Cultural Diversity and Welfare-improving Trade Policy:

Too many brands of wine?

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Abstract

This paper presents a tractable general equilibrium model for investigating the impact of the cultural effect on trade, which synthesizes the familiar monopolistic competition model and the habit formation model of consumption in macroeconomics. Introducing a *commodity-specific* intertemporal consumption externality, the model shows clear analytical results that a subsidy for firms can increase welfare in the case of a negative externality (smoothing consumption), while a tax can do so in the positive (addiction) case. These results are not based on nonstandard assumptions on preferences like other previous studies but on the standard familiar framework.

Keywords: cultural goods, habitual consumption, cultural protection, trade policy

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1. Introduction

This paper presents a tractable general equilibrium model for investigating the impact of the cultural effect on trade, which synthesizes the familiar monopolistic competition model developed by Dixit and Stiglitz (1977), Krugman (1980) and Ethier (1982) and the habit formation model of consumption in macroeconomics by Abel (1990) and Ravn *et al*. (2006). Introducing a *commodity-specific* intertemporal consumption externality, the model shows clear analytical results that a subsidy for firms can increase welfare in the negative intertemporal externality (habit formation) case, while a tax can do so in the positive intertemporal externality (addiction) case. These results are not based on nonstandard assumptions of preferences like other previous studies but on the familiar framework of habit formation and monopolistic competition with increasing returns.

There has been a dispute between the U.S.A. and other countries such as France and Korea over liberalizing imports of Hollywood films. France and Korea insist that cultural protection is necessary to establish national identity, while the U.S.A. suggests that increasing cultural variety is most important for improvement in the nation's welfare.[1]

In response to such debates, there are several studies that present differing results. Francois and Ypersele (2002) show that restrictions on the trade of cultural goods can raise welfare in both the importing and exporting countries when domestic and foreign consumers evaluate the goods differently and they are produced under increasing returns to scale. Janeva (2007) formalizes and introduces the notion of cultural identity into a Ricardian model

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1 The French were said to be the first to introduce the concept of *cultural exception* in the GATT1 negotiations in the 1990s when the question of whether the liberalization of trade should be applied to cultural goods and services was raised. In 2005, the UNESCO General Conference adopted the Convention on the Protection and Promotion of the Diversity of Cultural Expressions.

of trade and shows that trade is not always Pareto superior to autarky because of the public good aspect of cultural identity. Rauch and Trindade (2005) introduce a static consumption externality to analyze the demand side of cultural goods, while Bala and Van Long (2005) focus on the evolution of preferences by trade. Moreover, analyzing quotas in commercial broadcasting, Bekkali and Beghin (2005) argue that a quota reduces welfare, but Richardson (2006) disagrees.

Although the existing papers have analyzed important aspects of cultural goods, these models depend heavily on *ad hoc* assumptions on preferences. On the contrary, the advantage of our model presented here is that it allows a richer form of preferences under standard assumptions. Thus our model can be easily extended to analyze various policy effects.

The reminder of the paper is organized as follows. Section 2 presents a basic model under autarky. We define the consumer's habitual consumption behavior and derive the demand function of differentiated cultural goods. After obtaining the corresponding supply function, the characteristics of equilibria are studied. The dynamics of the firm's market share are explained, and the conditions under which cultural protection is justifiable are also derived. In Section 3, trade is dealt with, and Section 4 concludes.

2. The model

2.1 Habitual consumption and demand

In this section, we focus on a representative country under autarky. International trade is dealt with in the following section. Consider a representative consumer whose utility is homothetic over differentiated cultural goods. Suppose that there is a *commodity-specific* intertemporal consumption externality in consuming differentiated goods and that the present consumption of any cultural good exhibits a dynamic effect on the consumption of the good in the next period.[2] Hence we assume that the consumer derives utility from an object $\tilde{c}_{it}$ defined by:

$$\tilde{c}_{it} = c_{it}(c_{it-1} + \bar{c})^{\beta}, \tag{1}$$

where c_{it} and c_{it-1} are the consumption level of cultural good i in t and t–1, respectively, the number of goods (variety) produced in t is N_t, and $\bar{c}$ is a certain positive amount.[3] The parameter β measures the degree of external habit formation in consumption. With $\beta > 0$, the present consumption experience of a good increases utility in the next period, and hence the consumption externality is positive, which reflects addictive consumption. With $\beta < 0$, the consumer is more balanced and consumption is smoothed over several periods so that the consumption externality is negative. We call this case smoothing consumption. When there are no consumption externalities, $\beta = 0$ holds.

