Supply and demand explanations and their *ceteris paribus* clauses

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This paper argues that supply and demand explanations are causal explanations and that it is helpful to recognize this fact explicitly, for then one can appreciate that the variables impounded in the *ceteris paribus* clauses attached to supply and demand curves are other *causes*. One can then specify clearly the conditions of membership in a *ceteris paribus* clause: 1) include all those factors that within the given time period significantly affect the amount supplied or demanded but; 2) do not include any factors that themselves within the given time period significantly depend on the price of the particular commodity or service. Note the vague word 'significantly'. If one insists on the general interdependencies established in general equilibrium analyses, one must reject partial equilibrium analyses altogether, but to do so would rule out work that may be enlightening and useful. Such theoretical purism is also indefensible, since general equilibrium analyses rely on similar causal approximations. This analysis of *ceteris paribus* clauses is helpful in understanding where supply and demand analysis or comparative statics goes wrong, as in traditional functional distribution theory.

A severe frost cut Brazilian coffee output in 1976 to less than one-third of its previous level. During 1976 coffee prices were much higher. The simple and relatively uncontroversial explanation is that buyers competing with one another for the decreased supply of coffee bid up its price. According to Adam Smith, when the quantity of a commodity

> . . . which is brought to market falls short of the effectual demand, all those who are willing to pay . . . [its natural price] cannot be supplied with the quantity which they want. Rather than want it altogether, some of them will be willing to give more. A competition will immediately begin among them, and the market price will rise more or less above the natural price, according as either the greatness of the deficiency, or the wealth and wanton luxury of the

competitors, happen to animate more or less the eagerness of the competition (1776: 56).

This is a sketch of a causal explanation. The decreased supply and the actions of buyers and sellers on a market are causally responsible for the increase in price. The actual story is of course much more complicated. Any moderately detailed history of the 1976 coffee price increase would have to consider questions of international trade, transportation, and exchange rates, the role of wholesalers and retailers and their expectations concerning the consequences of the frost, the effects on different grades of coffees, the possibilities of employing different methods of roasting coffee beans and brewing coffee, the extent of substitutability between coffee and tea and so forth. But the simple supply and demand explanation surely captures the heart of the story.

This paper will examine in detail such simple supply and demand explanations as they are incorporated into neoclassical economics. Toward the end of the paper I shall offer a few words of cautious appraisal of neo-Walrasian high theory; but most of this essay is internal to neoclassical theory, whether it be Marshallian or Walrasian – an examination of its logic and structure.

A modern economist would dress up the above explanation for the increase in the price of coffee in the following familiar graph.

Figure 1 is a graph of the market demand function – a mapping from coffee prices to quantities per unit time of coffee demanded. Following Marshall, quantity is plotted on the horisontal axis and price on the vertical
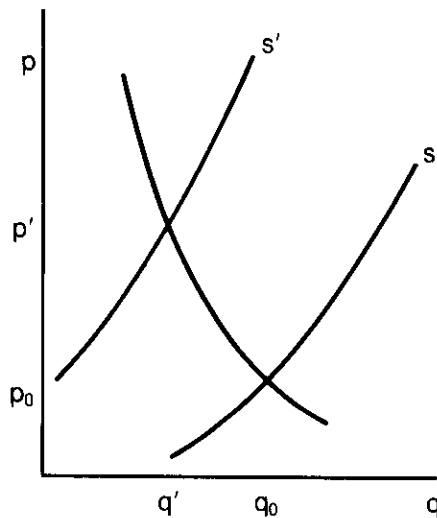

Figure 1

axis, even though in contemporary neo-Walrasian thought, price is the independent variable and quantity demanded or supplied the dependent variable.[1] A market demand function is supposed to be in some way the sum of individual demand functions; and both are designed as improvements on Adam Smith's colourful talk of the factors animating the eagerness of the competition among the buyers. D slopes downward to the right, which is an instance of the law of demand: *ceteris paribus* people demand more of a good at a lower price. S is the initial (prefrost) market supply function for coffee. Since we are considering a short run, in which there is no possibility of planting more coffee trees in Uganda and then harvesting the beans, S slopes sharply upward. Supply is quite inelastic in the short run. q_o is the initial amount exchanged per period and p_o the market-clearing price. S' is the supply function following the frost. It is considerably to the left of S. The new equilibrium price is p', which must be higher than p_o, since the demand curve slopes downward. The new total value of the coffee sold, $p'q'$, may be larger or smaller than old total value, $p_o q_o$, depending on the elasticity of demand.

