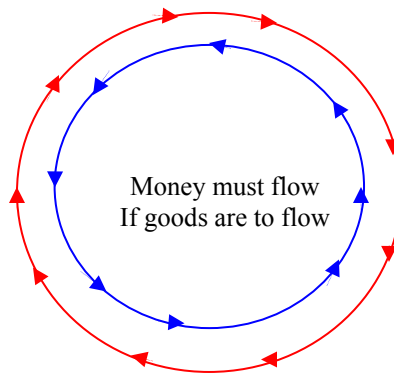


**Equality of Demand and Supply  
Neither Determines Price  
Nor Clears the Market**



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Working Paper 4/4

May 2004

# Equality of Demand and Supply Neither Determines Price Nor Clears the Market

## Abstract

The belief that equality of demand and supply determines price and clears the market is universal. Shockingly, this belief is unfounded. It contradicts macro's claim that equality of demand and supply determines output. It contradicts (new) monetary theory, which claims that equality of demand and supply is necessary but not sufficient to clear the market. In indirect trade, money also must be used. Micro says that price is equal to marginal cost, rejecting trade theory's claim that trade is gainful. To remove these and other contradictions, price theory must be repaired. Money's role in market clearing must also be acknowledged.

A new paradigm brings all of economics in a unified model of exchange. It abolishes the micro-macro division, and assimilates price theory with trade and monetary theory. It studies equality of demand and supply at four levels: for each good, transaction, agent, and economy. This equality determines output but not price. Arbitrage determines price. Producers and consumers as price-taker choose quantities, while arbitrageurs choose prices to clear the market. The equilibrium market price exceeds marginal cost to permit gainful trade. Intermediation breaks the link between cost and price and benefit. This new theory goes far beyond neoclassical economics.

## Keywords:

Market Clearing, Price, Allocation, Exchange, Entrepreneurship, Money, Unemployment  
Arrow, Jevons, Keynes, Kirzner, Marshall, Menger, Mises, Walras.

## JEL Classifications:

A20, B13, B41, B53, C67, C78, D44, D46, D51, D57, D70, E12, E24, E30, E40, E52, J60.

When demand  $x_d$  is equal to supply  $x_s$ , it determines output  $x^*=x_d=x_s$ .  
When demand  $x_d$  is equal to supply  $x_s$ , it does not determine price ( $y/x$ ).  
When  $x_d = x_s$ , it is not sufficient to lead to trade between  $x$  and  $y$ .  
When  $x_d = x_s$ , it is necessary for  $y_d = y_s$  to lead to trade between  $x$  and  $y$ .

The author gratefully thanks  
Mr. Vikas Vij for helpful suggestions.

Please send questions, comments, criticisms and suggestions to the author at  
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## 1. Background and Purpose

What happens when demand is equal to supply? Microeconomics says that it determines the price and clears the market. This universal belief however is inconsistent with macroeconomics, which says that equality of demand and supply determines output. This belief is inconsistent with (new) monetary theory which says that it is necessary but not sufficient to clear the market. It is inconsistent with the occurrence of involuntary unemployment. Microeconomics also claims that equality of demand and supply involves equality of marginal cost and price. This contradicts entrepreneurship and the rationale for gainful trade when the producer is not the consumer.

The purpose of this article is to expose the errors of microeconomics and repair the problem. We look at the equality of demand and supply at four mutually exclusive scenarios, each involving a different means of payment, and each with a different set of equilibrium conditions. We build a theory of price that applies to all cases. Prevailing price theory correctly applies only to subsistence, where there is no genuine exchange at all. If the buyer is different from the seller, then the buyer must pay. If the buyer must pay, the market does not clear until the buyer is able to pay. Microeconomics has no ability to consider this payment problem.

The root of the error lies in the Ricardian-Walrasian usurpation of exchange theory by allocation theory. It was aided and abetted by the Jevonian abortion of money as a means of payment. Double coincidence is a necessary condition for market clearing in addition to equality of demand and supply, but Jevons (1876) denied this.

In 1832, Bishop (later Archbishop) Whately recognized and anointed exchange as the king of economics, declaring that economics had to be a science of exchange. But no tool was available to formalize the theory of exchange. Its rudiments existed in the Smithian ideas of division of labor, but it was not formalized. Menger (1871), Mises (1949) and Kirzner (1979) advanced the ideas. But they do not show exchange in any visible form. Most economists cannot see what people say; and do not want to hear what they do not see. Thus the science of exchange remained a ghost without a formal body. The idea is up in the air, but not down to earth for the ordinary economist to grasp and embrace it.

David Ricardo (1817) delivered a cripple known as trade theory. It was not a true theory of exchange as it forgot payment. Ricardo contradicted the Smithian theory of exchange. In Smith, the entrepreneurs pursued profit and choose to specialize in the production of whatever maximized their profit according to competitive absolute advantage. Ricardo's error was to think that comparative advantage determines the division of labor (pattern of trade). It logically implies allocation by a single king of the world who owns all countries. It is indeed irrational for independent competitors to worry about comparative advantage instead of absolute advantage.

The big coup was launched by Leon Walras. He fashioned a model of pure allocation disguised as exchange, and he forgot payment. If there is no payment, there is no need either for money or for entrepreneurship. So there is neither money nor entrepreneurship in the Walrasian model. We will show that the Walrasian model applies only to subsistence where the buyer is identical with the seller. It does not apply to any real exchange.

In short, neither Ricardo nor Walras delivered a proper theory of exchange. They both produced models of allocation, but misnamed them as models of trade or exchange. Exchange was aborted and its place was usurped by allocation. Economics was declared by Robbins in 1932 as a science of allocation. After a century of Whately's recognition, exchange was exiled by allocation. Recently, exchange has been brought back, and allocation cut to size by Gani (2003).

## 2. How Allocation Banished Exchange

How did allocation manage to banish exchange from its rightful place and subjugate economics? The help came from four Englishmen (Ricardo, Marshall, Jevons, and Robbins) and one Frenchman (Walras) who disguised allocation as exchange. To rescue exchange, we must learn to distinguish them.

First, allocation is done by a single decision maker, but exchange always involves collective decision by the buyer and the sellers, most often also intermediaries. Market clearing requires collective decision and can never be accomplished by one decision maker. An allocation model can never admit more than one decision maker. So the allocation model is inherently unable to study collective decisions. Arrow's Impossibility Theorem (Arrow 1952) is an admission of this inherent analytical limitation of the allocation model. An allocation model is unable to unify economics (See Debreu 1991) exactly for this reason.

Secondly, allocation applies only to preexisting wealth and never to the creation of new wealth or value that does not exist already. The sole purpose of exchange is to create new wealth or add value. Only in exchange is it possible to add value by giving something of low value from its current owner to someone who attaches higher value to it or makes more productive use of it. Optimization requires a given budget and does not allow gains. Exchange allows gains.

Production is allocation, but selling is not. The goal of the seller is to get something more valuable in payment for the output. Otherwise, one consumes what one produces rather than sell it. Again, consumption is allocation, but buying is not. One buys what one does not already have; and one buys something instead of producing it, because one can get more by buying something from a better producer than if one had to produce it himself. The allocation model has therefore no legitimate credentials to study buying and selling. Its inherent limitation prevents it from seeing exchange.

The thin distinctions between production and selling, between consumption and buying, and between using wealth and creating it make it difficult for observers without sharp eyes to see who is the master (exchange) and who is the slave (allocation). The observer's lack of sharpness allowed allocation to impersonate exchange.