The utility function of the consumer is assumed to be:

$$U_t = \left[\int_0^{N_t} \tilde{c}_{it}^{(\sigma-1)/\sigma} di\right]^{\sigma/(\sigma-1)}, \tag{2}$$

in which σ (> 1) is the elasticity of substitution between any pair of goods.[4]

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2 Regarding the habit formation models, Abel (1990) introduces a reference consumption level into utility that depends upon a weighted average of the consumer's and the economy-wide average of immediate past consumption. Following Abel (1990), Ravn, Schmitt-Grohe and Uribe (2006) examine the effects of commodity-specific consumption externalities in a real business cycle model with monopolistically competitive firms. Their habit-adjusted consumption formation deals with consumers' cumulative consumption, and the firm must maximize a discounted sum of its profits over an infinite-time horizon. They, however, do not consider how the consumer's past consumption behavior affects her next-period consumption in a precise manner.

3 This term is introduced to make it possible to consume a specific good for the first time without the consumption experience.

4 The monopolistic competition model using the properties of the CES utility function, which is developed by Spence (1976) and Dixit and Stiglitz (1977), is convenient to specify preferences for varieties in a way in which variety is valued in its own right. For example, let the utility of a consumer be $U = \left[\int_0^n x_i^{\alpha} di\right]^{1/\alpha}$, where i is the index of the good variety. Under the symmetry assumption $x_i = x$ holds, so that $U = n^{1/\alpha}x$ and $\partial U/\partial n > 0$. The consumer's utility increases in the degree of goods variety.

Let the consumer's disposable income I_t be:

$$I_t = wL + \prod_t - \tau_t L, \tag{3}$$

where w is the wage, L is a constant labor endowment, $\Pi_t = \int_0^{N_t} \pi_{it} di$ is the industry's aggregate profits, and τ_t is a per capita lump-sum tax (transfer) in t. Let p_{it} denote the price of good i and $\tilde{p}_{it} = p_{it}\left(c_{it-1} + \overline{c}\right)^{-\beta}$; then, the consumer's budget constraint $I_{ht} = \int_0^{N_t} p_{it} c_{it} di$ will be redefined as:

$$I_{ht} = \int_0^{N_t} \tilde{p}_{it} \tilde{c}_{it} di \,. \tag{4}$$

Given (4), the demand for good i is the solution to the utility maximization problem:

$$c_{it} = p_{it}^{-\sigma} \tilde{P}_t^{\sigma-1} \left(c_{it-1} + \overline{c}\right)^{\beta(\sigma-1)} I_t \,, \tag{5}$$

where $\tilde{P}_t = \left[\int_0^{N_t} \tilde{p}_{it}^{1-\sigma} di\right]^{1/1-\sigma}$ is a habit-adjusted price index. If all goods are sold at the same price, then the habit-adjusted nominal price index reduces in the degree of goods variety and the degree of the consumption externality but increases (decreases) in goods' homogeneity (heterogeneity): $\partial\tilde{P}_t/\partial N_t < 0$, $\partial\tilde{P}_t/\partial\beta < 0$ and $\partial\tilde{P}_t/\partial\sigma > 0$. Rearranging (5), we have the following inverse demand function for good i:

$$p_{it} = \left[c_{it}^{-1} \tilde{P}_t^{\sigma-1} \left(c_{it-1} + \overline{c}\right)^{\beta(\sigma-1)} I_t\right]^{1/\sigma} . \tag{6}$$

In (5), we see that marginal increase in the degree of the consumption externality and the elasticity of substitution between goods increases the next-period consumption of good i: $\partial c_{it}/\partial\beta > 0$ and $\partial c_{it}/\partial\sigma > 0$. It is also clear that consumption of each good increases in the habit-adjusted price index and decreases in its habit-adjusted relative price: $\partial c_{it}/\partial\tilde{P}_t > 0$ and $\partial c_{it}/\partial(p_{it} / \tilde{P}_t) < 0$.

Lemma 1. A consumer's present consumption of a cultural good increases in the degree of consumption externality, the goods' substitutability, and habit-adjusted nominal price index but decreases in the good's habit-adjusted relative price.

2.2 Production

We assume that labor is the only production factor and that all goods are produced with the same cost function, which is defined as:

$$l_{it} = ay_{it} + F, \tag{7}$$

where l_{it} is the total labor necessary for the production of good i, y_{it} is its total output in time t, and a and F are constant parameters denoting the marginal and fixed labor requirements, respectively. L is the total amount of labor in the country, and therefore $L = \int_0^{N_t} l_{it} di$. This increasing-returns-to-scale specification with labor input alone is also present in the popular monopolistic competition models such as Montagna (2001).