Although more abstractly told, one has here the same story as at the beginning of the paper. The modern economist is offering a causal explanation of the price increase in which the shift in the supply function coupled with the fixed demand function and the given market mechanism are the causal or explanatory factors. Not all explanations are causal, but supply and demand explanations are supposed to state what *influences* or *determines* prices and quantities exchanged. Furthermore, like causes, the explanatory factors here can be used to manipulate the market outcome. Someone who wanted to have his or her coffee at a lower price could learn from this explanation to try tampering with the market mechanism or to try spreading the news that coffee is a carcinogen. Supply and demand explanations such as this one are causal explanations.

I have belaboured this rather obvious point, because economists are suspicious of causal language. There are two main reasons for these suspicions. First, many economists regard talk of causes as a commitment to *single-factor explanation*. Although few economists would deny that the frost led to the price increase, most would stress that there are other crucial influences and that in other circumstances the frost need not have had the same effect. Economists thus prefer to speak in terms of 'influence', 'determination' or 'dependence' rather than in terms of cause and effect. But economists' talk is consequently ambiguous between causal and mere mathematical influence, determination and dependence. One is better off relying upon old-fashioned talk of causal explanation, causes, causal factors and so forth. In using such language, I am not concerned with which among

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[1] For interesting discussions of why Marshall transposed the axes, see Gordon (1982) and Leijonhufvud (1974).

the various causal or explanatory factors should be called a 'cause' as opposed to a 'causal condition', nor am I concerned with the context-sensitive question of which among the various causes should be regarded as *the* salient cause. In using causal language I am in no way denying that many factors are causally relevant to economic outcomes. In Hicks' terminology (1979: 13) I am concerned with 'weak causality'. Although I shall often talk of causes, because any alternative would be ambiguous or cumbersome, my concern is with causal generalizations and causal explanations, not with singular causal claims. No analysis of causation or causal explanation will be offered, because the assumptions made here about them are consistent with all the prominent analyses.

The second reason why economists may be inclined to deny that supply and demand explanations are causal is that equilibrium or comparative statics analyses, of which supply and demand explanations are instances, are often *distinguished* from dynamic and explicitly causal accounts. Instead of tracing the chain of consequences of the Brazilian frost though various markets, neoclassical economists attempt to say what price and quantity would be in 'equilibrium' – that is in that state where there is no excess demand for coffee. Such partial equilibrium explanations differ from paradigm cases of causal explanation since they abstract from the actual sequence of events and the causal relations in that sequence. There is no explicit mention of time ordering, which according to Hume and others is essential to a causal relation. In the resultant static equilibrium, the supply and demand functions, the market institutions and the equilibrium price and quantity are all regarded as simultaneous, even though the former three are supposed to explain the latter two.

Although the distinction between dynamic and comparative statics accounts is an important one, both may be causal. The causal structure of comparative statics analyses is straightforward. In the background in such analyses is an implicit temporal story in which the parameter shift whose effects one is exploring precedes the establishment of a new equilibrium. In abstracting from the actual course of adjustment to the initial shock, one is assuming that the adjustment process has little effect on the final outcome. When this assumption is mistaken, one's explanation will be incorrect. But making such an assumption and then leaving the intermediate steps out does not make the explanation noncausal. Even those who insist that causes must always precede their effects can regard supply and demand explanations as causal.[2]

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[2] Many philosophers (and indeed some economists too – see Hicks, 1979: 62) find analyses of causation inadequate that require causes by definition to precede their effects. On accounts of causation such as those offered by Ehring (1982), Lewis (1973), Sanford (1976) or me (1984) temporal priority is not built into the analysis of causal priority. On each of these analyses (as well as on many others in the contemporary philosophical literature) supply and demand explanations are unproblematically causal. But see Sober (1983).

Having now, I hope, established that supply and demand explanations are causal explanations and allayed economists' fears of such metaphysical talk, I want to examine the structure of neoclassical supply and demand explanations in more detail, clarify the nature of the *ceteris paribus* clauses these explanations carry, and make precise the relations among fundamental theory, such supply and demand explanations and specific general equilibrium accounts. I shall also show how unclarity concerning the causal structure of supply and demand explanations can lead to mistakes in economic theorizing. This paper is *not* a general treatment of causation in economics, for it is not concerned with questions of identifiability nor with the problems of inferring specifically causal conclusions from statistical data.[3]

According to fundamental neoclassical theory, economic phenomena are to be explained in terms of the maximizing efforts of individuals given tastes, endowments with resources and abilities, and the set of production or technological possibilities. In the background is a set of institutional constraints. One great mathematical accomplishment of twentieth-century economics has been to demonstrate that when tastes, endowments and technology satisfy certain conditions, then individual maximizing efforts can be consistent – that there exists a general equilibrium (where there are no excess demands on any market). Most theorists concede that some of the givens upon which the properties of the resultant general equilibrium depend, such as technology, are themselves influenced by dependent variables such as factor prices (Hicks, 1979: 58); but as a first approximation (which is seldom or never relaxed) tastes, initial endowments and production possibilities are treated as primitives that have no economic explanation and are not dependent upon any economic variables. These primitives may, of course, change. But such changes are just exogenous shocks, whose consequences, but not causes, are open to economic investigation. General equilibrium primitives are the ultimate or underlying causes of economic phenomena.

