Part IV

Some technical questions

12 Lexicographic orderings

> [Economics] should have that delicacy and sensitiveness of touch which are required for enabling it to adapt itself closely to the real phenomena of the world ...
>
> Alfred Marshall [1920/49, p. 635]

The questions of the pervasiveness of equilibrium and maximization are fundamental and thus little of neoclassical literature seems willing or able to critically examine these fundamental ideas. This does not mean that neoclassical writers do not venture criticisms. There are many critiques but they are almost always about technical modelling questions such as what way to formally represent the consumer's utility function. As I noted in Chapter 1, the question of whether to assume a consumer is a maximizer is never put into question, only the assumptions about the nature of the function. I now turn to an examination of some of the technical disputes surrounding neoclassical theory to see if they are worth while criticizing. In the next three chapters I will examine key ideas employed in neoclassical demand theory that have acquired a status that puts them beyond criticism even though that status is unwarranted.

While it may be reasonable to put maximization beyond question along the lines discussed in Chapter 1, it is not obvious that the *form* of the utility function should be limited *a priori*. Nor is it obvious why the infamous Giffen good (i.e. the case of an upward sloping demand curve) should be acceptable in any demand theory which is used in conjunction with supply curves to explain price determination in the market. While a 'generalized' demand theory might be more convenient for mathematical model-builders, those neoclassical economists who wish to use their theory to deal with practical problems will not find such models very helpful. For example, economists who try to evaluate public policies by calculating net gains or losses in terms of 'consumer surplus' (which is represented by the area under the demand curve but above the horizontal line representing the

price) will be stymied by an upward sloping demand curve. Similarly, economists who see merit in a government's ordering its priorities before ordering alternative projects of a similar priority will find it difficult to form a sensible social utility function over all conceivable projects. That is, some economists consider lexicographic orderings to be a reasonable approach to public policy decision-making [see Encarnacion 1964] but, unfortunately, most neoclassical demand theorists are taught to believe that the concept of a lexicographic ordering is not plausible. The purpose of this chapter is to examine the issue in demand theory concerning the difficulty of using lexicographic orderings (*L*-orderings) in *lieu* of ordinary monotonic utility functions. In the next two chapters I will examine the issue of whether demand theory can or should preclude the possibility of upward sloping demand curves.

L-ORDERINGS

A formal preference ordering represents how a given consumer would rank-order two or more bundles of goods (where a 'bundle' specifies a quantity for each good being considered). A monotonic utility function can form the basis for such a preference ordering in a direct way. Obviously, when comparing any two bundles, the preferred bundle yields the most utility according to the utility function. The process whereby the individual goes about determining the utility for any bundles is seldom considered. The lexicographic ordering seems to appeal to those who think the *process* of ranking or assigning utility should be apparent.

The paradigm of an *L*-ordering is the dictionary and its ordering of words. It says that the order in which words are listed in the dictionary is alphabetical. And those words with the same first letter are sub-ordered according to their second letter, and so on. The *L*-ordering in the case of bundles of goods might say that the preferred bundles are those which give the most nutrition. And of those bundles which give the same nutrition, those which give the least calories are the most preferred; and so on.

Years ago, any advocacy of *L*-orderings was commonly criticized since such orderings cannot be represented by a utility function [see Georgescu-Roegen 1954; Newman 1965; Quirk and Saposnik 1968, Chapter 1]. Rarely today are such orderings mentioned and this, of course, is quite apart from the lingering suspicion of some economists that the consumer's *process* of deciding on an optimum choice is better presented by an *L*-ordering. The commonplace rejection of *L*-orderings on purely methodological grounds may be a mistake based on a confusion concerning what *L*-orderings are and how they differ from the existence of multiple criteria. If there is a confusion here it needs to be cleared up and a good starting place would be a clear understanding of the concept of an *L*-ordering.

One way to understand the concept of an *L*-ordering is to consider it to be a solution to the methodological problem created by the recognition of a multiplicity of relevant criteria for comparing goods. To the extent to which *L*-orderings solve a problem they must necessarily be *ad hoc* in the sense that they are invented to do the intended job. If we attempt to eliminate the 'ad hocery', we merely create the same (methodological) problem at a 'higher level', which means that the use of *L*-orderings as a means of explaining any consumer's choice can lead to an infinite regress. But this is not a sufficient reason for rejecting *L*-orderings since to the extent that they represent the reasons why an individual chose one particular bundle over any other affordable bundle, every form of ordering is *ad hoc* and if questioned would lead to an infinite regress.

THE DISCONTINUITY PROBLEM

If there are good reasons for rejecting the use of the *L*-ordering in demand theory, perhaps we will find them by examining how *L*-orderings might be used. There is one classic problem where it is clear that there are *formal* problems with the notion of an *L*-ordering. This classic problem (not to be confused with the methodological problems below) arises directly whenever it is assumed that the consumer is using goods themselves as an index in his or her *L*-ordering. Namely, if a person always prefers a commodity

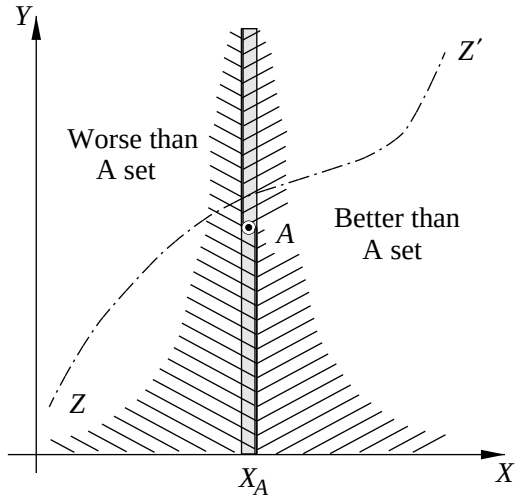


Figure 12.1 *A lexicographic ordering*

bundle with more of good *X* to any bundle with less *X* regardless of the quantity of *Y* in either bundle, and if (and only if) the two bundles being compared have the same quantity of *X*, then those bundles which have more *Y* will be preferred. For purposes of illustration let us assume points have thickness such that the consumer's ordering looks like Figure 12.1. Here there is only one point on the boundary between the 'worse than' and the 'better than' set, namely *A*, the point in question. One problem is that for a continuous set represented by any positively sloped line which does *not* pass through point *A*, such as *Z–Z*¢ in Figure 12.1, whenever we attempt to represent the consumer's preference ordering with an ordinary utility function there is a jump in the utility index as we 'move' along *Z–Z*¢ across the boundary between bundles with less and more *X* than point *A*. This is because all bundles with the same amount of *X* but with a different amount of *Y* will have a different utility index value. Those points on the vertical line above *A* have a higher index than those below *A*. The result is such that

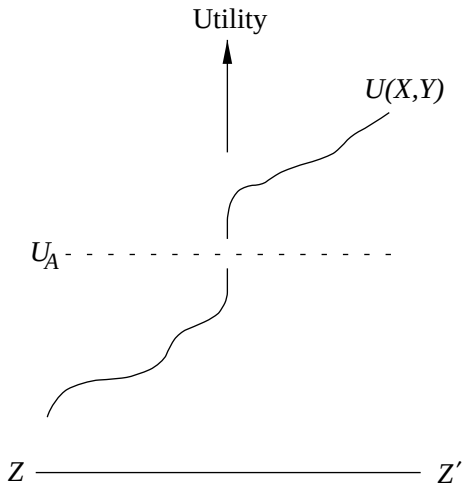


Figure 12.2 *Utility along Z–Z*¢ *line*

there is no point with the same utility as *A*. In Figure 12.2 this situation is represented by a utility function which assigns different levels of utility for each point on the *Z–Z*¢ line. Here all bundles on the *Z–Z*¢ line to the left of point *A* have a lower level of utility and all bundles to the right have a higher level. There is, however, a discontinuity since all bundles with the same quantity of good *X* but different amounts of *Y* have to have a different level of utility. This discontinuity may not be considered a serious problem but the following type of discontinuity always is.

When we directly use the quantity of good *X* as a proxy for the index of the utility, the real numbers used for the *index* of the utility (or of the implied ranking) turns out to be insufficient. If we assign a real number for every point in the *X–Y* space, there will not be enough numbers. For example, all those bundles which have the same quantity of *X* as point *A*, that is, X_A, will be represented by the same number, namely X_A, even though the consumer has ranked a sub-set of them according to the quantity of *Y*. That is, there exist an infinity of points for which there does in fact exist an ordering, but they all appear to be of equal rank since they have X_A as the index of utility.[1] This 'discontinuity' problem can also arise for more sophisticated *L*-orderings [see Georgescu-Roegen 1954]. The formal problem here is that we can never use one of the multiple criteria of any *L*-ordering as an index for the effect of the *entire* ordering on the space which represents all conceivable bundles of goods.

Neoclassical theorists reject *L*-orderings as a *form* of the utility function typically assumed in the theory of demand. This rejection of *L*-orderings does not seem to recognize the question of the *process* by which a consumer determines the best bundle and it is not clear that the neoclassical concept of a utility function is adequate for that purpose.

ORDERINGS AND CONSTRAINED MAXIMIZATION

Before considering multiple criteria as a basis for an explanation of the choice *process*, let us examine the only accepted way to use multiple criteria in neoclassical demand theory. In the case of constrained maximization, the choice of a best bundle involves two orderings: the unobservable preference ordering that is usually represented by an indifference map and the observable expense ordering as represented by the family of parallel budget lines where each budget line represents a different dollar value. Clearly an expense ordering by itself is insufficient to explain a consumer's unique choice since there are many points along the budget line which (by definition of that line) are ranked equally (i.e. they cost the same). Why does the consumer choose one rather than another? The consumer is thus thought to use these two orderings in a two-step manner. The consumer is thought to narrow the choice to the chosen bundle by *first* excluding all those points which he or she cannot afford (i.e. points beyond the given budget line) and *second* picking the best point among those that are affordable according to the preference ordering.[2] This is not really a choice process since it is more a 'static' choice which only requires that the individual be able to find the optimum bundle by correctly calculating utility levels for each point along the budget line.

Whether we can correctly represent the consumer's choice this way depends on what we assume about the unobservable preference ordering.

We could assume that within the consumer's affordable set of points there is a conceivable 'bliss point', that is, a point where the consumer is satiated, as illustrated with point *M* in Figure 12.3. If the consumer has a relatively large budget or income (e.g. the budget line furthest from the origin in Figure 12.3), then the consumer's choice is immediately narrowed to point *M* since the consumer will not want more of either good even though he or she can afford more of both. While assuming that the individual can afford his or her bliss point would allow us to narrow the choice it does so by making the prices irrelevant. Since one reason for developing a theory of the consumer's demand is to explain how prices are determined in the market, a theory of the consumer which makes prices irrelevant will not be very useful. For this reason, orderings which allow 'bliss points' are usually ruled out.[3] A more common assumption is that the consumer faces a 'strictly convex' preference ordering. Technically speaking, a strictly convex ordering is one for which, if we draw a straight line between any two points of equivalent rank, all other points on that line will be preferred to the end points. In Figure 12.3 there are two indifference curves that would be ruled out by an assumption of a *strictly* convex preference ordering, namely, the indifference curve through point *B* and the one through point *C*.[4]

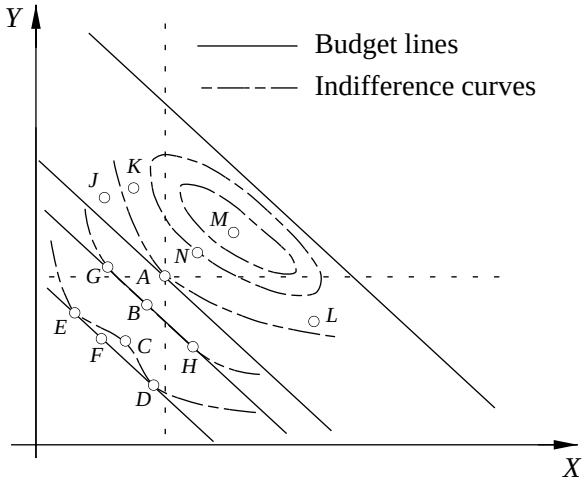


Figure 12.3 *Alternative budget lines and indifference curves*

Since neoclassical consumer theory claims to be able to explain why an observed point on the budget line was chosen, the assumption that there exists a strictly convex ordering may merely be *ad hoc* (since it is sufficient for the intended job – to explain a *unique* point). But of course, ad hocness in this sense is not considered a problem. Instead, the assumption of strictness is criticized for being 'too strong' because it is felt that we do not need 'uniqueness proofs'. For example, we may be able to narrow the choice to a set of points on the flat portion of the highest indifference curve but the choice within that set is quite arbitrary (see points between *G* and *H* in Figure 12.3). Accepting arbitrariness (so as to avoid 'strong' assumptions) may be a helpful method for avoiding arguments over the 'realism of assumptions', but it certainly will not help us to explain why the *one* point was chosen over all others.[5] Such willingness to avoid strong assumptions merely leads to arbitrariness without explanation. Since the consumer can only choose one point at any single point in time, neoclassical consumer theory must be able to explain not only why the one point was chosen but also why all other affordable points were not chosen. Along the lines of the two-step procedure noted at the beginning of this section, the assumption of a strictly convex preference ordering appears to be essential since it does help solve the problem of assuring a unique best point without making prices irrelevant.

AD HOC VS ARBITRARY

A slight digression on these words '*ad hoc*' and 'arbitrary'. The *ad hoc* characteristic of any assumption is not necessarily a criticism since assumptions are usually conjectures or guesses as to the nature of the universe. If the purpose of constructing any theory (i.e. specifying a set of assumptions) is to attempt to understand some aspect of our universe, then any *ad hoc* assumption which would insulate our understanding (viz. our theory) from criticism or from critical testing is to be avoided unless it too can be open to criticism. An assumption is arbitrary if we are unwilling to give reasons for why the assumption might be true independently of the purposes of the theory itself. Arbitrariness often occurs when the possibility of an infinite regress arises, such as when we ask for reasons for our reasons for our reasons ... , then arbitrarily stop to say that we will give no more reasons in this chain. Such arbitrariness is problematic only when we are expected to go on, for example when our reasons are suspect and are to be criticized. These methodological concepts play an important role in the understanding of the dissatisfaction with *L*-orderings.

