THE CONCEPTUAL BASIS OF
QUALITY IN MARKETING

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ABSTRACT

Theories of quality based directly on the assumption of rational economic man are important in marketing, and many alternative theories are influenced by it. It is shown that the fundamental assumptions common to these theories of quality are false, contrary to observed reality, in nearly all real situations. They are not simplifications of reality. This is true of assumptions on preferences and supply. Assumptions on objectivity of quality characteristics limit the application of the theory to a few possible cases. The possible application of the theories is further limited by extremely restrictive boundary assumptions. Further restrictions imposed by ad hoc assumptions effectively rule out any possibility that any situation exists where the assumptions apply, even as a simplification.

Conceptual and logical errors in the analysis arise from a confusion between the theory appropriate to choice between distinct goods, and that appropriate to choice between similar goods or product lines, differing in characteristics competition. Conceptual errors in the use of "characteristics space" are fatal to the theory.

The normal process of testing theories by their predictions is shown to be impossible for these theories. For instance, it is not possible to know that the assumptions of the theory hold in any situation, so a poor prediction may be ascribed to the assumptions not holding, rather than to logical or conceptual weaknesses in the theory. There has been no series of tests designed to "validate", "verify" or "add corroboration to" any one of these rational economic man theories.

This combination of weaknessesis shown to be fatal under five epistemological standpoints.

INTRODUCTION

In its early days, up to the 1970s or 1980s Marketing Science was an emerging science and borrowed tools and theory from other disciplines, including economics. It was assumed that if these were accepted by the established sciences they were valid. Many of these tools are still used today. More important, most of the tools and theory developed in marketing since then draw heavily on the basic concepts, assumptions and analysis of these imported tools and theory - even when they were developed as alternative approaches. Today we are no longer an emerging science, accepting that the older sciences know better, so we must ask whether these basic concepts, assumptions and analysis which underly so much of our theory are valid. Would the marketing scientists of today use them if they were building up the subject from first principles?

One influential group of theories of quality is based on the economist's concept of a perfectly rational "economic man" who has perfect knowledge of prices and qualities, making optimal choices between goods on the basis of their objective characteristics. These rational economic man (REM) theories are important in marketing and marketing economics and are dominant in mainstream economics. Their concepts also underlie many of the alternative

theories used in marketing which are apparently based on other assumptions. There are now well over 10,000 papers in the REM literature, all of which depend crucially on the basic concepts set out by Lancaster (1966, 1971, 1979),[1] Rosen (1974), Houthakker (1952), Thiel (1952) and Brems (1948, 1957). While the theories share similar fundamental concepts, they develop in very different directions.

In this paper it is shown that REM theories are fundamentally flawed, at a basic level common to all or nearly all theory based on REM. The analysis concentrates on the books and papers that set out the fundamental concepts of the theory, particularly Lancaster who rigorously and clearly laid down the formal foundations of the theory. He is by far the most cited person writing on quality and his 1966 paper is one of the most cited in economics as a whole.

The flaws identified here include: 1) the fundamental assumptions are not simplifications of reality - they conflict with it; 2) the boundary assumptions rule out most real-life situations; 3) the ad hoc assumptions rule out any other real life application; 4) there are major logical and conceptual errors in the analysis; 5) it is formally impossible to test the predictions of the theory under most epistemologies; 6) no attempt has been made to test the predictions under other epistemologies. Several different epistemological rationales for rejecting a theory are used in marketing, some of which are relatively tolerant of unrealistic assumptions and incorrect logic, but it will be shown that the flaws identified are fatal under all of them.

This paper does not present an alternative theory of quality. This would be naïve in view of the limited space available and the wide range of alternative theories available in marketing, such as the hedonic approach, compensatory models, perceived quality, behavioural, behaviourist and heuristics approaches, and in marketing economics (see Bowbrick 1992; Earl, 1986). One may weed the garden without first breeding a new hybrid chrysanthemum.

FUNDAMENTAL ASSUMPTIONS

The fundamental assumptions are ones on which all REM analyses are based. If they are dropped, or changed, none of the seminal papers can proceed to the second stage of analysis. The state of the art papers which base a long, complex analysis on established REM theory are even more susceptible, as a very small change in fundamental assumptions will invalidate the analysis - "for the want of a nail, a kingdom was lost".

The common fundamental assumptions that will be discussed here are on consumer preferences, characteristics space, supply price and objectivity. The boundary assumptions and ad hoc assumptions which determine the way different theories develop from the set of shared common assumptions are discussed in later sections.

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[1] Gorman (1956), Becker (1965), Muth (1966) and Ironmonger (1972) presented similar theory but it was not as fully developed and has been less influential.

Under nearly all epistemological approaches to marketing, theory should be realistic and non trivial. Some simplification is unavoidable and indeed desirable, but the assumptions should still be realistic. An infinite number of possible theories can be generated using unrealistic or trivial assumptions, but few people would argue that these have any place in marketing theory. It will be shown here that the fundamental assumptions of REM theory are contrary to observed fact, and are not applicable to any product in any market.

Assumptions can be "wrong" if they contradict each other or if, as Lancaster admits of his 1975 paper, they rule out all possible reality.

