The Paternity of the Price-Quality "Value Map"

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THE PATERNITY OF THE PRICE-QUALITY "VALUE MAP"[†]

by

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ABSTRACT

In the literature on firm strategy and product differentiation, consumer price-quality trade-offs are sometimes represented using consumer "value maps". These involve the geometric representation of indifferent price and quality combinations as points along curves that are concave to the "quality" axis. In this paper, it is shown that the value map for price-quality tradeoffs may be derived from a Hicksian compensated demand curve for product quality. The paper provides the theoretical link between analytical methods employed in the existing literature on firm strategy and competitive advantage with the broader body of economic analysis.

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1 Introduction

Of central concern in the literature on firm strategy is the notion of "competitive advantage" (Porter, 1980): a firm is said to enjoy a "competitive advantage" when its profits are consistently greater than those of its rivals (Besanko, Dranove and Shanley, 2000). A large part of the strategy literature is concerned with the sources, creation and sustainability of such an advantage. These issues are central to a large, and growing literature, on entrepreneurship and strategic management. The purpose of this paper is to expose the theoretical basis for a conceptual device that is often central to analyses of these issues, *viz.* the consumer "value map".

A "value map" consists of indifference curves, drawn in price-quality space, that represent indifferent combinations of price and quality for a consumer (or a group of consumers whose preferences over quality and price are identical). Figure 1 presents an example of a "value map" for a consumer who, in this example, has quasilinear preferences over price and quality. Along each of these indifference curves:

$$\frac{\partial U_i / \partial L}{\partial U_i / \partial P} = 0 \qquad (1),$$

where L is quality, P is price, and U is utility. Thus consumer surplus and utility are invariant along each indifference curve. The marginal rate of substitution (MRS) of price for quality along an indifference curve may be derived, as for conventional indifference curves (drawn in quantity-quantity space), from its slope, i.e. as

$$MRS_{LP} = -\frac{\Delta P}{\Delta L} \qquad (2).$$

The MRS is negative in such cases because

$$\frac{\partial U}{\partial L} \geq 0 \qquad (3);$$

and,

$$\frac{\partial U}{\partial P} < 0 \qquad (4).$$

That is, "quality" is a good, while price is a bad: increases (decreases) in price must be compensated by increases (decreases) in quality in order to maintain condition (1). It also follows that:

$$U_0 > U_1 > U_2 \qquad (5).$$

In the literature on strategy, the value map is used to describe the development of a competitive advantage. This involves, *inter alia*, the production of a price-quality combination that provides greater consumer surplus than the imperfect substitutes of rivals.

Suppose that the indifference curves in Figure 2 now represent the (homogeneous) preferences of every individual for whom the product is a utility function argument. The loci L_X, P_X; L_Y, P_Y; and L_Z, P_Z, represent the price-quality combinations offered by profit-maximising firms *X*, *Y* and *Z*. Note that, although *Z*'s output is a higher-quality substitute for *X*'s, the combinations L_X, P_X and L_Z, P_Z are located on the same indifference curve, U_0. Thus, consumers are indifferent between the output produced by *X* and *Z*, given their prices.[1] However, consumers are not indifferent between *Y*'s price-quality combination and those of rivals (*X* and *Z*): L_Y, P_Y provides greater consumer surplus than either of the substitutes, as indicated by its position on a lower indifference curve, U_1.

In a monopolistically competitive market, competition on price and quality will continue until a price-quality equilibrium is reached. Briefly, assume that the cost function is

$$C = C(L) \qquad (6),$$

[1] In the strategy literature, Firms *X* and *Z* are said to have achieved "surplus parity".

where C is cost and $\frac{\partial C}{\partial L} > 0$. The curve C_0=min[$C(L)$], in Figure 2, is the efficiency frontier for quality production: it depicts the least-cost production of each level of quality. The quality equilibrium in Figure 2 occurs at the tangency of U_2 and C_0 with the production L_Y at the price P_Y. At this point, there is zero opportunity to increase profit by modifying the price-quality combination offered, since $\frac{\partial C_E}{\partial L_E} = \frac{\partial P_E}{\partial L_E}$ and C_E=min[$C(L_E)$]. Note that, by assumption, firm Y currently enjoys some monopoly power, since $P_Y > C_Y$.[2]

2 The Derivation of the Value Map

It can be shown that the consumer's price-quality indifference curves can be derived from a Hicksian compensated demand (HCD) curve for product quality. Conversely, the HCD can be derived from the price-quality value map.

