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NON-WALRASIAN FOUNDATIONS OF MACROECONOMICS

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Non-Walrasian Foundations of Macroeconomics

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The aim of macroeconomics is, particularly after Keynes's General

Theory, to explain changes in the aggregate output or employment as

well as those in the price level.

The explanation of these changes in the macroeconomics of the so-called

monetarism is well founded on the traditional Walrasian microeconomics,

i.e., the determination of the price by the equilibrium of demand and

supply. Friedman [10] describes the effects of an increase in the rate

of growth of money supply at the long-run equilibrium where prices have

been stable. Because prices of products typically respond to an unanticipated

rise in nominal demand faster than the prices of factors of production,

real wages received go down—though real wages anticipated by employees

go up since at first they are likely to evaluate the wages offered at the

unchanged price level, with the result that in the short-run equilibrium

both demand and supply of factors of production are equally larger than those

in the long-run equilibrium. This " simultaneous fall ex post in real wages

to employers and rise ex ante in real wages to employees is what enables

employment to increase." But soon employees begin to realize rising prices

and demand higher nominal wages. To keep the supply of labor larger than

the equilibrium long-run supply, real wages now have to be higher than the

long-run equilibrium ones. Any rise in real wages, however, decreases

the demand for labor and tends to return employment to its former long-run

equilibrium level.

"Temporary increase in employment comes not from inflation per se, but

from unanticipated inflation," and exists only so far as inflation is

not fully anticipated even though the rate of money growth and price

rise continue to be higher than the initial long-run equilibrium rate.

This is quite a contrast to the quantity theory of money before Keynes.

Even in the discussion of transition period, Fisher admitted that " the

amount of trade is dependent, almost entirely, on other things than the

quantity of currency, so that an increase of currency cannot, even-temporarily,

very greatly increase trade. In ordinarily good times practically the

whole community is engaged in labor, producing, transporting, and exchanging

goods. The increase of currency of a boom period cannot, of itself, increase

the population, extend invention, or increase the efficiency of labor.

These factors pretty definitely limit the amount of trade which can be reasonably

carried on. "

In other words, pre-Keynesian quantity theory of money considered that any

changes in the supply of money are absorbed in changes in the price level,

with the level of employment unchanged even in the short-run.[1] The hard

core of Walrasian paradigm or research programme, i.e., the determination

of short-run eqilibrium by the equality of demand and supply, is shared

by both pre-Keynesian and post-Keynesian quantity theories of money. To

explain the changes in the level of employment in the short-run, which

the former cannot, however, the latter theory is equipped with a new protective

belt that discrepancy between anticipated and realized changes in real wages

changes both demand and supply of factors of production in the same direction.[2]

In the so-called fixprice model of macroeconomics considered by

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Barro-Grossman [2], Benassy[3], Malinvaud[13], and others, on the other
hand, demand and supply are not required to be equalized by changes in
prices and the level of output or that of employment is determined by the
short-side principle that either demand or supply, whichever is smaller, is
realized. Fixprice impliestthat prices are independent of the relation
between demand and supply. Since prices rise naturally in the face of
excess demand unless they are controlled institutionally, our main concern
with fixprice model is the Keynesian case where prices are not reduced
in the face of excess supply rather than the case of suppressed inflation
where prices cannot rise in the face of excess demand. The Keynesian
case in the fixprice model is more Keynesian than General Theory, since
excess supplies exist not only in labor market but also in goods market.
In other words, the first postulate of classical economics, i.e., the
equality of price and marginal cost, is also discarded so that firms wish
to sell more, if they can, at the current price or even at a price slightly
lower. In the depression, certainly, it is more realistic to suppose there
are excess or idle capacities and unintended inventory in firms as well as
involuntary unemployment for workers than to assume away, as in General
Theory, the former and to concentrate to analyze the latter.

