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The effects of the increase in tourists on the varieties of goods and services provided

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Abstract

The increase in tourists may enlarge the range of varieties consumed by tourists and instead reduce that by local residents. We obtain a general condition for this variety-shifting effect occurring and derive some welfare implications. In addition, we examine whether the effect emerges in the models with two specific types of preference, the model with the CES utility function and that with the quasi-linear utility function augmented by quadratic subutility.

Keywords: conflicts between residents and tourists; monopolistic competition models; service varieties; tourism

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1 Introduction

The number of international tourists has been steadily increasing grobally during the recent decades except the period of Covid19 prevalence. According to the UN Tourism, the total number of inbound tourists was 973 million in 2010, but rose to 1,195 million in 2015 and to 1,465 million in 2019. In parallel, international tourism receipts rose from 968 billion dollars in 2010 to 1,195 billion dollars in 2015 and 1,459 dollars in 2019. The share of those receipts in the world GDP has been also rising. In this way, international tourism is one of the most rapidly growing industries, which now undertakes an important part of economic activities.

The growth of tourism has far-reaching impacts on local residents.

The most important effect is probably the increase in their income brought about by the rise in factor prices. This is explained by the mere application of conventional international trade theory. We regard tourists' consumption at their destination, referred to as a "home economy," as the exports from the home economy to the tourists' economy.[1] Then the growth of tourism improves the terms of trade for the home economy, which benefits the residents there, as long as the tourism sector does not use a large amount of mobile factors and foreigners do not own a significant part of that sector (Copeland, 1991).

At the same time, the tourism growth has various negative effects, which are often discussed under the term "overtourism." The most important of those are the problems of negative externalities, such as congestion, noises, and pollution. At Kyoto in Japan, for example, the congestion of bus services due to the unprecedented increase in inbounds is becoming a serious threat to the peaceful quotidian life of local residents. To give another example, in many World Natural Heritage sites, massive tourism mars valuable natural environments, endangering biological diversity. Those negative externalities are familiar to economists: Economics has long accumulated the knowledge of their nature and the remedies for the associated problems.

What we discuss in this work is another class of negative effects. It is the effect that the increase in tourists crowds out the consumption of local residents. For instance, it drives out a number of local businesses that had been providing a wide variety of goods and services for daily needs of local residents, such as grocery stores, bakeries, book stores, and barbers. Instead, touristic areas see a mushroom growth of the businesses targeted at tourists, e.g., souvenir shops, currency exchanges, national-brand chain clothing stores, and global-brand fast food restaurants. Another example is that local residents are forced to give up continuing to live at a touristic city center due to the boost of land and housing rents, which arises because of the surge of the demand

[1] In this context, the difference between tourists' consumption and commodity export lies only in the attributes of the involved transport costs. That is, tourists pay the transport costs necessary to visit the destination country, whereas consumers or producers of the commodity pay the transport costs necessary to ship it abroad in the case of commodity export.

for accommodations, especially, hotels and private rooms for rent like Airbnb.[2] In this paper, we interpret such a broad stream of observations as the change in the produced varieties of goods and services from those for residents' consumption, or "residential varieties," to those for tourists' consumption, or "tourism varieties."

What illustrates the importance of this *variety-shifting effect* is the fact that it is one of the major reasons for the anti-tourism movements recently observed at major touristic cities particularly in Europe. An article of a newspaper, for example, reports the voices of local residents in Barcelona, where several large-scale anti-tourism demonstrations were held in the summer of 2024: One protestant says, "Tourists consume certain kinds of services that locals don't, and vice versa," and a butcher at a long-established market says, "Tourism has taken this market from us. Our customers can't come here anymore because they can't get through with their carts." [3]

This trade-off between residents' and tourists' consumption arises from the two distinctive characteristics of tourism. First, the composition of tourists' consumption is usually quite different from that of local residents'. For example, two major items in tourists' expenditure are the expense for accommodation and the transport costs to visit a destination country like air fares and long-distance train fees. Obviously, local residents seldom spend money on such services, except when they visit out-of-town places as tourists. Such a difference is attributed to the *difference in preference*. Second, considerable part of tourists' consumption is devoted to that of *nontradable goods and services*, such as accommodation services, and food and beverage services. Their production is constrained by the availability of inputs in the home economy. Because of this constraint, the increase in the production of tourism varieties results in the decrease in residential varieties. For the consumption of tradable goods and services, in contrast, tourists could substitute the varieties produced in the home economy with those produced in outside regions, and consequently, the home economy would not face the resource constraint.

In the former study (Takahashi, 2024), I have examined a simple model in which two monopolistically competitive sectors, residential service sector and tourism service sector, produce residential varieties and tourism varieties, respectively. I have shown that the model indeed exhibits the variety-shifting effect. However, the model is based on a particular class of preference, given by a quasi-linear utility function. A natural criticism is that the specific functional form may be responsible for the result. Indeed, it turns out to be true: the variety-shifting effect does not appear if we assume different forms for utility functions. The main purpose of this study is to answer that criticism by examining the effect without presuming a specific form.

More specifically, we derive a sufficient condition for the variety-shifting effect taking place

[2] In some cities such as Amsterdam and Barcelona, this problem is so serious that the city governments have introduced strict ordinances to prohibit launching new hotels in a city center.

[3] *The New York Times*, August 20, 2024.

in the general model. The condition is satisfied when all of the following three requirements are met. The first requirement is that a pass-through rate, which measures the response of the price of varieties to the change in production cost, is sufficiently low. The second requirement concerns how much residents increase their consumption when their income rises. The sufficient condition requires that this *income effect* be sufficiently weak. The third requirement is related to firms' pricing behaviors. An entry of a new firm usually intensifies the competitive pressure on incumbents to lower their prices. The requirement is that this *pro-competitive effect* must be sufficiently strong.

After the analysis of the general model, we examine two models with specific forms of utility function as examples. They are a "CES model" with a CES utility function and a "QL model" with a quasi-linear utility function augmented by quadratic subutility. The aim is to show that the derived sufficient condition may hold for some models but may not for others. We show that the outcomes are completely different between those two models. *The variety-shifting effect does not appear in the CES model, whereas it appears in the QL model for a broad range of parameter values.* This divergence is because the CES model possesses several idiosyncratic properties that end up effacing some of the important factors working at an equilibrium. One is that the range of residential varieties provided in the economy has no influence on the demand for a variable input. Another is that the pass-through rate becomes relatively high. Thus, an important message of this study is that we must be cautious in the use of the CES model when tackling a question involving two monopolistically competitive markets.

Furthermore, this work derives some welfare implications. We examine whether the local residents become better off or worse off as a result of the increase in tourists. The answer depends on the types of consumers, namely, skilled or unskilled workers, and several key parameters such as the share of skilled workers, the substitutability between varieties, and the technological efficiency. As well, we discuss the impacts on the aggregate welfare of local residents.

Additional contribution of this work is found in its theoretical approach. As has been discussed, it deals with two monopolistically competitive sectors. We can find many pieces of theoretical research that handle one monopolistically competitive sector and a competitive sector. To the best of my knowledge, however, there are few studies that explore the interrelations between two monopolistically competitive sectors.

Although the variety-shifting effect plays an important role in the discussion of the impacts of tourist increase, it has not attracted the interest of many economists. There are mainly two reasons. First, the topic becomes important only lately. Until recently, the number of tourists has been modest and the tendency for them to concentrate on a small number of major touristic areas has been much weaker. Therefore, the negative aspects of increasing tourists have not caused too serious problems. Second and more importantly, most economists believe that tourism is well studied by a mere application of conventional international trade theory, as mentioned earlier. They are not aware of the two distinctive characteristics of tourism mentioned earlier, namely, the difference in the preference between tourists and residents and the nontradable nature of the good and services consumed by tourists.

As related literature, there are some studies that discuss the relation of a tourism sector with other sectors. In particular, a number of works study the relation with a manufacturing sector, arguing that the growth of a tourism sector can hinder the advance of a manufacturing sector in exchange. This "de-industrialization" process may prevent future capital accumulation (Chao et al., 2007), or deprive of the advantage of various scale economies exclusive to the manufacturing sector (Capó et al., 2006; Zeng and Zhu, 2011; Faber and Gaubert, 2019).[4] In those studies, however, the tourism sector is considered competitive while the manufacturing sector is considered imperfectly competitive. In this work, in contrast, the tourism sector is also considered imperfectly competitive. As we have pointed out earlier, our model has two monopolistically competitive sectors, the tourism service sector and the residential service sector. This is a novel point that we cannot find in the existing literature.

The rest of the paper consists of four sections. In Section 2, we present a general model without assuming any specific form of utility functions. A sufficient condition for the variety-shifting effect occurring is derived. In addition, we examine the effects of the increase in tourists on local residents' welfare. Section 3 deals with the CES model while Section 4 with the QL model. Section 5 concludes.

2 General framework

In this section, we present a general framework that presumes no particular form of a utility function.

2.1 Model

Consider a home economy whose residents are composed of skilled workers, or type-S consumers, and unskilled workers, or type-U consumers. The share of the skilled workers is denoted by s. Each of those workers inelastically supplies one unit of skilled or unskilled labor. In

[4]However, not a few empirical works show that the de-industrialization effect is not too overwhelming, and that the overall effect of the growth of a tourism sector is positive, that is, the terms-of-trade effect dominates the de-industrialization effect. The work of Faber and Gaubert (2019) on Mexican municipalities is one of the most comprehensive and rigorous econometric analyses. Many other studies also examine a specific touristic country (Balaguer and Cantaella-Jordá, 2002; Dritsakis, 2004; Durbarry, 2004; Kim et al., 2006; Sheng and Tsui, 2009), and some studies examine a number of countries altogether (Sequeira and Nunes, 2008; Holzner, 2011; Arezki et al. 2012).

addition to those residents, tourists, or type-T consumers, visit that economy from the outside. We normalize the number of the home economy residents at the unity and denote the volume of tourists by constant L. All the skilled workers have identical preference and are endowed with equal income. The similar remark applies to the unskilled workers and the tourists, respectively.

There are three groups of goods and services: residential services, tourism services, and a manufacturing good. The two categories of services are differentiated products consisting of many varieties, which are produced by monopolistically competitive firms with increasing-returns-to-scale technology. The residential services, or service R, are the local services that the residents consume in their everyday lives. The tourism services, or service T, on the other hand, are those the tourists consume to carry out tourism activities. They are represented by accommodation and transport services. We assume that the residents consume no tourism services and the tourists consume no residential services. The main reason for this rather strong assumption is to emphasize the difference in the roles of residents and tourists played in the economy. In addition, the assumption makes the analysis much simple. However, it is not difficult to extend the model to allow for the possibility that the two types consume some of the same services. Both categories of services are immobile: they cannot be imported from or exported to the rest of the world. Finally, the manufacturing good is consumed by both the residents and the tourists. It is produced by competitive firms with constant-returns-to-scale technology. It is mobile, that is, it can be imported from or exported to the rest of the world. We consider the manufacturing good a numéraire.

