types of traded movies--blockbuster and auteur movies. We assume that the US has a comparative advantage in producing blockbusters while the French excel in production of auteur movies. All movies of each type are assumed to be perfect substitutes, while blockbuster and auteur movies are imperfect substitutes. Firms are heterogeneous in terms of their cost structure and derive revenue from sales in both markets and movies are an excludable public. Movies can be sold in both markets at no extra charge. We solve for a symmetric Cournot Nash equilibrium and analyze the effects of the introduction of a cultural tariff at the margin. We find that the most efficient firms produce both types of movies while less efficient firms specialize in the production of movies where their country has a comparative advantage. The introduction of a small tariff increases the number of French producers willing to enter the blockbuster market and reduces the number of French producers specializing in production of artistic movies.

This is caused by the cultural tariff which introduces a distortion into the relative price of movies. Notwithstanding the choice of market for French producers, the blockbusterness of the market falls. Aggregate consumption of auteur French-made movies and the self-sufficiency ratio of French producers increase with the introduction of a small cultural tariff.

1. Introduction

Many countries view Hollywood dominance in movie production and distribution not just as a threat to their domestic movie industry but also as a threat to their cultural sovereignty and national identity. During the 1994 G.A.T.T. negotiations, the majority of W.T.O.-member countries refused to bow to US pressure and lift restrictions on importation of Hollywood movies. The well-known director Claude Berri (*Jean de Florette*) reflected a popular attitude when he warned that "if the G.A.T.T. deal goes through as proposed, European culture is finished." French officials condemned Steven Spielberg's *Jurassic Park* as a "…threat to [French] national identity." After the French won the G.A.T.T. battle, French director Jean Jacques claimed: "We removed the threat that European culture would be completely eliminated."

Despite the fact that cultural protection barriers remained intact, the latest numbers show that the Hollywood market share in the world still exceeds 80%[46] and climbs to upper

[45] I would like to thank Harvey Lapan for his valuable comments and recommendations and John Beghin for his financial support in writing this paper. All errors are mine.
[46] A little known fact is that Bollywood (Indian movie industry) makes more movies than Hollywood, but most are made with small budget and rarely reach the international arena.

nineties in some markets[47]. There are many factors that helped such proliferation[48]. Quoted among the most significant are the size of the US market (in terms of per capita GDP). as well as English language[49]. Foreign governments see two big problems with Hollywood-made movies. First, they have low cultural content yet occupy the lion's share of the movie market. Hollywood movies are priced uncompetitively, which damages domestic filmmakers. The intuition for the former argument is that in an attempt to have as large an appeal as possible, Hollywood makes generic movies that are "safe" from a commercial point of view, therefore, it does not venture into the production of artistic movies[50]. The second reason stems from the relative size of the US market in comparison with most of its export markets. It is argued that US filmmakers recoup most of their production costs at home, and, given the public nature of the cinema industry where the greatest expense is the first-copy production, they can afford to sell movies in the international market at low prices. Worse than that, it is argued that American producers resort to dumping (defined here as total viewings over total production costs), as long as extra revenue is sufficient to cover minor incremental costs, such as dubbing. Therefore, foreign filmmakers, restricted by language and limited market reach, cannot compete with an "enormous [commercial] machine designed to pulverize." For these two reasons, foreign governments engage in protectionist policies, which vary in

[47] In the first half of 2006, of the top 12 studios, 11 Hollywood and Bueno Vista that caters to a Spanish-speaking audience, shared 92.8% of the world movie market. Moreover, in 2005, the top 25 movies based on gross receipts were made in Hollywood. The share of European movies in the US market rarely exceeds 5%.
[48] For a detailed history of international trade in movies, expansion of Hollywood and contraction of European cinema, please refer to Cowen (2002).
[49] Jayakar and Waterman (2000) and Lee (2002) find that language is not a significant predictor of the self-sufficiency ratio. At the same time, the British have the largest movie exports among all European countries, and their success is primarily attributed to their language (the British export to France is several times larger than that of France to UK).

severity beginning from production subsidies, cultural tariffs on sales of foreign movies, and ending with compulsory screen quotas imposed on domestic exhibitors. It is believed that such policies will create some breathing room for local studios. Given that domestic studios tend to specialize in artistic movies, as opposed to dumbed-down Hollywood blockbusters, the cultural value of the local movie market will increase as well.

Naturally, the United States, being the largest exporter of movies, opposes such measures. Prominent filmmakers, like Scorcese and Spielberg[51], pressure the US government to bully its French counterpart to liberalize one of the last bastions of trade. The French government fiercely resists and, as we mentioned earlier, has led the offensive against the United States during the Uruguay round of trade negotiations. However, the consensus is that if France does not adapt to a *new world order*, it will lose this war. The numbers for the past several decades are not inspiring; the French market share is dwindling, the system of cultural tariffs and subsidies is overused[52], and French contribution to the global market becomes internationally insignificant. However, despite these alarming statistics, there are a few signs of French recovery. For example, as of April 2006, the French movie *Les Bronzés 3 - amis pour la vie* trailed behind Hollywood blockbuster *Ice Age, The Meltdown* with the former commanding over $80 million in gross receipts (over 80% of which came from France), while Russian-made *Night Watch* and *Day Watch* grossed together just over $60 million

[50] The auteur theory, introduced by the French filmmakers Godard and Truffaut in the fifties, postulates that true artistic films bear the mark of their director-the-king and that everything else, including the audience, is secondary.
[51] Perhaps there exists some hypocrisy in the remarks of Gerard Depardieu and Jackie Chan, both of whom refer to Hollywood movies as dumbed-down and call their nations to unite against Hollywood yet, apparently, do not mind starring in the same dumbed-down Hollywood movies as long as they bring them hefty paychecks.
[52] It is estimated that over 50% of all production costs in France are covered, either directly or indirectly, by the government.

(over 50% was collected from Russian audience). Some movie critics attribute these successes to artistic values but even more so to local industries taking lessons from Hollywood and filming commercially viable movies[53]--a straightforward and easy to understand storyline for *Les Bronzés 3 - amis pour la vie* and extensive visual effects on par with the best Hollywood can offer for Russian *Night Watch* and *Day Watch*.

> Recently actress Kristin Scott Thomas has said that the resurgence in French cinema is down to a new approach amongst film-makers - who are no longer scared of commercial movies. She told … that a few years ago, such a film would have been shunned in France - but *Arsene Lupin* is typical of a new approach to movies in France. "I think it's very exciting, because for a long time in France 'commercial' was a dirty word," the Paris-based British actress added. "Now it's OK to make a lot of money with the films that you're making[54]."

These above examples illustrate that some domestic producers no longer view production of purely artistic movies as the sole option and that commercial aspect, including reaching out to international audience, ought to be considered the driving force behind production. More often than not, a new crop of French filmmakers are willing to dumb-down cultural content, to a certain extent, in exchange for acceptance by wider audiences and commercial appeal.