Keynesian or fixprice macroeconomics has been, however, not so well
founded on microeconomic theory. Unlike the macroeconomics of quantity
theory of money, it cannot be founded on traditional Walrasian microeconomic
theory, since we have to explain why price is not reduced in the face of
excess supply or why price changes so slowly that it remains practically
unchanged in the short run. We have to, therefore, develop non-Walrasian
microeconomic theory. In the next section, section (2), we argue that
Carl Menger, who shared with Walras the honor of being one of the founding
fathers of the marginal revolution, is the earliest and the greatest

non-Walrasian economist. We can start our consideration of non-Walrasian economics from the microeconomics of Menger, where he pointed out that the price or the ratio of exchange is not the only important factor in the theory of exchange and emphasized the asymmetry between demand (offer of money, the most liquid commodity) and supply (offer of other commodities), i.e., the former is easily realized while the latter is not. As a matter of fact, Fujino [13] pointed out to us, being based on his works [11] , [12] , [14] and referring to Menger, that such an asymmetry always exists in a monetary economy, irrespective of the existence of excess supply or excess demand, because money is superior in liquidity to goods. Our argument in the next section is, however, more limited and is confined only to the Keynesian case of excess supply. In section (3), then, we summarize our own argument on the microeconomic foundations of Keynesian macroeconomics, based on the theory of kinked demand curves which are perceived, not by oligopolistic firms as in Sweezy [23] , but by firms more competitive. The final two sections are devoted to argue that traditional Walrasian theory of perfect competition does not need to be based on the theory of large economy and to see the true difference between Walrasian and non-Walrasian economics.

Unlike Walras who considered ideally well-organized markets, Menger
is mainly interested in more realistic markets where we observe " that
it does not lie within our power, when we have bought an article for a
certain price, to sell it again forthwith at that same price. ─── The
price at which any one can at pleasure buy a commodity at given market
and a given point of time, and the price at which he can dispose of the
same at pleasure, are two essentially different magnitudes" (Menger[18]).
To explain this market-phenomena, Menger introduce the concept of
Absatzfaehigkeit der Waaren, i.e., saleableness or marketability of
commodities and considers that the smaller the difference between the higher
buying price and lower selling price, the more marketable the commodity
usually is.

We must note, at first, that Menger distinguishes the commodity
from the goods and has a separate chapter on the theory of commodity
in his Grundsaetz[17]. He defines " commodities as (economic) goods
of any kind that are intended for sale," and explains as follows the relation
between goods and commodities. " Commodity-character is therefore not
only no property of goods but usually only a transitory relationship
between goods and economizing individuals. Certain goods are intended
by their owners to be exchanged for the goods of other economizing individuals.
During their passage, sometimes through several hands, from the possession
of the first into the possession of the last owner, we call them commodities,
but as soon as they have reached their economic destination (that is,
as soon as they are in the hands of the ultimate consumer) they obviously
cease to be commodities and become consumption goods in the narrow sense
in which this term is opposed to the concept of commodity. But where this

does not happen, as in the case very frequently, for example, with gold,

silver, etc., especially in the form of coins, they naturally continue

to be commodity as long as they continue in the relationship responsible

for their commodity-character."[3]

But why some goods cease to be commodities quickly while coins never

cease to be commodities ? In other words, why little metal disks apparently

useless as such can be commodities and exchanged against useful things

which can become consumption goods ? This is because of the different

degrees of saleableness or marketability of commodities. Money is the

most salable or marketable of all commodities. " The theory of money

necessarily presupposes a theory of saleableness of goods."[4] Degree

of salableness or marketability is defined by Menger as " the greater

or less facility with which commodities can be disposed of at a market

at any convenient time at current purchasing prices, or with less or

more diminution of the same" (Menger [18]).

Although Menger detailedly described circumstances upon which the

degree of salableness or marketability of commodities depends, what is

interesting from our point of view is the fact that it depends on whether

the relevant market is well organized or poorly organized. " If the

competition for one commodity is poorly organized and there is danger

therefore that the owners will be unable to sell their holdings of the

commodity at economic prices, at a time when this danger does not exist at

all, or not in the same degree, for the owners of other commodities, it

is clear that this circumstance will be responsible for a very important

difference between the marketability of that commodity and all others.

---- Commodities for which an organized market exists can be sold without

difficulty by their owners at prices corresponding to the general economic

situation. But commodities for which there are poorly organized markets

change hands at inconsistent prices, and sometime cannot be disposed of
at all " (Menger[14][17], pp. 248-249).

