

ECONOMIC INCENTIVES FOR COUNTERTRADE

Rolf Mirus* and Bernard Yeung**

University of Alberta

Abstract

This paper examines countertrade using standard economic theory. We show that in many circumstances countertrade is a rational response to transaction costs, information asymmetry, moral hazard-agency problems, and other market imperfections. This paper also integrates countertrade into international business theories. Some preliminary hypotheses, that may be empirically testable after refinement, are developed.

As reports of countertrade arrangements have become frequent, academic interest has increased. Many popular explanations have been advanced, among them shortage of foreign exchange, balance of payments difficulties, exercise of monopsony power, and imposition of trade barriers. It has also been alleged that countertrade is an inefficient form of international trade and that it represents a retrograde development. Most of these arguments have not been established theoretically, nor have they been tested empirically.

Countertrade does not usually take the ancient form of barter and its existence does not imply the decline of international business into

*Rolf Mirus is Professor of International Business and Finance at the University of Alberta. He holds a doctorate in economics from the University of Minnesota and his research interests are in the area of international financial markets and managements.

**Bernard Yeung is Assistant Professor of International Business and Finance at the University of Alberta. He holds a Ph.D. in International Business from the University of Chicago, and his major research interest is in applying economic theory to international business phenomena.

Both authors are currently involved in a project to transfer management education to China under the auspices of the Canadian International Development Agency.

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bartering, but rather a complicated contractual exchange of economic resources, either contemporaneously or intertemporally. At the same time, countertrading parties normally have the option of diverting their resources into money-mediated trade elsewhere. It is therefore evident that a more thorough understanding of countertrade requires an examination of the trading parties' incentives for bypassing money-mediation. This paper undertakes such an examination through the application of economic theory.

The results suggest that countertrade is a rational economic response to differential transaction costs, information asymmetry, incomplete markets (in particular, the lack of forward and future markets), and political and ownership constraints that lead to principal-agency problems. In other words, countertrade occurs in situations where the superiority of market-mediated transactions is not well established; it may even lead to transactions that would otherwise not occur. In consequence, countertrade is not generally inefficient; indeed it often promotes rather than inhibits the growth of international business.

Our analysis also points out that countertrade involves a class of international transactions that can be viewed as vertical or horizontal integration of economic activities while ownership remains separate. Therefore, countertrade can be seen as a hybrid of joint venture, franchising, vertical integration, and foreign direct investment, under political and ownership constraints. The contribution of this paper is that it shows countertrade as an integral part of the theory of international business.

In section two, we provide an elementary conceptualization of countertrade contracts. Section three explains "intertemporal" countertrade, often referred to as "buy-backs" in the literature and section four discusses simple barter ("contemporaneous" countertrade). These two sections give rise to five simple hypotheses which may become suitable for empirical verification after some further refinement. Finally, in the fifth section we briefly extend our analytical result to the case of counter-purchase.

CONCEPTUALIZATION OF THE COUNTERTRADE PROBLEM

Countertrade involves "simple barter", "buy-back", and "counter-purchase". This paper suggests economic incentives for the first two types of countertrade and argues that some of the results may also be applicable to counter-purchase.¹ In the following, we present the motivation for our analysis.

Diverse and complex as the actual forms are, countertrade is characterized by a significant substitution of payment in kind for payment in an international money. To explain countertrade satisfactorily, the economic motivation for this preference needs to be uncovered. Two observations may help in this context. First, countertrade involves the exporter's and the importer's resources which usually have alternative uses. The opportunity costs of these resources are not less than their prices in money-mediated market transactions, and presumably countertraders would cover at least

these opportunity costs. For both parties to a countertrade there must then exist compatible economic incentives in order to forego ordinary market alternatives. Second, countertrade is often conducted in tightly controlled and/or less developed economies. In these economies, a competitive price system, pure profit motive, and private ownership of the means of production (especially foreign) are often absent. Also, market imperfections are the norm and business skills are often scarce, while foreign investors face many restrictions and a lack of information about the business environment. Were it not for these factors, countertrade would perhaps be displaced by money-mediated transactions in the form of commodity trade, factoring, forward sales, foreign direct investment and other forms of internalization. Based on these two lines of thought, we develop our analysis.