The preference of residents and that of tourists are represented by utility functions $u_R\left(\{q_j(v)\}\,|_{v\in N_R}\ ,\ z_j\right)$ and $u_T\left(\{q_T(v)\}\,|_{v\in N_T}\ ,\ z_T\right)$, respectively. Here, $q_j(v)$ is the amount of the v-th variety of residential services, or the v-th "residential variety" (service R variety), consumed by a worker of type $j \in \{S, U\}$, whereas $q_T(v)$ is the amount of the v-th variety of tourism services, or the v-th "tourism variety" (service T variety), consumed by a tourist. Furthermore, z_j and z_T represent the consumption of manufacturing good by each type of consumers ($j \in \{S, U\}$). N_R and N_T represent the sets of residential and tourism varieties, respectively.

The budget constraints of a type-j resident with income y_j and a tourist with income y_T are respectively given by

$$\int_{v\in N_R} p_R(v)q_j(v)\,\mathrm{d}v + z_j = y_j \quad \text{for} \quad j \in \{S, U\} \quad \text{and} \quad \int_{v\in N_T} p_T(v)q_T(v)\,\mathrm{d}v + z_T = y_T, \tag{1}$$

where $p_R(v)$ and $p_T(v)$ are the prices of the v-th residential and tourism varieties, respectively.

Residents and tourists maximize their utility subject to the relevant budget constraint. Note that resident's demand for each residential variety does not depend on the price nor the range of tourism varieties, because they do not consume the tourism varieties. The parallel remark applies to tourist's demand for each tourism variety. Because each type of consumers are identical, the aggregate demands for the v-th residential and tourism varieties are equal to

$$d_R(v) = sq_S(v) + (1-s)q_U(v) \quad \text{and} \quad d_T(v) = Lq_T(v), \tag{2}$$

respectively.

Manufacturing firms produce one unit of good using one unit of unskilled labor, which implies that the wage rate of unskilled labor is unity. The income of a tourist is given and equal to constant y. Then, we have

$$y_S = w, \quad y_U = 1, \quad \text{and} \quad y_T = y,$$

where w is a wage rate of skilled labor. It is useful to define the aggregate income of the home economy residents as

$$Y_R \equiv sw + 1 - s.$$

Each service firm produces one variety of services. To produce one unit of service i, it uses a_i units of skilled labor as a variable input for $i \in \{R, T\}$. In addition, it needs to employ F_i units of unskilled labor as a fixed input. We concentrate on the simple case in which the input requirements in the production of a residential variety are the same as those in the production of a tourism variety. In other words, we assume $a_R = a_T \equiv a$ and $F_R = F_T \equiv F$. Then, the profit of a firm in the service i sector is given by

$$\pi_i(v) = \big[p_i(v) - aw\big]d_i(v) - F \quad \text{for} \quad i \in \{R, T\}. \tag{3}$$

Service firms choose the price that maximizes the profit given by (3). Here, we adhere to the common practice in the literature that each firm does not take into account the repercussions of its pricing decision on its competitors' decisions. To take into account this point explicitly, it is useful for us to regard the aggregate demand faced by a firm in the service i sector as a function of its own price and a price index, P_i: $d_i(v) \equiv d_i(v)\big(p_i(v), P_i\big)$. Here, the price index is a symmetric function of the prices of all the varieties in the sector, which satisfies

$$\frac{\partial P_i}{\partial p_i(v)} > 0 \quad \text{and} \quad \frac{\partial d_i(v)\big(p_i(v), P_i\big)}{\partial P_i} > 0 \quad \text{for any} \quad v \in N_i. \tag{4}$$

The first inequality requires that the price index increase with the price of each variety. The second requires that the demand for each variety increase with the price index. The price index rises if a firm's own price and its competitors' prices increase. The requirement stipulates that the negative effect of the increase in its own price on demand be outweighed by the positive effect of the increase in its competitors' prices. For such a price index, the common practice prescribes that each firm decide its price so that

$$d_i(v) + \left[p_i(v) - aw\right] \frac{\partial d_i(v)\big(p_i(v), P_i\big)}{\partial p_i(v)} = 0 \quad \text{for} \quad i \in \{R, T\} : \tag{5}$$

the firm disregards the effect of $p_i(v)$ through P_i.

Because the firms in each service sector are identical, the prices they charge become equal to each other. We denote them as $p_i(v) \equiv p_i$ for any v. The equality of prices implies that a resident consumes an equal amount of each residential variety while a tourist an equal amount of each tourism variety, that is, $q_j(v) \equiv q_j$ and $q_T(v) \equiv q_T$ for any v and $j \in \{S, U\}$. Consequently, the firms in each service sector obtain an equal amount of demand, that is, $d_i(v) \equiv d_i$ for any v, and, therefore, an equal amount of profit, that is, $\pi_i(v) = \pi_i$ for any v.

In the service sectors, firms freely enter and exit, which makes the profit of each firm 0:

$$\pi_i = 0 \quad \text{for} \quad i \in \{R, T\}. \tag{6}$$

Next, we turn our eyes to a market clearing condition. Since all the services are produced within the home economy, the demand for skilled labor in the residential service sector and that in the tourism service sector must sum up to its supply:

$$a\big(n_R d_R + n_T d_T\big) = s. \tag{7}$$

Here, n_R and n_T are the ranges of residential and tourism varieties, respectively, that is, $n_R \equiv |N_R|$ and $n_T \equiv |N_T|$.

The equilibrium is defined as a triplet, $\{w, n_R, n_T\}$, that solves a system of equations (2), (5), (6), and (7). In more detail, the conditions for profit maximization, (5), give the price of varieties in each service sector as a function of the wage rate of skilled labor and the range of the varieties in that sector, that is,

$$p_i \equiv p_i(w, n_i). \tag{8}$$

Furthermore, the result of the utility maximization, (2), yields the aggregate demand for each variety:

$$d_i \equiv d_i\big(w, n_i, p_i(w, n_i)\big). \tag{9}$$

These results enable us to derive the equilibrium $\{w, n_R, n_T\}$ by solving three equations, namely, the two zero profit equations in (6) and the market clearing equation of (7). In what follows, we may omit the arguments of p_i in (8) and those of d_i in (9) to avoid heavy notations, as long as it causes no confusion.

Our analysis is confined to the utility functions that satisfy the following regularity conditions.

Assumption 1

$$\frac{\partial p_i}{\partial w} > 0, \ \frac{\partial p_i}{\partial n_i} \leq 0, \ \frac{\partial d_i}{\partial p_i} < 0, \ \textit{and} \ \frac{\partial d_i}{\partial n_i} < 0 \ \textit{for} \ i \in \{R, T\}; \quad \textit{and} \ \frac{\partial q_S}{\partial y_S} \geq 0.$$

Those conditions are sufficiently intuitive and weak enough to hold for most of the utility functions used in the literature. The first condition requires that the equilibrium prices of services rise if the wage rate of skilled labor increases, other things being equal. Let us denote the *pass-through rate* in sector i by μ_i. It is the ratio of the change in a price to that in a marginal cost:

$$\mu_i \equiv \frac{\partial p_i}{\partial (aw)} = \frac{1}{a}\frac{\partial p_i}{\partial w}.$$

Thus, the first condition is equivalent to the condition that the pass-through rate is positive. The second condition demands that the price of varieties fall or remain unchanged in each service sector if the range of varieties provided in that sector increases. If it falls, the entry of a new firm has a *pro-competitve effect* on the price. The third condition prescribes a downward-sloping aggregate demand curve for each variety. The fourth states that the aggregate demand for each variety is smaller when more varieties are provided, ceteris paribus. It is because each consumer allocates a given amount of budget among a larger number of varieties, which we call a *wider-selection effect*. The last condition stipulates a nonnegative income effect for skilled workers.

With respect to the third condition of the downward-sloping aggregate demand, one comment is worth adding for the subsequent analysis. Note that $\frac{\partial d_i}{\partial p_i} \equiv \frac{\partial d_i(w, n_i, p(w, n_i))}{\partial p_i}$ represents its slope *when all the firms in the service i sector simultaneously change their prices by the same amount.* In the determination of a price, to the contrary, each firm takes into account $\partial d_i(v)\big(p_i(v), P_i\big)/\partial p_i$, which is the slope *when that firm changes its price unilaterally* (see (5)). Obviously, the former aggregate demand curve is flatter than the latter because the simultaneous increase in the competitors' prices mitigates the decrease in demand caused by the rise in the own price. Formally, we can state as follows.

Lemma 1

$$\frac{\partial d_i\big(w, n_i, p_i(w, n_i)\big)}{\partial p_i} > \left.\frac{\partial d_i(v)\big(p_i(v), P_i\big)}{\partial p_i(v)}\right|_{p_i(v)=p_i\ \forall v \in N_i}. \tag{10}$$

Proof

Note that

$$\begin{aligned}
\frac{\partial d_i\big(w, n_i, p_i(w, n_i)\big)}{\partial p_i} &\equiv \frac{\mathrm{d} d_i(v)\big(p_i(v), P_i\big)}{\mathrm{d} p_i} \\
&= \frac{\mathrm{d} d_i(v)\big(p_i(v), P_i\big)}{\mathrm{d} p_i(v)} + \sum_{v' \neq v,\ v' \in N_i} \frac{\mathrm{d} d_i(v)\big(p_i(v), P_i\big)}{\mathrm{d} p_i(v')} \\
&= \frac{\partial d_i(v)\big(p_i(v), P_i\big)}{\partial p_i(v)} + \frac{\partial P_i}{\partial p_i(v)} \frac{\partial d_i(v)\big(p_i(v), P_i\big)}{\partial P_i} + \sum_{v' \neq v,\ v' \in N_i} \frac{\partial P_i}{\partial p_i(v')} \frac{\partial d_i(v)\big(p_i(v), P_i\big)}{\partial P_i},
\end{aligned}$$

where all the derivatives are evaluated at the equal price, $p_i(v) = p_i$, for any $v \in N_i$. This and (4) lead to (10). ■.

2.2 Variety-shifting effect

We say that the increase in tourists have a *variety-shifting effect* if it narrows down the range of residential varieties. In other words, that effect appears if $\mathrm{d}n_R/\mathrm{d}L$ is negative. To examine when the effect appears, we totally differentiate the three equilibrium equations in (6) and (7) with respect to the three equilibrium variables, w, n_R, and n_T.

First, we totally differentiate the zero profit equation for a residential service firm and that for a tourism service firm to obtain

$$\frac{\mathrm{d}w}{\mathrm{d}L}\frac{\mathrm{d}\pi_R}{\mathrm{d}w} + \frac{\mathrm{d}n_R}{\mathrm{d}L}\frac{\mathrm{d}\pi_R}{\mathrm{d}n_R} = 0 \quad \text{and} \quad \frac{\mathrm{d}w}{\mathrm{d}L}\frac{\mathrm{d}\pi_T}{\mathrm{d}w} + \frac{\mathrm{d}n_T}{\mathrm{d}L}\frac{\mathrm{d}\pi_T}{\mathrm{d}n_T} + \rho_T q_T = 0, \tag{11}$$

respectively. Here, $\rho_i \equiv p_i - aw$ denotes a price mark-up prevailing in the service i sector ($i \in \{R, T\}$). The volume of tourists affects the profit of a residential service firm through two channels, namely, through the change in the wage rate of skilled labor, i.e., a *wage channel*, and through the change in the range of residential varieties, i.e., an n_R *channel*. Similarly, the profit of a tourism service firm is affected through the wage channel and the change in the range of tourist varieties, i.e., an n_T *channel*. In addition, the volume of tourists directly affects the demand for tourism services, and thus, the profit of a tourism service firm. This *direct channel* is represented by the term $\rho_T q_T$. Note that the profit of a firm in each of the two service sectors does not depend on the range of varieties produced in the other service sector.

