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# Transportation Cost, Productivity, and Prices of Quality Goods: A Consideration for the "Pseudo" Alchian-Allen Effect

**Tetsuya Saito**

*Research Institute of Economic Science*

*College of Economics, Nihon University*

# Transportation Cost, Productivity, and Prices of Quality Goods: A Consideration for the "Pseudo" Alchian-Allen Effect[1]

Tetsuya Saito[2]

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[2]Ph.D. (Economics), Associate Professor of Economics, Nihon University College of Economics; Address: 1-3-2 Misakicho, Chiyoda-Ku, Tokyo, Japan 101-8360; Phone/Fax: +81-3-3219-3803; Email: saito.tetsuya@nihon-u.ac.jp

**Abstract**

This paper considers impacts of transportation cost in prices of quality goods. In the analysis, we find and evaluate an analogue of the Alchian-Allen effect to call pseudo Alchian-Allen effect (PAA): the shipping cost increases the average quality/price in the distant market and it decreases the average quality/price in the local market. In such cases, the relative demand for superior goods increases, as the genuine Alchian-Allen effect proposes. If the PAA does not hold, the genuine effect fails to exist. The existence of the PAA does not necessarily imply the existence of the genuine effect. Yet, the PAA is applied to much wider topics and to a preliminary test for the genuine effect.
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**Keywords:** *Alchian-Allen effect; transportation cost; trade of quality goods*

# 1 Introduction

The Alchian-Allen effect, as proposed in Alchian and Allen [1], is easily shown in a two-good consumption model using Hicksian demand functions.[1] Goods are classified as superior and inferior, or goods 1 and 2, respectively. The price of superior good $P_1$ is strictly higher than the price of inferior good $P_2$; hence, $P_1 > P_2$. Let $X_i = X_i(P_1/P_2)$ be the compensated demand function for good $i$. If there is a common shipping cost $T > 0$, the relative price of good 1 declines because

$$\frac{P_1}{P_2} > \frac{P_1 + T}{P_2 + T}, \tag{1}$$

and then the demand for superior good increases relative to the demand for inferior one. Therefore, the share of demand for superior good increases as the shipping cost increases, as a substitution effect.

If there is the Alchian-Allen effect, the average price in the distant market increases as the shipping cost increases. To see this, let $x$ be the share of demand for superior good:

$$x \equiv \frac{X_1}{X_1 + X_2}, \tag{2}$$

which increases as $T$ increases, $dx/dT > 0$, as (1) implies the relative price of the superior good decreases. The average price $\bar{P}$ is then computed as

$$\bar{P} = x(P_1 + T) + (1 - x)(P_2 + T). \tag{3}$$

Differentiating the average price with respect to shipping cost provides

$$\frac{d\bar{P}}{dT} = 1 + \frac{dx}{dT} \cdot (P_1 - P_2) > 0, \tag{4}$$

where the inequality follows from $P_1 > P_2$ and $dx/dT > 0$. In empirical study, we often examine if the average price goes up or down when there is an increase in the shipping cost or in the distance. We then support the Alchian-Allen effect if an increase in the shipping cost increases the average price, as it indicates that the superior good is consumed relatively more than the inferior one.

In naïve sense, the Alchian-Allen effect does not consider suppliers' problem. If we take into account for suppliers, the Alchian-Allen effect is supported in a limited environment. For example, Bertonazzi *et al.* [4] investigates several microeconomic structures including suppliers to find that the Alchian-Allen effect cannot hold unless a monopolist supplies goods in the distant market and the quality levels in production realize randomly. If we take the effect as a theorem, there are several critiques, as well surveyed and discussed in Anderson and Kjar [2]. There are also still several misspecification to verify the Alchian-Allen effect, as claimed by Cowen and Tabarroc [7].

In contrast to such arguments, there are several applications in various fields using much broader notions. Among many empirical studies, Hummels and Skiba [12] and Brown et al. [6] examine the genuine Alchian-Allen effect adequately using individual packet data and individual consumption data, respectively. In addition, Kroncke and Ressler [13] applies the

Alchian-Allen effect to the demand for higher education to show the existence of the effect: the demand for private schools (high tuition) increases against public schools (low tuition) when the anticipated unemployment (the fixed cost) increases. However, in many studies, such sophisticated manuscript data are not easily available. For example, Curzi and Olper [8], Goodhue *et al.* [10], Lavoie [14], Richards and Patterson [18], and potentially many other researchers use supplier-side data to discuss the Alchian-Allen effect.