MULTIPLE CRITERIA VS *L*-ORDERINGS IN A CHOICE PROCESS

Since all creations of human beings can be considered to be solutions to specific problems, we can ask, 'What is the problem solved by such and

such tool or assumption?' Of course, it is sometimes necessary to conjecture the problem since the creator of the tool (or idea) may not have been successful in realizing his or her intention. And, regardless of success, the unintended consequences may still be interesting. It turns out that the *L*-ordering is usually seen to be an attempt to solve a problem created by the mere existence of more than one relevant non-economic ordering for any choice (among bundles or points in goods-space). While multiple criteria are sometimes necessary to 'narrow the choice', as noted above, if the goods-space in question contains an infinity of points (such as when assuming infinite divisibility) we cannot always narrow the choice to one point in the two-step manner of neoclassical theory.

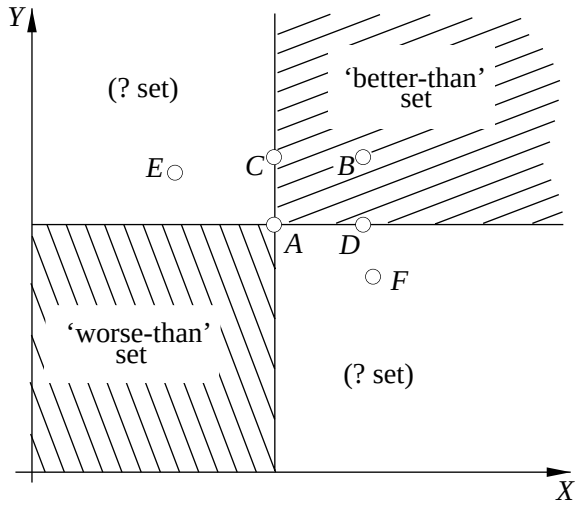


Figure 12.4 *Incomplete ordering*

To understand more clearly the problem thought to be solved by assuming that any consumer's preferences can be represented by an *L*-ordering, let us consider a situation where a person has multiple criteria that are not ordered in any way – that is, a situation only slightly different from the example of Figure 12.1. Specifically, in Figure 12.4, the consumer claims to be better off if he or she has more of either good. This would mean the consumer cannot compare point *A* with points not in the 'better than' or 'worse than' sets (the cross-hatched areas). With such an application of this non-ordered criterion, we have 'holes in the map' since there are large areas where there are many points (such as *E* and *F*) which represent more of one good and less of the other. Without introducing more criteria, points in these 'holes' cannot be compared with point *A* and thus the ordering is incomplete, another type of discontinuity. A slightly more general case is illustrated in Figure 12.5 where the consumer compares any two points by means of two separate criteria rather than by amounts of the goods themselves.

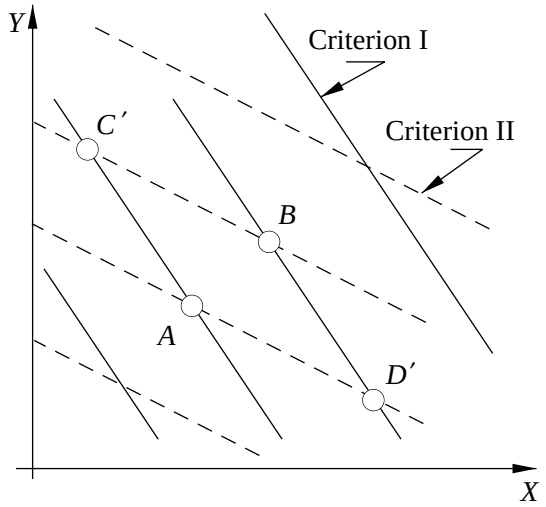


Figure 12.5 *Multiple criteria*

In Figure 12.4, without in some way ordering the two goods themselves the consumer cannot compare points *C* and *D*. Similarly, in Figure 12.5, without ranking the criteria themselves the consumer is unable to compare similar points *C*¢ and *D*¢. Now, in either case, if the consumer ranks the criteria lexicographically he or she can compare these points. For example, in Figure 12.5, if the consumer first orders by Criterion I, then by Criterion II, the consumer would say that *D*¢ is preferred to *C*¢. So we can see that, at least, *L*-orderings can help do the job of narrowing the choice to a single point (on the given budget line). However, they do so at the cost of (possible) arbitrariness. If Criterion II were given priority over Criterion I, the consumer would then prefer point *C*¢ to point *D*¢. In other words, changing the ordering of the criteria changes the ordering of the points in question.

To explain completely the rank ordering of the points we must explain the consumer's rank ordering of the criteria. Should the ordering of orderings be lexicographic, or should we opt for some *ad hoc* utility function over the criteria such as the higher-level utility function that is integral to Kelvin Lancaster's well-known characteristics approach to consumer theory,[6] we could try to order the criteria lexicographically.

Opting for the exclusive use of *L*-orderings in our explanation in order to avoid the *ad hoc* assumption of a monotonic utility function (as in either Lancaster's or the ordinary neoclassical approach to the explanation of consumer choice) leads, however, to an infinite regress.

THE INFINITE REGRESS VS COUNTER-CRITICAL 'AD HOCERY'

This observation leads me to another digression. When does the possibility of infinite regress indicate that an explanation may be inadequate? The answer is clearly that any model which involves a continually self-referring infinite regress cannot be considered an adequate explanation. For example, we cannot say that we 'learn *only* from experience' because we can always ask the self-referencing question 'How did we learn that we learn from experience?' and to be consistent we must answer that we learned that by experience. This leads to an infinite regress which is impossible to stop except by violating the original proposition. In such a regress nothing new or different is brought into the argument regardless of how many steps we go back in the regress.

In contrast to this extreme example we can have an infinite regress which puts more and more at stake with each step of the argument. The latter type of infinite regress is typical of any theoretical science. One begins usually with some proposition (e.g. a policy recommendation) and attempts to rationalize this with some set of theoretical propositions. If these are in turn questioned, then broader theoretical propositions are brought up for support (e.g. neoclassical theory). If questioned further we begin to examine our basic concepts which were brought in for support (e.g. of information needed for profit maximization, the sufficiency of utility as a measure of the intrinsic quality in goods, the ability to rationalize social welfare functions, etc.).[7] Each step is offered as an explanation of the previous step in the regress – but in no way is each next step necessary in the sense that there is no other possible explanation. But to say it is not a necessary step is not to say that it is *ad hoc* or arbitrary. We can always turn to our independently established views of the matter at hand which may be broader but which may not have been seen to be important for the original issue. This progressive type of infinite regress in effect makes our original proposition more testable by allowing us to examine more and more. An *ad hoc* stopping of such an infinite regress may be against our best scientific interests.

UTILITY FUNCTIONS VS *L*-ORDERINGS

Now the importance of this digression is to argue that, when viewed as alternative to a static utility function, any *L*-ordering may only be slightly better than a self-referring infinite regress as opposed to a jeopardizing infinite regress. It is difficult to see how anything new can be brought into the infinite regress of an *L*-ordering method of explaining consumer behaviour in the two-step manner of neoclassical demand theory. That is, nothing new may be put at stake except the next higher *L*-ordering in the regress. This criticism of *L*-orderings, however, cannot be considered an argument in favour of any utility functions which are clearly *ad hoc*. Counter-critical 'ad hocery' cannot be any better than the infinite regress of 'learning only by experience'.

Casual empiricism might indicate that lexicographic behaviour is more prevalent than utility maximization primarily because, as a multi-step *process*, an *L*-ordering is easier to learn or teach than a static utility function. Utility maximization may even require more introspective, more self-reliant individuals than is allowed by modern, highly structured societies where self-reliant individualism is not always appreciated. The neoclassical theorist's rejection of *L*-orderings and the assumption of the existence of utility functions have only been supported by the assumption that the neoclassical theory of the consumer is true (i.e. that consumers act to maximize their utility in a two-step manner using a static utility function). To have a maximum in a calculus sense requires a static monotonic utility index or function or something sufficiently similar which a static *L*-ordering can never be. The assumption that such a static utility function exists is necessarily *ad hoc* unless there can be constructed an independent test of its existence – that is, independent of the theory in question. Since such a test has yet to be devised (let alone applied), lexicographic orderings need not be rejected only because they cannot *formally* represent a usable utility index.

While one can recognize that a choice can be made with multiple criteria (e.g. Figures 12.4 and 12.5), such an ordering can never be complete (there are always 'holes in the map') until one orders the criteria. A strictly convex preference ordering (such as one implied by a utility function) over criteria performs this task. But there is no reason why the assumed preference ordering is the only conceivable ordering. This consideration of the non-uniqueness of utility functions then leads to an infinite regress since a complete explanation must explain why one utility function was chosen over any other conceivable alternative. This line of criticism will lead to yet a higher-ordered preference ordering which must implicitly recognize alternative higher-ordered preference orderings

between which the question is begged as to why one was chosen rather than any of the others. And so on.

A lexicographic ordering is always a conceivable alternative but only if it is seen to represent a process rather than the preference ordering used in the second step of the neoclassical explanation of demand. Since neoclassical economics is more concerned with representing choice in a manner analogous to the calculus-type constrained maximization, neoclassical economists will always choose convex preference orderings that can be represented by ordinary utility functions. What is the basis for this choice? The only reason lexicographic orderings are rejected is that they cannot be represented by formal utility functions even though they can perform the task of eliminating arbitrariness or incompleteness for the purpose of explaining a unique choice. It is clear to me that neoclassical economists put methodological considerations of mathematical formalism before even casual empirical questions whenever it comes to choosing an assumption to represent the non-economic basis of consumer choice.

NOTES

1 Note, however, that this ordinal ranking does work for the line *Z*–*Z*¢ of Figure 12.1 so long as we do not attempt to say anything about points off that line.
2 Technically, this procedure constitutes a rudimentary lexicographic ordering. Goods are first ordered by increasing costs, then by increasing utility. However, this is not usually the aspect of *L*-orderings that is put at issue in the criticism of such orderings.
3 Note that we would also have to rule out incomes so low that an individual could not afford the minimum level of utility that is necessary for survival. In this sense it could be said that neoclassical economics is middle-class economics since we are thereby ruling out both very high and very low incomes.
4 The curve through point *B* would allow us to pick two points such as *G* and *H* where all points on the line between them are not preferred to *G* and *H* (they are equivalent). In the case of the indifference curve through point *C*, at point *C* the curve is actually concave to the origin, that is, we can draw a line between points *D* and *E* such that points *D* and *E* are preferred to all other points on that line (e.g. point *F*).
5 Accepting stochasticism has similar consequences [see Boland 1986a, Chapter 8].
6 In his approach [Lancaster 1966], the consumer can order points on the basis of intrinsic characteristics such as vitamin content, salt content, or other criteria for which the content is proportional to the amount consumed. The consumer then forms a utility function over the amounts obtained of the characteristics to determine the best point and works backward to determine which bundle of goods provides the best characteristics point.
7 Such an infinite regress as this may seem risky and undesirable to some theoretical economists *because* more and more is put at stake at each step.

13 Revealed Preference vs Ordinal Demand

> Instead of dallying in the theory of consistency tests, an older writer on demand theory (one, that is, who was writing before Samuelson) would have proceeded at once, having laid his foundations, to the derivation of a much more famous principle – the principle that the demand curve for a commodity is downward sloping. We, in our turn, must now consider this basic proposition, which remains what it always was, the centre of the whole matter.
>
> John Hicks [1956, p. 59]

In 1938 Samuelson offered what he thought was a clear alternative to the unobservable static utility functions needed in the two-step procedure inherent in the neoclassical demand theory. Rather than having us assume the individual faces a preference ordering that is assumed to have the correct shape (convex, no bliss points, etc.), Samuelson would only require us to assume that the consumer makes well-defined, consistent choices. Choice will be consistent and well-defined if the individual will (a) choose the same bundle whenever he or she faces the same prices and income and (b) never choose any of the other affordable bundles except when prices and incomes change to levels that make the first (or preferred) bundle unaffordable. Armed with this notion of consistency and well-defined choices, Samuelson claimed we could dispense with assumptions about utility functions. Moreover, he claimed that everything necessary for a demand theory was observable (we can observe when a consumer makes an inconsistent choice).

At first it seemed that Samuelson had successfully developed an alternative to the neoclassical Ordinal Demand Theory of Hicks and Allen [1934] which was based on the two-step procedure with static utility functions being represented by indifference maps. Samuelson eventually reintroduced the notion of ‘preferences’ by claiming that consistent choices reveal the consumer’s preferences since the chosen point is revealed to be

preferred to all the other affordable points. Unfortunately, it never seems to have been asked why it is sensible to think of individuals being slaves to all of their past choices. Moreover, such consistency in behaviour is indistinguishable from individuals who are slaves to static utility functions.

It seems now that everyone agrees that the Ordinal Demand Theory of Hicks and Allen, which is based on assumptions concerning ordinal utility functions or preference orderings, and Revealed Preference Analysis, which is based on Samuelson's early work, are in some sense formally equivalent. The primary evidence for this equivalence is that the famous Slutsky equation can be derived either from conditions placed on ordinal utility functions or from some version of Wald's or Samuelson's Axiom of Revealed Preference, as applied to price–quantity situations.[1] Samuelson [1953, p. 2] and Hicks [1956, p. 139] even went as far as establishing what is called the 'generalized law of demand', namely that, *for normal goods*, the quantity demanded varies inversely with the price.[2] Consumer theory, whether based on the Ordinal Demand Theory of Hicks and Allen [1934] or on Samuelson's [1938, 1948] Revealed Preference Analysis, is a major part of the neoclassical theory of prices and, as such, has as its purpose the explanation of demand in general and the Law of Demand in particular. The Law of Demand is the commonly accepted notion that the demand curve for any commodity is downward sloping. This 'basic proposition', says Hicks [1956, p. 59], 'remains ... the centre of the whole matter'. Unlike 'the generalized law of demand', the Law of Demand is not restricted only to 'normal goods'.