In principle fundamental neoclassical theory leads to the view that there is just one big explanatory claim to be made (and then adjusted for each exogenous shift in tastes, technological possibilities, endowments or institutional environment). Indeed some general equilibrium theorists have rejected, at least by implication, all supply and demand explanations because of their inconsistency with a strict general equilibrium perspective. Christopher Bliss articulates what turns out to be the basis for such a

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[3] On causality mainly as relevant to questions of identifiability, see Koopmans (1953), Simon (1953), Strotz (1960), Strotz and Wold (1960) and Wold (1954; 1960). On questions concerning the inference of causal relations from statistical data and, to a lesser extent on questions of identifiability, see Engle *et al.* (1983), Geweke (1982; 1984) Granger (1969; 1980; 1985), Leamer (1984) and Sims (1972; 1977; 1983).

rejection as follows: nothing can be an economic cause unless it is a 'primitive' – that is, unless its analysis or explanation is 'largely outside the domain of theoretical economics as such' (1975: 29, 34, 120). Not every primitive is a cause of each economic phenomenon, but if x is a primitive and an 'alteration in its specification might necessitate an alteration of' y, then x is a cause of y (1975: 34). In the book on capital theory from which I am quoting, Bliss is not concerned to present or defend a general account of causal explanation in economics. I quote him only as one example of a brief and unsatisfactory treatment of the subject.

In the passages cited Bliss is concerned to show that specific marginal *products* (not marginal *productivities* or supply and demand functions) cannot be regarded as causing or explaining prices – which is entirely correct. But the argument proves too much. Marginal concepts are in Bliss's view nothing but 'optional extras' (1975: 37) merely because they are not primitives. For only primitives can supposedly be causes. Bliss is in effect dismissing the possibility of intermediate causes between the economic primitives and the particular variables to be explained. The same reasoning would demonstrate that supply and demand functions, which are certainly not primitives, cannot be used to explain prices either.

This implication of Bliss's discussion follows from *both* his criterion for judging the causal ordering or models[4] and from his commitment to general equilibrium models. But such theoretical purism will not do. Surely claims such as, 'Jones eats lots of potatoes because she is poor' may be true even though Jones's poverty is not an economic primitive. And indeed it is possible, at least approximately, to causally order (in Simon's sense (1953)) the basic general equilibrium model. For example, suppose that one adds Jones with Jones's tastes and her tiny endowment to an ongoing economy. The economy's price vector may be almost completely unaffected. In this case Jones's endowments and the more or less given prices jointly determine her income. Her tastes, her income and the prices then in turn determine her consumption. Her income can thus be causally between the general equilibrium primitives and her consumption. In this way the standard theory of consumption is 'approximately consistent'[5] with a full general equilibrium account and represents a partial causal ordering of a general equilibrium model. Supply and demand explanations are an extension of such partial and approximate causal ordering.

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[4] Although Bliss is not explicit on the point, he has proposed a criterion for judging the causal structure of a particular model, not a criterion for judging the causal ordering of the world. Any other interpretation of his views would make the answers to causal questions depend on where one draws the boundaries of economics or on whether one takes a variable in a particular model to be exogenous – which gets things exactly backwards. In constructing a model, one decides whether to consider some feature as primitive or exogenous by judging whether it is causally dependent on the other factors considered (Hausman, 1983).

[5] A continuum of traders (Aumann, 1964) permits exact consistency.

To get some useful grip on questions such as why the price of coffee increased and thus to use economic theory as an 'engine for the discovery of concrete truth' (Marshall, 1885: 159), economists often need to be able to treat single markets or small groups of markets in isolation. But markets are, of course, not isolated. Supply and demand depend on many other variables besides the price of coffee. To treat them, for the purposes of an approximate, but hopefully useful analysis, as functions of the price of coffee only, is reasonable only if the other factors that influence supply and demand remain constant or if one takes into account the shift in supply or demand caused by a change in these other variables. Economists conceptualize this issue, *which essentially involves separating different causal factors*, in terms of defining the *ceteris paribus* conditions for supply and demand functions.[6] Coffee supply and demand functions state how much coffee would be demanded and supplied at various prices, other things being equal. These other things are other *causes*, which are, in Hicks's terminology (1979: 13–14) assumed to be 'separable' and indeed 'additive'.