Despite its inherent inability to grasp exchange, the Walrasian allocation model produced a price theory and made it king by pretending to know about buying and selling. The idea that the seller sells at marginal cost is the hallmark of allocation, and a clear denial of exchange. Alfred Marshall was instrumental in visualizing the demand-supply interaction that allegedly fixed the price instead of fixing the quantity, though the idea existed before. But demand and supply must be seen along with the payments. We will show how that changes the story fundamentally, and exposes the Marshallian fallacy.

William Jevons (1876) produced a cruder version of Arrow's Impossibility Theorem in 1868 to deny the necessity of double coincidence. This is a central matter of monetary theory in particular and exchange theory in general. In every exchange, whether direct or indirect, and whether money is used or not, double coincidence must be present. It is simply the requirement that the buyer must pay the seller with some payment. Thus if seller  $j$  sells something to buyer  $k$ , the buyer  $k$  must sell back something or pay  $j$  with something. Suppose that we use  $x$  to denote a good, and let its first subscript denote the seller and the second denote the buyer. Then  $j$  sells  $x_{jk}$  to  $k$ , and gets back a payment named  $x_{kj}$ . This reciprocity ( $jk|kj$ ) in the subscripts is the simplest statement of double coincidence.

Jevons thought that double coincidence was needed only in barter, and that it was a mere inconvenience, not a necessity. Money allegedly overcame the inconvenience and made it

unnecessary to fulfill double coincidence. He did not see that it implies that the buyer does not pay. It sounds absurd that people could really believe this, but they do believe this without consciousness. The idea of neutrality of money means exactly this: the buyer does not pay (with money or anything). If the buyer in fact does pay with money, he cannot fail to affect what he buys with the money.

The Jevonian idea that double coincidence is not necessary may be seen with the Arrovian idea (Arrow 1951) that double coincidence is not possible. Here is how to see it. Suppose  $j$  has some apples denoted by  $x_{jk}$ , while  $k$  has some bananas denoted by  $x_{kj}$ . For an exchange to make sense, suppose that  $j$  prefers  $x_{kj}$  to his  $x_{jk}$ . So it will be gainful for him if he could persuade  $k$  to give the bananas in exchange for the apples. But why would  $k$  listen to  $j$ ? He would, if he happens to prefer the apples to bananas, so that the exchange is gainful to him too. He would not agree if he also prefers the bananas to apples. In that case, he will keep the bananas, and refuse the offer of apples from  $j$ .

Now we see what Arrow's Impossibility Theorem means. It says that the society (with two people  $j$  and  $k$ ) cannot have a transitive social preference order. Clearly, if a society with a single mind exists, it cannot possibly prefer apples to bananas and also prefer bananas to apples. It is simply self-contradictory.

Arrow overlooks that allocation is the militant errorist here. Who said that society is a single individual with a single mind? Only allocation requires a single mind, exchange does not. Since  $j$  and  $k$  are not the same individual with a single mind, and further because they are independent, there is nothing wrong with  $j$  preferring bananas to apples at the same time as  $k$  prefers them in the exact reverse order. Indeed, the opposite order of preference is necessary to make trade gainful for both. Double coincidence must and does exist for any trade as the buyer pays the seller. Society has no single mind: it has many people with many minds. Exchange is possible because of the anomalous endowment and preferences. One has apples but loves bananas more; the other has bananas but loves apples more. It is not disorder: it is drama.

Let us suppose that  $k$  has money instead of bananas, and with this money,  $j$  can buy bananas. Then the same preference order exists between  $(x_{jk}, x_{kj})$ , except that the preference for money is conditional on the availability of bananas from some seller who takes money and gives bananas. In short, double coincidence must exist for the market to clear. Jevons and Arrow cannot see this because they think as optimizers, and not as entrepreneurs.

Exchange involves agreement between many people, especially between the buyer and the seller. An allocation model can make no sense of agreement. It is the most serious limitation of the allocation model. The allocation model has no ability to study price, because price is the result of an agreement between the buyer and the seller, who are definitely not the same individual. A theory of price produced by the allocation model must therefore be void *ab initio*.

If there is no exchange, there is no profit. If there is no profit, there is no economics. Profitless allocation is well within the grasp of biology and political science, without any mention of the profit motive. Biology can make perfect sense to talk about a mother's investment in her children and how it helps the children, without ever talking about how the mother profits from it, because the mother does not profit from it. She merely allocates her scarce uterus, and makes the best use of her mammary glands, and enjoys making sacrifices for her kids. She gets utility from feeding the kids. It makes sense to talk biology until profit enters.

Political science can very well talk about how the great pharaoh allocates the kingdom's produce to his subjects according to some political rule, say to each according to need defined in some way. Likewise, it can talk all about division of labor according to a political rule such as

from each according to ability defined in some way. As long as profit has nothing to do with it, economics has nothing to do with any of the allocation matters of production, consumption, division of labor, distribution of output, savings or investment et cetera.

Economics can claim to be a separate science only if its studies profit-based exchange. The operation of the profit motive involves actions that are unintelligible to a biologist or political scientist. It involves paradoxical behavior: one produces what one does not consume, and one consumes what one does not produce. Only with profit motive can it make sense.

In an exchange model, a degenerate exchange occurs when the buyer is the seller himself. In that case, exchange degenerates into allocation. When the buyer is the seller, double coincidence degenerates into Pareto Optimality. If apples are preferred to bananas, and bananas are preferred to apples at the same time, it can hold if and only if they are equally preferred, especially since in that case, apples are exchanged against identical apples. Pareto Optimality cannot hold if there is exchange, in which case the buyer is not the seller, and the apples are traded not against themselves, but against something else.

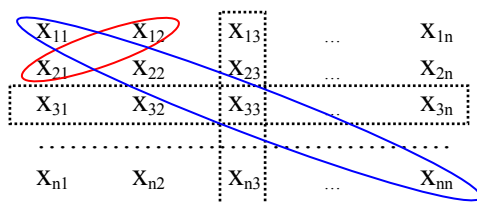
In a degenerate exchange, money degenerates into a store of value. If John pays himself with money for his own apples, what does he do with the money? He stores it. Where does he get the money from? Well, it must drop from Friedman's helicopter. Does it affect output? Well, of course it does not, and it cannot. Why? It does not even exist. It is not a means of payment, but just a numeraire. So John mentally assigns a numeraire value to the apples. The quantity theory applies perfectly. There is simply no trouble for John to double the numeraire price of the apples without changing anything real. He does not have to pay anything.

In degenerate exchange, profit vanishes, because the seller cannot bamboozle himself to pay a higher price than marginal cost. John can never produce one apple and persuade himself to give two apples in exchange. He must get identically one apple for one apple as long as he has to sell it to himself. Had there been exchange, he could get some bananas that gave him the utility of two apples against his delivery of just one apple.

Allocation banished exchange by delivering counterfeit models of trade and exchange. In this story, Ricardo, Marshall, Jevons, Walras, Pareto, Samuelson and Arrow play major role in keeping allocation on the throne. Adam Smith, Menger, Mises, and Kirzner talk and talk and talk about exchange, with listeners abandoning them to their own sermons. People need to see, but they merely tell. But we are going to turn a new leaf. Leontief's input-output table will now be the stage of the comeback of exchange, showing exchange in equations, matrices and graphs.

### 3 Staging the Comeback of Exchange from Exile

Suppose that there  $n$  different agents in the economy, each producing a unique kind of good. To look at exchange we show who buys and sells what. Each good is denoted by two subscripts, the first showing the seller and the second showing the buyer. The first subscript also denotes the kind, as a different seller is defined for each different kind of good. All exchanges in the economy are described in real terms by the exchange matrix  $X$



Let us look at demand and supplies at four different levels. We will show elements in the principal diagonal, the pair of transpose elements with the same subscripts in reverse orders, and at the row and column for each household. These are where we will see the hidden things.

