

EXCHANGE THEORY -- THE MISSING CHAPTER

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EXCHANGE THEORY -- THE MISSING CHAPTER*

In standard price theory we do not yet have an economic theory of exchange. Markets function as if by magic, without draining resources. Production transforms resources into goods, while consumption absorbs goods (and, in closed systems, may be regarded as creating the resource of labor power). But exchange is supposed to conserve both resources and goods, merely redistributing the totals in better accord with individual desires. It has been shown useful to think of consumption as a drain on resources (in particular, consumer time) as well as a sink for final goods.¹ And, similarly, the conception of exchange as a process that absorbs resources -- a process that is costly² -- permits the analysis of certain phenomena inexplicable under the traditional assumption. Indeed, these phenomena are more prevalent and central than is commonly realized.

Demsetz³ has pointed out that, if markets were perfect and costless, monopolistic divergences between marginal cost and price could not persist. The monopolist and his customers could and would negotiate a price schedule permitting mutually advantageous division of the gains achievable by an efficient rate of output. Coase⁴ had shown earlier that a comparable result would be obtained in the case of supposed divergences between private and social cost: in an ideally functioning market system all "externalities" would be internalized, as outside parties make bids or offers designed to induce or restrain the spillovers in question. And in the theory of corporate finance, Modigliani and Miller⁵ have shown that the balance between debt and equity securities selected by the firm cannot be explained in a model of perfect and costless markets for funds. But it is indubitable that monopoly and externalities

exist, and equally undeniable that the corporate problem of optimal financial balance is an important economizing choice!

A number of other everyday observations are also impossible to reconcile with the assumption of perfect and costless markets: the normal gap between the buying prices and selling prices of many (all?) commodities; the large number of commodities that are not marketed at all despite the existence of potentially willing sellers and buyers; and, finally, the existence of money as a specialized medium of exchange. An economic theory of exchange would also be of use for analyzing policy-relevant questions like the impacts of transactions taxes (as opposed to taxes on production or consumption), the welfare cost of monetary inflation, and the public-good aspect of markets.

Not all these issues can be addressed here. This paper has more modest, mainly expository aims: To examine the elements of exchange as an economic (costly) process (Part I), present relatively simple models and illustrations of optimization and equilibrium in a world of costly trading (Part II), and thus build a foundation for comprehending the role and functioning of money (Part III). The bulk of the space is devoted to Part II, with main reliance upon diagrammatic exposition.

The key simplification permitting a relatively elementary treatment is the assumption throughout of perfect markets. A perfect market, as the term is employed here, may involve some trading charge or admission fee (whereas a freely accessible market may be an imperfect one). Market perfection has two main aspects: First, each trader (having paid whatever fee is involved) is fully informed as to the terms on which he can trade. Thus, there is no "market uncertainty."⁶ Second, trading terms take the form of simple pricing, i.e., there is a single quoted price at which the individual may buy or sell

the quantity of his choice -- upon payment of the required transaction fees.
(Note, however, that a fee proportioned to quantity exchanged would import a gap, from the trader's point of view, between net buying and selling prices; with more complex fee structures, the price inclusive of trading charges may also vary with the quantity traded.) Simple pricing precludes quantitative restrictions on trading, all forms of price discrimination, and strategic bargaining behavior. It does not rule out monopoly; however, competitive models only will be employed here.

I. WHAT ARE COSTS OF EXCHANGE?

Exchange as an economic process involves cost. A casual inspection of the most obvious statistical sources suggests that enormous proportions of our resources are devoted to exchange-related activities. In 1971 15,142,000 of the total employed civilian labor force of 79,120,000, some 19%, were reported as engaged in Wholesale and Retail Trade alone. And substantial numbers were involved in other activities seemingly connected at least in part with exchange: Transportation and Communication; Finance, Insurance, and Real Estate; Services; and Government. Can our standard models really have assumed away activities of these magnitudes?

To approach this question requires a closer analysis of the process called exchange. An elementary yet vital distinction must be made between market trading, and the physical transfer of goods:

(1) Interpersonal economic integration through market interactions of individuals necessarily entails certain "trading costs". Offers must be communicated, agreements negotiated, and contracts enforced. (2) But in any multi-person economy goods and resources must somehow be transferred among persons, so that "transfer costs" constitute a broader category of which trading costs may be a subset. (Costs of transfer other than those associated with

market trading may be called "pure" transfer costs.) Think of a society in which trade in our sense does not exist, e.g., an ant economy. Inter-individual transfers of "goods and services" still take place, governed (one presumes) entirely by instinct. Or on a more human if not more humane level, think of some ultimate "command economy": a hyper-socialist system in which all inter-personal transfers are dictated by orders from above -- with ordinary economic motivation effectively suppressed by appropriately ferocious penalties.

From the point of view of any single individual in a trading economy, this distinction may make no difference. Consider transportation. If suppliers are geographically separated from consumers, goods must be moved to people or people to goods in any case -- transportation is essentially a pure transfer cost, not a trading cost. And yet the effect of a transportation charge, so far as the individual trader is concerned, would be exactly the same as if there were an equivalent charge levied upon transacting per se without regard to any geographical separation. Similarly for "handling costs" (breaking bulk and the like) which also are essentially due not to trade but to transfer as such.

But from the social point of view the difference is crucial. For one thing, it will be evident that money economizes on trading costs like negotiation and cannot in any way eliminate pure transfer costs like transportation. (Indeed, as we shall see, in economizing on transfer costs the institution of money may entail some partially offsetting increase in other categories of cost. Pure transfer costs really fall under the social category of production rather than exchange. "Adding" transportation to a good so as to physically bring it to the consumer is in principle the same as "adding" baking services to dough so as to make bread the consumer will want to eat.