Assumptions on Consumer Preferences
The terminology used in REM theory is usually that a good may be defined as a unique mix of characteristics. A unique blend of after-dinner coffee is a good, while coffee is a group of goods. The characteristics are the objective properties of goods, while the subjective properties, which exist in the mind of the consumer, are attributes.
The fundamental assumptions were made in order that the indifference curve between two characteristics would be of the shape of the indifference curves between two goods in textbooks (Figure 1). The formal basis of the REM theories is set out by Lancaster (1966, 1971). He shows that in order to be able to proceed using this curve, in order "that the consumer's preferences can be expressed in terms of an ordinal utility function of the neo-classical kind, with its first order partial derivatives positive", it is necessary to assume transitivity, completeness, continuity, strict convexity, non-satiation and all characteristics positively desired. These assumptions are fundamental: without them there is no REM theory.

The concept is wrong. An analysis based on indifference curves between <u>two different goods</u> cannot be identical to an analysis based on indifference curves between <u>two</u> <u>characteristics of the same good</u>. The goods can be bought separately and consumed separately, milk and shirts for instance, while the characteristics of a good are necessarily bought together and usually consumed together, the toffee and the flavouring in a sweet for instance. The characteristics come together in a good and the consumer cannot alter the proportions in that good, only buy another good or set of goods.

One extreme case, the most favourable to REM theory, is one where the consumer values each characteristic, but the utility obtained from one is independent of the utility obtained from another, or from the level of the other. The usual assumption is made that there is first increasing, then constant, then declining marginal utility as the level of the characteristic rises. However, the preference map and indifference curves that would arise with these assumptions are shown in Table 1. When marginal utility is rising, consumers prefer to spend all their money on one characteristic or the other, so the indifference curve is concave - contrary to the fundamental assumption. The indifference curves become convex, then concave again, as the marginal utility declines and then becomes negative. The maximum utility is shown by a bull's eye. The consumer can move to different points on this surface by buying different goods, which is the only way to buy different characteristic mixes. These

indifference curves are totally unlike the REM indifference curves of Figure 1. It is only possible to get indifference curves like those in Figure 1 by assuming there is always a <u>declining but positive</u> marginal utility for each characteristic, an extraordinarily restrictive and unrealistic assumption.

In general this assumption, that the consumer values characteristics independently, is untenable. The value a consumer puts on the level of chocolate in an ice cream is not independent of the amount of sugar; the value a consumer puts on the power of an automobile is not independent of the efficiency of the braking system, or its road-holding ability. In general, therefore, the utility obtained from one characteristic depends on the levels of others, and ratios and proportions are important. Figure 2 gives the example of orange juice, showing an individual's preferences for mixes (goods) containing different levels of sugar and acid. A juice with a low acid content is perceived as bland, one with a high acid content as sour. Similarly, too much sugar is as bad as too little. This consumer prefers to buy a carton with medium acid, medium sugar levels, a point at the centre of the bull's eye. The consumer certainly does not want to drink the orange juice with the maximum amount of sugar and acid, though this is what the REM theory assumptions imply. Clearly, the fundamental assumptions of strict convexity, non-satiation, and all characteristics positively demanded do not apply here.

The fundamental assumptions do not hold for many other types of product. Figure 3 shows the indifference curve for sugar and acid in another product. This individual has two utility peaks, one for a medium-sweet, medium-acid dessert apple, one for a very sweet, very acid cooking apple (a Bramley for instance). The curves do not meet any of the fundamental assumptions of transitivity, convexity, all characteristics positively desired. The REM characteristics approach fails here, though one of the chief claims made for it is that it avoids the problems of different end uses, different perceptions etc. which cause problems with some alternative theory. Multiple peaks like this do not arise out of the perceptions of a few eccentrics. They are common and many arise out of the laws of physics. For example the utility from a superconductor depends on the highest temperature at which superconductivity is achieved, and Figure 4 (from Emsley 1990) shows two peaks. Again, when two musical notes are the characteristics of a chord, the maximum utility is where they are identical or an octave apart. The discords in between give less utility.

Empirical work in marketing also produces results that conflict with the fundamental assumptions of REM theory. Huber (1974) plotted an individual's preferences for levels of tea and sugar in a cup, in an experiment where the lemon and the colour of the "tea" were kept constant (Figure 5). The individual whose preferences are shown here prefers a brown liquid with five spoonfuls of sugar and, over a wide range, is indifferent to the amount of tea in it.

All products are subject to contamination. Fuel, oil or insecticides, which are valuable products when pure, are contaminants when they are characteristics of orange juice. Orange juice with more than a very small amount of diesel oil cannot be sold, and diesel oil with more than a very small amount of orange juice cannot be sold. It is not possible for a

consumer to buy a bottle of orange juice and somehow separate out the contaminants before drinking it. Figure 7 shows this: the diagonal is the product possibility curve, 100% of the contents of the bottle. For those products for which no contamination is acceptable, the indifference curve consists of points on the axis. For other products, where some contamination is possible, the indifference curves consist of points on the product possibility curve (Figure 8).[2]

In fact, all products may be contaminated, so individuals must have indifference curves like this for all goods. The fundamental assumption of REM theory is that individuals do not have indifference curves like this for any goods and characteristics. The REM theory cannot even get to step one, optimum consumer choice, if indifference curves like this exist.