### 3.1 The Four Equations of Exchange (supply on left, demand on right side)

Equation (1)	for each good:	$S(x_{kk})= D(x_{kk})$	(subsistence);
Equation (2)	for each transaction:	$(p_k x_{kj}= p_j x_{jk})$	(barter);
Equation (3)	for each agent:	$(\sum_j p_k x_{kj}= \sum_j p_j x_{jk})$	(money);
Equation (4)	for each economy:	$(\sum_k \sum_j p_k x_{kj}= \sum_k \sum_j p_j x_{jk})$	(bonds);

These four equations together describe the exchange matrix completely. Prevailing microeconomics asserts only equation (1) and ignores all the rest, while macro jumps to equation (4) without the three others. But all of them are necessary to describe the economy. The first applies to each cell in the matrix. The second applies to each pair of transpose elements between off-diagonal elements. The third applies to each household's row and column, and the fourth sums up all columns and rows. Each has something unique to it.

To understand exchange, let us look at equation (2). There are two dimensions to the exchange. One is that the quantity of traded output must be determined by imposing equality of demand and supply at every level. Equation (2) implies Equations (3) and (4), but not vice-versa. It also implies equation (1) as a degenerate form where the buyer is made identical with the seller so that the good pays for itself.

The shock and drama is that even though demand is equal to supply at every level, equation (4) violates Equation (3), which violates Equation (2), which in turn violates Equation (1). The violation occurs only in respect of the kind of payment, but not in respect of the value of payment. A good's demand must be equal to its supply whether it is consumed by the producer or by somebody else and regardless of how it is paid for. Prevailing economics cares only about the equality of demand and supply, and does not care about how the buyer pays. Our job is to discover how the buyer pays. We find four different ways, each violating the other because they are mutually exclusive. Let us see what this means.

Under subsistence (autarky), the producer is the consumer. Equality of demand and supply degenerates into equality of production and consumption by the same individual. If the producer and the consumer is the same person, equilibrium necessarily means that marginal cost is equal to marginal benefit (marginal utility measured in the same units as cost) in Equation (1).

Under barter in Equation (2), equality of demand and supply still must hold, but the consumer is no longer the producer. This changes the equilibrium fundamentally in two ways. First, because the consumer is not the producer, there is nothing to require or assure equality of marginal cost with marginal benefit. Indeed, trade must be gainful, and it is both required and possible that marginal cost is lower than marginal benefit. This changes the agent's optimization. He now equates the marginal cost of what he produces with the marginal benefit of what he consumes. These are two different goods. Per unit of value, j equates the marginal cost of  $x_{jk}$  with the marginal benefit of  $x_{kj}$ , while k equates the marginal cost of  $x_{kj}$  to the marginal benefit of  $x_{jk}$ . This leaves room for gains from trade. Because j is not k, and they do not have to have the same preferences, it is possible that j prefers  $x_{kj}$  to  $x_{jk}$  while j has precisely the opposite preference. In fact, this opposite preference is necessary for trade to be gainful.

Secondly, demand of one good becomes dependent on the demand for the other good. Now the producer of  $x_{jk}$  cannot produce it unless  $k$  produces  $x_{kj}$  to pay for it and vice-versa. One good cannot be produced and sold unless the other is. This becomes more complicated with the third equation.

Equation (2) holds under barter without further complication. But Equation (3) violates Equation (2) by permitting indirect trade so that a real good no longer pays for a real good directly, but pays for a real good indirectly. Here, money enters as a means of payment, as a tool to create access to a third real good. Even more importantly, money creates a more complex pattern of dependence of demand than under barter. In barter, two goods are dependent on each other as mutual payments, but they do not affect any other goods. In indirect trade, a first good pays for a second, but is paid for by a third good. The third good may in turn be paid for by a fourth good and so on. Now, the demand for the first goods depends on both the second and the third, and through the third, on even more goods. There is a transmission mechanism to propagate the failure of demand anywhere. The failure of the demand for one affects the demands of others.

Equation (4) is the conventional core of macroeconomics. This violates equation (3) by permitting a household to borrow or lend. A bond is a store of value used as a means of payment here. But it cannot have a transmission mechanism, because it is essentially a barter deal between the lender and the borrower. The failure of one borrower affects just two people: the lender and the borrower, and cannot affect others. Hence a problem with bonds cannot have a multiplier effect. Yet macroeconomics of all stripes regards a store of value as the crucial element to explain business cycle. A bond is mutually exclusive with money. Much confusion is created by regarding money as a bond.

The key point to learn from the four equations is that demand depends on the means of payment. It matters whether the consumer has to produce the good himself, or pay directly with a real good, or pay with money or pay with a bond. Unless we consider all four equations, we cannot uncover the dependence of demand for one good on the demand for others. But once we find the pattern of dependence in one matrix, we effectively merge micro and macroeconomics inseparably. Trade theory enters via equation (2) while monetary theory arrives with equation (3). The four equations effectively unify all of economics.

Let us now explore the equations one by one. The goal here is to show that the allocation model leaves out the essence of exchange.

### 3.2 The Optimal Allocation Realm of Walras in Equation 1: $S(x_{kk}) = D(x_{kk})$

The first equation is pure micro which requires only allocation, because there is no exchange and no entrepreneurship. It is the optimal allocation realm of Walras. Suppose that there is a single agent who produces all  $n$  different goods and consumes them. His actions are described by the matrix of subsistence as follows:

$$\begin{array}{ccccccc}
 x_{11} & 0 & 0 & \dots & 0 \\
 0 & x_{22} & 0 & \dots & 0 \\
 0 & 0 & x_{33} & \dots & 0 \\
 \dots & \dots & \dots & \dots & \dots \\
 0 & 0 & 0 & \dots & x_{nn}
 \end{array}$$

This matrix has no off- diagonal terms. The Walrasian model of pure exchange applies here purely. For each good, demand (consumption) is equal to supply (production) as given below: (Disregard the second subscript, because there is no second person. The same person is split into many based on different kinds of goods).

$$\begin{aligned} S(x_1) &= D(x_1) \\ S(x_2) &= D(x_2) \\ S(x_3) &= D(x_3) \\ &\dots\dots\dots \\ S(x_n) &= D(x_n) \end{aligned}$$

This is how the Walrasian General Equilibrium Model looks at the world. For each good, demand is set equal to supply. This holds without any further problem if and only if the producer buys his own goods. If there are several agents, each of whom independently produces and consumes the goods, one just adds up the demands and supplies without any complication.

This is also the Ricardian realm with a twist. If one agent owns the world and the factors are immobile, the allocation exercise leads to production specialization according to comparative cost advantage. Though there is no real price here, suppose that a numeraire is used to denote prices ( $p_1, p_2, \dots, p_n$ ). The budget equation is obvious. The agent owns all the factors and already owns all the goods. His real income  $I$  is surely and identically equal to the value of his output, which he buys from himself. As a consumer, he maximizes utility subject to his budget constraint. Let  $U(x_1, x_2, \dots, x_n)$  be his utility function. Then he maximizes utility:

$$\text{Max } U(x_1, x_2, \dots, x_n) + \lambda (I - (p_1x_1 + p_2x_2 + \dots + p_nx_n))$$

The first-order condition of maximization gives  $U_i = \lambda p_i$  for  $i=1, 2, \dots, n$ . Let us call  $(U_i/\lambda)$  by the name marginal benefit. It is marginal utility measured in numeraire units via the Lagrangean multiplier  $\lambda$ .

By similar exercise, the supply of  $x_i$  is optimally chosen when [marginal cost = price]. Putting the production and consumption sides together,

$$\text{marginal cost} = \text{marginal benefit} = \text{price.}$$

The ratio of marginal costs define comparative advantage. As long as one owner owns all the countries, it makes sense to maximize global income and minimize global cost (both are mathematically the same) by allocating production according to comparative advantage.