Although G.A.T.S. requires that countries remove impediments to trade and treat all W.T.O. members equally, countries that turn to protectionist policies often cite an exemption clause where governments may exempt goods and services it deems vital to its national identity. This clause is invoked not only for trade in movies, but also trade in theater, radio broadcasting and television, as well as trade in books and magazines.

[53] "The success of the French film *Amelie* signals a new direction in French cinema. National Public Radio's Nick Spicer reports that the French are starting to see bigger box office receipts thanks to some lessons learned from Hollywood." NPR (2002).
[54] BBC Entertainment News (2005).

In this paper, we investigate the claim that protection of domestic industries from foreign competition leads to new entry of domestic producers, and, given that domestic producers are more skilled in production of auteur movies, they produce auteur movies that are deemed rich in cultural content. This, it is alleged, gives a boost to the Hollywood-abused domestic culture[55].

We build a model of international trade between two countries, for example, the US and France, in two types of movies--blockbuster, which are viewed as low in cultural content, and auteur movies, which are viewed as rich in cultural content. Both markets are oligopolistic, and players play a quantity game where studios supply their movies to perfectly competitive exhibitors' clearing houses. All studios differ in their production efficiency but otherwise are identical and have no sunk and dubbing costs. Each country has a fixed number of identical consumers whose preference ordering is blockbusters, auteur movies and leisure. All movies within each genre are assumed to be perfect substitutes while genres themselves are imperfect substitutes. Preferences are assumed to be quasi-linear so that leisure absorbs all of the income effect. We assume that the parameters of the model are such that in the unconstrained equilibrium, some firms fully specialize while others cater to both auteur and blockbuster markets (necessary restrictions on the parameter space follow). We show that cultural tariff may induce entry of fresh French filmmakers into the auteur market. However, established French producers enter the *wrong* (blockbuster) market or genre, in the mind of French policymakers, who view the blockbuster genre as void of cultural value. Even though the average blockbusterness of the market falls, the fact that established players now favor

[55] There is some support for the dumbed-down argument in Chung and Song (2006) who find that Korean

production of *junk* movies over auteur movies may come as a surprise to a policymaker. Aggregate consumption of French-made auteur movies rises in response to a tariff--a welcome result for a domestic regulator.

Our paper is an extension of the analysis done by Francois and van Ypersele (2002) who show that restrictions on trade in the movie industry, characterized by increasing returns to scale technologies where individuals have discrete valuations of domestic (cultural genres) and foreign movies, may help resurrect production of valuable cultural genres for both the exporter and importer, which subsequently may increase welfare in both countries. However, Francois and van Ypersele focused on the welfare effects of cultural policies. The reason governments imposes tariffs on foreign movies in the first place is because they either have non-economic objectives they want to reach or they perceive that auteur movies bring positive externalities that the free market fails to take into account. Therefore, performing a welfare analysis while ignoring the policymakers' underlying rationale to engage in protectionism weakens welfare conclusions. In this paper, we shy away from welfare analysis. Instead, we concentrate on the question of whether the cultural tariff is a justified policy to either increase cultural value of the movie market or revenue share of domestic producers.

There exists empirical literature, Lee and Bae (2004), Lee (2002), regarding the impact of cultural protectionist polices on the self-sufficiency ratio[56]. These studies find that the quota system is not a significant predictor of the self-sufficiency ratio, suggesting that the quantitative restrictions on imports are not an effective mechanism to limit the number of

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moviegoers are willing to pay a premium for domestic movies.

foreign films shown in local cinema. We, however, find that in a symmetric environment with two types of movies supplied by heterogeneous studios, marginal import restrictions in the form of the small cultural tariff increase the self-sufficiency ratio.

Our paper also makes a contribution to the literature regarding quasi-competitiveness of the Cournot games (Frank and Quandt (1963), Novshek (1985), Okuguchi (1974), and Ruffin (1971)). We show that for quasi-linear preferences and heterogeneous producers facing no entry costs and producing two types of public goods, equilibrium is not quasi-competitive--prices increase with entry.

2. The Model

The US and French consumers have utility functions over auteur movies, $m_{k,i}^{a}$, blockbusters, $m_{k,i}^{b}$ and leisure, l_k, given by:

$$U_k \equiv \frac{1}{\eta}\left(\left(\sum_{i=1}^{n^{a,US}+n^{a,FR}} m_{k,i}^{a}\right)\left(\sum_{i=1}^{n^{b,US}+n^{b,FR}} m_{k,i}^{b}\right)\right)^{\eta} + l_k \qquad (1),$$

where $\eta < 0$ (assumption A1) and $n^{h,j}$ refers to the number of firms in country j producing movies of type h (it is customary in economic literature to refer "$-h$" as a type other than h and a country $-j$ as a country other than j). Subscript k refers to a country where sales take place. Hereunder, we refer to η as concavity parameter.

All movies within each genre (auteur and blockbuster) are assumed to be perfect substitutes, while the genres themselves are imperfect substitutes by virtue of assumption on parameter

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[56] Self-sufficiency ratio is defined as the proportion of revenues collected by domestic filmmakers.

space of the concavity parameter η[57]. The budget constraint for unitary income endowment is given by $\sum_{h=\{a,b\}}\sum_{j=\{US,FR\}} p_k^h M_k^{h,j} = 1 - l_k$, where $M_k^{h,j} \equiv \sum_{i=1}^{n^{h,j}} m_{k,i}^h$, is demand for movies of type h produced by firm i based on country j and sold in country k. Solving for demand yields $M_k^h = \left(p_k^h\right)^{\frac{\eta-1}{1-2\eta}} \left(p_k^{-h}\right)^{-\frac{\eta}{1-2\eta}}$. The elasticity of demand with respect to own price is given by $\frac{1-\eta}{1-2\eta}$, which belongs to $(1/2,1)$ interval. Even though the range of admissible elasticities is rather limited, it proves to be sufficient for our analysis. We refer to demands with elasticity of demand closer to lower boundary as not responsive to price changes while calling demands with elasticity in the vicinity of the unitary elasticity as responsive demands.

We normalize sizes of both countries to unity. Further, we assume that the US producers have a comparative advantage in producing blockbuster movies, where the French had such an advantage in producing auteur movies. Firms have a constant marginal cost of movie production given by i when produced using technology in which the firm has a comparative advantage and ic, $1 < c < \frac{\eta-3}{\eta-1}$ (assumption (A2)). Assumption (A2) guarantees that in an equilibrium, firms produce both types of movies.

Parameter i is an integer greater than one, and we assume that all firms have unique efficiency parameters and can be ranked in the ascending order of i. We further assume that firms incur no additional costs in selling movies abroad[58]. Further, heterogeneity of firms

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[57] Please note that $\eta \leq 1/2$ is required for utility maximization problem. Further restrictions, that $\eta < 0$, guarantees that blockbusters and auteur movies are substitutes.