We first consider the firm's optimization problem in time t. Given $\tilde{P}_t$ and w and assuming that $y_{it} = c_{it}$, firm i maximizes:

$$\pi_{it} = p_{it}y_{it} - w(ay_{it} + F(1-s_t)), \tag{8}$$

in which p_{it} is given in (6), and s_t is a government policy parameter. $s_t > 0$ indicates a production subsidy, while $s_t < 0$ indicates a restrictive production tax.[5] We assume that tax revenue in (3) will be equally distributed among producing firms; that is, $N_t wFs_t = \tau_t L$. Solving the first-order condition gives firm i's habit-adjusted equilibrium output, $y_{it} = y_{it-1}^{\beta(\sigma-1)} \tilde{P}_t^{\sigma-1} I_t \left[\frac{\sigma-1}{aw\sigma}\right]^{\sigma}$. This implies the following optimal price of the firm:

5 In the case of a subsidy, $s_t > 1$ is actually too large so that $1 \geq s_t > 0$ is implicitly assumed for feasible

$$p_{it} = \frac{aw\sigma}{\sigma - 1}, \tag{9}$$

which is the familiar markup formula and indicates that the price of each good is common across the variety. Then the habit-adjusted nominal price index is given as:

$$\tilde{P}_t = \frac{aw\sigma}{\sigma - 1} Y_{t-1}^{1/(1-\sigma)}, \tag{10}$$

where $Y_{t-1} = \int_0^{N_t} y_{it-1}^{\beta(\sigma-1)} di$. Hence firm *i*' s optimal output in *t* is:

$$y_{it} = \frac{\sigma - 1}{aw\sigma} I_t \theta_{it-1}, \tag{11}$$

in which:

$$\theta_{it-1} = \frac{y_{it-1}^{\beta(\sigma-1)}}{\int y_{it-1}^{\beta(\sigma-1)} di} = \frac{y_{it-1}^{\beta(\sigma-1)}}{Y_{t-1}} \tag{12}$$

is firm *i*'s quasi production share in *t*–1. Note that firm *i*'s equilibrium output depends not only on its past production level and its past production share but also on the goods' substitutability and the degree of consumption externality. The firm's current production level relates positively to its previous production level and its previous quasi market share but negatively to the industry's previous aggregate output: $\partial y_{it} / \partial y_{it-1} > 0$, and $\partial y_{it} / \partial \theta_{it-1} > 0$. The effects of marginal changes in σ and β on y_{it} are in general indeterminate; however, the stronger the degree of the consumption externality, the greater the production of the good if the number of goods produced in *t*–1 was sufficiently large: $\partial y_{it} / \partial \beta > 0$.

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subsidy level.

Lemma 2. The habit-adjusted price index in t decreases in the aggregate industry's output in t–1 but increases in the degree of consumption externality. The firm's current production level relates positively to its previous production level and its previous quasi market share but negatively to the industry's previous aggregate output. If the number of firms was sufficiently large in t–1, the firm's production level in t increases in the degree of the consumption externality.

2.3 Market equilibrium

Substituting (9) and (11) into the firm's zero profit condition, that is $\pi_{it} = 0$, we get the following equilibrium output of each firm:

$$y_{it} = \frac{F(1-s_t)(\sigma-1)}{a}. \tag{13}$$

Because all firms produce the same amount, the market equilibrium number of firms in t is solved as:

$$N_t^{ME} = \frac{L}{F[s_t(1-\sigma)+\sigma]}, \tag{14-1}$$

and if s_t is zero, it is:

$$N_t^{ME}\Big|_{s_t=0} = \frac{L}{F\sigma}, \tag{14-2}$$

where superscript *ME* denotes the market equilibrium.

2.4. The social optimum

Next, we consider the socially optimal number of goods. Because the present model is an almost static one except for the effects of the intertemporal consumption externality, the main problem is to allocate labor across firms in the industry. Consider the following *hypothetical* representative agent's utility maximization problem with technology constraints:

$$\max \; U_t = \sum_{t=1}^{\infty} \rho^t \left[\int_0^{N_t} \tilde{c}_{it}^{\,(\sigma-1)/\sigma} di \right]^{\sigma/(\sigma-1)} \tag{15-1}$$

$$\text{s.t. } L = \int l_{it} di\,, \;\; N_t \geq 1\,, \;\; c_{i0} = 0 \qquad \forall i,\, t = 1, 2, \ldots, \tag{15-2}$$