The circular flow of income applies here beautifully. The consumer owns the factors, and sells them to the producer firms, who own the products and sell them back to the consumers. There is no genuine circle, but actually just a single point, because the producer is the consumer, and no real man really buys anything from himself or sells anything to himself. But that is how the Walrasian model visualizes the market: the buyer is the seller.

The Ricardian model gives the appearance that country 1 is different from country 2. But it makes no sense unless both are owned by the same king. It is irrational for independent producers to care at all about comparative cost. For example, between Bangladesh and America, Bangladesh certainly has comparative cost advantage in the production of food compared to cloth. However, America has the absolute advantage in the production of food. America exports

food to Bangladesh. It is irrational for America to waste the most advanced and enormously productive agricultural resource bases merely because Bangladesh is comparatively efficient at producing food than cloth. In fact, Bangladesh exports cloth to America and imports food. This is because these are independent countries that don't at all care about comparative cost, but care about absolute advantage. Leontief Paradox is amore general exposure of the same.

To see why Equation (1) does not represent genuine trade, let us consider genuine trade of the simplest sort in the next equation.

### 3.2 The Gainful Exchange Realm of Smith and Menger in Equation 2: ( $p_k x_{kj} = p_j x_{jk}$ )

Equation (2) represents genuine trade between two different agents (j, k). Here, the real good on the left side is different from that on the right side. Equation (2) is not a statement of equality of demand and supply of one good, but is a statement of the payment restriction in each transaction. The buyer must pay the seller with a payment of equal value. This must hold in addition to the equality of demand and supply for each good.

This equation is missing in the Walrasian Model so that one can have equality of demand and supply for every good, but nobody has balance of income and expenditure. What happened to budget in the Walrasian exchange model? It is just not there. This creates big problems as follows. Thus suppose that j produces and sells 10 dollars of apples. Now, what does j do with the money? What does he buy? What is there to tell us that the apple seller indeed spends exactly as much as he earns? There is nothing to tell us about that. In the next equation, we will see that it robs the model of its ability to deal with money and balance of payment issues. The Walrasian model is useless to study the balance of payment and exchange rate issues. Indeed, the exchange rate issue is the price issue. There is no genuine basis to study price in the Walrasian model.

The crucial reason is that the equality of demand and supply of one good cannot determine its price, but can determine its output only. In trade, one good pays for another, and the price of the first good is the quantity of the second good that pays for the first good per unit. Price is an expression of the equivalence relation in equation (2). It has no meaning for one good in isolation. We have much to say on this.

It is critical to see how entrepreneurship and profit enters the picture here. Why does j produce apples  $x_{jk}$  and give them to k instead of consuming them himself? And why does k buy apples rather than producing them himself? If k consumes apples, why does he produce bananas rather than apples? These actions are not irrational if and only if exchange is gainful.

Smithian division of labor is more articulate about cost, so let us use the cost-based analysis first. Suppose that the utility is the same for apples or bananas of the given quantities. Let us suppose that both j and k are able to produce both apples and bananas. Let us measure cost in some real factor or combination of factors, let us say in hours of work accompanied by a comparable bundle of capital (land, seed, implements etc). Now, if j has lower cost per apple than k, and if k has lower cost per banana than j, it is mutually gainful for them to exchange. Notice that a cost comparison will make no sense unless they yield the same utility. If the thing with the lower cost yields proportionately lower utility, and the cost per unit of utility is the same, there are no gains from trade. It will not occur if marginal utility per unit cost is the same.

As long as the same unit is used to measure costs, the difference in absolute advantage between two goods also implies difference in comparative advantage, but not vice-versa. If one party is absolutely worse in both products, that party will be unable to sell and hence unable to buy. There will be autarky, but the absolutely better producer will prosper; the other will not.

Menger (1871) takes a subjectivist view and explicitly recognizes gains from trade in utility terms. Thus suppose that j has some apples and k has some bananas. But j prefers the bananas to his apples while k prefers the apples to bananas. They can exchange the apples against bananas, giving utility gains to both.

We need to add an explanation of why the anomaly in endowment would exist. Why would j produce apples if he prefers bananas? The anomaly in production must be based on anomalous endowments. Though j likes bananas more than he likes apples of a given value, he happens to have the ability to produce apples at lower cost than bananas.

The two most critical differences between the first and the second equations are the following: First the marginal cost and marginal benefit per unit value is no longer equal for any given good because the producer is different from the consumer.

Secondly, one good is paid for by another, and hence the demand for apples is dependent on the demand for bananas. The Walrasian model makes the demand for each good independent of the demand for any other by failing to impose the budget restriction on each household.

A revolution was needed to assert the second point. The Keynesian idea of multiplier effect is an expression, sadly unclear, of the dependence of demand of one good on demand of another. As long as apples must pay for bananas, the demand for apples depends on the demand for bananas. It gets more complex with indirect trade, as shown by the third equation.

### 3.3 The Indirect Exchange Realm of Mises in Equation 3: $(\sum_k p_j x_{jk} = \sum_k p_k x_{kj})$

The third equation imposes budget balance requirement on household j. Income from sales  $\sum_k p_j x_{jk}$  must be equal to expenditure  $\sum_k p_k x_{kj}$  on purchases. It permits indirect trade and money as a means of payment. It is the catallactic realm of Mises.

What is the harm if one does not write this equation? It would then mean that a buyer could buy whatever he pleased, without worrying about paying. Likewise, a seller could simply sell, without bothering to get payments. It is clearly absurd. But the Walrasian model does not impose these restrictions. Walras requires Equation (1), which does not fulfill Equation (3) except for subsistence.

The opportunity to build money into the model is lost by not writing the budget equation fully. Let us write it fully here and show what it means. We have, for household or nation j, the following sales (on the left) and purchases (on the right):

$$(p_j x_{j1} + p_j x_{j2} + \dots + p_j x_{jn}) = (p_1 x_{1j} + p_2 x_{2j} + \dots + p_n x_{nj})$$

In the exchange matrix, we get the following column for purchases and row for sales of j:

0	$p_1 x_{1j}$	...	0
0	...	...	0
$p_j x_{j1}$	$p_j x_{jj}$	...	$p_j x_{jn}$
...	...	...	...
0	$p_n x_{nj}$	...	0

The critical task is to impose the second equation on each transaction. Thus the sales to agent 1 must be balanced by purchases from agent 1 and so on for every agent. Once we try to sort this out, we come face to face with indirect trade. What happens if some customers of j's

good do not have the goods that j wants to buy? And what happens if some suppliers sell real goods to j but do not buy j's good? How can j pay the suppliers who would not take j's real good? How can j sell to customers whose good j refuses to buy?

Apparently nobody raised these questions about the Walrasian model or Ricardian model. And hence it was not shown how indirect trade happens. Let us show it with an example. Indirect trade requires at least 3 real goods. Suppose that we have three households whose sales and purchases (in value) are shown by the Wicksell Matrix as follows:

$$\begin{array}{ccc}
 0 & p_i x_{ij} & 0 \\
 0 & 0 & p_j x_{jk} \\
 p_k x_{ki} & 0 & 0
 \end{array} = \begin{array}{ccc}
 0 & 1 & 0 \\
 0 & 0 & 1 \\
 1 & 0 & 0
 \end{array}$$

The above is an indirect exchange involving three real goods, say  $(x_{ij}, x_{jk}, x_{ki})$  among three agents  $(i, j, k)$ . It is important to notice that Equation (3) holds for each household. Each sells just as much as each buys in real terms. Yet Equation (2) fails in every case. First agent  $i$  sells real good  $p_i x_{ij}$  to  $j$ , but buys nothing real from  $j$ ; he buys real good  $p_k x_{ki}$  from  $k$ , but sells nothing real to  $k$ . Similarly,  $j$  sells  $p_j x_{jk}$  to  $k$  but buys nothing from  $k$  while he buys  $p_i x_{ij}$  from  $i$  but sells nothing to  $i$ . Lastly,  $k$  sells  $p_k x_{ki}$  to  $i$  but buys nothing from  $i$ , and buys  $p_j x_{jk}$  from  $j$  but sells nothing to  $j$ . Notice that for every good, there is both demand and supply, and every buyer has enough income to buy. Yet no trade is possible, because no barter is possible. The question is: why does not barter occur, and if it does not occur, how can the buyer pay the seller, namely, pay with what?