Since Walrasian model of market is that of a well organized one,
Menger's theory of commodity for which market is poorly organized and whose
marketability is not high suggests us a non-Walrasian theory of market.
Menger's criticism on pre-Mengerian economics that " investigation into
the phenomena of price has been directed almost exclusively to the quantities
of the commodities exchanged, and not as well to the greater or less
facility with which wares may be disposed of at normal prices " (Menger[15][18],
Menger[14][17], p.242), can also be applied to Walrasian economics. In
other words, Menger's theory of marketability of commodities is a first
attempt of non-Walrasian economics.

Fixprice models of recent studies of macroeconomics are based on the
short-side principle that in disequilibrium transaction realized equals
the minimum of supply and demand. From the point of view of Menger's
marketability, the short-side principle can be interpreted to imply
that commodities are highly marketable when its suppliers are on the
short-side of the relevant market and not so much marketable when they
are on the long-side of the market. In the type of markets which Menger
considered, however, we can argue that suppliers of commodities other
than money are likely to be on the long-side of the market in general,
in the sense that they wish, if they can, i.e., if there is enough demand,
to sell more at the current price. This is because, unlike in the type
of markets which Walras considered where all the commodities are as
marketable as the money is, there is asymmetry in Mengerian markets
between demand which is to offer money, the most marketable commodity,
and supply which is to offer less marketable commodities.

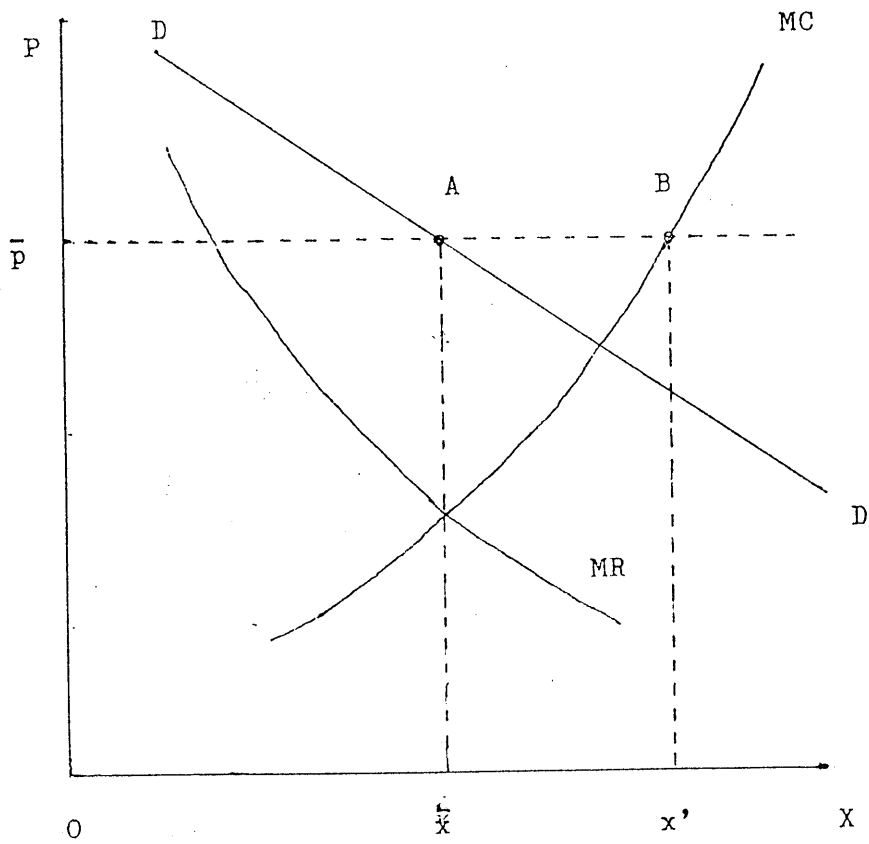In Figure 1, we consider the case of a typical supplier of a commodity,

Figure 1

i.e., a firm which produces it, and the level of output x is measured horizontally, and price p and cost, vertically. A downwardly sloping demand curve D D is perceived by this firm, not particularly because it is a monopolist, nor its product is differentiated, but more fundamentally because the market in which the commodity is exchanged with the money is poorly organized, so that the larger amount of the commodity can be disposed of in the market only with the less favorable ratio of exchange. The equilibrium of the firm is shown to be at A, or ($\bar{p}$, $\bar{x}$), with the marginal revenue MR equilized with marginal cost MC at $\bar{x}$. At the current price $\bar{p}$, the firm wishes to sell as much as x', but is quantitatively constrained at $\bar{x}$, since there is not enough demand. There exists and implicit excess supply AB or x' - $\bar{x}$, and the commodity is less marketable than the money.