To look at the wage channel and the n_i channel more closely, note that

$$\frac{\mathrm{d}\pi_i}{\mathrm{d}w} = ad_i(\mu_i - 1) + \rho_i \frac{\mathrm{d}d_i}{\mathrm{d}w} \quad \text{and} \quad \frac{\mathrm{d}\pi_i}{\mathrm{d}n_i} = d_i \frac{\partial p_i}{\partial n_i} + \rho_i \frac{\mathrm{d}d_i}{\mathrm{d}n_i} \quad \text{for} \quad i \in \{R, T\}. \tag{12}$$

This shows that the effect through each channel is decomposed into two components. One is the effect through the change in a price mark-up. This *mark-up effect* is represented by the term with $\mu_i - 1$ for the wage channel or the term with $\partial p_i / \partial n_i$ for the n_i channel. The other component is the effect through the change in demand. This *demand effect* is captured by the term with $\mathrm{d}d_i / \mathrm{d}w$ for the wage channel or the term with $\mathrm{d}d_i / \mathrm{d}n_R$ for the n_i channel.

The demand effects for the wage channel are further rewritten as

$$\frac{\mathrm{d}d_R}{\mathrm{d}w} = \frac{\partial p_R}{\partial w}\frac{\partial d_R}{\partial p_R} + s\frac{\partial q_S}{\partial y_S} \quad \text{and} \quad \frac{\mathrm{d}d_T}{\mathrm{d}w} = \frac{\partial p_T}{\partial w}\frac{\partial d_T}{\partial p_T} < 0. \tag{13}$$

Three remarks follow. First, the demand for each category of services is affected by its own price but not by the price of the other category of services. Second, the increase in the wage rate of skilled labor means the rise in the skilled workers' income, which enhances the demand for each residential variety by $\partial q_S / \partial y_S$. This *income effect* appears in the effect on d_R, but does not appear in the effect on d_T. Third and finally, it is important to note that $\mathrm{d}d_T / \mathrm{d}w$ is negative by the regularity conditions, although $\mathrm{d}d_R / \mathrm{d}w$ can be positive. Likewise, we can express the demand effect for the n_i channel as

$$\frac{\mathrm{d}d_i}{\mathrm{d}n_i} = \frac{\partial p_i}{\partial n_i}\frac{\partial d_i}{\partial p_i} + \frac{\partial d_i}{\partial n_i} \quad \text{for} \quad i \in \{R, T\}. \tag{14}$$

The first term at the right hand side represents the non-negative impact of the pro-competitive effect on the price, whereas the second term does the negative wider-selection effect. Note that the price of service i depends on the number of firms in the service i sector, but not on that in the other service sector, because the pro-competitive effect is limited within each sector. As well, the demand for each variety of service i is directly affected by the number of firms in that sector, but not by that in the other service sector.

One important observation is that the effect through the n_i channel is negative.

Lemma 2

$$\frac{\mathrm{d}\pi_i}{\mathrm{d}n_i} < 0 \quad \textit{for} \quad i \in \{R, T\}.$$

Proof

It follows from the condition for profit maximization, (5), and Lemma 1 that

$$d_i + \rho_i \frac{\partial d_i(w, n_i, p_i(w, n_i))}{\partial p_i} > 0 \quad \text{for} \quad i \in \{R, T\}.$$

Therefore, by the regularity conditions, we obtain

$$\frac{\mathrm{d}\pi_i}{\mathrm{d}n_i} = \frac{\partial p_i}{\partial n_i}\left[d_i + \rho_i \frac{\partial d_i(w, n_i, p_i(w, n_i))}{\partial p_i}\right] + \rho_i \frac{\partial d_i}{\partial n_i} < 0 \quad \text{for} \quad i \in \{R, T\}. \qquad \blacksquare$$

Next, in addition to the two zero profit equations, we differentiate the market clearing equation, (7), to obtain

$$\frac{\mathrm{d}w}{\mathrm{d}L}\left(n_R \frac{\mathrm{d}d_R}{\mathrm{d}w} + n_T \frac{\mathrm{d}d_T}{\mathrm{d}w}\right) + \sum_{i \in \{R,T\}} \frac{\mathrm{d}n_i}{\mathrm{d}L}\left(d_i + n_i \frac{\mathrm{d}d_i}{\mathrm{d}n_i}\right) + n_T q_T = 0. \tag{15}$$

This shows that the increase in tourists affects the demand of skilled labor through the wage channel, the n_R channel, the n_T channel, and the direct channel.

The system of equations consisting of (11) and (15) determines the three variables $\mathrm{d}w/\mathrm{d}L$, $\mathrm{d}n_R/\mathrm{d}L$, and $\mathrm{d}n_T/\mathrm{d}L$. However, those solutions are rather too complicated and do not provide much insight. Thus, we take an alternative approach of deriving a sufficient condition for the variety-shifting effect occurring. We show that the effect occurs if all the following three conditions are satisfied.

The first condition is that the pass-through rate is lower than 1:

$$\mu_i < 1 \quad \text{for} \quad i \in \{R, T\}. \tag{16}$$

We call it a *low pass-through condition*. The second condition is that

$$\frac{\mathrm{d}d_R}{\mathrm{d}w} < 0. \tag{17}$$

This condition requires that the positive income effect on the aggregate demand be weak enough to be more than offset by the negative price effect (see the first equation in (13)). If both of this *weak income effect condition* and the precedent low pass-through condition hold, the wage channel effect on the residential firms' profit, $\mathrm{d}\pi_R/\mathrm{d}w$, is negative (see the first equation in (12)). Therefore, it immediately follows from the first equation in (11) and Lemma 2 that the sign of $\mathrm{d}w/\mathrm{d}L$ is opposite to that of $\mathrm{d}n_R/\mathrm{d}L$ unless both of them are zero. In other words, we have $\frac{\mathrm{d}w}{\mathrm{d}L} \cdot \frac{\mathrm{d}n_R}{\mathrm{d}L} < 0$

or $\frac{\mathrm{d}w}{\mathrm{d}L} = \frac{\mathrm{d}n_R}{\mathrm{d}L} = 0.$

Proposition 1

Suppose that both the low pass-through condition and the weak income effect condition are satisfied. Then, as tourists increase, the wage rate of skilled labor and the range of residential varieties change in the opposite directions unless both variables remain unchanged.

The proposition implies that the range of residential varieties decreases when the wage rate rises: Thus, *we cannot take advantage of the increase in wage and that in the variety range at the same time*.

Finally, we introduce the third condition:

$$\frac{n_i}{d_i}\frac{\mathrm{d}d_i}{\mathrm{d}n_i} \geq -1 \quad \text{for} \quad i \in \{R, T\}. \tag{18}$$

This requires that the elasticity of aggregate demand in each sector with respect to the number of firms in that sector be sufficiently high. It holds if the positive impact of the pro-competitive effect is sufficiently strong compared to the negative impact of the wider-selection effect (see (14)). Thus, we refer to this condition as a *strong pro-competitve effect condition*. Obviously, the condition is satisfied when $\mathrm{d}d_i/\mathrm{d}n_i$ is positive.

We can prove that $\mathrm{d}w/\mathrm{d}L > 0$ and $\mathrm{d}n_R/\mathrm{d}L < 0$ if those three conditions, (16), (17), and (18), are satisfied.

Proposition 2

Suppose that all of the low pass-through condition, the weak income effect condition, and the strong pro-competitive effect condition are satisfied. Then, as tourists increase, the wage rate of skilled labor rises and the range of residential varieties shrinks.

Proof

Suppose that $\mathrm{d}w/\mathrm{d}L$ is nonpositive. Since the sign of $\mathrm{d}n_R/\mathrm{d}L$ becomes opposite to that of $\mathrm{d}w/\mathrm{d}L$ or both of them become zero according to Proposition 1, $\mathrm{d}n_R/\mathrm{d}L$ becomes nonnegative. Moreover, recall that $\mathrm{d}d_T/\mathrm{d}w$ is negative (see the second equation in (13)). This, together with the low pass-through condition, implies that $\mathrm{d}\pi_T/\mathrm{d}w$ is negative. These two observations lead to the conclusion that $\mathrm{d}n_T/\mathrm{d}L$ at the second equation in (11) is positive. Now, look at the market clearing equation, (15). The strong pro-competitive effect condition, along with the weak income effect condition and the second equation in (13), implies that the left-hand side of (15) becomes positive. This is a contradiction. Hence, $\mathrm{d}w/\mathrm{d}L$ must be positive, and therefore, $\mathrm{d}n_R/\mathrm{d}L$ is negative. ■

It would be worth discussing one application of these findings. Casual observations suggest that the problem of the variety-shifting effect is more noticeable in advanced economies than developing economies, although it is a matter of empirical scrutiny. If this conjecture is true, one may explain it from the fact that the three requirements of the sufficient condition for the variety-shifting effect are less likely to be met in developing economies. For one thing, those economies are prone to a higher pass-through rate and a weaker pro-competitive effect probably due to immature industry structure with a more monopolistic power. For another thing, they tend to be characterized by a stronger income effect because the residents earn relatively lower income. These factors work against the sufficient condition for the variety-shifting effect.

2.3 Welfare implications

The next question is how the increase in tourists affects the welfare of home economy residents.

Let $v_j\big(y_j, n_R, p_R(w, n_R)\big)$ be the indirect utility of a type-j worker ($j \in \{S, U\}$). In what follows, its arguments are omitted if doing so causes no confusion. The effect of the increase in tourists on the indirect utility is described by the following equation:

$$
\begin{aligned}
\frac{\mathrm{d}v_j}{\mathrm{d}L} &= \frac{\mathrm{d}y_j}{\mathrm{d}L}\frac{\partial v_j\big(y_j, n_R, p_R(w, n_R)\big)}{\partial y_j} + \frac{\mathrm{d}n_R}{\mathrm{d}L}\frac{\partial v_j\big(y_j, n_R, p_R(w, n_R)\big)}{\partial n_R} + \frac{\mathrm{d}p_R}{\mathrm{d}L}\frac{\partial v_j\big(y_j, n_R, p_R(w, n_R)\big)}{\partial p_R} \\
&= \frac{\mathrm{d}w}{\mathrm{d}L}\frac{\mathrm{d}v_j}{\mathrm{d}w} + \frac{\mathrm{d}n_R}{\mathrm{d}L}\frac{\mathrm{d}v_j}{\mathrm{d}n_R} \quad \text{for} \quad j \in \{S, U\}, \\
&\qquad \text{where} \quad \begin{cases} \dfrac{\mathrm{d}v_S}{\mathrm{d}w} = \dfrac{\partial v_S}{\partial w} + \dfrac{\partial p_R}{\partial w}\dfrac{\partial v_S}{\partial p_R}, \quad \dfrac{\mathrm{d}v_U}{\mathrm{d}w} = \dfrac{\partial p_R}{\partial w}\dfrac{\partial v_U}{\partial p_R}, \quad \text{and} \\ \dfrac{\mathrm{d}v_j}{\mathrm{d}n_R} = \dfrac{\partial v_j}{\partial n_R} + \dfrac{\partial p_R}{\partial n_R}\dfrac{\partial v_j}{\partial p_R}. \end{cases}
\end{aligned}
\tag{19}
$$

The first line of (19) shows that the effect consists of three components. The first component is the effect through the change in income level. For a skilled worker, it is brought about by the change in the wage rate of skilled labor, which is represented by $\frac{\mathrm{d}y_S}{\mathrm{d}L}\frac{\partial v_S}{\partial y_S} \equiv \frac{\mathrm{d}w}{\mathrm{d}L}\frac{\partial v_S}{\partial w}$. This income effect is absent for unskilled workers, because their income level is fixed: $\frac{\mathrm{d}y_U}{\mathrm{d}L} \equiv 0$. The second component is the effect through the change in the range of residential varieties. The last component is the effect through the change in the price of those varieties. These three effects, the *income effect*, the *variety effect*, and the *price effect*, are represented by the three terms at the right-hand side of the first line, respectively.