In discussing *ceteris paribus* clauses in the context of supply and demand explanations, I shall follow the literature and focus on demand curves. The conditions on membership in the *ceteris paribus* clause of the demand function for some commodity or service are simple: One would like the *ceteris paribus* clause for a demand curve to include: 1) all those factors besides the price that within the given time period significantly affect the amount of the commodity or service demanded; and 2) none which are themselves within the given time period significantly affected by the price. 'Significantly' is, of course, a vague word, but if one is to have any hope of defining demand as a function separately of price and of other factors impounded in a *ceteris paribus* clause, one must seize every opportunity to simplify the causal structure.[7]

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6 *Ceteris paribus* clauses may also be regarded as vague excuses that may enable one to reconcile the commitments of economists to certain statements, which one might regard as fundamental 'laws' of economics, with the same economists' recognition that these statements are not true. See my 1981, Chapter 7. But there is the alternative of taking the specification of disturbances or interferences that economic theory *itself* provides more seriously. On such a view, the other things which must be equal consist of tastes, technology, endowments and institutional structure. The *ceteris paribus* clauses in specific applications of neoclassical economics would then reflect its commitment to a particular structure of causal explanation. As better defined and delimited, such *ceteris paribus* clauses are more scientifically respectable. Although they may still function as excuses, they are not excuses for all occasions. They do not, for example explain away apparent instances of non profit-maximizing activity on the part of firms or entrepreneurs. Note also that these constrained *ceteris paribus* clauses have no place in specific *general* equilibrium explanations or predictions. In maintaining that tastes, technology, endowments and basic institutional structure are the *only* relevant causal factors, one is eschewing the vague all-purpose excuse of some totally unspecified disturbance or interference.

7 The extent to which one variable depends upon another is an empirical question, although, like other empirical questions, it cannot be answered in a completely presuppositionless way. An

The justification of these two general conditions on membership in the *ceteris paribus* clause of a demand curve is straightforward. If one leaves a significant causal factor out, then one will sometimes be mistaken about the quantity demanded, even though, supposedly, all other things are equal. If, on the other hand, one includes a factor that is significantly affected by the price of the commodity or service, then one's *ceteris paribus* clause can never be satisfied. As price varies, one should move along a single unshifting demand curve. Demand and supply curves may shift because of a change in one of the variables in their *ceteris paribus* clauses, but they should not *shift* merely because the price of coffee changes. In short-run supply and demand explanations, one may also include in the *ceteris paribus* clause of a demand function factors (such as coffee acreage) which are very sensitive to the price of coffee, but which take a long time to adjust.[8]

Milton Friedman suggests that one also include in one's *ceteris paribus* clause those variables which do not affect demand (1953a: 58) at all. But one specifies the content of a *ceteris paribus* clause precisely to make explicit possible disturbances or interferences, not to list irrelevant variables. Although it may not be worth the trouble to remove irrelevant variables from a *ceteris paribus* clause, it is desirable to do so, since one need not worry about the effects of changes in their values.

There is one further complication. Demand for coffee also depends on variables such as the price of tea, which cannot be regarded as unchanging in the short run as the price of coffee varies, and which thus do not qualify for membership in the *ceteris paribus* clause. There are two options here: either one *provisionally* includes such factors in the *ceteris paribus* clause anyway and then later corrects one's solution for 'indirect effects', or one may be able to deal with a small number of markets simultaneously.

Finally, since one wants to be able to use a demand curve to explain the change in prices which results from a shift in supply (and *vice versa*) the factors included in the *ceteris paribus* clauses for the supply and demand curve should differ to some extent. Otherwise every shift in supply would be equally a shift in demand, and there would be little point to categorizing

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econometrician who is undecided whether a particular coefficient is small enough that it may be treated as zero may estimate the value of that coefficient. But in carrying out that estimation, the econometrician will need a model in which other coefficients are regarded as small enough that they can be regarded as zero. But the inability to read causal structure out of the unvarnished facts does not mean that questions of causal structure are not empirically answerable. Theoretical and causal presuppositions are essential, but they are also correctible in further inquiries.

[8] It should be stressed that although Marshall's short-run thus has a lot to with a short period of time, his notion of long-run equilibrium has little to do with any long period of real history. Over any long time period tastes and technology will change enormously – as Marshall not only recognized, but looked forward to. Unexplained shifts will then carry more of the explanatory burden than economic theory itself. Neoclassical theory has, I suggest, little fruitful application to long periods of time.

factors into influences on supply and influences on demand (Friedman, 1953b: 8).[9]

We can at last articulate the structure of the supply and demand explanation for the coffee price increase. The economist assumes that there is an initial equilibrium in which at the market price the amount demanded equals the amount supplied. There is then a change in some factor other than the price of coffee upon which the amount of coffee supplied depends – in other words in one or more of the variables included in the supply function's *ceteris paribus* clause. In 1975, for example, there was an abrupt drop in the endowment of ripe and healthy coffee beans. Presumably such a drop has some effect on the demand for coffee as well. This small effect may be ignored, although it need not be.