INTERTEMPORAL BUY-BACK²

Intertemporal buy-back is the most prevalent form of countertrade (Walsh 1984). It usually involves the export of a technology package, frequently amounting to the provision or construction of an entire plant combined with start-up operating assistance. The buyer pays the technology supplier by delivering a share of the output in the future. There are some unique aspects to technology and capital packages that are significant in this context. First, they are ambiguously defined bundles of goods and their quality is difficult to judge *ex ante* for anyone except the supplier. Second, physical capital usually requires continuous maintenance; the effort devoted to this is also difficult to observe for outsiders. Third, most physical capital and technology is in the form of highly specialized assets and can only be altered slowly and/or at high costs. Investment in capital and technology is mostly provided by the final user due to these market imperfections.

A firm motivated by a desire to integrate horizontally or vertically, or to benefit from firm-specific advantages, would want to apply its capital and technology in production abroad. However, due to high ownership costs and political constraints, it may be prevented from assuming ownership. In this situation, the imperfections intrinsic in markets for capital and technology are not overcome by internalization, resulting in the divergence of the economic interests of the user and supplier of capital and technology. This problem is aggravated by the information asymmetry between the user and the supplier. We argue that buy-back is a rational contractual resolution to market imperfections and is, in fact, a substitute for internalization in three kinds of situations.

Buy-back as a Double Coincidence of Wants

In the simplest case, where the quality of the capital/technology package is unimportant, buy-back is simply the result of a double coincidence of wants. This notion is best illustrated by the following scenario. A firm is searching for access to a needed raw material and has a firm-specific

advantage in its mining and processing. This firm may be bothered by the absence of long-term futures and forward markets for the raw material in question. It would normally respond by backward integration to assure itself of a reliable source of supply. Of course, there may exist other benefits in this integration. When the resource exists in an environment where ownership is impossible (e.g., in the People's Republic of China) or perceived as prohibitively expensive (e.g., in South Africa), the usual response of vertical integration is precluded.

For the owner of the resources the alternatives to countertrade are to allow foreign ownership and receive tax income, or to buy the technology package and develop the market for output. The first alternative may not be better than countertrade if there is a preference for ownership or control. The second alternative can also be inferior to countertrade, as there are costs of market penetration and uncertainty concerning future sales. In addition, it may be difficult to determine a money price acceptable to both the buyer and the seller. Offering output in return would lower market penetration costs, especially for the inexperienced producer, although less learning benefits would be gained. In addition, this tactic establishes a much needed long-term continuous forward sale with obvious economic advantages. There may thus be powerful economic incentives for countertrade. The market development need of the resource-owner and the backward integration motive of a foreign firm constitute a double coincidence of wants that obviates the need for money. Generalizing from these considerations, we hypothesize the following:

H1: Intertemporal buy-back of natural resources is more likely the more expensive forward purchase of input supply by the user, the more expensive (or prohibitive) foreign ownership, the more advantageous vertical integration to the capital owner, and the more costly market penetration/development for the owner of the natural resources.

It is desirable to examine the nature of the capital and technology involved in the development of the original resources and the production of the commodity. If this capital/technology package is homogeneous and has a competitive market, the pure motives for countertrading are forward sales, savings in market development cost (by the owner of the resource) and backward integration (by the capital/technology supplier). Countertrade is merely the result of a double coincidence of wants. If the package is heterogeneous so that potential suppliers have differential provision costs (these may include management and maintenance costs), countertrade gives further advantages to the resource owner. The heterogeneity property means that a standard price for the package may not be readily available (to the owner of the resource), nor are the differential costs usually observable at reasonable expense, especially for less developed countries. Through countertrade the resource-owner avoids a cost accounting problem: no explicit mutual agreement on the price of capital is needed. The resource-owner is then protected against overstatement of capital costs. Moreover, the moral hazard problem of shirking behavior by the

capital/technology supplier is avoided because the capital supplier is compensated by what his technology produces. Lastly, the countertrade scheme ensures that the most efficient capital supplier, the one who is able to extract the highest expected net economic benefits from the final output, is the most competitive bidder. Thus, most economic rent can be extracted. Since all these advantages are also available in a revenue-sharing contract, the prime motive for countertrade must still be convenient forward sale, i.e., savings in marketing cost.

This explanation of countertrade hinges on the double coincidence of wants: the internalization need of the foreign firm encountering high ownership costs and the desire by the owner of the local resources for production and market development. It appears that this is the only way to explain the simplest case, where heterogeneity of capital and technology is not important to the buyer, as there is no fundamental economic conflict between the buyer and seller and countertrade is used for no other purposes. This explanation, however, may also be extended to the more complicated cases analyzed below.