The shapes of indifference curves can be changed by changing the definitions of the characteristics, talking of sweetness or fructose content instead of sugar content, but there is a danger of introducing subjective attributes here instead of the objective characteristics required by REM theory.

The fundamental assumptions of REM theory are, therefore, false. They run counter to observed reality and they are not in any way simplifications of reality:
- For any pair of characteristics it is unlikely that the indifference curve will be like that in Figure 1. It is very unlikely indeed that it will be of this shape for all pairs of characteristics of any good.
- For many pairs of characteristics, different, often complex, indifference curves exist.
- All goods may have their value reduced by contamination, and will have some curves like those in Figures 7 and 8.

It follows that no good has all indifference curves between all pairs of characteristics or even most curves of the shape shown in Figure 1. Since REM theory cannot reach even the first paradigm cases unless they do, it has no application.

Fundamental Assumptions on Characteristics Space

The fundamental assumptions of REM theory and the logical analysis from them are fatally flawed by a conceptual error. All the curves and the analysis are in a single "characteristic space", defined by axes in the form "[Level of] Characteristic A" and "[Level of] Characteristic B".

Reality demands many more characteristics spaces, and the shape of an indifference curve is very different depending on which space it is plotted in. There is one space for the level of characteristics in a stew, another for the level of characteristics in ice cream, another for the level of the characteristics in a meal and another for level of the characteristics in one's diet. Much of basic REM theory is based on an individual's preference for characteristics (vanilla flavouring, white-wall tires for instance) in total consumption, though I am not aware of any

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[2] Bowbrick (1992, 1996 forthcoming) examines the complex shapes that may arise from these analyses.

empirical evidence to suggest that people do have concepts of the optimum level of such characteristics in total consumption. Figures 9a and 9b show indifference curves for two common characteristics, sugar and chilli powder in two common products, showing how the shapes change when they are plotted in different characteristics spaces.

In practice REM theorists use different characteristics spaces interchangeably, without realizing they are moving from one to the other. Lancaster, for example, uses well over a dozen: -

1.   Total amount of characteristic in total consumption.
2.   Total amount of characteristic in diet (1971 p17).
3.   Total amount of characteristic in one unit of a good, an automobile (1971 pp157-174).
4.   'Cleaning power per dollar' for detergent (1966 p153).
5.   Level of characteristic obtained from one or more goods within a group of goods, but not obtained from other goods. (especially 1971 pp 125-139)
6.   Characteristics per unit of a good (1979 p28).
7   A 'normalized' characteristic, defined such that all consumers have the same efficiency frontier - his second paradigm case. This may however be built on any of the above - characteristics in total consumption, an automobile, unit quantity of a good etc. While Lancaster does attempt to present 'normalized' curves in the 'characteristics in total consumption' space, most of his followers present identical diagrams in an explicitly different space '[normalized] level of characteristic [in total consumption] per dollar'. The conversion of the analysis to the second paradigm case of 'normalized' preference and supply is only possible when the boundary assumptions of linearity, additivity, perfect knowledge, etc. apply (see below). No consideration has been given by anyone to the problems of 'normalizing' curves in the other characteristics spaces mentioned.

Fundamental Assumptions on Supply

The supply assumptions of REM theory are also fundamental, in that one cannot reach the first paradigm case without them. The assumptions apply to <u>all</u> supply functions for <u>all</u> characteristics. Here it will be shown that there are few products for which the assumptions hold for even a few characteristics. This confirms the conclusion of previous sections that REM theory conflicts with reality.

In traditional analysis it was reasonable to assume that it is always possible to get more of a <u>good</u> by paying more, and that each <u>good</u> has a positive price. This assumption is carried through to the REM theory of quality. It is assumed that it is always possible to buy a good with more of a <u>characteristic</u> by paying more, and that all characteristics are always positively priced. A look at real goods will show that this is not normally the case.

In REM theory, it is also assumed that prices of characteristics are not affected by market demand. It is assumed that the characteristics sugar and acid in orange juice are necessarily positively priced, regardless of consumer demand, so very sweet, very acid orange juices are

always the most expensive. Figure 10, however, shows what market prices may exist. The medium sweet, medium acid orange juices are the most popular on the market, so they fetch the highest price, and the constant outlay curves form a bull's eye around this point.[3] The juices that are more or less acid are on lower constant outlay curves. Such supply functions, though common, conflict with REM theory assumptions.

The indifference curves shown in this figure are those of an individual who prefers a slightly sweeter, more acid orange juice than most people. The optimum choice is then where the indifference curves are <u>concave</u> to the origin, not convex, and there may be a trade off between quality and quantity. REM theory requires on the other hand that the consumer always buys the most acid, sweetest good, and that indifference curves are always <u>convex</u> to the origin.

Short term aggregate demand strongly influences prices in price taking markets, so in these markets preferences like those in Figures 2 to 8 will produce supply functions very different to those of REM theory. In price making markets costs of characteristics may influence costs of goods more directly for goods such as those where the ingredients of a good are its characteristics, but not those many goods where there is no direct relationship between ingredients and quality characteristics - most industrial and agricultural goods for instance. However, a price making market cannot operate under the REM assumptions of perfect knowledge of level of objective characteristics and no confusing subjective properties like brand images and cues.