[58] The direct extra costs of selling abroad are dubbing costs, however, small marginal dubbing costs do not change the qualitative results. Moreover, in the real world, dubbing costs are small in comparison with production costs, therefore, we ignore them.

allows us to derive monopolistic competition equilibrium even when sunk costs are not present. Therefore, we assume fixed costs are zero. We assume studios make their production and sales decisions simultaneously. Movies are sold in a perfectly competitive exhibitors' market. We assume there exist a large number of studios in the market and the market prices are determined by free entry--firms enter until marginal profits are exhausted. Firms export all their movies. Domestic sales and foreign sales are identical, therefore, foreign and domestic prices for each type of movie are identical as well.

We define τ as a cultural tariff imposed by France on US sales. Then the profit functions are given by:

$$\pi_i^{US} = \left(\left(2-\tau\right)p^a - ic\right)m_i^{a,US} + \left(\left(2-\tau\right)p^b - i\right)m_i^{b,US} \qquad (2),$$

$$\pi_i^{FR} = \left(2p^a - i\right)m_i^{a,FR} + \left(2p^b - ic\right)m_i^{b,FR} \qquad (3),$$

where prices are marginal utilities given by $p^h \equiv \left(\sum_{j=\{US,FR\}} M^{h,j}\right)^{\eta-1}\left(\sum_{j=\{US,FR\}} M^{-h,j}\right)^{\eta}$.

Define $f_i^{h,j}$ as the market share of firm i of country j of movie type h. Our preferences allow us to write the first-order conditions for an interior solution as:

$$\left(2-\tau\right)p^a\left(1+\left(\eta-1\right)f_i^{a,US} + \eta f_i^{b,US}\right) = ic, i = 1,2,\ldots,n^{a,US} \qquad (4),$$

$$\left(2-\tau\right)p^b\left(1+\left(\eta-1\right)f_i^{b,US} + \eta f_i^{a,US}\right) = i, i = 1,2,\ldots,n^{b,US} \qquad (5),$$

$$2p^a\left(1+\left(\eta-1\right)f_i^{a,FR} + \eta f_i^{b,FR}\right) = i, i = 1,2,\ldots,n^{a,FR} \qquad (6),$$

$$2p^b\left(1+\left(\eta-1\right)f_i^{b,FR} + \eta f_i^{a,FR}\right) = ic, i = 1,2,\ldots,n^{b,FR} \qquad (7).$$

Lemma 1: Under assumptions (A1) and (A2), in the neighborhood of zero cultural tariff, the symmetric equilibrium where most efficient firms enter both markets (or diversify),

while least efficient firms enter only the market in which the country has comparative advantage (or specialize), exists and is unique. All firms can be ranked in terms of efficiency and the least efficient US and French firms make zero profit.

Proof: *See Appendix.*

Solving the equilibrium and evaluating at the symmetric equilibrium in the vicinity of zero cultural tariff yields

$$\left(n^{b,US}-n^{a,US}\right)=\left(n^{a,FR}-n^{b,FR}\right)=\frac{(1-\eta)(c-1)2\left(-2c(-1+\eta)^{3}+\eta\left(1-4\eta+2\eta^{2}\right)\right)}{((1-\eta)c+\eta)(-1+\eta)(-1-2\eta+c(-1+2\eta))}$$ and

$$n^{a,US}=n^{b,FR}=\frac{2\left(-2c(-1+\eta)^{3}+\eta\left(1-4\eta+2\eta^{2}\right)\right)}{((1-\eta)c+\eta)(-1+\eta)(-1-2\eta+c(-1+2\eta))}.$$ The former is the equilibrium number of firms that fully specialize. The latter is the number of firms that produce both types of movies.

Lemma 2: Under assumptions (A1) and (A2), in the symmetric equilibrium, there are more (less) firms that diversify (specialize) than those that specialize (diversify) if and only if $c\le(\ge)\dfrac{2-\eta}{1-\eta}$***. As difference in technologies vanishes, the number of firms that fully specialized lessens.***

Proof: *More (less) US firms diversify (specialize) means that* $n^{b,US}-n^{a,US}\le(\ge)n^{a,US}$*. By free entry condition, we have* $n^{b,US}=n^{a,US}\left((1-\eta)c+\eta\right)$*, therefore* $\left(n^{b,US}/n^{a,US}\right)-1=(1-\eta)(c-1)$ *which yields the result. Similarly,* $n^{a,FR}-n^{b,FR}\le(\ge)n^{b,FR}$ *and* $n^{a,FR}=n^{b,FR}\left((1-\eta)c+\eta\right)$ *imply that there are more (less) French firms that diversify. Taking the limit of* $\left(n^{b,US}-n^{a,US}\right)=\left(n^{a,FR}-n^{b,FR}\right)$ *as* $c\to1$ *yields the result.*

The conclusions of Lemma 2 are not surprising--when the technology difference is large, only the most efficient domestic firms can afford to enter the market where their country has a comparative disadvantage. In our particular case, it amounts to the American firms producing blockbusters while French firms produce auteur movies. This is in line with the spirit of Ricardian gains from international trade; firms specialize in the production of goods where they have a comparative advantage. This result is driven purely by the assumption that American (French) firms are more skilled in the production of blockbuster (auteur) movies. Therefore, abstracting from the dynamic aspects of the real world, one of the reasons why Hollywood dominates the blockbuster niche (France was chosen to be a proxy for EU, and the EU and US markets are approximately of the same size) while the French are famous for their artistic movies is that Hollywood and French movie industries have sizable differences in technologies. Some of the properties of the symmetric equilibrium solutions are given in Lemma 3 below.

Lemma 3: Under assumptions (A1) and (A2), in the symmetric equilibrium around small cultural tariff, the equilibrium number of firms that produce either one or two types of movies (i) decreases in concavity parameter and (ii) increases in the technology parameter.

Proof: *See Appendix.*

Recall that the elasticity of substitution is an increasing monotonic transformation of the concavity parameter. Therefore, the higher the elasticity of demand, the smaller the number of firms on the market. This is the standard result for Cournot games for either homogenous or heterogeneous firms; higher elasticity of demand means that consumers are less willing to put up with higher prices. In our model, equilibrium numbers of firms are proportional to prices. Therefore, when people have a relatively high elasticity of demand, the number of firms on the market is relatively small.

Responses of the equilibrium number of firms to changes in the technology parameter are driven by the structure of the model—the absence of entry costs makes the equilibrium number of firms strictly increase with new entry. Given that higher costs correspond to higher prices, they, by extension, contribute to a higher number of firms in the market. This implies that consumption of movies is inversely related to the technology parameter, a standard result of economic theory.

3. Government policy

In the real world, Hollywood makes movies of both genres. However, the Hollywood movies that are mostly shown on foreign screens are blockbusters. The sheer size of the US market means that blockbusters capture the lion's share of foreign screens, which leaves little room for auteur movies. It is argued that the latter are rich in cultural content while blockbusters have a dumbing-down effect on domestic culture. Hence, foreign governments justify intervention into the movie market based on a rationale of domestic culture preservation. Policymakers believe that domestic producers excel in the production and marketing of auteur movies, therefore, protection allows new domestic producers to enter the movie industry and create artistic movies.