No explanation of indirect trade is possible without explicitly recognizing gains from trade through the double coincidence condition. One could willy-nilly suppose that barter is a limiting case where the preferences are weak, that is, it occurs even if there is no gain in utility. This cannot be used for three or more goods unless we are willing to say that people randomly decide what to buy, what to sell, and what to ignore (neither buy nor sell). For the case above, we must explain why  $j$  refuses to take  $k$ 's real good instead of buying  $i$ 's good; and why he just does not keep his good to himself rather than going through the hassle of giving it to  $k$  and getting its compensation from  $i$ ?

The sensible answer is that  $j$  prefers  $i$ 's good most strongly to  $j$ 's good and to  $k$ 's good. Obviously  $k$  has a real good of right value, but  $j$  refuses to take it only because it is the least preferred to him. By the same token, the preferences of the three agents are described by the following three relations. Let  $U$  denote utility, and let a superscript denote the agent. Here are the underlying preferences of  $(i, j, k)$ :

$$\begin{aligned}
 U^i(x_{jk}) &< U^i(x_{ij}) < U^i(x_{ki}) \\
 U^j(x_{ki}) &< U^j(x_{jk}) < U^j(x_{ij}) \\
 U^k(x_{ij}) &< U^k(x_{ki}) < U^k(x_{jk})
 \end{aligned}$$

The strict inequality signs cannot be replaced by weak inequality signs. Each agent buys one good (the most preferred), sells one good (the medium preferred) and ignores one good (the least preferred). Each good is least preferred by one who neither buys nor sells it, mildly preferred by the seller, and strongly preferred by the buyer. Barter is impossible because the prospective buyer in each case offers a good that is least preferred by the seller. This is exactly the scenario in Arrow's Impossibility Theorem. It is impossible to resolve the preference orders to arrive at a transitive preference order for all three agents.

Yet the solution is staring at our face. We need a Misesian entrepreneur whose job is to make the impossible easy to do. Consider  $j$ . It is irrational from an optimizer's point of view for  $j$  to buy  $(x_{ki})$  with his own good  $(x_{jk})$  because he loses utility, but let him buy it only to sell it again. He avoids the loss of utility by not consuming  $(x_{ki})$ . Now, he gives this to  $i$ , who gladly takes it in payment for  $(x_{ij})$ , the good that gives the most utility to  $j$ . By buying what he does not consume, and by selling what he does not produce,  $j$  has acted as an entrepreneur, and increased his utility. He turned a real good into money, and allowed trades that were otherwise impossible. What is impossible to Arrow's optimizer is easy to Mises' entrepreneur.

Let the entrepreneur arrive with trumpets announcing that he does what no optimizer dares to do: he bravely buys what he does not consume, and daringly sells what he does not produce. Thus he turns the merchandise into commodity money. And he creates fiat money out of thin air, and lends it to the poor optimizers, and he sets the value of the fiat equal to the value of the real good. He sets the price and the optimizers obey him. He is the merchant who creates the market and works there as the supreme authority, as the arbiter and the senior.

We must notice that money is absolutely necessary to permit indirect trades. The exact job of money is to transfer the claim on real output.  $J$  wants  $(x_{ij})$  in exchange for his own  $(x_{jk})$ , but  $i$  wants  $(x_{ki})$  and not  $(x_{jk})$ , so  $j$  creates a claim on  $(x_{ki})$  by giving  $j$ 's good to  $k$ , and giving  $k$ 's good to  $i$ . The bigger point is that the entrepreneur is the creator of fiat money. By managing the payments of assorted optimizers who cannot manage payments at all by barter, the arbiter and senior chooses the price and the means of payment. If he sells real goods against a piece of paper, who is there to challenge him? By his own readiness to sell real goods against fiat, he makes it rational for others to sell real goods to him against fiat. He really gives to  $j$  what  $i$  produced, and gives to  $k$  what  $j$  produced and so on. He uses the fiat as just a management tool.

Money is a management tool to arrange the transfers, only if the manager cares to use it. It has absolutely nothing to do with allocation. Money does not affect production or consumption at all, but affects selling and buying completely. We must be able to tell the difference between production and selling, and between buying and consumption. The entrepreneur buys but does not consume. He sells, but does not produce. This distinction is fatal to the Walrasian worldview which does not distinguish between buying and consumption, or between selling and production. Production and consumption is the work of the poor optimizers. The entrepreneur does not do such work. He clears the market by buying and selling, and he clears the payments. He gives orders, and manages. He is the arbiter, and he fixes the price. He is the senior, and he arranges the payments. Optimizers cannot do what he does.

The elusive Misesian entrepreneur who once lived only in long verbal sermons has now been captured by the strictly formal input-output table. In a small corner of Leontief's table hides the Wicksell Matrix. Leontief's Matrix is easily decomposed into four component matrices according to the four equations, but without the permission of Leontief. In the Wicksell Matrix is the indirect exchange that exposes Arrow's Impossibility and Misesian Possibility. It shows how real goods that have demand equal to supply, and households that have incomes equal to expenditures fail to trade, unless Mises allows his entrepreneurs to do their audacious work. We will bring the transpose of Wicksell Matrix, and call it Keynes Matrix to show where and how money must be used. We will show what Keynes wanted to show, but could not.

We must stress that the function of money is to serve as a means of payment (by transferring claims on real output). It has absolutely nothing to do with storing value. Every agent has budget balance in real terms, and nobody needs any borrowing to finance purchases.

The failure to impose the budget balance in Equation (3), and the payment in each transaction in Equation (2) doomed the Walrasian Model. It forfeited the right to talk about price (Equation 2) and payment (Equation 3). It should by now be clear that equality of demand and supply does not even have to refer to the market at all. It applies to goods that are produced and consumed under subsistence. All it says is that the quantity of the output is determined. It has nothing to say if the good is traded or not. To show that a good is sold, one must bring in Equation (2) to assure that the buyer has a payment of the right value (quantity and price), and then Equation (3) to assure that the buyer has the right means of payment.

The failure to study payments by imposing Equations (2) and (3) left people puzzled about money. Why would people take intrinsically worthless money that they never consumed? The idea that money could be a store of value appealed to people. We have just shown that money has nothing to do with storing value. Money of course transfers value. It is like an omnibus that circulates. It does not store anything. The distinction is clarified by Equation (4).

### 3.4 The Bond Realm of Keynes in Equation 4: $(\sum_k \sum_j p_k x_{kj} = \sum_k \sum_j p_j x_{jk})$

By 1932, allocation reached its height of power to suffocate economics by exiling exchange and entrepreneurship. It thunderously proclaimed that the correct price was enough to clear the market. But unemployment is inevitable when money is missing from the Wicksell Matrix. And it is missing because the bankers never care about throwing money from the skies, or issuing precisely how much is needed by whom. Inflation is impossible unless bankers disregard output and issue excessive quantities of money. Unemployment is inevitable when bankers refuse to issue the required money. But the allocation model sees nothing of payment, and cannot imagine that merely because buyers do not have money (though they have real goods), they fail to buy!!!!!! It adamantly thinks that money is neutral, namely, it is not a payment. But the Wicksell Matrix now shows what really happens. Not to store, but to transport the goods from the sellers to the buyers, money must arrive as a means of payment.