One would not want to suggest, of course, that a society could shift over

to a command economy and thereby simply save resources "wasted" in the trading process. There is every reason to believe that an individualist trading economy provides incentives making possible larger social totals of production, and more generally preferred distributions of those totals.

Part II following examines the individual's choice situation and economic equilibrium in a market economy. The analysis explains the existence of "middlemen" who may equally well be engaged in facilitating pure transfers (e.g., transportation) or trading (e.g., brokers). The social aspect of the trading process will come to the fore in Part III, where the focus will be upon the institution of money as related to trading and transfer costs.

II. COSTLESS VERSUS COSTLY EXCHANGE

Fig. 1 portrays the optimizing decision of an individual in the simplest world of costless exchange. There are just two commodities X and Y. The individual has a productive opportunity set, bounded by the transformation locus QQ' which shows the alternative combinations of X and Y attainable with his given resources. Letting Y be the numeraire commodity, and P the price of X in units of Y, there will be a family of market or iso-wealth lines defined by the equation $W = P X + Y$. The optimization can be regarded as taking place in two steps. First, the individual finds the combination along QQ' that maximizes wealth, i.e., attains the highest possible iso-wealth line (MM') -- this is the productive optimum $Q^* = (x^q, y^q)$. Note that this productive optimization is entirely independent of the individual's preference function. Second, the individual moves along the attained iso-wealth line to locate his consumptive optimum $C^* = (x^c, y^c)$. The consumptive optimization in turn depends only upon the preference function and attained wealth, and is independent of the specific form of the productive opportunities. This two-stage separation of the decision

process is the crucial consequence, on the private level of analysis, of the assumption of costless exchange.

Supply and demand relations can be derived in various ways from the data of Fig. 1. We can deal with either commodity X or commodity Y, and with several different net or gross supply and demand concepts. Fig. 2 shows three such relations, for commodity X plotted against its price P. The curve s^q can be called the individual's productive or gross supply; it is the X-coordinate in Fig. 1 of the productive optimum Q^* , as the latter varies in response to changes in price P. The curve d^c is the individual's consumptive or gross demand; it is the X-coordinate of the consumptive optimum C^* as that varies in response to changes in P. The individual s^q curves could be aggregated into an economy-wide supply curve S^q , and the individual demand curves d^c similarly into an economy-wide D^c curve -- whose intersection would determine the equilibrium price P^* . However, such a formulation would obscure the key issue of interest here, since the market exchanges would not be clearly distinguished from the self-supplied quantities. The curve d^m is therefore drawn to show the individual's net or excess or market demand for X as a function of P; d^m is simply the horizontal difference $d^c - s^q$. For sufficiently high prices, of course, net demand is negative. Rather than deal with negative net demand, it is useful to reverse the sign in this region and think in terms of positive net supply s^m . Thus, Fig. 3 shows this individual's net (positive) supply and net (positive) demand as functions of price. The price P^0 where net demand is zero will be called the "sustaining price" for the individual. (The sustaining price corresponds to the tangency slope of an indifference curve with the productive locus QQ' , at the point K^* in Fig. 1.)

Finally, in Fig. 4 we see aggregated market supply and demand curves S^m

and D^m , whose intersection determines the equilibrium price P^* . While the individual's net s^m and d^m curves intersect only at the vertical axis, the market-wide aggregation will lead in general to an interior intersection showing a positive quantity of X traded on markets.

With this as background, we now want to consider economic (costly) models of the inter-individual transaction process. The costs may be regarded as associated either with pure transfer operations or else specifically with trading activity as such. In either case, these costs will tend to be a function both of the number of distinct transactions (orders or transfers) and of the volume of goods exchanged. In transporting goods, for example, costs may depend both upon the number of distinct shipments and upon the ton-mile volume. In a trading context, commission charges for the use of a market like the New York Stock Exchange typically involve a fixed fee per transaction as well as a component depending upon dollar volume.

In what follows only two polar cases will be considered: exchange costs strictly proportional to volume, and exchange costs depending only upon the number of separate transactions.

A. Proportional exchange costs (costs of volume)

Proportional exchange costs can be handled by an easy adaptation of the traditional model. Instead of a single price P for commodity X (continuing to use Y as numeraire), there are now two prices P^+ and P^- -- a higher "buying price" and a lower "selling price". The gap $G = P^+ - P^-$ is, of course, the proportional exchange cost. It can be thought of as the price of "middleman" services. If a quantity x^m is traded between two parties, an exchange cost of Gx^m will necessarily be incurred by the pair.

Fig. 5 shows the attainable consumptive combinations for a trader possessing

the same productive opportunities as Fig. 1, but now with truncated market opportunities due to a fixed gap between selling and buying prices. Note the directions of the arrows: he can only move southeast (buy X) along the steeper market line emerging from the tangency B^* or northwest (sell X) along the flatter line emerging from A^* . Three alternative classes of consumptive optima are illustrated by indifference curves U , U' , or U'' . There will still be a "sustaining price" P^0 , the absolute slope of the indifference-curve tangency with QQ' (e.g., at the point K^* for the individual with indifference curve U).

Net market supply and demand curves for an individual are shown in Fig. 6. He will be a net supplier only if the selling price P^- is higher than his sustaining price P^0 -- as represented by the dashed $s^m(P^-)$ curve. He will be a net demander only if the buying price P^+ is lower than P^0 -- as represented by the solid $d^m(P^+)$ curve. Thus it is the inner curves in Fig. 6 that determine individual behavior. It is also convenient to show the (solid) $s^m(P^+)$ and the (dashed) $d^m(P^-)$ curves, each differing from its partner solely by the vertical gap G . (Middleman services are assumed to be competitively supplied, hence their price G is taken as constant by traders.)