There are two kinds of demand and supply, i.e., regular, stable demand and supply and irregular, casual demand and supply. For example, the demand curve in Figure 1 is concerned with regular demand which is perceived by a regular supplier. When A and B do not coincide and there exists an excess supply of regular supplier, casual demands will be easily satisfied by regular suppliers with current price $\bar{p}$. Casual supply has to compete with regular excess supply to catch casual demand and will not be easily satisfied, unless price is reduced. The marketability of the relevant commodity is low and the resale price of those casual suppliers who want to get rid of commodity they just bought will be much lower than the price at which they bought as regular demanders.

As we saw in the preceeding section, Menger's theory of commodity suggests us that demand and supply are asymmetric and competitive suppliers perceive downwardly sloping demand curves in non-Walrasian markets. In our arguments on microeconomic foundations of Keynesian economics, however, we have been insisting that in Keynesian situation competitive suppliers perceive demand curves which are not only downwardly sloping, but also flatter to the left than to the right, having an upward-pointing kink in the middle. Such a kinked demand curve was used by Sweezy[20] to explain observed price rigidity in oligopolistic industries.[5] Although the reason for the existence of a kink in the demand curve perceived in Keynesian situation is different from the one given by Sweezy in the case of oligopoly, our explanation of why the price is not reduced in the face of excess supply is, at least in formal aspects, very similar to Sweezy's explanation of oligopolistic price rigidity.

Sweezy insisted that the perceived demand curve, which he called the imagined demand curve, can only be thought of with reference to a given starting point, i.e., a price-output combination that depends upon the history of the case. In Figure 2, where the quantity q is measured horizontally and the price p vertically, the point P is such a starting point, i.e., the point of currently realized price and the sale of output of an oligopolistic firm. The firm perceives a subjective demand curve through this starting point. Sweezy pointed out that rival firms react asymmetrically according to whether a price change is upward or downward. If the firm raises its price it must expect to lose business to its rivals who will not raise their price, while if the firm cut its price it has no reason to believe it will succeed in taking business away from its rivals
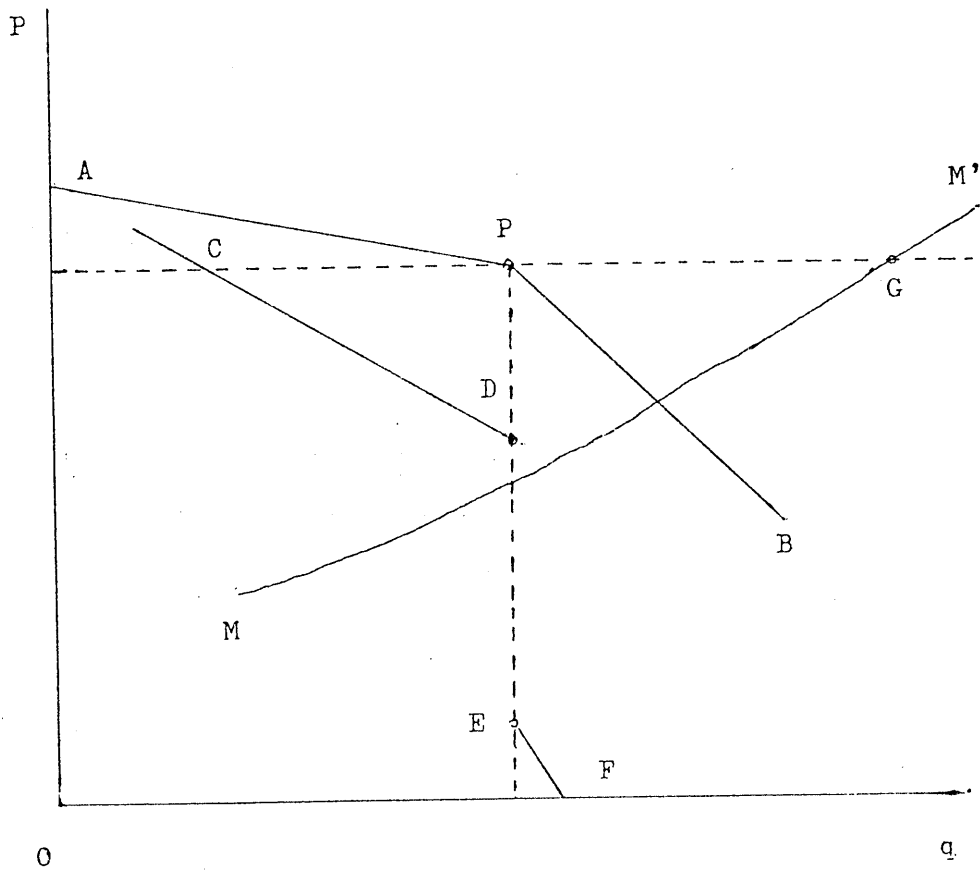
Figure 2