We investigate the effects of government cultural tariff on the production decisions of French producers. More specifically, we want to know if these two policies lead not only to entry of new French producers but also entry in the *correct* (auteur) market. We also investigate the effects of cultural tariff on self-sufficiency ratio and the average *cultural* content of French markets.

Proposition 1: Under assumptions (A1) and (A2), in the symmetric equilibrium under free trade, the introduction of a marginal cultural tariff, leads to:

(i) entry of French producers into the blockbuster market,

(ii) entry of specialized American producers into the blockbuster market,

(iii) exit of French fully specialized producers from the auteur market, and

(iv) exit of diversified American producers from the auteur market.

Further, the total number of firms serving the auteur market shrinks while the total number of firms serving the blockbuster market increases.

Proof: *See Appendix.*

Since responses of the equilibrium number of firms to changes in cultural tariff are closely tied to changes in equilibrium prices, we state the following corollary to Proposition 1.

Corollary to Proposition 1: Under assumptions (A1) and (A2), in the symmetric equilibrium around zero cultural tariff, marginal changes in cultural tariff:

(i) increase prices of auteur movies,

(ii) increase prices of blockbuster movies, and

(iii) reduce the relative price of auteur movies.

Proof: *See Appendix*.

The choice of market is determined by the interaction between changes in relative prices and technology differences between the two countries. Prices are determined by Nash behavior of all market participants; however, given differences in technology, the blockbuster market is dominated by American producers while the auteur market is dominated by French producers. Thus, the key determinants of blockbuster prices are American firms while key determinants of auteur prices are French firms. Further, changes in cultural tariff affect American firms through changes in prices while changes in tariff level affect French producers only indirectly. This implies that the tariffs are likely to have larger effects on American firms than French firms, and consequently, changes in American behavior are likely to play a dominant role in determining equilibrium prices.

American firms excel in production of blockbusters and find production of artistic movies costly, therefore, an indiscriminate tariff (i.e. a tariff imposed on all American imports irrespective of the type of the movie) makes American firms less willing to produce a movie type which they already find costly. Hence, such a tariff skews production of American firms away from artistic movies towards blockbusters. Given that American firms drive changes in the blockbuster price (both by virtue of having larger share of the blockbuster market and by virtue of being affected both directly and indirectly) and that prices increase with new entry, American firms move away from production of auteur movies towards production of blockbusters. Once tariff is introduced, French producers find the blockbuster market more attractive and switch from production of artistic movies towards production of blockbusters. Switching production to the movie type in which ones' country has technological disadvantage may be costly. Blockbuster and auteur movies are substitutes, therefore, higher blockbuster prices have a positive effect on auteur prices. Since blockbuster prices increase faster than auteur prices, the net effect is that the relative price of auteur movies to blockbusters falls.

An alternative explanation for marginal changes in prices and numbers of firms is that the rising French cultural tariff rate leaves less room for American firms to operate, and given that firms recoup their costs from sales on both markets, the least efficient US firms that produced both types of movies now resort to complete specialization. Furthermore, given that relative prices of blockbusters rise, new entry of American studios in the blockbuster market occurs. French firms also observe higher blockbuster prices and reallocate their resources towards the sector that guarantees higher profit margins. Existence of profit causes new entry into the blockbuster market by already existing French studios, i.e. studios that fully specialized before the policy was implemented now find it profitable to cater to both markets.

Regarding total number of firms, American firms leave the auteur market because producing auteur is too costly. At the same time, having an advantage in production of auteur movies, French producers are not so keen to leave the auteur market. The relative price of blockbuster movies is increasing, therefore, they have higher incentives to enter the blockbuster market as well. Since firms can cater to both markets at once, the end result is that the total number of firms serving the auteur market falls, mostly at the expense of American producers leaving the auteur market. Similar intuition applies to the total number of firms that service the blockbuster market; higher relative prices of blockbusters attract new French entry. As for American studios, on the one hand, they are pushed out of the French market, and, given that they derive revenue from sales in both US and French markets, their ranks shrink. On the other hand, because the relative price of blockbuster movies is increasing in cultural tariff, they are not as willing to leave the blockbuster market as to leave auteur market.

We investigate a common belief that tariffs assist French firms in entering the movie market (or swell French firms' market share) and also raise cultural content of the market, given that the French are known for producing quality artistic movies. We choose proportion of blockbuster movies (deemed low in cultural content) in the total volume of movie consumption as a proxy for the blockbusterness of the French market. Response of blockbusterness to changes in cultural tariff is summarized in the following proposition.

Proposition 2: Under assumptions (A1) and (A2), in a symmetric equilibrium around free trade the introduction of a marginal cultural tariff reduces blockbusterness of the market.

Proof: *The ratio of aggregate demand for blockbusters consumed by French consumer over the aggregate French consumer demand for auteur movies is given by*

$\frac{\sum_{j=\{US,FR\}} M^{b,j}}{\sum_{h=\{a,b\}} \sum_{j=\{US,FR\}} M^{h,j}} = \frac{\left(p^a / p^b\right)}{1+\left(p^a / p^b\right)}$. *By corollary to Proposition 1, relative price of auteur movies falls, therefore, so does the blockbusterness.*

This result may seem unusual at the first glance. After all, cultural tariff leads to new entry of both American and French producers into the blockbuster market. However, because our equilibrium does not have quasi-competitiveness property, new entry into blockbuster market raises prices. This means that consumers reshuffle their consumption basket away from blockbusters, which leads to a drop in blockbusterness. This is the response French policymakers supposedly want to achieve. Of course, the cost of achieving this goal is that French producers focusing more attention on blockbusters.

The second question of interest is what happens to aggregate consumption of French auteur movies given by $F^a M^a$.

Proposition 3: Under assumptions (A1) and (A2), in a symmetric equilibrium around free trade the introduction of a marginal cultural tariff increases aggregate consumption of French-made auteur movies.

Proof: *See Appendix.*

Lastly, to investigate the effect of the cultural tariff on the self-sufficiency ratio defined as $E \equiv \dfrac{\sum_{h=\{a,b\}} p^h M^{h,FR}}{\sum_{h=\{a,b\}} \sum_{j=\{US,FR\}} p^h M^{h,j}} = \dfrac{1}{2}\left(F^a + 1 - F^b\right)$.

Proposition 4: Under assumptions (A1) and (A2), in a symmetric equilibrium around free trade, the introduction of a marginal cultural tariff increases the self-sufficiency ratio.

Proof: *See Appendix.*

The market share of French firms in the blockbuster market is increasing since US firms may or may not leave the blockbuster market depending on cost structure and preferences. The share of French firms in the auteur market may either fall or rise depending on the parameters; however, the overall effect is that cultural tariff increases the share of revenue collected by domestic producers. The above conclusion does not contradict the empirical findings that trade barriers are weak predictors for self-sufficiency ratio.