The essentialness of the Law of Demand will not be put at stake in this chapter. I will take up that matter in Chapter 14. Here I want to critically examine the alleged equivalence of Ordinal Demand Theory and Revealed Preference Analysis with regard to the Law of Demand.

It is well known that necessary and sufficient reasons for the Law of Demand have yet to be established using Ordinal Demand Theory with a set of conditions or specification that are placed on preference orderings (except, of course, by ruling out inferior goods).[3] Contrary to the popular opinions concerning equivalence [e.g. Samuelson 1950; Houthakker 1961], in this chapter I will *attempt* to provide necessary and sufficient reasons for the Law of Demand by showing how the Axiom of Revealed Preference can be interpreted as saying *more* than Ordinal Demand Theory about the Law of Demand. The approach taken here is to examine consumer behaviour without first specifying an *ex ante* preference ordering (such a specification would not be directly testable anyway) and I will not be requiring that we must have observed all possible points in goods-space so as to construct *ex post* a preference ordering.[4] I shall develop the primary entailment of consumer behaviour that is directly relevant for the Law of Demand: the price–consumption curve (PCC) which I briefly discussed in Chapter 4.

Unlike Gustav Cassel [1918] or Henry Moore [1929] there is no intention here to eliminate utility or preference orderings – such orderings will always be assumed to exist. On the basis of maximizing choice, and somewhat like Cassel, the basic empirical assumptions will be to conjecture specific demand curves directly. However, where Cassel would simply assume that they are properly shaped [1918, pp. 66–88], I will put that assumption at stake since it is the moot point. That is to say, I will examine the explicit or implicit conditions that must be satisfied by any given *set* of demand curves rather than just examine as usual the implicit conditions based on properties of metaphysical utility functions. Unlike Moore [1929, pp. 5–10], here it will not be presumed that the theory of consumer behaviour can be *induced* from observations – statistical or otherwise.

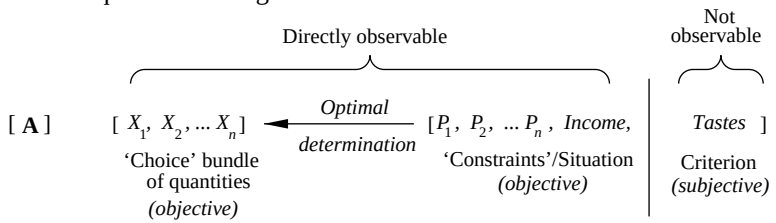
CONSUMER THEORY AND INDIVIDUALISM

As one half of a neoclassical theory of prices, consumer theory is a particular conjunction of ideas that is intended to explain why the quantity demanded is what it is at the going *market price*. In neoclassical economics it is usually taken for granted that no individual in society should have the power to influence (substantially) the going prices *directly*, yet together (in conjunction with supply) large groups of individuals do determine the prices of all the goods that they buy. Although the *necessity* that this determination involves only downward sloping market demand curves will not be examined until Chapter 14, in this chapter that requirement will be assumed to hold. Moreover, it is a sufficient argument that *if* all individuals have downward sloping demand curves for any particular good, *then* the market demand curve will be downward sloping for that good. The neoclassical notion of demand curves is always in terms of partial equilibrium – that is, nothing is required regarding other individuals, other markets, etc. Particularly, we do not require that other markets be in equilibrium. This is the basic feature of both Marshall's and Pareto's approaches to economics [Pareto 1916/35, footnote to Section 1978; Marshall 1920/49, Book V]. This approach reveals their view of what is 'scientific': one *must* begin with the smallest element and work up to broad generalities [Pareto 1916/35, Section 2078; Marshall 1920/49, footnote p. 315; see also Schumpeter 1909, pp. 214–17]. If in our theory we allow any individual to have an upward sloping demand curve, we must then explain why the net outcome for the whole market will still be a downward sloping demand curve as required. This would in turn require some theoretical statement about consumers as a group (perhaps, about the distribution of

people with negative sloping demand curves[5]). That everyone has a downward sloping demand curve is not merely sufficient but also desirable for the maintenance of strict methodological individualism.[6] For the purpose of this chapter, the *necessity* of downward sloping demand curves will continue to be accepted without question as well as the necessity of maintaining the strict methodological individualistic view of economics. So I will thus assume that we must explain why every individual's demand curve is negatively sloped. This, I think, is the meaning of Hick's statement that the Law of Demand is 'the centre of the whole matter' and that 'centre' is focused on the individual's demand curve as the outcome of the individual's behavioural response both to his or her economic constraints (going prices and income) and to his or her disposition regarding the goods bought (i.e. tastes).

THE LOGIC OF EXPLANATION

Let us then begin with a general look at the two-step logic of explaining all individuals' behaviour regarding their choice of the quantities of goods that they buy. We say that consumers are maximizing when they buy the best quantity combination subject to *their* economic constraints and subject to *their* criterion as to what is 'best'. We say, in effect, that their choice of quantities is optimally *determined* conjointly by the state of those constraints *and* the nature (shape) of their criterion. We say that their choice is optimal, hence it can be rationalized by *anyone* whenever the consumers can clearly state the nature of their tastes. That is, given a specified preference ordering, if the choice is optimal, then we can independently *determine* what that choice would be. In that manner we say that we can explain the consumer's choice. The *determinateness* is the crucial element in this theory of explanation. To summarize schematically, we have the following elements in our explanation of the consumer's choice of quantities of *n* goods:



where X_i is the quantity of good *i* purchased at price P_i.

That the consumer optimally picks the best point (or bundle) in no way requires that the tastes as represented by a preference ordering be of any particular shape whatsoever, except that the 'best' be well defined. What does limit the shape of the consumer's preferences is the requirement that the individual be *responsive* to changes in his or her constraints[7] – without responsiveness we could not say that prices in any way influence the consumer's choice. The only place where *all* of the consumer's constraints are influential is on the boundary of his or her 'attainable set', that is, where the consumer is spending all of his or her income (or budget) on the goods in question.

The question of *determinateness* of the choice situation facing an optimizing consumer leaves open several different ways for the theorist to approach the explanation of the consumer's behaviour. We could, on the one hand, begin with a consumer's fully specified ordering (i.e. with *ex ante* specified properties) and then examine the expected logical consequences of that consumer facing different price and income situations. On the other hand, we might avoid the requirement that the consumer in question be able to specify *ex ante* his or her preferences, and instead attempt to deduce the nature of those preferences from observed coincidence of different price–income situations and actual choices made on the basis of a static preference ordering. We could then use the deduced preference ordering as a basis for our 'prediction' of the consumer's behaviour.[8]

On the basis of *our theory* that the consumer wishes to maximize his or her utility (or, equivalently, pick the 'best' point), certain logical requirements must be satisfied either by the unobservable *ex ante* preference ordering *or* by the revealed *ex post* behaviour in observable price–income–choice situations. Because of the *determinateness* of our explanations and the *responsiveness* of the consumer's behaviour to all aspects of the price–income situation, satisfaction by one implies satisfaction by the other. That is to say, the theoretical and philosophical necessity of *determinateness* and *responsiveness* is what gives rise to the apparent equivalence between Ordinal Demand Theory and Revealed Preference Analysis. I say 'apparent' because it is only true in the case where the Marshallian requirement of being able to rationalize the Law of Demand is *not* imposed upon the optimal choice determination. As yet, the recognized conditions for an optimal choice determination that is placed on ordinal preferences are either insufficient or unnecessary for the exclusion of 'Giffen goods'. I will try to show here that the Axiom of Revealed Preference can be interpreted *consistently with the above dual approach to consumer behaviour* to show that it does seem to say something more than the assumptions of Ordinal Demand Theory can and also try to show that some well-known interpretations of demand theory are contradicted by this interpretation of the Axiom of Revealed Preference. More specifically, I will attempt to use the *determinateness* to specify *indirectly* the nature of the preferences which allow inferior goods while still excluding Giffen

goods. This indirect specification will be based on the properties of price–consumption curves.

PRICE–CONSUMPTION CURVES (PCCS)

To compare the assumptions of Ordinal Demand Theory with those of Revealed Preference Analysis I need to identify something that they have in common. The one thing that they do have in common is the behavioural consequences entailed in the assumptions. The Slutsky equation, for example, is entailed in both sets of assumptions, and both seem to be insufficient to deal with the Law of Demand – they only describe the behaviour at one point, and do not help us to explain it in relation to other points. My approach here will be to examine the behaviour by first examining the families of the PCCs which can be considered either the logical consequences of using any preference ordering (map) or the implications of any set of observed choices. The properties of these PCCs are *the* central concern of the theory of consumer behaviour. To examine the properties of a PCC family or grid, I will lay out all the conceivable options which must be dealt with and then try to explain the significance of the various options with respect to either Ordinal Demand Theory or Revealed Preference Analysis. To keep this task manageable in two-dimensional diagrams, I will deal only with two-good cases. And to assist in the task, I am again going to enhance the usual representation of a PCC by adding an arrowhead to indicate in which direction (along the PCC) the price rises for the good in question.

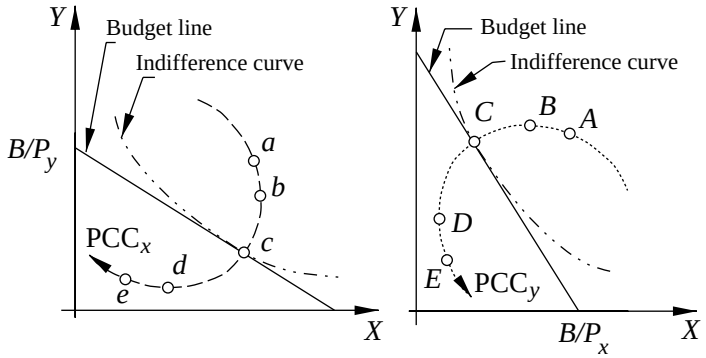


Figure 13.1 *Possible slopes of price–consumption curves*

In Figure 13.1(a), I have drawn a PCC for good *X* representing all five possible slopes.[9] At point *a* the implicit *demand curve* would be positively sloped since as the price of *X* rises the consumer will move from point *a* toward *b*, and thus we note that the consumer must buy more of good *X* (a Giffen good situation). At point *b* the demand would be perfectly inelastic; relatively inelastic at point *c*; at point *d* it would have 'unit' elasticity; and at point *e* it would be relatively elastic.[10] Similarly, in Figure 13.1(b), I have represented the possible cases for good *Y*. This means that (ignoring collinear configurations) there are five cases for each good which in turn can be combined in twenty-five different ways, see Figure 13.2. Since passing through every point on a consumer's indifference map there will be one PCC_x and one PCC_y (each with its own slope), with Figure 13.2 I have catalogued each point as being one of the twenty-five cases.[11]

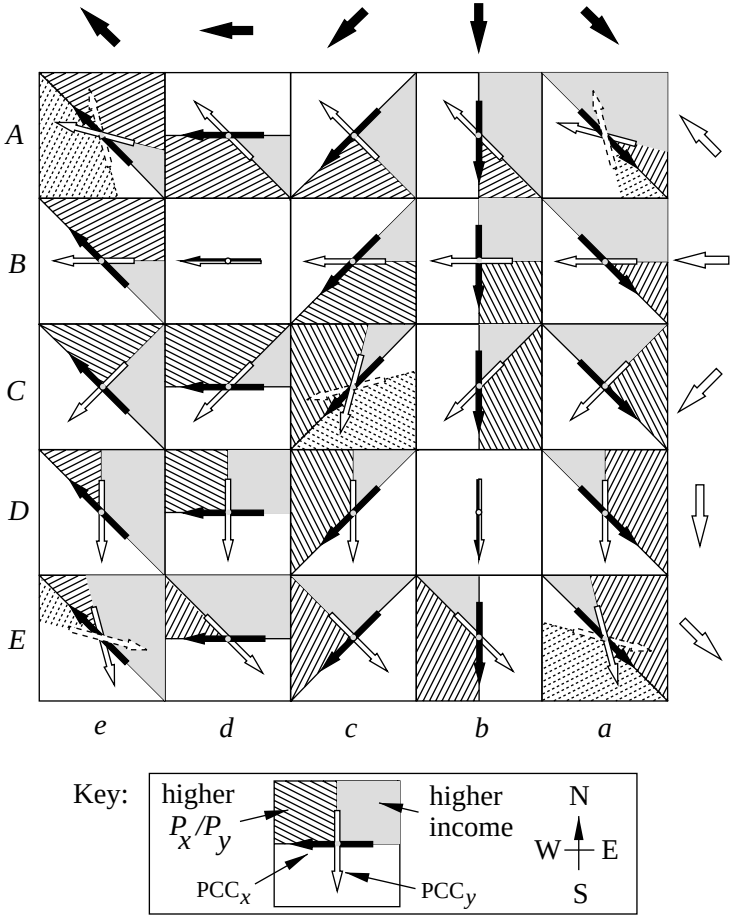


Figure 13.2 *Possible relative slopes of PCCs*

Now, before examining the logic of the situation, we need to get a clear idea of what is meant by 'responsiveness' and 'determinateness' in our explanation of behaviour. *Responsiveness* means simply that whenever the consumer faces significantly different price–income situations,[12] the consumer will choose to buy different combinations of quantities of goods. That is, no two different price–income situations determine the same goods–quantity combination. In other words, the mapping from goods-space into situation-space is *unique*. *Determinateness* means that for any particular price–income situation there is *only one* particular goods–quantity combination that will be chosen – the *mapping* from situation-space into goods-space is *unique* (i.e. 'well defined'). To keep within the Hicksian tradition, my concern here will be only with preference orderings which are representable by indifference maps.[13] A particular indifference map may (when used with neoclassical behavioural assumptions) allow for more than one of the choice situations of Figure 13.2, but at any given point in goods-space, only one choice situation. By considering all possible price situations, a particular indifference map will give rise to a family of PCCs, that is, one sub-family for all PCC_xs and implicitly one for all PCC_ys in the two-goods case plus a set of income–consumption curves (ICCs) which are merely generated from the PCCs.[14] This relationship between the curves is illustrated in Figure 13.3 where representative curves are drawn in the form of a grid.[15] Any particular PCC for good X (PCC_x) is drawn by definition only on the basis that the income (or budget, expenditure, etc.) is held constant and the price of good Y is held constant.

