

AN ABSTRACT OF THE THESIS OF

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New types of exchange arrangements are becoming increasingly popular for a wide range of goods traded internationally. Several types of countertrade arrangements have been identified, ranging from pure barter to more elaborate schemes where only a portion of the trade is "paid for" in goods, including bilateral trading agreements with clearing arrangements and those with arrangements for partial or total compensation in goods.

The economic feasibility of these arrangements has been questioned by a number of economists as well as by government officials. In this paper a partial equilibrium model of exchange is developed that incorporates countertrade by focusing on the transaction costs associated with various types of trading arrangements. The role of transaction costs in determining the types of trading arrangements that emerge when exchange is not

costless is examined. The model is presented graphically and mathematically.

The effect of changes in demand and in the levels of transaction costs on the shares of trade accounted for by cash, credit and countertrade are examined. Several testable hypotheses emerge from this discussion.

The hypothesis that the share of trade accounted for by countertrade increases when the unit cost of credit transaction services increases is tested. Correlation coefficients are calculated for countertrade shares of trade for several products and sales agreements versus hard currency debt, the current account deficit, net external borrowing and the current account balance. All product categories examined except minerals and metals support the hypothesis.

Countertrade: A Transaction Costs Approach

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## COUNTERTRADE: A TRANSACTION COSTS APPROACH

### Introduction

Countertrade--an exchange of goods between two parties without the use of money<sup>1</sup>--is discussed more and more frequently in the news media as well as in business journals and trade magazines. Just how much of world trade is accounted for by countertrade, however, is very difficult to determine. Estimates range from as low as 4.8 percent of world trade (Organization of Economic Cooperation and Development) to as high as one third of all international trade (U.S. Department of Commerce).

What is countertrade? Why is it apparently gaining popularity? How can its presence be explained in a world where money exists, a world where money facilitates exchange and so causes all other types of exchange to appear inefficient? Does the neoclassical model provide a framework for analyzing the phenomenon? Does the pure theory of exchange?

These are some of the questions facing the countertrade analyst. Many researchers and market analysts have put aside these basic questions and have focused on the mechanics of countertrade instead. Government analysts and policy makers do the same thing.

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<sup>1</sup>That is, pure barter. Variations are discussed later.

Their policies reflect little understanding of the economics of countertrade except the notion that if traders are doing it, they must find it profitable. The United States for example, "views countertrade in general as a costly and cumbersome way to do business. Nevertheless, if countertrade negotiations are undertaken freely between the contracting parties, the U.S. Government will not intervene" (Walsh).

Countertrade is seen as a short term solution to a variety of problems. These problems include difficulty in obtaining foreign exchange, having soft currencies or overvalued currencies and the need for disposing of agricultural commodity surpluses. It is believed that countertrade can help overcome these difficulties. Traders, bankers and government officials embrace countertrade as a panacea for their trading ills. The perspective appears to be: It is here, some countries demand it, how do we get into the action? "While few executives like the concept of countertrade, a large number now recognize it as a problem--or an opportunity--with which they must deal" (Business International).

But, why do they deal with it? Why not write it off as inefficient? "Money is a device that reduces the cost of market trading" (Hirshleifer). And it can be argued that money evolves in social environments because for

most transactions it costs less to use money than to barter.

If the focus is on overcoming the short term problems associated with countertrade or trying to find the "problem" that countertrade has solved in each transaction, then one loses sight of the fact that traders are profit maximizers and that costs matter. Traders have many options and they may choose countertrade even in the presence of alternative ways to complete a trade. Thus, investigators should now ask new questions: Why would someone choose countertrade and are there circumstances in which it costs less to countertrade than to use money?

What costs concern the trader? What costs influence the decision to trade? In general, the neo-classical model of trade holds that trade takes place at that price and quantity where excess supply equals excess demand and assumes no transaction costs. At zero transaction costs, why not countertrade? When transaction costs are examined more closely it becomes clear that these costs differ significantly depending on the type of exchange. Transaction costs exist for a money transaction and for a countertrade transaction. This is where the costs of countertrade compared to money exchanges can be captured and the magnitude of countertrade costs determined. The closer the focus on transaction costs the clearer it

becomes that the magnitude of these costs can determine whether or not it is efficient to countertrade or even to trade at all.

By examining the market for transaction services closely, the model moves away from being solely concerned with countertrade to a new framework for looking at trade, one that focuses on the emergence of various trading arrangements. Allowances can now be made for cash exchanges, credit exchanges, a combination of these and/or some form of countertrade.

This paper will explore a new theoretical framework for analyzing trade. It is a framework that explicitly considers transaction costs and is concerned not only with trade taking place, but with the type of trading arrangement that occurs. While the current fascination with and growth in countertrade is the motivating force behind this study, as one analyzes what is at work in countertrade one realizes that countertrade is not really as counter-intuitive as it appears at first glance. Once transaction costs are given an explicit role in the trade model, countertrade, another type of arrangement or, more likely, a combination of arrangements can emerge as efficient in an economic sense. The question of "Why countertrade?" is replaced with "Why not countertrade?"

The paper focuses on countertrade in international transactions, but similar arguments could be made for

domestic and interpersonal transactions as well. The definitions of the transaction costs involved would differ, but the analysis would remain the same. The discussion begins with the definitions of countertrade that are used throughout the paper. Next is a summary of the current state of economic analysis of countertrade and the role of money, as well as an overview of current thinking and research on countertrade. The model is then developed graphically and mathematically. The discussion is limited to three types of trading arrangements--cash, credit and countertrade, but could be expanded to cover any number. Finally, an empirical analysis is presented followed by conclusions and suggestions for further research.

### Definitions

Countertrade encompasses many different and complex trading arrangements. In this discussion the term countertrade refers to several types of transactions where some or all of the exchange is made in goods. Three broad categories of countertrade are pure barter, bilateral trading agreements with clearing arrangements, and bilateral trading agreements with arrangements for partial or total compensation in goods.

Pure barter is the classical trading arrangement where goods are exchanged for goods. No money or

currency changes hands. Import and export transactions are arranged at the same time. Pure barter requires a double coincidence of wants. Each party must have what the other one wants. Three way barter arrangements are often used because of the difficulty in finding agreeable two way matches.

Some examples of pure barter transactions are the Nigerian trade of 20,000 tons of cocoa beans for machinery from the USSR (Obadina). The Nigerians also traded crude oil to two French companies in return for help in construction of the Ajaokuta steelworks (Obadina). Brazil traded foodstuffs in return for Malaysian oil (Bell). Jamaica traded \$13 million worth of bauxite to the United States for surplus anhydrous milkfat (Welt, 1984). In 1982 Iran imported mutton from New Zealand in exchange for oil (Organization of Economic Cooperation and Development). An example of a three way trade is the arrangement made in 1979 of Israeli potash to Poland, Polish sugar to Brazil and Brazilian coffee to Israel (Weigand).

Bilateral trade agreements with clearing arrangements are set up between governments, but when similar arrangements are made between private traders and governments they are called evidence accounts. In this type of arrangement a set volume of goods to be traded is agreed upon. This is what makes the transaction a

countertrade transaction. The volume of goods on both sides is set and the agreement is based on the commitment that both sides will receive goods. Each contractual partner establishes a special or clearing account with the central or state bank in the other's country. All payments are made in local currency from and into this account. A hard currency may be used as the "clearing unit" but only for accounting purposes. No hard currency is actually used or transferred. Clearing arrangements allow traders to use only their own currency. The transactions usually do not occur simultaneously, so the clearing accounts are credited and debited as the exchanges occur. The countries are granted credit limits called swing credits. Countries can be called upon to "pay up" when these swing credit limits are reached. Settlement of these debts is foreseen to be in goods.

Another aspect of the clearing arrangements is a time limit on their duration. At the end of the time limit countries are expected to clear their accounts. Often it is acceptable to switch the credits to another country. This action is called "switch trading" and allows a country to collect its debt from a third country without resorting to the use of hard currency.

The last category is bilateral trade agreements with arrangements for partial or total compensation of imports and exports in the form of goods rather than currency.

The value of suppliers' exports are partially or fully compensated for by imports of specific goods from the client's country. The proportion of the original export that is offset by counterdeliveries is known as the "countertrade ratio." One example of this is an agreement by a U.S. firm to supply salt cod fish to a Brazilian firm in exchange for shrimp. They exchanged equal volumes of seafood, but at the same time the U.S. firm deposited \$1.50 U.S. per pound exchanged in a U.S. bank in the name of the Brazilian firm (Wrenn).

Two types of countertrade are included in the compensation category--counterpurchase or parallel barter and compensation or buyback. In counterpurchase agreements the supplier contractually agrees to make reciprocal purchases of goods and services from the buyer within a specified time and up to the countertrade ratio. Two separate contracts are negotiated, one for the initial sale and one for the reciprocal purchase. Both contracts are written as cash for goods contracts, but they are usually linked with a letter of understanding.

Compensation agreements involve the sale of technology, equipment or other capital goods with a written commitment to purchase a certain quantity of the products produced as full or partial payment. For example, the British toy manufacturer, Dunbee-Combex-Max, Ltd., agreed to provide \$50 million worth of toy

manufacturing machinery and molds to the People's Republic of China. In return the Chinese paid half the bill in hard currency and the other half in finished toys. The British company retained sole rights to sell the toys in Britain for ten years and in the United States for three years (Weigand).

Another example of a compensation agreement is the following exchange between Ghana and Bulgaria.

Ghana is reported to have concluded compensation agreements with Bulgaria, for the delivery of \$8 million worth of agricultural equipment, pharmaceuticals, veterinary products, leather and tyres in exchange for \$5 million worth of Ghanaian cocoa, wood, rubber and industrial diamonds. The balance would be made up by a three-year loan from Bulgaria. (Organization of Economic Cooperation and Development)

Jamaica also reportedly signed a compensation agreement with Yugoslavia in 1984. The exchange was 450,000 tons of alumina for prefabricated houses and construction materials over a five year period (Organization of Economic Cooperation and Development).

Compensation agreements also use two separate contracts linked by a letter of protocol. Compensation agreements may encompass several years and millions of dollars worth of trade. Technical assistance may also be provided for a specified number of years.

The above examples show the diverse nature of countertrade arrangements. While these forms will be used extensively in this paper to explore the underlying

economic issues, it is important to note that in practice countertrade can be combinations of and variations on the above. The model that follows can be expanded to include any of these various arrangements.

## REVIEW OF LITERATURE

There are two sets of literature to be considered when looking at the economics of countertrade. One set deals with the emergence and existence of money in an exchange economy. The question of "Why money?" is investigated and all of the advantages of using money in an exchange are examined. The other set of literature starts with the question "Why countertrade?" and analyzes the emergence of countertrade based on distortions in the market caused by various government trade policies. Along with this second group of analyses is a discussion of countertrade as a marketing device, as a means of circumventing regulations, and as a method for expanding trade. The second set also includes anecdotal literature on specific countertrades and the circumstances surrounding the exchanges.

This section reviews both sets of literature with a view toward integrating them in order to move toward a model that includes countertrade as one of various trading arrangements.

Money, Transaction Costs and Trade

Niehans and Jones present arguments for the emergence of media of exchange. Both consider transaction costs and their influence on the types of exchanges that occur.

Niehans argues that ". . . a theory of money can be based on the concept of different exchange arrangements, ranging from barter to full monetization, as the result of differences in transactions costs" (p. 773). His main objective is to provide an environment in which money emerges as a medium of exchange, but in so doing he demonstrates effectively how some combination of money exchanges and barter may be efficient due to the transaction costs involved.

In his model "exchange causes costs." These transactions costs are defined as those costs that arise not from the production of goods, but from their transfer from one owner to another. These costs include the costs associated with the traders communicating, inspecting, measuring or marking goods, drawing up contracts and transferring titles.

Several results of Niehans' model are worth noting. By varying the value and size of transaction costs, different exchange arrangements can emerge as well as different levels of trade. If transaction costs are reduced to zero for one particular good, it is inefficient to use any other good as a medium of exchange. The good with the lowest transaction costs emerges as the medium of exchange. On the other hand, if the transaction costs are increased for using any one good as a medium of exchange, that good will be replaced

as a medium of exchange. Another good may emerge as the medium of exchange or many other goods may substitute depending on the level of transaction costs. As transaction costs increase for all goods, direct barter will begin to replace the use of a medium of exchange. Direct barter is regarded as a wasteful system, but this is generally not true: ". . . given the exchange technology embodied in a particular set of transactions costs rates, it may well be the most efficient trading pattern available" (p. 779).

So, while Niehans shows how a single medium of exchange may emerge, he also gives evidence for how this medium could fall out of use due to changes in transaction costs. If one assumes that the medium of exchange is currency, then as the transaction costs associated with using currency increase, currency may be replaced as the medium of exchange, or as Niehans points out, barter may emerge. Further worth noting is that even when a medium of exchange is possible, barter may be efficient in this model.

Niehans' model comes closest to what is needed to analyze countertrade and approximates most closely what is presented later in this thesis. The major differences are that his model is a general equilibrium model, while this paper uses a partial equilibrium approach with an intentional focus on particular markets. Although

Niehans can force different trading arrangements to emerge by varying transaction costs, he does not measure the effects of the changes on the various forms of exchange that do emerge in terms of their share of total trade. Thus, it is difficult to move from his model to empirical work.