Consider consumer trade-offs between product quality (L) and quantity (T), where $\frac{\partial U}{\partial L} \geq 0$ and $\frac{\partial U}{\partial T} \geq 0$. More generally, one might invoke Lancaster's (1966a, 1966b) approach to consider product characteristics, or bundles of these, that are utility-producing. In this way, one could, for example, focus on consumer indifference between quantities of **a particular product characteristic**, and the quantities of the product, *per se*. For example, one could consider trade-offs between the quantity of meat consumed, and the quality of meat, as measured by reductions in its fat content, *ceteris paribus.*

Insofar as it is recognised that variations in "quality" *per se* can arise due to variations in more than one characteristic of a good, the analysis becomes more

[2] A further implication is that of constant-returns to scale: firm Y is on the efficiency frontier C_0 despite

complicated. For example, using the example of meat, reductions in the quantities per kilogram (kg) both of fat and/or of gristle, *ceteris paribus*, may be responsible for "quality-improvements" in the product. Furthermore, if both gristle and fat are bads, consumers might be indifferent between various combinations of these.

Figure 3 presents indifference curves in quantity-quantity space for these two characteristics of meat that, for the consumer preferences represented, are "bads".[3] That is, $\frac{\partial U}{\partial F} < 0$, and $\frac{\partial U}{\partial G} < 0$, where F is the quantity of fat per kg, and G is the quantity of gristle per kg. In Figure 3, indifference curves closer to the origin represent higher levels of utility: at the origin, there is a zero quantity of each bad, while north-east movements represent increasing quantities of one or both bads.[4] Supposing gristle and fat are the only two characteristics of meat that affect quality, it may thus be said that each bad-bad combination on a single indifference curve indicates meats that are considered of identical quality by the consumer. Thus, the indifference curves in Figure 3 provide, at least conceptually, the basis for deriving a quality index.

Thus, one need not be constrained, conceptually, by the multi-characteristic nature of quality for meat, or any other product. The analyses developed in the following diagrams do not demand cardinal measures of "quality": all that is necessary is that consumers be able to rank, completely, bundles of different quality, *ceteris paribus.*

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its monopoly profiit.

[3] Here it is acknoweldged that quality, like beauty, is "in the eye of the beholder". For this consumer, in the range depicted, reductions in fat and gristle are utility-increasing. In reality, reductions in fat may also reduce the tenderness of meat so, for some consumers, reductions in fat (over some range) will likely be utility-reducing.

[4] Note that the axes of Figure 3 will be constrained by the fact that the maximum quantity of fat or gristle per kg of meat is 1kg.

It is convenient to return now, to the notion of "quality" as a single characteristic. Consider Figure 4, in which the consumer's budget line is indicated, in quality-quantity space, by the line 1-2. This budget line represents all quality-quantity combinations of good *X* available to the consumer. The consumer's preferences over quality and quantity are assumed to be well-behaved (i.e., reflexive, complete, transitive, continuous, convex and non-satiable) and preferences over the quality and quantity of *X* are given by the indifference curves I_0, and I_1. The initial utility-maximising bundle, given the budget 1-2, involves the consumption of T_A of the commodity at quality L_A.

Now, suppose that the price of "quality" falls *ceteris paribus*, and the budget line pivots to 1-3. The price effect is L_B-L_A. Taking the equivalent variation (4-5), the substitution effect is L_C-L_B and the income effect is L_B-L_C. Figure 4(b) presents a Hicksian (income-) compensated demand curve (*HD*) for quality, derived from Figure 4(a). This compensated demand curve may now be used to derive a price-quality indifference curve for the consumer.