Let us focus on the previous case in which the wage rate of skilled labor rises and the range of residential varieties shrinks. First, note that

$$\frac{\partial v_S}{\partial w} > 0 \text{ and } \frac{\partial v_j}{\partial p_R} < 0 \quad \text{for} \quad j \in \{S, U\}, \tag{20}$$

because residents can still consume the same amounts of goods and services even if their income rises or the price decreases. Second, we consider only the class of utility functions for which the increase in the range of residential varieties gives a favorable impact on the indirect utility:

$$\frac{\partial v_j}{\partial n_R} > 0 \quad \text{for} \quad j \in \{S, U\}. \tag{21}$$

Equations (20) and (21) imply that $\frac{\mathrm{d}v_j}{\mathrm{d}n_R}$ is positive for $j \in \{S, U\}$. Third, note that $\frac{\mathrm{d}v_U}{\mathrm{d}w}$ is negative. The following proposition immediately follows from those three observations (see (19)).

Proposition 3

Suppose that the wage rate of skilled labor rises and the range of residential varieties shrinks as a result of the increase in tourists. Then,

i) the indirect utility of an unskilled worker necessarily decreases, and

ii) the indirect utility of a skilled worker decreases if the income effect is sufficiently weak ($\partial v_S/\partial w$ is sufficiently small) .

For an unskilled worker, the rise in w has only a negative impact through the rise in the price. For a skilled worker, instead, it has a positive income effect in addition to the negative price effect. Therefore, whether they become worse off or not depends on the relative size of the income effect.

Combining Proposition 2 and Proposition 3 immediately yields a corollary that i) and ii) in Proposition 3 hold if all the low pass-through condition, the weak income effect condition, and the strong pro-competitive effect condition are satisfied.

Finally, we examine the aggregate welfare of home economy residents, which is defined as

$$\Omega \equiv s v_S + (1-s) v_U.$$

Note that (19) yields

$$\begin{gathered}\frac{\mathrm{d}\Omega}{\mathrm{d}L} = \frac{\mathrm{d}w}{\mathrm{d}L}\left(s\frac{\partial v_S}{\partial w} + \frac{\partial p_R}{\partial w}\frac{\partial \Omega}{\partial p_R}\right) + \frac{\mathrm{d}n_R}{\mathrm{d}L}\left(\frac{\partial \Omega}{\partial n_R} + \frac{\partial p_R}{\partial n_R}\frac{\partial \Omega}{\partial p_R}\right), \\ \text{where} \quad \frac{\partial \Omega}{\partial p_R} = s\frac{\partial v_S}{\partial p_R} + (1-s)\frac{\partial v_U}{\partial p_R} < 0 \quad \text{and} \quad \frac{\partial \Omega}{\partial n_R} = s\frac{\partial v_S}{\partial n_R} + (1-s)\frac{\partial v_U}{\partial n_R} > 0.\end{gathered} \tag{22}$$

Consider again the case in which w rises and n_R decreases. Since the coefficient of $\mathrm{d}n_R/\mathrm{d}L$ in (22) is positive, a sufficient condition for $\mathrm{d}\Omega/\mathrm{d}L$ being negative is that

$$s\frac{\partial v_S}{\partial w} + \frac{\partial p_R}{\partial w}\frac{\partial \Omega}{\partial p_R} < 0.$$

It is satisfied if s or $\partial v_S/\partial w$, or both are sufficiently close to zero. This immediately leads to the following results.

Proposition 4

Suppose that the wage rate of skilled labor rises and the range of residential varieties shrinks as a result of the increase in tourists. Then, the aggregate welfare of residents worsens if

i) the share of skilled workers is sufficiently small, and/or

ii) the skilled workers' income effect ($\partial v_S/\partial w$) is sufficiently weak.

3 Example 1: The model with CES preference

In this section, we examine a *CES model* with a CES utility function as an example. It is one of the most frequently used specifications to describe a monopolistically competitive market especially in the literature of international trade theory, spatial economics, and industrial organization. The reason to examine this model is that it gives a counterexample to the variety-shifting effect: it does not produce that effect, that is, *the range of the residential varieties always expands as tourists increase*.

3.1 Model

Because the model is so widely used in the literature, this section rather aims at introducing notations. In the CES model, the utility function for a type j worker ($j \in \{S, U\}$) and a tourist are respectively given by

$$\begin{aligned} &u_j = Q_j^{\alpha} z_j^{1-\alpha} \quad \text{and} \quad u_T = Q_T^{\alpha} z_T^{1-\alpha}, \\ &\qquad \text{where} \quad Q_j \equiv \left[\int_{v\in N_R} q_j(v)^{\frac{\sigma-1}{\sigma}}\,\mathrm{d}v\right]^{\frac{\sigma}{\sigma-1}} \quad \text{and} \quad Q_T \equiv \left[\int_{v\in N_T} q_T(v)^{\frac{\sigma-1}{\sigma}}\,\mathrm{d}v\right]^{\frac{\sigma}{\sigma-1}}. \end{aligned} \tag{23}$$

Here, to avoid unnecessary complications, we are assuming that the residents and the tourists have the same expenditure share of service varieties, $\alpha \in (0, 1)$, and the same elasticity of substitution between them, $\sigma > 1$. It is not difficult to extend the model so as to allow for their differences.

Maximizing (23) subject to budget constraint (1) and applying (2) to the obtained result, we derive the aggregate demand for each variety:

$$d_R(v)\big(p_R(v), P_R\big) = \alpha Y_R \frac{p_R(v)^{-\sigma}}{{P_R}^{1-\sigma}} \quad \text{and} \quad d_T(v)\big(p_T(v), P_T\big) = \alpha Ly \frac{p_T(v)^{-\sigma}}{{P_T}^{1-\sigma}}, \tag{24}$$

where the price index of service i is given by $P_i \equiv \left[\int_{v\in N_i} p_i(v)^{1-\sigma}\, \mathrm{d}v\right]^{\frac{1}{1-\sigma}}$ ($i \in \{R, T\}$). It is readily verified that both price indices satisfy (4).

Equation (5) gives the well-known condition for the profit maximization that the price becomes a constant multiple of the wage rate of skilled labor:

$$p_i(w, n_i) = \frac{\sigma}{\sigma - 1} aw \equiv p.$$

Here, the price of residential varieties and that of tourism varieties become equal to each other, and thus, we denote them simply by p. It is important to note that the price does not depend on the ranges of service varieties, or, the number of firms. This lack of the pro-competitive effect is not consistent with empirical observations, for which the CES model has often drawn strong criticism.

Because of the equality of the prices, (24) is reduced to

$$d_R\big(w, n_R, p_R(w, n_R)\big) = \frac{\alpha Y_R}{pn_R} \quad \text{and} \quad d_T\big(w, n_T, p_T(w, n_T)\big) = \frac{\alpha Ly}{pn_T}.$$

We can confirm that the CES model satisfies all the regularity conditions in Assumption 1. Furthermore, it is readily verified that Lemma 1 actually holds, because the left-hand side of (10) is reduced to $-d_R/p$ whereas the right-hand side to $-\sigma d_R/p$.

One of the easiest ways to show the existence of an equilibrium is to solve the system of equations explicitly for $\{w, n_R, n_T\}$ and then check the validity of the derived solutions. It is straightforward to obtain them uniquely:

$$w = \frac{\alpha(\sigma-1)}{\sigma(1-\alpha)+\alpha} \cdot \frac{1-s+Ly}{s} \quad \text{and} \quad \begin{cases} n_R = \dfrac{\alpha\Big[\alpha(\sigma-1)Ly + \sigma(1-s)\Big]}{\sigma F\big[\sigma(1-\alpha)+\alpha\big]} \\[2ex] n_T = \dfrac{\alpha Ly}{\sigma F}. \end{cases} \tag{25}$$

Since all the three values are positive, we can conclude that a valid unique equilibrium indeed exists.

3.2 Variety-shifting effect

It immediately follows from (25) that both $\mathrm{d}w/\mathrm{d}L$ and $\mathrm{d}n_R/\mathrm{d}L$ are positive. Thus, we have established the following result.

Proposition 5

In the CES model, as tourists increase,

i) the range of residential varieties always expands, and

ii) the wage rate of skilled labor always rises.

Thus, the CES model exhibits no variety-shifting effect. Then, a question arises: among the three conditions that constitute the sufficient condition for that effect, which fails to be fullfilled? The weak income effect condition, (17), and the strong pro-competitive effect condition, (18), are satisfied, because $\mathrm{d}d_R/\mathrm{d}w = -\alpha(1-s)\big/\big(pn_R\big) < 0$ and $\big(n_i/d_i\big)\cdot\big(\mathrm{d}d_i/\mathrm{d}n_i\big) = -1$. However, the low pass-through condition, (16), does not hold because $\mu_i = \sigma/(\sigma-1) > 1$. We can give the following explanation for the absence of the variety-shifting effect in the case of too high a pass-through rate. The increase in tourists tightens the market of skilled labor and raises its wage, ceteris paribus, which affects the price mark-up. The point is that the mark-up increases more sharply when the pass-through rate is high. Thus, if the rate is sufficiently high, the mark-up is large enough to enhance the profit of residential service firms, which induces the entry of those firms, and therefore, residential varieties increase.

It goes without saying that even if the sufficient condition is not satisfied, we cannot deny the possibility for the variety-shifting effect to show up. For the absence of that effect, it is necessary for other factors to intervene in addition.

One of them concerns the market clearing equation, (15). Observe that $d_i + n_i\big(\mathrm{d}d_i/\mathrm{d}n_i\big)$ becomes 0 in the CES model. That is, neither the n_R channel nor the n_T channel operates for the skilled labor demand in that model. This special property enables us to rewrite (15) as

$$-\frac{1}{w}\frac{\mathrm{d}w}{\mathrm{d}L}\big(1-s+Ly\big)+Ly=0,$$

which implies that $\mathrm{d}w/\mathrm{d}L$ is positive.

