In this paper, based on the qualitative economics of Lancaster (1966, 1971) and the concept of multiple quality product of Cheung (2001), we conceptualize and operationalize the third law of demand, also known as the ‘shipping the good apple out’ theory or the Alchian-Allen effect, first proposed by Alchian and Allen (Alchian and Allen, 1964), and we extend this law to explain the demand decisions of multiple quality products in different market segments.

The Third Demand Law of Single Quality Product

Alchian and Allen introduce the third law of demand via the following discussion. There is a larger proportion of good quality relative to poor quality oranges or grapes sold in New York State than in California. Alchian and Allen even claim that this finding is still true when the wealth effect is taken into consideration. In *University Economics*, (Alchian and Allen, 1964), they wrote, “Is it because New York’s population is richer or more discriminating? Possible; but then why are the oranges and grapes sold even in the poor district of New York State better than those sold in California?” Table 1 exhibits the numeric example of the third demand law introduced in their famous textbook.

The grape story in table 1 is very popular for its pedagogical performance in introducing the demand law that the relative price, rather than the nominal price, determines the quantity demanded (Razzolini, Shughart and Tollison, 2003). Because Alchian and Allen tell little about the conditions formalizing the establishment of this law, like insufficient information about the customer backgrounds in California and New York State, for the convenience of further analysis, we assume there is no difference between the representative customers of both states. For example, the representative Californian and New Yorker are equally wealthy. They have identical preference of grapes or oranges. Both of them take choice grape, the high-end grape, and the low-end grape, standard grape, as close substitutes. According to the demand law, because the shipment cost makes the relative price of high-end grape to low-end grape in New York State lower than the same kind of relative price in California \((1.5 < 2)\), the representative New Yorker consumes more high-end grapes than the representative Californian, and the representative Californian consumes more low-end grapes.

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grapes than the representative New Yorker. That is, California, the origin state of both high-end and low-end grapes, is the target market segment of the low-end grape, and New York is the target market segment of the high-end grape.

Since the first introduction of the third law of demand, debates on the construct validity of this law never ends. A common and superficial criticism comes from the wealth effect (or income effect). Because, on average, standard grapes are purchased by customers of average income and choice grapes are sold to wealthy customers, the wealth effect offers a more plausible reasoning to explain the market segmentation phenomena across high-end and low-end products than what the third law of demand provides. Critics usually comment that the third law of demand is a redundant theory to explain the consumption behaviors between the high-end and low-end products.

In fact, the wealth effect is a sufficient rather than a necessary condition of distinguishing high-end and low-end products in different market segments. When we take wealth condition into consideration, the increase in wealth makes the high-end grape a normal good and the low-end grape an inferior grape to the customers in the high-end segment. When people reckon both the wealth effect and the third law of demand in the analysis of the market segmentation strategy across high-end and low-end grapes, the conclusion of the grape story in Alchian and Allen (1964) is not only valid but also further supported. The representatively wealthier customer demands more high-end grapes, which is a normal good, in the high-end segment than in the low-end segment. In contrast, the wealthily representative customer in the high-end market segment also demands less low-end grapes, because the wealth effect makes the low-end grape an inferior good. That is, the wealth effect and the third law of demand are two complementary rather than competitive theories of dividing a big market into different market segments of different product features.

A hidden, neglected, and, however, insightful implication in the conclusion of the grape story is the relationship between the nominal prices and the quantities demanded of high-end and low-end grapes in different market segments. Check Table 1. To the representative customers in both States, New York State is the high-end grape market and California is the low-end grape market. In comparison with the representative Californian, the representative New Yorker likes to pay a higher nominal price for high-end grapes and demands more quantity of the high-end grape. On the contrary, the representative Californian prefers to consume more low-end

<table>
<thead>
<tr>
<th></th>
<th>California</th>
<th>New York State</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-End Grape</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Shipment Cost</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Low-End Grape</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Relative Price</td>
<td>2</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Monetary Unit of Nominal Price: U.S. Cent
grapes than the New Yorker and likes to pay for the low-end grape at a lower price in California than in New York State. This finding will be reinforced if the wealth effect is taken into consideration.

In other words, in the high-end market segment, the higher the nominal price of the high-end product, the higher its quantity demanded. In the low-end market segment, the lower the nominal price of the low-end product, the higher its quantity demanded. That is, if the high-end product is sold in the high-end market segment, the quantity demanded is greater and the high-end product can be sold at a higher price. In contrast, if the low-end product is sold in the low-end market segment, the quantity demanded is greater when the low-end product is sold at a lower price. The positive correlation between the nominal price and quantity demanded in the high-end market and the negative correlation between the nominal price and quantity demanded in the low-end market offer people an apparatus, which is a sufficient condition, with which to ponder if a product of specific quality is sold in a fitted market segment.