Figure 5(a) presents the Hicksian demand curve derived in Figure 4 and, together with Figure 5(b), the derivation of the price-quality indifference curve, U_0, is indicated. The derivation of U_0 may be understood by commencing with the observation that the Hicksian demand curve, *HD*, is the consumer's marginal benefit curve for quality when real income is held constant. Expressed differently, *HD* describes the consumer's willingness to pay for marginal increments in product quality. At this point, it is perhaps useful to think of the case of perfect first-degree price discrimination and its consequences in terms of consumer surplus: if first-degree price discrimination were practised along *HD*, consumer's surplus (CS) is zero for all *L*.

An element of the consumer's value map may has now been derived: indifference curve U_0 is the consumer's price-quality indifference curve for CS=0. Thus, U_0 is, in fact, the consumer's total benefit curve for quality, derived from *HD*. A noteworthy reference point in this diagram occurs at quality L_{MAX}, where the marginal benefit of quality improvements is zero. Since $\frac{\partial U}{\partial L} = 0$ for all $L>L_{MAX}$, it follows that $\frac{\partial P}{\partial L} = 0$ for U_0 all $L>L_{MAX}$.

Indifference curve U_0 has an important meaning that may be understood by recalling the elements of Figure 4(a) from which U_0 was derived. Specifically, U_0 was derived by varying the relative prices of quality and quantity along I_0 from the equilibrium point *A*, where 1-2 was exhausted. If the budget constraint and relative prices implicit in 1-2 apply, it follows that L_A, P_A in Figure 4 is the utility-maximising quality-price combination for this consumer. All price-quality combinations for $L<L_A$ on U_0 are affordable to the consumer, however, the relative prices implicit in 1-2 indicate that qualities $L<L_A$ are available only at $P>P(U_0)$. Price-quality combinations $L>L_A$ on U_0 are, on the other hand, not affordable to this consumer. In terms of the consumer's current real income then, U_0 represents the maximum total benefit available to the consumer from the consumption of various qualities of good *X*. Points on indifference curves above U_0 represent combinations of price and quality that would only be available to the consumer if real income were increased.

It is then a straightforward matter to derive the remainder of the consumer's "value map". The derivation of indifference curves (geometrically) lower than U_0 merely involves starting with a real income less than I_0 in Figure 3, while the derivation of (geometrically) higher indifference curves involves commencing with real incomes greater than I_0. For the analysis of consumer welfare in this framework,

consumers located on successively lower indifference curves than U_0 enjoy successively higher levels of consumer surplus

3 Conclusion

This paper links a conceptual approach referred to in the strategy literature as "value map analysis", to other tools of consumer theory, including the Hicksian compensated demand curve. The paper shows that the price-quality indifference curves employed in the literature are, in fact, total benefit curves for quality, and may be derived from the Hicksian-compensated demand curve for product quality. The analysis may also be applied to consider consumer preferences over price and a single quality-affecting characteristic of a commodity, or via a quality index derived from a bundle of product characteristics. This paper provides the foundation for analytical methods that are presently being used, without a substructure, in the economic literature.