Jones argues that media of exchange will emerge ". . . through the unconcerted market behavior of individuals" (p. 757). Individuals seek to minimize transaction costs, defined here as time spent searching for complementary trading partners. In this model individuals will reduce the time needed to make the exchange they want by making an indirect trade for a common good. The common good is the most frequently encountered good. The individual does this ". . . if he believes that the fraction of individuals in the market desiring to buy or sell that most common good exceeds the sum of the fractions desiring to buy or sell the two goods he is ultimately exchanging" (p. 765). The good with the highest probability of being accepted in the market becomes the medium of exchange. However, not all exchanges will be through the medium of exchange. Direct barter may still have the lowest transaction costs for some trades.

Jones concludes that there may be different stable equilibria in terms of the level of monetization of

trade. Various combinations of barter and use of media of exchange may be stable. Complete monetization of trade or complete barter may also be stable. The particular combination of trade on which an economy converges depends on the initial pattern of trade and the desired exchanges.

While Jones is intent here on showing that a medium of exchange may emerge because of the transaction costs involved in exchange, he also gives a convincing argument for the co-existence of direct exchange and the use of media of exchange based on transaction costs. By extending barter trade to include the various forms of countertrade, it is apparent that a combination of countertrade and money exchanges in international trade may represent a stable equilibrium. It is not necessary to view countertrade as temporary or inefficient when considering the transaction costs. Using Jones' argument, countertrade may be here to stay.

Starr (1972) examines the "coincidence of wants" condition associated with barter and argues that it is a severe restriction on the trades that can take place. The introduction of money can help alleviate the difficulties associated with barter.

In a barter exchange each trader must have what the other one wants so that each trader is simultaneously fulfilling excess demand and reducing excess supply. It

is this simultaneity that bothers Starr. With money in the economy,

. . . all excess demands can be fulfilled by trades each of which satisfies some excess demand of the trader accepting goods, alleviates an excess supply of the trader furnishing same, and includes direct payment in full to the supplier for goods received. This is not generally true in a barter economy. (p. 299)

In a monetary economy there is no need for direct exchange. Starr concludes that anything that can be done in a barter economy can be done better or at least as well in a monetary economy, but only in the case where the monetary system is costless.

While Starr's main contribution may be in the area of a microeconomic theory of money, he does make some useful points regarding countertrade. Is there necessarily a double coincidence of wants in a countertrade exchange or can it too be viewed as an indirect exchange in some cases similar to a monetary exchange? If the monetary system is not costless, then how do the barter and monetary economies compare in performance? Once again the role of transaction costs is important.

Ostroy puts forward an argument for the use of money based on money's ability to carry information. He argues that the use of money in exchange ". . . has its origin

in the trading arrangement and not in the nature of the money commodity" (p. 600).

What all of these articles reveal is that the role of money in exchange is directly related to its usefulness to the exchange. In all of the models money or a medium of exchange is used only when it facilitates the exchange. If the use of money is more costly or takes more time than a direct exchange, the direct exchange will occur. That is, the transaction costs of money matter.

While most of the articles move from a barter economy to a monetary economy, they do not preclude either the simultaneous existence of both types of exchange or the resurgence of a barter economy when money fails to live up to its expectations. The basis for the theoretical framework for countertrade comes out of this literature where the use of money in exchange is not inevitable, but a matter of choice based on transaction costs.

These articles do not address the issue of transaction costs in the context of how markets select mixes of transactions and how the mixes change with changes in transaction costs. The model developed here addresses this issue directly.

### Countertrade as Solution

Several other researchers look specifically at countertrade and attempt to explain it in a variety of ways. They view countertrade as a short term phenomenon that could be used to enhance exports for many countries. This section discusses the more salient articles.

Prentice and Tyrchniewicz examine countertrade as an export promotion device. They look at Canada's agricultural surpluses and ask how Canada can dispose of these commodities. One answer they find appealing is to locate a buyer who has a product that Canada does not produce (tropical fruits, for instance) and to countertrade. They are considering markets from a seller's perspective where buyers face foreign exchange problems. Their view of countertrade is primarily that of a marketing device.

Prentice and Tyrchniewicz use the Edgeworth box in their theoretical discussion, emphasizing the importance of the institutional setting and the relative bargaining power of the traders on the final outcome. If both traders are price takers the result will be the competitive solution. If both can set prices, the result is efficient, but indeterminate. And, if only one trader can set prices, the monopolistic solution may result. Only in the case of unequal bargaining power is ". . . an

opportunity created for using barter or countertrade to achieve a disproportionate economic benefit for one trader" (p. 34).

Outters-Jaeger uses Meade's analysis of barter exchanges to illustrate the possible terms of trade in different barter arrangements. She points out that most of the current "barter" agreements are not pure barter, but some form of countertrade. The terms of trade that result in international barter depend, in large part, on the bargaining positions of the trading partners.

Outters-Jaeger also examines Caves' work on preferential trading as it applies to bilateral trading agreements. Caves concludes that both competitive and monopolistic discrimination exist in bilateral trade agreements of developing countries. Outters-Jaeger provides some evidence to support this conclusion, showing that the terms of trade for the countries examined--Egypt, Ghana, India, Nepal and Sri Lanka--". . . were generally not worse, and in some cases, were even better than those obtainable in trade on a multilateral basis" (p. 109).

Outters-Jaeger gives economic and political reasons for the emergence of countertrade in developing countries. The economic and political causes are interdependent and sometimes difficult to separate. The economic reasons for countertrade include foreign

exchange constraints, increasing dependence on foreign imports due to rising populations, increasing incomes and growing industrialization, limited export expansion opportunities, low world market prices for traditional exports, promotion of minor traditional and new industrial products, and the stability created by the long term planning and execution of countertrade exchanges.

Some of the political reasons are an attempt to diversify foreign trade relations away from ex-colonial powers, to enhance relations with socialist governments, particularly with Sino-Soviet bloc countries, to open up sources of development assistance and to foster political alliances and trade among developing countries.

While Outters-Jaeger gives some thought to the underlying economics of countertrade, the main thrust of the publication is to assess the impact of countertrade on the economic development of the less developed countries.

The game theory model of triangular trade, as developed by Shapley and Shubik, offers an interesting approach to countertrade, but does not offer an explanation of countertrade concurrent with monetary exchanges. Countertrade is still seen as a short term solution to a problem rather than as a deliberate, rational, efficient choice with long term viability.

Banks (1983) gives a critical appraisal of the popular arguments for and against countertrade. He covers the economic and political arguments as well as the argument that countertrade is a threat to the international trading system. He argues against the claim that countertrade can overcome the problems of hard-currency shortages, availability of credit, promotion of exports, improving the terms of trade and offsetting the effects of dumping and price cutting. In the short run countertrade may alleviate some of these problems, but in the long run it may aggravate them and delay corrective action by the government such as devaluation of the currency or reevaluation of domestic price controls. Countertrade is, in short, ". . . a slow, complicated and hence costly way of doing business" (p. 164), and considerably restricts trading opportunities.

Banks does not view countertrade as a threat to the international trading system and dismisses the two major arguments generally cited--market disruption and a return to bilateralism. Market disruption could occur if goods were "dumped" on a market at very low prices. To ensure that this does not occur he suggests strengthening some of the rules of the General Agreement on Tariffs and Trade (GATT) regarding injury and dumping. This would address the problem adequately.

A return to bilateralism is also a possibility with the use of countertrade. As countries arrange their agreements there is a tendency to shift the pattern of trade toward bilateral balancing. Banks argues that bilateralism leads to a reduction in overall trade. Since this outcome is undesirable and since countertrade is so costly, it will, in effect, self destruct. Banks concludes by saying:

The self-inflicted costliness of countertrade in a world where, at least in trade with the industrial countries, efficient alternatives exist is thus the main reason why it is unlikely to ever become a serious threat to the multilateral trading system. (p. 179)

While Banks presents convincing arguments for the inadequacy of countertrade to accomplish all that its proponents and even its detractors claim it will, his claim of the costliness of countertrade goes unexplained and unexamined. If "efficient" or less costly alternatives to countertrade exist, why then does countertrade occur, especially if it does not alleviate the problems Banks cites? Examining the costs of countertrade, specifically the transaction costs, allows a fuller understanding of the reasons for its existence.

In a second article Banks (1985) pursues the regulation discussion along a different vein and provides some cause and effect arguments. He maintains that barter activity is increasing, but mostly in the primary commodities. Primary commodities are being used because

of the surpluses of these commodities in market economies. The surpluses are a result of domestic price controls, international price controls and exchange rate controls. Countertrade is only a temporary solution to the problems these controls create and it may only be a third-best solution in some cases. Banks sees a currency devaluation as the best solution and a trade/subsidy/tax package as second best.

Murrell contends that countertrade can also be a solution to problems that occur when the quality of products is unknown, particularly in Eastern Europe. He shows that countertrade can be quite useful when quality information is important but cannot be obtained directly and when a country has a reputation for poor quality. His model, based on market signaling theory, illustrates that by using a buy-back arrangement a better "price" can be received than if buyers assume an average quality based on country of origin.

There are numerous popular publications and business journals that report on various aspects of countertrade ranging from definitional and "how-to", to descriptions of actual trades. These include Forbes, South, Seatrade, Euromoney, Export Today, Across the Board and California Management Review.

Some of the arguments put forth in these articles for why and where countertrades occur are that

countertrade is better than no trade (Welt, undated), countertrade can open up new markets or help keep a foothold in established but changing markets (Weigand, Cooper), countries with artificial exchange rates are likely to embrace countertrade as a way of continuing to trade while maintaining the official exchange rate (Briggs, Cooper), where foreign exchange is scarce countertrade provides a way of keeping the trade flowing (Obadina, Briggs, Weigand).

But here again countertrade is viewed as a solution to market distortions and is not seen as a long term trading arrangement. A money exchange is the preferred arrangement, but countertrade will be considered under certain circumstances. The question remains, however, that given the unpleasantness of countertrade, why do traders agree to it and why does it occur? Could countertrade be an alternative rather than a last resort? Does it perhaps offer as much to the trader as a money exchange does?

Goldstein analyzes countertrade in terms of its short and long term effects on a country's economy. She asserts that countertrade can be beneficial in the short run to circumvent trade impediments, but in the long run can be detrimental because it reduces the supply of available foreign exchange. She develops a theoretical model of trade ". . . between a debtor country, assumed

to initiate the countertrade offer, and a creditor country, assumed to agree to the request" (p. 2). Her model deals specifically with country to country trade and assumes that trade-offs between monetary policy and national policies regarding countertrade can be made. Countertrade is looked at from an aggregate point of view rather than in a competitive framework at the firm to firm level.

Goldstein argues that when there are barriers to trade such as lack of marketing expertise, foreign exchange controls, and foreign exchange fluctuations on the world market, it may be beneficial to countertrade in order to ". . . promote exports and sales opportunities that otherwise would not be available" (p. 12). By using countertrade a country does not have to alter its official policy on exchange rates and can reduce some of the risks associated with exchange rate fluctuations by locking in an agreed upon volume of goods to be exchanged.

If a country is faced with a decrease in international lending, it may then encourage countertrade so that it does not have to depreciate its currency in order to decrease the demand for foreign exchange. It may be politically unwise to depreciate the currency, but trade can be maintained through the use of countertrade.

Countertrade is a short run solution that treats the symptoms of the problems listed above. Goldstein argues that if countertrade is encouraged to continue, in the long run a country may fail to address the impediments that lead to countertrade in the first place. If this happens, a continued dependence on countertrade could develop and reduce the supply of foreign exchange available to the country. This results from price distortion and currency based trade displacement.

Goldstein's model gives a good representation of countertrade, but it fails to consider transaction costs in its determination of "premium price" or to consider any of the trade impediments as factors contributing to increased transaction costs. By including these transaction costs a better idea of how changes in these impediments could affect the trading pattern emerges. A better understanding of longterm effects could be obtained by varying the different transaction costs to see what effect these changes have on the types of exchanges that occur. To say that in the long run ". . . countertrade may then become institutionalized and even be used when more efficient forms of trade become available" (p. 20) is to ignore the fact that costs matter.

From the two bodies of literature presented above it appears that countertrade needs to be considered in light

of both. What properties of money, so essential to its use in exchange, are failing to meet the needs of traders? Do countertrades only occur under market distortions as listed above or do they occur at all levels of human interaction? Do transaction costs play such a major role in exchange that their influence cannot be ignored?

Neither body of literature provides a fully satisfactory exploration of these issues. If transaction costs are included explicitly in the trade model, is there greater explanatory power? Does the new model offer a way of explaining why so many problems discussed above have the same solution--countertrade? The next section presents and develops a model that includes transaction costs.

## MODEL

In this paper countertrade is analyzed using transaction costs. One argument for the emergence and acceptance of money in the exchange process is that it reduces the transaction costs associated with exchanging goods. Money can reduce the number of transactions required to reach the desired ultimate exchange. Money can serve as a store of value because one can sell what one has now and wait until later to purchase what is wanted. One does not have to find or establish a concurrent complementarity of wants to exchange.

In order to analyze countertrade using transaction costs, a partial equilibrium trade model with no transaction costs is used. Then, transportation costs are introduced along with transaction costs. The objective is to demonstrate that transaction costs can be treated in a fashion similar to the standard treatment of transportation costs.