who will retaliate by cutting their prices so as to avoid the loss. The perceived demand curve tends to be elastic going up and inelastic going down from the starting point P. In other words, it has a corner or a kink at P, like APB in Figure 2.

The marginal revenue curve derived from APB is CDEF, whic has a discontinuity at the level of output where the perceived demand curve has a kink. If the marginal cost curve MM' passes, as in Figure 2, between the two parts of the discontinuous marginal revenue curve, the starting point P is also the point of profit maximization. Sweezy pointed out that any disturbance that affects only the position of the marginal cost curve may leave the equilibrium price and output entirely unaffected. More important for oligopolistic price rigidity is, however, the fact that, as Sweezy stated, any shift in demand will clearly first make itself felt in a change in the quantity sold at the current price. In other words, a shift in demand changes the position of the starting point P at which the kink occurs to the right or left without affecting the price. If the marginal cost is not increasing rapidly, the equilibrium price remains unchanged while shifts in demand are absorbed by changes in the level of output.

While kinked demand curve in Sweezy's theory of oligopoly is due to the asymmetric reaction of rival firms, it is considered to be a result of asymmetric reaction of customers in our case of competitive firms in Keynesian situation. " Lower prices asked by a supplier may not be fully advertised to customers currently buying from other suppliers who are maintaining their current price, while a higher price charged by the same supplier necessarily induces present customers to leave in search of lower price suppliers " whom they easily find, since in Keynesian situation there are many other firms which wish to supply more at the current price

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unchanged.[6] In Figure 2, therefore, AP is horizontal and CD coincides

with AP for a competitive firm in Keynesian case. In Keynesian terminology,

we may call the determination of the level of output at which the expected

profit is maximized with given marginal revenue and marginal cost curves

as the problem of the short-term expectation. Since short-term expectation

is assumed to be realized by Keynes,[7] such a level of output must coincide

with the level of output corresponding to the given starting point P in

Figure 2. Although it wishes to supply at the current price up to the

level of output corresponding to point G where the current price and the

marginal cost are equalized, the firm is trapped at the level of output

corresponding to P, with no incentive to reduce price to increase demand.

There exists an implicit excess supply or idle capacity GP due to the

deficiency of the aggregate effective demand. Any shift in the aggregate

effective demand changes the position of P horizontally, with price

unchanged. If the marginal cost is not increasing rapidly, shifts in the

aggregate demand are entirely absorbed by changes in the level of output.[8]

It is encouraging for us to see that Scitovsky[22] also emphasized

the possibility of asymmetric behavior of customers which renders the demand

curve kinked.. " A price increase causes those who have previously bought

to buy less or stop buying altogether ; a price reduction prompts previous

buyers to buy more and some people who previously bought nothing to start

buying. Now that last group of people are in a very different position

from all the others, in that most of them learn about the price change

only if the producer goes to the trouble and expense of advertising it.