Fig. 7 shows the reason for introducing these latter curves. The solution determining buying price is found where the $S^m(P^+)$ and $D^m(P^+)$ curves -- the aggregates of the corresponding (solid) individual curves -- intersect. This must evidently be at the same trading volume as the intersection of the dashed curves whose intersection indicates the equilibrium selling price.

What happens if the trading cost, the size of the gap G , changes? In Fig. 6, for any individual the inner curves are unaffected. But if G increases the outer pair would diverge farther from their partners, leading in Fig. 7 to an upward shift of the $S^m(P^+)$ curve and a downward shift of the $D^m(P^-)$ curve.

The consequence is a fall in the equilibrium quantity of transactions. And indeed, for sufficiently high G no trade at all will take place -- all individuals will remain at autarchic solutions like K^* in Fig. 5.

In poorer economies, active trading occurs in products like used containers and cigarettes by the unit (rather than by the pack) -- markets not seen in the United States. It appears that middleman services are relatively more costly to provide in advanced economies, presumably because of their labor-intensiveness. The market for used clothes is one that has substantially disappeared over the last few decades; we now give them or throw them away. It might also be noted that a tax on transactions will have consequences similar to an increase in the real cost of transferring or trading.

The preceding discussion represented a partial-equilibrium analysis, for the size of the gap G was taken as given. Since G is the price of middleman services, it is itself a solution variable in general equilibrium. (And, there should be a distinct gap G for each separate non-numeraire commodity.) It is possible to provide an intuitive representation of general equilibrium where X is the only non-numeraire commodity.

We saw earlier that an increase in G would tend to diminish the volume of transactions. More generally, a demand relation for middleman services T can be derived; it shows, for each G , the desired volume of transactions. G can be defined as the rate of payment to a (competitive) middleman for effectuating the transfer or market trade of a unit of X . Then, T must be numerically equal to the volume of transactions in X . What about the supply of middleman services? Those who provide T must sacrifice resources that could otherwise be applied to produce X and Y , as indicated by the three-dimensional productive opportunity locus $QQ'Q''$ in Fig. 8. At the overall equilibrium the prices P^+ and P^- must

be such that market supplies and demands for X are in balance -- while the implied gap G must be such that middlemen are induced to provide exactly the requisite quantity of T. (Note that middlemen would have to reserve some T for effectuating transactions on their own account.) The formal equation structure will not be set down here, but the following numerical example will illustrate the nature of the system.

Example

The economy consists of three individuals, all behaving competitively, all with utility function $U = xy$. John's productive opportunity locus $QQ'Q''$ is degenerate down to a single point -- a given commodity endowment $E_j = (x_j^e, y_j^e) = (40, 0)$. Similarly for Karl, but his endowment is $E_k = (x_k^e, y_k^e) = (10, 30)$. Isaac has a partially degenerate productive opportunity surface $y_i^q = 20 - 1/40 t_i^2$. That is, Isaac can produce alternative combinations of Y and T, but no X.

John will obviously be a net supplier of X. Hence his consumptive optimality condition is $-dy/dx|U = y/x = P^-$ and budget equation is $xP^- + y = 40P^-$. These imply a net market supply $s_j^m = 20$ (regardless of price, so a vertical supply curve). Karl will be a net demander of X. His consumptive optimality condition is $y/x = P^+$ and budget equation $xP^+ + y = 10P^+ + 30$. These imply $d_k^m = -5 + 15/P^+$.

Isaac will exploit his transformation opportunity until $-dy^q/dt = G$, since G is the value in numeraire units of a unit of T. Then $t_i = 20G$. But as he is a buyer of X, his consumptive optimality condition is $y/x = P^+$. His budget equation is $xP^+ + y = y^q + Gt$ -- where the RHS is the value of his optimal produced combination. Substituting to eliminate t leads to his market demand equation $d_i^m = (10 + 5G^2)/P^+$.

John is the only supplier of X, and Isaac the only supplier of T. Hence $s_j^m = 20 = t_i$. But $t_i = 20G$, so the price gap $G = 1$. Substitution in Isaac's market demand equation leads to $d_i^m = 15/P^+$. The market conservation condition for X is $20 = d_k^m + d_i^m = -5 + 30/P^+$, so that the gross price $P^+ = 6/5$. Then the net price $P^- = 1/5$. Using these prices all the consumptive optimum commodity combinations $C^* = (x^*, y^*)$ can be found:
 $C_j^* = (20, 4)$, $C_k^* = (17 \frac{1}{2}, 21)$, $C_i^* = (12 \frac{1}{2}, 15)$.

This proportional-cost model explains the observed gap between buying and selling prices, but does not explain the holding of inventories. There is no role for stocks of goods because the solution is in the form of a continuous steady-state flow over time. It would be possible to introduce a need for inventories by assuming some cyclical or other imbalances in productive, consumptive, or trading flows -- for example, that people produce relatively more during the week but consume relatively more on weekends. Or that trading is cheaper by daylight. The cost of holding inventories would also then have to be allowed for. Rather than develop such models here, a rationalization for the holding of inventories will be provided in terms of a fixed or "set-up" cost of transacting.

B. Fixed exchange costs (costs of transactions)

Suppose that production and consumption take place as level flows over time, as before. Markets remain perfect, and let there be zero proportional costs of trading. This leads us back to the simpler case with unique market price P . However, now assume there is a fixed cost F that every trader must incur (in units of numeraire Y) each time a transaction takes place. Then a discrete sequence of transactions separated by a time-interval θ replaces the previous continuous trading.

Consider someone who, at a particular price P , is a net purchaser of X . Fig. 9 shows a possible solution, for given θ , in terms of production and consumption flows and inventory history. First, the individual retains a self-supplied production flow x^q per unit of time. At discrete intervals $\theta, 2\theta, 3\theta$, etc., he purchases a further quantity χ (not a flow, but a stock magnitude). This permits a level consumption flow of $x^c = x^q + \chi/\theta$. There will be a corresponding diagram, showing regular accumulation rather than decumulation of inventory, for commodity Y .