Figure 10 also demonstrates that it is not possible to plot an individual's indifference curve by observing his or her purchases, even if a good has only two characteristics. A very large number of purchases would have to be observed in a carefully designed test situation, with the prices of goods varied and all other prices held constant. In practice it is seldom that anyone makes a dozen directly comparable purchases of anything in a year - and the theory is based on the behaviour of individuals, not on aggregate market demand.

Fundamental Assumptions on Subjective or Objective Quality
REM theories are presented as a way of analysing quality using only the objective characteristics of goods. The major attraction of this approach is that is avoids the complexities of theories which take into account variations in perceptions and psychology, and it avoids the necessity for expensive studies into how consumers perceive and value the product. The fundamental assumptions of most REM approaches are that (i) consumers base their choices solely on objective characteristics; (ii) all individuals base their choices on the same set of characteristics; (iii) all individuals perceive the characteristics identically; (iv)

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[3] Diluting the orange juice to bring a medium-acid medium-sweet product also dilutes all the other characteristics that give it its flavour, its texture and its quiddity "orange juiciness". For some product economies of scale in production or distribution means that prices are lowest for the most popular mix. The mixes (ie "goods") that appeal to a few people may be marketed, expensively, through delicatessens.

individuals may value these characteristics differently. Subjective attributes are explicitly assumed away, and non-measurable characteristics may also be.[4]   (Lancaster, 1979 p18)[5]

These fundamental assumptions conflict with the accumulated experience of marketing and market economics. They also conflict with much of economics - the economics of information, the economics of advertising, the theory of monopolistic competition etc.

It is possible to have theory based on totally different assumptions. For example, it may be argued that quality is in the mind of the consumer, and that a consumer values a good purely for those qualities he or she attributes to it. The choices are never made on characteristics, always on these attributes. The attributes may be quite independent of any characteristics. If there is a relationship, then it will be a complex one, because of advertising, brand image etc. The consumers may or may not be able to perceive the objective characteristics, and if they do, they may or may not use them as proxies or cues for attributes. Much of marketing is consistent with this.

Hedonic theory too, does not require the REM assumptions. One version is "I, the researcher, subjectively perceive that the goods in this market have the objective characteristics A, B, C, D, ... which are relevant to consumer choice. Regressions show that goods with higher levels of characteristics A, B and C get a higher price. It is my hypothesis that if the marginal producer increases the level of these characteristics he or she will get a higher price." In this formulation decisions need not be made on characteristics, but the characteristics may be cues.

Hedonic analysis can avoid objective characteristics entirely: "Market research has shown that consumers think that the goods in this market have W, X, Y & Z attributes. The goods to which they think have the highest levels of these attributes get the highest prices. It is my hypothesis that if the marginal producer can increase the level of these attributes in his or her product, possibly by advertising or by changed manufacturing specifications, the price achieved will be higher",[6]

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[4]   'The characteristics which appear in the analysis are assumed to be objectively quantifiable, as well as objectively identifiable, even though there are important characteristics (color for example) that do not fit this specification. Although color can be objectively <u>defined</u> by primary color composition and degree of saturation, color differences cannot be put on a simple scale like size or horsepower or vitamin C content so that everyone agrees that good A has twice as much per pound as good B.'

[5]   (Lancaster, 1979 p18)

[6] Most of the specification errors discussed in this paper may also arise with hedonic theory. However, one advantage of using attributes in this way is that an attribute like "fashionable" "safe" or "comfortable" may often be thought of in a way that is linearly related to utility, where characteristics are not.

Since subjective attributes and perceptions are so important in marketing and much of economics, it may be asked whether they can be introduced to REM theories of quality. Lancaster was emphatic that they could not be:

> "If individuals were to "see" the same goods in fundamentally different ways, there would be little point in devising an analysis to take account of the objective properties of goods. For them either it is meaningless to speak of "objective" properties, or those properties which are objective are irrelevant to people's relationship to goods." (Lancaster, 1971, p6).

REM theory cannot work unless it is possible to plot every individual's indifference curves and price curves between the same axes, in the same "characteristics space", and unless every individual faces the identical supply prices. If individuals perceive a good differently, so that they have to plot it on a different set of axes, the analysis cannot begin. This may happen generally, if each considers a different set of characteristics to be important. It may also arise from perceptions, if people perceive nonexistent characteristics like "lucky", "dietary fibre in meat", "a miracle ingredient" or if they are not aware of "objectively important" factors like the pesticide residues in food. Once attributes are admitted to the analysis, it becomes unlikely that all consumers will judge a dress, for instance, by the same set of characteristics: well-cut, fashionable, suitable for the office, washes well, flattering to my figure, my mother would not approve, for instance. Still less would there be any agreement on the level of these attributes. This means first, that it is not possible to plot different people's preferences or prices on the same set of axes, as they each have a different set of attributes for axes. Second, even where some consumers have the same set of axes, one dress would occupy a different position in each customer's diagram, because each perceives it differently. Prices would be affected in the same way.

Even with the situation where all individuals value the same set of characteristics for a good, and perceive them perfectly - a heroic assumption - it may not be possible for them to plot it in the same characteristics space. Consumers may all value the power of an automobile, but some will conceive of this in terms of acceleration from a red light, others in terms of cruising speed, ability to pull a trailer, horse power, engine capacity, top speed etc.