If there are two countries, each with a demand for X and both capable of supplying X, whether or not trade will take place between these two countries can be determined by looking at the differences in prices in the two countries. The standard back to back diagram depicts this situation graphically. Figure 1 shows supply and demand functions in two countries. The quadrants have the same origin, but increases in quantity for country A

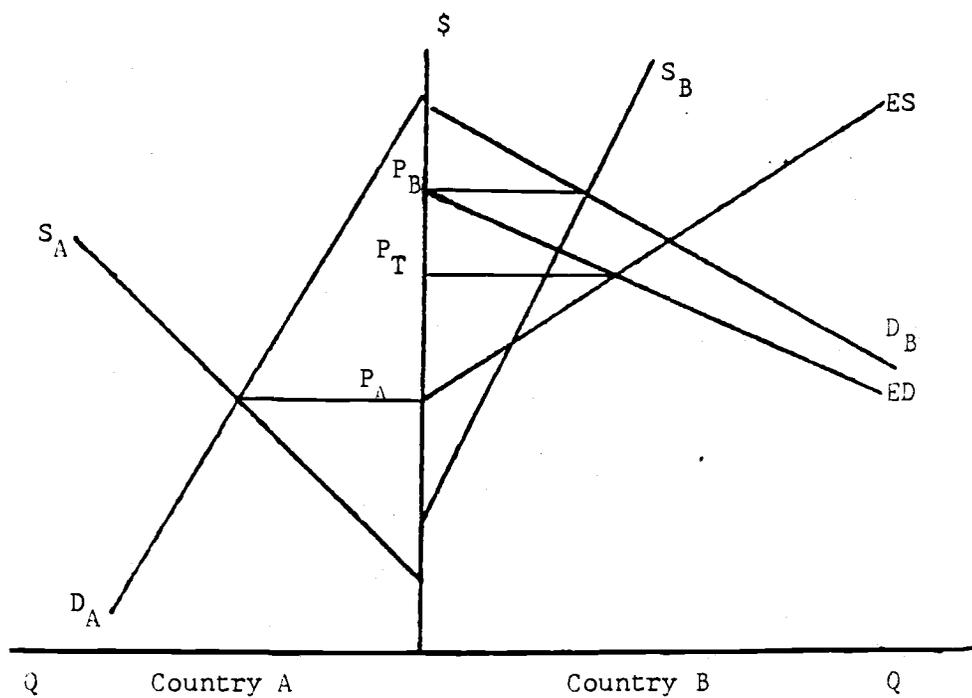


Figure 1. Back to Back Diagram of Trade

Source: Just, Hueth and Schmitz, p. 164.

are to the left and increases in quantity for country B are to the right. The equilibrium prices differ in the two countries providing an incentive for buyers in country B to purchase from sellers in country A. The price in country A,  $P_A$ , is lower than the price in country B,  $P_B$ , so that while all the demand is filled in country A at price  $P_A$  there are demanders in country B who would be interested in purchasing more of the good at country A's price, or any price below the no-trade equilibrium price,  $P_B$ , in country B. At the same time, suppliers in country A would be willing to sell more than the present amount if the price were higher. So, given the price differential, there is excess demand in country B and excess supply in country A. The trade equilibrium price will be somewhere between the no trade equilibrium price in country A,  $P_A$  and the no trade equilibrium price in country B,  $P_B$ .

In Figure 1 the trade equilibrium price is  $P_T$ . The amount that country A will supply at every price in country B is found by horizontally subtracting  $D_A$  from  $S_A$ , giving the excess supply curve ES. The amount that country B will demand at every price is found by horizontally subtracting  $S_B$  from  $D_B$ , giving the excess demand curve ED.

Figure 1 does not include any of the transaction costs involved in getting the product from country A to

country B. One major transaction cost that has received considerable attention is the cost of transportation. It is clear that goods do not move from one place to another at zero cost. The trade equilibrium price must reflect the cost of moving the goods from country A to country B. If it is assumed that transportation costs are a fixed amount per unit shipped, they can be represented graphically by using supply and demand curves for transportation services.

The demand curve for transportation services is a construct used to show how much demanders would be willing to pay for transportation services.

In Figure 2, the supply and demand curves for transportation services are shown below the excess supply and demand curves for the good being traded between country A and country B. The curves are drawn under the assumption that the number of units of transportation services per unit of goods exchanged is constant. When the cost of transportation services is included, the new trade equilibrium prices are now  $P_{AT}$  in country A and  $P_{BT}$  in country B. The difference between these prices goes to the providers of the transportation services to cover the cost of moving the good from country A to country B.

Since transportation costs may vary by distance, weight or value, a different type of representation is called for. Kindleberger suggests that costs may vary

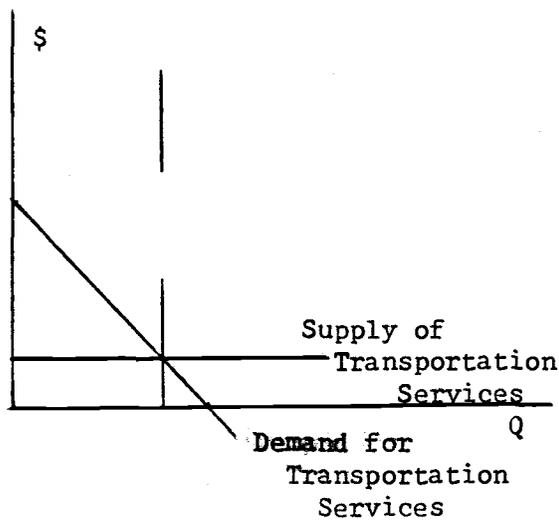
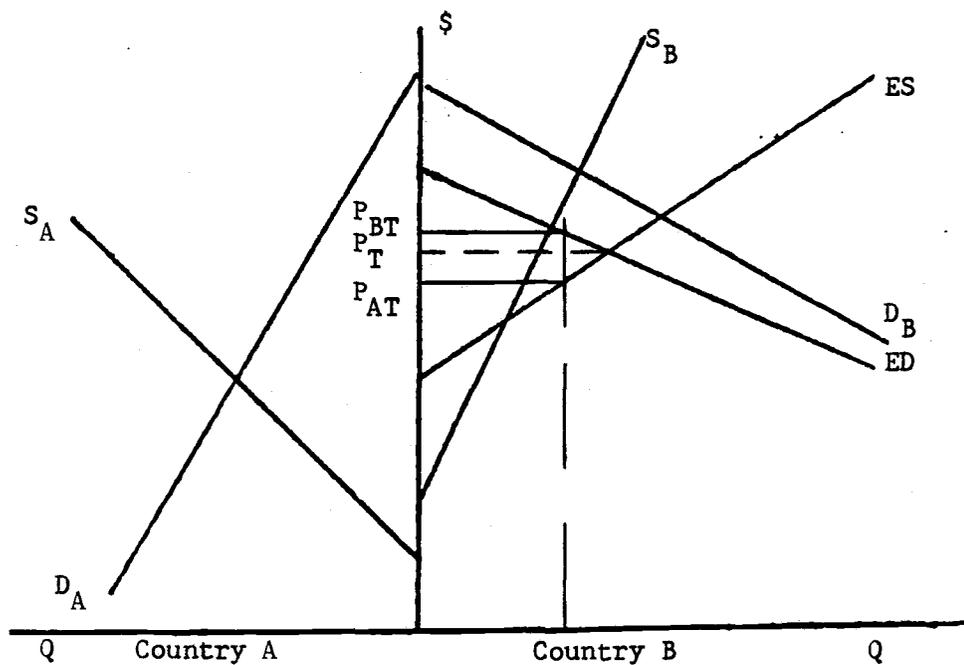


Figure 2. Back to Back Diagram with Transportation Costs

Source: Just, Hueth and Schmitz, p. 164.

with type of transportation such as rail, truck or barge. His representation of transportation costs is shown in Figure 3. While barge costs are high initially, as distance increases it becomes less costly to use a barge. Conversely, for short distances it is cheaper to use a truck, and for intermediate distances rail is the cheapest type of transportation.

Kindleberger's work on transportation costs provides a means to include transaction costs in the model. Transportation costs can be expanded to include all transaction costs and the effect, if any, of differences in the transaction costs on equilibrium prices can be examined.

## Transaction Costs

### Definitions

This analysis examines three types of exchanges, cash, credit and countertrade along with their associated transaction costs. Transaction costs are defined as all costs associated with exchange. All three types of exchanges include transaction costs of transportation, licenses, packaging and labeling, and other costs associated with trading a product. Some transaction costs do not vary with the type of transaction, so the discussion focuses on only those that have the potential

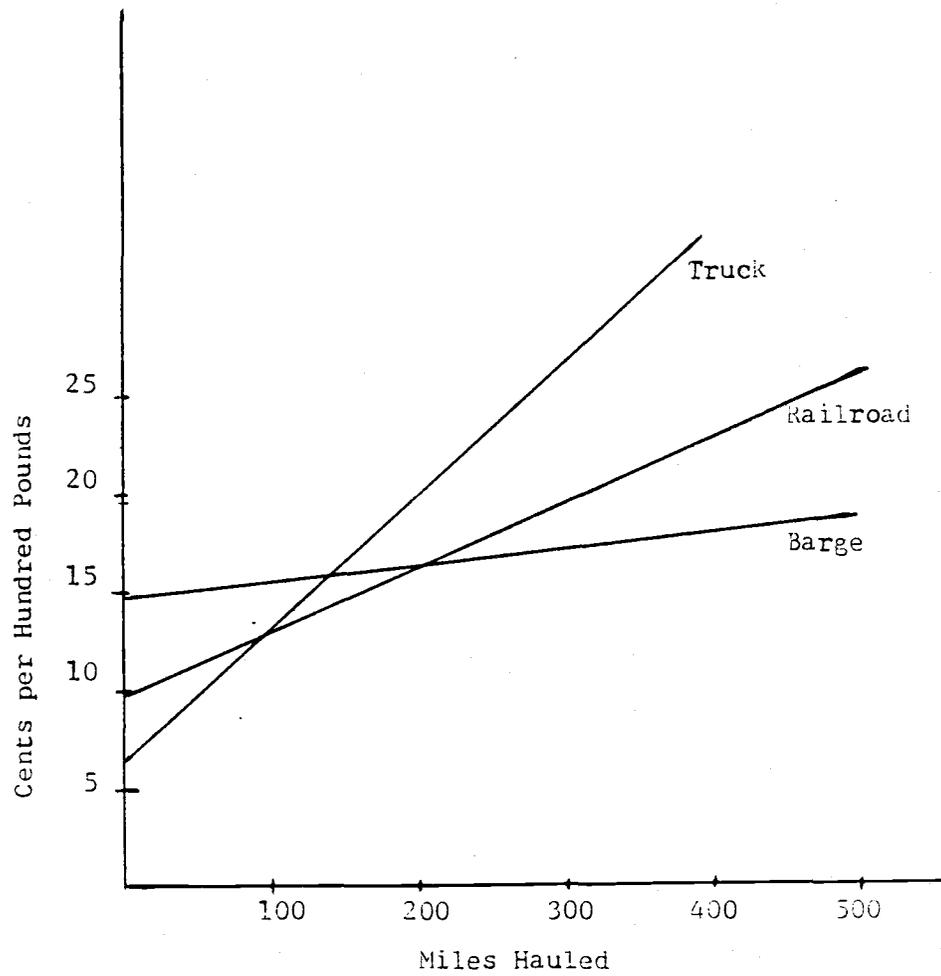


Figure 3. Transportation Costs

Source: Kindleberger, p. 145.

for affecting a trader's decision on what kind of exchange to negotiate.

Transaction costs (TC) for exchanges involving cash can be expressed by:

$$\text{TC (cash)} = f (\text{currency conversion costs, bank services, contacts, negotiations, market research, tariffs, other})$$

Transaction costs for exchanges involving credit can be expressed by:

$$\text{TC (credit)} = f (\text{commercial interest costs, gov't interest costs, currency conversion costs, bank services, negotiations, market research, contacts, tariffs, other})$$

Transaction costs for exchanges involving countertrade can be expressed by:

$$\text{TC (countertrade)} = f (\text{use/disposal of goods received, contacts, bank services, negotiations, market research, tariffs, other})$$

Most of the terms used here, such as currency conversion costs, interest costs, and tariffs, are straightforward, but a few need clarification. For purposes of this discussion the perspective is that of the buyer. While much of the discussion of countertrade has been from the perspective of the seller, the present analysis treats final consumer demand as exogenous to the model, and thus takes a demand perspective.

Contacts consist of locating a seller who has what the buyer wants and who is willing to move to

negotiations. It requires time and search effort to locate someone willing to discuss the trade. Contact costs can be measured by number of different leads initiated, length of time between initial communication and movement to negotiations, and length of discussion before negotiations. While the term "contacts" does not include deciding on the terms of the contract or trade, it does involve discussion and agreement on what the possibilities for negotiations are. For example, the trader will know if countertrade is an option before going to negotiations, but does not know if a countertrade arrangement will emerge. So, some negotiations on what will be discussed occur at this stage, but no actual agreement need be reached on what trade will take place. Other contact costs include costs of a broker to do the leg work for the buyer and the cost of determining the reliability of the supplier.

Bank services include providing checks, letters of credit, loans (exclusive of the interest costs), maintaining records and accounts, and obtaining personnel for witnesses, notaries and the like.

Interest costs are the costs associated with obtaining credit, exclusive of the interest rate.<sup>2</sup> The state of the economy in a country may affect the interest costs and the amount of credit that is available. For example, an individual in a high debtor nation may find the cost of credit for imports extremely high. If a country is following an import reduction program to meet the requirements of the International Monetary Fund (IMF) it may be difficult to obtain credit at any price.