This paper assumes there are larger demands for discussions for the Alchian-Allen effect beyond the third law of demand, as Umbeck [20] claims, and the purely fixed shipping cost. We consider what is required for an analogue of the Alchian-Allen effect to be consistently discussed including suppliers when the distant market is thick. For instance, we look for conditions that generate a positive correlation between the shipping cost and the average price in the distant market and a negative correlation between the shipping cost and the average price in the local market, which can be said that the good apples are shipped out. Let me call it the *pseudo Alchian-Allen effect* (PAA) in this paper, as I believe that the Alchian-Allen effect emanates from the third law of demand when a fixed shipping cost is charged while I do not deny the broader notions of the effect to call a kind of the Alchian-Allen effect. The PAA is an argument on the supplier side and then it supports fruitful empirical discussions using supplier-side data.

The discussion is developed as follows. In Section 2, we setup the model using a mechanism to induce *truth-telling*, as usually there is an adverse selection issue since sellers do not know actual preferences of buyers when we discuss a choice of quality (a discussion for modeling with competitive framework is provided in Appendix A). The average prices in the distant and the local markets are computed and examined in Section 3.1 to assess the PAA. In addition to the impact of the shipping cost, we also verify the difference in valuations of the quality of the objects in Section 3.2. As a final argument, a (cosmetic) consistency with the demand side and the genuine Alchian-Allen effect is discussed in Section 3.3. For reference, Section 3.4 provides a numerical example. We then conclude our discussion in Section 4.

## 2 An Adverse-Selection Mechanism

We consider a model of two-point trade between areas called A and B. In A, there are supplies of quality objects. The quality of the is measured by $q \geq 0$ in an increasing manner. The quality in A is distributed as cumulative distribution function $F(q)$ and density function $f(q) \equiv dF/dq$. This framework is interpreted, for example, as a heterogeneous firm model or a stochastic quality-production model. For a representative agent in A, an object generates a value $v(q)$ if one locally utilizes the object, where $v(0) \geq 0$, $dv/dq > 0$ and $d^2v/dq^2 < 0$. If a seller in A sends an object to B, a shipping cost is charged by

$$T(q) \equiv \tau(q) + T_0, \tag{5}$$

where $T_0 > 0$ is a common fixed cost and $\tau(q) \geq 0$ is a variable cost for each quality level. The shipping cost is incurred by the shipper, as we assume the market in B is thick. In B, the price for each quality is given by $p(q)$. The decision of each seller whether or not shipping out one's object is then given by a comparison between the net *free-on-board* (f.o.b.) payoff function for the seller $\omega(q) \equiv p(q) - v(q)$ and the shipping cost:

$$v(q) \leq p(q) - T(q) \quad \Longrightarrow \quad T(q) \leq \omega(q). \tag{6}$$

Each buyer in B has one's own preference type $\theta \geq 0$. The preference type is measured analogously as $q$ in an increasing manner. The buyer tells the seller the quality one wants. For simple notation, we use the same notation for the message and the quality to purchase; hence, a buyer declares a quality $q$ to purchase.

If a buyer with type $\theta$ utilizes the object with quality $q$, a value $u(q,\theta)$ is generated, where $\partial u/\partial q > 0$ and $\partial^2 u/\partial q^2 < 0$. The net payoff of the buyer is then given by

$$\Pi(q,\theta) = u(q,\theta) - p(q). \tag{7}$$

We assume that the marginal valuation of the quality increases faster in B than in A if the buyers in B confess their true types:

$$\left.\frac{\partial^2 u}{\partial q^2}\right|_{\theta=q} > \frac{d^2 v}{dv^2}. \tag{8}$$

In addition, we assume the valuation of the least quality is higher in B than A if buyers in B confess their true types; hence, $u(0,0) \geq v(0)$. However, we allow the marginal valuation in A to exceed the marginal valuation in B.

If there is an optimum quality as a *truth-telling equilibrium*, the payoff of this buyer must satisfy the first order and the second order conditions respectively given by

$$\left.\frac{\partial \Pi}{\partial q}\right|_{\theta=q} = \left.\frac{\partial u}{\partial q}\right|_{\theta=q} - \frac{dp}{dq} = 0 \quad \text{and} \quad \frac{\partial^2 \Pi}{\partial q^2} = \left.\frac{\partial^2 u}{\partial q^2}\right|_{\theta=q} - \frac{d^2 p}{dq^2} < 0, \tag{9}$$

which provide conditions for the pricing schedule with respect to quality, $p(q)$, to satisfy:

$$\left.\frac{\partial u}{\partial q}\right|_{\theta=q} = \frac{dp}{dq} > 0 \quad \text{and} \quad \left.\frac{\partial^2 u}{\partial q^2}\right|_{\theta=q} < \frac{d^2 p}{dq^2}. \tag{10}$$

In this mechanism, as it is well-known, any positive informational rent is not left for the lowest type $\theta = 0$; hence, $u(0,0) = p(0)$. From (10), we find that $\omega(q) = p(q) - v(q)$ is inverse hump-shaped or monotonically increasing and convex, as

$$\frac{d^2 p}{dq^2} - \frac{d^2 v}{dv^2} > \left.\frac{\partial^2 u}{\partial q^2}\right|_{\theta=q} - \frac{d^2 v}{dv^2} > 0, \tag{11}$$

where the last inequality follows from the assumption (8). The inverse hump-shaped case appears when there is a range of quality with $dv/dq > du/dq$. If $dv/dq \leq du/dq$ for all $q$, the net f.o.b. payoff is monotonically increasing in $q$ and convex.