The drop in the endowment of coffee beans causes a leftward shift in the supply function. At the old equilibrium price less coffee will be supplied than will be demanded. The market mechanism somehow increases the price of coffee until the amount demanded equals the amount supplied. One must also consider indirect effects of the new coffee price on tea or cream prices and the feedback consequences of these effects on coffee prices. The process of price adjustment may be lengthy and rocky. There is no guarantee that adjustment mechanisms will ever find the equilibrium price, let alone find it rapidly and costlessly, nor that the actual equilibrium will be unaffected by the details of the adjustment process.

In the real world the nonequilibrium prices that prevail in the market at any given moment obviously have a role via the market mechanism in the process of determining equilibrium prices. From an explicitly dynamic perspective, price and quantity bear causal and explanatory relations to one another. One might have expected that these explanatory

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9 This analysis of *ceteris paribus* clauses is compatible with the two main positions in the literature concerning demand curves (see Yeager, 1960; Friedman, 1953a). In the case of the standard Hicksian demand curve the consistency is obvious, apart from the problems with substitutes or complements. The alternative, 'Chicago' demand curve, defended by Milton Friedman, is not so obviously consistent, since the real income of coffee drinkers depends on the price of coffee. But provided that one makes the proper compensation for the income effect of the change in the price of coffee, Friedman's variables can satisfy the general conditions on membership in the *ceteris paribus* clause of a demand curve.

It is worth pointing out that Friedman's defence of his demand curve as analytically superior to the standard demand curve is unsuccessful. Friedman argues that the Hicksian demand curve is inconsistent with general equilibrium. For example, if a government subsidy shifts the supply curve for some commodity to the right, more of the commodity will be consumed. But given the *ceteris paribus* clause, where will the resources come from to produce the additional amount of the commodity (1953a: 60–61)? Other endowments must appear from nowhere without affecting prices or incomes. But Friedman's demand curve is at best only more explicit about its inconsistency with general equilibrium theory. As one moves along one of his demand curves some of the general equilibrium primitives must change in order to keep the real income of the demanders constant. Those who insist on strict consistency with general equilibrium analysis (unreasonably, as I shall argue) had better not soil their hands with supply and demand curves at all.

relations would carry over into the equilibrium analysis, but this expectation is mistaken. In the comparative statics account the explanatory factors reduce to the old demand curve, the shifted supply curve and the unspecified market mechanism. The relations between equilibrium price and quantity are as epiphenomenal as those between barometer readings and storms. Barring a causal ordering of the model, the values of the variables are simply effects of common causes or explanatory factors. They are mutually or simultaneously determin*ed* rather than mutually determin*ing*.

Unlike specific equilibrium or disequilibrium prices or quantities, or specific marginal products, marginal rates of substitution, scarcities etc., supply and demand *functions* may thus have a role in explaining prices. Supply and demand explanations should be acceptable to any neoclassical theorist provided that the particular supply and demand functions are causally prior to the equilibrium prices and quantities they are supposed to explain. They will be causally prior if and only if the causal factors which affect the supply and demand for a given commodity or service (apart from its price) are to some degree of approximation independent of its price, so that the *ceteris paribus* condition can be met. I cannot resist here a plug for my construal of causal priority (1984), which makes independence among the various causes of a given effect central to the difference between causes and effects.

The apparatus of supply and demand leads to problems when the *ceteris paribus* conditions cannot be met – that is, when the other causal factors which influence supply and demand themselves depend on the price. In such cases economists sometimes make mistakes, which the explication of this paper can help them to avoid.[10] I shall comment briefly on a venerable example.

Functional distribution theory is the attempt to explain the distribution of income to the owners of the principal factors of production: capital, labour and land. Neoclassical functional distribution theory, like the classical theory which preceded it, has traditionally explained distribution in terms of supply and demand. For brevity let me focus on the theory of wages. Demand for labour depends on the marginal productivity of labour,[11] and it

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[10] Applications of IS-LM analysis provide interesting instances of such causal mistakes. For a relevant, although I believe somewhat flawed discussion of IS-LM analysis see Leijonhufvud (1983).

[11] Since demand curves are typically defined on the *ceteris paribus* assumption that other prices (rather than input quantities) are held constant, marginal productivity curves will not, strictly speaking, be demand curves. (See Bronfenbrenner, 1971: 137). There are several different marginal product concepts: marginal physical products, marginal value products, marginal revenue products (Chamberlin, 1936) and marginal *net* value of physical products (Bliss, 1975: 95–100). When no single marginal product can be defined, input price will lie between the value of the decrease in product when one fewer unit of input is used and the value of the increase in product when one additional unit is used.

is a decreasing function of the wage because of diminishing returns. Theories of the supply of labour are more varied and controversial and will not be discussed here. A textbook example of a supply and demand account of wages might be a simplified explanation for the higher wages of workers and the lower rents of peasants after the black death in terms of a dramatic shift in the labour supply curve.