Buy-back as an Incentive Contract - Output with a Quality Dimension

In the presence of ownership constraints, where the final user of the capital and technology is not the supplier of the package, there is no guarantee that the recipient and the supplier of the package have compatible economic interests. Generally, it is not in the supplier's interest to provide quite the technology the recipient desires, and the behavior of the former is not observable (ex ante, at least). This gives rise to a subtle principal-agency problem.³ In this subsection we show that when the output has a distinct quality aspect, which is determined by the quality of the production technology, countertrade is an incentive compatible contract that allows both parties to achieve their objectives: integration for the technology-supplier and the transfer of quality technology for the recipient.

The quality attribute of a capital and technology package is often unidentifiable to anyone but the supplier. When a capital/technology transfer takes place, a problem is caused by the fact that the capital/technology recipient has inferior information about its quality. The supplier will have an incentive to overstate (undersupply) the quality of the capital/technology he provides, as long as the supply cost increases with quality and/or his revenue increases with the claimed quality; this represents a typical principal-agency problem. Conceivably, when profits are the only objectives for the supplier and the recipient, a revenue-sharing contract that resolves the problem can be constructed.^{4,5}

If the technology recipient's desire is not just profits from the final output but also the quality of the technology transferred, another dimension is added to the principal-agency problem. The quality decision made by the supplier is fundamentally unobservable (at least, ex ante) to the recipient and cannot be controlled directly. In particular, under an ordinary revenue-sharing contract, the supplier has the freedom to choose both the quality and quantity of output; the resultant quality in technology transfer

may not satisfy the recipient's demand.

By writing a contract that gives the supplier, in return for the technology, a fixed quantity of output for a specified number of years, the recipient has a means to influence the supplier's provision of quality.⁶ The assumption is that the distinct quality attribute of the output is determined, in a monotonic manner, by the quality of the capital/technology input. Usually, the price of the output varies with its perceived quality. In this situation the supplier's decision on quality is dependent on its stipulated quantity return. If quantity and quality are substitutes (complements) from the supplier's point of view, a decrease (an increase) in its quantity return will induce more supply in quality. Therefore, the quantity-sharing contract is a desirable incentive contract for the recipient to offer whenever the supplier's decisions on quantity and quality are not independent.⁷

A caveat is that with this type of contract the supplier has no incentive to conceal its quality decision, either *ex ante* or *ex post*. First, a statement of the quality provision is not required in the contract. Second, the supplier's actual payoff depends only on the actual input in quality. On the other hand, the supplier does have an incentive to misrepresent the functional relationship between its quality decision and its quantity return. We conjecture that this problem is not material if a hedonic market price function for the output is observable *ex ante*. The quantity buy-back contract may also have the favourable signalling effect mentioned in Murrell (1982). Of course, the countertrade arrangement does not displace further monitoring requirements in technology transfer. Still, it is reasonable to propose the following hypothesis:⁸

H2: When technology transfer with a quality dimension is involved, countertrade (in buy-back form) is more likely the more unobservable the quality dimension, the less available services for monitoring supply performance, the stronger the recipient's desire for quality, and the more explicit and stronger the relationship between the quality decision of the supplier and its quantity return.

The significant implication, of course, is that foreign exchange shortage has nothing to do with this type of arrangement. It is the very nature of markets for technology, information asymmetry coupled with ownership constraints, that explain the phenomenon: countertrade is an incentive contract that ensures the transfer of desirable quality technology and post-installation service performance. In this type of contract, the recipient influences the supplier's decision on the quality of the technology and capital transferred by stipulating a quantity of final output in return. The crucial assumption that leads to the incentive compatibility is the relationship between the quality of the technology and capital input on the one hand, and per unit value of the final output on the other. Without this relationship, our result does not obtain.

Buy-back as an Incentive Contract - A Differentiated Product Used as an Input by the Technology-Supplier.

Buy-back is an incentive contract in the more complicated case whereby a firm contracts to provide a production facility to another accepting in return some of the output for use in further production. We assume that the output is production process-specific, so that other firms would find it costly and time-consuming to adjust their production process to make use of the good. It would be equally difficult for the original firm to find a replacement for the input. An example would be the recent construction of an engine production plant in the German Democratic Republic by VW. As compensation the company receives every year during a specified period a fixed quantity of the engines produced. In comparison with the previous case, the complexity of the situation increases due to a time inconsistency problem and a double information asymmetry problem.