If there is a pricing schedule that satisfies condition (10), assuming $u(0,0) = p(0) > v(0)$, $\omega(q)$ and $T(q)$ are depicted as an inverse hump-shaped or a monotonically increasing and convex function as depicted in Figure 1 (a further argument regarding the functional form is

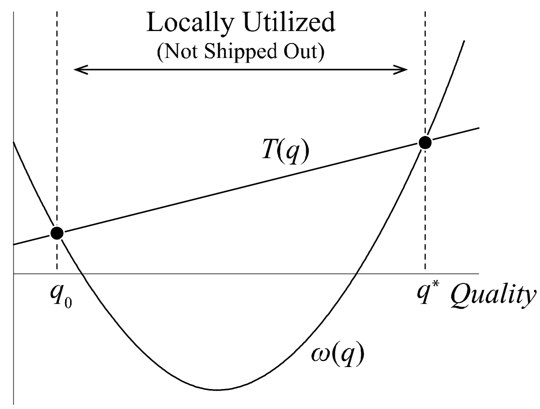


Figure 1: Decision of shipping out

provided in Section 3). In this figure, the quality level between $q = q_0$ and $q = q^*$ is utilized locally and the quality level $q = q^*$ is shipped out from A to B. An increase in the shipping cost $T(q)$ then increases $q^*$ reduces $q_0$; hence, the varieties consumed in the local market is widened by an increase in the shipping cost, which is an analogue of Echazu [9] when we focus on the local market.[2]

In order to avoid ordering puzzles in multiple qualities framework, for example as discussed in Saito [19] and Liu [15], let us classify the goods into two quality levels: *superior* and *inferior classes*. The superior class consists of quality levels above $q = q^*$ and the inferior consists of quality levels below $q = q_0$. Using Figure 1, the next proposition summarizes basic characters of the two quality classes in the distant market when the shipping cost increases.

**Proposition 1** *An increase in the shipping cost increases the average quality of the superior class while it decreases the average quality of the inferior class in the distant market.*

# 3 The Pseudo Alchian-Allen Effect

We define the *pseudo Alchian-Allen effect* (PAA) as follows.

**Definition 1 (PAA)** *An existence of the PAA implies that an increase in the shipping cost increases the average quality level for the distant market while it decreases the average quality level in the local market.*

If there is a PAA, we observe average prices as in the next proposition.

**Proposition 2** *If there is a PAA, the average price of the distant market is higher than the average price of the local market. In addition, the average quality and the average price is positively correlated.*

The following subsections explore conditions for the PAA (Sections 3.1 and 3.2) and a consistency with the *genuine* Alchian-Allen effect (Section 3.3).

### 3.1 Average Price

Let $G(q_0, q^*)$ be the share of locally utilized quality:

$$G(q_0, q^*) = F(q^*) - F(q_0). \tag{12}$$

Let $\bar{P}$ be the anticipated average price when all objects are sold in the distant market:

$$\bar{P} = \int_0^{+\infty} p(q) f(q)\, dq. \tag{13}$$

The average price in the distant market (B) is then computed as

$$P(q_0, q^*) = \frac{\int_{q \in S} p(q)\, dF(q)}{1 - G(q_0, q^*)} = \frac{\bar{P} - L(q_0, q^*)}{1 - G(q_0, q^*)}, \tag{14}$$

where $S = \{q : T(q) \leq \omega(q)\}$ represents the set consisting of quality levels to ship out, and $L(q_0, q^*)$ the integral to compute[3]

$$L(q_0, q^*) = \int_{q_0}^{q^*} p(q) f(q)\, dq. \tag{15}$$

Since $\bar{P}$ is fixed, differentiating the average price (14) with respect to shipping cost provides

$$\frac{dP}{dT} = \frac{\left\{\bar{P} - L(q_0, q^*)\right\} dG/dT - \{1 - G(q_0, q^*)\}\, dL/dT}{\{1 - G(q_0, q^*)\}^2},$$

where $dL/dT$ and $dG/dT$ are respectively computed as

$$\frac{dL}{dT} = p(q^*) f(q^*) \frac{dq^*}{dT} - p(q_0) f(q_0) \frac{dq_0}{dT} > 0, \tag{16}$$

$$\frac{dG}{dT} = f(q^*) \frac{dq^*}{dT} - f(q_0) \frac{dq_0}{dT} > 0. \tag{17}$$