where ρ is the discount factor, and L is assumed to be constant over time. Consider the case in which the constraint, $N_t \geq 1$, is not binding, and consider the interior optimum (the corner solution will be discussed later). In t = 1, no intertemporal externality effects from past consumption of all goods exist, *i.e.*, $\tilde{c}_{i1} = c_{i1}\left(c_{i0} + \overline{c}\right)^{\beta} = c_{i1}\overline{c}^{\beta}$. Consider the production level of each firm in this period. Inserting $c_{it} = y_{it}$ into (15-1) and differentiating it with respect to y_{it} yields a symmetric solution, *i.e.*, y_{11} = y_{21} = $\cdots$ = $y_{N1}(\equiv y_1)$. In t = 2, intertemporal externality effects across goods are the same, *i.e.*, $\tilde{c}_{i2} = c_{i2}\left(c_{i1} + \overline{c}\right)^{\beta} = c_{i2}\left(y_1 + \overline{c}\right)^{\beta}$. Thus, the socially optimal amount of production by each firm is the same, in t = 2, 3, ….

Furthermore, denoting l_{it}^{v} as firm i's variable type labor input, *i.e.*, $l_{it} = a y_{it} + F = l_{it}^{v} + F$, we get the following symmetric solution of labor allocation:

$$l^{v} = l_1^{v} = l_2^{v} = \ldots = l_N^{v} = \frac{L}{N} - F\,. \tag{16}$$

From substitution of y_{it} = y_{it-1} = $(L/N_t - F)/a$ for (15-1), we reduce the problem to the following static one:

$$\max \; U_t = \left[N_t \left(\frac{L - N_t F}{a N_t} \right)^{(1+\beta)(\sigma-1)/\sigma} \right]^{\sigma/(\sigma-1)}. \tag{17}$$

Differentiating (17) with respect to N_t gives the social optimum number of goods, N_t^{SO}:

$$N_t^{SO} = \frac{L\left(1-\beta(\sigma-1)\right)}{F\sigma}, \tag{18}$$

in which $\partial N_t^{so}/\partial\sigma < 0$, $\partial N_t^{so}/\partial\beta < 0$, and $\partial N_t^{so}/\partial F < 0$, and superscript SO denotes the social optimum.

2.5 Comparison between market equilibrium and social optimum

Finally we are ready to compare the social optimal number of goods in (18) with that of the market equilibrium in (14-2). The difference is:

$$N_t^{SO} - N_t^{ME}\Big|_{s_t=0} = \frac{-\beta(\sigma-1)L}{F\sigma}, \tag{19}$$

which shows that the sign of this difference depends on the sign of β. If an intertemporal consumption externality does not exist, *i.e.*, β = 0, the equilibrium number of goods always coincides with the social optimum. When β > 0 (< 0) holds, however, the market equilibrium number of goods is larger (smaller) than that of the social optimum. By equating (14-1) and (18), the collective tax or subsidy is:

$$s_t = \frac{\beta\sigma}{\beta(\sigma-1)-1}. \tag{20}$$

The results are clearly summarized as the following proposition.

Proposition 1. If β < 0 (smoothing consumption), the goods variety is socially smaller and a production subsidy will be justified, while if β > 0 (addictive consumption), the goods variety is socially larger and a production tax will be introduced. If a *consumption externality does not exist, i.e., β = 0, the market equilibrium number of goods always coincides with the social optimum.*

2.6 Dynamics of market share

As seen in Section 2.2, the current output of each good depends on the past production level. We now check the dynamic change of the share of each good and the stability of the market equilibrium. From (11) and (12), we get:

$$\theta_{it} = \frac{y_{it}^{\beta(\sigma-1)}}{\int y_{it}^{\beta(\sigma-1)} di} = \frac{\theta_{it-1}^{\beta(\sigma-1)}}{\int \theta_{it-1}^{\beta(\sigma-1)} di}. \tag{21}$$

This equation indicates that the quasi production share θ_{it} of a particular good follows a simple first-order difference equation. Furthermore, taking logarithms and subtracting the equation for one good from another, we get:

$$\log[\theta_{kt}] - \log[\theta_{mt}] = \beta(\sigma - 1)\left(\log[\theta_{kt-1}] - \log[\theta_{mt-1}]\right). \tag{22}$$

For any combination of shares of differentiated goods, the ratio between the two shares group, *k* and *m*, is described by this first-order linear difference equation. If this equation converges to zero, the share of goods becomes equal. Hence the dynamics of market share can be analyzed for the following five cases.

(i) No consumption externality ($\beta = 0$)

There exists no dynamic consumption effect, and (22) shows no dynamics.