The others are already established customers, who learn about the price

change automatically, in the course of their routine purchases and at

no cost to the seller. In other words, the whole market responds to a

price increase but only part of it responds to a price reduction, unless

the seller advertises it."[9]

In our non-Walrasian microeconomics, it is argued that even a perfectly
competitive supplier cannot perceive an infinitely elastic demand curve
for its product and has to admit that the price must be reduced so as to
increase the sale. By the perfect competition we mean that suppliers are
supplying a homogeneous good (the product is not differentiated) and they
perceive infinitely elastic demand curves only in a well organized market
where the information is perfect. The objection to this argument, which
has been raised to us most often, is that even in non-Walrasian situation
a single supplier can perceive an infinitely elastic demand curve, since
its size is infinitesimally small relative to the market, and an infinitely
large, relatively speaking, market can absorb any changes in the supply
of a single supplier without any change in the price. In Walrasian
tatonnement market, the number of suppliers can be finite and a not
infinitesimally small supplier can safely assume an infinitely elastic
demand curve since its assumption is justified and it can sell the amount
of its product which it wished to sell at the price cried by the auctionner
when the tatonnement is finished, while no actual trade is carried out
until the tatonnement is finished. Certainly, however, there are other
non-Walrasian justifications of infitely elastic demand curve, which
presuppose the existence of infinitely many suppliers whose size is
infinitesimally small.

An example is Cournot's theory of oligopoly without product differentiation,
in which oligopolistic firms non-cooperatively compete each other under
the assumption that other firms do not change their level of output.[10]
Suppose, for the sake of simplicity, that the demand function for the
industry as a whole is linear and is given in its inverse form as

(1) $\quad p = A - B \sum\limits_{i=1}^{i=n} X_i$

where A and B are positive constants and X_i is the level of output of the

i-th firm, i = 1, ---, n. The inverse demand function for a single firm,

say the first firm, is also perceived as linear, i.e.,

(2) $\quad p = A - B \sum\limits_{i \neq 1} X_i - B X_1$

since X_i's, $i \neq 1$, are regarded as constants by the first firm. The

condition for the equilibrium of the first firm, i.e., the equality of

the marginal revenue and the marginal cost is

(3) $\quad A - B \sum\limits_{i \neq 1} X_i - 2 B X_1 = C$

where the positive constant C denotes the marginal cost. If we suppose

all the firms are identical, $X_1 = X_2 = \text{---} = X_i = \text{---} = X_n$, at the equilibrium,

we can see from (3) that

(4) $\quad X_i = (A - C)/ B (n + 1)$, for all i.

Then by substituting (4) into (1), we have

(5) $\quad P = (A + n C)/ (n + 1)$.

If the number of firms, n, get infinitely larger, we can see from (5) that

the price p converges to the marginal cost C, which is equal to the marginal

revenue. In other words, an infinitesimally small firm perceives an

infinitely elastic demand curve.

We have to admit, therefore, the existence of infinitely many firms

is a sufficient condition for the perfect competition in which a single

firm perceives an infinitely elastic demand curve. It is, however, by

no means a necessary condition. Even for the case of n = 2, i.e, a

duopoly, Bertrand and Fellner argued that the price will be equalized

to the marginal cost if each duopolist assumes that the other will keep

his price (not output) unchanged and average as well as marginal costs

are constant.[11] If the price will be higher, each firm will undercut

its rival by a very small margin because it will obtain maximum profits

by undercutting infinitesimally. In other words, Bertrand-type duopolist

behaves as if it perceives an infinitely elastic demand curve. Bertrand's

assumption can be criticized, of course, since duopolists will know, when

they are out of equilibrium or when they decide to test their assumption,

that their assumptions are incorrect ; their rivals do not keep their

prices constant. But Cournot's assumption is also subject to the same

criticism, and we cannot accept Cournot and at the same time reject Bertrand.[12]

We can slightly generalize the case for Bertrand when the number of

firms are increased. Suppose the marginal cost function is, though still

identical for all firms, are not constant but increasing, though not

continuously but stepwisely. When n is large but still finite, there is

an equilibrium where the price is equalized to the marginal costs, and

no oligopolists have incentive to reduce the price to increase the sale,

assuming that others keep their price unchanged. Under the same assumption,

there is also no incentive to raise the price, since in general other firms

can increase their sales without increasing marginal costs. At least

at equilibrium, therefore, each oligopolist perceives and infinitely

elastic demand curve. In this case, unlike in the case of constant

marginal cost, the equilibrium profit can be positive for each identical

firms.