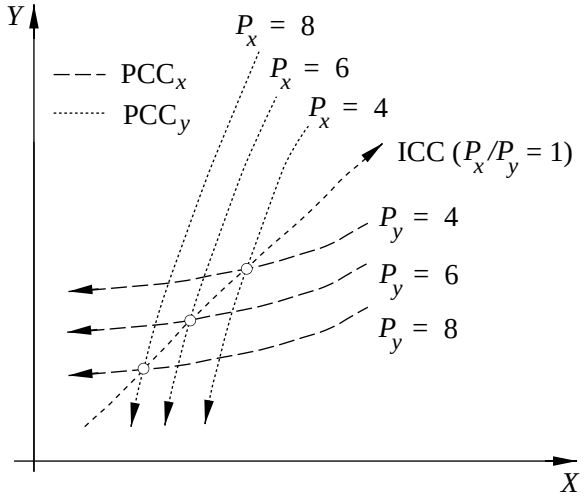


Figure 13.3 *An implicit ICC*

As the major concern of this chapter is the ability to derive the Law of Demand and hence explain price behaviour, I will always assume that income or budget, B, is fixed and thus the same for all PCCs considered. This is only a minor concern since all income changes can be represented (inversely) by proportional changes in all prices simultaneously. This leaves only P_y, the fixed price of Y, to be the identifying feature of any particular PCC for good X. If we change the fixed and given P_y we will get a different PCC_x. Similarly P_x, the price of X, is the identifying feature of any particular PCC_y. If we assume the budget or income is fixed, then to be on any particular PCC_x, the consumer is faced with an implied P_y and thus the PCC_x is labelled with the given P_y. Figure 13.3 thereby represents a grid of PCCs or more important a grid of iso-price lines where at each line there is a PCC_x and a PCC_y for the given prices, P_x and P_y. Armed with such a grid we can say what the prices must be for the consumer to choose any point in the goods-space (given a fixed income, of course). The usual income–consumption curve will be generated as the locus of intersecting PCCs with the labels in a constant ratio, P_x/P_y. In Figure 13.3 the line representing the ICC has an arrowhead indicating the direction of increasing income. The map formed for all the implicit PCCs for any particular indifference map will be called the 'PCC grid' for that indifference map. On the basis of either responsiveness or determinateness there is a one-to-one correspondence between PCC grids and indifference maps.

Assuming income constant, note that if we consider a *particular* PCC as a vector function on goods-space into price-space, $P = \phi(X)$, or an inverse function on price-space into goods-space, $X = \phi^{-1}(P)$, then its projection, $X_i = \phi_i^{-1}(P_i)$, is the individual's demand function but the projection need not be 'well defined' even though the PCC itself is. The PCCs can be interpreted in other ways: as a mapping from all-goods-space into one-price-space, $X \rightarrow P_i$, such as Wald's demand function[16] or a mapping from all-price-space into one-good-space, $P \rightarrow X_i$ such as Cassel's demand functions [Cassel 1918, p. 80]. But the entire PCC grid is not in any way an indirect utility function.[17]

The importance of PCC grids here is that the PCC grid is the one thing that Ordinal Demand Theory and Revealed Preference Analysis *necessarily* have in common. Conditions placed on preference orderings of demand theory ultimately must be reflected in the nature of the consequential PCC grid. Likewise, 'axioms' of Revealed Preference Analysis are direct statements about the nature of the implicit PCC grid.

CHOICE ANALYSIS WITH PREFERENCE THEORY ASSUMPTIONS

It would seem that the alleged equivalence between the Revealed Preference Analysis and Ordinal Demand Theory should be apparent in the categorical logic of the consumer's situation that has been outlined in Figure 13.2. In particular, the logical significance of the assumptions concerning preferences or choices is always in terms of which PCC situations (of Figure 13.2) are *ruled out* as impossible by those behavioural assumptions.

The primary tool in this section will be the array of cells illustrated in Figure 13.2. Let me be clear about what that figure shows. Each cell is drawn for one point with the two PCCs intersecting as shown. Note that at each point of an indifference map there is a PCC_x for a given price of *Y* and a PCC_y for a given price of *X* and implicitly a specific P_x/P_y. Relative to this P_x/P_y I have identified the cross-hatched areas (points) where P_x/P_y would *definitely* have to be higher for those points to be chosen. Similarly, there are shaded areas (points) where *income* would definitely have to be greater for those points to be chosen. With Figure 13.2 in mind, I will now examine the consequences of some of the usual assumptions concerning the shape of preferences. Throughout this examination I will be referring to the various cells in Figure 13.2 by identifying the row with a capital letter and a column with a lower-case letter, (e.g. the lower left cell is *Ee*). Each cell in Figure 13.2 represents the possible relative slopes of the two PCCs at the point of intersection and corresponding to the points labelled in Figures 13.1(a) and 13.1(b).

Greed (dominance, non-satiation)

The most common neoclassical assumption is to rule out 'bliss points'. The effect of ruling out bliss points is that people will always prefer more of any good if none of any other has to be given up. The major implication of this assumption is that indifference curves are always negatively sloped. For my purposes here, this assumption rules out those situations in Figure 13.2 where the ICC is positively sloped *but* has the arrowhead (increasing income) pointing 'south-west'.[18] Such cases as those represented by the dotted lines in *Aa* and *Ee* become problematic here if we require that the slope of the PCCs *guarantee* that this assumption is fulfilled.[19]

Hicksian assumption of diminishing MRS (convexity)

Next let us consider the effect of utilizing the Hicksian assumption that indifference curves should be convex to the origin. Convexity is assured by an assumption about the 'marginal rate of substitution' (MRS) – that is, about the slope of an indifference curve. Since the PCC grid is based on maximization, we can easily determine the value of the marginal rate of substitution. Specifically, a necessary condition for maximization is that MRS equals the given P_x/P_y. To see what the Hicksian assumption of a diminishing MRS means, consider any indifference curve drawn through the point of intersection of two PCCs. If the MRS is diminishing then (1) at all points along the curve that are 'north-west' of the intersection point, the slope of the indifference curve[20] must be higher (i.e. steeper) than the slope at the intersection point and (2) at all points along the curve that are 'south-east' of the intersection, the slope must *not* be higher. In Figure 13.2 there are a few cells which would contradict this requirement. This is most clearly seen in situation *Bb* where below and to the right all points (whether or not they are on the one indifference curve in question) must necessarily have a steeper MRS[21] which contradicts directly the assumption of diminishing MRS. Note that so long as indifference curves are negatively sloped (which is the only way we would ever use them)[22] and they are not straight lines, indifference curves must be drawn in a direction which lies in the angle formed by the arrowhead of one PCC and the tail end of the other PCC. That is, as one moves along a curved indifference locus, MRS is changing (diminishing or increasing). Now, in the context of diminishing MRS along a negatively sloped indifference curve, one can see that more situations are ruled out. In addition to *Bb*, situations *Ab*, *Aa* and *Ba* are clearly seen as logically impossible. Recognizing that 'greed' implies negatively sloped indifference curves,[23] situations *Ad*, *Ac*, *Bc*, *Cb*, *Ca* and *Da* are also impossible. Situations *Bd* and *Db*, and the conceivable cases represented by the dotted lines in cell *Cc*, are also impossible. The situations *Ae* and *Ea* are problematic under the assumption of diminishing MRS since some of the cases allowed contradict diminishing MRS. But since they are extreme cases, Hicks argued, they are unlikely.[24] If his argument were considered sufficient we could see how Hicks' assumption might eliminate Giffen goods since they are to be found anywhere in rows *A* and B or columns *b* and *a*.

Assumption of 'normal goods'

There is one assumption which is more than sufficient for ruling out Giffen goods. If one assumes that all goods are such that any increase in income (or lowering of all prices) would mean that more of all goods would be bought, then the ICC would always be positively sloped with its arrowhead pointing 'north-east' (i.e. the shaded area would be restricted to appear *only* 'north-east' of the intersection point). This assumption can be seen in

Figure 13.2 to rule out the situations *Ae*, *Ad*, *Be*, *Bd*, *Db*, *Da*, *Eb* and *Ea* as being impossible (since they contradict this assumption). Also, the additional situations *Ac*, *Ab*, *Aa*, *Ba*, *Ca*, *Ce*, *De*, *Ee*, *Ed* and *Ec* would be problematic as above. If the assumption is that the goods must *necessarily* be 'normal' (never inferior) then only the remaining situations would be possible. If one uses both the diminishing MRS and the 'normality' assumptions then only situations *Cd*, *Cc*, *Dd* and *Dc* are possible (i.e. no elastic demand for any good!). Obviously this conjunction of assumptions rules out too much if we only want to rule out Giffen goods.

Interdependence of elasticities

On the assumption that the consumer's income is entirely spent, the following simple situation is always maintained:

$$P_x \cdot X + P_y \cdot Y = B \qquad [13.1]$$

And, using a little calculus, for any PCC one can generate the following relationship involving the elasticity of demand, ε_i, for good *i*, and the slope of the PCC, $(\partial Y/\partial X)_i$, for PCC_i:

for good *X*,

$$[1 + (1/\varepsilon_x)] + [(\partial Y / \partial X)_x / (P_x / P_y)] = 0 \qquad [13.2a]$$

for good *Y*,

$$[1 + (1/\varepsilon_y)] + [(P_x / P_y) / (\partial Y / \partial X)_y] = 0 \qquad [13.2b]$$

which taken together gives the following relationship between elasticities at one chosen point in *X*–*Y* space since at any one point these two relationships must have the same (P_x/P_y):

$$[1 + (1/\varepsilon_x)] \cdot [1 + (1/\varepsilon_y)] = (\partial Y/\partial X)_x / (\partial Y/\partial X)_y \qquad [13.3]$$

That is to say, the ratio of the slopes of the two PCCs indicates directly the product involving the two demand elasticities. This result only conflicts with the conceivable situation *Ee* represented by the dotted lines and the solid case *Ae*. The ratio of the slopes of PCC_x to PCC_y must be less than one, by definition of demand elasticities, but in the *Ee* dotted case and the *Ae* solid case that ratio would be greater than one.

CHOICE THEORY FROM REVEALED PREFERENCE ANALYSIS

Referring back to the schemata [**A**], one can see the logic of options available to the ordinary neoclassical demand theorist. Neoclassical demand theorists up to the time of the acceptance of Samuelson's Revealed Preference Analysis would have us assume a given and known ordinal preference map [e.g. Hicks and Allen 1934, pp. 55, 198]. With a known map and any given price–income situation, we can deduce the optimal choice in goods-space. Unfortunately, this approach is based on a presumption of the availability of the consumers' subjective knowledge. Without such knowledge, it would be impossible to apply this version of demand theory directly to any person without some heroic philosophical jumps.[25] Many thought that this was merely a minor difficulty since we could ask the individual what his or her relative preferences were at any given point [e.g. Hicks and Allen 1934, Part II; Allen 1950], even though a complete map still requires more information than is conceivably possible.[26] At one time many thought that there might be a short-cut to actually constructing the map; we could observe the person's choices and *ex post* deduce from the actual observations what the person's preference ordering was [e.g. Little 1949]. Without a known ordinal preference map it would seem to be quite arbitrary whether we specify *ex ante* certain properties of the map that are assumed to exist, or deduce that map *ex post* on the basis of a simple notion of consistent choice.[27] The question then is, when does a particular difference in price–income–choice combinations imply different preferences? Samuelson's answer [1948, pp. 243-4] was in effect that any time two different price–income–choice combinations satisfy the Axiom of Revealed Preference, we can utilize the neoclassical theory of the consumer (i.e. utility maximization or optimum choice) to infer the preference map that this individual consumer was assumed to be using. As it turns out, satisfying the Axiom of Revealed Preference is like satisfying the usual conditions of Ordinal Demand Theory. These two approaches are sufficiently alike that they have important consequences in common which have led Houthakker [1961] and others to consider them equivalent.

What I am going to do here is a little different. Since it has been shown that certain versions of the axioms of Revealed Preference Analysis imply the existence of a preference ordering [Houthakker 1950, 1961; Arrow 1959a], I want to apply one of the axioms, the Axiom of Revealed Preference, to specific situations which were derived from preferences. There should be no danger of contradiction here even though I may be violating the intentions for inventing the Axiom of Revealed Preference. In particular, I am going to apply the Axiom of Revealed Preference to two points on any given PCC. There is no way two points on the same PCC can directly violate the Axiom of Revealed Preference if we always assume 'greed' (lowering one price alone always means that the consumer's real income has increased). The question here is, what are the implications of the Axiom of Revealed Preference for the shape of the PCC?