Thus, the direction of change in $P$ when $T$ changes is written as

$$\frac{dP}{dT} \gtreqless 0 \iff \frac{\bar{P} - L(q_0, q^*)}{1 - G(q_0, q^*)} = P(q_0, q^*) \gtreqless \frac{dL/dT}{dG/dT} = P_L(q_0, q^*) \cdot \frac{\hat{L}}{\hat{G}}, \tag{18}$$

where $P_L(q_0, q^*) \equiv L(q_0, q^*)/G(q_0, q^*)$ is the average local price, and $\hat{L} \equiv dL/L$ and $\hat{G} \equiv dG/G$ are the rates of changes in $L$ and $G$, respectively. The next proposition investigates conditions for the PAA to appear.

**Proposition 3** *If the average price in the distant market is higher than the average local price and the average local price decreases as the shipping cost increases, then, the average price in the distant market increases with the shipping cost. In this case, an increase in the shipping cost increaes the average quality of the distant market and it decreases the average quality of the local market; whence, there is a PAA.*

Table 1: Direction of change in $P$

| | $\boldsymbol{P > P_L}$ | $\boldsymbol{P \leq P_L}$ |
|---|---|---|
| $\boldsymbol{\hat{P}_L \geq 0}$ | ? | $dP/dT \leq 0$ |
| $\boldsymbol{\hat{P}_L < 0}$ | $dP/dT > 0$ | ? |

**Proof.** By definition, the rate of change of the local price provides

$$\hat{P}_L = \hat{L} - \hat{G} \quad \Longrightarrow \quad \hat{P}_L \gtreqless 0 \quad \Longleftrightarrow \quad \frac{\hat{L}}{\hat{G}} \gtreqless 1. \tag{19}$$

In addition, condition (18) is rearranged as

$$\frac{dP}{dT} \gtreqless 0 \quad \Longleftrightarrow \quad \frac{P}{P_L} \gtreqless \frac{\hat{L}}{\hat{G}}. \tag{20}$$

Conditions (20) and (19) then provide the signs of $dP/dT$ for each case as summarized in Table 1. As this table suggests, the existence if the PAA is not guaranteed. It is noteworthy that the genuine Alchian-Allen effect also does not hold in some cases as Minagawa [16] points out. For the PAA, by definition, we have to have $\hat{P}_L < 0$ (Definition 1) and then $P > P_L$ follows from Proposition 2. According to Table 1, such a case consistently has $dP/dT > 0$, as proposed by the PAA. ■

From Proposition 3, as summarized in Table 1, there is a PAA so long as $\hat{P}_L < 0$ and $P > P_L$. The next proposition discusses feasibility of the PAA in terms of the functional forms and parameters.

**Proposition 4** *In order to discuss the Alchian-Allen effect based on the PAA, we have to have an inverse hump-shaped or a monotonically increasing and convex net f.o.b. payoff function; an appropriate range of shipping fees; and a higher valuation of the least quality in the distant market than in the local market in order to keep both the superior and the inferior goods classes. In addition, if the net f.o.b. payoff is a monotonically increasing function, we have to have a positive variable shipping fees.*

**Proof.** If the effective range is truncated or the shipping cost is too high for the given net f.o.b. payoff, only an either quality class is shipped out. If the inferior class vanishes, an increase in the shipping cost increases both $P$ and $P_L$, as $q^*$ increases while there is no impact of $q_0$. In some sense, in this case, sellers are shipping the good apples out. However, they increases the average quality level of the locally sold apples, and that seems inconsistent with the basic idea of the Alchian-Allen effect. If the superior class vanishes, an increase in the shipping cost reduces both $P$ and $P_L$, as $q_0$ decreases while there is no impact of $q^*$, which is to say "shipping the bad apples out". In such cases, the existence of the PAA is not supported and so is the genuine Alchian-Allen effect. If the shipping cost is too small for the given net f.o.b. payoff, there is no impact of the shipping cost and then no argument for the Alchian-Allen effect arises.

If the net f.o.b. payoff function is hump-shaped or monotonically increasing and convex, as $d^2u/dq^2 > d^2v/dq^2$, an increase in the shipping cost increases $q_0$ and it decreases $q^*$, which contradicts the basic notion of the Alchian-Allen effect. If the net f.o.b. payoff function is linear, as $du/dq = dv/dq$, either the superior or the inferior class vanishes. As discussed above, the existence of the PAA is not supported. Therefore, the net f.o.b. payoff function must be inverse hump-shaped or monotonically increasing and convex. It is noteworthy that a positive variable cost is required if $\omega(q)$ is monotonically increasing to maintain the inferior class.