Negotiations are the discussions that lead to the final terms of agreement for a trade or to a decision not to trade. The costs associated with negotiations include length of time for discussions, gathering information for the discussions, level of skill of the negotiator, and the fee for hiring a negotiator if the buyer does not have one.

Market research includes the pre-contact work of finding potential suppliers as well as the process of investigating the demand for a product in a given market. The latter is included here because the cost of doing market research for a product received in countertrade

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<sup>2</sup> Interest rates are not included because it is assumed that they are the opportunity cost of using credit. For some transactions these costs may be reflected in the interest rate. Witness the current use of "interest rates" by car companies versus the use of higher "interest rates" by credit card companies. Including interest rates directly would not materially affect the present analysis.

may be reflected in the selling price of the good exchanged in the countertrade rather than in the later reselling price of the countertraded good received.

### Factors Affecting Costs

Many of the same variables appear in each function, but for different types of exchange--cash, credit or countertrade--these variables may have different relationships to volumes traded. The following discussion of the relative costs is for illustrative purposes only. There may be cases where the posited relationships are reversed. The point of the discussion is to demonstrate how transaction costs may differ among the different types of exchange.

The cost of bank services may vary greatly among the three types of exchange. For a cash exchange the buyer can use existing business channels, sometimes a branch of the local bank. While cultivating a relationship requires some time and the related services may require a fee, the cost is minimal because the transaction is relatively straight forward and the prices for these services are usually determined in competitive markets. There may be instances where this cost is substantial if the banking infrastructure is not well developed or where there is a hard currency shortage. This would be especially true of a developing country.

Likewise, for the trader using credit, establishing a line of credit involves some costs and must be considered, but once again search and information costs for doing this would be relatively low compared to search and information costs for countertrade. If a trader has a poor credit rating the costs associated with bank services would be higher as the trader must search longer to get a positive response. Once the relationship is established the cost of obtaining a letter of credit, exclusive of the interest costs, would be quite low.

Bank services for a countertrade exchange may be quite different depending on the type of countertrade arrangement agreed upon. A countertrader may need bank services for some part of the exchange or as a participant in a clearing arrangement. If the bank is unfamiliar with the process or considers the arrangement a risk, then it may charge more for these services than for cash or credit services. However, if no bank services are needed for a countertrade these costs would be zero.

Contact costs may also vary. It may be easier and take less time or fewer contacts to locate someone willing to discuss selling goods for cash or credit than to locate a potential countertrader. An established cash or credit trading relationship may be necessary before a countertrade exchange will be considered by the trading

partners. The time between initial contact and negotiations could be substantially less for a cash or credit trade than for a countertrade. This is due in part to lack of information. Once a trading relationship is established the costs could drop off significantly.

The cost of negotiations may also vary with the type of exchange. As seen above, much of the cost is associated with information. World market prices do play a major role in the cash and credit negotiations, but may only be rough guidelines for the countertrader. The time associated with the negotiations could be significantly higher for the countertrader as more than a numerical price must be agreed upon. Negotiating skill may be more important in a countertrade and finding and using a good negotiator may be an additional cost for the countertrader.

Market research costs also vary across transactions. A countertrader will have goods to market once he has made the exchange. If he receives a product unrelated to his own business, extensive market research may be necessary in order to market the product. If he receives inputs for his own production, his market research costs will not be as high. Cash and credit exchanges also have market research costs, but generally their costs end when the exchange takes place.

Tariffs may or may not vary according to the type of exchange. Welt (undated) has argued that countertrade is attractive because tariff charges can be reduced by undervaluing the product. No clear evidence of this exists because it is very hard to obtain data from the traders, but tariffs are included because they may in fact influence the cost the trader associates with each kind of trade.

#### Transaction Costs Model

In order to describe the above costs using the transportation cost model, the axes must be redefined. The horizontal axis of Figure 3 must be defined as quantity per unit of time rather than quantity per unit of distance. An alternative approach is to let  $Q$  measure the number of transactions. As in the case of transportation services, the number of transaction services is assumed to be constant per number of goods exchanged. Thus  $Q$  can measure either the number of transactions or the volume of goods exchanged. The transaction cost curves as defined for cash, credit and countertrade exchanges can now be shown graphically. Assume that the curves are similar to those in Figure 4.

There are now three curves (using straight lines for convenience of presentation and computational ease) representing the market supply of transaction services

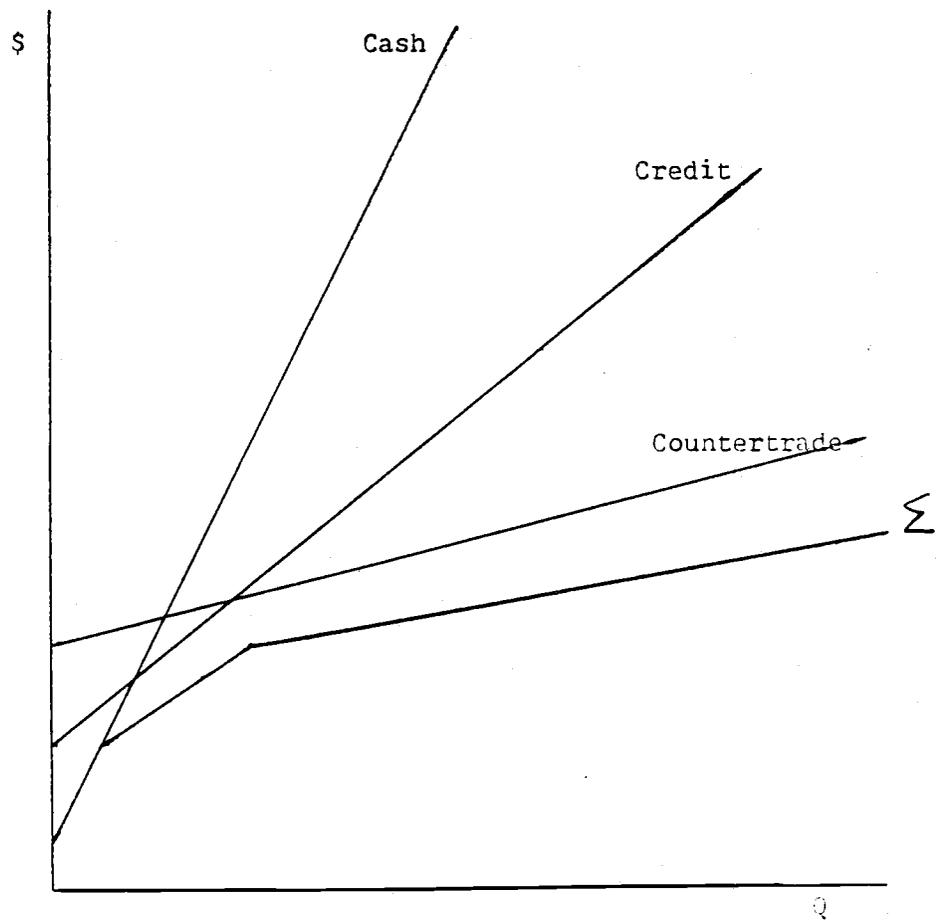


Figure 4. Transaction Costs

for cash, credit, and countertrade exchanges. The horizontal summation of these curves gives the total availability of transaction services at every price.

The unit costs associated with cash and credit may increase as the quantity purchased increases because of increases in the costs associated with finding a lender for increasingly larger quantities of money. Credit risk is reflected in the interest rate, which helps determine the location of the supply curve for credit transaction services. For example, government subsidized credit, such as that from the U.S. Commodity Credit Corporation, may help to lower the interest costs and that is reflected in the position of the curve. The difference between the subsidized costs and the non-subsidized costs is the transaction costs associated with the use of credit.

The curves in Figure 4 can be used to determine the quantity of goods traded under each type of exchange when used in conjunction with excess supply and demand curves for a good in Figure 5. The top figure is excess demand and supply. The lower figure is the transaction services market.<sup>3</sup>

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<sup>3</sup> It is assumed, for example, that 100 units of soybeans involve the same transaction costs whether traded for hams or cotton. Transportation costs may differ for products of different weights, but this would be accounted for during negotiations and reflected in the demand for countertrade transaction services.

Relative prices are used on the vertical axes in all of the figures that follow. The reason for this is that a countertrade is a goods for goods exchange, not a goods for money exchange. Using relative prices may seem to be circular reasoning in that the exchange ratio between the two goods is not known until the cost of transaction services is established. And, this cost cannot be determined without knowing the exchange ratio. But, if the small country assumption is made, these prices are exogenous. The exchange ratio will be known and the analysis proceeds as presented.

Another way to view the exchange, however, is to note that each countertrade generally consists of at least two contracts. Each is written as a goods for money exchange and the two contracts are linked by a letter of protocol. The letter makes the exchange a goods for goods exchange. In this case, money or currency is used as a unit of account rather than as a medium of exchange and allows "prices" to be calculated in currency. The analysis then proceeds as presented. "Prices" may be valued in either goods or currency although no money changes hands.

Given the excess supply curve of Country A and the excess demand curve of Country B in Figure 5, and the assumed set of transaction costs, the demand for transaction services is determined. The demand for

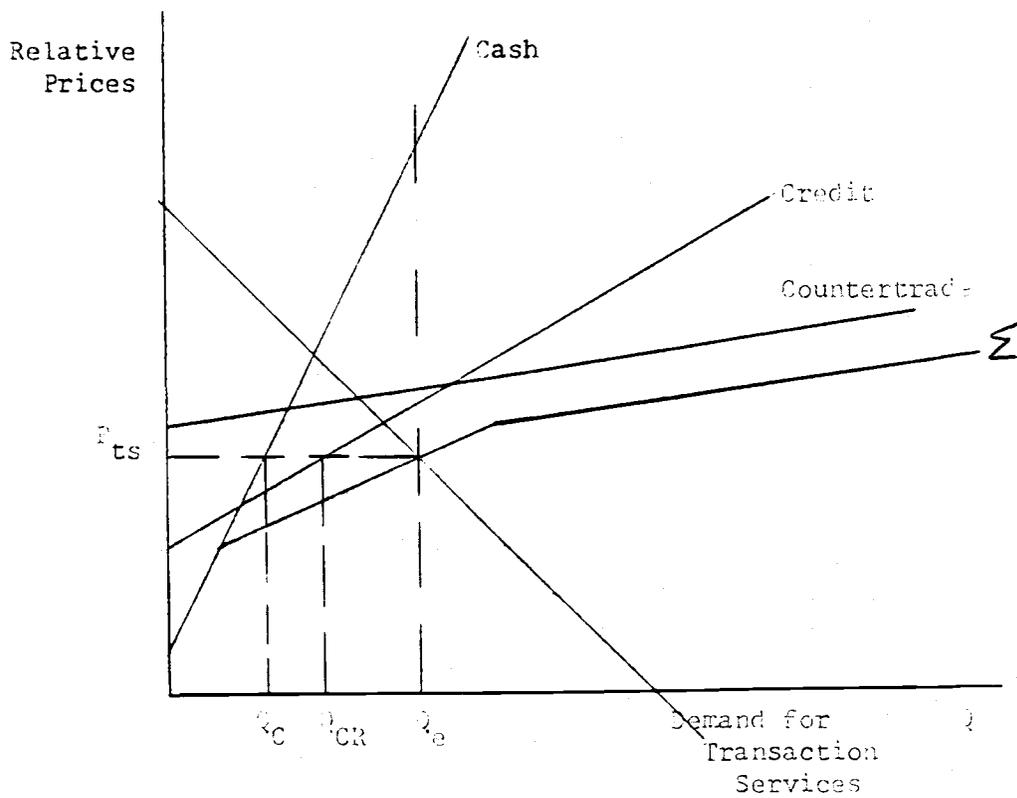
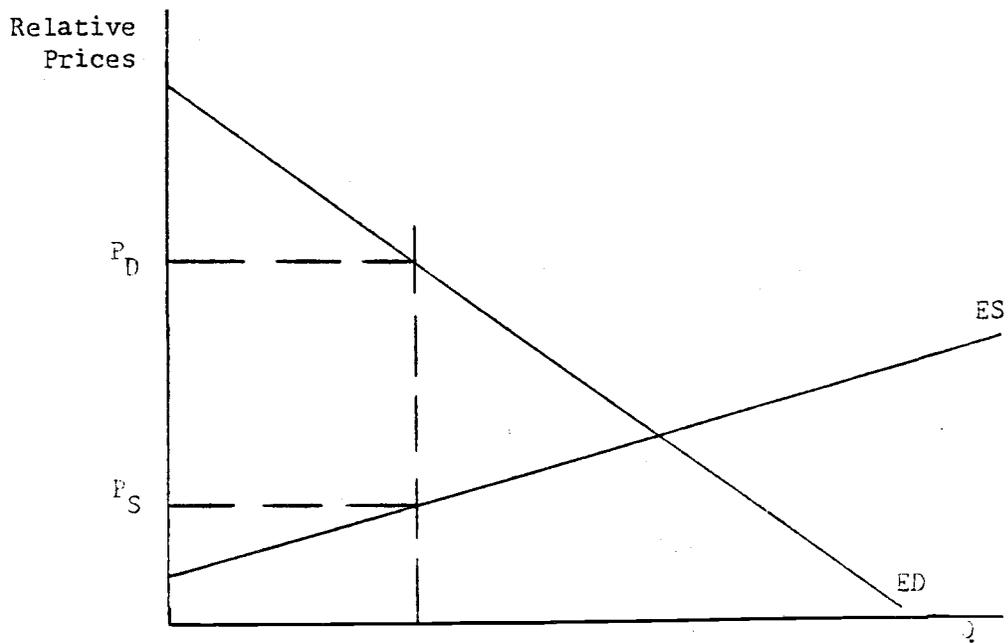


Figure 5. Trade with Transaction Services

transaction services ( $D_{ts}$ ) is a construct used to show the maximum price demanders of a good would be willing to pay for different quantities of transaction services for that good (Friedman). This determines the equilibrium price of transaction services and what quantity of goods will be traded through each type of exchange.