To answer this, a way must be found to express that axiom in terms of PCCs and budget lines rather than in terms of quantities of goods and/or indifference curves. It will be recalled from Chapter 4 that the Axiom of

Revealed Preference says that point A (in X–Y space) is 'revealed preferred' to point B when A is bought at prices P_x^A and P_y^A and B is bought at prices P_x^B and P_y^B such that

$$\text{if} \quad P_x^A \cdot X_A + P_y^A \cdot Y_A \geq P_x^A \cdot X_B + P_y^A \cdot Y_B \qquad [13.4a]$$

$$\text{then} \quad P_x^B \cdot X_A + P_y^B \cdot Y_A > P_x^B \cdot X_B + P_y^B \cdot Y_B \qquad [13.4b]$$

Of course, this must be true for any two points on any PCC_x where by definition $P_y^A = P_y^B$ $(= P_y)$. Hence the Axiom of Revealed Preference can be stated in this particular case as:

$$\text{if} \quad P_x^A \cdot (X_A - X_B) \geq P_y \cdot (Y_B - Y_A) \qquad [13.5a]$$

$$\text{then} \quad P_x^B \cdot (X_A - X_B) > P_y \cdot (Y_B - Y_A) \qquad [13.5b]$$

Parenthetically, at this point it becomes possible to point out a potential error in Houthakker's [1961] famous survey of consumer theory. He says that the Axiom of Revealed Preference

> is nothing but a generalization of the Law of Demand to arbitrary price changes. To see how it relates to the ordinary Law of Demand we need only put $\Sigma_i P^A \cdot Q^B$ equal to $\Sigma_i P^A \cdot Q^A$ and assume vectors P^A and P^B are identical except for one (say [good X]) price. After some subtractions we then get that
>
> $$\text{if} \quad \Sigma_i P^A \cdot Q^B = \Sigma_i P^A \cdot Q^A \quad \text{then} \quad \Sigma_i (P_x^A - P_x^B) \cdot (X_A - X_B) < 0$$
>
> or in words: if a price changes in such a way that in the new situation the consumer can buy what he bought in the old, then the price change and the quantity change are necessarily of opposite signs. [1961, p. 707]

Unfortunately for Houthakker's attempt to apply the Axiom of Revealed Preference to demand theory, his 'if-clause' can never be satisfied on any one PCC curve (and hence on a demand curve). It must always be an inequality if only one price is varied and all the income is spent because all the points on any PCC are optimum ('equilibrium') points. In neoclassical textbook terms, no two different points on one budget line can be on the same PCC as PCCs and budget lines necessarily cross at only one point.

Perhaps I am misinterpreting Houthakker, so I will push on. If one defines $\partial X = (X_A - X_B)$ and $\partial Y = (Y_A - X_B)$ then the Axiom of Revealed Preference in this particular case says that:

$$\text{if} \quad P_x^A \cdot \partial X \geq -P_y \cdot \partial Y \qquad [13.6a]$$

$$\text{then} \quad P_x^B \cdot \partial X > -P_y \cdot \partial Y \qquad [13.6b]$$

By specifying merely that $\partial X > 0$ and $P_y > 0$, one can say that

$$\text{if} \quad (P_x^A / P_y) \geq -(\partial Y / \partial X) \qquad [13.7a]$$

$$\text{then} \quad (P_x^B / P_y) > -(\partial Y / \partial X) \qquad [13.7b]$$

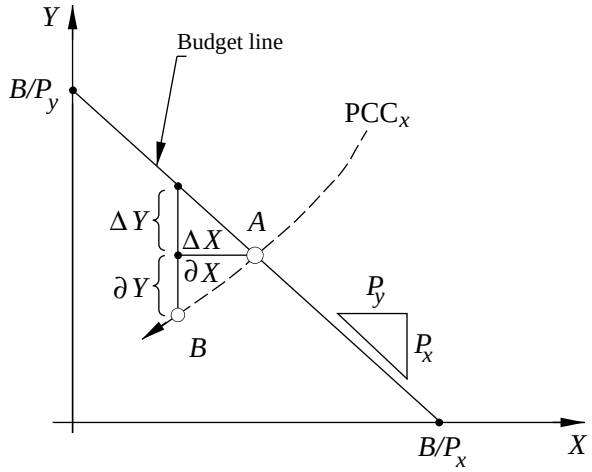


Figure 13.4 *Comparing slopes of PCC and budget line at a point*

If, as is usual, the consumer is assumed to be maximizing his or her satisfaction, then the slope of the budget line, $(\Delta Y/\Delta X)$, equals the negative of the going price ratio, that is, $-(P_x/P_y) = (\Delta Y/\Delta X)$, (see Figure 13.4) then one gets the following:

if the slope of $\text{PCC}_x \geq$ the slope of the budget line of the preferred point

then the slope of $\text{PCC}_x >$ the slope of the budget line of the inferior point

that is,

$$\text{if} \quad (\partial Y/\partial X) \geq (\Delta Y/\Delta X) \text{ at } A \qquad [13.8a]$$

$$\text{then} \quad (\partial Y/\partial X) > (\Delta Y/\Delta X) \text{ at } B \qquad [13.8b]$$

When the slope of the PCC_x along that curve between the two points is positive (i.e. demand is relatively inelastic) this hypothetical condition is easily satisfied. When the slope of PCC_x is negative, the situation gets problematic again. In this case, the Axiom of Revealed Preference says that the slope of the budget line must be steeper than the slope of the PCC_x at point B if the slope of the PCC_x is not steeper than the budget line's slope at A. To see what this says, consider the two cases shown in Figures 13.5a and 13.5b which represent columns *a* and *e*, respectively, of Figure 13.2. Since the slopes can be compared directly by comparing ∂Y with ΔY for a $\partial X = \Delta X > 0$, the first clause of the Axiom of Revealed Preference requires that

$$\partial Y \geq \Delta Y \text{ at } A \qquad [13.9]$$

and this is true in Figure 13.5b and is false in Figure 13.5a since both ∂Y and ΔY are negative. Now the Axiom of Revealed Preference can be restated as follows:

if at point *A* the *demand curve* is not positively sloped then at any point *B* (corresponding to a higher P_x) that demand curve is definitely negatively sloped. [13.10a]

[13.10b]

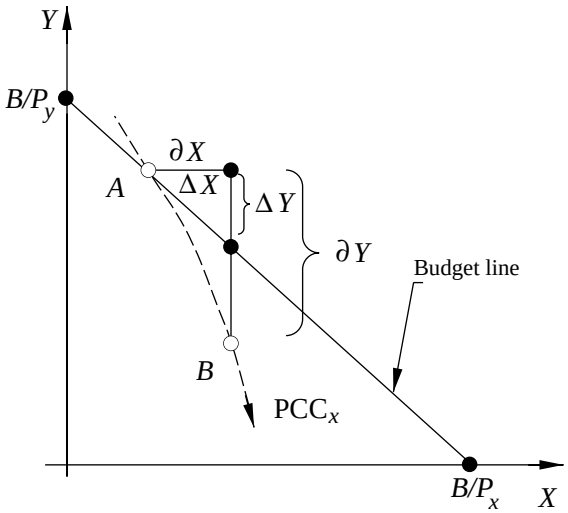


Figure 13.5a *Giffen PCC*

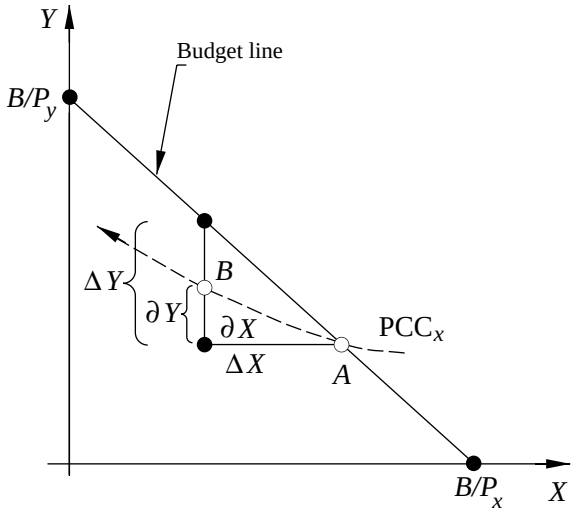


Figure 13.5b *Non-Giffen PCC*

The direct implication of this reformulation (at least in the case used here) is that demand curves as shown in Figure 13.6(a) are made impossible by the Axiom of Revealed Preference (although those as in Figure 13.6(b) are still possible).

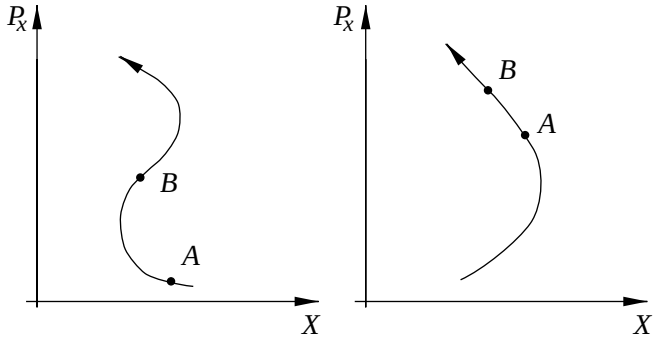


Figure 13.6 *Possible Giffen demand curves*

While this interpretation and use of the Axiom of Revealed Preference may not seem surprising on its own, it is still interesting to note that Hicks gives precisely the demand curve of Figure 13.6(a) as the *plausible* description of the case of a Giffen good [see Hicks and Allen 1934, Figure 6, p. 68]. If my interpretation of the Axiom of Revealed Preference is correct, then one can see that the axiom does say something more than the Ordinal Demand Theory (of Hicks and Allen) which alone will not exclude Giffen goods except by excluding 'inferior goods'. By adding the Axiom of Revealed Preference to Ordinal Demand Theory, however, we can get *slightly* closer to the Law of Demand.

METHODOLOGICAL EPILOGUE

Clearly, writing about a subject that has received so much attention in the past is difficult to justify. Some would accept this reconsideration if it had pedagogical utility – that is, on the presupposition that we all know all there is to know about neoclassical demand theory but we always can use some clever device with which to help teach undergraduates. I think that if there is a use for better pedagogical devices, such a potentiality reflects a poor understanding of the matter at hand. Of course, others would accept this reconsideration merely if it involves the demonstration of some new mathematical devices or techniques. Although most seem unwilling to admit it, the application of a complicated mathematical technique to a simple concept always 'costs' more than the resulting 'benefits' warrant.

The years of clothing demand theory in a mathematized fabric has left us where we began – Hicks' half of the 1934 Hicks and Allen article. All that we have to show for our heroic efforts are a few vacuous generalities such as 'the generalized law of demand'. Our explanation of consumer behaviour has not changed, nor has our understanding of our explanation changed. The Emperor has no more clothes on today than he had prior to 1934. Above all, our task of establishing the Law of Demand has neither been assisted nor corrected by our sophistication.

Now, rather than dismissing the Law of Demand, as many would seem willing to do [Samuelson 1953, p. 106; Lipsey and Rosenbluth 1971], we must attempt to deal with it, one way or another. First, because, as claimed here, Revealed Preference Analysis and Ordinal Demand Theory are not equivalent with respect to the Law of Demand.[28] And second, but more important, because its significance is intimately involved with our theory of prices, as I will explain in the next chapter, to dismiss *ad hoc* the necessity of the Law of Demand without examining its broader significance cannot help us understand economic behaviour, nor can it foster the development of 'testable' implications of neoclassical theories.

NOTES

1 For the derivation of the Slutsky equation from Revealed Preference Analysis, see McKenzie [1957] and Samuelson [1947/65, Chapter 5].
2 Samuelson calls this the 'Fundamental Theorem of Consumption Theory'.
3 See further Lipsey and Rosenbluth [1971, p. 132] and Samuelson [1947/65, p. 115, footnote 17].
4 Such a task is impossible, quite apart from the 'integrability problem', since it requires an impossibly faultless inductive logic [see further, Wong 1978].
5 For example, one person may be allowed to have a positively sloping demand curve as long as no other person does.
6 I discussed the methodology of individualism in Chapter 2, note 8 and Chapter 8, note 14. For more detail see Boland [1982a, Chapter 2].
7 Except we do exclude a change in response to any homogeneous change where all prices and income are multiplied by the same scalar.
8 Not a very 'risky' prediction, however.
9 Note that I have not included a point representing where the slope would be positive and the arrowhead would indicate a rising price. The reason is simple. Since the income and the price of Y are assumed fixed, whenever only the price of X increases, the purchasing power of the income must fall, yet the excluded point would imply the opposite, which is impossible (viz. more of both goods is bought as the price of X rises).
10 The relationship between the elasticity of the implied demand curve and the slope of the PCC is entirely mechanical. Recall that the definition of demand elasticity of good X says that if the price of good X *rises* by 10 percent, an elastic demand means that the consumer buys more than 10 percent *less* of good X. Since the budget (or income) and the price of good Y are fixed (by definition of the demand curve for good X), buying more than 10 percent less of good X whose price has risen by 10 percent means that the consumer is spending less on good X. This leaves more money to be spent on good Y with its price fixed. To keep the budget fixed, the consumer must buy more of the good with the fixed price. Thus we see that at point e an increase in the price of X means that the consumer buys more Y, which fulfills the definition of a point of elastic demand.
11 Actually there are thirty cases since five of the cells represent two cases. I have represented the two alternative cases by representing one of them with dotted rather than solid lines.
12 As always, multiplying all prices and income by the same scalar does not constitute a changed situation.
13 Of course, L-orderings are excluded, too.
14 Once you know the family of PCCs for good X, you have enough information to determine the family of PCCs for good Y as well as the implicit family of ICCs. In other words, there is sufficient information in any one set of PCCs to deduce the other PCCs and thus the ICCs.
15 Specifically, in Figure 13.3 every intersection point can be represented by the solid lines of cell *Cc* of Figure 13.2.
16 See above, pp. 52-60.
17 They may be in some sense 'inverse demand functions' but they contain more information than a single inverted demand function.
18 The arrowhead of the ICC will always be in the shaded area.
19 Consider the location of the ICC's arrowhead in the dual-purpose cells. When considering the dotted-line PPC_y, higher income is represented by the white area demarcated by the extensions of the tail ends of the two PCC arrows. While there are parts of this area that are not 'south-west' of the intersection, if we wish to preclude the *possibility* of violation of the assumption of 'greed' it is the possibility of any higher-income points being 'south-west' of the intersection which necessitates the exclusion of cells *Aa* and *Ee*.
20 That is, the $\Delta Y/\Delta X$ needed to remain on the same indifference curve.
21 That is, $\Delta Y/\Delta X$, which is the measure of the slope of the indifference curve, must be more negative.
22 That is, we are not comparing 'goods' with 'bads'.
23 Which means that the indifference curves cannot pass through the intersection point in question and be found 'south-west'.
24 This occurs in both Hicks [1956] and [1939], which has been copied by virtually everyone who has wanted to assume the possibility of inferior goods.
25 Quite apart from the problem of induction if *we* know the consumer's preferences, they are no longer subjective.
26 This is the problem of induction – more information is required than is conceivably possible.
27 This, too, is probably arbitrary without a known map (*ex post* or *ex ante*).
28 The late Cliff Lloyd suggested to me that I have said the following. Since the Axiom of Revealed Preference implies *more* than the Slutsky relations (S+) and the Axiom of Revealed Preference can be deduced from Ordinal Demand Theory (ODT), then, it must be true that ODT implies S+, which is contrary to what seems to be the consensus concerning ODT. If Cliff was correct then we should be able, by means of the PCC analysis of this chapter, to show that ODT does imply S+.