Like supply and demand explanations generally, such accounts are supposed to be causal explanations. Yet economists are uncomfortable in regarding the marginal productivity of labour as in any sense one of the causal factors responsible for the wage.[12] In many cases this discomfort stems from the recognition that the marginal productivity of labour is not an economic primitive.[13] But as already stressed, this fact is not sufficient grounds to reject supply and demand explanations of the distribution of income, for marginal productivities may be explanatory intermediaries in causally ordered general equilibrium models. Hicks, for example, asserts, 'as these things [the ultimate determinants of marginal productivity] change, so the marginal product of labour changes with them; and these changes in marginal productivity exert pressure, in one direction or the other, upon the level of wages' (1932: 18–19).

Yet modern supply and demand explanations of the distribution of income

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[12] Most modern theorists would dissociate themselves completely from the claims made by some nineteenth-century theorists that the marginal product*ivity* of labour is *the* cause of the wage. (See Boehm-Bawerk, 1888: 223–34; Carver, 1894: 400; J. B. Clark, 1902: 106, 160, 162, 167, 180, 187; Taussig, 1939: Volume II, 56; Wicksteed, 1894: 10). But the most common reason for this rejection is that marginal productivity provides only an account of the demand for labour and that to explain wages, one must also consider the supply of labour (see, for example, Machlup, 1963: 208). But to say that marginal productivity cannot *by itself* determine wages is not of course to say that it is not *one* of the causal determinants of the wage. And many reputable theorists have maintained that marginal productivity is one of the determinants of the wage. (Examples are Blaug, 1978: 460–61; Carver, 1904: 153, 165; Douglas, 1927: 73; Dunlop, 1957: 9; Fellner and Haley, 1946: vii; Hicks, 1932: 18–19; McCormick, 1969: 64–65; Machlup, 1963: 208; Marshall, 1930: 532; Pierson, 1965: 278; Samuelson, 1973: 541; Wood, 1889: 14). Walras makes the surprising claim (1926: 145) that '*rarete* is the cause of value in exchange'. (see also 1926: 307). Many economists have argued that the notion of marginal productivity applies mainly or even exclusively at the level of the firm (Alam, 1970: 240; Bronfenbrenner, 1971: 186; Durand, 1973: 746). But at the level of the firm marginal productivity figures in an explanation of employment, not of wages, which the firm finds more or less 'given'. Mark Blaug makes the puzzling claim that marginal productivity theory 'is a theory of wages on the industry level, the supply of labour to the industry being given' (1978: 460).

[13] Those who have denied that the marginal product*ivity* of labour influences the wage (at least if causal influence is taken to be an asymmetric relation) include Alam, 1970: 248; Bronfenbrenner, 1971: 136–37, 172–73, 188; J. M. Clark, 1931: 69; Commons, 1893: 179; Friedman, 1962: 173–76; Hutchison, 1953: 319; Jaffe, 1954: 512–13; Robertson, 1931: 222; Rothschild, 1954: 30; Schultz, 1929: 514; Schumpeter, 1954: 943; Walras, 1926: 417, 495; Weintraub, 1985: 14–17. Given terminological and conceptual difficulties and the fact that few economists address the causal questions explicitly, most of the attributions in this and the preceding footnote required considerable interpretation on my part. In his lengthy book on the historical development of marginal productivity theory, George Stigler (1941) never

remain problematic. Since, as Ricardo already recognized, relative prices depend significantly on the wage rate, one cannot impound relative prices in the *ceteris paribus* clauses of labour demand and supply functions.[14] In general one cannot sensibly consider what demand for labour would be, were the wage larger than it is, prices being what they are, because if the wage were larger, relative prices would not be what they are. Prices may not *change* immediately with changes in wages, but remember that what is being attempted is an explanation of equilibrium wages. The *ceteris paribus* condition built into supposed labour demand and supply functions can never be satisfied. The causal structure is awry; the supposed demand and supply *functions* depend on equilibrium wages and employment as well as *vice versa*.

The point is a simple one, although it is presented here in an unfamiliar way. Questions of functional income distribution are general equilibrium questions. Partial equilibrium accounts such as a supply and demand explanation of the distributional consequences of the black death will not do. Not only can one hardly suppose that the demand function for labour will remain unchanged with the loss of one-third of the population (which suggests the futility, but not necessarily the incoherence of the analysis in terms of supply and demand), but, more importantly, one cannot suppose that relative prices will remain unchanged as wages and employment change. And since one cannot define a demand for labour function, the dramatic decrease in the population of labourers does not automatically imply higher wages.[15]

Defenders of a traditional partial equilibrium treatment of functional income distribution have two possible responses. First, they might reasonably object that supply and demand explanations of wages are impossible only if the sensitivity of prices to both wages and employment is appreciable. If demand and supply functions for labour which ignored price changes were not too far off, one could still use them to explain wages and employment. But the onus is on the defender of traditional income distribution theory to demonstrate that prices are sufficiently insensitive to changes in wages and employment that one can continue to define approximate supply and demand curves. Arguments like those of Durand (1937: 750f), Archibald

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directly faces the causal question. Neither does Hicks in his *Theory of wages* (1932). I would argue, however that both Hicks and Stigler believe that the marginal productivity of labour does influence the wage (see Hicks, 1932: 18–19 quoted below in the text).