A time inconsistency problem exists because of the putty-clay nature⁹ of the project and prohibition of ownership. Assuming the motives of the technology-supplier include the diversification of sourcing, cost reduction, and collection of economic rents on its firm-specific advantage, the normal solution would be to internalize the market by means of foreign direct investment. This choice is not feasible if there are restrictions on, or high cost associated with ownership. In such a situation, a contractual arrangement between the technology-buyer and supplier becomes necessary. The technology-buyer would face significant risks if a plant were purchased and some of its output in subsequent periods were sold back to the technology-supplier. As market transactions these would be separated and sequential in nature. By the putty-clay feature of the project, the current seller of the technology would be the sole future customer for the product. In later periods, he has the incentive and ability to monopsonistically depress the price of the output, or to increase the price of the management and production services provided. In anticipation of being "locked-in and ripped-off," the technology-buyer might want to cut short the local commitment. A similar fear may also exist on the technology-supplier's side. He may worry that, in the later periods, the plant owner (the technology recipient) may suddenly monopolistically inflate the price of the output. Given that a steady supply of this output at a predetermined price is vitally important to him, he may then want to cut short his technology and capital commitment in the construction of the plant. These circumstances, in a non-cooperative Nash game setting, would result in an equilibrium of less/lower technology being coupled with lower amounts of (local) labor as compared to the internalization outcome. In the extreme, it is possible that no plant would be built. In short, in this particular case the time inconsistency of the decisions necessitates a credible contract that ties the value of technology to the value of future output. For both parties such a contract should be an improvement over the non-cooperative Nash outcome.

When a contract is specified in terms of prices, however, there is still the double information asymmetry problem. The problem arises from the fact

that the valuation of the output, which is tied to the value of its marginal physical productivity in further production, is much better known to the technology-supplier. From the perspective of the technology recipient this creates the possibility that the supplier will understate the value of the output in contract negotiations that try to specify a mutually agreed money-price. The net cost of the output to the technology-supplier is the price he pays for the local participation. This price will be positively related to the agreed money-price of the output. Therefore, the technology-supplier will have an incentive to understate his valuation of the output. The supplier can also inflate the value of other management and production services and, at the same time, undersupply the promised provisions. The technology recipient may be hard pressed to assess the quality, reliability and, thus, the value of the technology. On the other hand, because of the lack of a competitive local factor market,¹⁰ the technology-supplier may have an information disadvantage as regards the shadow price and the productivity of local participation. The supplier may be suspicious that the local partners inflate their factor cost schedules (practicing monopsonistic pricing). Hence, a severe double "informational-asymmetry-moral-hazard" problem exists.

A contract that specifies physical quantities can first of all overcome the problem of quantity-quality substitution referred to in the previous case. It thus satisfies the recipient's desire for state-of-the-art technology. But even when quality is not an issue, a quantity contract will conceivably induce the supplier to reveal his valuation of the product by furnishing technology to the extent that the marginal revenue from extra technology is equated to its marginal cost. Similarly, the recipient has no incentive to waste labour resources or to put less than the best effort forward. In this fashion, the countertrade contract is an institutional choice that overcomes difficulties that, in all likelihood, prevent a market solution. At the same time, there is good reason for the two parties to contract to exchange technology for output because this is the original motive for the transaction. Viewed in this light, the observed practices are a substitute for foreign direct investment and are the direct result of the high costs of ownership.¹¹

Finally, it appears that countertrade, in the present case, is efficiency-improving. There are four possible relationships between the technology supplier, who wants to internalize a firm-specific advantage, and the technology recipient, who wants a local industry: (i) no deal, (ii) the non-cooperative Nash equilibrium, (iii) a monetary contract equilibrium, and (iv) a countertrade equilibrium. Our analysis suggests that countertrade is the most Pareto-efficient among the last three equilibria. Countertrade then materializes if it is more Pareto-efficient than the no deal situation. If this is indeed the case, countertrade is efficiency-improving and creates trade. This argument also applies to the previous case (case (b)). As a tentative hypothesis we would argue that:

H3: Given informational asymmetry, the more costly is ownership, the more likely is this type of countertrade. Also, it follows that the more "putty-clay" the nature of a plant (i.e., the more "lock-in" and "rip-off" is

possible), the more likely is this type of countertrade contract.

Our analysis of buy-back has thus progressed from a simple situation of double coincidence of wants to the present complicated case. Buy-back arises as a rational economic resolution to market imperfections caused by high ownership costs¹² (or politically motivated ownership constraints) and information asymmetry. It is not necessarily an inefficient form of international trade, nor is it inevitably a reflection of a shortage of foreign exchange. Countertrade is simply a substitute for other more standard forms of internalization under the conditions outlined. In this sense, our analysis links countertrade to the existing theory of international business.