14 Giffen goods vs market-determined prices

> Marshall modified his theory on two points. The first was that he slightly modified his assertion of the universality of negatively sloping demand curves and in fact introduced the Giffen paradox as an exception. The second alteration was in his treatment of consumers' surplus: 'When the total utilities of two commodities which contribute to the same purpose are calculated on this plan, we cannot say that the total utility of the two together is equal to the sum of the total utilities of each separately.'
>
> George Stigler [1950, p. 327]

The idea of the Law of Demand was commonly accepted long before Marshall mentioned the Giffen paradox. The Giffen paradox has always been interpreted as a problem for demand theorists.[1] They were required to somehow assure us that their theories of consumer behaviour imply the allegedly observed regularity of the absence of Giffen goods – that is, imply the 'universal rule' of negatively inclined demand curves. The basis of this requirement is usually viewed as a matter imposed on us by tradition or casual knowledge rather than as a matter of an interaction of demand theory with the other parts of price theory. If the Law of Demand is retained as a matter of tradition it can be callously abandoned. If it is a matter of casual knowledge we might wish to be more careful. But if it is a matter of dealing with the interaction with other parts of price theory, the Law of Demand may actually be an imperative.

With little doubt the task facing any demand theorist is to explain the quantity demanded in the market. For some the task is to go as far as explaining the lawness of the Law of Demand. If there were a problem over the insufficiency of the usual conditions placed on utility functions with respect to establishing the Law of Demand, one could simply drop all utility analysis, as was suggested long ago by Gustav Cassel. Or one could even declare the neoclassical assumptions about utility analysis to be obviously false, as some of the critics noted in Chapter 1 have done. Tradition, casual knowledge or perhaps theoretical imperatives have ruled out these two approaches to demand theory. George Stigler, decades ago, noted that although the dictates of casual knowledge were strong enough to reject Cassel's notions on the utility of utility analysis, 'it could not reject even the imaginary Giffen paradox' [1950, p. 395]. I will argue in this chapter that the Giffen paradox is important because it is contrary to a market equilibrium theory of prices and not because it might be seen to be contrary to any theory of demand. I will discuss both aspects of the significance of Giffen goods.

The inability of demand theorists to specify conditions on utility functions or indifference maps that would preclude Giffen goods without excluding inferior goods has been a skeleton in our closet which if let out would create a scandal. In the interests of professional stability and security, the tradition has been to accept almost any *ad hoc* argument which would do the job of eliminating the logical possibility of upward sloping demand curves. All this tradition has existed without ever manifesting a clear understanding as to why they must be eliminated.

It will be argued here that the exclusion of Giffen goods is an important methodological constraint on the development of neoclassical demand theory because that theory is part of a larger theory based on the 'going prices' that are market-determined. And further, if we are free to ignore Giffen goods, then we are free to ignore the remainder of neoclassical demand theory as well. Stated another way, Giffen goods and market-determined prices do not go together. It should be recognized that, above all, neoclassical demand theory was created to explain the quantities demanded which in turn are to be used in the explanation of prices. Contrary to popular views of methodology, it is my view that neoclassical theory should be expected first to conform to the theoretical job to be done (explain prices in this case) more than to the nature of the real world that the theory intends to explain or describe. This is not to say we should ignore the 'realism of the assumptions' but that the realism is not the guiding factor in the development of neoclassical theory [Stigler 1950, pp. 394–6]. If my view is correct it means that there may be more at stake with Giffen goods than merely trying to get one logical consequence to conform to the nature of the real world.

By viewing the Law of Demand as an imperative for demand theorists we may have only two options available to us. One option is to drop all of neoclassical demand theory and start from scratch. The other option is to retain as much as possible of neoclassical theory and choose between the following: (1) an *ad hoc* exclusion of the logical possibility of Giffen goods in demand theory; or (2) an *ad hoc* dropping of any reference to market-determined prices in demand theory. The maintenance of neoclassical

demand theory with either of these latter choices requires 'ad hocery'. A possible third choice might be suggested, namely, to 'rehabilitate Giffen goods' [e.g. Lipsey and Rosenbluth 1971] without giving up market-determined prices (and hence without giving up most of neoclassical theory). But this possible third option, I will argue, is self-contradictory. And furthermore, it may render neoclassical price theory untestable or, worse, irrelevant.

Any argument over the purposes of any theory in question should be resolvable merely by consulting the history of that theory. Unfortunately, demand theory has a long history involving too many contributors whose individual aims differed widely. Although economics textbooks may agree to a great extent, they still vary widely in some of the details discussed in this chapter. One could probably construct an historical, episodic account of every version of neoclassical demand theory. However, I think one could understand our present theory more clearly if one were to attempt seeing each of its details as a timely and rationalizable solution to a particular theoretical problem involving the aims of the theorist and the obstacles to fulfilling those aims. This method, called 'rational reconstruction', will be used to present neoclassical demand theory as an outcome of certain intended consequences of the problem–solution based development of that theory. Criticism and understanding in this context will always be 'internal', having to do with the chosen means of overcoming obstacles rather than be 'external' by objecting to the aims of the theorist [see Wong 1978].

So long as we find neoclassical demand theory interesting, I think the job remains to rehabilitate the Hicksian version. If this is to be done in the context of market-determined prices then some way must be found to replace John Hicks' weak argument against the existence of Giffen goods (which I discussed in Chapter 13). But since this rehabilitation may involve some 'ad hocery', I will again offer a brief digression on 'good' and 'bad' ad hocery. So as not to keep the reader in suspense, I can give the following hint: 'good' ad hocery exposes skeletons whereas 'bad' ad hocery hides them either by closing the closet door or by moving to another house (i.e. to another set of intended consequences).

A RATIONAL RECONSTRUCTION OF NEOCLASSICAL DEMAND THEORY

In this section I present my rational reconstruction of neoclassical demand theory. The overall purpose is to understand the methodological and theoretical constraints on any attempt to develop or repair neoclassical demand theory. My rational reconstruction of demand theory will lay out the logic of the situation to explain why that theory exists in its present form. In short, I will present what I think is the theoretical problem that is solved by neoclassical demand theory. I will again be concerned precisely with the allegation of Hicks that the central purpose of demand theory is to provide a rational basis for the Law of Demand [Hicks 1956, p. 59]. The issue can be put simply: in economics (or even physics) we usually call any hypothesis a 'Law' only when, if it were false, everything we consider important falls with it. For example, without the 'Law of Gravity' there would be no Newtonian physics; without the Law of Thermodynamics there would be no explanation of engines or refrigerators, and so on. In this case, without the Law of Demand, I will argue, there would be no complete theory of *market*-determined prices.

The question at issue: Why is the Law of Demand so central to demand theory? The answer, as I shall show, is simply that the Law of Demand is necessary for any neoclassical explanation which claims or assumes that all prices are exclusively determined by market equilibria. In other words, the Law is necessary for the completion of each and every neoclassical explanation. It will be a sufficient argument that any criticism of the Law of Demand (or of the non-existence of Giffen goods) must be a criticism of the entire neoclassical demand theory if it can be shown (1) that the Law of Demand is necessarily true whenever the neoclassical theory of market prices is true and (2) that together the basic assumptions of neoclassical demand theory are sufficient but individually are not necessary for the explanation of consumer demand. Moreover, it will be apparent that the basic assumptions exist in neoclassical demand theory only by virtue of the necessity of the Law of Demand. A corollary is thus that any criticism of market-determined prices is also a criticism of the necessity of the *entire* theory and its use as a basis for understanding the economy.

Walrasian stability and Marshallian stability

I begin now by showing why I think the Law of Demand is a necessity whenever we wish to explain prices as being determined in the market. The basic focus of neoclassical price theory is to explain why the price of any good is what it is *and* not what it is not. The neoclassical reason given is that the price of any good is a market *equilibrium* price, which is to say, if for any reason the price were higher than it is now it would fall back to the equilibrium level (and rise when it is lower). This raises certain questions which are essentially about specifying requirements for a successful 'equilibrium explanation'. The first requirement is simply a set of reasons why the price must fall when it is higher (and rise when it is lower) than the 'equilibrium level'.

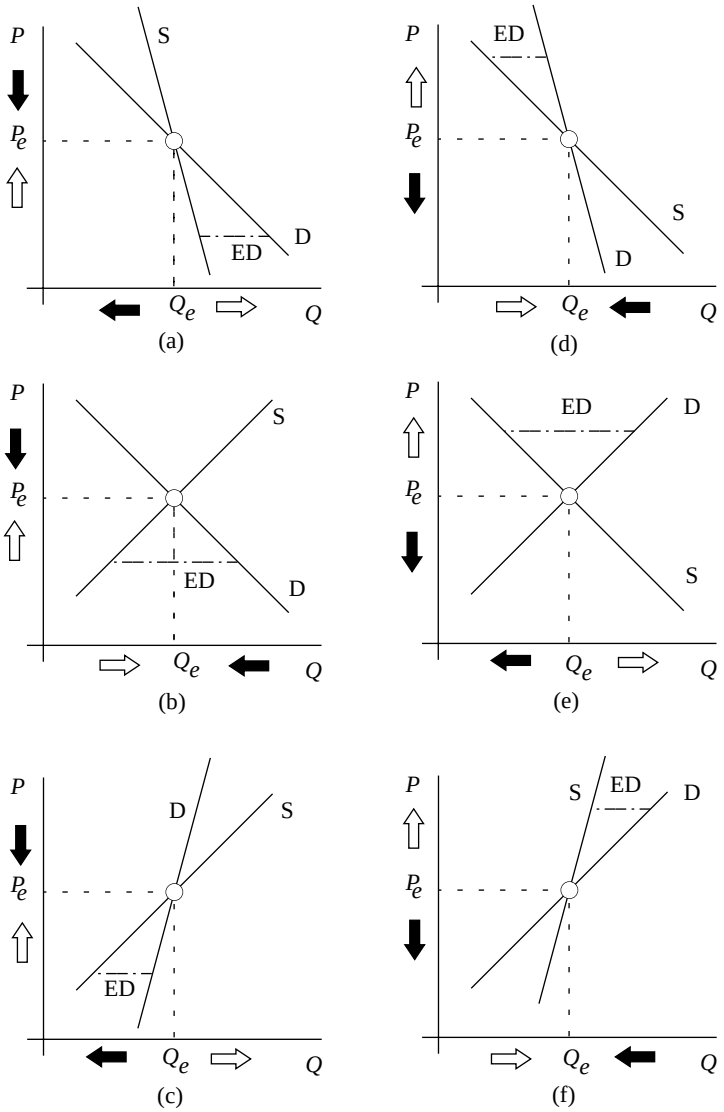


Figure 14.1 *Intersecting slopes in alternative markets*

The reasons usually given broadly define what is traditionally called 'Walrasian stability'. Specifically, it is claimed that the world is such that:

(1) Any time the quantity supplied exceeds demand, there is at least one person, a seller who will offer to sell at a lower price to achieve his or her own goals (and when demand exceeds supply, a buyer will offer a higher price) *and*

(2) Any time the going price is greater than the equilibrium price there will exist a situation where supply exceeds demand (and when the price is less there will be excess demand).

Walrasian stability then involves these two behavioural *assumptions* about the nature of the real world, neither of which is necessary or sufficient for the question[2] but it can be argued that they are together sufficient. They hang together. One can only criticize their sufficiency,[3] which is always easy, much easier than criticizing their necessity.[4] What, then, are the implicit assumptions that underlie the presumed sufficiency of these behavioural assumptions, (1) and (2)?

The first behavioural assumption is seldom suspect, it is merely accepted either as a direct behavioural assumption or as a definition of competition which is assumed to exist. The second can be rationalized, that is, we can give a rational argument for why, when the going price is greater than the equilibrium price, there will exist an excess supply. To understand this second behavioural assumption we need to examine the logic of the situation. Consider the following question. If our assumptions are true then what logically *possible* states of the world are thereby claimed *not* to represent the real world? To answer this question I note that there are six possible situations that might be found in the world, that is, six combinations of demand and supply curves, as shown in Figure 14.1.[5]

In a Walrasian world the behavioural assumption (1) will work to promote equilibrium only if the assumption (2) is true, that is, only if the world is not like situations (d), (e) or (f) of Figure 14.1. Thus assumption (2) implicitly asserts that the world is like (a), (b) or (c). Now without support assumption (2) becomes a mere *ad hoc* empirical assumption about the real world. To avoid the ad hocery, we must be able to explain why the relative slopes of the demand and supply curves are as indicated in (a), (b) or (c) and not like (d), (e) or (f). This *might* require a joint explanation of demand and supply. Such a joint explanation is precluded by the ideology behind much of neoclassical theory, viz. *laissez-faire* individualism where all individuals, whether buyers or sellers, must be independent. Particularly, demand must be independent of supply. Without our providing a joint explanation, assumption (2) is simply an *ad hoc* attempt to save the equilibrium theory of prices. And furthermore, without a joint explanation, there is no way to distinguish worlds (a) and (d), or (c) and (f), without violating the independence of buyers' and sellers' decision-making. In these cases, demand and supply are both negatively or both positively sloped and, to distinguish (a) from (d) or (c) from (f), one has to specify which curve is steeper.[6]

Fortunately, there could be another way to avoid this ad hocery. Implicit in the neoclassical theory of the competitive firm there is an additional equilibrium theory, namely, Marshall's theory of quantity adjustment which is formally the same as that described so far for prices. In the Walrasian view of stability we have one price and two different quantities, the quantity demanded and the quantity supplied. In Marshall's theory of the firm we find one quantity (the supply) and two prices, the offering price (which is the price at which all demanders would be maximizing their utility with their contribution to the market demand) and the asking price (which is merely the marginal cost of the quantity being supplied by the firm). Thus, it can be shown that

(1¢) Any time the quantity bought and sold in the market, Q, is greater than the equilibrium quantity, Q_e, the quantity will fall (when less, the quantity will rise).