Another example is Edgeworth's demonstration that the only stable

outcome of a pure exchange economy is the perfectly competitive equilibrium

and all the other allocations are blocked by traders cooperatively when

the number of traders is infitely large. Figure 3 is an Edgeworth box

diagram, where the quantity of the first good is measured horizontally,

that of the second good, vertically, the quantities of goods given to

trader A are measured with the origin at A, those given to trader B, with

the origin at B, curve DEF is the contract curve which is a locus of points

where indifference curves of two traders are tangent, point C denotes

the initial allocation of goods before trade, and point E is the perfectly

competitive equilibrium with the common tangent to indifference curves

at E passing through point C. It is clear that all the points on the

contract curve between D and F are stable outcome if there are only two

traders A and B, while Edgeworth insists that all the points except E can

be blocked by a coalition of some traders if there are infinitely many

identical (in taste and initial holdings) traders A and infinitely many

identical traders B.[13]

Since identical amount of goods must be allocated to the identical

traders after trade, the Edgeworth box diagram can still be used to consider

exchanges among infinitely many traders. Consider point H. This allocation

can be blocked by a coalition formed by all the A traders and more than

half but less than all of the B traders. In the coalition some traders A

still continue trade with B traders and are located at H, while the rest

of A traders having no trade partners are located at C. By increasing

the number of B traders joining coalition sufficiently and therefore

increasing the number of A traders located at H, we can make the average
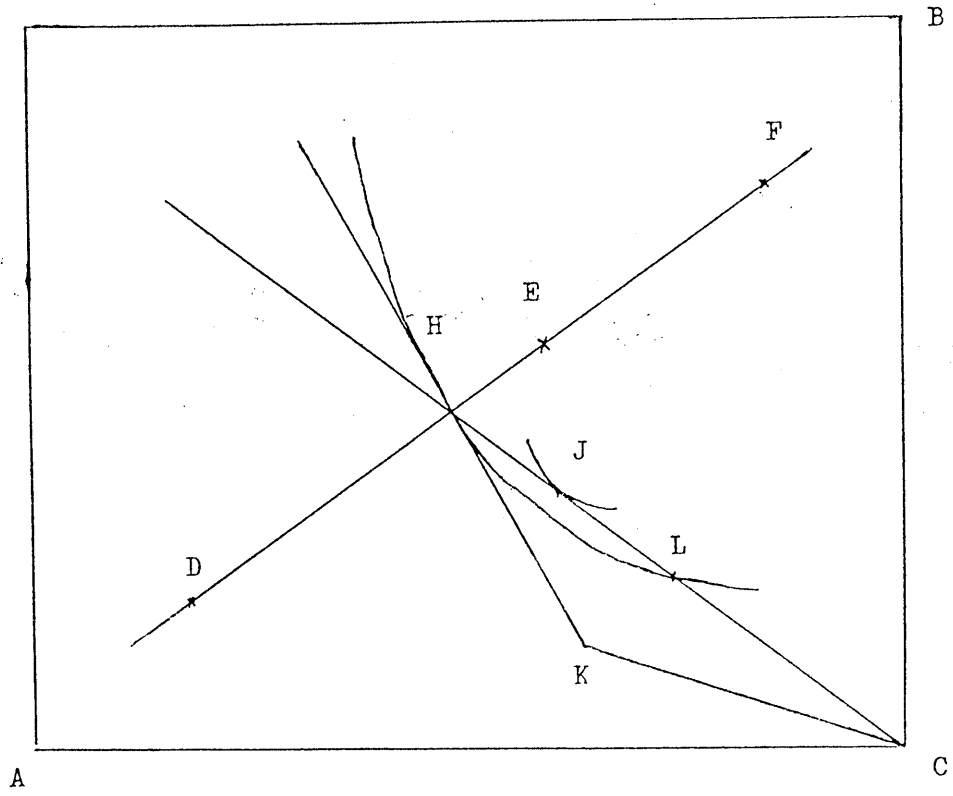
Figure 3

allocation of A traders (some at H, some at C) J located on CH between L and H. By reallocation among themselves, therefore, all the A traders are better off than they are at the allocation H. With some side-payments to B traders in the coalition, all the traders joining coalition can be better off than they are at H, and the allocation H is blocked by such a coalition. Obviously only the point E belongs to the core, i.e., the set of allocations which are not blocked by such a coalition.