(ii) Highly addictive consumption and the corner solution ($\beta(\sigma - 1) > 1$)

In this case, equation (22) has explosive positive roots, and hence the equilibrium ratio is unstable; the difference between θ_k and θ_m increases to its maximum over time. One ratio goes to unity while the other goes to zero. The larger β and σ become, the more likely the path will be explosive and the more likely the share is biased. This implies that only one good survives under stronger addiction, *i.e.*, $\beta > 0$ and larger substitutability. From (18) and the constraint (15-2), when $\beta(\sigma - 1) > 1$, the optimal number of goods is at a minimum, that is, unity (the corner solution). Hence this case in fact attains the social optimum.

(iii) Moderate addictive consumption ($1 > \beta(\sigma - 1) > 0$)

Equation (22) has positive roots and monotonically converges to zero, and therefore the equilibrium share of firms is stable. Hence the equilibrium number of firms is also stable.

(iv) Smoothing consumption ($0 > \beta(\sigma - 1) > -1$)

The equation has negative roots and a dampened period-2 cycle emerges. The difference of share converges to zero, and the equilibrium number of firms also converges to (14).

(v) Stronger smoothing consumption ($-1 > \beta(\sigma - 1)$)

The equation has negative roots, and an explosive period-2 cycle emerges. The magnitude of periodic change of consumption is growing over time.

Summarizing the five cases shows that (1) the sign of β (addiction or smoothing consumption) determines the root signs: a positive β (addictive consumption) produces positive roots and a monotonic path, while a negative β (smoothing consumption) produces negative roots and produces period-two cycles; and (2) the size of $\beta(\sigma - 1)$ is important for stability: if the absolute value of $\beta(\sigma - 1)$ is larger than unity, the equation is explosive. Although the equilibrium number of goods is not affected, the nature of the dynamic adjustment process is determined by the sign of β.

Lemma 2. The dynamics of the good's share are affected by β and σ. If $\beta > 0$, a monotonic path emerges, while if $\beta < 0$, a two-period-2 cycle emerges. If the absolute value of $\beta(\sigma - 1)$ is larger than unity, the path is explosive.

3. Trade

3.1 Symmetric cultural protection policy under trade

We extend the model to a two-country one, home (*h*) and foreign (*f*). Suppose that all goods are traded without transport costs and any other trade barriers. To make the point clear, we assume that the countries are identical in every respect apart from consumers' tastes regarding firms' production technologies and that labor in both countries is unable to move beyond the national border. We also presume that the aggregate labor force endowment in both countries is the same. This specification follows Krugman (1980). Hence the basically the same results discussed in the previous section are applied here.

The number of goods available for consumers in each country is equal to the sum of aggregate varieties produced in the two countries. Hence the aggregate number of goods in the world market in *t*, N_t^*, is defined by:

$$N_t^* = N_{ht}^* + N_{ft}^*, \tag{23}$$

where N_{ht}^* are the goods supplied by the firms in the home country and N_{ft}^* are those in the foreign country. Subscripts *h* and *f* denote the variables related to the respective countries, and the asterisk denotes the regime under trade. The utility function of a consumer in country $m = h, f$ in t is

$U_{mt}^{*} = \left[\int_0^{N_{ht}^{*}+N_{ft}^{*}} \tilde{c}_{mit}^{*\,(\sigma-1)/\sigma} di \right]^{\sigma/(\sigma-1)}$, in which $\tilde{c}_{mit}^{*}$ is her demand for internationally traded good *i*. We define the habit-adjusted integrated-market price index faced by all consumers in two countries as $\tilde{P}_t^{*} = \left[\int_0^{N_{ht}^{*}} \tilde{p}_{hit}^{*(1-\sigma)} di + \int_0^{N_{ft}^{*}} \tilde{p}_{fjt}^{*(1-\sigma)} dj \right]^{1/(1-\sigma)}$, $i \neq j$, which can be rewritten as:

$$\tilde{P}_t^{*} = \left[\tilde{P}_{ht}^{*1-\sigma} + \tilde{P}_{ft}^{*1-\sigma} \right]^{1/(1-\sigma)}. \tag{24}$$