If the valuation of the least quality is higher in the local market than in the distant market, $p(0) = u(0,0) \leq v(0)$ implies $\omega(0) = p(0) - v(0) \leq 0$. In this case, the inferior class vanishes, as $T(0) > 0$; hence, $p(0) = u(0,0) > v(0)$ for $\omega(0) > 0$ must hold to maintain the inferior class. ■

The requirements stated in Proposition 4 is justified as follows. The importing area (B) utilizes the least quality better than in the exporting area (A); hence, $p(0) = u(0,0) > v(0)$. The exporting area may be able to utilize a certain quality range relative to the importing area, so that, $p(q) < v(q)$ and $dp/dq < dv/dq$ may hold for some $q$. However, the importers utilize the superior class than the exporters; hence, $p(q) > v(q)$ and $du/dq > dv/dq$ for such $q$. This is guaranteed by $d^2u/dq^2 > d^2v/dq^2$, e.g., the marginal valuation increases as quality improves at much faster rate in B than in A. In summary, if there is a PAA, the importing area has a better technology than the exporting area to utilize the inferior and the superior quality classes.

## 3.2 Impact of Change in Valuation

Data sets often include various locations and/or periods. Those locations and periods may have different preference types for valuations of objects. In addition, aggregate demand and supply affect the valuation in the market. If there is a positive change in valuation in the distant market, the pricing schedule $p(q)$ goes up to make an upward shift of a downward shift of $\omega(q)$ in Figure 1. Such a change then generates an analogous effect as a decrease in the shipping cost: the range of locally utilized quality narrows. Similarly, if there is a positive change in the local market, the valuation function $v(q)$ goes up to make a downward shift of $\omega(q)$ in Figure 1. Such a change then generates an analogous effect as an increase in the shipping cost: the range of the locally utilized quality expands. This argument is summarized as the next proposition.

**Proposition 5** *An increase in the local valuation increases the average quality of the superior class in the distant market while it decreases the inferior class there. Analogously, an increase in the valuation in the distant market decreases the average quality of the superior class in the distant market while it increases the average quality of the inferior class there.*

Within the context of aggregate demand and supply, an increase in the volume of transactions increases the valuation of the object in the market. If the transactions increase in the distant market, the average quality decreases in the distant market in exchange for an increase in the average local quality. If the transactions increase in the local market, on the other hand, the average quality in the distant market increases in exchange for a decrease in the average local quality. These results seem plausible in the real world.

The above argument confirms that an argument for the PAA is held only if the difference between the valuations in the distant and the local markets is moderate to keep the impact of the shipping cost. For example, the importance of the valuation manners in finding the (pseudo) Alchian-Allen effect is also suggested empirically by Lavoie [14] and Richards and Patterson [18].

## 3.3 Consistency with the Genuine Effect

In order to look for a (cosmetic) consistency with the *genuine* Alchian-Allen effect, we consider aggregate demands for superior and inferior goods. Let $\chi$ be the relative demand for superior good. Since the relative demand must be equal to relative supply,[4] for consistency, we have to have

$$\chi = \frac{1 - F(q^*)}{F(q_0)}. \tag{21}$$

In order to verify if the relative demand (21) increases as the shipping cost increases, we prove the next proposition.[5]

**Proposition 6** *The relative demand for superior class increases as the shipping cost increases, as the average price of the superior goods is higher than that of the inferior ones. Therefore, the existence of the PAA is (cosmetically) consistent with the existence of the genuine Alchian-Allen effect.*

**Proof.** Let $\breve{F}(q^*) \equiv 1 - F(q^*)$, so that, $d\breve{F}/dq^* \equiv -f(q^*)$. Differentiating the relative demand (21) with respect to $T$ provides

$$\frac{d\chi}{dT} = -\frac{F(q_0) f(q^*) dq^*/dT + \breve{F}(q^*) f(q_0) dq_0/dT}{F(q_0)^2}. \tag{22}$$