The allocation model kept telling that the correct price would clear the market, but the real world came crumbling down under the Great Depression with massive unemployment. John Maynard Keynes fought back. He created a revolution to explain why shortage of money had to be the culprit behind the depression. Though his '*General Theory of Employment, Interest and Money (1936)*' is indeed centrally concerned with the circulation of money as a means of payment, the influence of his teacher Alfred Marshall did not let him denounce the claims of price theory. This loyalty stopped him from overthrowing price theory. It made his monetary theory unintelligible. The trouble does not sleep with the price of money (interest rate), but rides with its circulation virulently.

Keynes used Equation (4) to say that the equality of (aggregate) supply and (aggregate) demand determines (aggregate) output. Logically, he was required to denounce the error that the equality of demand and supply determines price, but he did not do so. Instead he attacked Say's Law, which was a crude version of Equation (2). The idea behind Say's Law is that every seller wants a payment of equal value, which says that every seller demands something of equal value. This is of course correct, and hence the attack is misdirected.

The problem is that Equation (2) requires two necessary conditions. The two goods that pay for each other must be of equal value, as Say's Law implies. In addition, double coincidence must exist. If all trades were barter with automatic double coincidence, Say's Law would hold, and no unemployment would occur. But double coincidence is not automatic in indirect trade.

Money is deliberately used to create artificial double coincidence. That is brought out by Equation (3). Say's Law fails because indirect trade necessitates money in payment.

Instead of writing down the budget equation for each household fully as in Equation (3), Keynes noticed that Equation (4) can violate Equation (3) if bonds are used. A household that wants to buy more than it sells in real output can do so if it can borrow. Likewise, a household may accumulate a surplus of sales over expenses if it can lend. A borrower issues a bond which the lender buys. Essentially, a bond is a real good and not at all a fiat, except that the good belongs to another period. And trade in bond must be barter, because it is impossible to borrow or lend indirectly. The borrower must remain personally liable to the lender, and this liability cannot be transferred. And above all, a bond is a genuine store of value for the lender who buys it, only so far as the borrower agrees to do the negative of storing.

Keynes did not seemingly make up his mind about the nature of the bond. Savings and investment is not exactly the same thing as lending and borrowing. But somehow he argued that a failure of savings to be equal to investment would disrupt the equality between aggregate demand and supply, thus thwarting full employment. The interest rate would somehow fail to clear the market. He apparently did not see that the correct price (interest) was necessary but not sufficient to clear the (bond) market. His critics were not fully convinced that some kind of liquidity trap or rigidity would impede the market's alleged tendency to set the correct price. We are not convinced that equality of savings and investment averts unemployment.

The key piece in Keynesian theory is the idea of multiplier effect. Money as a means of payment is the only possible vehicle of transmission that could create the multiplier effect. But Keynes treats money as a store of value, and hence fails to convince. A store of value does not circulate: if it circulates, it is not a store of value. Thus imagine that all trades occur with barter, and there is no indirect trade and no money. Paul lends his surplus output of walnuts to buy bonds. He wants a store of value and so he stores it. How can it affect anybody else? It cannot. There would be no multiplier effect of his success or failure. If he fails to lend the walnuts, he alone goes nutty. It does not bother anybody else, who sell all they want under barter.

But suppose that indirect trade occurs, and Paul has some cash he does not want to spend on consumption. So he saves it. It is perfectly proper to store money if it is a store of value. But this perplexes Keynes. Oh no, storing money is saving, and it must be invested. But the saver does not find suitable investments, and has a pessimistic outlook. So he hoards the cash rather than investing. It is not convincing why storing cash is a problem if it is indeed a store of value, but Keynes talks about the paradox of thrift, making Pigou (1927) upset.

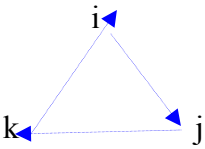
The trouble Keynes faces is that he cannot denounce Marshall and see that money is not a store of value, but a means of payment. If one man hoards the cash, all others are disabled from conducting indirect trade with it. Thus suppose that we use the Wicksell Matrix. Previously  $j$  used to borrow a dollar at the beginning of the period from an outside lender, buy  $i$ 's good with it, who then bought  $k$ 's good, who in turn bought  $j$ 's good, who then returned the money to the lender. This period, for some reason, the lender refuses to lend the dollar. But 3 dollars of trade are aborted because 1 dollar of cash does not circulate anymore, namely, there is a multiplier effect. In real life, payment circuits may be quite long. Suppose that a piece of money is used  $n$  times before it returns to the original creator. Then if it is not in circulation  $n$  dollars of output is aborted for every dollar of cash. Keynes meant to say this, but managed not to say it. His multiplier is not based on the modeling of the payment circuit (as in the Wicksell Matrix) with length  $n$ . It is based on the marginal propensity to save. It is like fighting against price theory with the full confidence that price theory is right.

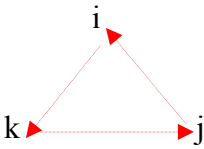
Keynes made incredibly complex arguments to explain unemployment without denouncing price theory's false claim that demand and supply determine price. We accept Keynes when he says that demand and supply determine output. We reject the claim that demand and supply determine price.

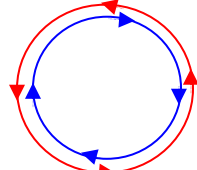
We can overcome the perplexity that haunted Keynes by recognizing money as a means of payment. The Wicksell Matrix shows the real output under indirect trade. The transpose of this matrix shows where the money must be to pay for the goods. We can call that matrix by the name of Keynes Matrix to honor Keynes.

$$\begin{array}{l}
 \text{Wicksell's real good} + \quad \text{Keynes' money} = \quad \text{full employment} \\
 \text{(No money, no jobs)} \qquad \qquad \qquad \text{(Yes to money, yes to jobs)}
 \end{array}$$

$$\begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{pmatrix} + \begin{pmatrix} 0 & 0 & \underline{1} \\ \underline{1} & 0 & 0 \\ 0 & \underline{1} & 0 \end{pmatrix} = \begin{pmatrix} 0 & 1 & \underline{1} \\ \underline{1} & 0 & 1 \\ 1 & \underline{1} & 0 \end{pmatrix}$$







The Wicksell Matrix fulfills equivalence (as demand=supply for each good, and income = expenditure for each agent, with correct price), but does not fulfill double coincidence. The Keynes Matrix fulfills double coincidence with artificial payments. Together, they clear the market to ensure full employment. Money is not a store of value here, but a pure means of payment. Take \$1 of cash away, and \$3 of real goods must fail to be sold.

Indirect trade creates a payment circuit. For three goods, a triangle shows the circuit. Red arrows show the direction of flow of money, while the blue arrows show the direction of goods. These are opposite directions. The general idea can be expressed by circles with many points. If the goods go in the clockwise direction, money must go in the counter-clockwise direction. Notice that the payment circuit for barter can also be shown by a circle with two points.

The payment circuit derived from the Wicksell Matrix should leave no doubt that money must circulate to transfer the goods from the seller to the buyers. This is separate from the condition that the goods must also be of the correct price.

#### 4 Two Necessary Conditions of Market Clearing

Let us now summarize what we have learned from the four equations of exchange. The market clearing requirement in any exchange is the same. The payment must meet two conditions: it must be of the correct quantity and price, as in the Wicksell Matrix, and it must also be of the correct kind, as in the Keynes matrix. The correct quantity is decided by equivalence. The correct kind is decided by double coincidence.