We consider the situation where the consumer's previous-period consumption level of any good is the same among countries; that is, $c_{hit-1} = c_{fit-1}$ $\forall\ i$. Applying a similar procedure to that in Section 2, we get the following integrated market's aggregate demand for good *i*: $c_{it}^{*} = p_{hit}^{*-\sigma} \tilde{P}_t^{*\sigma-1} \left(c_{hit-1} + \bar{c} \right)^{\beta(\sigma-1)} I_t^{*}$, where $c_{it}^{*} = c_{hit}^{*} + c_{fit}^{*}$ and $I_t^{*} = I_{ht}^{*} + I_{ft}^{*}$ is the aggregate income of the integrated market. Because we suppose that governments *h* and *f* may provide a production subsidy for their industries, aggregate income of countries *h* and *f* will be:

$$I_{ht}^{*} = (w - \tau_{ht}^{*}) L_h + \Pi_{ht}^{*} \tag{25-1}$$

and

$$I_{ft}^{*} = (w - \tau_{ft}^{*}) L_f + \Pi_{ft}^{*}, \tag{25-2}$$

respectively, in which $\Pi_{ht}^{*} = \int_0^{N_{ht}^{*}} \pi_{hit}^{*} di = \int_0^{N_{ht}^{*}} [p_{hit}^{*} y_{hit}^{*} - w(a y_{hit}^{*} + F(1 - s_{ht}^{*}))] di$ and $\Pi_{ft}^{*} = \int_0^{N_{ft}^{*}} \pi_{fjt}^{*} dj = \int_0^{N_{ft}^{*}} [p_{fjt}^{*} y_{fjt}^{*} - w(a y_{fjt}^{*} + F(1 - s_{ft}^{*}))] dj$. Profit maximization of each firm in the two countries gives the following optimal output: $y_{mkt}^{*} = \tilde{P}_t^{*\sigma-1} y_{mkt-1}^{\beta(\sigma-1)} I_t^{*} \left(\frac{\sigma - 1}{a w \sigma} \right)^{\sigma}$, $m = h, f$ and $k = i, j$, which leads to the common optimal price, $p^*_{kt} = \dfrac{aw\sigma}{\sigma - 1}$. Hence the optimal habit-adjusted integrated-market price is:

$$\tilde{P}^*_t = \frac{aw\sigma}{\sigma - 1}\left[Y^*_{ht-1} + Y^*_{ft-1}\right]^{\frac{1}{1-\sigma}}, \tag{26}$$

where $Y^*_{ht-1} = \int_0^{N^*_{ht}} y^{\beta(\sigma-1)}_{hit-1} di$ and $Y^*_{ft-1} = \int_0^{N^*_{ft}} y^{\beta(\sigma-1)}_{fjt-1} dj$. Firm *i*'s optimal aggregate output is derived from using a good's common price and (26): $y^*_{hit} = I^*_t \dfrac{\sigma - 1}{aw\sigma}\theta^*_{hit-1}$, where $\theta^*_{hit-1} = \dfrac{y^{\beta(\sigma-1)}_{hit-1}}{Y^*_{ht-1} + Y^*_{ft-1}}$ is firm *i*'s quasi past production share under trade.

Assuming that the firm's zero-profit condition is $I^*_t\theta^*_{hit-1} = F\sigma w\left(s^*_{ht} - 1\right)$, the equilibrium output of a firm in country *h* is:

$$y^*_{ht} = \frac{F(1 - s^*_{ht})(\sigma - 1)}{a}, \tag{27}$$

and that in country *f* is $y^*_{ft} = \dfrac{F(1 - s^*_{ft})(\sigma - 1)}{a}$. Accordingly, the equilibrium number of firms under trade, N^{*ME}_t, is:

$$N^{*ME}_t = N^{*ME}_{ht} + N^{*ME}_{ft} = \frac{L_h}{F[s^*_{ht}(1-\sigma) + \sigma]} + \frac{L_f}{F[s^*_{ft}(1-\sigma) + \sigma]}, \tag{28-1}$$

and with $s_{ht} = s_{ft} = 0$ and under the assumption $L_h = L_f$, the number becomes:

$$N^{*ME}_t = N^{*ME}_{ht}\Big|_{s_{ht}=0} + N^{*ME}_{ft}\Big|_{s_{ft}=0} = \frac{2L_h}{F\sigma}. \tag{28-2}$$

Note that country *h*'s cultural protection policy may contribute to increasing not only her own welfare but also world welfare.