In determining the level of θ , the individual is of course constrained by the costs of holding inventory -- whether of X awaiting consumption or of Y awaiting sale. Fig. 10 illustrates a comparison of two different levels of θ . The outer $Q'Q'$ locus corresponds to choice of a relatively small θ , say θ' . Since the short waiting time between transactions requires only a small commitment of resources to inventory, the locus $Q'Q'$ lies relatively far out from the origin. The individual, however, cannot now exchange along the market line $M'M'$ through his productive optimum position $Q'^* = (x^q, y^q)$; he must first pay the fixed charge F each time he transacts. Let us suppose that the interval θ' corresponding with the outer locus $Q'Q'$ is precisely the unit period of time. Then, he will have just one transaction per period. Consequently, the market line actually relevant for him is $N'N'$, drawn through the point $N'^* = Q'^* - F$ whose coordinates are $(x^q, y^q - F)$.

Now consider the alternative of a somewhat larger inventory interval θ'' . More resources are absorbed in holding inventory, so the appropriate productive transformation locus is the inner curve $Q''Q''$. (For simplicity, inventory costs are assumed to take only the form of diverting resources from production.) Suppose that θ'' is exactly twice as long as θ' . Then an average transaction

fee of only $F/2$ will be incurred per unit period of time. Consequently, the attainable market line $N''N''$ might now be higher than $N'N'$ as in Fig. 10 even though the productive opportunities are less, since the vertical drop from the productive optimum Q''^* to $N''^* = Q''^* - F/2$ is only half as great. (In Fig. 10, for diagrammatic convenience the points Q'^* and Q''^* are shown vertically aligned, which would not in general be exactly the case.) The optimized θ will be that trading interval for which the market line, after payment of an average transaction fee F/θ , is highest. The individual choosing this θ may be said to have maximized his marketable income.

But the θ leading to the highest marketable income is not necessarily the optimal situation. There is another possibility still to be considered, the autarchic solution. In Fig. 11 the productive locus $\hat{Q}\hat{Q}$ and associated \hat{Q}^* and \hat{N}^* points refer to a θ and an inventory level optimized in terms of marketable income. But the individual might do better by engaging in no trade at all, devoting no resources to holding inventories. (In Fig. 9, for such a choice x^c and x^q would coincide -- the inventory history would be zero at all points.) The individual would then be in a position to move along the largest conceivable productive opportunity locus, shown as the dashed curve QQ in Fig. 11, but in doing so could not engage in any market transactions at all. The autarchic solution K^* might be superior as shown in Fig. 11, or might not -- depending upon the size of the trading fee F , the inventory costs, and the degree to which the individual's own productive opportunity happened to coincide with his preferences among commodities.

Looking at the individual's excess-supply and excess-demand offers in Fig. 12, there will now be a range of prices around the sustaining price P^0 under which he will prefer the autarchic solution K^* of Fig. 11. As the

market price diverges from P^0 , however, consumptive combinations attainable only by trading become increasingly interesting. For a sufficiently wide divergence, it will pay to incur the trading fee F and the inventory costs associated with market exchanges.

The individual curves can again be aggregated, in analogy with Fig. 4, into market supply and demand curves. The market curves can intersect in the interior of the positive quadrant, even though Fig. 12 shows that for each person separately the s^m and d^m curves do not intersect even along the vertical axis. But there is also a possibility of non-intersection, i.e., autarchic solutions might be so attractive for the separate individuals that no pair of traders is willing to incur the transaction charges (and associated inventory costs) of market dealings.

The endogenous determination of the transaction charge F , in a general equilibrium solution with market price P , introduces a new element because of the non-flow nature of the solution. Only a general outline can be indicated here. As before, some individuals will find it advantageous to use some or all of their resources to provide middleman services. Where the aggregate flow of income to middlemen in a proportional-cost situation was $GE|x^m|/2$, here the flow of revenue per unit of time to middlemen is $F\sum 1/\theta_j$, where θ_j is the inventory period of the j -th individual engaged in trade. (There may, under either regime of costs, be persons who do not engage in trade.) Whereas under proportional costs a middleman balances the marginal return G against the cost of servicing transfer of another unit of commodity, here he will balance the return F against the cost of servicing another transaction.

It has been implicitly assumed here that the set-up charge, F , is levied on each trader -- both buyer and seller. (Whereas, above, the burden of the

proportional-cost gap G was assumed to be shared by the buyer-seller pair.) This would be appropriate, in a competitive model, if in fact the cost incurred by middlemen was of this nature. The middleman service might, for example, consist essentially of providing a communication system; the cost of handling a message to "Buy 100 units" is the same as "Buy 1000 units". On the other hand, if the middleman service was more of the nature of a transportation system, costs would tend to be proportional to physical volume traded. In general, costs would contain elements of both types. But in competitive equilibrium, the set-up charge would have to equal the marginal cost per transaction and the proportional charge the marginal cost per unit of volume.

III. MONEY

A complete theory of money can obviously not be developed here. Rather, the discussion is intended only to suggest how the existence of transfer and trading costs are related to the institution of money.

First of all, and most important, pure transfer costs (not due to market exchange) have nothing to do with the case. As regards transportation, for example, given geographical distributions of resources and consumers together with given productive and consumptive commodity vectors dictate certain minimal shipping costs that would have to be incurred even by some idealized ant-type or command economy. The institution of money can do nothing to reduce this cost. And similarly, imperfect synchronization of productive and consumptive flows or the existence of lumpy elements along the production-transfer-consumption chain will dictate the holding of some minimal commodity inventories -- regardless of the institutional and incentive structure. Again, money cannot eliminate these categories of expense.