Another factor is that the wage channel has a positive effect on the profit of a residential service firm:

$$\frac{\mathrm{d}\pi_R}{\mathrm{d}w} = \mu_i - 1 + \frac{\rho_R}{a}\frac{\mathrm{d}d_R}{\mathrm{d}w} = \frac{\alpha s}{a\sigma n_R} > 0.$$

Here, the positive pass-through rate, μ_i, is high enough to dominate the negative demand effect of wage rate, $\dfrac{\rho_R}{a}\dfrac{\mathrm{d}d_R}{\mathrm{d}w}$. Since the effect through the n_R channel, $\mathrm{d}\pi_R/\mathrm{d}n_R$, is negative (see Lemma

2), the first equation in (11) implies that the sign of $\mathrm{d}n_R/\mathrm{d}L$ is the same as that of $\mathrm{d}w/\mathrm{d}L$. Of course, this conclusion can be derived more easily by directly computing that equation:

$$\frac{\mathrm{d}w}{\mathrm{d}L} = \frac{\mathrm{d}n_R}{\mathrm{d}L}\frac{Y_R}{sn_R}. \tag{26}$$

Since $\mathrm{d}w/\mathrm{d}L$ is positive due to the first factor, the second factor implies that $\mathrm{d}n_R/\mathrm{d}L$ is also positive, that is, no variety-shifting effect occurs.

To close this subsection, let us recapitulate the two idiosyncratic properties of the CES model that are responsible for the result of no variety-shifting effect: First, the range of residential varieties does not influence the demand for skilled labor. Second, the pass-through rate is relatively high.

3.3 Welfare implications

The next task is to examine whether skilled and unskilled workers become better off as tourists increase. Note that the indirect utility of a type-j worker is given by

$$v_j(y_j, n_R, p_R(w, n_R)) = ky_j\left(\frac{n_R{}^{\frac{1}{\sigma-1}}}{p}\right)^{\alpha} \quad \text{for} \quad j \in \{S, U\},$$

where $k \equiv \alpha^{\alpha}(1-\alpha)^{1-\alpha}$ is a positive constant. The indirect utility actually satisfies (20) and (21).

To begin, we examine the welfare of skilled workers. Recall that $\mathrm{d}v_S/\mathrm{d}n_R$ is positive. Since $\mathrm{d}w/\mathrm{d}L$ and $\mathrm{d}n_R/\mathrm{d}L$ are also positive in the CES model, $\mathrm{d}v_S/\mathrm{d}L$ becomes positive if $\mathrm{d}v_S/\mathrm{d}w$ is positive (see the second line of (19)). It is the case in which the income effect is sufficiently strong. It turns out that the effect is indeed "sufficiently" strong in the CES model, and consequently, the skilled workers become better off. (For the proof, see that of Proposition 6.)

Next, we turn our eyes to unskilled workers. Because they are not subject to the income effect, the rise in the wage rate of skilled labor gives only the adverse impact through a price hike: $\mathrm{d}v_U/\mathrm{d}w < 0$. In general, we cannot determine a priori if this negative effect dominates the positive effect of the expansion of the residential variety range. In the CES model, however, it is indeed the case. Thus, we can prove the following proposition.

Proposition 6

In the CES model, as tourists increase,

i) skilled workers become better off, and

ii) unskilled workers become worse off provided that $\sigma > 2$.

Proof

i) Note that $\mathrm{d}v_S/\mathrm{d}w = (1-\alpha)v_S/w > 0$. Since both $\mathrm{d}w/\mathrm{d}L$ and $\mathrm{d}n_R/\mathrm{d}L$ are positive in the CES model, it follows from the second line of (19) that $\mathrm{d}v_S/\mathrm{d}L$ is positive.

ii) Observe that

$$\frac{\mathrm{d}v_U}{\mathrm{d}L} = -\alpha v_U \left[\frac{\mathrm{d}w}{\mathrm{d}L}\frac{1}{w} - \frac{\mathrm{d}n_R}{\mathrm{d}L}\frac{1}{(\sigma-1)n_R} \right] = -\alpha v_U \frac{\mathrm{d}n_R}{\mathrm{d}L}\frac{(\sigma-2)sw + (\sigma-1)(1-s)}{(\sigma-1)swn_R}, \tag{27}$$

where the last equality is derived by the substitution of (26). Consequently, $\mathrm{d}v_U/\mathrm{d}L$ is negative when $\mathrm{d}n_R/\mathrm{d}L > 0$, provided that $\sigma > 2$. ■

Because empirical studies indicate that σ is much higher than 2, we can safely assume $\sigma > 2$.[5]

Finally, to see the effect on the aggregate welfare of home economy residents, we compute (22) and then substitute (26) into the obtained result to derive

$$\frac{\mathrm{d}\Omega}{\mathrm{d}L}\frac{1}{\Omega} = \frac{\Psi}{n_R^2}\frac{\mathrm{d}n_R}{\mathrm{d}L}, \quad \text{where} \quad \Psi \equiv 1 - \alpha + \frac{\alpha}{\sigma-1} - \alpha\frac{1-s}{sw}.$$

Substituting the equilibrium value of w, we obtain

$$\Psi \left\{ \begin{matrix} \geq \\ = \\ < \end{matrix} \right\} 0 \quad \text{if} \quad L \left\{ \begin{matrix} \geq \\ = \\ < \end{matrix} \right\} L^0 \equiv \frac{(1-\alpha)(1-s)}{y\big[\alpha + (\sigma-1)(1-\alpha)\big]}. \tag{28}$$

This implies that Ω decreases with L for $L < L^0$ while it increases for $L > L^0$. Therefore, Ω reaches a global minimum at $L = L^0$.

Proposition 7

In the CES model, as tourists gradually increase, the aggregate welfare of residents first decreases, reaches a minimum, and then increases.

In addition, it is readily verified from (28) that the effect of the increase in tourists on the aggregate welfare depends on various parameters in the following way:

Proposition 8

In the CES model, the increase in tourists is more likely to raise the aggregate welfare when the share of skilled workers is large (s is large), the total expenditure of tourists is large (yL is large), consumers spend relatively more money on the service varieties compared with the manufacturing good (α is high), and the service varieties are more substitutable with each other (σ is high).

[5] For instance, Bergstrand et al. (2013) find out that the parameter equals approximately 7. Anderson and Wincoop (2004) review the literature and conclude that the parameter lies between 5 and 10.

Obviously, this result is equivalent to the fact that L^0 decreases with s, y, α, and σ.

4 Example 2: The model with quasi-linear preference

In the preceding section, we have demonstrated that the CES model does not yield the variety-shifting effect. In this section, we turn our eyes to an alternative model, a *QL model*, which is built upon a quasi-linear utility function with quadratic subutility. It is the specification that has been frequently used in the literature of spatial economics and international trade theory since Ottaviano et al. (2002). We show that the QL model indeed demonstrates the variety-shifting effect for a broad range of parameters.

4.1 Model

In the QL model, the utility functions of a type j worker ($j \in \{S, U\}$) and a tourist are respectively given by

$$\begin{aligned} u_j &= \alpha \int_{v\in N_R} q_j(v)\,\mathrm{d}v - \frac{\beta}{2}\int_{v\in N_R}\left[q_j(v)\right]^2 \mathrm{d}v - \frac{\gamma}{2}\left[\int_{v\in N_R} q_j(v)\,\mathrm{d}v\right]^2 + z_j \quad \text{and} \\ u_T &= \alpha \int_{v\in N_T} q_T(v)\,\mathrm{d}v - \frac{\beta}{2}\int_{v\in N_T}\left[q_T(v)\right]^2 \mathrm{d}v - \frac{\gamma}{2}\left[\int_{v\in N_T} q_T(v)\,\mathrm{d}v\right]^2 + z_T. \end{aligned} \tag{29}$$

Here, α, β, and γ are positive constants. α measures the importance of service i for a consumer. The positive β means that a consumer loves varieties. Finally, γ is a parameter related to the substitutability between the service varieties in each sector. To avoid unnecessary complications, we are focusing on a simple case in which the utility functions of a local resident and a tourist have the same coefficients. It is not difficult, however, to extend the model to allow for their differences.

Since the marginal utility at $q_j(v) = 0$ ($q_T(v) = 0$, resp.) is not positive infinity, residents (tourists, resp.) may not consume some of residential (tourism, resp.) varieties at all. Taking account of this possibility and maximizing (29) subject to the budget constraint (1), we obtain

$$\begin{aligned} &q_j(v) = \max\left[0, \hat{q}_R(v)\right] \quad \text{for} \quad j \in \{S, U\} \quad \text{and} \quad q_T(v) = \max\left[0, \hat{q}_T(v)\right], \\ &\qquad \text{where} \quad \hat{q}_i(v) \equiv \frac{1}{\beta}\left[\alpha - p_i(v) - \frac{\gamma\left(\alpha n_i - P_i\right)}{\beta + \gamma n_i}\right] \quad \text{for} \quad i \in \{R, T\}. \end{aligned} \tag{30}$$

Here, the price index of service i is again given by $P_i \equiv \int_{v\in N_i} p_i(v)\,\mathrm{d}v$ ($i \in \{R, T\}$).

It is important to note that (30) shows the well-known property of the QL model that it exhibits no income effect, that is, the amount of the consumption of each variety does not depend on consumers' income levels. In particular, $\partial q_S(v)/\partial y_S = 0$.

The demand for each variety becomes positive and given by $\hat{q}_i(v)$ if

$$p_i(v) < \frac{\alpha\beta + \gamma P_i}{\beta + \gamma n_i}. \tag{31}$$

Later, we will show that this condition is actually satisfied at the equilibrium. Thus, we concentrate on the case in which the individual demand is given by $\hat{q}_i(v)$. Then, (2) implies that the amounts of aggregate demand become equal to $d_R(v) = \hat{q}_R(v)$ and $d_T(v) = L\hat{q}_T(v)$. It is readily verified that our price index satisfies the two conditions in (4) for such demand functions.

By solving the condition for profit maximization, (5), and considering the equality of the prices, we obtain

$$p_i(w, n_i) = \frac{\alpha\beta + aw(\beta + \gamma n_i)}{2\beta + \gamma n_i}. \tag{32}$$

These prices satisfy the first two regularity conditions in Assumption 1. First, the pass-through rate is positive. Second, the pro-competitive effect is present. In this regard, the QL model makes a sharp contrast with the CES model.

Since the equality of prices implies that $\hat{q}_i(v)$ and, therefore, $d_i(v)$ are equal in size for any $v \in N_i$, respectively, the aggregate demand is given by

$$d_i\Big(w, n_i, p_i(w, n_i)\Big) = \frac{L_i(\alpha - p_i)}{\beta + \gamma n_i} \quad \text{for} \quad i \in \{R, T\}, \tag{33}$$

where $L_R \equiv 1$ and $L_T = L$. It is readily verified that (33) satisfies the third and the fourth regularity conditions in Assumption 1.

Before proceeding to the analysis of the increase in tourists, it is necessary for us to solve for the equilibrium value of $\{w, n_R, n_T\}$ for two reasons. First, by confirming the validity of the solution, we can assure the existence of equilibrium, as in the CES model. Second, examining the equilibrium value enables us to demonstrate that the condition for positive demand given by (31) is indeed satisfied.

To obtain the equilibrium, we rewrite the zero profit equation for firms in each service sector given by (6), using (32) and (33), as

$$n_i = \frac{1}{\gamma}\left[(\alpha - aw)\sqrt{\frac{\beta L_i}{F}} - 2\beta\right] \quad \text{for} \quad i \in \{R, T\}. \tag{34}$$

Equation (34) shows that the range of each category of service varieties shrinks as the wage rate of skilled labor rises. To explain this, note that the pass-through rate becomes equal to

$$\mu_i = \frac{\beta + \gamma n_i}{2\beta + \gamma n_i} \quad \text{for} \quad i \in \{R, T\}, \tag{35}$$

which is lower than 1. This implies that the price mark-up decreases with the wage rate, provided that the range of service varieties is kept fixed. Therefore, entering the business becomes less lucrative as the wage rate rises.