For example, if Amazon works very hard to promote its high-end tablet, Fire HD, in the U.S., a market segment of high-end tablets, and fails, then product upgrade or downgrade are two possible strategies for Amazon to reposition its tablet PC. Given the existence of the competitive and high-priced substitute, iPad, and iPad’s high price and brilliant sales success, offering a low-end tablet computer may be an appropriate repositioning strategy for Amazon if they want to continue the tablet computer business, especially when Amazon finds it is very difficult to position Fire HD on a level as high as that of the iPad in the U.S. tablet computer market.

However, the positive relationship between the nominal price and the quantity demanded of the high-end product across the low-end product segment and the high-end product segment induces a value paradox. The shipment cost lowers the relative price of the high-end grape to the low-end grape and increases the quantity demanded of the high-end grape in the high-end segment. However, from the pecuniary perspective, the adding shipment cost raises the nominal price of high-end grape from 10 cents to 15 cents and increases the quantity demanded of the high-end grape in the high-end segment. That is, the increase of the quantity demanded appears when both the relative price of the high-end product to the low-end product decreases and the relative price of the high-end product to each cent of monetary unit increases. We are going to explain why this relative price inconsistency exists in the following discussion, and it is not a paradox of value.

Although the third law of demand approves workable propositions to investigate the consumption decisions of products of different qualities across different market segments, nonetheless, excepting the pedagogical function, the application of the third law of demand is limited. Debate of its theoretical construct validity never terminates, and little progress has been made since its first introduction. Still worse, some researchers disapprove its theoretical generality and also challenge the validity of the third law of demand as a demand law (Gould and Segall, 1969; Razzolini, Shughart, and Tollison, 2003). We found that the extremely brief introduction of Alchian and Allen (1964) makes huge extra room for researchers to decipher the third law of
demand in very different directions. In fact, if a researcher immerses himself/herself in the study of relevant literatures, he/she can find that scholars are always out of focus in their discussions. Without consensus, it is too difficult for the following researchers to conclude what the law is, let alone continue further development based on the conclusion.

Some scholars defend the Alchian and Allen effect as a demand law (Borcherding and Silberberg, 1978; Umbeck, 1980; Bertonazzi, Maloney and Mccormick, 1993; Cowen and Tabarrok, 1995; Cheung, 2001; Hummels and Skiba, 2004; Brown, Rascher, McEvoy, and Nagel, 2006) by means of offering supplementary conditions that make the law refutable. In this paper, we don’t intend to pick one side in the controversy of literatures. We take the stand of approving the construct validity of the third law of demand as a demand law only if the boundary condition of the theory is clearly delimited. In the following, a generalized form of the third law of demand will be explored. The conclusion of this discussion makes table 1, the original example of the third law of demand, not only a foundation of this generalized theory, but also a special case of this generalized form.

The Third Law of Demand of Multiple Quality Product

Table 2 demonstrates an example to which we applied the third law of demand to explore how relative price can be a pricing strategy and distinguishes the high-end curtain treatment from the low-end curtain treatment in different market segments. The representative prices of blinds and curtain components across different quality levels in table 2 come from a field study of Chu (2011). The price of the curtain treatment is equal to the price of the curtain component added to the price of the blind.

The product of table 2 is different from the product of table 1 in two aspects. First, in table 1, the representative grape consumer treats grape as a single quality product, and in the curtain treatment, both the blind and the curtain component reflect that there are more than one quality features perceived by customers that determine its full performance. Secondly, the purchase decision behavior of a multiple quality product varies from the purchase decision behavior of a single quality product. Before we can confidently decipher the purchase decision of multiple quality products, several characteristics of the purchase behavior of the multiple quality products have to be well defined.

As a multiple quality product, a noticeable purchase behavior when a consumer makes the purchase decision of curtain treatments is concern for the blinds, although at least two different features—blinds and curtain components—make up the full perceived value of the curtain treatment. In general, the blind feature is usually the main feature consumers take into consideration when they pay for curtain treatments, and the way consumers count blinds is exactly the way consumers count curtain treatments. On the contrary, consumers have little knowledge of curtain components. This feature is usually invisible and neglected.
Being about multiple quality products, the foregoing discussion reflects the complicated purchase decision process of multiple feature products. Different judgments have to be made when consumers intend to purchase a product that owns a set of characteristics. In addition, some decision characteristics have to be clarified before making further decisions or analysis. For example, Cheung (2001) claims that the transaction unit, i.e., the unit of product quantity, has to be clearly specified and accepted by both sellers and buyers if price is sufficient to coordinate the purchase behaviors across different products of various characteristics. In other words, in a multiple quality product, how many features or qualities can be included in a product? What is the sufficient condition of a countable unit of a multiple quality product? Both questions can be categorized in the issue of product countability, and Cheung (2001) regards the product countability issue as the first issue that has to be explicated when people intend to fully explore the nature of the third law of demand.