[14] Classical theorists avoided this problem, since they took the supply of labour to be given by the population of labourers, while the demand for labourers was taken to be determined by the 'wages fund', which consists of the preceding harvest (Hausman, 1984b). Supply and demand for labour were thus regarded as fixed before the wages of a given period were determined.

[15] In Cambridge models of capital reversing, a shift to a technique that is *less* labour-intensive may lead to *lower* wages

(1960), Fisher (1971), Simon (1979) and Thurow (1975: Chapter 3) suggest that the influence of wages and employment on prices is significant. One should also note that this defence of supply and demand theories of wages turns out to be a backhanded defence of the labour theory of value. If prices are not sensitive to wage changes and thus to changes in the rate of interest, then they may be approximated by labour values.

Secondly, defenders of traditional functional distribution theory might reasonably object that the entire argument rests upon taking the notion of 'labour' as a single input too seriously. There are many varieties of labour services, and explaining the prices of these presents no special theoretical problems.[16] Yet in the retreat to offering separate explanations for the wages of different kinds of labour (which may be a sensible move to make), one has also abandoned traditional functional distribution theory.

One might search for another construal of supply and demand explanations which is consistent with interdependencies among the labour market and other markets. For example, one might treat the demand for labour as a function of both wages and relative prices, or one might try treating the price change as an indirect effect whose reciprocal action on wages has to be taken into account. But these *particular* proposals will not do since supply and demand for labour depend not only on the wage rate, but also on the amount of employment. The size and composition of the demand for goods and the relative cost of production depend on the size of the employed labour force and its total expenditures.

Some theorists have, however, proposed a more radical way of redefining demand and supply curves. Suppose that one regards some or all of the general equilibrium primitives as functions of a parameter, k. Suppose further that for each value of k there is a unique equilibrium. One can then derive a reduced form relation that shows the equilibrium values of wages, employment and prices to be explicit functions of k and of any primitives which are independent of k (which are *ceteris paribus* variables here). Such a reduced form relation, although rather differently described, is called by Don Patinkin, a 'market equilibrium curve' (1956: 45). Suppose, to simplify matters further, that one takes k to be the total endowment of labour services, which one also takes to be the completely inelastic supply of labour. Since the market equilibrium curve now correctly states *ceteris paribus* for each value of the supply of labour what equilibrium wages will be, why not take the market equilibrium curve itself to be the demand curve? James Buchanan argues that demand curves should always be understood as such

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16 This objection downplays constancies in the relative wages of different occupations, and there is, apparently some evidence of such constancies. According to Reddaway (1959: especially 40), the structure of relative wages among different kinds of labour is not very flexible. Phelps Brown reports that the relative wages of English masons, carpenters and labourers, for example, remained constant for more than five centuries (1962: 132).

market equilibrium curves (1958: 263–64; see also Knight, 1944: 310). According to Buchanan (1958: 264) and Milton Friedman, the purpose of a demand curve is to enable one to predict correctly the new equilibrium that will result with a change in supply. Since market equilibrium curves enable one to do just this, Buchanan argues that demand curves should be interpreted as market equilibrium curves.

A market equilibrium curve and a given supply of labour may jointly enable one to *deduce* equilibrium wages and employment, but one should not jump to the conclusion that market equilibrium curves have any role in *explaining* wages and employment nor to the conclusion that market equilibrium curves are demand curves. One can deduce the height of a flagpole from the length of its shadow and the angle of elevation of the sun, but one has not thereby explained why the flagpole has that height. One can deduce the wage share of national income from the nonwage share, but such a deduction explains nothing.[17] A mathematical dependency is not automatically a causal or explanatory dependency.

Unlike an ordinary demand curve, a market equilibrium curve is not a partial equilibrium tool. It does not summarize the preferences and choices of those on one side of a particular market and it bears no direct relation to the demand for labour functions of individual firms. Instead it is a function showing what wages would be, given adjustments in all markets. The best way to appreciate this point is to consider the general case where equilibrium wage and employment are both variable functions (*ceteris paribus*) of the parameter, k. Here the supposed supply and demand curves coincide. The determination of *which general equilibrium one is in* is not a determination of a price or quantity through the forces of supply and demand in any single market.