If the number of traders is infinite, therefore, stable outcome of a pure exchange economy with perfect information and no friction (no restriction of trade, no cost of trade, no cost of organizing coalitions, etc.), can be derived as an equilibrium of perfect competition in which each trader is behaving as if taking price ratio (the slope of EC) constant. In this sense, the existence of infinitely many traders is a sufficient condition for perfect competition. But again it is not necessary, since as we argued elsewhere only E belongs to the core when there are only two A traders and two B traders if we rule out lump-sum transaction, assume the divisibility of transaction and take arbitrages leading to the law of indifference into consideration.[14]

Consider point H in the box diagram, which cannot be blocked by a coalition of two A traders and one B traders in a way suggested by Edgeworth, since L is located nearer to H than to C. We note that there must be at least two successive transactions like CK and KH and the ratio of exchange should vary in the course of exchange between C and H, if allocation H ever can be reached by exchange staring from C. Otherwise, i.e., if there is only a single transaction and exchange ratio remains unchanged throughout exchange process, it must be equal to the slope of CH and exchange must proceed on CH, starting from C and toward H. Such an exchange process has to, however, be terminated at J, since it is unfavorable for A to go beyond.

Suppose, therefore, A_1 trader exchange with B_1 trader, firstly along with CK and then along with KH, and A_2 trader exchange with B_2 trader similarly. Then the allocation H can be blocked by arbitrages of different exchange ratios. B_1 proposes to A_2 some new CK transaction or slightly less favorable (to B_1) one, so that B_1 can be better off than at H. A_2 accepts, on the other hand, this proposal of B_1 by cancelling a part of his CK transaction with B_2, so that A_2 is ind fferent to or better off than at H. Since B_2 is not the only supplier of the second good, A_2 expects that the rest of his transaction with B_2 would not be cancelled by B_2. Not only B_1, but also B_2, A_1, and A_2 will do similarly to take advantage of different exchange ratios. The only allocation which can be blocked neither by Edgeworth coalitions nor by arbitrages is point E, even if there are only two A traders and two B traders.

In view of arguments in the preceding section and in this section, it is now clear that the difference between Walrasian economics and non-Walrasian economics lies not in whether the number of traders is assumed to be infinite or finite but in whether or not the market is perfect in the sense that the information is free and perfect, there is no cost to organize coalitions, and so on.

Footnotes

1)   See Fisher[9], pp. 55-73. Discussion with Professor Hirotaka Kato was highly useful and appreciated.

2)   For the concepts of research programmes, hard core, and protective belt, see Lakatos[15].

3)   See Menger[17], pp. 239,240-241. (paginations are those in English translation).

4)   See Menger[18], where Absatzfaehigkeit is translated into salableness. See also Menger[17], p. 242, where absatzfaehig translated into liquid and Absatzfaehigkeit into marketability.

5)   For the significance of the theory of kinked demand curve, see Reid[21], and Negishi[19], pp. 79-81.

6)   See Negishi[19], pp. 36, 87.

7)   See Negishi[19], pp. 28-29, 90. It is interesting, on the other hand, to note that short-term expectations are assumed not to be realized in the modern quantity theory as was shown in section (1).

8)   See Negishi[19], pp. 89-90, and Reid[21], pp. 65-66.

9)   See also Reid[21], p. 97.

10)   See Cournot[5], pp. 79-98 (paginations are those in English translation). See also Fellner[8], pp. 56-69.

11)   See Bertrand[4] and Fellner[8], pp. 77-86. Discussion with Professor Yoshihiko Otani was highly useful and appreciated.

12)   Edgeworth[7], pp. 111-142 and Fellner[8], pp. 79-82, introduced different cost functions for different firms and/or upper limits on the amounts firms produce, and argued that price oscillation appears. We disregard, however, these complications, since we are considering the possibility of perfect competition with finite number of firms and different costs and capacity limits imply essentially the imperfectness of the competition.

13)   See Edgeworth[6], pp 34-42, and Negishi[20].

14)   See Negishi[20] for details, and see also Akashi[1] for a closely related and more rigorous demonstration.

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