The buyers in country B would pay  $P_D$  and the suppliers in country A would receive  $P_S$ . The difference between the prices would go to the providers of the transaction services. That is, the difference pays for bank services, contacts, negotiations and so on.

In Figure 5 amount  $Q_e$  would be traded. Transaction services would be provided at price  $P_{ts}$ . The quantity  $Q_C$  would be traded using cash and the quantity  $Q_{CR}$  would be traded with credit. Under this set of cost curves and supply and demand curves no countertrade exchanges would emerge.

If there is a shock to the system that results in a movement of one of the curves it is possible for a different combination of transactions to emerge between country A and country B. For example, suppose there is an increase in demand in country B. The excess demand curve would shift to the right as in Figure 6. The demand for transaction services would also shift to the right. Now, using the same set of curves representing excess supply and transaction costs, a change in the

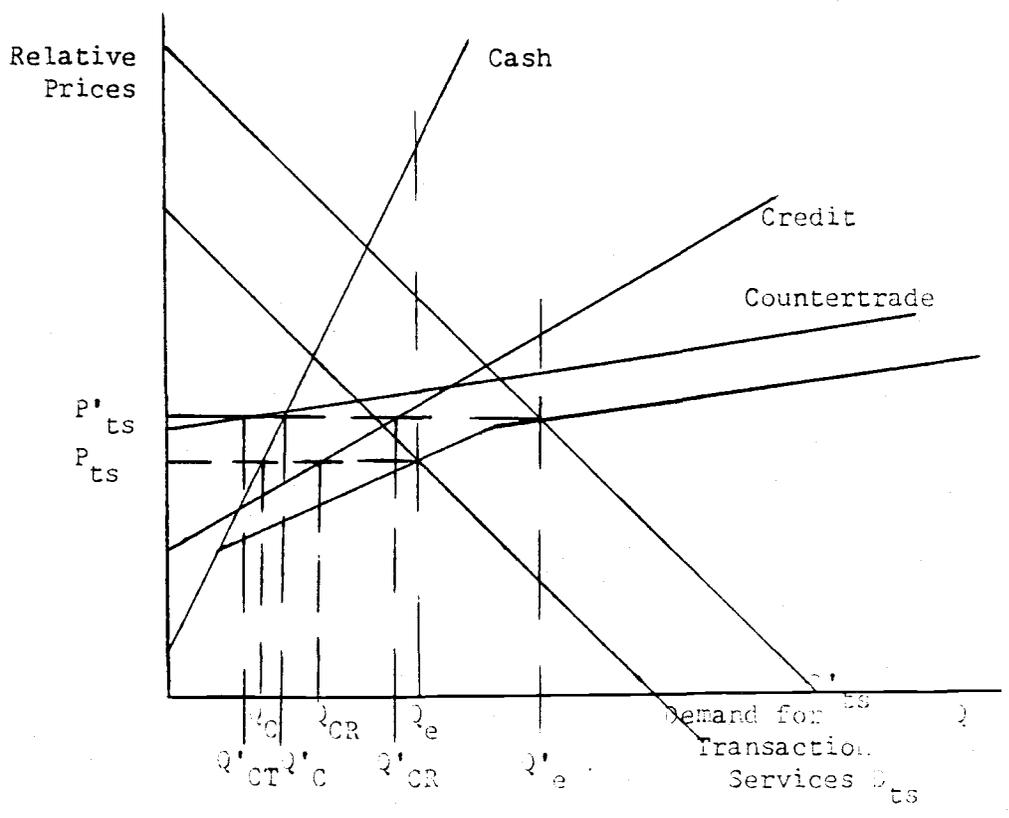
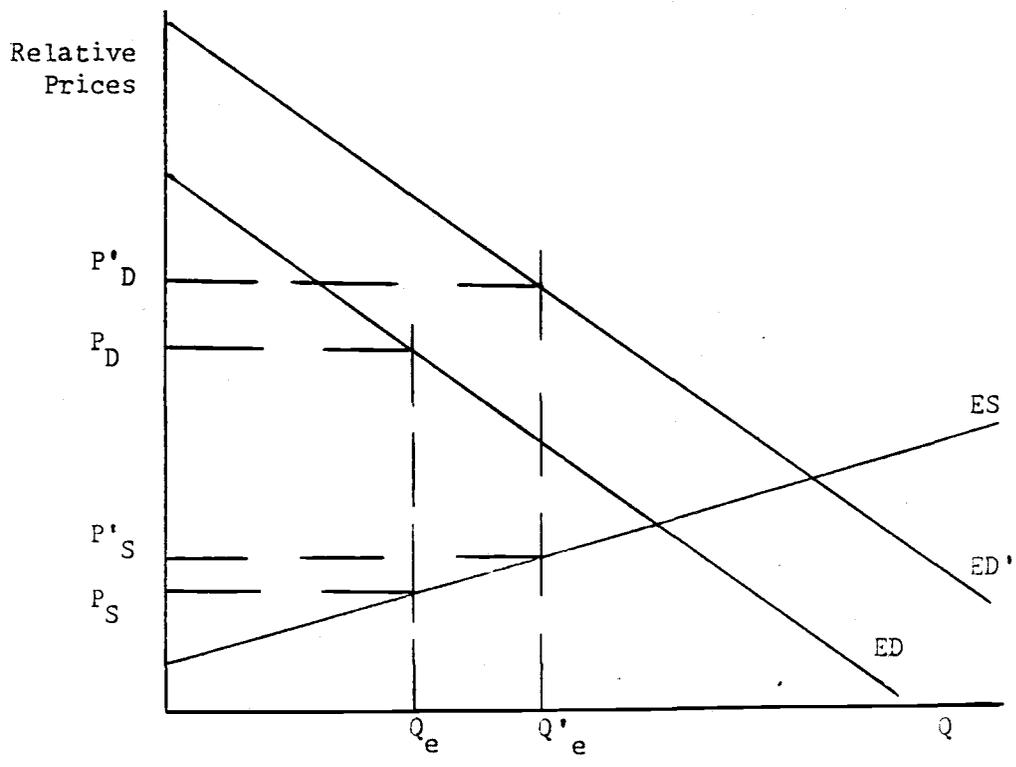


Figure 6. Increase in Demand for Product

distribution of the types of exchanges between country A and country B is expected. With an increase in demand, the quantity of cash exchanges increases from  $Q_C$  to  $Q'_C$ , the quantity of credit exchanges increases from  $Q_{CR}$  to  $Q'_{CR}$  and countertrade exchanges now occur at the level  $Q'_{CT}$ .

There is no reason to believe that the curves depicted in Figure 4 are the only curves that reflect the various combinations of transaction costs. It may well be that interest costs for credit are so high in a country that credit transaction costs are higher than cash or countertrade transaction costs even for exchanges of very low volume. This may be what is happening in the developing countries.

Cash transaction costs could also be quite high in a given country because of the high contact or bank services costs of obtaining foreign exchange. Here again, even at low volume trades, it may be more expensive to make a cash exchange than to use credit or countertrade. This may be most noticeable in the Eastern Block countries, but may also be the case in some developing countries.

Countertrade transaction costs may also be higher than cash or credit costs over a wide range of volume. Contact and negotiation costs may be quite high in a country and at the same time interest costs and bank

services costs could be low. These latter low rates would give cash and credit exchanges an added advantage over the countertrade exchange. Under these conditions it is unlikely that a countertrade exchange would emerge. Most trade between developed countries would fall in this category because obtaining credit and foreign exchange is usually not as costly as the contact costs and negotiating costs of a countertrade exchange for developed countries.

The resulting relationship among the kinds of transactions observed in equilibrium will depend on not only the specific costs affecting each curve, but will also depend on the magnitude of the costs in the other curves. That is, if calculating transaction costs for all three exchanges as done above results in credit exchanges only, given current transaction costs, then the conclusion is that a credit exchange is the best choice. This may be true for the current set of conditions. However, if interest costs increase with all other costs held constant, the countertrade or cash exchange rejected earlier may be a more efficient exchange at some volumes given the new interest costs at a later date.

Given these conditions, it becomes clear that the magnitude of the costs is not the sole consideration, but the relationship of the cost curves to one another is also important. For example, in Figure 7 there is a new

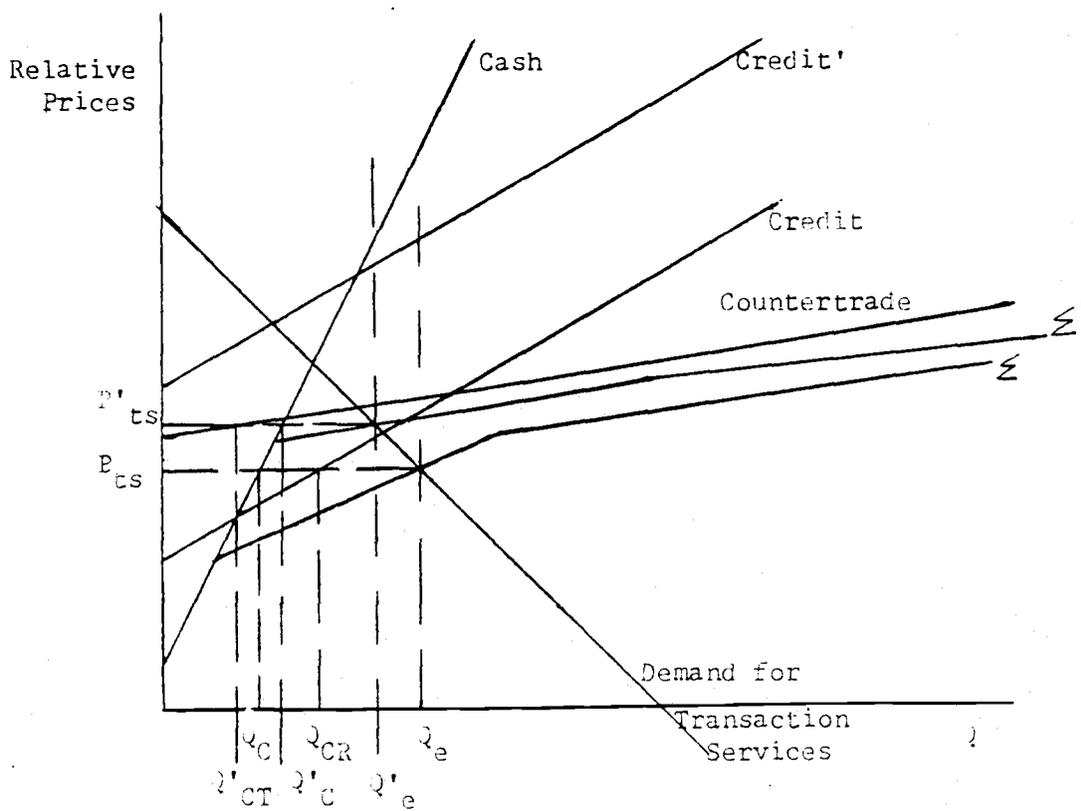
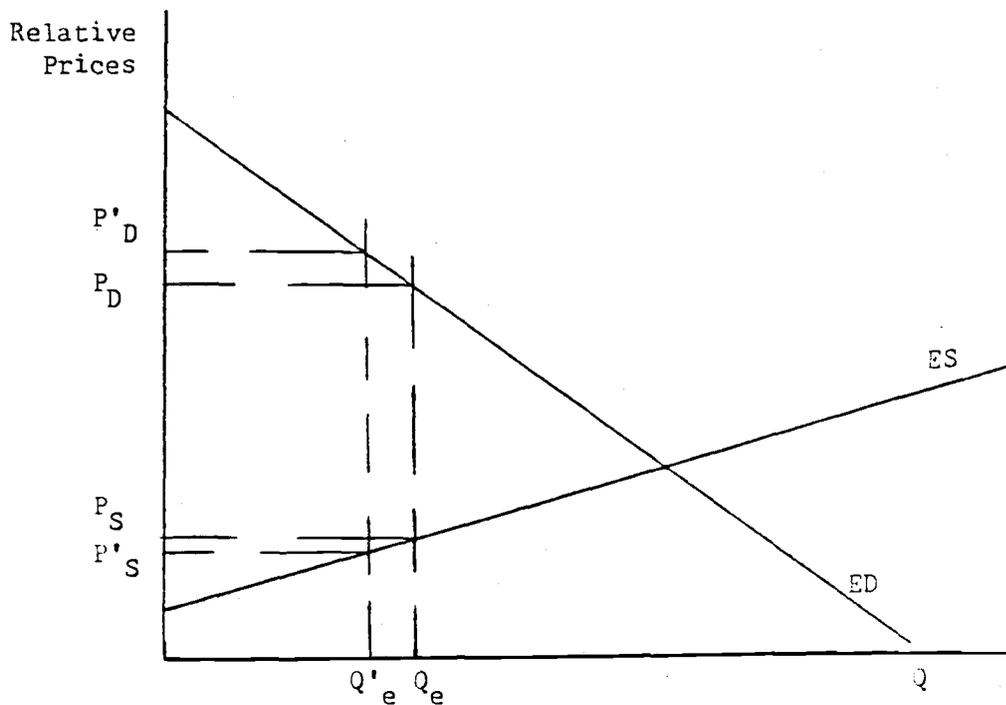


Figure 7. Increase in Cost of Credit Transaction Services

transaction cost curve for credit transactions. This curve is based on higher interest costs than the curve in Figure 5. The excess supply and excess demand curves in Figure 7 are the same as in Figure 5. The transaction services market is affected by the change in credit costs, and now there is a different mix of exchanges taking place. Demanders pay  $P'_D$  and suppliers receive  $P'_S$ . The difference between the prices goes to the suppliers of the transaction services. With the new interest rate the quantity of goods being traded decreases from  $Q_e$  to  $Q'_e$ . Credit transactions go to zero. The quantity of goods traded with cash increases from  $Q_C$  to  $Q'_C$  and countertrade exchanges increase from zero to  $Q'_{CT}$ .