4. Conclusion

It is believed that Hollywood, in an attempt to have as wide an appeal as possible, sacrifices artistic quality. Little empirical literature that exists supports this belief by finding that domestic consumers are willing to pay a premium for domestic movies. Pursuant to this belief, governments around the world engage in protectionist policies. They believe that by imposing barriers to entry on Hollywood movies (and it is assumed that Hollywood is better at producing blockbusters), a new crop of domestic artists and cinematoFigures will fill the gap left by American studios. Moreover, it is believed that these new producers and artists would produce works of high artistic value. Therefore, restriction on Hollywood's sales not only increases market share of domestic producers and self-sufficiency of the domestic market but also increases cultural level of the movie industry. In this paper, we address these questions.

In the unconstrained equilibrium, more efficient firms produce both types of movies, while less efficient firms fully specialize in production of movies in which their country has the comparative advantage. Once cultural tariff on Hollywood imports is imposed, contrary to the intuition of the policymakers, Hollywood leaves the auteur market more aggressively than the blockbuster market, if Hollywood leaves the blockbuster market at all, while French producers increase production of blockbusters. The relative price of auteur movies falls, and French consumers pay premium for the opportunity to watch blockbusters.

Notwithstanding the choice of market of French producers, the blockbusterness of the market falls. This result stems from the fact that the relative price of blockbusters increases, which implies that people consume less blockbuster and more auteur movies.

Aggregate consumption of French-made auteur movies increases in cultural tariff. If the ultimate goal of the regulator is to increase consumption of domestic movies, then certainly the policy in question is the right tool to use.

We also found that the self-sufficiency ratio of French producers increases with marginal cultural tariff. This implies that the demands of local producers for protection from perceived unfair Hollywood competition are not left unmet.

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6. Appendices

Proof of Lemma 1: To show that firms enter markets in the order of efficiency, we consider the first-order conditions around zero cultural tax for firms i and $i+1$ of country j for movie types h.

$$FOC_i^{h,-j} \equiv 2p^h\left(1+(\eta-1)f_i^{h,j}+\eta f_i^{-h,j}\right)-ic^h \le 0, f_i^{h,j} \ge 0, FOC_i^{h,-j} f_i^{h,j}=0 \tag{8),}$$

$$FOC_{i+1}^{h,-j} \equiv 2p^h\left(1+(\eta-1)f_{i+1}^{h,j}+\eta f_{i+1}^{-h,j}\right)-(i+1)c^h, f_{i+1}^{h,j} \ge 0, FOC_{i+1}^{h,-j} f_{i+1}^{h,j}=0 \tag{9).}$$

Assume that the less efficient firm, $i+1$, enters the market but the more efficient firm, i, stays out. To investigate whether such equilibrium exists, we consider the following cases: (i) the case where firm i does not enter either market but firm $i+1$ enters one market, (ii) firm i does not enter either market but firm $i+1$ enters both markets, (iii) firm i enters one market and firm $i+1$ enters another market, (iv) firm i enters one market but firm $i+1$ enters both markets.

(i) Solving the equilibrium under the assumption that $f_i^{h,j}=0$ yields $f_i^{-h,j}=f_{i+1}^{h,j}=0$ and $f_{i+1}^{-h,j}=\dfrac{\left(c^{-h}/2p^{-h}\right)-\left(ic^{-h}/2p^{-h}\right)}{\eta-1}$. Substituting into the first-order conditions yields $FOC_i^{-h,j}=\dfrac{ic^h}{2p^h}$, $FOC_{i+1}^{h,-j}=\dfrac{ic^h}{2p^h}+\dfrac{\eta\left(\left(c^{-h}/2p^{-h}\right)-\left(ic^{-h}/2p^{-h}\right)\right)}{\eta-1}$,

$FOC_i^{-h,j} = \frac{ic^{-h}}{2p^{-h}}$. This cannot be an equilibrium because profit function of firm i from sales on either market is strictly increasing in the market share.

(ii) Setting $f_i^{h,j} = 0$ yields $f_i^{-h,j} = 0$,

$$f_i^{h,j} = \frac{\eta\left(c^{-h}/2p^{-h}\right) + (\eta - 1)\left(ic^{h}/2p^{h}\right) - \eta\left(ic^{-h}/2p^{-h}\right)}{2\eta - 1}, \text{ and}$$

$$f_i^{-h,j} = \frac{(1-\eta)\left(c^{-h}/2p^{-h}\right) + (\eta - 1)\left(ic^{-h}/2p^{-h}\right) - \eta\left(ic^{h}/2p^{h}\right)}{2\eta - 1}.$$ Plugging these solutions into the first-order conditions yields $FOC_i^{h,j} = ic^h/2p^h$ and $FOC_i^{-h,j} = ic^{-h}/2p^{-h}$, both of which are strictly positive. Therefore, such equilibrium does not exist.

(iii) Setting $f_i^{h,j} = 0$ yields $f_{i+1}^{-h,j} = 0$ and solving for optimal market shares yields

$f_{i+1}^{h,j} = \frac{\left(c^h/2p^h\right) - \left(ic^h/2p^h\right)}{\eta - 1}$ and $f_{i+1}^{h,j} = -\frac{ic^{-h}/2p^{-h}}{\eta - 1}$. Substituting into the first-order conditions yields $FOC_i^{h,j} = \left(ic^h/2p^h\right) + \frac{\eta\left(ic^{-h}/2p^{-h}\right)}{1-\eta}$ and

$$FOC_{i+1}^{-h,j} = \left(ic^{-h}/2p^{-h}\right) + \frac{\eta\left(\left(c^h/2p^h\right) - \left(ic^h/2p^h\right)\right)}{\eta - 1}.$$ Simple manipulations show that it cannot be the case that $FOC_i^{h,j} \leq 0$ and $FOC_{i+1}^{-h,j} \leq 0$, therefore, such equilibrium does not exist.

(iv) In the usual manner, we set $f_i^{h,j} = 0$ and solve the first-order conditions for the equilibrium market shares. We obtain

$$f_i^{-h,j} = \frac{(\eta-1)\left(\left(c^h/2p^h\right)-\left(ic^h/2p^h\right)\right)+\eta\left(\left(ic^{-h}/2p^{-h}\right)-\left(c^{-h}/2p^{-h}\right)\right)}{1-2\eta},$$

$$f_{i+1}^{h,j} = \frac{\left(ic^{-h}/2p^{-h}\right)}{1-\eta}, \text{ and}$$

$$f_{i+1}^{-h,j} = \frac{(\eta-1)\left(\left(c^{-h}/2p^{-h}\right)-\left(ic^{-h}/2p^{-h}\right)\right)+\eta\left(\left(ic^h/2p^h\right)-\left(c^h/2p^h\right)\right)}{1-2\eta}.$$ Substituting

these solutions in the first-order conditions and rearranging yields

$FOC_i^{h,j} = \left(ic^h/2p^h\right)+\dfrac{\eta\left(ic^{-h}/2p^{-h}\right)}{1-\eta}$. This expression is non-negative, therefore,

such equilibrium does not exist.