Cheung (2001) proposes the concept of proxy quantity to deal with the countability problem of multiple quality products transacted in the market. Cheung noticed that people adopt various forms of proxy quantity in order to facilitate the transaction activities in markets. For example, time is the proxy quantity when the work force is paid by hourly wage. Some fruits are paid by weight because weight is the most convenient approach of trading fruit. Coffee in Starbucks is paid by cup, which implies volume is the proxy quantity of coffee in transaction, and so are most drinks. In general, people choose a proxy quantity that saves the most transaction cost. The choice of proxy quantity has significant impact on the way people coordinate resources by price. For example, different forms of proxy quantity generate different market contracts that create different organizations in the market. Cheung (1983) discusses how the choice among different transaction proxy quantities influences the existent conditions of the firm.

Given the proxy quantity of a multiple quality product, according to Cheung (2001), how to appropriately assess the value in a multiple quality product, including the value of individual features and the value of the whole multiple feature product, is the second issue that should be well defined when people explore the relationship between the third law of demand and the purchase decision of multiple quality products. Different multiple quality products offer different value to their customers and different evaluation approaches are applied to rate the value of different multiple quality products. Cheung (2001) compares several evaluation approaches of different

Table 2: The Relative Price of High-End Curtain Treatment and Low-End Curtain Treatment

<table>
<thead>
<tr>
<th>Component</th>
<th>High-End</th>
<th>Low-End</th>
<th>Blind</th>
<th>High-End</th>
<th>Curtain Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-End</td>
<td>5,200</td>
<td>200</td>
<td>5,000</td>
<td>600</td>
<td>5,600</td>
</tr>
<tr>
<td>Low-End</td>
<td>1,200</td>
<td>1,000</td>
<td>1,000</td>
<td>1,600</td>
<td></td>
</tr>
<tr>
<td>Relative Price</td>
<td>4.33</td>
<td>5</td>
<td></td>
<td>3.5</td>
<td></td>
</tr>
</tbody>
</table>

Monetary Unit of Nominal Price: New Taiwan Dollar
multiple quality products. For example, although different features exist in a watermelon, people pay for watermelon by weight and buy the watermelon like a single quality product. In contrast, diamonds are paid for by a much complicated way. The purchasers pay for every feature in a diamond, such as color, clarity, cut and carat weight, and diamond purchasers have to learn different assessment skills of different features before they are capable of evaluating the diamond quality accurately.

In the following discussion, we follow the opinion of Cheung (2001) that both the proxy quantity and the value of the multiple quality product have to be well defined given the proxy quantity of multiple quality product if the third law of demand can be applied to analyze the demand behavior of the multiple quality product. For the simplicity of analysis, we assume the total value of a multiple quality product is the summation of the value of each quality item in a multiple quality product. The value of a multiple quality product is measured by the price that customers like to pay. For the convenience of communication, in a multiple quality product, we call the set of qualities in the product the product portfolio, and every multiple quality product owns its quality portfolio. In a quality portfolio, we call the quality that defines the proxy quantity the main quality. Most qualities in quality portfolios are secondary qualities apart from the main quality. For example, in the curtain treatment example, the main quality comes from the blinds, and the curtain component delivers the secondary quality. Although Cheung (2001) points out that proxy quantity may be defined by product property with little value, in this paper, we keep our focus on the multiple quality product in which the main quality also defines the transaction unit of the product.

Generally speaking, the main quality not only defines the transaction unit but also determines the product concept of the multiple quality product. The inclusion and exclusion of a quality in a multiple quality product may influence a consumer’s willingness to pay for this multiple quality product and also change the relative price between this multiple quality product and its competitive counterparts. However, how do we determine the content of the quality portfolio in a multiple quality product? Do consumers accept any quality combination of different quality levels in a multiple quality product? For example, how do people explain the following facts? In a high-end multiple quality product, people always notice that most features have higher quality, and, in a low-end multiple quality product, most features are in low-end quality. Such as in a BMW automobile, people can always find multiple function sunroof, high-end stereo system and comfortable seat design. In a five-star hotel, most service are better than the counterparts in a three-star hotel.
Table 3 derives from table 2. In table 3, 400, which is the difference in price between the high-end component and the low-end component, is like the difference in perceived value between the high-end and low-end secondary qualities in different multiple quality products. In fact, table 3 is similar to table 1. The high-end and low-end blinds sold with the low-end component are like the choice and standard grapes sold in California. The high-end and low-end blinds sold with high-end components are like the choice and standard grapes sold in New York state. The difference in price between the high-end and low-end secondary components is like the shipment cost between California and New York state. According to table 3, which follows the analysis of table 1, in a high-end multiple quality product, the high-end secondary quality feature goes with the high-end main quality feature, and, in a low-end multiple quality product, the low-end secondary quality feature goes with the low-end main quality feature. That is, either high-end or low-end multiple quality products, by including compatible quality features in the quality portfolio, reduces the relative price to its competing substitutes.