3.2 Social optimum

Next we investigate the characteristics of the social optimum under trade. The socially optimal goods number will be derived by solving the following technologically constrained representative agent's utility maximization problem:

$$\max\ U_{ht}^{*}+U_{ft}^{*}=\sum_{t=1}^{\infty}\rho^{t}\left[\left[\int_{0}^{N_{ht}^{*}+N_{ft}^{*}}\tilde{c}_{hit}^{*\ (\sigma-1)/\sigma}di\right]^{\sigma/(\sigma-1)}+\left[\int_{0}^{N_{ht}^{*}+N_{ft}^{*}}\tilde{c}_{fjt}^{*\ (\sigma-1)/\sigma}dj\right]^{\sigma/(\sigma-1)}\right]$$

(29-1)

s.t. $L_h = \int_{0}^{N_{ht}^{*}} l_{hit}di = \int_{0}^{N_{ft}^{*}} l_{fjt}dj$, $i\neq j$ and $c_{ih0}=c_{if0}=0 \quad \forall i$, $t = 1, 2, \ldots.$ (29-2)

Applying the same procedure as in Section 2.4, and solving the first-order conditions of the above Lagrangian function gives country *h*'s socially optimal number of goods under trade: $N_{ht}^{*SO}=\dfrac{L_h(1+\beta(1-\sigma))}{F\sigma}$. The same is true for country *f*. Then the world socially optimal number of goods becomes:

$$N_{t}^{*SO}=\frac{2L_h(1-\beta(\sigma-1))}{F\sigma}. \qquad (30)$$

Hence the optimal number of goods under trade is twice as much as that under autarky.

3.3 Comparison

Next, we compare the socially optimal number of goods in (30) with that of the market equilibrium (henceforth, simply the equilibrium) in (28-2). The difference is:

$$N_t^{*SO} - N_t^{*ME}\Big|_{s_{ht}*=s_{ft}*=0} = \frac{-\beta(\sigma-1)2L_h}{F\sigma}, \tag{31}$$

in which $N_t^{*SO} < (>) \, N_t^{*ME}$ because $\beta > (<) \, 0$ in the symmetric subsidy regime. The collective tax or subsidy is easily calculated from equating (28-1) to (30); that is:

$$s_{ht}^* = s_{ft}^* = \frac{\beta\sigma}{\beta(\sigma-1)-1}. \tag{32}$$

Each government intervenes in its own domestic market to the same extent as in autarky. Note that the utility is larger in trade than in autarky because the variety of goods increases.

Proposition 2. When consumption smoothing exists in the utility function, the number of goods in the integrated market is smaller, and world welfare increases if countries h and f provide lump sum production subsidies for each of their domestic industries.

3.4 Asymmetric cultural protection and the comparison

We consider the case that the home country alone intervenes while the foreign country does not, i.e., s_{ft}^* = 0; we call this asymmetric intervention. The assumptions introduced here follow those in the symmetric situation in Section 3.1. Note that in this subsection, we consider only the variety of goods and do not fully deal with optimal allocation because the allocation of the foreign country is suboptimal. Hence, in this subsection, we analyze the second-best situation.

We first consider the case that the home government maximizes its own utility given the number of goods supplied by the foreign country, N_{ft}^{*ME} = $L_f/(F\sigma)$. The maximization problem becomes:

$$\max \; U_{ht}^{*} = \sum_{t=1}^{\infty} \rho^{t} \left[\int_{0}^{N_{ht}^{*}+N_{ft}^{*}} \tilde{c}_{hit}^{*\,(\sigma-1)/\sigma} di \right]^{\sigma/(\sigma-1)} \tag{33-1}$$

$$\text{s.t. } N_{ft}^{*ME} = L_f/(F\sigma),\; L_h = \int_{0}^{N_{ht}^{*}} l_{hit} di \text{ and } c_{hi0} = 0 \quad \forall i,\; t = 1, 2, \ldots. \tag{33-2}$$

Solving this problem gives the following optimal number of goods produced in the home country, N_{ht}^{*A1SO}:

$$N_{ht}^{*A1SO} = \frac{L_h(1-\beta(\sigma-1))}{F\sigma}, \tag{34}$$

which is the same as (18), where superscript *A1* denotes the regime of unilateral intervention by the home government. Thus, if the home country aims to maximize its own utility, the optimal variety of goods produced in the home country is the same as that under autarky.

Next consider the case that given N_{ft}^{*ME}, the home government maximizes world utility consisting of not only her own utility but also the foreign country's utility as in (29-1). Note that even if the home government behaves altruistically, the optimal number of goods produced in the home country is $N_{ht}^{*A2SO} = \frac{L_h(1-\beta(\sigma-1))}{F\sigma}$, where superscript *A2* denotes the regime of unilateral intervention by the altruistic home government. Then the world socially optimal number of goods is equal in both cases to:

$$N_{t}^{*ASO} = N_{t}^{*A1SO} = N_{t}^{*A2SO} = \frac{L_h(2-\beta(\sigma-1))}{F\sigma}, \tag{35}$$

where superscript *ASO* denotes the regime of unilateral intervention. On the other hand, the market equilibrium number of goods in the integrated market is:

$$N_t^{*AME} = N_{ht}^{*AME} + N_{ft}^{*AME} = \frac{L_h}{F[s_{ht}^*(1-\sigma)+\sigma]} + \frac{L_f}{F\sigma}. \tag{36}$$