Subjectivity implies that individuals do not perceive characteristics correctly. In principle, an individual might be able to plot his or her own preferences against subjective axes like "My perception of Level of Characteristic A in ice cream" (Though experience suggests that this is not possible in practice). However, this plotting could not be transferred into another space like "John Doe's perception of Level of Characteristic A in ice cream". One good (a unique mix of characteristics) would be in different positions in each diagram, and budget and price lines certainly would be. The curves also ignore factors considered important in marketing, like strength of belief in the existence and level of characteristics and risk. Conceivably, a researcher could replot the individual's preferences against axes reflecting his or her own attributes, though this would be very difficult and expensive, requiring that the researcher is able to identify and evaluate each good on each individual's indifference surface. Again, it is

difficult to believe that this is possible in practice. If the individuals had drawn indifference curves with any of the smooth shapes of Figures 1-8, the curves would be jagged and strange when replotted. For instance if a consumer believes Brand X is twice as good as Brand Y while the researcher thinks they are identical, the same good is on two entirely different indifference curves.

It is claimed that characteristics-based REM theories have the special advantage over other quality theories that they permit analysis based only on changes in a good's objective characteristics (changes in production specifications, for instance), and can ignore perception, belief and so on. However, it is well recognized that it is easy to change the utility obtained from a good without changing its attributes, by advertising for instance, and it is also possible to change the production specifications of a good without changing the utility it produces.

Lancaster is clearly correct in his view that if subjectivity is allowed to enter REM theories of quality, they collapse. With subjectivity, the simple paradigm cases of comparing decisions of different individuals are no longer possible. However, since few researchers, including proponents of REM theory, find it possible to work without allowing for subjective elements, it must be concluded that the theory has limited practical application.

BOUNDARY ASSUMPTIONS
While the fundamental assumptions apply to all REM theory, the boundary assumptions limit the application of each branch of the theory, so Rosen's theory applies within one set of boundaries, Thiel's in another and so on, and each develops differently. Confusion is caused because they are seldom spelt out formally and explicitly. Again Lancaster is the exception, and this rigour explains why his theory is dominant. He assumes, among other things, that

1. A consumer gets the same satisfaction from a characteristic whatever good it is part of. A gram of chilli powder gives the same satisfaction whether it is in chilli con carne, it is in ice cream or it is eaten by itself.
2. Any goods can be consumed together and it is the combination of characteristics in total consumption that determines the satisfaction required.

The optimization and aggregation procedures can only work where these assumptions apply. The assumptions limit the possible application of his theory to a very few goods, essentially to a simplified version of the least-cost chicken feed problem from which his theory evolved.

Hendler (1975), Ladd & Zober (1977) and Lucas (1975) made powerful criticisms of this theory for its over-restrictive boundary assumptions. It is worrying that only 1.5% of the people, citing Lancaster in recent years also cited these critics.

AD HOC ASSUMPTIONS
Ad hoc assumptions usually introduce a new constraint or a mathematically convenient relationship. They are made purely because the theory will not work with just the fundamental and boundary restrictions and restrict the application still further (Popper 1972, pp15-16; 1976, pp40, 42). They are unrealistic and should not be confused with the realistic

assumptions needed to turn a simplified theory into a situation-specific model. Nor should they be confused with simplifying assumptions. Each explicit ad hoc assumption introduces implicit ones, with an ever increasing risk that they will be contradictory, making the theory meaningless. Each additional ad hoc assumption reduces the possible application of the theory as a whole.

Few theorists attempt to make their ad hoc assumptions explicit, and it is common practice to take the conclusions of a previous author and proceed with the analysis without mentioning the ad hoc assumptions necessary to reach these conclusions and proceeding to introduce new, possibly contradictory, ad hoc assumptions. Again Lancaster is the exception: In Consumer Demand 1971 he made some 63 explicit assumptions, at least 40 of which are ad hoc. Some examples are:

- When one is dealing with a group of closely related goods, all other goods may be treated as equally close substitutes for this group (Lancaster 1971 pp128-9). [He uses "goods" in the sense of a single product line.]

- There is a uniform distribution of income so that average income is constant over preferences and there is a rectangular distribution of preferences, with constant density taken to be unity (Lancaster 1971 p79).

- The consumption technology is linear, after ignoring invariant characteristics, and a characteristic is irrelevant if there is a linear dependence in the technology (Lancaster 1971 p142).

- "The most heroic assumption is the *uniformity assumption* on the nature and distribution of preferences". "In geometric terms it implies that the transformed indifference curves in specification-quantity space are all of identical shape and are tangent to the [Product Differentiation Curve] at the specification corresponding to the most-preferred good" (Lancaster, 1979, p.47).

There are also powerful ceteris paribus assumptions. These are useful at some stage in the analysis, but if they are not dropped they are no more than ad hoc assumptions.

It will be noted that there is no way of verifying that most of these assumptions hold in any particular case, though it may be easy to show that they do not. Formally, they are similar to assumptions about how many angels can dance on the end of a pin.

Surprisingly, on the basis of these and a further set of ad hoc assumptions, Lancaster felt it possible to draw a wide range of conclusions on `welfare, variety and the GNP', `intra industry trade between identical economies', `variety in capital goods', `the optimal division

of labour', and `variety and economic development' in the final chapters of <u>Variety, Welfare and Efficiency</u> (1979).