The market equilibrium curve is an artefact of a particular factoring of a general equilibrium account of wages and employment: first one derives the market equilibrium curve as a function of k, then, given k, one derives the equilibrium values of the variables. One might reasonably question the usefulness and the explanatory power of such a factoring, but let us turn to the more basic question: is any general equilibrium explanation of the distribution of income possible, whether it is so factored or not? For the only viable way of theorizing about the distribution of income appears to be from a general equilibrium perspective. Since the mathematical and data demands of completely disaggregative general equilibrium theories render them infeasible (Hahn, 1973; Hausman, 1981a), the only real options for treating problems like income distribution theory are simplified aggregated general

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[17] The first example has been much discussed in the philosophical literature. See Bromberger (1966) and Hausman (1982). The second example is Bliss' (1975: 34).

equilibrium theories where one includes only a fairly small number of commodities, inputs and representative agents.

But such models rediscover the problems of defining *ceteris paribus* clauses in questions about the proper kind and degree of aggregation. For aggregation presupposes that the relations among the diverse units that are treated as one are not themselves significantly affected in the short run by the variables one is attempting to explain.[18] For example, if one attempted to use a one-commodity model to explain the change in distribution following the black death, one would be implicitly assuming that the mix of commodities produced and their relative prices do not depend on wages. So a one-commodity general equilibrium model of income distribution is as unacceptable as a simple supply and demand account, and for the same reason. The problems of choosing a suitable aggregative general equilibrium model and of defining demand and supply curves with satisfiable *ceteris paribus* clauses are variants of the same problem of causal analysis. The aggregative general equilibrium approach provides more flexibility than the standard partial equilibrium approach, although at the cost of somewhat greater complexity.

Thinking of supply and demand explanations as causal explanations and of the conditions that define supply and demand functions and their *ceteris paribus* clauses as causal conditions will hardly revolutionize neoclassical economics. Indeed implicitly and none too clearly this is how economists already think of them. But clear thinking about the tools of supply and demand curves and of comparative statics in general requires an explicit appreciation of their causal structure. This paper breaks no new philosophical ground and says little that is philosophically controversial. But this lack of philosophical originality is a *virtue*: the meagre and truistic philosophical basis of this analysis of the causal structure of supply and demand explanations makes the analysis much more readily available to current economic practice than would a more original and controversial philosophical account. In fact I have some philosophically controversial things that I could say about causation and causal explanation (1982; 1983; 1985; 1986), but the theses defended in this paper do not presuppose any particular philosophical theory.

In closing let me step back from contemporary neoclassical economics and offer one general reflection on the basic neo-Walrasian theoretical enterprise. As I have suggested throughout this paper, to reject partial equilibrium analyses because they are not strictly logically consistent with a many-commodity general equilibrium approach reflects a misplaced theoretical purism. Good sense demands that one be willing to regard weak causal

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[18] One can devise an index in order to insure that some of the relations between the commodities one is aggregating will be independent of the variables one is attempting to explain. But one will then need special justification to apply conventional generalizations such as decreasing returns or constant returns to scale to this commodity index.

connections as nonexistent in order to permit supply and demand analyses.

But the purism of general equilibrium theorists is not only misplaced; it is not theoretically defensible. In regarding tastes, technology and endowments as economic primitives, the general equilibrium theorist is already making exactly the same kind of causal approximation that partial equilibrium analyses require. Both kinds of theories disregard the dependence of tastes, technology and endowments on specifically economic variables such as prices, and both abstract from the complications of adjustment processes and of nonequilibrium trading. Supply and demand explanations merely add to the list of causal approximations by disregarding the small influences on the values of other economic variables exerted by the price and quantity one is attempting to explain. Only if these influences were, as a matter of empirical observation, never small, would partial equilibrium analyses be unacceptable.

Although supply and demand explanations thus do make more causal approximations than do general equilibrium analyses, it seems to me that the causal approximations in supply and demand explanations may actually be less problematic. For there is an interesting tension or conflict in the causal approximations that are common to general and partial equilibrium theories. In both cases one abstracts from: 1) the causal dependence of general equilibrium primitives on economic variables; and 2) the complications of adjustment processes. But the former leads one *toward* a short-run application, where this reciprocal dependence of 'primitives' on economic variables is most likely to be negligible, while the latter leads one *away from* the short run, where the complications of adjustment processes are likely to be significant. In some partial equilibrium analyses this tension may not be serious, since the process of adjustment in a single market may be fairly straightforward, and a short-run application unproblematic. But are there many applications of general equilibrium theory in which one can reasonably abstract simultaneously from adjustment processes and from the reciprocal dependence of economic variables on general equilibrium primitives?

In conclusion, I would urge economists to think explicitly about the causal claims they are making and to use the apparent guidance offered by general equilibrium theories cautiously.

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