Comparing N_t^{*ASO} with N_t^{*AME}, we have $N_t^{*ASO} > N_t^{*AME}$ if $-\beta(\sigma - 1) > 0$, and it is easily shown that $s_{ht}^{*A1} = s_{ht}^{*A2} = \frac{\beta\sigma}{\beta(\sigma-1)-1} = s_{ht}^* = s_{ft}^*$, where s_{ht}^{*A1} and s_{ht}^{*A2} are the collective tax or subsidy in each regime.

Furthermore, consider the third case that the world consists of $m \geq 2$ identical countries including the home country. In this case, the world socially optimal number of goods is $N_t^{*SOm} = \frac{mL_h(1-\beta(\sigma-1))}{F\sigma}$ from (30), in which the superscripts $A3$ denote the third case of the asymmetric subsidy regime. If the home government alone subsidizes her own industry, the number of goods supplied in the market equilibrium is $N_t^{*AMEm} = N_{ht}^{*AME} + (m-1)N_{ft}^{*AME}$. Hence the subsidy of the home country becomes $s_{ht}^{*A3} = \frac{m\beta\sigma}{m\beta(\sigma-1)-1}$, which indicates that the subsidy (tax) level decreases (increases) in the number of countries when addiction (smoothing behavior) is present in the utility function: $\partial s_{ht}^{*A3}/\partial m = (-\beta\sigma)/[m\beta(\sigma-1)-1]^2$.

The optimal subsidies among different regimes are characterized by the following relations:

$$s_{ht}^{*A3} = \frac{m\beta\sigma}{m\beta(\sigma-1)-1} \gtreqless ms_{ht}^* = \frac{m\beta\sigma}{\beta(\sigma-1)-1} = ms_{ht}^{*A1} = ms_{ht}^{*A2}, \tag{37}$$

which shows that with $\beta = 0$, we have $s_{ht}^{*A3} = s_{ht}^* = 0$, and $s_{ht}^{*A3} > s_{ht}^*$ holds if $\beta(\sigma - 1) > 1/m$. Note, however, that the total amount of the subsidy is larger in the asymmetric case 3 than in the symmetric case if $1/m > \beta(\sigma - 1) > 0$, which indicates that addiction exists in the utility function and the threshold value decreases in the number of trading countries. Thus, there are cases where addiction (too much variety) corrected by greater number of countries may be costly as in the smoothing consumption case (fewer variety), *i.e.*, $s_{ht}^{*A3} < s_{ht}^{*}$ with $\beta < 0$, in this specification. These results seem to be explained intuitively by focusing on the scale effects caused by increasing-returns-to-scale technology: if socially excessive (fewer) varieties exist, fewer countries levy taxes (subsidies) to make full use of the scale economy effects.

The obtained results are clearly summarized as the following proposition.

Proposition 3. When addictive consumption (smoothing consumption) is present in consumers' utility and the number of goods is socially larger (smaller), intervention costs paid by only one country are smaller than those by a larger (smaller) number of countries. In such a case, country h's production tax (subsidy) for her own industry will contribute to increasing not only the nation's welfare but also world welfare.

4. Concluding remarks

This paper presented a tractable model for commodity-specific habit formation or addiction, and using the model, we analyzed the effect of a subsidy or tax. Introducing the *commodity-specific* intertemporal consumption externality, the model shows clearly that the subsidy for a firm can increase welfare in the negative intertemporal externality (habit formation) case while the tax can do so in the positive (addiction) case. These results are not based on nonstandard assumptions of preferences like other previous studies but on the familiar framework of habit formation and monopolistic competition with increasing returns.

Using the model, we have analyzed some aspects of cultural goods. Among others, one of our important results is to make a distinction between the influence of habit formation and addiction. The model shows that cultural protection is desirable if the utility is habit forming while undesirable if addictive. Many arguments confuse both. If Hollywood movies create strong addiction in other countries' audiences, a tax on this is desirable if the model is applied literally to the real world. However, how about French or Korean films? These films also seem to create addiction, and the restriction is needed.

Hence the problem is sensitive to the nature of the goods: if the problem is excessive variety, a subsidy on home-produced goods worsens the situation. Furthermore, even in the second-best case, it is less costly when a small number of countries restrict variety under addiction. Therefore addictive goods such as liquor and cigarettes may have excessive variety, and it is undesirable to subsidize too many brands.

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