This follows directly from the neoclassical theory of the firm. For example, if the offering price is greater than the asking price, the firm will increase its output to increase its profit.[7] To form a sufficient argument for a so-called Marshallian stability of the equilibrium quantities, the real world must be such that

(2¢) Any time $Q>Q_e$ the asking price must be greater than the offering price (and when $Q<Q_e$, the asking price must be less).

This assertion about the nature of the real world is similar to the one made to define Walrasian stability, and needs likewise to be rationally supported or to be acceptably *ad hoc*. To assure Marshallian stability, another empirical assumption is thus required, namely, one that would now assure that the market situation in the real world not be like (a), (c) or (e) of Figure 14.1 and that the real world is like (b), (d) or (f). Now it turns out that by itself this Marshallian assertion about the nature of the real world would require an argument involving the joint behaviour of demand and supply prices similar to the previous discussion. Note also that there is something else in common between the two market equilibrium theories: they both exclude the possibility of the world being like situation (e) of Figure 14.1 and both allow situation (b). If we could independently argue why the world is like (b) and is not like (a), (c), (d), (e) or (f), we then could avoid the ad hocery of asserting Walrasian stability or its counterpart in terms of quantity, Marshallian stability. Such is the task of our independent theories of demand and of supply. Situation (b) is merely a joint statement of the Law of Demand and an analogous Law of Supply, which says that as the price rises the quantity demanded must always be falling and the quantity supplied must always be rising. If an explanation of the Law of Demand can be given independently of an explanation for the Law of Supply, then ad hocery can be avoided and prices be explained as market-determined without the risk of condoning a methodologically dangerous interaction between any buyer and any seller, as such interaction might undermine the virtues of a competitive price system.[8]

It may be distasteful for recently trained economists to admit that there is a lot of silly philosophy underlying ordinary neoclassical economics, but I think such is the case. It is seldom recognized because our textbooks try to socialize us into believing that our theories are merely descriptions of the real world and those theories were actually derived from observations of the real world, or worse, it is all a game of logic and language, of *a priori* assumptions and all that. To some extent all theories are descriptions but only to the extent that they are empirical. Of course, anyone can make an empirical statement without deriving it from the real world; for example, by conjecture or by accident. Moreover, not all empirical statements are true. The Law of Demand has always been a fiction (abstraction, non-description, generalization, etc.) to the extent that we present it as an inductively proven empirical truth instead of a possible empirical challenge to our understanding of prices.

In spite of the long history of believing in the empirical fact of the Law of Demand, I think it should be obvious that the necessity of the Law of Demand for an explanation of equilibrium prices is the outcome of avoiding either ad hocery or undesirable ideological implications of our theory, or both. But my argument intends to go further by showing that neoclassical demand theory can be rationally reconstructed *only* if we see that theory as an attempt to rationalize the Law of Demand.

There is only one fundamental behavioural assumption made about the process of consumption, namely, that consumers are maximizing utility (or, which amounts to the same thing, choosing the 'best' bundle). The rest of the assumptions are made in an attempt to facilitate the conjunction of the maximization assumption and the Law of Demand. To facilitate the maximization assumption we use assumptions which limit the shape of the assumed utility function or preference ordering (e.g. greed, diminishing MRS, transitivity, continuity, etc.). But as discussed in Chapter 13, these assumptions are usually insufficient to rule out the logical possibility of Giffen goods – that is, the demand curves could be upward sloping without violating the axioms of consumer theory. Several additional assumptions have been attempted. All seem to be unsatisfactory for one reason or another.

As was seen in Chapter 13, the most effective way to rule out Giffen goods is to rule out 'inferior goods'. Of course, this is unsatisfactory because it does too much. It is a case which Martin Hollis and Edward Nell

[1975, p. 61] describe as solving a New York City slum problem by redefining the city boundaries. Another *ad hoc* method considered has been to require the satisfaction of the Axiom of Revealed Preference which, as I have shown in Chapter 13, does not rule out entirely Giffen goods although it does limit them somewhat. Unfortunately, the limits placed on the slope of the demand curve are insufficient to assure that the market demand curve intersects the market supply curve as shown in case (b) of Figure 14.1 and thereby leaves open the question of market stability. Thus it might seem that we must choose between *ad hoc* eliminations of inferior goods or *ad hoc* assertions that markets are stable.

The imperatives of demand theory

Now I would like to present neoclassical demand theory in a slightly different way to show why it is important to avoid this choice problem. The central question of neoclassical demand theory is: Why is the quantity demanded at the going price what it is? And why would that quantity demanded fall if the price rose? To be neoclassical it is required that the theory of demand not only assume maximizing behaviour but that it be consistent with *laissez-faire* individualism, that is, with the philosophy that everyone *should* make independent rational decisions in the market – or as, Voltaire said in *Candide*, we should till our own gardens. As noted above, this leads us to argue that, to assure Marshallian and Walrasian stability, the real world would have to be like (b) of Figure 14.1 since that would allow us to explain demand and supply independently. That is, if we have separate arguments for why demand curves are always negatively sloped and for why supply curves are always upwardly sloped, then we would never have to consider a violation of the independence of the decision-makers. Without the 'always' we could never rationally reconstruct demand theory.

This then is the task facing any neoclassical demand theorist: to give reasons why the Law of Demand is true without assuming anything which would have us violate the rationality or the independence prescribed by *laissez-faire* individualism. However, there is a slight complication. The arguments about stability are relevant for *market* demand curves, and neoclassical demand theory is about the behaviour of the *individual* consumer. Thus we have an added problem facing the demand theorist. The reasons given for the slope of the market demand curve must be seen as a consequence of the individuals' demand curves. On the surface this would seem to allow much more latitude for maintaining independence of consumers' decisions, but that latitude would be at the expense of the strength of our arguments for the Law of Demand. Specifically we say that the quantity demanded is the aggregate effect of all the individual consumers' rational attempts to maximize their (independent) personal utility.

It is a sufficient argument that if *all* individual demand curves are negatively sloped their aggregation, the market demand curve, will also be negatively sloped. If one could show that rational maximization necessarily leads to negatively sloped *individual* demand curves, then the central task of demand theory would be fulfilled. Unfortunately, that has not yet been shown by anyone. But, the question might be asked, is it necessary for all individuals to have negatively sloped demand curves? The obvious response would be to say 'No' [see Lloyd 1967, p. 24; De Alessi 1968, pp. 290–1]. For example, one or two demanders could easily have upward sloping demand curves, yet in the aggregation the negative slope of all the other demanders could cancel out the positive slope. Unfortunately, that reasonable response leads to problems over the independence of the demanders themselves.

Let me try to explain. Say there are N demanders whose respective demands at the going price are $d_1, d_2, d_3 \ldots d_m, d_{m+1} \ldots d_{N-1}, d_N$. And say that the first m demanders, who respectively demand d_1 through d_m, each have negatively sloped demand curves and that demanders of d_{m+1} through d_{N-1} have upward sloped demand curves such that a slight change in price would leave the aggregate demand of the N–1 demanders unchanged (the positive and negative slopes just cancel out). If this market is to be both Marshallian and Walrasian stable and preserve the independence of suppliers and demanders, then the Nth demander's behaviour is no longer independent of the other N–1 demanders. This is because to avoid an embarrassing contradiction of the philosophically desirable independence between suppliers and demanders, the Nth demander's demand curve must be negatively sloped.[9] It clearly would be best if *all* individuals' demand curves could be shown to be negatively sloped as a consequence of the logic of their *individual* situations, namely, as a result of their *rational* maximization and the *nature* of their situational constraints.

AD HOCERY VS TESTABILITY

I now turn to some general questions of methodology that are raised in this consideration of Giffen goods. What is the difference between (1) straightforwardly ruling out Giffen goods as Cassel [1918] or Moore [1929] might, and (2) setting out a group of assumptions (with, or within, the theory) which if taken together logically exclude Giffen goods as Hicks [1956] tried to do? Is this merely the difference between 'good' and 'bad' ad hocery?

It must be realized that to a certain extent both options are *ad hoc*. Every assumption is *ad hoc* in one sense. If an assumption is formally a strictly universal proposition (e.g. 'all swans are white') it cannot be empirically demonstrated to be true even if it is true. Hence, assuming it to be true without such a demonstration of its truth can be viewed as being *ad hoc*. It is *ad hoc* merely because it may be necessary or sufficient for the theory in which it is assumed. Since all assumptions, all observations, are in some way dependent on the acceptance of certain universals, the acceptance of assumptions, theories and observations is in this sense *ad hoc*. Ad hocery in this fundamental sense can neither be criticized nor recommended (because the criticism or recommendation would also be *ad hoc* in the same sense). The ad hocery that might be criticized is that which arises when counter-examples are arbitrarily ruled out when the theorist narrows the 'applicability' of his or her theory – for example, by assuming that our theory applies only to 'normal goods'. Such ad hocery might be criticized because it avoids criticism or it handicaps the theorist's understanding of the objects of his or her study. In general, we can say that any ad hocery which reduces the testability of a theory is considered 'bad' by most theorists today. Conversely, any ad hocery which increases the testability is considered 'good'.

The question arises as to how one increases the testability of a theory. I have previously dealt with the subject of how model-building assumptions can affect testability [Boland 1989, Chapters 2 and 3] where I have set out an analysis of the ingredients of a model (viz. the number of parameters, standard-form coefficients, exogenous variables, endogenous variables, etc.) and demonstrated a measure of a model's testability such that it is possible to say when a model is 'more testable'. The basic idea is that the more information needed to test a newly modified model than was needed without the modification, the less testable the model becomes. Such a modification would constitute 'bad' ad hocery. Testability, however, need not be viewed as an *ad hoc* test of ad hocery. Testability is closely linked with the explanatory power of any theory, or with its empirical 'meaningfulness' as followers of Paul Samuelson's methodology [1947/65] like to say. An *ad hoc* specification of a theory which would make it possible to test the theory with less information would be considered an improvement – that is, it would be 'good' ad hocery. Testability, however, can only be viewed as a means to an end, never as an end in itself. Even when the good *ad hoc* modification produces a model which turns out to be false (when tested), we still do not know whether it is the modification or it is something in the original model which is yielding the contradictions between the modified model and the test evidence.[10]

Now *ad hoc* modifications such as limiting the applicability of a model or theory not only increase the amount of information needed to test the model (since we would now also need to know the 'applicability' of the model), they also insulate the model from empirical criticisms. If our objective in constructing a model or theory is to understand the subject in question (e.g. consumer behaviour) then, as most followers of Samuelson's methodology realize, our understanding must deny the existence of something in the real world. If our understanding is to be an improvement over past understanding the new understanding must contradict some of the old understanding. Any *ad hoc* modification which avoids such contradictions can only be a loss, a backward step.

In summary, *ad hoc* specifications that limit further the conceivable states of the real world (which possibly can be compatible with the model or theory) are 'good' since they increase testability. *Ad hoc* specifications which increase the content by increasing the number of exogenous variables that might affect the determination of the endogenous variables can also increase the testability since more possible counter-examples can be deduced from the model and thus be used as indirect tests of the model.

With regard to the *ad hoc* models of consumer theory being considered in this and the previous chapter, we can say the following: Hicks' assumption that extremely inferior goods are less likely than slightly inferior goods is probably false. But that does not jeopardize the original consumer theory if it is still possible to exclude Giffen goods by specifying directly the nature of preferences. However, all specifications of preferences need not be improvements. Some of the specifications may increase the 'likelihood' of Giffen goods, but those specifications which do increase the 'likelihood' may themselves be 'unlikely', since they may be very special (*ad hoc*) cases.[11]

GIFFEN GOODS AND THE TESTABILITY OF DEMAND THEORY

A couple decades ago the issue of the testability of demand theory itself was actually publicly debated. The debaters were Cliff Lloyd [1965, 1969] and Gordon Welty [1969]. The importance of Giffen goods for the testability of demand theory was only implicitly raised in their debate. However, Giffen goods were the explicit topic of Welty's [1971] critique of Louis De Alessi's [1968] views on the Giffen paradox. I will comment here on the Welty–Lloyd debate and Welty's critique of De Alessi's views in hopes of furthering the understanding of the significance of Giffen goods or upward sloping demand curves.

Lloyd [1965] discusses the general issue of the falsifiability of demand theory. Lloyd seems to think that 'traditional demand theory' can be tested. For him a prerequisite of testability would be falsifiability. He outlines

what he considers to be testable 'implications' of demand theory. Basically, if one can determine whether a good is not an inferior good, we can test the Slutsky equation (which presumes maximization of utility). An upward sloping demand curve for a non-inferior good is clearly contrary to traditional demand theory. Whether one can actually test demand theory in this case would depend on the acceptance of the conventions used to establish the non-inferiority of the good in question and to measure the slope of the demand curve. The test will only be as good as the testing conventions used. But, as a matter of logic, Lloyd argues that demand theory is falsifiable, hence not untestable for reasons of internal logic of the individual consumer.