However, the value paradox existing in table 1 can also be found in table 3 (or table 2). That is to say that the relative price between both high-end and low-end substitutes are lower if the secondary quality and main quality items are compatible with each other. However, from the monetary perspective, both high-end and low-end multiple quality products are more expensive when one more secondary quality is integrated in them. This mismatch of different relative prices which derive contradictory conclusions from identical purchase problem always confuse people when they have to make the choice decision between products of different quality.

Lancaster’s multiple property product theory offers a way to resolve this value paradox (Lancaster, 1966). Lancaster suggests that goods are not the direct object of utility, and instead, he supposes that the properties or characteristics of goods from which utility is derived truly matter. In Lancaster’s theory, the so-called properties and characteristics in the product can be regarded as different qualities in the multiple quality product in our research. When Cheung’s proxy quantity concept of multiple quality product (Cheung, 2001) is integrated with Lancaster’s theory, people will find that table 1, which discusses the purchase decision of differentiating two single quality substitutes in two different market segments, is a special case of table 2, which is about the purchase decision of differentiating two multiple quality substitutes in

Table 3: A Simplified Version of the Relative Price of High-End Curtain Treatment and Low-End Curtain Treatment

<table>
<thead>
<tr>
<th>Curtain Treatment</th>
<th>Difference in Component Price</th>
<th>Curtain Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-End</td>
<td>5,200</td>
<td>5,600</td>
</tr>
<tr>
<td>Low-End</td>
<td>1,200</td>
<td>1,600</td>
</tr>
<tr>
<td>Relative Price</td>
<td>4.330</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Monetary Unit of Nominal Price: New Taiwan Dollar
two different market segments, and find no contradictory conclusion from different relative price perspectives.

In the decision of purchasing curtain treatment, when people counts curtain treatments, they usually count by blinds. That is, the blind offers the transaction unit, which is the proxy quantity, of the curtain treatment. In a curtain treatment, blind and curtain component deliver different perceived qualities. Customers can always tell the quality levels of blinds. By contrast, consumers may have the primary knowledge about the standard, the low-end, curtain component, they have little information of the high-end curtain component. In other words, they are not very sure why they need to pay higher cost if they choose high-end curtain component. According to table 3, when the high-end blind is sold with high-end curtain component and the low-end blind is sold with the low-end curtain component, in the high-end market segment, the set of high-end blind and high-end component creates the lowest relative price across the high-end and low-end curtain treatments and the set of low-end blind and low-end component generates the lowest relative price across the low-end to high-end curtain treatments in the low-end market segment.

We assume curtain treatments are competing substitutes. Suppose the prices of curtain treatments also reflect consumers’ evaluation of the high-end blind, the low-end blind and the low-end curtain component. The full value of the curtain treatment is the summation of every different value derived from its quality item. Because consumers have little knowledge of the high-end curtain component, the value of high-end curtain component is supposed to be as high as the value of low-end component. That is, the value that the curtain treatment comprised of high-end blind and high-end component offers is equal to the perceived value of the curtain treatment composed of high-end blind and low-end component. The value of low-end blind sold with the high-end curtain component is identical to the value of the low-end blind sold with the low-end curtain component. Table 4 exhibits the value of blinds, of curtain components and of different curtain treatments.