We substitute (34) to the labor market clearing equation, (7), to obtain the equilibrium wage rate of skilled labor:

$$w = \frac{\alpha}{a} - \frac{\gamma}{\lambda a^2 (1+L)} \left(1 + \lambda s + \sqrt{L}\right), \quad \text{where} \quad \lambda \equiv \frac{\gamma}{2a\sqrt{\beta F}}. \tag{36}$$

Here, λ is a parameter positively related to the substitutability between varieties, γ, and the technological efficiency, $1/\left(a\sqrt{F}\right)$. In the rest of the paper, we concentrate on the case in which parameter α is large enough to bring about a positive wage rate. Furthermore, substituting (36) into (34) yields the equilibrium ranges of service varieties:

$$\begin{cases} n_R = \dfrac{2\beta}{\gamma(1+L)} \left(\lambda s + \sqrt{L} - L\right) \\ n_T = \dfrac{2\beta}{\gamma(1+L)} \left(\lambda s \sqrt{L} + \sqrt{L} - 1\right). \end{cases} \tag{37}$$

Those equilibrium values provide two observations. First, using the equilibrium prices given by (32), we can rewrite the condition for positive demand, (31), as

$$\alpha - aw > 0. \tag{38}$$

However, the equilibrium wage rate of (36) indeed satisfies this inequality. Therefore, at the equilibrium, all the varieties are indeed consumed.

Second, the first equation in (37) indicates that the range of residential varieties would become negative or 0 if the volume of tourists were extremely large. It is because the limited amount of skilled labor is used up to produce too many tourism varieties. Similarly, the second equation shows that the range of tourism varieties would become negative or 0 if the volume of tourists were too small. Therefore, if the ranges of both categories of service varieties are positive, the volume of tourists must lie in a certain interval, say, $\left(\underline{L}, \overline{L}\right)$, which we call a *permissible interval* of L.

It is straightforward to derive the permissible interval.

Lemma 3
i) $n_R > 0$ *if and only if* $L < \overline{L} \equiv \frac{1}{2}\left(1 + 2\lambda s + \sqrt{1 + 4\lambda s}\right)$.
ii) $n_T > 0$ *if and only if* $L > \underline{L} \equiv \left(\frac{1}{1 + \lambda s}\right)^2$.

Proof
i) It follows from the first equation in (37) that $n_R > 0$ is equivalent to $\lambda s + \sqrt{L} - L > 0$. The last inequality holds if and only if either of the following two conditions is satisfied. One is $L \leq \lambda s$. The other is that both the following two inequalities hold: $L > \lambda s$ and $\Gamma(L) < 0$, where

$$\Gamma(L) \equiv L^2 - L(1 + 2\lambda s) + \lambda^2 s^2.$$

Equation $\Gamma(L) = 0$ has two solutions, $L_\Gamma \equiv \left(1 + 2\lambda s - \sqrt{1 + 4\lambda s}\right)/2$ and $\overline{L}$. Therefore, $\Gamma(L) < 0$ if and only if $L \in \left(L_\Gamma,\ \overline{L}\right)$. However, since λs turns out to lie in the interval $\left(L_\Gamma,\ \overline{L}\right)$, we can conclude that the second condition is satisfied if and only if $L \in \left(\lambda s,\ \overline{L}\right)$. Combining the two conditions, we establish that $n_R > 0$ if and only if $L < \overline{L}$.
ii) It is obvious from the second equation in (37) that $n_T > 0$ is equivalent to $\sqrt{L} > 1/(1 + \lambda s)$.
■

Since $\underline{L} < 1$ and $\overline{L} > 1$, we have $\underline{L} < \overline{L}$. Therefore, there exists L for which both the residential and the tourism varieties are supplied in the home economy. In what follows, we focus on such a value of L.

Assumption 2
We assume that $L \in \left(\underline{L},\ \overline{L}\right)$.

Furthermore, $\underline{L}$ decreases with s and λ, whereas $\overline{L}$ increases with them. Therefore, as these parameters increase, the permissible interval $\left(\underline{L},\ \overline{L}\right)$ expands. In other words, both categories of services are more likely to be supplied when the skilled labor is relatively abundant, the varieties are relatively close substitutes, and the production technology is relatively efficient.

4.2 Variety-shifting effect

It is readily verified that the QL model satisfies all the three conditions that constitute the sufficient condition for the variety-shifting effect. First, as has been mentioned on (35), the pass-through rate is lower than 1. Therefore, the low pass-through condition is satisfied. Second, because there is no income effect, $\mathrm{d}d_R/\mathrm{d}w = \left(\partial p_R/\partial w\right)\left(\partial d_R/\partial p_R\right)$, which is negative by the regularity conditions. Therefore, the weak income effect condition is satisfied. Third and finally, the strong pro-competitive effect condition is satisfied since

$$\frac{n_i}{d_i}\frac{\mathrm{d}d_i}{\mathrm{d}n_i} = -\frac{\gamma n_i}{2\beta + \gamma n_i} \geq -1.$$

Consequently, it immediately follows from Proposition 2 that the range of residential varieties shrinks and the wage rate of skilled labor rises if tourists increase.

Proposition 9

In the QL model, as a result of the increase in tourists,

i) the range of residential varieties always shrinks, and

ii) the wage rate of skilled labor always rises.

4.3 Welfare implications

4.3.1 Effects on the levels of indirect utility

To examine whether the home economy residents become better off as tourists increase, we obtain the indirect utility of a type-j worker:

$$v_j\big(y_j, n_R, p_R(w, n_R)\big) = \frac{n_R(\alpha - p_R)^2}{2(\beta + \gamma n_R)} + y_j \quad \text{for} \quad j \in \{S, U\}.$$

The indirect utility satisfies (20) and (21).

We have shown in Proposition 3 that the indirect utility of a skilled worker may decrease or increase as a result of the increase in tourists, depending on the size of the income effect. To see this more closely, we substitute the equilibrium price, (32), and the equilibrium demand, (33), into the zero profit equation for a residential service firm, which gives

$$\frac{\mathrm{d}w}{\mathrm{d}L} = -\frac{\gamma(\alpha - aw)}{a(2\beta + \gamma n_R)} \cdot \frac{\mathrm{d}n_R}{\mathrm{d}L}. \tag{39}$$

Next, we compute (19) and then rewrite the derived expression using (39) to obtain

$$\begin{aligned} \frac{\mathrm{d}v_S}{\mathrm{d}L} &= -\frac{\mathrm{d}n_R}{\mathrm{d}L} \cdot \frac{\beta(\alpha - aw)^2}{2(2\beta + \gamma n_R)^2(1+L)} \cdot \Theta(L), \\ \text{where} \quad \Theta(L) &\equiv \big[4\lambda(1+L)\big] + \big[-(1+L)\big] + \big[L - \sqrt{L} - \lambda s\big] \\ &= 3L - 1 + 4\Big[\lambda(1 - s + L) - \sqrt{L}\Big]. \end{aligned} \tag{40}$$

The three pairs of square brackets in the first line of the definition of $\Theta(L)$ correspond to the positive income effect, the negative variety effect, and the negative price effect, respectively, which we have explained in terms of (19). Here, the negativity of the price effect follows from the fact that $L - \sqrt{L} - \lambda s < 0$ as long as $n_R > 0$.

Since $\mathrm{d}n_R/\mathrm{d}L$ is negative in the QL model, $\dfrac{\mathrm{d}v_S}{\mathrm{d}L} \left\{ \begin{smallmatrix} \leq \\ \equiv \\ > \end{smallmatrix} \right\} 0$ if $\Theta(L) \left\{ \begin{smallmatrix} \leq \\ \equiv \\ > \end{smallmatrix} \right\} 0$. We begin the analysis of the sign of $\Theta(L)$ by noting that the function is increasing in the permissible interval (see the proof of the next lemma). This implies that there are three cases to consider depending on the magnitudes of $\underline{L}$ and $\overline{L}$. In the first case, $\Theta(\overline{L})$ is nonpositive. Then, for any $L \in \left(\underline{L}, \overline{L}\right)$, $\Theta(L)$ is negative and, therefore, $\mathrm{d}v_S/\mathrm{d}L$ is negative. Skilled workers become worse off by the increase in tourists. The second case occurs when $\Theta(\overline{L})$ is positive and $\Theta(\underline{L})$ is negative. In this case, there exists L^* in $\left(\underline{L}, \overline{L}\right)$ such that $\Theta(L) \left\{ \begin{smallmatrix} \leq \\ \equiv \\ > \end{smallmatrix} \right\} 0$ if $L \left\{ \begin{smallmatrix} \leq \\ \equiv \\ > \end{smallmatrix} \right\} L^*$. The increase in tourists gives a negative impact when L is small, but a positive impact when L is large. The third case is the one in which $\Theta(\underline{L})$ is nonnegative. In this case, for any $L \in \left(\underline{L}, \overline{L}\right)$, $\Theta(L)$ is positive and, therefore, $\mathrm{d}v_S/\mathrm{d}L$ is positive. Skilled workers become better off by the increase in tourists. These three cases are depicted in Fig. 1, where the solid lines represent $\Theta(L)$. We summarize our three cases as follows.

—— Insert Fig. 1 around here. ——

Lemma 4

There are three cases to consider.

$$
\begin{array}{llllll}
\textit{case i)} & \dfrac{\mathrm{d}v_s}{\mathrm{d}L} < 0 & \textit{for} & L \in \left(\underline{L}, \overline{L}\right) & \textit{if} & \Theta(\overline{L}) \leq 0. \\[2ex]
\textit{case ii)} & \dfrac{\mathrm{d}v_s}{\mathrm{d}L} \left\{ \begin{matrix} < \\ = \\ > \end{matrix} \right\} 0 & \textit{for} & \begin{cases} L \in \left(\underline{L}, L^*\right) \\ L = L^* \\ L \in \left(L^*, \overline{L}\right) \end{cases} & \textit{if} & \Theta(\underline{L}) < 0 \;\; \textit{and} \;\; \Theta(\overline{L}) > 0. \\[2ex]
\textit{case iii)} & \dfrac{\mathrm{d}v_s}{\mathrm{d}L} > 0 & \textit{for} & L \in \left(\underline{L}, \overline{L}\right) & \textit{if} & \Theta(\underline{L}) \geq 0.
\end{array}
$$

There exists a set of valid parameter values that supports the respective cases.