From $dq_0/dT < 0$ and $dq^*/dT > 0$, we find

$$\frac{d\chi}{dT} \gtreqless 0 \quad \Longleftrightarrow \quad \frac{\breve{F}(q^*)}{F(q_0)} \gtreqless -\frac{f(q^*) dq^*/dT}{f(q_0) dq_0/dT} = \frac{d\breve{F}(q^*)}{dF(q_0)}, \tag{23}$$

which is further arranged as

$$\frac{d\chi}{dT} \gtreqless 0 \quad \Longleftrightarrow \quad \frac{d\breve{F}(q^*)/\breve{F}(q^*)}{dF(q_0)/F(q_0)} = MRS \lesseqgtr 1, \tag{24}$$

where $MRS$ represents the marginal rate of substitution between superior and inferior classes. For consistency, letting $P_1$ and $P_2$ be the average prices of the superior and the inferior classes, respectively, $MRS$ must be equal to the inverse of the relative average price of the superior class:

$$MRS = \frac{P_2}{P_1} < 1 \quad \Longleftrightarrow \quad \frac{d\chi}{dT} > 0, \tag{25}$$

where the result follows from the definition, as such $P_1 > P_2$. Therefore, the relative demand decreases as the shipping cost increases. ■

### 3.4 A Numerical Example

For a numerical analysis, we specify $v$ and $u$ as Cobb-Douglas functions, such as

$$v(q) = q^\alpha \theta_A^{1-\alpha} + v_0 \quad \text{and} \quad u(q,\theta) = q^\alpha \theta^{1-\alpha} + p_0, \tag{26}$$

where $v_0 = v(0)$, $p_0 = p(0)$, $\alpha \in (0,1)$, and $\theta_A > 0$. In (26), $\alpha$ is a common valuation parameter and $\theta_A$ is a regional parameter interpreted as a common message declared by the local agents in A; hence, $q = \theta_A$ maximizes $v(q)$. From (26), we find

$$\frac{\partial u}{\partial q} = \alpha \cdot \left(\frac{\theta}{q}\right)^{1-\alpha} \quad \Longrightarrow \quad \frac{dp}{dq} = \left.\frac{\partial u}{\partial q}\right|_{\theta=q} = \alpha, \tag{27}$$

which provides the pricing schedule function as

$$p(q) = \alpha q + p_0. \tag{28}$$

In the simulation, we apply $v_0 = 0$, $p_0 = 1$, $\alpha = 0.8$, and $\theta_A = 1$. The quality $q$ is distributed as a Gamma-distribution $\Gamma(k,\lambda)$ with shape parameter $k = 2$ and scale parameter $\lambda = 0.5$; hence, the average and mode of the quality index are $k\lambda = 1$ and $(k-1)\lambda = 0.5$, respectively. The charts shown in Figure 2 depict the net f.o.b. payoff function $\omega(q)$ and the density function, respectively. From the left chart, we find that the effective range of the shipping cost and the quality for the argument are $T(q) \in (0.8, 1)$ and $q \in (0,1)$, as discussed in Sections 3.1 and 3.2.

In order to derive the average prices in Figure 3, $\tau(q) \equiv 0$ and then $T \equiv T_0$ is applied; hence, there is no variable shipping cost. In this example, the PAA holds for $T \in (0.8, 0.9)$, where $dP/dT > 0$, $dP_L/dT < 0$ ($\hat{P}_L < 0$), and $P > P_L$. The relative demand/supply is shown in Figure 4. The PAA looks consistent with the genuine Alchian-Allen effect for $T \in (0.8, 0.9)$.

# 4 Concluding Remarks

This paper proposed an analogous effect of the Alchian-Allen effect to call the pseudo Alchian-Allen effect (PAA). If the PAA does not hold, the genuine Alchian-Allen effect holds. However, the PAA does not imply the genuine effect in a naïve sense even if there is a cosmetic consistency between the pseudo and the genuine effects. In this paper, the main argument is based on an adverse-selection model. However, as shown in the appendix, the same argument applies to competitive frameworks.

In the discussion, we have found that the PAA exists if the net f.o.b. payoff function of the local seller is inverse hump-shaped or monotonically increasing and convex, and the difference between the valuations in the local and in the distant markets are moderate relative to the shipping cost. In this argument, it does not matter whether or not the shipping cost is fixed or variable. For empirical application, if there are the superior and the inferior classes