Two Stage Models

Lancaster (1966) presents a two-stage model which was abandoned as unworkable in his later work. It requires a large number of further restrictive assumptions. For example it assumes that all individuals perceive the same characteristics from the food bought in any market basket, regardless of which combination of many possible meals is prepared from it and regardless of who cooks them.

HEDONIC PRICES

In the preceding sections reference has been made to hedonic analysis which goes back to Waugh (1928) and which is market based, not REM based. This was established 35 years before most REM theory and is logically independent of it. Nevertheless Rosen (1974) is an attempt to justify Waugh from a REM standpoint and Lancaster is seen to have the same objective by Earl (1986) and Steenkemp (1989) among others. The failings of REM theory discussed above, mean that REM theory does not justify it.

In addition, however, REM theory uses different prices from the regression-generated prices used in hedonic theory.[7]

In REM theory the consumer makes a choice on the prices and characteristics of all goods on offer. This requires a price list valid at the time, not a regression: it is not necessary to know "the price of a characteristic". Regressions give little weight to those prices at which few transactions took place in the past and none of those at which none took place. This means that most of the options open to a marginal consumer are missing from a hedonic price.

Figure 10 shows how easy it is to get totally misleading prices from linear hedonic regressions. If most transactions had taken place in the SW quadrant, prices would appear to be positive, if in the NE, both would appear to be negative. If most transactions were in the SE or NW, one characteristic would be positively priced, one negatively. There would be a poor fit if transactions were scattered randomly. Yet this is a situation where there is a clear, consistent and logical relationship between the price of goods and the level of their characteristics.

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[7] "Hedonic prices are defined as the implicit prices of attributes and are revealed to economic agents from observed prices of differentiated products and the specific amount of characteristics associated with them. Econometrically, implicit prices are estimated by the first-step regression analysis (product price regressed on characteristics) in the construction of hedonic price indexes". (Rosen, 1974, p.34). The REM analysis is confusing: Rosen (1974) appears to assume that the set of prices facing buyers is <u>at the same time</u>:
- a market clearing price
- an average equilibrium price at the end of a day's trading
- the price facing each buyer and each seller at all periods through the day

Why would a consumer with a price list wish to know the regressions or the "price of each characteristic"? Market research suggests that people are more likely to rank goods by their characteristics or attributes and then by their prices and then make a choice. REM theories and hedonic theories deal with different types of prices so REM theory can neither support nor refute hedonic theory.

CAN THE THEORIES BE TESTED?

A theory of this sort cannot be tested by its predictions as it is not specific to any real world situation. At first sight it appears that it can be tested indirectly: if those models of real world situations that make use of this theory are good predictors, while others are not, some corroboration is added to the theory.

Such an indirect test is only valid if one can say unequivocally that the assumptions of the theory apply in that case. Without this information, the fact that models produce bad predictions may mean that it is a bad theory (with incorrect logic for instance) but it may mean that a good theory is being applied where its assumptions do not hold - and under most epistemologies a theory cannot be expected to work outside its domain.

It has been shown above that it is impossible to demonstrate that all the assumptions of REM theory hold in a particular case, though it may be very easy to show that some do not. There is a general presumption however that the REM theory assumptions on preferences do not apply for most characteristics and almost certainly do not apply for contaminants. There is a presumption that the supply assumptions do not apply in any instance, and it is not possible to challenge this presumption. Accordingly, no series of good or bad predictions add to or subtract from the credibility of the theory.

TESTING REM THEORIES BY THEIR PREDICTIONS

Some of the epistemologies discussed below do not require realistic assumptions or correct logic: they require only that the predictions of a theory have been tested repeatedly and have been found to be consistently good predictors. This may be modified to the statement that they have been found to be good predictors in X% of cases, which requires that a much greater sample has been tested.

It could be extremely difficult and expensive to carry out such a programme of tests in the necessary systematic fashion. Several extensive literature searches have failed to show any evidence of such a programme for any one of the REM theories or their variants. Even if a programme had been attempted, it is doubtful whether meaningful results would have been obtained as there are well-recognized problems identified by the Victorians,[8] Hutchinson (1938), Machlup (1963) and "sophisticated falsificationists" (including Popper) in refuting a theory in this way.

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[8] "The ingenuity of these nineteenth century writers knew no bounds when it came to giving reasons for ignoring apparent refutations of an economic prediction, but no grounds, empirical or otherwise, were ever stated in terms of which one might reject a particular theory" Blaug (1980, p55).

Very few uses of the theory have been designed as tests of a theory: instead researchers have used the theory as a tool to make a prediction. The situations chosen have not been selected as random samples of a specific type of situation from a known population, and very few of the uses are reported - some gave "negative" results and are unpublishable and others are commercial secrets. One cannot therefore, comb the literature and show that Theory X gives a better prediction in y% of cases.

The published literature is also misleading in another way: many of the papers do not use the theory they cite and much of what purports to be based on REM theory is in fact based on quite different theory, often theory based on Waugh (1928). Lancaster complained of this (1971, pp113-4). Recent examples of misattribution include: Larue, 1991; Williams, 1991; McDaniels, Kamlet and Fischer, 1992; Ortono and Scacciati, 1992; Thomas, 1993; Berliant and Raa 1991; Thomas 1993; Johnson and Fornell, 1987; Heffernan, 1990.