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FIGURE 1
PRODUCT DIFFERENTIATION AND EQUILIBRIUM

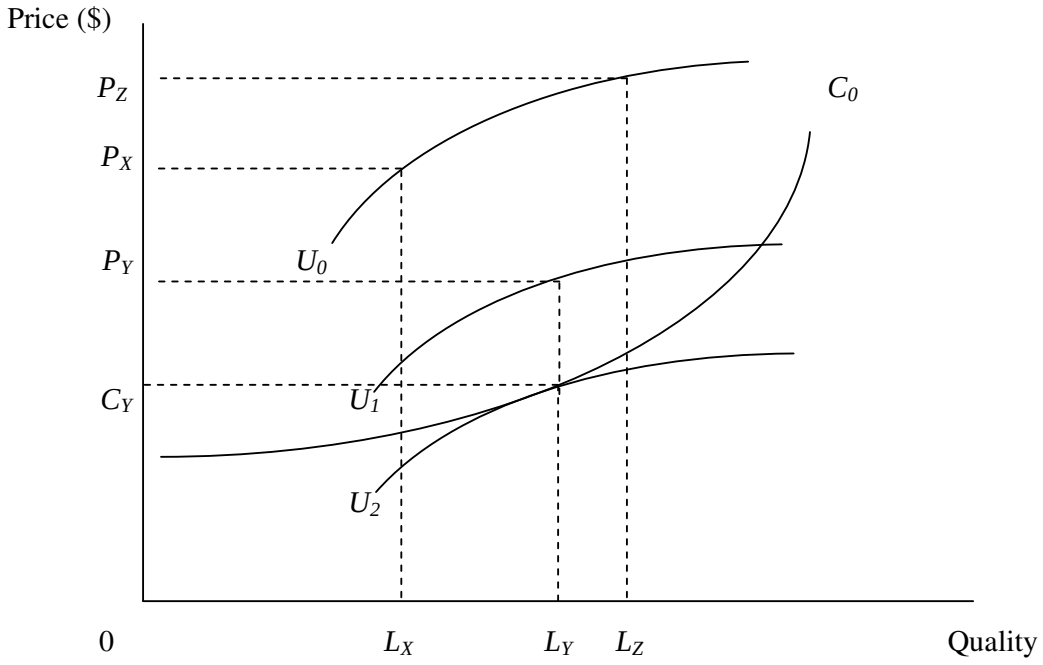


FIGURE 2
THE CASE OF TWO "BADS" IN CONSUMPTION

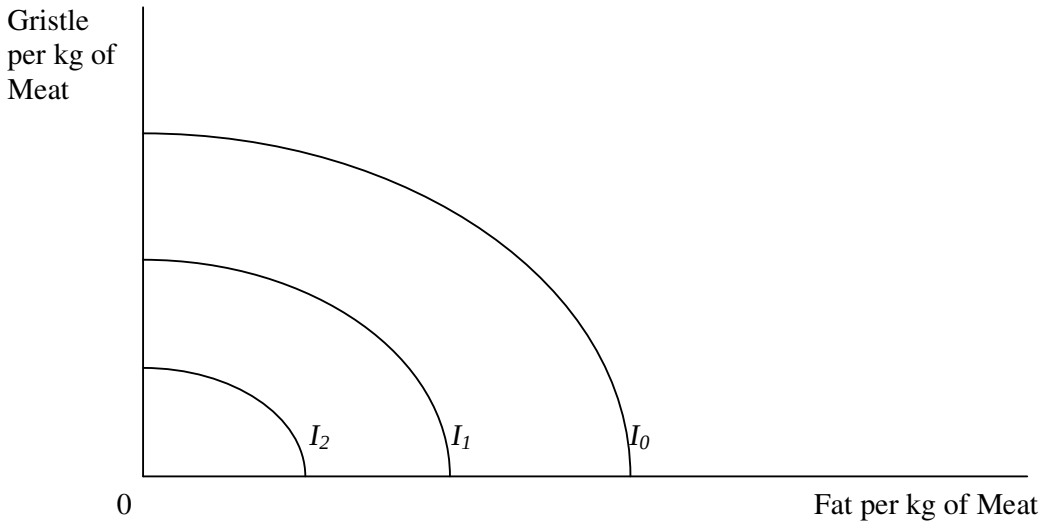