Money can reduce trading cost proper, as will shortly be seen. But matters

are made a bit tricky by a category of what might be called "induced" transfer costs: costs associated with the same activities as pure transfers (e.g., transportation, handling, holding inventories) but which come into existence only because of market trading.⁷ These costs can also be economized by the institution of money.

Traditionally, money serves two key functions: medium of exchange, and temporary store of value. These functions can be analyzed in terms of the concepts of transfer and trading cost developed above. In doing so, all problems connected with uncertainty as to terms of exchange (prices) will for simplicity be assumed away.⁸

A. Medium of exchange

The rationale for the medium of exchange function can be most clearly seen in terms of the proportional transaction cost, level-flow model of II.A. above. To fix ideas, suppose that there are N commodities -- each produced exclusively by a single individual (some of whom may also serve as middlemen). But all N persons are willing to consume (pay the going price for) any commodity. Thus, we have specialization in production but nonspecialization in consumption. In an economy of this type, the famous "double coincidence" problem of barter does not arise.

Under a command economy suppose the dictator is perfectly efficient (and benevolently seeks Pareto-optimal solutions). There is no resource "wastage" due to trading. Even so, pure transfer costs may rule out some of the $N(N-1)$ possible commodity movements as uneconomic: transportation costs, for example, may make it necessary for a California orange-grower to do without Maine lobsters. (But suitable commands could still provide for shipment of less perishable California oranges to Maine in some triangular or still more complex pattern of transfers.)

Now consider barter trade. As an empirical fact, trading costs impose strong pressure toward bilateralism -- contracts involving two parties only. Multilateral contracts seem exceedingly difficult to negotiate and enforce. If trading costs were to strictly impose bilateralism, there would be $\frac{N(N-1)}{2}$ possible 2-way channels in place of the previous $N(N-1)$ possible 1-directional movements. Now the California oranges are unlikely to go to Maine at all, since the bilaterally required lobster shipment is uneconomic. Evidently, bilateral barter would lead to considerable autarchy.

Selection of a single commodity, say gold, as universal medium of exchange reduces the required number of bilateral channels to only $N-1$. Each non-money commodity can be traded only for money. The effect is to reduce the cost of multilateral trading, through a surrogate bilateral accounting device. And yet transfer costs proper are likely to increase: not only will California oranges be exchanged for Maine lobsters once more, with an increase in intercontinental transportation, but the shipping and handling of gold itself must evidently rise by an enormous factor. This suggests that the commodity chosen as medium of exchange should be one that can be cheaply transported and handled -- features suggested by traditional emphases upon such desirable properties as portability, divisibility, etc. (The traditional property of homogeneity tends to reduce inspection costs, which fall under the trading-cost heading.)

B. Temporary store of value

It is perhaps arguable whether a mere intermediating commodity, serving only as medium of exchange, should be regarded as money. We generally think of money not as a flow but as a stock magnitude⁹ performing a function rather like that of a catalyst in a chemical transformation. For like a catalyst, money facilitates a flow process (exchange) while remaining itself exactly

the same at the end as it was in the beginning. A mere intermediating commodity, on the other hand, would be produced and consumed like any other good -- being distinguished only by entering into multiple transactions on the way.¹⁰

Money as temporary store of value (abode of purchasing power) must be a stock. We saw earlier that even in a world of pure productive and consumptive flows, imperfect synchronization would lead to the existence of inventories. And production and consumption themselves are ordinarily not pure-flow processes but generally do themselves require stocks (e.g., of machines). Finally, any pure transfer costs that take the form of a set-up charge per transaction (as in II.B. above) will dictate inventory-holding. So even in an idealized command economy with no trading, inventories would exist along the production-transfer-consumption chain.

The introduction of barter trade brings into existence additional trading inventories. To some extent these fall into the category of "induced" transfer costs. A set-up fee per transaction reflecting trading cost (e.g., a recording or communication charge), over and above those charges due to pure transfer costs, will tend to reduce the frequency of transactions and thus increase average inventory holdings.¹¹ There is one newer feature, however, connected with the "double coincidence" problem.

Let us now assume a certain degree of specialization in consumption, so that the typical individual is no longer interested in consuming all commodities. Nevertheless, in a world of bilateral trading with discontinuous transactions, it may become optimal for any Mr. A, let us say, to hold stocks of commodities he neither produces nor consumes. These would be "trading inventories" in the narrower sense (which fall under the category of costs of trading per se

rather than induced transfer costs). If his supplier Mr. B does not care to receive in exchange A's product, and his customer Mr. C prefers not to deliver in exchange any of those commodities that A wants to consume, Mr. A will tend to hold trading inventories of a variety of products in which he has no direct interest.

Inventoried goods will vary in the degree to which they impose inconvenience and loss due to factors like deterioration, risk of theft, neighborhood effects, etc. In addition there may be increased costs due to their very multiplicity (e.g., record-keeping). It thus becomes efficient for all parties in an economy to agree to accept in bilateral exchange some one "store of value" commodity for settling accounts. Properties like compactness and durability that tend to reduce inventory holding costs are obviously desirable. In addition, absence of attrition through consumption would be very desirable.

In principle there might be some conflict between the properties of a money of most interest for the two functions of medium of exchange and store of value. And aside from desirable properties, the cost of providing the monetary commodity must also be considered. As it happens, however, the invention of an artificial commodity in the form of paper money -- and the further development of this into the purely abstract category of demand deposits -- meets all the requirements at a cost that is very low indeed.

One final note. In this discussion the usefulness of money to society as a whole has been emphasized. But we do not yet have a model to explain why and how it pays particular economic agents to invent the institution in the first place and to generate, maintain, and regulate the supply of money. In point of fact, government almost everywhere tends increasingly to control if not monopolize this activity. The dangers that ensue are suggested by the phrases "inflation is a tax on money" and "the power to tax is the power to destroy."