HOW SERIOUS ARE THESE WEAKNESSES?

Marketing theorists and practitioners are not agreed on the grounds for rejecting theories, so the impact of the criticisms raised may be examined in the light of a range of epistemological viewpoints. The criticisms made above are:

Fundamental Assumptions

A.   The fundamental assumptions on preferences are wrong. They are contrary to observed fact. They are not simplifications of reality. It is improbable that any individual will have preferences like those assumed for any product group.

B.   Serious logical errors arise from confusions about characteristics space.

C.   The fundamental assumptions on supply are wrong in most cases. They may apply in price making markets but here other REM assumptions do not apply.

D.   The REM theories depend crucially on assumptions of objectivity. Most researchers on quality think it essential to include subjectivity in any analysis.

Boundary Assumptions

E.   Boundary assumptions rule out most of the real world.

Ad Hoc Assumptions

F.   The large number of ad hoc assumptions means that the theories do not apply to any real world situation.

Do the assumptions apply?

G.   It is not possible to say in any situation that the fundamental boundary or ad hoc assumptions apply, though it may be possible to say they do not. It is not possible to plot a multidimensional indifference surface for an individual, or even, in practice, the prices facing an individual. Accordingly, bad predictions may arise because the theory is operating outside its domain, not because it is a bad theory.

Has the Theory been tested?

H.　　There has been no programme of crucial tests on any of the REM theories or their variants.

EPISTEMOLOGICAL POSITIONS

All REM theory is constructed in the belief that there is a special virtue in applying strict logic to stated assumptions, a belief which is implicit in nearly all marketing literature. The logical errors in REM theory are fatal under virtually all epistemologies.

Marketing theorists and professionals usually believe that there is a virtue in working from what we know - observed facts about markets - to what we do not know - predictions. Most marketing professionals can expect to lose their jobs if they make patently false assumptions, that beef grows on trees, for instance, however accurate the predictions of the resulting model. From this epistemological viewpoint the REM theories must be rejected because they conflict with observed reality.

Some other epistemological positions are discussed below. These are seldom made explicit in the literature and there is often considerable confusion.

Theory as Logic

Most marketing practitioners appear to believe that theory is a string of logic. It is possible to take some or all of the logic from a theory and "cut & paste" it, to create a model of a specific market. In much the same way engineers use mathematics and realistic assumptions on soil, water flow and slopes to design irrigation systems. All that can be expected of a theory is that it is logically correct; it cannot be expected to apply everywhere and it does not represent the truth. An infinite number of logically correct theories can be generated if there is no restriction on whether or not assumptions must be realistic, most of them being of no value whatsoever. It is normal to select ones which

a)　　are logically correct

b)　　have assumptions close to the reality of the situation being modelled

c)　　are "easy to use" or subjectively pleasing. This falls outside the subject of this article.

Situation-specific <u>models</u>, unlike the theories, are intended to describe the truth. They can be tested by the realism of their assumptions, their logic, or the accuracy of their predictions.

This epistemology rejects REM theory because its assumptions are not realistic and because its logic is incorrect. It is not possible to say that the assumptions apply in the situation described by a model (though it may be possible to say that they do not), so the theory is formally untestable, and is "unscientific" in Popper's sense.

Theory as Truth
Another epistemological position is that theory bears a similar relation to truth as the physical sciences do. There is only one truth, and it can be discovered by observation. If the theory represents truth, its assumptions must correspond to the truth, and its logic must be correct. REM theory fails on both these grounds.

Models of specific markets describe the truth in one situation. Again their assumptions must correspond to the truth and their logic must be correct, so REM theory cannot be used. A model is rejected if its predictions are wrong. It is implicit in the "theory as truth" epistemology that the assumptions are true in all situations or within stated boundaries, so the failure of a prediction, shows either that this is false or that the theory is wrong for other reasons.

Theory as Probability
The `theory as truth' approach may be modified to the `theory as probability' approach where it is probable, normal, common or occasionally the case that the assumptions apply in real life. Where they do, the theory is the truth.

One application of this is similar to the "Theory as Logic" approach. First the reality of a situation is identified, then theory with assumptions appropriate to this reality is selected, then a model is constructed which represents truth and can be tested by the realism of its assumptions, by its logic or by its predictions. REM theory is rejected by this approach for the same reasons as in the "Theory as Logic" approach.

Another application is to apply the theory to creating models of a range of situations even though it is not known whether the assumptions apply in these situations. It is believed that the assumptions probably, normally, commonly or sometimes do apply, and that where they do the theory then describes the truth. This is appropriate where it is easy to test models by their predictions and difficult to verify their assumptions - which is the reverse of the marketing situation. The resulting models may be tested for realism of assumption, logic and predictive accuracy. The REM theories cannot be used here because of unrealistic assumptions and incorrect logic.

Furthermore the approach is only useful if researchers have some knowledge of the probability that the assumptions will hold in a certain type of situation, or with certain types of consumer, or with certain types of product. There has been no attempt to assess any of these probabilities with REM theory using the necessary replicated tests of predictions, with sample situations drawn from a defined parent population etc. As the probability falls, the number of replications needed rises. More replications still are needed when one takes into account that it is generally accepted that there are many perfectly valid reasons why a good theory should produce bad predictions.