Therefore, it cannot be the case that more efficient firms abstain from entry while their less efficient competitors do not. Given ordering of firms, we can define $F^a \equiv \sum_{i=1}^{n^{a,FR}} f_i^{a,FR} = 1-\sum_{i=1}^{n^{a,US}} f_i^{a,US}$ and $F^b \equiv \sum_{i=1}^{n^{b,US}} f_i^{b,US} = 1-\sum_{i=1}^{n^{b,FR}} f_i^{b,FR}$ as aggregate market shares of, correspondingly, the French and the US firms over auteur movies and blockbusters. Aggregating the first-order conditions over firms yields:

$$(2-\tau)p^a\left(n^{a,US}+(\eta-1)\left(1-F^a\right)+\eta\left(F^b-\sum_{i=n^{a,US}+1}^{n^{b,US}} f_i^{b,US}\right)\right)=c\sum_{i=1}^{n^{a,US}} i \quad (10),$$

$$(2-\tau)p^b\left(n^{b,US}-n^{a,US}+(\eta-1)\sum_{i=n^{a,US}+1}^{n^{b,US}} f_i^{b,US}\right)=\sum_{i=n^{a,US}+1}^{n^{b,US}} i \quad (11),$$

$$(2-\tau)p^b\left(n^{b,US}+(\eta-1)F^b+\eta\left(1-F^a\right)\right)=\sum_{i=1}^{n^{b,US}} i \quad (12),$$

$$2p^b\left(n^{b,FR}+(\eta-1)\left(1-F^b\right)+\eta\left(F^a-\sum_{i=n^{b,FR}+1}^{n^{a,FR}} f_i^{a,FR}\right)\right)=c\sum_{i=1}^{n^{b,FR}} i \quad (13),$$

$$2p^a\left(n^{a,FR}-n^{b,FR}+(\eta-1)\sum_{i=n^{b,FR}+1}^{n^{a,FR}} f_i^{a,FR}\right)=\sum_{i=n^{b,FR}+1}^{n^{a,FR}} i \quad (14).$$

$$2p^a\left(n^{a,FR}+(\eta-1)F^a+\eta\left(1-F^b\right)\right)=\sum_{i=1}^{n^{a,FR}} i \qquad (15).$$

Equations (10) and (13) refer to, correspondingly, aggregation of the first-order conditions over the US and the French firms that diversify, equations (11) and (14) refer to, correspondingly, aggregations of the first-order conditions over the US and the French firms that enter the market in which their respective countries have comparative advantage (in other words, such firms fully specialize), and equations (12) and (15) refer to, correspondingly, aggregation of the first-order conditions over all US and French firms. The system of equations (10)-(15) implicitly defines prices and shares of both US and French firms that diversify or specialize.

In the absence of fixed costs, firms enter the market until marginal profits are driven to zero (we assume that the equilibrium number of firms is large so that setting marginal profits equal to zero serves as an approximation to having a least profitable firm that stays out of the market deriving negative profits while a least profitable firm entering the market deriving marginal profits barely above zero). For firms that fully specialize, this condition reduces to $(2-\tau)p^b=n^{b,US}$ and $2p^a=n^{a,FR}$. For firms that diversify, we set marginal profits of a firm that produces no movies of a genre in which its country has comparative disadvantage equal to zero. Solving equations $(2-\tau)p^a\left(1+\eta f_i^{b,US}\right)-ic=0$ and $(2-\tau)p^b\left(1+(\eta-1)f_i^{b,US}\right)-i=0$ for $f_i^{b,US}$, and equations $2p^b\left(1+\eta f_i^{a,FR}\right)-ic=0$ and $2p^a\left(1+(\eta-1)f_i^{a,FR}\right)-i=0$ for $f_i^{a,FR}$ yields the remaining entry conditions- $(2-\tau)p^a p^b=n^{a,US}\left((1-\eta)cp^b+\eta p^a\right)$ and $2p^a p^b=n^{b,FR}\left((1-\eta)cp^a+\eta p^b\right)$.

The system of equations given by (10)-(15) and four entry conditions implicitly define equilibrium prices, the number of specialized and diversified US and French firms, and the shares of firms as a function of cultural tariff. Defining $n^{a,FR}=n^{b,US}=\overline{n}$, $n^{a,US}=n^{b,FR}=\underline{n}$, $F^a=F^b=F$, and $p^a=p^b=p$ and imposing symmetry by evaluating the equilibrium around zero cultural tariff yields

$$2p=\overline{n} \tag{16),}$$

$$2p=\underline{n}\left(\left(1-\eta\right)c+\eta\right) \tag{17),}$$

$$2p\left(\underline{n}+(\eta-1)(1-F)+\eta\left(F-\sum\nolimits_{i=\underline{n}}^{\overline{n}} f_i^{h,j}\right)\right)=\frac{c\underline{n}\left(\underline{n}+1\right)}{2} \tag{18),}$$

$$2p\left(\overline{n}-\underline{n}+(\eta-1)\sum\nolimits_{i=\underline{n}}^{\overline{n}} f_i^{h,j}\right)=\frac{\left(\overline{n}+\underline{n}\right)\left(\overline{n}+1-\underline{n}\right)}{2} \tag{19),}$$

$$2p\left(\overline{n}+\eta-F\right)=\frac{c\overline{n}\left(\overline{n}+1\right)}{2} \tag{20),}$$

where $\sum\nolimits_{i=\underline{n}}^{\overline{n}} f_i^{h,j}$ represents the aggregate market share of specialized firms in which firms do not have a comparative advantage.

We can solve the above system of equations for $\overline{n}=\dfrac{2\left(-2c\left(-1+\eta\right)^3+\eta\left(1-4\eta+2\eta^2\right)\right)}{\left(-1+\eta\right)\left(-1-2\eta+c\left(-1+2\eta\right)\right)}$,

$\underline{n}=\dfrac{2\left(-2c\left(-1+\eta\right)^3+\eta\left(1-4\eta+2\eta^2\right)\right)}{\left(\left(1-\eta\right)c+\eta\right)\left(-1+\eta\right)\left(-1-2\eta+c\left(-1+2\eta\right)\right)}$, $p=\dfrac{\left(-2c\left(-1+\eta\right)^3+\eta\left(1-4\eta+2\eta^2\right)\right)}{\left(-1+\eta\right)\left(-1-2\eta+c\left(-1+2\eta\right)\right)}$, and

$F=\dfrac{-1+3\eta-4\eta^2+c\left(3-7\eta+4\eta^2\right)}{2\left(-1+\eta\right)\left(-1-2\eta+c\left(-1+2\eta\right)\right)}$.