In this example, where demand is held constant, there is a different distribution of the types of exchange that emerges from a change in one component of transaction costs, interest costs. While changing only one factor is the easiest change to graph, several factors may change simultaneously. The shapes and magnitudes of the transaction cost curves that result from these changes are what determine the distribution of the methods of exchange for a given demand.

The foregoing model lends itself to analysis of government regulations restricting trade, availability of credit, or any of the "constraints" generally accepted as

underlying causes of countertrade. These constraints can be translated into transaction costs and their effects will be reflected in the shape and position of the supply of transaction services curves.

Since the relative positions of the curves help determine the mix of transactions that emerge, the model can be used to assess the effects of government policies and their interaction with other economic factors on the mix of trading arrangements.

All three types of exchanges take place on the international, national and personal level. That is, while focus here has been on international transactions, examples abound in the domestic market ranging from transactions between subsidiaries of vertically integrated firms to the exchange of commuting services or car pools.

Some or all of the constraints reviewed in the preceding chapter may be present when countertrade is taking place, but it is also possible to view them as affecting transaction costs. So, while the constraints may affect the level of countertrade, they are not prerequisites for its existence.

### THE MODEL--MATHEMATICALLY

A mathematical presentation of the model gives a clearer illustration of how the curves described earlier might shift in response to changes in demand or supply or to changes that affect the transaction cost curves. All the functions are restricted to a linear form for simplicity. The results are generalizable to other functional forms. It is not the functional form that the results are dependent on, but rather the relationships among the different curves or lines that are important.

To begin, define excess demand and supply curves with relative prices as a function of quantity.

$$\text{Excess demand : } P_d = a_0 - a_1 Q_d + a_2 X \quad (1)$$

$$\text{Excess supply : } P_s = b_0 + b_1 Q_s + b_2 Y \quad (2)$$

where:  $P_d$  = demand price

$Q_d$  = quantity demanded

$X$  = exogenous demand shift parameter

$P_s$  = supply price

$Q_s$  = quantity supplied

$Y$  = exogenous supply shift parameter

$a_i, b_i, > 0$ , all  $i$ ,  $i = 0$  to  $2$

The demand for transaction services can be found in equilibrium by subtracting the supply price from the demand price for each quantity level. This is equal to the price of transaction services ( $r$ ). The resulting

equation relates the quantity of transaction services sold to the maximum price buyers are willing to pay under the assumption that the number of units of transaction services used for each unit of the good bought and sold is constant. Derived demand for transaction services is represented as:

$$P_d - P_s = r = (a_0 - a_1 Q_d + a_2 X) - (b_0 + b_1 Q_s + b_2 Y) \quad (3)$$

The supply of transaction services is the sum of cash transaction services, credit transaction services and countertrade transaction services. Each of these supply curves is a function of the price of transaction services. Supply of transaction services is given by:<sup>4</sup>

$$\text{cash; } q_c = h(r) = \alpha_0 + \alpha_1 r \quad (4)$$

$$\text{credit; } q_{cr} = j(r) = \beta_0 + \beta_1 r \quad (5)$$

$$\text{countertrade; } q_{ct} = k(r) = \gamma_0 + \gamma_1 r \quad (6)$$

$$\text{where: } \alpha_0, \beta_0, \gamma_0 \geq 0; \alpha_1, \beta_1, \gamma_1 > 0$$

$$q = q_c + q_{cr} + q_{ct} = h(r) + j(r) + k(r) \quad (7)$$

Transaction services are assumed to be a constant proportion of  $Q$  and thus:  $\sum q = \alpha Q$ , (8)

where  $\alpha$  is a constant.

It follows that:<sup>5</sup>

$$\alpha Q = \alpha_0 + \alpha_1 r + \beta_0 + \beta_1 r + \gamma_0 + \gamma_1 r \quad (9)$$

<sup>4</sup> These relationships are plotted with  $r$  on the vertical axis in earlier figures.

<sup>5</sup> All mathematical derivations are appropriate only when some of all three services are used.

Applying equation (3) produces:

$$r = (a_0 - a_1 Q_d + a_2 X) - (b_0 + b_1 Q_s + b_2 Y) \quad (3)$$

Since in equilibrium  $Q_d = Q_s$ , the following equation results:

$$r = \left[ a_0 - \frac{a_1 (\gamma_0 + \beta_0 + \delta_0)}{\alpha} + a_2 X - b_0 - \frac{b_1 (\gamma_0 + \beta_0 + \delta_0)}{\alpha} - b_2 Y \right] / \left[ 1 + \frac{(a_1 + b_1) (\gamma_1 + \beta_1 + \delta_1)}{\alpha} \right] \quad (10)$$

In order to look at what happens to the price of transaction services ( $r$ ) when there is a change in demand (as done earlier in Figure 6) calculate  $dr/dX$ .  $X$  is an exogenous shift parameter of the demand curve such as income or population.

$$dr/dX = a_2 / [(a_1 + b_1) (\gamma_1 + \beta_1 + \delta_1) + \alpha] \quad (11)$$

Equation (11) shows that  $r$  is positively related to shifts in the demand curve. As demand increases with everything else held constant,  $r$  increases. Similarly, if the demand decreases,  $r$  will decrease. The magnitude of the change in  $r$  depends on the slope of the demand curve for the good, the slope of the supply curve of the good and on the slopes of the transaction services supply curves.

The steeper the supply curves of the transaction services, the greater the change in  $r$  as demand changes:  $(\partial^2 r / \partial X \partial \gamma_1)$ ,  $(\partial^2 r / \partial X \partial \beta_1)$ ,  $(\partial^2 r / \partial X \partial \delta_1) < 0$ . As  $\gamma_1$ ,  $\beta_1$  and  $\delta_1$  increase, the effect on  $r$  of a change in demand falls. The slope of the demand curve ( $a_1$ ) is also important in determining the magnitude of the change in  $r$

when demand for the good shifts. The smaller the value of  $a_1$ , the greater the effect on  $r$  of a given vertical shift in demand.

What effects do shifts in the demand curve and the resultant effects on the price of transaction services have on the quantity of transactions of each type and their relative shares of the transaction services market? These can be determined by looking at:  $dq_c/dX$ ,  $dq_{cr}/dX$ ,  $dq_{ct}/dX$  and  $d(q_c/\alpha Q)/dX$ ,  $d(q_{cr}/\alpha Q)/dX$ , and  $d(q_{ct}/\alpha Q)/dX$ , respectively.

The effect of a change in demand on the quantity traded using countertrade is given by:

$$\begin{aligned} dq_{ct}/dX &= (dq_{ct}/dr) (dr/dX) & (12) \\ &= \gamma_1 \alpha a_2 / (a_1 + b_1) (\lambda_1 + \beta_1 + \gamma_1) + \alpha \end{aligned}$$

Here the change in the price of transaction services ( $r$ ) is important, but equally important is the slope of the supply curve of countertrade services,  $\gamma_1$ . The larger  $\gamma_1$ , the smaller the effect on  $r$ , but any change in  $r$  will have a greater effect on the quantity traded using countertrade,  $q_{ct}$ , the larger  $\gamma_1$ .

Similarly, for cash and credit exchanges the slopes of the supply curves,  $\lambda_1$  and  $\beta_1$ , respectively, are important in determining the magnitude of the effect of a change in demand on levels of cash and credit exchanges.

What is the effect on the share of trade held by each type of transaction--cash, credit and countertrade?

With an increase in demand the total quantity of trade increases. If this in turn leads to an increase in the quantity of cash transactions, credit transactions and countertrade transactions, what happens to the share of trade of each type of transaction? If  $qct/\alpha Q$  represents the share of total trade transacted using countertrade, then in order to see what happens to this share with a change in demand look at:

$$\begin{aligned} d(qct/\alpha Q)/dX &= (d(qct/\alpha Q)/dr) (dr/dX) & (13) \\ &= \alpha a_2 \frac{[\gamma_1(\alpha_0 + \beta_1 r + \beta_0 + \beta_1 r + \gamma_0 + \gamma_1 r) - (\alpha_1 + \beta_1 + \gamma_1)(\gamma_0 + \gamma_1 r)]}{(\alpha_0 + \beta_1 r + \beta_0 + \beta_1 r + \gamma_0 + \gamma_1 r)^2 [(a_1 + b_1)(\alpha_1 + \beta_1 + \gamma_1) + \alpha]} \end{aligned}$$

When will this be positive and when will it be negative? Or, when will the share of total trade transacted using countertrade increase or decrease with a change in demand? The denominator is always positive, so the sign of the numerator is of interest.

The numerator will be positive if  $\gamma_1(\alpha_0 + \beta_0) > \gamma_0(\alpha_1 + \beta_1)$ . This could happen under a variety of circumstances. For example, the numerator will be positive when countertrade transaction costs per unit are higher at low volumes than those of cash or credit transactions and the costs of countertrade transactions rise more slowly with increases in quantity than do cash and credit transaction costs.

Assuming that  $X$  increases,  $r$  will rise in response to this change and the share of countertrade transactions

will also rise if all three curves meet the criteria above. If  $X$  decreases  $r$  will fall, and the share of countertrade transactions will decrease.

These calculations can also be carried out for cash and credit transactions. Instead of  $qct/\propto Q$ , use  $qc/\propto Q$  for cash and  $qcr/\propto Q$  for credit. Once the values of  $\gamma_0$ ,  $\gamma_1$ ,  $\beta_0$ ,  $\beta_1$ ,  $\zeta_0$  and  $\zeta_1$  are determined, predictions about whether the share of each will increase, decrease or remain the same for given changes in demand can be made.

The change in the share in response to a change in demand is dependent not only on the transaction costs of the type of transaction of interest, but also on the transaction costs of the alternatives. The transaction costs of a certain type of exchange relative to the costs of the other types of exchange determine the share, rather than the costs of a particular type of exchange alone.

In order to determine what happens to the price of transaction services,  $r$ , and the new distribution of trade among the three types of transactions when one of the supply curves for transaction services changes, first look at  $dr/d\zeta_0$ ,  $dr/d\beta_0$ , and  $dr/d\gamma_0$ . This is a change in  $r$  when the intercept of one of the transaction services curves changes. A change in the intercept,

everything else held constant, will result in a parallel shift in the curve.

What happens when the supply curve for credit transaction services shifts? Several factors could shift the supply of credit transaction services. These include government policies restricting the availability of credit such as a surcharge on credit, a reduction in the amount of available credit or a policy reducing restrictions on credit making credit more available. Only the last factor would lower the cost of credit while the others would make credit more expensive.

What happens to  $r$ , the price of transaction services, with a shift in the supply of credit transaction services? Equation (14) describes the result:

$$dr/d\beta_0 = -a_1 - b_1 / (a_1 + b_1) (\gamma_1 + \beta_1 + \gamma_1) + \alpha \quad (14)$$

The new price of transaction services depends on the slope of the demand,  $a_1$ , and supply,  $b_1$ , curves for the good, as well as on the slopes of the supply curves of the transaction services. The slopes of all three transaction services curves are important because it is the horizontal summation of these that gives the total supply of transaction services. The combination of the demand and supply for the good determines the demand for transaction services. And  $r$  in turn is determined by the supply and demand for transaction services.

When  $\beta_0$  decreases, that is, the unit cost of credit transaction services increases, what will happen to the level of  $r$ ? Will it increase or decrease? Here the denominator of  $dr/d\beta_0$  is positive, so the value of interest is the numerator,  $(-a_1-b_1)$ . Since  $a_1$  and  $b_1$  are always positive, there is a negative relationship between  $\beta_0$  and  $r$ . That is, if  $\beta_0$  decreases (the credit curve shifts to the left) then  $r$  will increase. An increase in the cost of credit is reflected in the price of all transaction services.

To determine how the distribution of trade among the three types of transaction services changes when one of the supply curves changes examine:  $d(qc/\alpha Q)/d\beta_0$ ,  $d(qcr/\alpha Q)/d\beta_0$ ,  $d(qct/\alpha Q)/d\beta_0$ . In this case there is a shift in the credit transaction services curve. Equation (15) depicts what happens to the credit share of trade when there is a shift in the supply of credit transaction services:

$$\begin{aligned} d(qcr/\alpha Q)/d\beta_0 &= (d(qcr/\alpha Q)/dr) (dr/d\beta_0) \quad (15) \\ &= \frac{[\beta_1(\xi_0 + \xi_1 r + \beta_0 + \beta_1 r + \gamma_0 + \gamma_1 r) - (\xi_1 + \beta_1 + \gamma_1)(\beta_0 + \beta_1)](-a_1 - b_1)}{(\xi_0 + \xi_1 + \beta_0 + \beta_1 r + \gamma_0 + \gamma_1 r)^2 (\alpha + (a_1 + b_1)(\xi_1 + \beta_1 + \gamma_1))} \end{aligned}$$

Once more the slopes of the demand curve,  $a_1$ , and supply curve,  $b_1$ , for the good are important. The steeper the slopes of the curves, the smaller the effect on the quantity traded when  $r$  changes due to a shift in one of the transaction services curves. This is true for

total quantity traded as well as for quantity traded under each type of exchange.