Proof

First, we prove that $\dfrac{\mathrm{d}\Theta(L)}{\mathrm{d}L} > 0$ for any $L \in \left(\underline{L}, \overline{L}\right)$. It follows from the definition of $\Theta(L)$ that $\dfrac{\mathrm{d}\Theta(L)}{\mathrm{d}L} > 0$ if $L > \widehat{L} \equiv \left(\dfrac{2}{3+4\lambda}\right)^2$. Since $s < 1$ implies that $1 + 2\lambda(2-s) > 0$, we have $\dfrac{1}{1+\lambda s} > \dfrac{2}{3+4\lambda}$. Consequently, $\widehat{L} < \underline{L}$. Hence, $L > \widehat{L}$ and, therefore, $\dfrac{\mathrm{d}\Theta(L)}{\mathrm{d}L} > 0$ for any $L > \underline{L}$. What is left to be proved is that for each of the three cases, there exists a set of parameter values that indeed results in the case in question. It is equivalent to the claim that each of $\Theta(\underline{L})$ and $\Theta(\overline{L})$

becomes positive for some parameter values and negative for other parameter values. Suppose that λ goes to 0. Then, $\underline{L}$ approaches 1. Therefore, $\Theta(\underline{L})$ converges to -2, which is negative. Instead, suppose that λ goes to positive infinity. Then, $\underline{L}$ approaches 0, and $\Theta(\underline{L})$ diverges to positive infinity. Consequently, depending on the value of λ, we have a possibility that $\Theta(\underline{L})$ becomes positive and a possibility that it becomes negative. Similarly, we can verify that $\Theta(\overline{L})$ can become positive and negative. ■

In the intermediate case of ii), whether the skilled workers are hurt by the increase in tourists depends on the volume of tourists. They are hurt if L is smaller than the critical value L^*, while they are benefited if L exceeds that value. Therefore, their welfare reaches a minimum (in the permissible interval) at $L = L^*$.

The next question is how parameters affect the effect on the skilled workers' welfare. Note that $\Theta(L)$ decreases with s and increases with λ. Thus, it is more likely that $\mathrm{d}v_S/\mathrm{d}L$ is negative when s is high and λ is low. That is, it is more likely that skilled workers are hurt by the increase in tourists when they occupy large part of population, the substitutability between varieties is low, and the technology is relatively inefficient.

This is also illustrated by the fact that the critical value L^* increases with s and decreases with λ.[6] To see this, look atthe second panel of Fig. 1. It shows that the curve representing $\Theta(L) = 0$ shifts downward from the solid line to the dotted line as s increases and/or λ decreases. Then, the intercept of the horizontal axis moves rightward, that is, L^* rises. The point is that the increase in s and/or the decrease in λ results in the expansion of interval $\left(\underline{L}, L^*\right)$, the interval associated with negative $\mathrm{d}v_S/\mathrm{d}L$ in case ii) of Lemma 4. Those findings are summarized as a following proposition.

Proposition 10

Consider the QL model with Assumption 2 being satisfied. It is more likely that the increase in tourists hurts skilled workers if

i) the volume of tourists is small,

ii) the share of skilled workers is large,

iii) the substitutability between residential varieties is low, and/or

iv) production technology is inefficient.

---

[6]To see this formally, we can totally differentiate equation $\Theta(L) = 0$ with respect to s and λ, respectively.

$$\frac{\mathrm{d}L^*}{\mathrm{d}s} = \frac{4\lambda\sqrt{L}}{\Xi(L)} \quad \text{and} \quad \frac{\mathrm{d}L^*}{\mathrm{d}\lambda} = -\frac{4\sqrt{L}(1-s+L)}{\Xi(L)}, \quad \text{where} \quad \Xi(L) \equiv (3+4\lambda)\sqrt{L} - 2.$$

Note that $\Xi(\underline{L}) = \dfrac{1+2\lambda(2-s)}{1+\lambda s} > 0$. Since $\Xi(L)$ is an increasing function, we conclude that $\Xi(L) > 0$ for any $L \in (\underline{L}, \overline{L})$. Hence, $\mathrm{d}L^*/\mathrm{d}s$ is positive while $\mathrm{d}L^*/\mathrm{d}\lambda$ is negative.

To look at the results in Lemma 4 from a different angle, note that $\Theta(\underline{L}) \left\{ \begin{smallmatrix} \leq \\ = \\ > \end{smallmatrix} \right\} 0$ if $s \left\{ \begin{smallmatrix} \geq \\ = \\ < \end{smallmatrix} \right\} 1 - \frac{1}{4\lambda}$. Therefore, either case i) or case ii) occurs if and only if

$$s > 1 - \frac{1}{4\lambda}. \tag{41}$$

Consequently, *there exists some $L \in (\underline{L}, \overline{L})$ for which skilled workers are hurt by the increase in tourists, if and only if (41) holds*. In other words, (41) is a *necessary condition* for skilled workers' becoming worse off. Note that this condition is more likely to hold if s is large and λ is small, which is consistent with Proposition 10.

Another way to derive a precise result is to examine the limiting cases of parameter λ. We can prove the following proposition.

Proposition 11

Consider the QL model with Assumption 2 being satisfied. For a given value of L,

i) the increase in tourists hurts skilled workers when service varieties are not substitutable enough with each other and/or production technology is too inefficient, and

ii) the increase in tourists is, conversely, beneficial to skilled workers when service varieties are sufficiently substitutable with each other and/or production technology is sufficiently efficient.

Proof

i) We prove that $\lim_{\lambda \to 0} \Theta(L) < 0$. Suppose that λ approaches 0. Then, $\Theta(L)$ approaches $\tilde{\Theta}(L) \equiv 3L - 1 - 4\sqrt{L}$. If $3L - 1$ is nonpositive, $\tilde{\Theta}(L)$ is negative. Instead, suppose that $3L - 1$ is positive. Then, $\tilde{\Theta}(L) < 0$ is equivalent to $\Lambda(L) \equiv 9L^2 - 22L + 1 < 0$. The equation $\Lambda(L) = 0$ has two solutions, $L_{\Lambda 1} \equiv \frac{11 - 4\sqrt{7}}{9}$ and $L_{\Lambda 2} \equiv \frac{11 + 4\sqrt{7}}{9}$. Note that $L_{\Lambda 1} < 1$ and $L_{\Lambda 2} > 1$. Since $\underline{L}$ goes to 1 from below and $\overline{L}$ goes to 1 from above, any $L \in (\underline{L}, \overline{L})$ lies in the interval $(L_{\Lambda 1}, L_{\Lambda 2})$ when λ is sufficiently close to 0. In that case, therefore, $\Lambda(L)$ is negative and consequently, $\tilde{\Theta}(L)$ is negative for any $L \in (\underline{L}, \overline{L})$,.

ii) As λ rises unboundedly, $\Theta(L)$ goes to positive infinity. ■

To understand these findings intuitively, look again at the first line of the definition of $\Theta(L)$ in (40), which describes the decomposition of the total effect into the three sub-effects. In the first case of Proposition 11, where λ approaches 0, the price effect, given by $L - \sqrt{L} - \lambda s$, dominates the income effect, given by $4\lambda(1 + L)$, and the sum of those two effects becomes negative. This is explained as follows. When service varieties are not substitutable enough and/or production technology is too inefficient, relatively strong monopoly power prevails in the residential service sector. Thus, a given amount of the increase in tourists pushes up the price of residential varieties so sharply that the price effect surpasses the income effect.

i) and ii) of Proposition 11 state *sufficient conditions* for skilled workers' becoming worse off and better off, respectively. Therefore, if they hold, the corresponding necessary conditions must hold. Indeed, we can verify that sufficiently small λ satisfies (41) whereas sufficiently large λ does not.

4.3.2 Effects on the aggregate welfare of residents

This subsection examines the impact on the aggregate welfare of home economy residents in the QL model.

Evaluating (22) at the equilibrium values, we obtain

$$\frac{\mathrm{d}\Omega}{\mathrm{d}L} = -\frac{\mathrm{d}n_R}{\mathrm{d}L} \cdot \frac{\beta(\alpha - aw)^2}{2(2\beta + \gamma n_R)^2(1+L)} \cdot \Phi(L), \quad \text{where} \quad \Phi(L) \equiv L(3 + 4\lambda s) - 1 - 4\sqrt{L}. \tag{42}$$

Four properties of function $\Phi(L)$ are important: It is convex, reaches a global minimum at $L = \widetilde{L} \equiv \dfrac{2}{3 + 4\lambda s} > 0$, takes a negative value at $L = 0$, and goes to positive infinity as L diverges unboundedly. These properties imply that there exists unique $L^{**} > \widetilde{L}$ such that $\Phi(L) \left\{ \begin{smallmatrix} < \\ = \\ > \end{smallmatrix} \right\} 0$ if $L \left\{ \begin{smallmatrix} < \\ = \\ > \end{smallmatrix} \right\} L^{**}$. Because it turns out that L^{**} exceeds $\underline{L}$, we can distinguish two cases depending on the position of $\Phi(L)$, as in Fig. 2.

—— Insert Fig. 2 around here. ——

Lemma 5

There are two cases to consider.

$$\begin{array}{llll} \textit{case i)} & \dfrac{\mathrm{d}\Omega}{\mathrm{d}L} < 0 & \textit{for} \quad L \in \left(\underline{L}, \overline{L}\right) & \textit{if} \quad \Phi(\overline{L}) \leq 0. \\ \textit{case ii)} & \dfrac{\mathrm{d}\Omega}{\mathrm{d}L} \left\{ \begin{matrix} < \\ = \\ > \end{matrix} \right\} 0 & \textit{for} \begin{cases} L \in \left(\underline{L}, L^{**}\right) \\ L = L^{**} \\ L \in \left(L^{**}, \overline{L}\right) \end{cases} & \textit{if} \quad \Phi(\overline{L}) > 0. \end{array}$$

There exists a set of valid parameter values that supports the respective cases.

Proof

First, suppose that $\Phi(\overline{L}) \leq 0$. Then, the four properties of $\Phi(L)$ mentioned above immediately imply that $\Phi(L) < 0$ for any $L \in \left(\underline{L}, \overline{L}\right)$. Therefore, $\mathrm{d}\Omega/\mathrm{d}L < 0$ for $L \in \left(\underline{L}, \overline{L}\right)$. Second, tedious computation yields $\Phi(\underline{L}) = -1 - \underline{L} < 0$. Therefore, $L^{**} > \underline{L}$. Consequently, if $\Phi(\overline{L}) > 0$,

L^{**} necessarily lies in the interval $(\underline{L}, \overline{L})$. This gives the result in case ii). What is left to be proved is that there exists a set of parameter values that supports each of the two cases. As in the proof for Lemma 4, this is accomplished by verifying that $\Phi(\overline{L})$ can take both a positive value and a negative value depending on parameter values. Suppose that λ goes to 0. Then, $\overline{L}$ approaches 1, and therefore, $\Phi(\overline{L})$ converges to -2, which is negative. Instead, suppose that λ rises unboundedly. Then, $\overline{L}$ diverges to positive infinity, and therefore, $\Phi(\overline{L})$ goes to positive infinity. Thus, $\Phi(\overline{L})$ can take both a positive value and a negative value. ■

In case ii), the increase in L reduces the aggregate welfare if L is smaller than L^{**}. The intuitive explanation is that when the volume of tourists is too small, the benefit of increasing returns to scale cannot be fully exploited in the tourism service sector and, therefore, the rise in wage rate remains too modest. If L exceeds L^{**}, by contrast, that benefit is great enough to raise the wage rate sufficiently, and thus, the increase in L enhances the aggregate welfare. Consequently, there is a minimum level of the aggregate welfare as in the case of the skilled workers' welfare, which is reached at $L = L^{**}$.

Let us examine the impacts of the changes in parameters. Note that $\Phi(L)$ increases with s and λ. Thus, other things being equal, it is more likely that $\Phi(L)$ becomes negative when s and/or λ is low. In other words, the aggregate welfare is more likely to decrease when the share of skilled workers is small, the substitutability between varieties is low, and the technology is inefficient. In terms of Lemma 5, these findings correspond to the fact that L^{**} decreases with s and λ.[7] Thus, as s and/or λ decreases, the welfare worsening interval in case ii) of Lemma 5, $(\underline{L}, L^{**})$, expands.