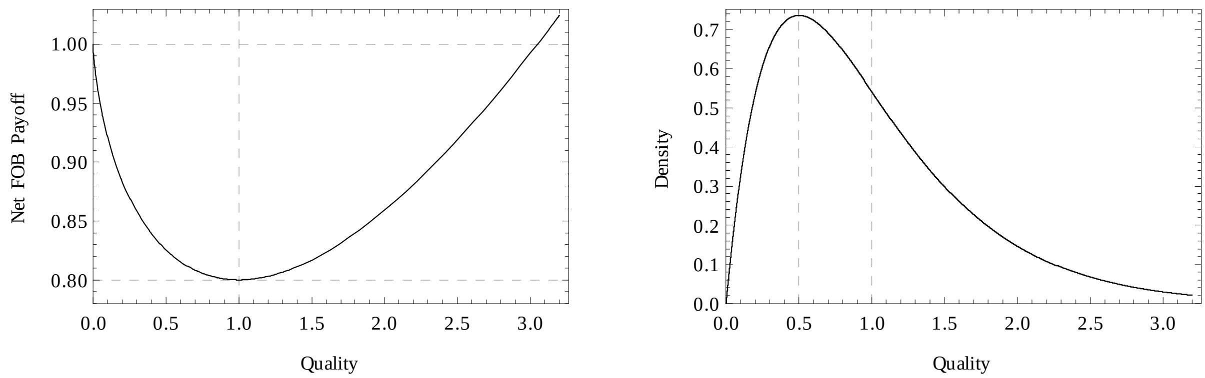


Figure 2: $\omega(q) = p(q) - v(q)$ and density

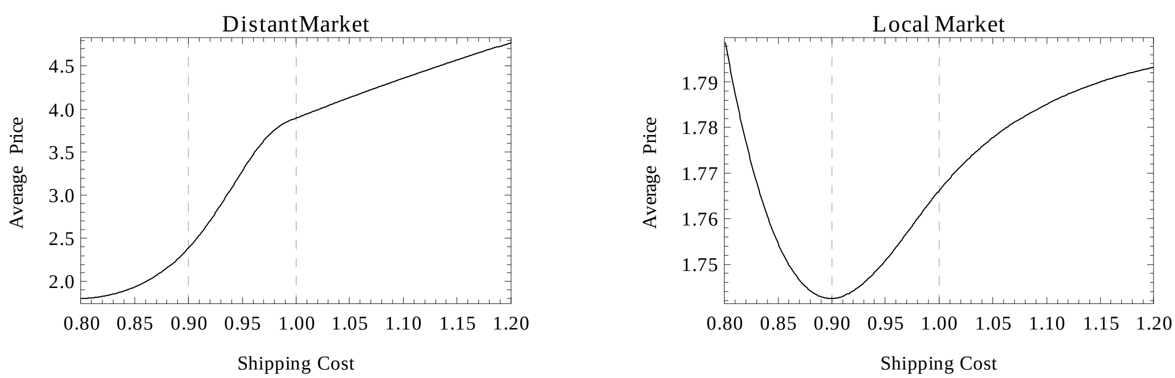


Figure 3: Numerical example (result)

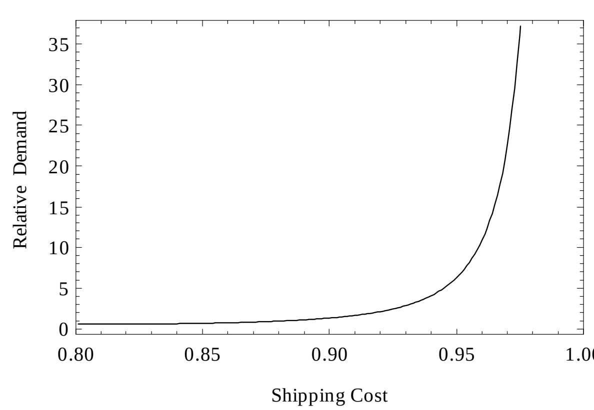


Figure 4: Relative demand for superior goods (numerical example)

classified by average prices, the existence of the PAA is verified by examining if the average price of the local market decreases and the average price of the distant market increases as the shipping cost (distance) increases.

# Appendix

## A Competitive Model

In a competitive market, there is no asymmetric information and the pricing schedule $\tilde{p}(q)$ is determined by maximizing the net payoff of the buyer in B. For instance, letting $\tilde{u}(q)$ be the value of an object of quality $q$ such that $d\tilde{u}/dq > 0$, the first order condition to maximize $\tilde{u}(q) - \tilde{p}(q)$ is given by $d\tilde{p}/dq = d\tilde{u}/dq$. If $d^2\tilde{u}/dq^2 > d^2v/dq^2$, $\tilde{u}(q)$ is an analogue of $u(q, \theta)$ under the truth-telling equilibrium $\theta \equiv q$. In such a case, we have an inverse hump-shaped or a monotonically increasing and convex net f.o.b. payoff function for the local seller: $\tilde{\omega}(q) = \tilde{p}(q) - v(q)$. Therefore, the same argument directly applies to the PAA in a competitive framework.

# Notes

[1] A proof in a general equilibrium framework using Hicksian demand functions (*á la* third law of demand) is provided by Borcherding and Silberberg [5]. A consideration with an income effect is given by Gould and Segall [11]. Borcherding and Silberberg's proof is extended by Bauman [3] with many third goods. A simple proof with Marshallian demand functions (including income effect) derived from a utility function of homogeneous of degree $n > 0$ is shown by Saito [19]. Further more, further considerations with multiple qualities (brands) is provided by Liu [15] and with income and endowment effects by Minagawa and Upmann [17].