But now the relationships among the transaction services curves and the price,  $r$ , of transaction services are also important in determining what the shares of trade are. In this instance, how is the share of credit transactions affected as the supply of transaction services curve for credit shifts? Equation (15) shows that  $(d(q_{cr}/\alpha Q)/d\beta_0)$ , the change in credit share of trade, is positive if  $\beta_1(\lambda_0 + \gamma_0)$  is less than  $\beta_0(\lambda_1 + \gamma_1)$ . There will be a negative relationship between the change in  $\beta_0$  and the credit share of trade if  $\beta_1(\lambda_0 + \gamma_0)$  is greater than  $\beta_0(\lambda_1 + \gamma_1)$ .

The curves in Figure 8 are selected so that they satisfy the inequality:  $\beta_1(\lambda_0 + \gamma_0) < \beta_0(\lambda_1 + \gamma_1)$ . Thus, if  $\beta_0$  decreases (curve shifts to the left), the share of credit transactions will decrease. Once the relative positions and shapes of the transaction cost curves are known, predictions can be made about what will happen to the share of different types of exchanges as exogenous variables change.

The effect on the share of countertrade exchanges when there is a shift in the supply curve of credit transaction services is described in:

$$[d(q_{ct}/\alpha Q)/d\beta_0].$$

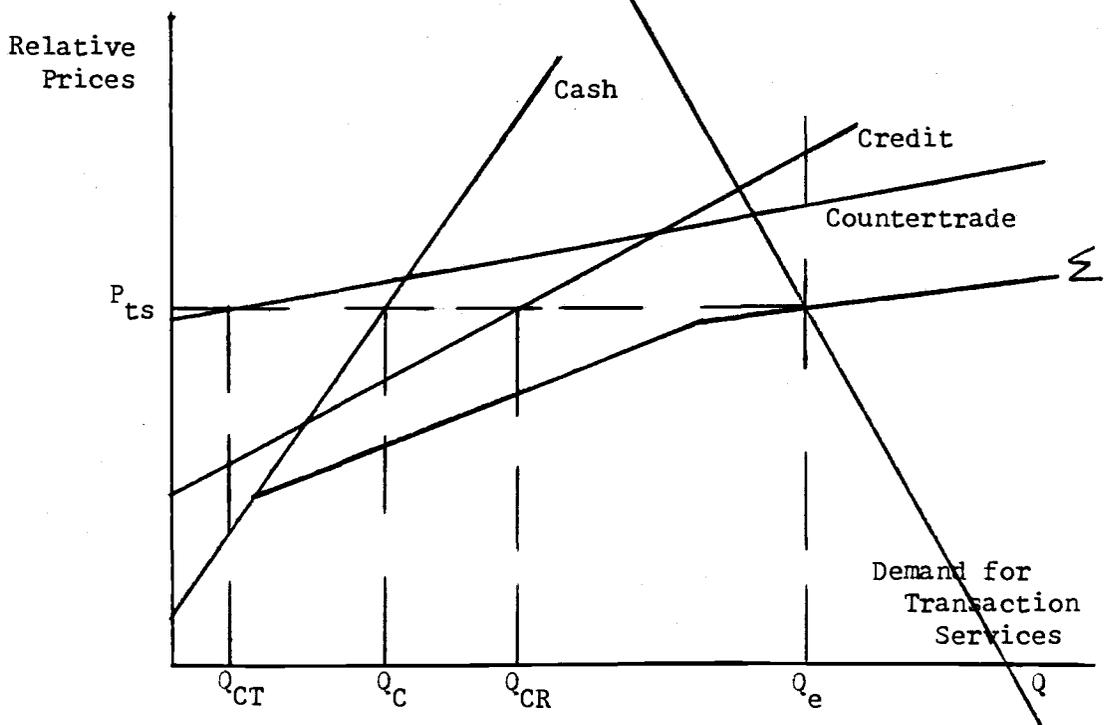
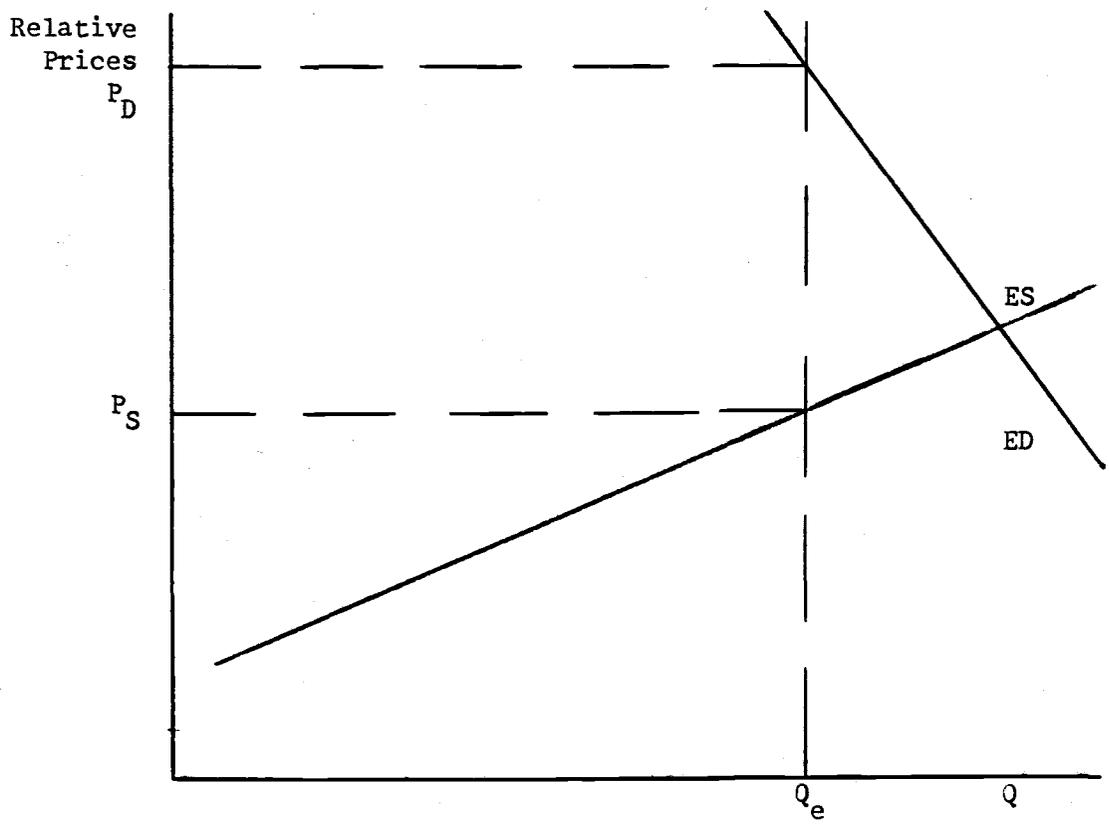


Figure 8. Trade Using All Three Transaction Services

$$d(qct/\alpha Q)d\beta_0 = d(qct/\alpha Q)/dr (dr/d\beta_0) \quad (16)$$

$$= \frac{[\gamma_1(\beta_0 + \beta_1 r + \beta_0 + \beta_1 r + \gamma_0 + \gamma_1 r) - (\beta_1 + \beta_1 \gamma_1)(\gamma_0 + \gamma_1 r)](-a_1 - b_1)}{(\beta_0 + \beta_1 r + \beta_0 + \beta_1 r + \gamma_0 + \gamma_1 r)^2 (\alpha + (a_1 + b_1)(\beta_1 + \gamma_1))}$$

The sign of the numerator is important, specifically in whether  $\gamma_1(\beta_0 + \beta_1 r)$  is  $\geq \gamma_0(\beta_1 + \beta_1 r)$ . The numerator is positive if  $\gamma_1(\beta_0 + \beta_1 r) < \gamma_0(\beta_1 + \beta_1 r)$  and negative if  $\gamma_1(\beta_0 + \beta_1 r) > \gamma_0(\beta_1 + \beta_1 r)$ . If, as depicted in the graphs,  $\gamma_1(\beta_0 + \beta_1 r) > \gamma_0(\beta_1 + \beta_1 r)$ , then as  $\beta_0$  decreases, the countertrade share of trade will increase.

The figures are referred to in order to illustrate one specific relationship among the curves. The mathematical presentation, however, allows for any relationship among the slopes and intercepts of the curves and for negative intercept values. When the intercepts are negative, there are no transaction costs at some levels of each service. The levels at which transaction costs begin may differ for each type of transaction service.

The same calculations can be carried out for the effects on the cash share of trade when there is a shift in the credit transaction services supply curve. The effects of shifts in the other transaction services supply curves can also be determined using the same method.

Several testable hypotheses emerge from the above discussion. One hypothesis is that the share of trade accounted for by countertrade increases when the unit cost of credit transaction services increases. Another is that the share of trade accounted for by credit decreases when the unit cost of credit transaction services increases. These hypotheses are explored in the next section.

## AN INDIRECT TEST

Data

Several testable hypotheses emerge from the preceding discussion. The problem facing the researcher in trying to carry out a test of any of these is the lack of data. No particular government agency is responsible for collecting data specifically on countertrade transactions. As a result there are only limited data available. Private company data sources are difficult to tap into as there are concerns that public disclosure of these data may be beneficial to competitors.

However, there are some data on U.S. countertrade imports gathered in 1982 and 1984 by the U.S. International Trade Commission. While these data may not reflect all U.S. countertrade transactions--many goods received in a countertrade exchange by a U.S. company may not ultimately be imported into the United States--they do provide a starting point for examining countertrade shares of trade. Another problem is that these data are only for a short time series; two sets are for seven years the other for five years. But by analyzing these available data, a pattern in trade may emerge to provide a partial test of the model presented above.

The three series of countertrade data to be used in the analysis are U.S. imports of products other than

chemicals, minerals and metals obtained through countertrade from all sources from 1974 to 1980 (Table 1), U.S. imports of metals and minerals obtained through countertrade from less developed countries from 1974 to 1980 (Table 2), and U.S. sales agreements with a countertrade obligation from 1980 to 1984 (Table 3). The data include public and private transactions.

The other data used in the analysis are the current account deficit, hard currency debt, net external borrowing and the current account balance for developing countries. These are provided in Tables 4 through 7. The International Monetary Fund (IMF) links the amount of credit made available to developing countries with their export performance and the size of their debt. For this reason, the above data are potentially good measures of exogenous shift parameters for the credit transaction services supply curve. Further, these data are thought to reflect changes in credit costs because credit availability is linked to a country's overall economic performance. If a country's current account balance is very negative, credit costs may be quite high for that country. Thus, as the current account balance changes, the cost of credit also changes. The poorer a country's

TABLE 1

Estimated U.S. Imports of Products Other Than Chemicals,  
Minerals, and Metals Obtained Through Countertrade,  
and Total Imports From All Sources, 1974-1980

Countertrade		(In thousands of dollars)					
Item	1974	1975	1976	1977	1978	1979	1980
Ale and beer-----	105	176	124	122	192	527	884
Hams-----	20,471	35,183	43,697	49,041	65,173	48,937	28,662
Footwear-----	5,952	11,361	19,559	14,969	28,352	21,659	24,439
Tobacco-----	-	-	-	-	601	1,171	1,455
Liquor-----	-	-	1/	1/	1/	1/	2,767
Soybeans-----	12	19	15	8	39	19	42
Total-----	26,540	46,739	63,395	64,140	94,357	72,313	58,249
<b>Total Trade</b>							
Ale and beer-----	68,765	94,103	139,744	157,309	238,027	337,742	367,606
Hams-----	334,597	387,177	414,154	374,778	427,580	380,120	328,868
Footwear-----	1,153,390	1,301,403	1,724,547	1,879,840	2,665,762	2,919,606	2,969,980
Tobacco-----	290,923	382,665	445,508	373,028	452,238	494,514	522,139
Liquor-----	687,604	675,248	709,970	735,596	911,514	1,027,755	1,136,493
Soybeans-----	19	18	227	59	39	122	1,975
Total-----	2,537,212	2,840,614	3,434,150	3,520,610	4,695,121	5,159,859	5,327,001

1/ Not available

Source: Data compiled from U.S. Department of Commerce, U.S. Imports of Merchandise, IM 146, 1974-80, and U.S. International Trade Commission, "Analysis of Recent Trends in U.S. Countertrade," U.S.I.T.C. Publication 1237, March 1982.