FOOTNOTES

* This paper has benefited from discussions with many colleagues, particularly J. Ostroy and R. M. Clower. An earlier version appeared under the title "Some Fundamentals of Exchange Theory," Rand Corporation P-4667 (June 1971).

¹ Becker (1965).

² Recent articles have made considerable progress in formulating non-costless models of exchange. This paper is most closely related to Clower (1967 and 1970), Foley (1970), Niehans (1969 and 1971), Ostroy (1972), and Wallace (1972). Baumol (1952), Demsetz (1968), Brunner and Meltzer (1971), and Feige and Parkin (1971) should also be cited.

³ Demsetz (1968), p. 33.

⁴ Coase (1964).

⁵ Modigliani and Miller (1958). See also Hirshleifer (1966), pp. 264-68.

⁶ Hirshleifer (1973). On the other hand, the model is robust under "technological uncertainty" about endowments and production functions as these vary over states of the world.

⁷ Thus, these are "excess" transfer costs over what an ideal ant or command economy would hypothetically incur. All trading expenses proper are "excess" in this same sense. One need hardly repeat that an actual ant-type or command economy could surely not attain the same productive-consumptive vectors as even a barter trading economy.

⁸ Some theories of money place this uncertainty in a central role, so as to make money-holding a form of risk-avoiding behavior. Without utterly rejecting this idea, one can nevertheless explain the usefulness of money without it.

⁹ Demand deposits, while of stock dimensions, illustrate that money does not have to correspond to any material or physical stock.

¹⁰ Historically, societies that invented money first attached this function as an auxiliary to some convenient ordinary good. But gradually the monetary function tends to become associated with some "peculiar" commodity not subject to production and consumption in the usual sense.

¹¹ On the other hand, if such charges become so onerous as to shift individuals over to autarchic solutions, inventories will tend to decrease.

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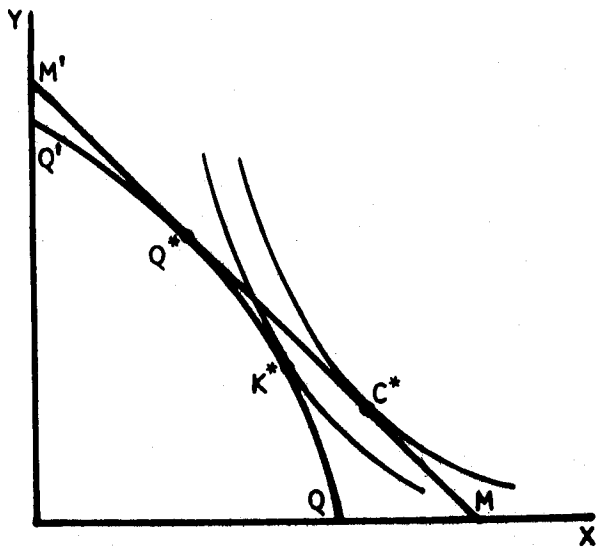


Fig. 1 - Optimizing decision of individual with costless exchange.

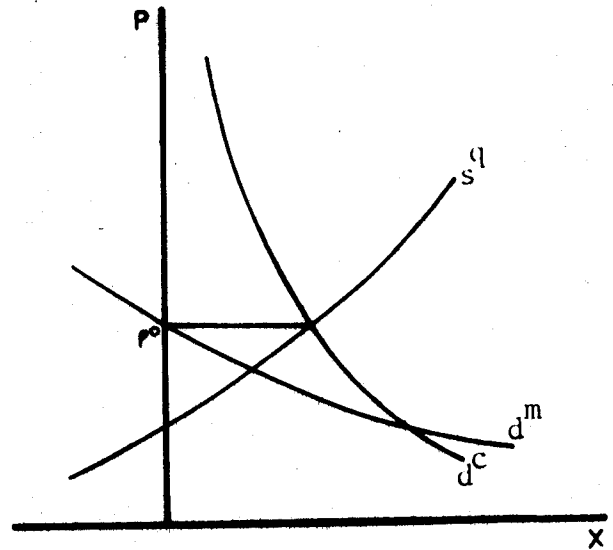


Fig. 2 - Individual's supply and demand relations in costless exchange.

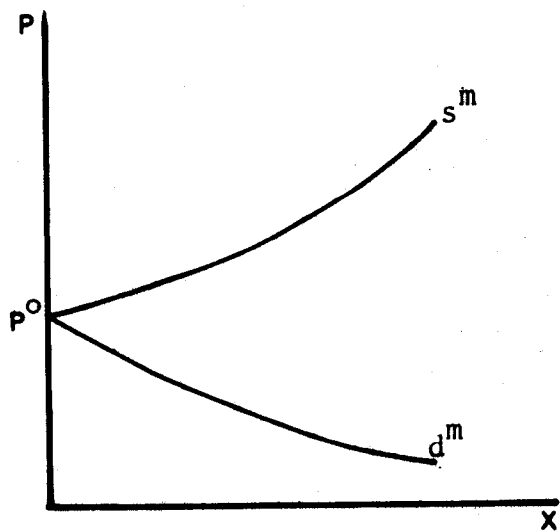


Fig. 3 - Individual's net supply-demand offers in costless exchange.

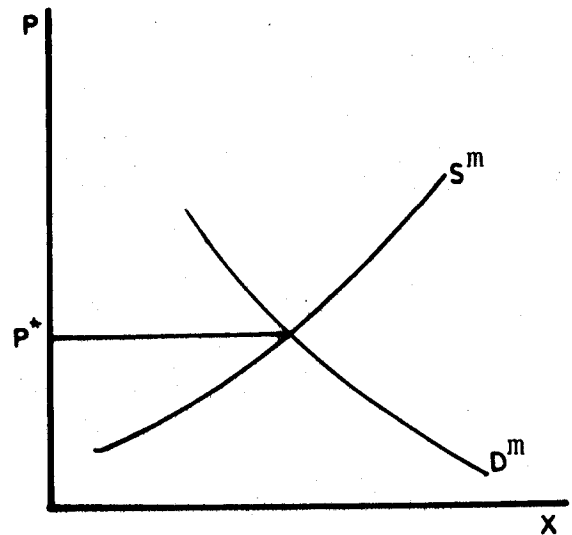


Fig. 4 - Market supply and demand curves in costless exchange.