Here, one may notice that the direction of the impact of s on the aggregate welfare is opposite to that on the skilled workers' welfare: Skilled workers are more likely to *benefit* from the increase in tourists when its population share is small, according to i) of Proposition 10. The reason for this divergence is that unskilled workers always become worse off by the increase in tourists. As their share rises, this negative effect expands. Thus, even if skilled workers become better off, it is more likely that the negative effect for unskilled workers outweighs the positive effect for skilled workers when the share of skilled workers is small.

The above findings are summarized as follows.

Proposition 12

In the QL model with Assumption 2 being satisfied, it is more likely that the increase in tourists

[7] Totally differentiating the equation $\Phi(L) = 0$ with respect to s and λ, respectively, yields

$$\frac{\mathrm{d}L^{**}}{\mathrm{d}s} = -\frac{4\lambda L\sqrt{L}}{\Psi(L)} \quad \text{and} \quad \frac{\mathrm{d}L^{**}}{\mathrm{d}\lambda} = -\frac{4sL\sqrt{L}}{\Psi(L)}, \quad \text{where} \quad \Psi(L) \equiv (3 + 4\lambda s)\sqrt{L} - 2.$$

Since $\Psi(\underline{L}) = 1 > 0$ and $\Psi(L)$ is an increasing function, we conclude that $\Psi(L) > 0$ for any $L \in (\underline{L}, \overline{L})$. Hence, both of $\mathrm{d}L^{**}/\mathrm{d}s$ and $\mathrm{d}L^{**}/\mathrm{d}\lambda$ are negative.

worsens the aggregate welfare of residents if

i) the volume of tourists is small,

ii) the share of skilled workers is small,

iii) the substitutability between residential varieties is low, and/or

iv) production technology is inefficient.

Finally, we can examine the limiting cases of λ in the same manner as we have done for the change in skilled workers' indirect utility.

Proposition 13

Consider the QL model with Assumption 2 being satisfied. For a given value of L,

i) the increase in tourists worsens the aggregate welfare of residents when service varieties are not substitutable enough with each other and/or production technology is too inefficient, and

ii) the increase in tourists, conversely, improves the aggregate welfare of residents when service varieties are sufficiently substitutable with each other and/or production technology is sufficiently efficient.

Proof

First, suppose that λ approaches 0. Then, $\Phi(L)$ approaches $3L - 1 - 4\sqrt{L}$, which is equivalent to $\tilde{\Theta}(L)$ defined in the proof of Proposition 11. In that proof, we have shown that $\tilde{\Theta}(L)$ is negative for any $L \in (\underline{L}, \overline{L})$. Therefore, $\lim_{\lambda \to 0} \Phi(L) < 0$. Second, it is readily verified that $\Phi(L)$ goes to positive infinity as λ rises unboundedly. ■

Thus, the changes in the substitutability between varieties and the efficiency in production, respectively, affect the aggregate welfare in the same direction as they affect the skilled workers' indirect utility.

5 Concluding remarks

This study explores the effects of the increase in tourists on the service varieties provided in a home economy. The increase may enlarge the range of varieties consumed by tourists and reduce that by local residents. This variety-shifting effect is attributed to the two unique characteristics of tourism. First, tourists and residents have different preferences over the goods and services. Second, considerable part of tourists' consumption is devoted to that of nontradable goods and services.

To begin, we have constructed a general model without assuming any particular form of a utility function. We have shown that the variety-shifting effect occurs if all the following three requirements are fulfilled: the pass-through rate is sufficiently low, the income effect is sufficiently weak, and the pro-competitive effect is sufficiently strong. Then, we have examined two examples of the models with specific forms of utility function, the CES and the QL models. It has been shown that the CES model does not exhibit the variety-shifting effect, whereas the QL model does so for a broad range of parameter values. In addition, we have discussed whether the local residents become better off or worse off by the increase in tourists. It turns out that the answer depends on their type, namely, skilled or unskilled workers, and several key parameters such as the share of skilled workers, the substitutability between varieties, and the technological efficiency.

This research has several limitations. One of the strong assumptions made in this study is that the volume of tourists is exogenously given. However, whether a tourist visits a particular region or not depends on the level of indirect utility obtained if s/he actually does. Because it hinges upon the prices and the availability of tourism varieties provided there, the volume of tourists also depends on them. If one takes into account this endogenous relation, the volume is to be determined simultaneously with the prices and the range of tourism varieties. Consequently, the increase in tourists, if any, is attributed to a certain exogenous shock on parameters, such as the rise in their income due to economic development, the decrease in the cost to go abroad thanks to the spread of low-cost airlines, and the decrease in the cost to obtain necessary information about the destination because of the advance of internet technology. Exploring the impact of such shocks on the volume of tourists in a particular country entails a formal analysis of tourists' choice over destinations, probably based on some discrete choice models.

Another strong assumption is that local residents consume no tourism varieties whereas tourists consume no residential varieties. We acknowledge that in most cases, they consume some of the same varieties, as a matter of fact. For example, the food and beverage services in restaurants, bars, and coffee shops are consumed not only by tourists but also by locals. For a better understanding of the variety-shifting effect, we need to consider such a possibility.

Finally, we have not considered the problem of congestion arising from the increase in tourists. The change in welfare caused by the variety-shifting effect may or may not be dominated by the change due to congestion. Thus, particularly for a practical purpose, it will be fairly important to incorporate it into the model in future research.

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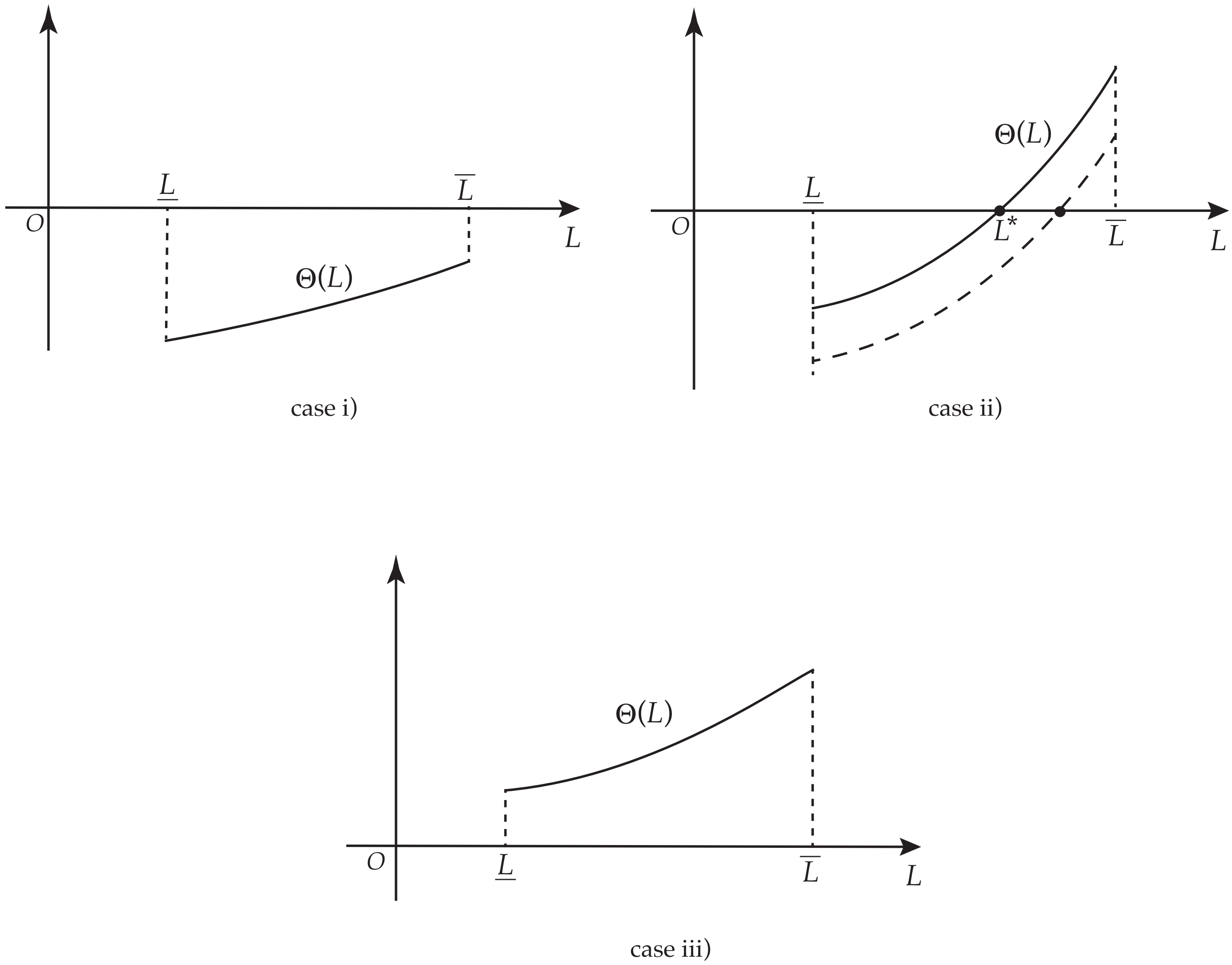

Fig. 1. Three cases of the position of $\Theta(L)$

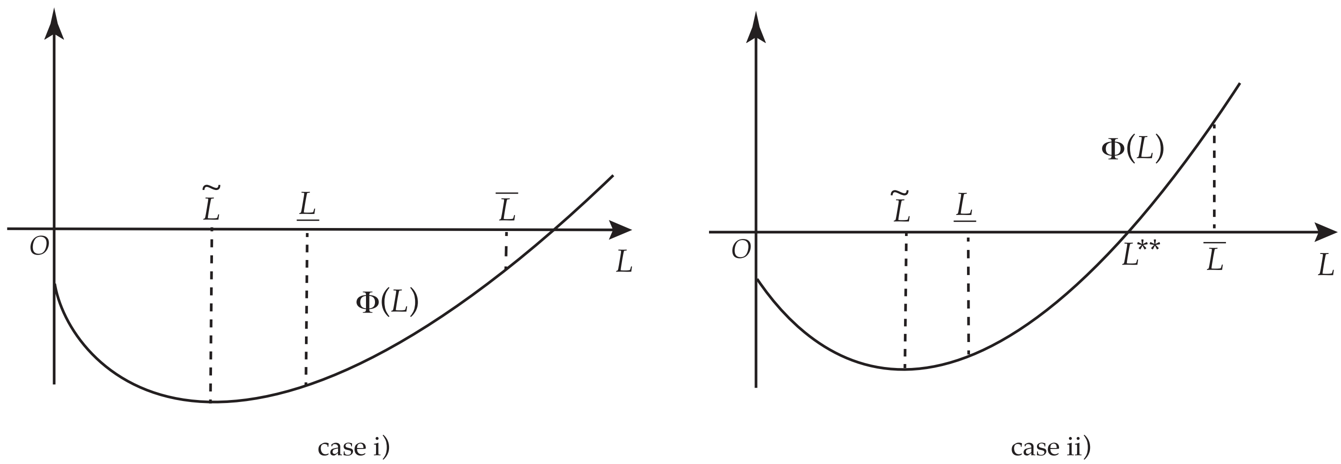

Fig. 2. Two cases of the position of $\Phi(L)$