Please note that these solutions are unique. We require that

$1 > F > \left(\sum_{i=\underline{n}}^{\bar{n}} f_i^{b,US}\right) = \left(\sum_{i=\underline{n}}^{\bar{n}} f_i^{a,FR}\right) > 0$ which is equivalent to $1 < c < \dfrac{\eta-3}{\eta-1}$ ■

Proof of Lemma 3. Differentiating the equilibrium number of diversified and specialized firms with respect to η and evaluating at symmetric equilibrium yields

$$\frac{\partial n^{a,FR}}{\partial \eta} = \frac{\partial n^{b,US}}{\partial \eta} = -2 + \frac{2}{(-3+c)\,(-1+\eta)^2} + \frac{2\,(-7+c)\,(-1+c)^2}{(-3+c)\,(1+c+2\eta-2c\eta)^2},$$

$$\frac{\partial n^{a,FR}}{\partial \eta} - \frac{\partial n^{b,FR}}{\partial \eta} = \frac{\partial n^{b,US}}{\partial \eta} - \frac{\partial n^{a,US}}{\partial \eta} = -2 + \frac{2\,(-7+c)\,(-1+c)}{(1+c+2\eta-2c\eta)^2} + \frac{2c}{(c+\eta-c\eta)^2}.$$

Under assumptions (A1) and (A2), both of these expressions are negative. Similarly, differentiating the equilibrium number of firms with respect to c and evaluating at the symmetric equilibrium yields

$$\frac{\partial n^{a,FR}}{\partial c} = \frac{\partial n^{b,US}}{\partial c} = \frac{-4+6\eta}{(-1+\eta)\,(1+c+2\eta-2c\eta)^2}$$ and

$$\frac{\partial n^{a,FR}}{\partial \eta} - \frac{\partial n^{b,FR}}{\partial \eta} = \frac{\partial n^{b,US}}{\partial \eta} - \frac{\partial n^{a,US}}{\partial \eta}$$
$$= (8c^2 - 2\,(1+3c\,(-2+5c))\,\eta + 2\,(1+3c\,(-6+7c))\,\eta^2 - 4\,(-1+c)\,(-3+7c)\,\eta^3 + 8\,(-1+c)^2\,\eta^4) \big/ ((1+c+2\eta-2c\eta)^2\,(c+\eta-c\eta)^2)$$

Both of these expressions are positive.

Proof of Proposition 1: Fully differentiating the system of equations given by (10)-(15) with respect to cultural tariff and evaluating at the symmetric equilibrium yields:

$$\frac{\partial n^{a,FR}}{\partial \tau} = -\frac{\partial n^{b,US}}{\partial c}$$
$$= -(c\,(-2+3\eta)\,(2c\,(-1+\eta)^3 + \eta\,(-1+4\eta-2\eta^2)))\big/ ((-1+\eta)\,(2c^3\,(-1+\eta)^3\,(-1+2\eta) + \eta\,(-1+2\eta+6\eta^2-4\eta^3) + c^2\,(4-5\eta-18\eta^2+34\eta^3-12\eta^4) + 2c\,(1+2\eta-\eta^2-13\eta^3+6\eta^4))),$$

$$\frac{\partial n^{a,FR}}{\partial \tau}-\frac{\partial n^{b,FR}}{\partial \tau}=-\left(\frac{\partial n^{b,US}}{\partial \tau}-\frac{\partial n^{a,US}}{\partial \tau}\right)=-\frac{c\,(-1+\eta)\,\eta\,(2\,c^2\,(-1+\eta)^3+\eta\,(1-4\,\eta+2\,\eta^2)+c\,(2-7\,\eta+10\,\eta^2-4\,\eta^3))}{(c+\eta-c\,\eta)^2\,(2\,c^2\,(-1+\eta)^3+\eta\,(1-4\,\eta+2\,\eta^2)-c\,(2+\eta-10\,\eta^2+4\,\eta^3))}.$$

Then, assumptions (A1) and (A2) guarantee that

$\frac{\partial n^{a,FR}}{\partial \tau}-\frac{\partial n^{b,FR}}{\partial \tau}<0$, $\frac{\partial n^{b,FR}}{\partial \tau}>0$, $\frac{\partial n^{b,US}}{\partial \tau}-\frac{\partial n^{a,US}}{\partial \tau}>0$, and $\frac{\partial n^{a,US}}{\partial \tau}<0$. Further, we obtain $\frac{\partial n^{a,FR}}{\partial \tau}+\frac{\partial n^{a,US}}{\partial \tau}=-\left(\frac{\partial n^{b,US}}{\partial \tau}+\frac{\partial n^{b,FR}}{\partial \tau}\right)<0$ ■

Proof of Corollary to Proposition 1: Differentiating equations (10)-(15) with respect to τ and evaluating at $\tau=0$ yields

$$\frac{\partial p^a}{\partial \tau}=-(c\,(-2+3\,\eta)\,(2\,c\,(-1+\eta)^3+\eta\,(-1+4\,\eta-2\,\eta^2)))\Big/\left(2\,(-1+\eta)\,(2\,c^3\,(-1+\eta)^3\,(-1+2\,\eta)+\eta\,(-1+2\,\eta+6\,\eta^2-4\,\eta^3)+c^2\,(4-5\,\eta-18\,\eta^2+34\,\eta^3-12\,\eta^4)+2\,c\,(1+2\,\eta-\eta^2-13\,\eta^3+6\,\eta^4))\right),$$

$$\frac{\partial p^b}{\partial \tau}=-((2\,c\,(-1+\eta)^3+\eta\,(-1+4\,\eta-2\,\eta^2))\,(2\,c^2\,(-1+\eta)^3-2\,c\,\eta\,(2-5\,\eta+2\,\eta^2)+\eta\,(1-4\,\eta+2\,\eta^2)))\Big/\left(2\,(-1+\eta)\,(2\,c^3\,(-1+\eta)^3\,(-1+2\,\eta)+\eta\,(-1+2\,\eta+6\,\eta^2-4\,\eta^3)+c^2\,(4-5\,\eta-18\,\eta^2+34\,\eta^3-12\,\eta^4)+2\,c\,(1+2\,\eta-\eta^2-13\,\eta^3+6\,\eta^4))\right).$$

Under assumptions (A1) and (A2), both prices are increasing in cultural tariff. Further, differentiating the relative (to blockbuster) price of auteur movies with respect to cultural tariff and evaluating at the symmetric equilibrium yields

$$\frac{\partial (p^a/p^b)}{\partial \tau}\propto\left((-1+c)\,(2\,c\,(-1+\eta)^3+\eta\,(-1+4\,\eta-2\,\eta^2))^2\right)\Big/\left(2\,(-1+\eta)\,(2\,c^3\,(-1+\eta)^3\,(-1+2\,\eta)+\eta\,(-1+2\,\eta+6\,\eta^2-4\,\eta^3)+c^2\,(4-5\,\eta-18\,\eta^2+34\,\eta^3-12\,\eta^4)+2\,c\,(1+2\,\eta-\eta^2-13\,\eta^3+6\,\eta^4))\right).$$

The relative price of auteur movies is falling in cultural tariff for all values of (c,η) that satisfy assumptions (A1) and (A2).