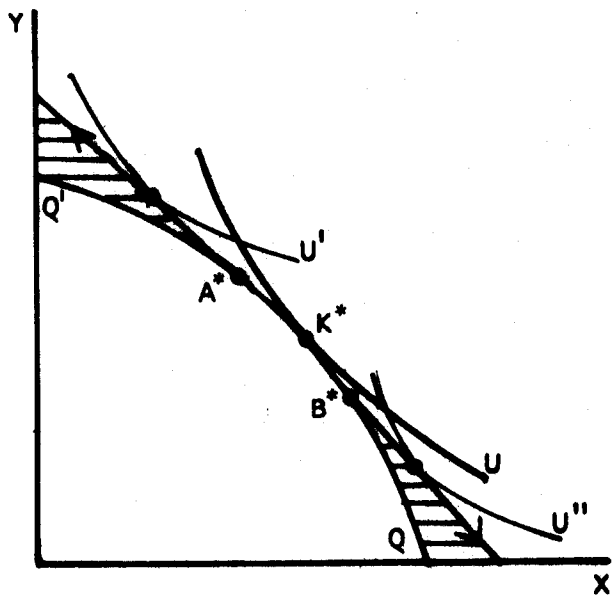


Fig. 5 - Optimizing decision of individual, proportional transaction costs.

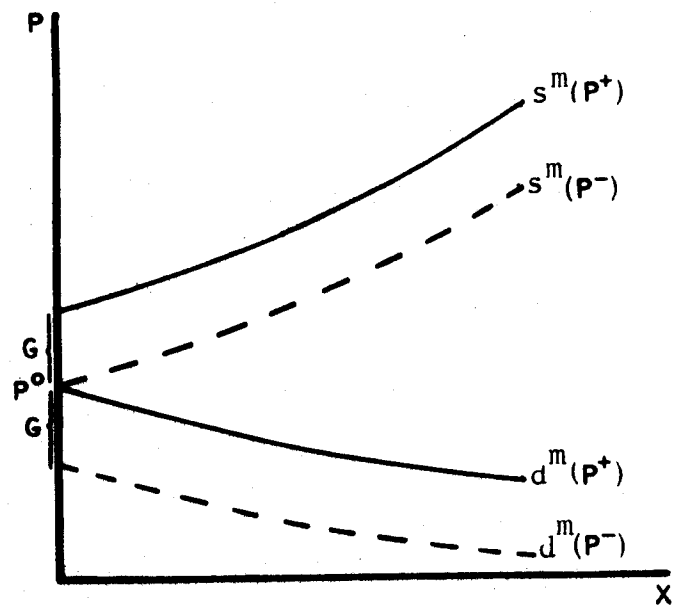


Fig. 6 - Individual's net supply-demand offers, proportional transaction costs.

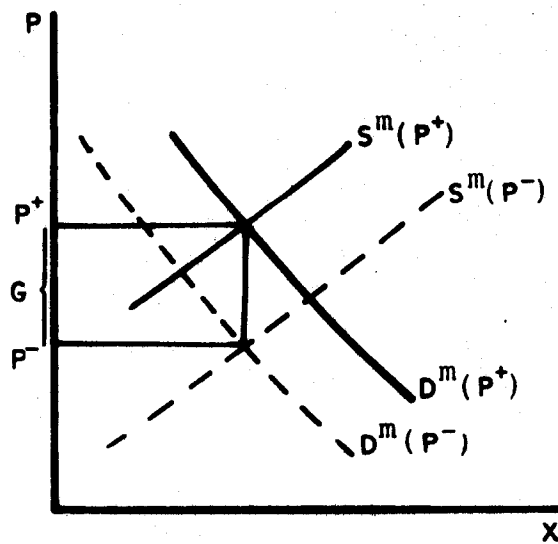


Fig. 7 - Market supply and demand curves, proportional transaction costs.

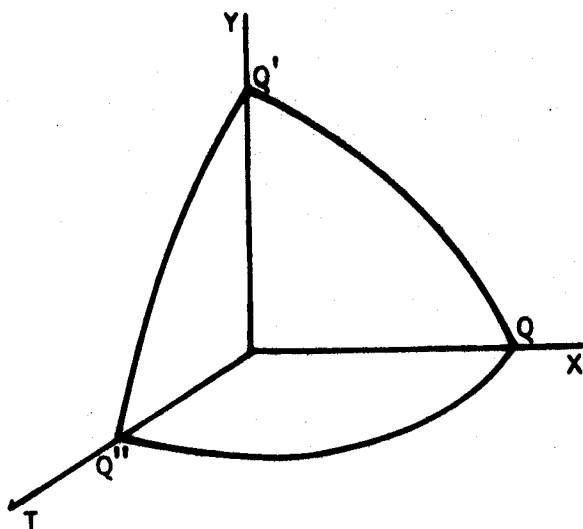


Fig. 8 - Middleman services as a function of resources committed.