[2] In Echazu [9], however, an increase in the variety is considered as an increase in the quality of consumption. Thus, we cannot directly compare the work within the naïve Alchian-Allen context.

[3] If $L$ is deflated by $G$, it is the average price of the local market.

[4] In actual data, observations must be adequately classified by origins, destinations, and periods in order to equate the relative demand and the relative supply.

[5] From (21), it is easy to see that the proof is based on the marginal rate of substitution, which looks immediately available from the definition. However, we have to be careful about the signs of equations in the inequality; hence, we prove the proposition using step-by-step calculations.

# References


[1] Alchian, Albert A. and William R. Allen (1964). *University Economics*. Belmont, CA: Wadsworth.

[2] Anderson, William L. and Scott Kjar (2008). Can good apples be mixed with bad economics? A Mengerian critique of the Alchian and Allen theorem. American Journal of Economics and Sociology, 67(4), 645-60.

[3] Bauman, Yoram. (2004). Shipping the good apples out: A new perspective. *Economic Inquiry*, 42(3), 534-36.

[4] Bertonazzi, Eric P., Maloney, Michael T., and Robert E. McCormick (1993). Some evidence on the Alchian and Allen theorem: The third law of demand? *Economic Inquiry*, 31(3), 383-93.

[5] Borcherding, Thomas E. and Eugene Silberberg (1978). Shipping the good apples out: The Alchian and Allen theorem reconsidered. *Journal of Political Economy*, 86(1), 131-38.

[6] Brown, Matthew T., Rascher, Daniel A., McEvoy, Chad D., and Mark S. Nagel (2009). Treatment of travel expenses by golf course patrons: Sunk or bundled costs and the first and third laws of demand. *International Journal of Sport Finance*, 2(1), 45-53.

[7] Cowen, Tyler and Tabarrok, Alexander (1995). Good grapes and bad lobsters: Applying the Alchian and Allen theorem. *Economic Inquiry*, 33(2), 253-56.

[8] Curzi, Daniele and Alessandro Olper (2012). Export behavior of Italian food firms: Does product quality matter? *Food Policy*, 37(5), 493-503.

[9] Echazu, Luciana (2009). Product differentiation, firm heterogeneity and international trade: Exploring the Alchian-Allen effect. *Research in Economics*, 63(2), 95-101.

[10] Goodhue, Rachael E., LaFrance, Jeffrey T. and Leo K. Simon (2009). Wine taxes, production, aging and quality. *Journal of Wine Economics*, 4(1), 27-45.

[11] Gould, John P. and Joel Segall (1969). The substitution effects of transportation costs. *Journal of Political Economy*, 77(1), 130-37.

[12] Hummels, David and Alexandre Skiba (2004). Shipping the good apples out? An empirical confirmation of the Alchian-Allen Conjecture. *Journal of Political Economy*, 112(6), 1384-1402.

[13] Kroncke, Charles O., Jr. and Rand W. Ressler (1993). The Alchian-Allen effect in higher education: Public versus private enrollment. *Economics of Education Review*, 12(4), 345-49.

[14] Lavoie, Nathalie (2005). Price discrimination in the context of vertical differentiation: An application to Canadian wheat exports. *American Journal of Agricultural Economics*, 87(4), 835-54.

[15] Liu, Liqun (2011). The Alchian-Allen theorem and the law of relative demand: The case of multiple quality-differentiable brands. *Mathematical Social Sciences*, 61(1), 52-57.

[16] Minagawa, Junichi (2012). On Giffen-like goods. *Economics Letters*, 115(2), 282-85.

[17] Minagawa, Junichi and Thorsten Upmann (2012). The generalized Alchian-Allen theorem. *CESifo Working Paper Series*, No.3969, CESifo Group Munich, Germany.

[18] Richards, Timothy J. and Paul M. Patterson (2005). A bilateral comparison of fruit and vegetable consumption: United States and Canada. *Journal of Agricultural and Resource Economics*, 30(2), 333-49.

[19] Saito, Tetsuya, (2008). An expository note on Alchian-Allen theorem when sub-utility functions are homogeneous of degree $n > 0$ with two-stage budgeting. *Economics Bulletin*, 6(30), 1-12.

[20] Umbeck, John (1980). Shipping the good apples out: Some ambiguities in the interpretation of “fixed charge”. *Journal of Political Economy*, 88(1), 199-208.

*Research Institute of Economic Science*
*College of Economics, Nihon University*

1-3-2 Misaki-cho, Chiyoda-ku, Toyko 101-8360 JAPAN
Phone: 03-3219-3309　Fax: 03-3219-3329
E-mail: keikaken.eco@nihon-u.ac.jp
http://www.eco.nihon-u.ac.jp/center/economic/