Proof of Proposition 3: Differentiating $F^a M^a$ with respect to the cultural tariff yields $\frac{\partial F^a M^a}{\partial \tau} = \frac{\partial F^a}{\partial \tau} + \frac{F^a}{p^a(1-2\eta)}\left((\eta-1)\frac{\partial P^a}{\partial \tau} - \eta\frac{\partial P^b}{\partial \tau}\right)$. Substituting for $\frac{\partial F^a}{\partial \tau}$, $\frac{\partial P^a}{\partial \tau}$, and $\frac{\partial P^b}{\partial \tau}$, and evaluating at $\tau = 0$ yields

$$\frac{\partial F^a M^a}{\partial \tau} = \Big(12 c^4 (-1+\eta)^7 \eta (-3+4\eta) + \eta^3 (1-4\eta+2\eta^2)^2 (2-11\eta+12\eta^2) - 2 c^3 (-1+\eta)^4 (10-25\eta-46\eta^2+246\eta^3-292\eta^4+96\eta^5) - 2 c \eta (2-20\eta+83\eta^2-248\eta^3+667\eta^4-1194\eta^5+1154\eta^6-540\eta^7+96\eta^8) + c^2 (-8+54\eta-125\eta^2+344\eta^3-1545\eta^4+4148\eta^5-5936\eta^6+4604\eta^7-1824\eta^8+288\eta^9)\Big) \Big/ \Big(4 (-1+\eta)(-1+2\eta)(\eta(-3+14\eta-8\eta^2)+c(-7+21\eta-22\eta^2+8\eta^3)) (2 c^3 (-1+\eta)^3 (-1+2\eta) + \eta(-1+2\eta+6\eta^2-4\eta^3) + c^2 (4-5\eta-18\eta^2+34\eta^3-12\eta^4) + 2 c (1+2\eta-\eta^2-13\eta^3+6\eta^4))\Big)$$

Under assumptions (A1) and (A2), this expression is strictly positive.

Proof of Proposition 4. Self-sufficiency ratio is given by

$E \equiv \frac{\sum_{h=\{a,b\}} p^h M^{h,FR}}{\sum_{h=\{a,b\}} \sum_{j=\{US,FR\}} p^h M^{h,j}} = \frac{1}{2}\left(F^a + 1 - F^b\right)$. Differentiating it with respect to cultural tariff and evaluating at zero tariff yields

$$\frac{\partial E}{\partial \tau} = (c(-2+3\eta)(2c(-1+\eta)^3 + \eta(-1+4\eta-2\eta^2))) \Big/ \Big((1-3\eta+2\eta^2) (2 c^3 (-1+\eta)^3 (-1+2\eta) + \eta(-1+2\eta+6\eta^2-4\eta^3) + c^2 (4-5\eta-18\eta^2+34\eta^3-12\eta^4) + 2 c (1+2\eta-\eta^2-13\eta^3+6\eta^4))\Big)$$

Under assumptions (A1) and (A2), $\frac{\partial E}{\partial \tau} > 0$.

CHAPTER 5. GENERAL CONCLUSIONS

General discussion

My first essay considers the impact of cultural quota imposed on radio stations in increasing consumption of domestic programs. 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. The model assumes that individuals have one-to-one mapping from preference ordering over the types of music to preference ordering over the mix of domestic and foreign content. One of the possible extensions is to develop a model of trade in cultural goods where this limitation is removed. Secondly, I assume Cobb-Douglas specification for the sub-utility of radio consumption. This restriction imposes constraints on the range of the conclusions we reach with respect to government policy regulations. Perhaps a promising extension would be to assume CES specification. This may yield a richer model and wider range of policy recommendations. Further, I consider marginal changes in the discrete level of the content ratio. Another fruitful approach to tackle the same issue is to consider the impact of discrete changes in the level of content requirement.

My second essay analyzes regulation of television broadcasting via two policy vehicles,- direct regulation of the proportion of the domestic programs in the total volume of broadcasting and tax-cum-subsidy policies. Marginal changes in content requirement increase (decrease) consumption of domestic shows when individuals are sensitive (insensitive) to the provided content. Tax-cum-subsidy polices have negative (no) effect on consumption of the domestic content when preferences of individuals of the country subject to regulation are highly sensitive (insensitive). Finally, I find that capping advertising increases consumption of domestic programs.

One of the limitation of our analysis is the assumption on the duopolistic structure of the market in which only the firm located on the lower domestic content scale is directly affected by the government regulation. This assumption allows us to derive symmetric equilibrium and reach analytical results. A possible extension would be to consider an environment in which the assumption of the structure of the market is relaxed. I feel that this may render the model intractable, however, numerical analysis may yield richer results. For one, with just two firms on the market, one of the driving components of our model is a strategic interaction between these firms. When market is competitive then the weight of this strategic effect would be diminished and new, even unexpected results, can be obtained. In addition, I consider the effects of policies on terrestrial broadcasting only and completely abstain from cable television,- sector with different revenue structure. However, in many countries cable television dominated the television market, therefore, some of the conclusions arrived at in this paper are weakened in such markets. It may be interesting to consider the impact of domestic content policy regulations on cable television. One of the most widely used policy is called “carry-on”, where, instead of regulating proportion of domestic programs in the total volume of broadcasting for every station, as is done in this paper, governments instead require that cable operators reserve slots for domestic or public channels. This is one of the directions for further research that I plan to proceed with.

The last essay addresses the question of whether a cultural tariff is a proper policy to raise consumption of domestic movies, especially artistic ones, as opposed to foreign blockbuster movies. "Hollywood" blockbuster movies allegedly have low-cultural value and cultural tariff intends to increase the average cultural level in the country implementing the policy. Starting from free trade, a small cultural tariff decreases the average blockbusterness of the domestic market as intended although the number of local producers willing to enter the blockbuster market increases and reduces the number of local producers specializing in the production of artistic movies. The cultural tariff introduces a distortion into the relative price of movies. Aggregate consumption of artistic movies that are locally made increases and so does the self-sufficiency ratio of local producers.

I build a model where equilibrium is determined through quantitative interaction among movie producers. An alternative specification would be to build a model where firms instead compete in prices. Due to the fact that fixed costs comprise a large chunk of final movie production costs, such model has to introduce either exogenous or endogenous product differentiation. I feel that the latter has a great potential for it may shed light on the formation of the cultural component of cultural goods. In addition, all movies are of the same quality. This is not necessarily the case in the real world. It is believed that one of the reasons why Hollywood dominated the movie market is because its domestic market is large, therefore, studios are able to recoup even large investment of capital. Since there exist a monotonic relationship between the movie budget and movie quality, it is said that Hollywood has movies of higher quality. Given that all movies are sold at approximately the same prices, consumers naturally favor movies of higher quality. Therefore, the aspect of difference in quality, which we ignore, may have a sizable impact on policy analysis.

All of the models above consider the impact of government policies on trade in cultural goods in a static environment. This assumption gives little credit to the strategic interaction among firms and evolution of firms' behavior in response to policy instruments. In order to incorporate the strategic effect it is necessary to frame models in a dynamic setting. I, however, shined away from dynamic approach since static environment proved to be sufficient to arrive at the main conclusions.

Lastly, all the models are theoretical in nature. I believe that it is equally important to assess the empirical validity of my policy conclusions and recommendations. This is the route which I plan to take next.