After we clearly defined the transaction unit of a curtain treatment, which is counted by the blind, the values of different curtain treatments, which are concluded in table 4, and the prices of different curtain treatments, which are discussed in table 2, the values of curtain treatments per dollar are summarized in table 5. Even when consumers have little knowledge of the value of the high-end curtain component, the

<table>
<thead>
<tr>
<th>Curtain Treatment</th>
<th>Low-End Blind</th>
<th>High-End Blind</th>
<th>Low-End Curtain Treatment</th>
<th>High-End Curtain Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-End Component</td>
<td>5,200</td>
<td>5,000</td>
<td>5,200</td>
<td>5,200</td>
</tr>
<tr>
<td>Low-End</td>
<td>1,200</td>
<td>1,000</td>
<td>Unknown</td>
<td>1,200</td>
</tr>
<tr>
<td>Relative Value</td>
<td>4.33</td>
<td>5</td>
<td>4.33</td>
<td>4.33</td>
</tr>
</tbody>
</table>

Monetary Unit of Nominal Price: New Taiwan Dollar
The Third Law of Demand: Revisit and Extension © Chu, Chih-Ning

High-end blind should be sold with the high-end curtain component because it creates the highest value of each dollar paid by consumers (0.93 > 0.75, according to table 5). This conclusion is consistent with the decipherment based on the perspective of relative price between competing products. As a result, if the product value is taken into consideration, no contradiction exists in the peculiar perspective and the relative price perspective between competing substitutes of different quality levels when the third law of demand is applied to explore the nature of the purchase behaviors of multiple quality products.

The analysis above, based on the value of each dollar paid by consumers, can also be applied to the single quality product in table 1 without any hurdle, and it makes table 1 as a special case of table 2. If both high-end and low-end grapes are competitive products, the relative price of the high-end and low-end grapes in California, where the grapes are planted, reflects their relative value, which is 2 to 1. When both high-end grapes and low-end grapes shipped to New York State, and new relative price between the high-end grape and low-end grape always makes consumers choose to buy high-end grape in New York State because the value of per unit of money, which is cent, is higher in high-end grape than in low-end grape (for example, 2/3 > 1/2). When we try to explore the product differentiation strategy based on the relative price between two single quality substitutes of different quality levels, we can also find that no value paradox exists in the conclusion of product differentiation strategy between the monetary perspective, when the product value is contemplated, and the relative price perspective.

Conclusion

In this paper, we delimit the boundary conditions of the third law of demand to competing substitutes of different quality content, investigating its theoretical implications and extend the theory to explain the demand decision of multiple quality products. We have several findings.

First, based on the concept of multiple feature product proposed by Lancaster (1966), the proxy quantity concept of multiple quality product and the proper evaluation way of multiple quantity product suggested by Cheung (2001), we found that the quality content of the multiple quality product can be leveraged as the pricing strategy of differentiating products of different quality levels in different market segments. Second, for creating the most competitive relative price, the third law of demand for

Table 5: The Values of Curtain Treatments Per Dollar if Consumers Have Little Information of the High-End Component

<table>
<thead>
<tr>
<th>Component</th>
<th>Low-End Component</th>
<th>High-End Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-End Blind</td>
<td>5,200/5,200 = 1</td>
<td>5,200/5,600 = 0.93</td>
</tr>
<tr>
<td>Low-End Blind</td>
<td>1,200/1,200 = 1</td>
<td>1,200/1,600 = 0.75</td>
</tr>
</tbody>
</table>

Monetary Unit of Nominal Price: New Taiwan Dollar
multiple quality product explains why most quality items are high-end in the high-end multiple quality product and most quality items are low-end in the low-end multiple quality product. For example, people always find and even expect the following fact. The facilities in five-star hotels should be better, or even luxurious, than the similar facilities in three-star hotels.

Third, when a high-end multiple quality product is sold in a high-end market segment, the higher the nominal price of the high-end multiple product, the higher its quantity demanded. In contrast, when the low-end product is sold in low-end market segment, compared to the high-end segment, the lower the sales price, the greater the quantity demanded. That is to say, given the market segment, the quantity demanded and the nominal price can be applied to infer whether a product, in comparison with its competing substitutes, is a high-end product or not.

For example, in average, the hotel rate of five-star hotels in New York City is obviously higher than the hotel rate of five-star hotels in Taipei City. The total number of five-star hotel rooms sold in New York City is also much greater than the number of five-star hotel rooms sold in Taipei City. Given this observation, although all hotels in both cities we are discussing here are five-star hotels, the five-star hotels in New York City can be ranked in higher level than the five-star hotels in Taipei City. Most leading hotel groups must know this fact. If they plan to serve more tourists by highest luxurious service and charge their guests the most expensive hotel rates to make tremendous profit, New York City, rather than Taipei City, is their target market segment.

Plenty of applications can be extended from this research. For example, the current microeconomic theory mainly focuses on the quantity decision problems. We are introducing a research approach to explore the nature of quality decision problems in economic theory. In past years, we find the third law of demand offers a theoretical support to the hedonic regression method, which is based on Lancaster’s revealed preference method of estimating demand or value, especially when different demands exist in different market segments. Some empirical researches based on open and proprietary data is doing (Chu, working paper), and the primary finding significantly supports our theory.

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