The payment must be of equal value of the good that it pays for. This is the principle of equivalence for every transaction. This is fulfilled if first, every good has equality of demand and supply, second, every agent has balance of (income plus borrowing) with (expenditure plus lending), and the prices are such that the values are equalized for every good with its payment.

The second necessary condition is that the buyer must actually pay, which sounds ridiculous unless one sees the double coincidence implied by it. The payment must be acceptable to the recipient, and that requires the payment to be preferred to the good against which it acts as the payment. The payment must also be offered, which means that the buyer must prefer the good to the payment. In utility terms, the double coincidence condition means that the buyer prefers the good to the payment, while the seller prefers the payment to the good.

The payment may take three forms: first, a direct and immediate real good (barter); secondly, a direct but future real good (bond); or thirdly, an indirect current real good (money).

Indirect exchange is the case where each good is offered against a second good and accepted against a third good. Double coincidence requires it to be offered and accepted against a second good. Money is an artifice to create an artificial double coincidence. The seller of a real good really does not prefer money to the good, and really does not consume the money. He merely pretends to prefer money when he accepts it against the real good. It is linked to the other part of the indirect exchange. This time, the possessor of money pretends to prefer the real good to the money, even though he does not produce the money. In short, barter has real double coincidence in real goods, while indirect trade uses money to create artificial double coincidence to permit transactions between a real good and money.

We must insist that every transaction requires double coincidence, real or artificial. Every transaction must fulfill both equivalence and double coincidence. The market clearing price is the price that makes the two elements of a transaction equal in value. It fulfills the equivalence requirement and assures that the buyer has sufficient real income to pay the seller. But it is not enough. The payment must also be of the right kind to fulfill double coincidence, whether real or artificial, either directly in barter or indirectly through money.

## **5 Determination of Output and Price**

Let us conclude this article by recounting the reasons why prevailing price theory cannot be sustained. We have rejected the claim that the correct price at which demand is equal to supply is enough to clear the market. We have shown that the means of payment must also be of the correct kind to clear the market. If it is indirect trade, the payment must be money.

Let us now examine the idea that the equality of demand and supply determines price. We have already found that it determines output. Equality of demand and supply is a necessary ingredient of equivalence even in the degenerate case of subsistence. Even when there is no exchange, the demand (consumption) must be equal to supply (production) to determine the output.

We recognize the prevailing idea that arbitrage determines price. The issue is not the novelty, but the consistency of the idea. How did microeconomics contradict macroeconomics as well as the idea of arbitrage? And how did it manage to say that price determines demand and then demand determines price?

There are two possible explanations. The first is that the gurus of entrepreneurship theory (Menger, Mises, and Kirzner) did not formally show how arbitrage works, but just wrote down verbal expositions which students can hardly read. That is, they did not see how arbitrage works. They could not see the difference between the producer and the seller, namely, that a seller can be a seller without being a producer. They did not see how a buyer could act entrepreneurially such that marginal cost and marginal benefit were not related any more. They just hard about entrepreneurship, but did not see it, and hence they did not see the contradiction between saying that arbiters settle prices and saying that demand and supply determine price.

The other explanation is an indictment against the practice of partial equilibrium analysis. Partial equilibrium models make it necessary to make mistakes by omitting relevant variables.

How did the idea arise that the equality of demand and supply determines price? Classical economics arose in the climate of thinking where natural law reigned supreme in science. Physics provided the role model for economics, which sought to discover a natural mechanism in the market. It found the law of the market in a flexible price mechanism. Classical thinkers were consistent in their worldview. They thought that demand was a natural force born out of human propensity to consume, and supply was a force that arose out of human propensity to produce. They thought that it was natural for humans to engage in truck, barter and exchange. People of course worked in self-interest. The big mystery was to figure out how the apparently isolated individuals managed to dovetail their actions. The big discovery was the natural law of price. If supplies exceeded demands, the price fell. If supplies fell short of demand, the price rose. The imagery was mechanistic. Somehow the weights of demand and supply had to be equal. If supply was heavier than demand, it pushed the price down. If it was lighter than demand, the price sprang upwards. This was clearly a cogent idea except that it did not explicitly show the intermediaries who acted entrepreneurially.

If one stayed faithful to classical price theory, one would have said that an automatic price mechanism adjusted the quantities, but not the other way round. Excess supply itself did not lower the price, but the price lowered itself to remove the excess supply. The term automatic should not have been used. But the moral thinking of that age did not see the merit of the merchant and one did not feel delighted to show merchants. The traumatic exploits of the merchants were renamed as the automatic changes in prices.

Suppose that the successors of the classical thinkers could accept the presence of the merchants with a straight face. They could legitimately claim that the merchants perform useful functions by cutting down transactions costs beyond the control of the producers and consumers. Then they could see the job of the merchant quite simply. First, let us suppose that the merchant is just an auctioneer. He has no control over the decision to produce or consume. He stands under the banyan tree, has no capital, and no budget. He neither produces nor consumes. The producers bring supplies of what they have already produced. The auctioneer takes it as *factum valid*. Then he waits for the buyers. Once they arrive, his job is to find a price at which the market will clear. And he sets it. Producers and consumers have no control over the price, and the auctioneer has no control over the quantities. In one day, the auctioneer may perform hundreds of auctions, with a difference price each time, but in each case, he does set a price. Many producers act as auctioneers on their own behalf; but it makes no difference to the story. The price is settled by arbitrage, and not by production or consumption.

But the coherent classical view was grafted onto a neoclassical allocation model quite incoherently. The allocation model knows nothing about exchange. It knows only about production and consumption under given budgets, preferences, technologies, and endowments. Unless the price, the income, and the preferences are all given, it cannot find the optimal demand. Unless the price, the technology, and the factor endowments are all given, it cannot find the optimal supply. An optimizer must take price as given, and cannot control the price. Yet the allocation model ventured beyond its domain, and tortured theory ever since. It botched and bungled the job. One must wonder how many mistakes one can make with respect to one thing.

Consider the following list: mistake in verbal definition, mistake in mathematical reasoning, self-contradiction through circular reasoning, confusing one thing with another, and rampant guessing.

### 5.1 Mistake in Definition

Consider the definitions. Price must be defined in the context of exchange. It is the quantity of payment per unit of good. Thus if the buyer pays  $y$  (say \$5) for  $x$  (say 1 shirt), the price  $p_x$  of the shirt ( $x$ ) is the quantity of the payment ( $y$ ) per unit of ( $x$ ), that is, the price is the ratio ( $y/x$ ).

Next, demand  $x_d$  is the quantity of ( $x$ ) the buyer is able and willing to buy.

And supply  $x_s$  is the quantity of ( $x$ ) the seller is able and willing to sell.

Hence, when  $x_d=x_s$ , the relation determines the output  $x^*=x_d=x_s$ .

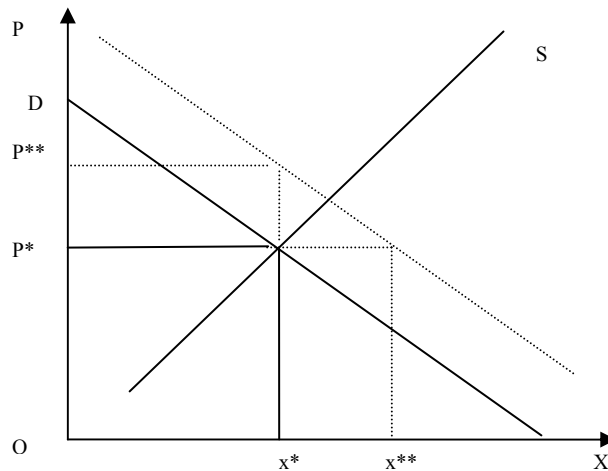
It does not determine the ratio ( $y/x$ ) at all.