Many economists may think that limiting any testing of demand theory to non-inferior goods renders the theory irrefutable. As De Alessi put it in 1968,

> The theoretical admission that the income effect may dominate the substitution effect in the case of inferior goods implies that the demand curve of an individual, derived holding money income constant, may be either positively or negatively sloped; it follows that the sign of the slope of the corresponding aggregate demand curve is also indeterminate, and thus cannot be refuted by experience. [p. 287]

If Lloyd's proposed test is only a test of an individual's behaviour, De Alessi claims,

> Under no circumstances a single observation pertaining to a single individual would provide a test of any economic hypothesis. [p. 290]

And further,

> in the final analysis, ... economists accept negatively sloped demand curves ... because empirical evidence suggests that negatively sloped demand curves work. [p. 291]

It seems that De Alessi sides with George Stigler [1950] in accepting negatively sloped demand curves as a fact until hard evidence to the contrary is provided. And until this occurs, the job of any demand theorist is to explain the implicit regularity – the non-existence of Giffen goods. De Alessi suggests a possible modification of traditional demand theory.[12]

Welty argues that Lloyd and De Alessi are both wrong as the former's testing conventions and the latter's modification would each make the traditional theory unfalsifiable. The basis of Welty's critique of Lloyd is the role of *ceteris paribus* clauses and to what extent such clauses refer to unspecified variables. If one were to say the Law of Demand is true *ceteris paribus* then one could always use the *ceteris paribus* clause as an escape hatch to avoid almost any conceivable refutation.[13]

Welty's arguments concerning *ceteris paribus* clauses are based on a simple matter of logic. Adding extra clauses to any theory can insulate that theory from refutation. By the well known property of logic called *modus tollens*, we know that a false conclusion derived from a valid logical argument implies the existence of at least one false statement contained in that argument. Unfortunately, *modus tollens* cannot usually indicate which statement (of the valid argument) is false. If the argument consists of the original theory plus some additional clauses, then a false conclusion (or prediction) does not tell us whether it is the original theory or the added clause which is at fault.[14] However, if the added clause can be independently tested, then this matter of logic – the ambiguity of *modus tollens* – need not concern us.[15]

Implicit in this debate and criticism is the view that the existence of the possibility of deducing upward sloping demand curves from a given theory of the consumer is evidence of the failure of demand theory. Not everyone would accept this view. Many seem to think that neoclassical (microeconomic) consumer theory can be refuted without negating either the Law of Demand or neoclassical price theory. For example, observance of conceivable counter-evidence would lead Lloyd to reject Ordinal Demand Theory, yet, as he said, there are an infinity of possible theories of the consumer. What one replaces it with need not be anything like the original consumer theory. However, the given refuting evidence would now have to be explained by the replacement. Lloyd's notion of convincing refuting evidence is the observation of upward sloping demand curves for non-inferior goods (as well as Giffen goods). But, if my arguments in this chapter are correct, his counter-evidence would overturn neoclassical price theory as well. Of course, neoclassical price theory can be false and the traditional demand theory true without any need for *ad hoc* modifications. In this case the indeterminacy that De Alessi and others point out would not matter. It would not matter because if price theory were false and Giffen goods were considered possible, demand theory would no longer be interesting as it would not have any intellectual purpose. However, in this latter case, if price theory is false, there are no market-determined prices in the neoclassical sense.

In the absence of a successful test of demand theory as suggested by Lloyd, what are we to conclude? Should we accept *ad hoc* modifications in order to explain the presumed regularity inferred from the absence of conclusive evidence of the Giffen paradox? De Alessi seems to think we should. Others such as Stigler can argue that there is no independent evidence of such a regularity either and thus we can drop the necessity of being able to deduce only negatively sloped demand curves. Welty seems

to think that such a weak approach would make demand theory untestable but his conclusion is based on what may be a mistake, the alleged indeterminacy of the slope of the demand curve. Lloyd and others have shown, however, that the slope may always be determinate. It is only that the slope is indeterminate with the *a priori* conditions placed on utility functions or indifference maps.

CONCLUDING REMARKS

This brings us full circle. I have argued that the Giffen paradox is contrary to our market equilibrium theory of prices. Apart from our neoclassical price theory, the existence of the Giffen paradox would not be a refutation of consumer theory. Lloyd's positively sloped individual demand curve for a non-inferior good would be a refutation of both traditional consumer and traditional price theories, but that is still not a case of a Giffen good in the Hicksian sense. Giffen goods themselves are still consistent with Ordinal Demand Theory. The problem is that Ordinal Demand Theory which allows Giffen goods may not be consistent with our individualist theory of market prices.

If the existence of Giffen goods has never been empirically established then a realistic theory of demand should at least explain the fact of their non-existence. Any demand theory which does not explain that 'fact' (if it is agreed that it is a fact) has not done its empirical job, let alone whether or not it has done its intellectual job with regard to explaining the demand side of price theory consistent with *laissez-faire* individualism. More subtly, in any given demand theory, if Giffen goods are allowed as a possibility for the individual but not for the aggregate demand curve, then such a theory puts the desired independence of decision-makers into jeopardy whenever market-determined prices are to be the 'given prices' upon which the individual consumers base their demand decisions. If Giffen goods are allowed in consumer theory but not in price theory, then some explanation must be provided concerning the given income distribution. That is to say, we would have to explain why income is sufficiently well distributed such that the kind of income–expenditure situation Hicks and Marshall describe for the Giffen paradox could never occur. Of course, that theory of income distribution must also avoid contradictions with our *laissez-faire* individualism. If the so-called Cambridge controversy over capital and distribution is any indication, the possibility of such a neutral theory of income distribution does not seem promising.

NOTES

1 It should again be noted that Marshall's concern for Giffen goods was due to doubts not about his theory of demand but instead about the ability to calculate consumers' surplus since such a calculation would require a downward sloping demand curve [see further Dooley 1983].
2 For example, we could have publicly or privately administered prices. And with (1) excess demand does not necessarily lead to a rising price without someone having the notion that by raising the price the situation will somehow be improved.
3 The existence of a counter-example (a case where the world is as described here, but there still is no movement toward equilibrium) will be sufficient evidence for the insufficiency of the combination of (1) and (2). Their necessity has never been asserted except by those who might wish to claim that is the way the world *should* be.
4 To successfully criticize the necessity we would have to produce a successful theory that did not explicitly or implicitly use both of these assumptions (1) and (2).
5 I will ignore the cases that cannot be represented as 'well defined functions' (viz. vertical and horizontal lines) and those cases of parallel demand and supply curves which imply a covariance that would contradict independent decision-making.
6 For example, if both curves are positively sloped (e.g. a case involving a Giffen good), Walrasian stability would not be assured if the market is characterized as case (f). Thus we must be able to explain why the supply curve will be steeper than the demand curve as in case (c).
7 In other words, if the price is above marginal cost, the firm will increase the quantity produced.
8 It is interesting to note that one can argue that both Marshall and Walras used both stability concepts. So-called Walrasian stability must hold in the short run and Marshallian stability in the long run [see Davies 1963]. In this light, note also that most neoclassical arguments involving prices in applied economics presume the existence of a long-run equilibrium. And since the long run is but a special short-run equilibrium, both stability conditions must hold in applied neoclassical economics based on market-determined prices. Some Post-Keynesian economists may wish to dismiss the long-run aspect but the fulfillment of Marshallian stability is already built into the neoclassical short-run theory of supply. Other more mathematically minded economists may argue that neither condition needs to hold if one merely adds an appropriate time-differential function for price changes to assure convergence to an equilibrium price over time. The stability of such a market determination of price depends entirely on an *arbitrarily* chosen coefficient representing the speed of response [see Lancaster 1968, p. 201]. For a discussion of the methodological problem posed by this *ad hoc* dynamics strategy, see Boland [1986a, Chapter 9].
9 Or at least not positively sloped if the supply curve is not vertical. Note that the argument would hold even if we were only concerned with one type of stability as we would still have to distinguish between (a) and (d) or between (c) and (e) of Figure 14.1.
10 For a discussion of using models to test theory, see further Boland [1989, Chapters 1 and 7].

11 In particular, Lipsey and Rosenbluth [1971] argue that Giffen goods are more likely when we base utility on 'characteristics' rather than the goods themselves. Unfortunately, they use Lancaster's *linear* model of the relationship between goods and characteristics and it is the linearity *alone* which produces their result. There are many possible non-linear models of characteristics production which would yield the Hicksian conclusions concerning 'likelihood'.

12 He suggests that we assume that 'individual utility functions [are such] that the absolute value of the deduced income effect is less than the absolute value of the deduced substitution effect in the case of inferior goods' [De Alessi 1968, p. 293]. This would seem to be as testable as Lloyd's considerations, only a little more complicated.

13 For example, the Giffen paradox can be avoided by assuming *ceteris paribus* the constancy of the marginal utility of money and then with an additive utility function using diminishing marginal utility we can explain the Law of Demand. Any substitution as the result of a change in price would change the marginal utility of money, hence rendering this theory of demand untestable. With regard to such counter-critical uses of *ceteris paribus* clauses Welty would be quite correct but Lloyd does not use *ceteris paribus* in this manner.

14 In philosophy literature, this is known as the 'Duhem–Quine' thesis, see further, Boland [1989, Chapter 7].

15 De Alessi's added clause might not be independently testable or it might only be more difficult to test than other statements contained in the traditional theory (such as the fixity of money income, fixity of prices of other goods, etc.). On this matter De Alessi's modification may not seem to be very problematic. The only criticism Welty can give reduces to the accusation that De Alessi offers a 'demonstrably arbitrary' modification of traditional demand theory. That is, De Alessi's modification is *ad hoc*.

Epilogue

Learning economic theory through criticism

Some opponents of neoclassical economics will complain that my exploration of ways to criticize neoclassical theories was not exhaustive. I welcome them to take up any other line of criticism they might have in mind. My interest has been to develop a clear understanding of neoclassical theory by determining the essential ideas that are used to form *any* neoclassical explanation. Trying to pin down the essential ideas is sometimes difficult because neoclassical economics always seems to be a moving target. I remember conversations (arguments?) with radical Marxist students in the 1960s who often would claim to have the definitive critique of neoclassical economics. Whenever they explained their criticism to me it always seemed that they were criticizing economics as it was understood about 1870. These conversations convinced me that if the critics really wanted to form effective criticisms of neoclassical economics they should learn more about how neoclassical economics is understood today. The more they understand neoclassical economics the better will be their critiques. The fear in the 1960s was always that one would be indoctrinated if one went through a formal process of learning neoclassical economics. Indoctrination might be possible but nevertheless I cannot see how one can form an effective criticism of neoclassical economics without a clear understanding of neoclassical theory.

When it comes down to its essential ideas, neoclassical economics seems now to have settled down into the clear research programme which was fairly well defined in the 1930s. Of course, the techniques of modelling neoclassical theories have changed significantly over the last fifty years and it is all too easy to confuse advancements in techniques with improvements in essential ideas. While some of the rhetoric is different, there are two identifiable streams. On the one hand there is the approach of Marshall and his followers. On the other there is the one developed by Hicks and Samuelson which follows Walras. Both are based on the neoclassical maximization assumption. Both are concerned with the

necessary conditions which follow from the existence of a competitive equilibrium. While over the years the means of determining the necessary conditions have varied widely, the necessary conditions of interest are the same for both.

The source of the necessary conditions is the maximization assumption and the details are due to the particular *form* assumed for the objective functions (utility or profit). But Marshall, the mathematician, had a deeper understanding of necessary conditions than mere technical questions concerning the form of the objective functions. The questions that have preoccupied the followers of Walras are almost exclusively concerned with what assumptions one must make about the form of the objective functions to assure an equilibrium. Marshall clearly understood that one cannot explain an individual's behaviour as a matter of *choosing* the optimum unless there is sufficient freedom to choose other options. This he expressed with his Principle of Continuity which is a reflection of his approach that focuses on the necessary conditions by analyzing the calculus-based neighbourhood properties of any equilibrium. For Marshall the idea of the availability of alternative options translates into the requirement of a continuum of options. So, from Marshall's perspective, one says that one *understands* phenomenon *X* because one has assumed that *X* is the logical result of maximization given that the decision-makers had numerous alternative options from which to choose. Moreover, prices must matter in the individual's choice if the logic of the choice process is to be used to explain prices. If one's choice is limited to an extreme point on the continuum then one can explain the choice without reference to prices and thus prices do not matter. Clearly, one cannot explain or understand prices with a model in which prices might not matter!

Marshall's [1920/49, p. 449] understanding that one cannot generally assume that knowledge is perfect implicitly recognizes that knowledge is important. Yet few if any neoclassical models try to explain how the maximizing individual decision-maker knows the prices or income or even knows the utility or profit functions. Attempts to give a neoclassical explanation of knowledge by explaining the economics of information [e.g. Stigler 1961] begs the question of how information becomes knowledge – do we always have to assume knowledge is acquired inductively?

Leaving aside the difficult question of explaining knowledge, to what extent do we understand fundamental things like prices with neoclassical models? If our understanding is that all prices are general *equilibrium* prices then at least logically the explanatory basis will be adequate but only if those prices are the only prices implied by our model. This raises the old problem of whether one must require uniqueness or completeness in models. If we are only interested in local maximization then a successful neoclassical model would seem not to require uniqueness or completeness. But the question remains whether a neoclassical model based on local maximization can be a basis for *understanding* why prices are what they are and not what they are not. Unless one has shown that the prices are consistent with global maximization the possibility exists that there are multiple local optimal prices that could have been obtained. Whenever there are many possible sets of general equilibrium prices within an offered explanatory model, the question is begged as to why the world faces the one set of equilibrium prices rather than any other logically possible set of equilibrium prices. If we understand prices by being able to explain them then the basis of our explanation is a critical issue. The basis for understanding is not just the neoclassical maximization hypothesis but, I am arguing, it also includes the assertion that those are the only possible prices.

What I am saying here about the requirement of understanding is not widely accepted by economic theorists today. This is partly because most economists today think that if there is any problem with neoclassical economics it is most likely a technical modelling issue. Few economists think there is anything fundamentally wrong with their notion of explanation or understanding. Unfortunately, if the question of uniqueness and completeness is considered to be a mere technical modelling question, it can be dismissed since any model which might provide uniqueness or completeness is usually 'intractable'. So much for tractable models! The question I ask is just how do we understand prices?

Put in more methodological terms, how do we know when a neoclassical explanation of price is false? If we say we *understand* prices with a neoclassical explanation then conceivably we must be recognizing the possibility that such an explanation could be false – otherwise it would be a vacuous tautology! Any claim that says you know why the world is what it is must entail an assertion that you know why the world is not what it is not. Whenever people claim to have explained something, the challenge is for them to explain what evidence it would take for them to admit that their explanation is false (if it is false). This is my challenge to believers in neoclassical economic explanations of prices. What would neoclassical economists accept as a situation that would force them to admit that they might not actually understand why prices are what they are?

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