TABLE 2

Minerals and Metals: Estimated U.S. Imports for Consumption from  
Less Developed Countries (LDCs) Resulting from Countertrade, and  
Total Imports from LDCs, 1974-1980, and Countertrade Share

Item	(In millions of dollars)						
	1974	1975	1976	1977	1978	1979	1980
Countertrade imports from LDCs:							
Bauxite	20	37	45	50	57	57	58
Copper	7	9	5	1	1	1	1/
Chromite	2	3	5	5	4	3	4
Iron	24	34	32	18	28	24	18
Lead	2	1	3	4	3	3	2
Manganese	7	12	11	9	5	4	7
Tin	4	4	4	6	4	5	1
Rutile	-	-	-	-	-	2	10
Tungsten	5	4	2	6	7	10	8
Total	71	104	107	99	109	109	108
Total imports from LDCs:							
Bauxite	157	235	304	339	384	376	381
Copper	130	36	50	21	26	48	102
Chromite	29	59	61	66	53	54	57
Iron	696	861	980	957	845	923	773
Lead	15	12	30	40	25	33	24
Manganese	43	77	74	57	37	27	46
Tin	36	44	39	61	44	54	11
Rutile	39	36	43	21	48	31	50
Tungsten	41	32	23	56	68	85	87
Total	1,186	1,392	1,604	1,618	1,530	1,631	1,531
Countertrade share (in percent)	5.99	7.47	6.67	6.12	7.12	6.68	7.05

1/ Less than \$500,000

Source: U.S. International Trade Commission, "Analysis of Recent Trends in U.S. Countertrade,"  
U.S.I.T.C. Publication 1237, March 1982.

TABLE 3

## Total U.S. Countertrade Obligations, 1980-1984

(In millions of dollars)

Year	Sales	Countertrade (military and nonmilitary) obligations	
		Europe	Asia
1980	2,959	285	295
1981	1,520	719	601
1982	483	201	235
1983	3,561	3,183	245
1984	1,848	1,378	953
Total	10,371	5,766	2,329
		Other	
1980	3,801	301	301
1981	3,486	1,551	1,551
1982	676	482	482
1983	976	190	190
1984	484	431	431
Total	9,423	2,955	2,955
Countertrade share (in percent)			
1980	10.5		
1981	47.1		
1982	53.5		
1983	66.9		
1984	38.7		

Source: U.S. International Trade Commission, "Assessment of the Effects of Barter and Countertrade Transactions on U.S. Industries," U.S.I.T.C. Publication 1766, October 1985.

TABLE 4

Non-Oil Developing Countries: Financing of Current Account  
Deficits and Reserve Accretions, 1973-1980

	1973	1974	1975	1976	1977	1978	1979	1980
	Billion U.S. Dollars							
Current account deficit-----	11.3	36.9	45.8	32.1	28.0	36.2	54.9	68.0
Increase in official reserves----	9.7	2.1	-2.0	12.8	12.0	18.0	11.6	8.8
Total-----	21.0	39.0	43.8	44.9	40.0	54.2	66.5	76.8

Source: World Economic Outlook, A Survey by the Staff of the International Monetary Fund, May 1980.

TABLE 5

Capital Importing Developing Countries: External Financing, 1979-1985  
(In billions of U.S. dollars)

	1979	1980	1981	1982	1983	1984	1985
Net external borrowing-----	67	94	116	96	68	46	30
From private sources-----	48	66	75	48	18	11	8
From official sources-----	19	28	39	37	40	33	21

Source: International Monetary Fund, Annual Report 1986.

TABLE 6

Hard Currency Debt (Official and Private) of Nonmarket Economy  
Countries and Less Developed Countries, 1974-1980

(In billions of dollars)

Year	Nonmarket economy countries	Less developed countries
1974	16.2	141.9
1975	28.9	168.1
1976	38.9	211.0
1977	48.2	257.6
1978	58.3	316.9
1979	64.7	369.2
1980	<u>1/</u> 70.4	416.0

1/ Estimated by the World Bank

Source: U.S. International Trade Commission, "Analysis of Recent Trends in U.S. Countertrade," U.S.I.T.C. Publication 1237, March 1982.

TABLE 7

## Current Account Balances of Industrial, Non-Oil-Developing and Eastern European Nonmarket Economy Countries, 1973-1984

(In billions of dollars)

Item	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Industrial countries <u>1/</u> -----	13.0	-22.9	8.8	-10.1	-15.4	17.8	-24.6	-59.6	-18.0	-22.9	-19.4	-58.3
Non-oil-developing countries <u>2/</u> -----	-6.6	-30.0	-38.4	-24.9	-23.9	-33.2	-49.5	-72.1	-92.8	-69.4	-52.1	-37.9
Eastern European nonmarket economy countries <u>3/</u> -----	-2.3	-5.0	-5.8	-5.8	-5.5	-6.2	-7.6	-7.0	-5.6	-.4	2.0	2.3

1/ United States, Canada, Australia, Japan, New Zealand, Austria, Belgium, Denmark, Finland, France, West Germany, Iceland, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom

2/ All developing countries except Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Oman, Qatar, Saudi Arabia, United Arab Emirates, Venezuela

3/ Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania

Source: U.S. International Trade Commission, "Assessment of the Effects of Barter and Countertrade Transactions on U.S. Industries," U.S.I.T.C. Publication 1766, October 1985.

performance, the riskier it is to lend money and the higher the credit costs.<sup>6</sup>

### Testing the Model

As an indirect test of the model, correlation coefficients between countertrade shares of trade and the cost of credit were calculated. According to the model, one instance in which the countertrade share will change is if there is a shift in the credit transaction services supply curve. The model predicts that the countertrade share will increase if at all quantities the cost of credit is increased, given the specific relationships among the linear curves postulated, everything else held constant.

In order to get an idea of credit market performance over time, measures of the hard currency debt, the current account deficit, and net external borrowing for developing countries were used.

Table 1 shows levels of U.S. imports from countertrade in thousands of dollars for several products from 1974 to 1980. These figures were estimated by the U.S. International Trade Commission. Table 1 also shows total U.S. imports of these same products over the same

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<sup>6</sup> This could also be viewed another way: the higher the credit costs, the more out of balance a country's current account will be, so that the current account moves with credit costs.

time period. From these two sets of data the countertrade share of imports for all products was calculated as well as the countertrade share for hams and footwear. These are given in Table 8.

The countertrade share of imports for all products doubles from a little over one percent in 1974 to over two percent in 1978 and then drops off again in 1979 and 1980. The countertrade share of imports for hams more than doubles from 6 percent in 1974 to 15 percent in 1978 and then slowly declines to just under 9 percent in 1980. The countertrade share of footwear imports doubles from 0.5 percent in 1974 to 1.1 percent in 1976 and is up and down slightly over the next four years.

Is there any correlation between the calculated countertrade shares and either the current account deficit or hard currency debt? The assumption is that increases in the current account deficit and hard currency debt represent increases in the cost of credit. The model predicts a positive correlation. The coefficients of correlation for product totals are 0.63 and 0.41, respectively. For hams the coefficients of correlation are 0.25 and 0.45 and for footwear 0.19 and 0.45 (see Table 9).

The correlations for the current account deficit cover a wide range, 0.19 to 0.63 while the range for hard

TABLE 8  
Countertrade Share of Trade  
(In Percent)

	1974	1975	1976	1977	1978	1979	1980
Hams-----	6.12	9.09	10.6	13.1	15.2	12.9	8.72
Footwear-----	0.52	0.09	1.13	0.80	1.06	0.74	0.82
All products-----	1.05	1.65	1.85	1.82	2.01	1.40	1.09

TABLE 9  
Coefficients of Correlation

	Current Account Deficit	Hard Currency Debt	Net External Borrowing	Current Account Balance
Various Products				
Total-----	.63	.41	-	-
Hams-----	.25	.45	-	-
Footwear-----	.19	.45	-	-
Minerals and Metals-----	-.47	.27	-	-
Sales Agreements-----	-	-	-.12	.15

currency debt is from 0.41 to 0.45. All correlations are positive.

In a broad general sense, then, these data support the hypothesis that the share of countertrade transactions is related to the size of the transaction costs. Based on the assumption that the current account deficit and hard currency debt reflect the price of using credit to transact exchanges, then the share of trade accounted for by countertrade increases when the cost of credit transaction services increases. Certainly, these data can also be used to support other hypotheses and other models. For example, both countertrade and the credit and cash variables may be positively related to hard currency shortages as Banks (1983) suggests.

Using data from 1980 to 1984 on U.S. sales agreements with a countertrade portion, the countertrade share of trade of these agreements can be calculated. (See Table 3). These data are not precisely what are needed to test the model. The International Trade Commission, when gathering these data did not request total sales figures for each of the five years. Therefore, it is impossible to determine the countertrade share of total trade for the set of companies interviewed. However, what is available is the countertrade share of sales agreements that have a countertrade portion. This should give some indication

of what is happening to countertrade's share of total trade.

Net external borrowing is assumed to be an indicator of changes in the credit services market and provides a way to indirectly test the model. Restated, the assumption is that net external borrowing is negatively related to interest costs so that as credit costs increase net external borrowing would decrease. Under these conditions, the model predicts an inverse relationship between countertrade and net external borrowing. The actual coefficient of correlation is  $-0.12$ . This is consistent with the model since the expectation is that as borrowing decreases (credit costs are increasing), countertrade increases.

The current account balance is also used as a measure of changes in the credit transaction services market: the assumption is that as the current account balance increases, credit costs increase. The model predicts a positive correlation between the current account balance and the 1980 to 1984 countertrade share data. The coefficient of correlation is  $0.15$ . This result is consistent with the model and similar to the ones discussed earlier.

Analysis of data in Table 2 gives mixed results. In comparing hard currency debt to the countertrade share of

U.S. imports of minerals and metals the correlation coefficient is 0.27. There is a positive correlation.

Correlating the current account deficit with the countertrade share of U.S. imports of minerals and metals from developing countries results in a correlation coefficient of -0.47. This is not consistent with the earlier findings nor with the coefficients assumed in the graphical presentation. There are several reasons why this could happen. One reason is that the minerals and metals market may have special constraints on it because of the strategic importance of some minerals and metals. Since these minerals and metals may be imported into the United States for the strategic stockpile, there may be factors affecting these imports other than the transaction costs associated with the exchange. As a result, a simple correlation may not capture all of the interactions that are occurring in the market.

Another reason for the negative correlation may be that the relationship among the transaction services supply curves for minerals may be different from those postulated. Recalling the mathematical model, the prediction is that the countertrade share will decrease with an increase in the unit cost of credit transactions if  $\gamma_1(\alpha_0 + \beta_0) < \gamma_0(\alpha_1 + \beta_1)$ . Is it likely that this is the case for minerals and metals?

Consider a hypothetical example. Suppose that all three supply curves of transaction services have the same slope ( $\alpha_1 = \beta_1 = \gamma_1$ ) and that credit and cash services have the same intercept ( $\alpha_0 = \beta_0$ ). Where does the supply curve for countertrade transaction services have to lie in order for  $\gamma_1(\alpha_0 + \beta_0)$  to be less than  $\gamma_0(\alpha_1 + \beta_1)$ ? That is, does  $\gamma_0$  have to be greater than or less than  $\alpha_0$  and  $\beta_0$ ? It may be easier to visualize the relationship by looking at  $\frac{\alpha_0 + \beta_0}{\gamma_0} < \frac{\alpha_1 + \beta_1}{\gamma_1}$ . In order for this to hold, given the above conditions,  $\gamma_0$  must be greater than  $\alpha_0$  and  $\beta_0$ . This is different from the earlier assumption about the relationship among the transaction services supply curves.

The transaction services supply curve for countertrade, when plotted with  $r$  (price of transaction services) on the  $y$  axis, will lie below the cash and credit supply curves of transaction services.

The supply curve of countertrade transaction services could lie below the credit and cash supply services for a number of reasons. If minerals and metals are a large portion of a developing country's exports, long term contracts may be in force that have a countertrade portion in order to ensure a market for their production. There may be only one product group that a country can be sure of supplying even if its currency is going through severe fluctuations. The

transaction costs for countertrade exchanges would thus be lower than those for cash or credit.

The above results, though mixed, generally support the hypothesis that transaction costs play a role in determining the types of exchanges that emerge in a given market. While these countertrade data are not comprehensive and strong assumptions were made about what the current account balance, net external borrowing, the current account deficit, and hard currency debt represent, the model is a step toward a better understanding of countertrade. Further, it is a model that can be rigorously tested once data are available.

## CONCLUSIONS

The model presented here incorporates transaction costs in the trade model. It allows the analyst to examine the emergence of different trading arrangements whose differences can be attributed to their transaction costs. Using transaction costs allows including a vast array of otherwise seemingly unrelated impediments to trade along with more established notions of transaction costs to address the issue of whether or not to use countertrade as an alternative to more conventional trading arrangements.

Viewing constraints on trade without considering how they are translated into costs loses sight of the fact that countertrade occurs at all levels of trade including interpersonal exchanges. Another theory or model would be needed to include the exchanges that individuals arrange everyday, since all these exchanges are not subject to trade impediments. If, however, one thinks in terms of transaction costs, then it becomes evident that all countertrade exchanges, from international trade down to person to person exchanges, are related. A countertrade exchange is only one of the options available to traders and when all costs are considered, the traders choose that one that minimizes costs based on their assessment of these costs. Markets then behave as if they too, minimize transaction costs.

Countertrade is a viable option and does not need to be viewed as an all or nothing phenomenon. Countertrade levels respond to cost changes just as the level of investment changes as interest rates change. There may be changes in countertrade levels even if the impediments to trade do not change because of changes in other costs. So, long run effects of countertrade cannot be based solely on the persistence of trade constraints or lack of policy changes by a government.

The model and the analysis presented here only just begin to touch on what can be done within this framework for trade. The statistical results of the indirect test of the model are encouraging. While the assumption cannot be made that these results are in any way conclusive, they are indicative of the potential of the model to help in delineating the underlying economics of countertrade. More comprehensive data are needed for a fuller test of the model and an accurate assessment of its predictive powers.

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