If demand is 1 shirt, and supply is 1 shirt, how can their equality mean 5 dollars?

### 5.2 Mistake in Mathematical Relation

The demand function is a relation of the form  $x_d=f(y)$  where  $y$  is the independent variable and  $x$  is the dependent variable. Likewise, the supply function is of the form  $x_s=g(y)$ . Setting this two functions equal as  $f(y)=g(y)$  does not determine the independent variable in a legitimate sense. It determines the dependent variable  $x$ . Of course there is only one value of  $y$  at which  $x$  satisfies both  $f$  and  $g$  functions, but it still remains the case that  $y$  determines  $x$ , and not the other way round. Otherwise, the distinction between independent and dependent variable makes no sense.

The demand function should be fully written in the form such as  $x_d=D(p, I, U)$  where  $p$  is price,  $I$  is income and  $U$  denotes the preference pattern. Demand depends on both prices and incomes, and utility function. If we do not care about assuming unobserved changes in utility as the cause of observed changes in demand, we must at least keep both  $p$  and  $I$  in the function as determining variables. The supply function may be written as  $x_s=S(p, c(t, e))$ , where  $c$  is marginal cost which is based on technology  $t$  and endowment  $e$ .



**Figure-1: Price and Output**

In Figure-1, what determines what? Does  $x$  determine  $p$ , or does  $p$  determine  $x$ ? Of course in equilibrium, there is a one-to-one relation between  $p$  and  $x$ . At the intersection between supply and demand, we also have a given budget underlying the demand curve. Are we to say that demand and supply also determine the income? The supply curve has an underlying technology and endowment. Are we to say that the intersection also determines the cost, the technology and the endowment? How many things does this intersection determine? The legitimate answer is that the intersection determines the equilibrium output.

### 5.3 Self-contradiction through Circular Reasoning.

The terrible danger of partial equilibrium analysis is that it compels people to contradict themselves by forgetting relevant things they say elsewhere. In consumer behavior analysis, one confidently says that price and income together determine demand under given preferences. Likewise, price and marginal cost together determine supply. What happens in the interim to permit the student to say that demand and supply determine price? So price determines demand and demand determines price, and is this how partial truths are told?

Let us see how much the student must forget in order to say that a rise in demand pushes the price up. Is there a budget? If there is, how is it possible for the consumer to both buy more (for the rise in demand) and pay more per unit (to increase the price)? Where is the extra income? It is impossible for demand to rise unless the income rises before it.

Does the student remember the first order conditions of utility maximization? It says that the demand equilibrium requires price  $p_x$  to be equal to marginal benefit ( $U_x/\lambda$ ). Unless there is a change in income, the ( $\lambda$ ) cannot change, and hence optimal demand cannot change in favor of another price unequal to marginal benefit. How does he manage the feat of fulfilling the first-order conditions by changing the price and increasing demand without changing the marginal benefit? He cannot. He just forgets what he said elsewhere.

In like manner, the equilibrium supply requires equality of price and marginal cost. Unless there is prior change in marginal cost (based on technology and endowment), marginal cost cannot change, and hence supply cannot change.

In short, the student who claims that a rise in demand raises the price has no legitimate explanation of how the rise in demand is to occur. Nor does he have any legitimate reason to claim a change in supply. He ought to know that a prior change in income may raise demand and allow the price to rise. He should remember that a prior decrease in marginal cost (say owing to technological progress) can increase supply and reduce price. That is, if there is a change in price, it can come from a change in income or cost, and not from a change in demand or supply.

In short, the classical model is right when it says that demand and supply together determine price, though it uses unpardonable language. It means to say that entrepreneurial buyers and sellers (who are not consumers or producers) determine price by bargaining. But neoclassical models have no right to speak about price in the first place because it has no idea about buying (which is surely not consumption) and selling (which is surely not production). To gain that right, neoclassical model must learn to derive a demand curve without a utility function, and a supply curve without a production or cost function. It certainly cannot do that. It can talk about price only if it contradicts itself.

### 5.3 Self-mutilation through Bluntness

Except for sleepiness in the classroom, the student has no good excuse to forget the simple distinctions. How much sharpness does it require to see that a merchant is not an optimizer? He buys what he does not consume and hence ignores marginal benefit of consumption. And he sells what he does not produce and hence ignores marginal cost of production.

The merchant does not choose the quantities, does he? The choice of quantities is the job of the producers and consumers. The merchant chooses prices, and in this, he disregards both marginal cost and marginal benefit. His aim is to clear the market. If there is oversupply, he may have to cut the price down below marginal cost, and he will not flinch. This may ruin the producer who made the terrible decision to overproduce. This may make the consumer happy, but the merchant does not care. He applies the iron law of market clearing to set the price.

## 5.4 Arbitrage and Competition

The idea that arbitrageurs settle prices is not hard to visualize, unless one goes beyond optimization. There is nothing to optimize. The arbitrageur is an entrepreneur who buys cheap and sells dear. He needs no real capital and has no real budget constraint. His essential contribution is to clear the market.

This may not seem satisfactory as the optimization model is addicted to determinate and perfectly foreseeable outcome. All optimization exercises produce determinate results. These is because all optimization problems have predefined parameters. But entrepreneurship is essentially uncertain. The entrepreneur copes with this like true adventurers, who look for great gains, and bear risks, but cannot foretell exactly what is going to happen. Thus we may not be able to say exactly what price the entrepreneur will choose. But we can put floors and ceilings between which it may occur.

The floor for the price is the marginal cost and the ceiling is the marginal benefit. All we can say is that the price will be higher than marginal cost and lower than marginal benefit:

$$\text{Marginal cost} \leq \text{price} \leq \text{marginal benefit}$$

Because the producer is not the consumer, there is no reason for marginal cost to be equal to marginal benefit. The idea that competitive price equalizes marginal cost to price required the assumption of perfect competition. This idea arose out of much bluntness and forgetfulness. First, marginal cost is equal to marginal benefit only under subsistence, if the producer consumes his output. There is simply no reason to think about competition here at all. Secondly, trade must be gainful, and it cannot be gainful unless marginal cost is lower than price.

Competition is misunderstood if the students manage to forget what exists and remember what does not. One thing to remember is factor endowment. Perfect information does not change the endowment and does not enable the incompetent to become competent. One should not remember perfect information that does not exist and forget ignorance that does exist. (See Kirzner 1979). Another thing to remember is transaction cost, and it involves not just information, but also organization, innovation, and legitimization.

It is generally supposed that if marginal cost is below price, the producer will keep increasing supplies until there is no further gains from trade. The problem is that producers run out of factor endowment long before output reaches the level of market deluge. The relentless drive to reinvent the products and differentiate them is an ongoing attempt to avoid having to reach that dreadful scenario. The factor endowment should not be forgotten.

While optimizers are robotic by virtue of the optimization model, entrepreneurs are not. Game theory has much to do about modeling creative bargaining, based on actual study of pricing strategies by actual merchants. It would be profitless to presume that the world is inexorably doomed to that perfect competition where profit is zero. We should not remember what did not happen, namely, the homogenization of product through competition. Competition means that people who begin with the homogeneous product ends with differentiating them.

Let this stop the allocation model from using the partial equilibrium approach to spawn endless streams of self-contradiction. And let exchange take over its legitimate place, with the entrepreneur firmly in place. Let the optimization model learn to obey price rather than fix it. Let us learn all four equations, and not be partially taught by the first equation. Let our equilibrium be truly general as in Leontief (and not in Walras) rather than partial.

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