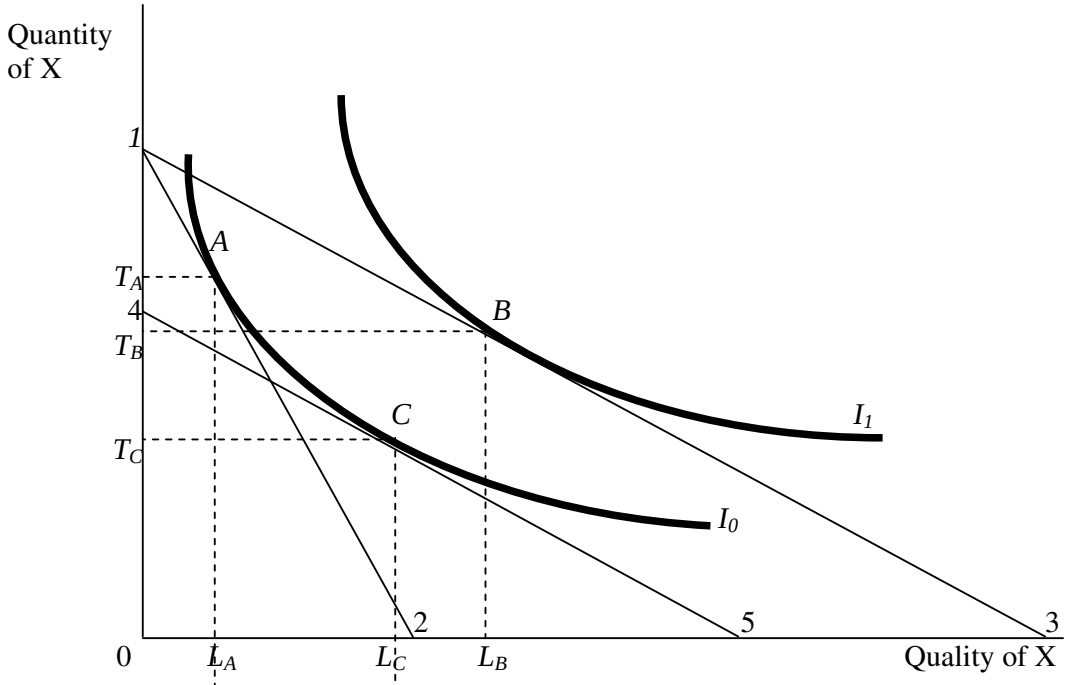
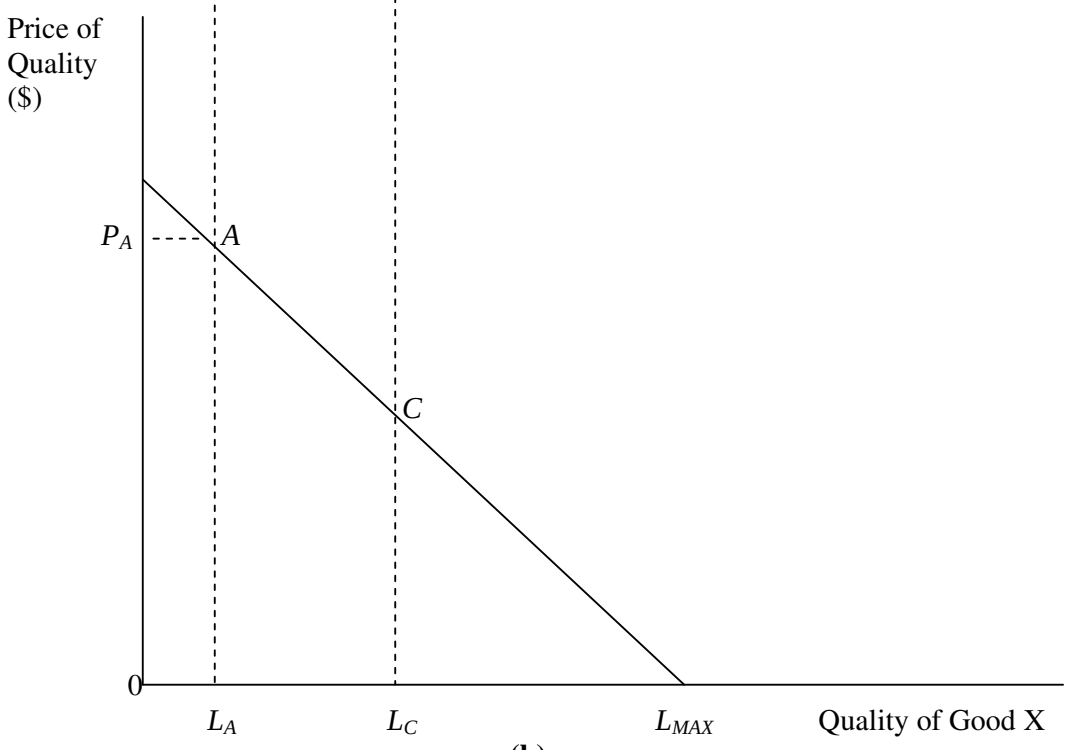


FIGURE 3
DERIVATION OF A HICKSIAN COMPENSATED DEMAND CURVE FOR THE QUALITY OF GOOD X



(a)



(b)

FIGURE 4
DERIVATION OF CONSUMER A's INDIFFERENCE CURVE FOR PRICE AND QUALITY OF GOOD X