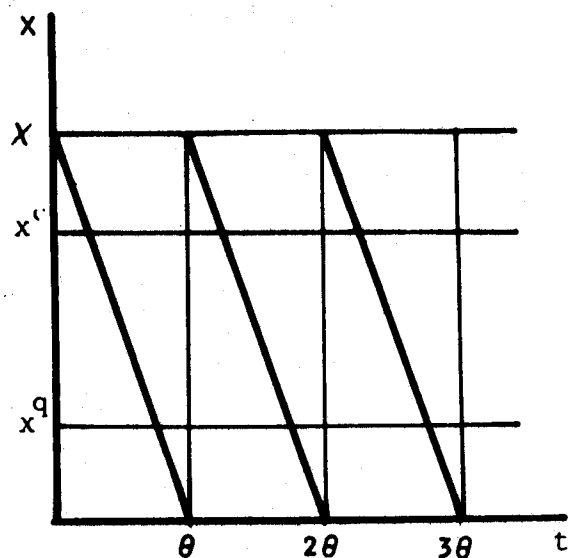


Fig. 9 - Possible inventory history for individual, fixed transaction costs.

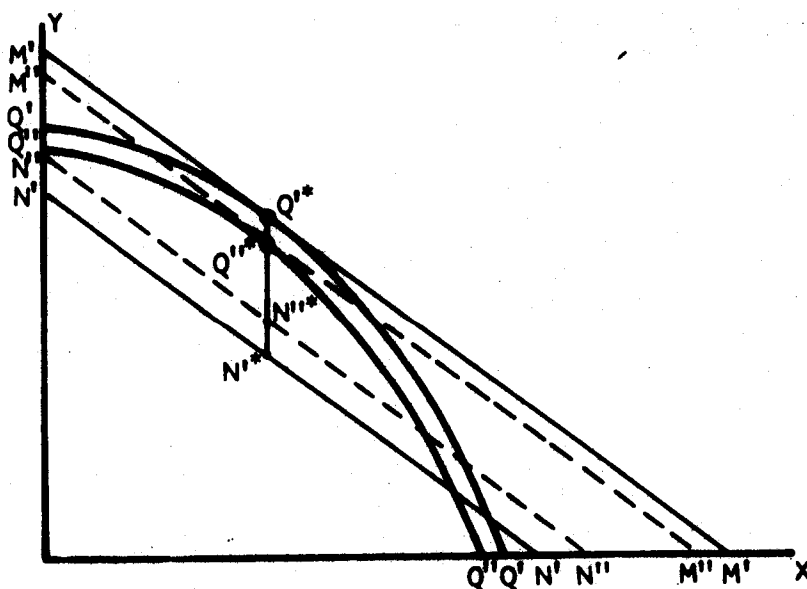


Fig. 10 - Comparison of alternative trading intervals, fixed transaction costs.

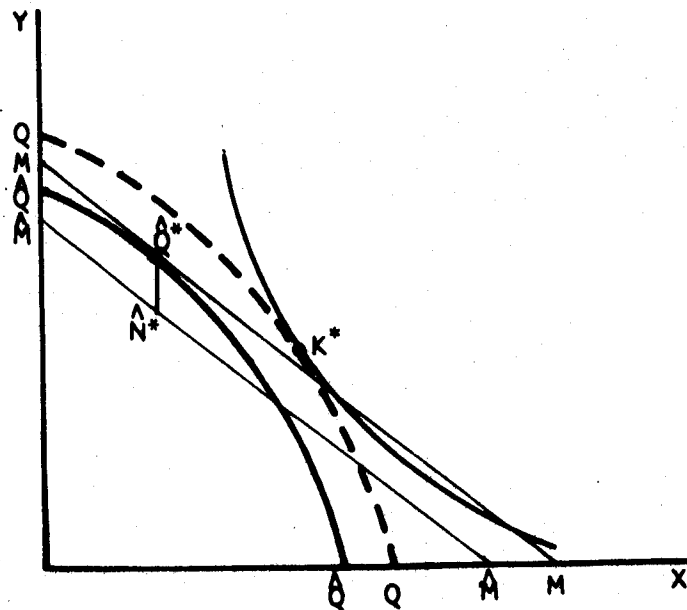


Fig. 11 - Individual autarchic optimum, fixed transaction costs.

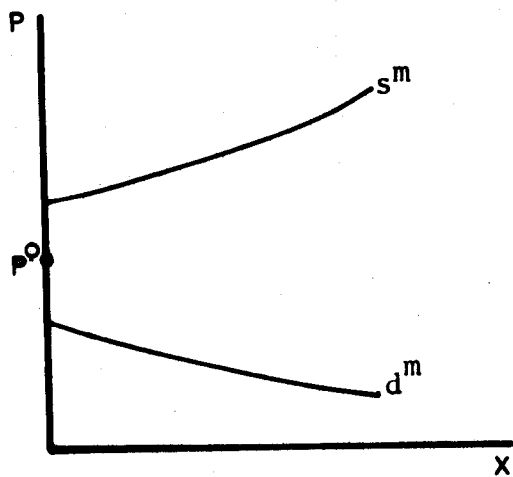


Fig. 12 - Individual's net supply-demand offers, fixed transaction costs.

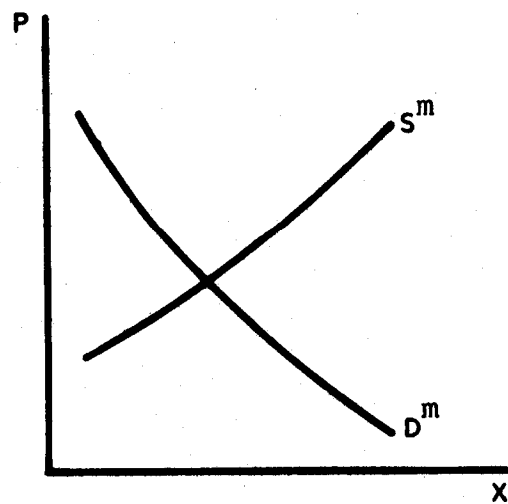


Fig. 13 - Market supply and demand curves, fixed transaction costs.