"As If" Theory

Another set of epistemological approaches accepts that REM theory does not correspond to the truth, as individuals clearly do not behave like Economic Man, but argues that aggregate consumer behaviour is as if consumers did behave like Economic Man. It is possible therefore to use REM theories as though they were true, even when their assumptions are clearly wrong[9]

This approach is used in elementary economics to justify the assertion that more is bought when prices fall. It is less credible that such an approach can be used for the more complex REM theories of quality, especially as these tacitly assume away most of the problems of aggregation. Credibility is further stretched when it is used for the complexities of real products and real markets.

An infinite number of theories can be generated if unrealistic assumptions are acceptable. Under this epistemology, one cannot reject those with unrealistic assumptions or even, it would seem, incorrect logic. The only way of identifying theories that performed 'as if' they were true would be to screen all possible theories, selecting those that consistently performed 'as if' they were true would be to screen all possible theories, by testing their predictions, then selecting the ones that <u>always</u> predicted accurately. This would require statistical replication of experiments for each model. No attempt has been made at this.

If one variant of one REM theory did by chance predict as if it were true, this would give no corroboration to other variants, nor to REM theory in general, even if the other variants shared the same fundamental assumptions. In the epistemologies where the theory or the model represents the truth, it is possible to say that any logical extension of this theory or model also represents the truth. It is also possible to say that any logical extension of the theory or model, when combined with realistic assumptions, also represents the truth. This is not possible with 'as if' theory. The fact that one formulation appears to be a good predictor is no indication that a logical extension of this formulation will be, much less a logical extension combined with new assumptions, realistic or otherwise.

It is seldom claimed in fact that such "as if" models are universally applicable.

"Probably as if"

A less extreme formulation is that consumers in aggregate probably, normally, usually or sometimes act as though a theory was true, even though it is accepted that the theory is not true. Again there is an infinite number of possible theories derived from unrealistic theories, many of which will occasionally give accurate predictions.

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[9] These epistemologies may be linked to methodological approaches like those of Mieses (1949), Menger, Robbins (1935), Knight (1940, 1941), Machlup (1963) or Friendman (1953) which argue that the testing or verification of assumptions is unnecessary or undesirable. One school of thought is that theories based on unrealistic assumptions, not simplified assumptions, is actually to be preferred (e.g. Trail, 1995, Sternthal, 1995). This appears to be based on an unusual interpretation of Friedman.

Again the only way to select which to use is by a screening process. However, since there is only a probability that the predictions will be accurate, a much larger number of replications would be needed than for the "as if" formulation. This has not been attempted for REM theory.

If one formulation of one version of any REM theory proves to be often an accurate predictor, this is no indication that a logical extension of the theory nor an extension with realistic assumptions will be. Nor is it any indication that other versions of this or any other version of REM theory will be.

The belief that one version of REM theory is frequently a good predictor can only be justified by repeated, replicated experiments. Even if this had been done, it would be unsatisfactory. It would be risky to base an investment on the belief that some of the theory justifying it "frequently" works, without having any reason to believe that it works in this instance. With the other epistemologies, theory as logic, theory as truth and theory as probability, one can make a reasoned decision even in a totally new environment, with some confidence that the results will be correct.

Conclusion

For the purposes of exposition this paper has been presented as a refutation of a single approach to quality, covering perhaps 20% of the papers on quality in marketing. It could have been presented as covering a wider range of theories, more positively. From the analysis above it is possible to draw conclusions related to all theories of quality used in marketing, not just those derived from economic man assumptions. It is possible to present points made not as criticisms of an existing theory, but as new insights that must be incoroporated into all approaches to quality.

The analysis presented clearly refutes those approaches based directly on the economic man theories. They are wrong and no fiddling with assumptions or analysis can save them. They also refute those approaches based less directly on economic man theories. In these, most of the assumptions, concepts and logic are retained, but there have been changes in one or two assumptions, and a large superstructure has been built up. When a theory is based on a handful of assumptions, as economic man theories are, the changing of one of the five assumptions means that the whole new theory has to be worked out from first principles: none of the existing theory is valid. The position is very different with real-life models based on hundreds of realistic assumptions, where changing one or two assumptions is likely to change the numbers produced, but not the analysis or theory. When a large superstructure has been added to the theory, there is a long chain of logic from the initial assumptions to the

conclusions. The longer the chain of logic the more likely it is that a slight error in logic or misspecification of assumptions will lead to major errors in the conclusions. In this paper

major errors in logic and assumptions have been identified, so the refutation applies particularly to the theories based less directly on economic man theories.

Most of what has been presented in this paper can be taken as a positive contribution to the theories of quality which do not suffer from the totally unrealistic assumptions of economic man theory. These can be improved if they are adapted to absorb the concepts presented here. This would include realistic shapes for indifference curves, a conceptually sound visualization of 'characteristics space', proper specification of axes (see Figure 9 in particular), careful distinction between objective characteristics and subjective attributes, realistic supply assumptions, and a more orthodox methodological approach. This may require significant changes to some theories, but good theories can be expected to be better predictors.

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