CONTEMPORANEOUS COMMODITY EXCHANGE

Simple barter is of a one-time, simultaneous exchange of often unrelated commodities. Again, it is troubling to accept foreign exchange shortage as a general explanation for the occurrence of this type of international transaction when countries such as the Soviet Union or the German Democratic Republic are involved. These are nations with relatively good international credit standing that should have little trouble raising the necessary import/export financing for such one-time deals, even on a more or less ongoing basis. Indeed, a nation that has successfully arranged a barter trade could have instead used the good "exported" in the barter deal as collateral for a foreign exchange loan so as to finance the very same imports. Moreover, countries that experience the most severe credit problems do not seem to be the most active in seeking countertrade deals.¹³ It would appear that there must have been a political decision that is at the root of some of the observed countertrade: the decision not to access financial markets. It is idle to speculate why one would forego borrowing but perceived loss of independence or loss of face might be possible motives. In the following, we suggest two different reasons for countertrades.

It appears that foreign exchange shortage or rationing and other forms of capital control can explain some countertrade when we focus on the Western suppliers. When an exporter has identified a customer and an order is likely, the fact that foreign exchange is rationed in the importer's country implies a time-consuming foreign exchange allocation process, so much so that uncertainty surrounds not only the conclusion of a contract but also its value. In this setting, the supplier may accept payment in terms of a marketable commodity to move the deal forward in time. This will be more likely the longer the expected waiting time and the higher the uncertainty of being able to conclude a money-based contract.¹⁴ In a very real sense, countertrade here is akin to selling an account receivable (i.e., factoring). Moreover, in this context, countertrade may actually be seen as an officially sanctioned way of bypassing a black market for foreign exchange.¹⁵ We, therefore, tentatively hypothesize the following:

H4: Given regulatory difficulties in currency exchanges, simple barter is more likely to occur the greater the uncertainty, the longer the expected

waiting time for the foreign exchange allocation and the lower the implicit marketing cost of the countertrade goods.¹⁶

The nature of some observed countertrade transactions suggests further possible rationales. When, for example, VW sells compact cars to the German Democratic Republic in return for canned hams, the impression gained is that the GDR wants to sell a temporary excess supply. Such situations tend to have a low probability of recurrence. In the normal course of events, (additional) exports of this product would saddle the seller with extra search and transactions costs (in either direct sale or indirect sale through a marketing agent). By availing itself of VW's familiarity with Western markets, cars-plus-marketing services are obtained for ham, while the benefit of learning from the experience of direct sale is foregone. From the countertrader's point of view, two necessary imports, in this example cars and marketing services, can apparently be more cheaply obtained bundled together¹⁷ and the shared savings may exceed the loss due to the foregone learning benefit from direct sales experience. The other side of the deal is that the Western firm gets a bundle: a product and reduced uncertainty regarding future market access. Payment consists of its own goods and marketing services. The Western exporter stands to gain whenever the sum of the net (of marketing cost) gain of the goods accepted and the long-run benefit of more certainty in future market access is not less than the cost of its exports. From that perspective, countertrade is economically more efficient than the same trade conducted in terms of money, and it is conducted to save search and transaction costs. The scenario reveals that countertrade is an exchange of bundled goods and services according to comparative advantage. This cost-benefit analysis leads to the following tentative hypothesis.

H5: Simple barter is more likely the lower the benefit of learning from direct sales experience, the higher the cost of direct sale of a stochastic commodity surplus with low probability of recurrence, and the lower the implicit cost of marketing services for the Western supplier.

Our assessment of simple barter would lead to the conclusion that the often stated reason giving rise to the practice, that is foreign exchange shortage, is at best a partial and somewhat, superficial explanation. The deeper causes must be sought in government policy choices regarding access to financial markets and bureaucratic delays inherent in maintaining overvalued exchange rates. In this light, countertrade appears to be a form of uncertainty resolution from the Western supplier's point of view.

In addition, given the specialized nature of marketing skills and the comparative advantage of Western firms in market knowledge, countertrade may be a reflection of high transactions and search costs faced by a trader in Eastern Europe (or elsewhere) when trying to dispose of occasional surplus production. These observations amount to bringing observed countertrades into the fold of the theory of the firm. It shows that the firm rationally responds to market conditions: countertrade may be more Pareto-efficient than ordinary trading modes; it helps markets function.

COUNTER-PURCHASE

There is now need to discuss counter-purchase and to assess the extent to which our explanations also apply to this case. In a typical counter-purchase arrangement, a seller, usually from the Western world, is partially paid in terms of trade credits that must, subject to a time and an availability constraint, be used for purchase from a prespecified list of goods. (Part of the payment may be made in convertible currencies.) While these trade credits are sometimes negotiable, nonfulfillment of a counter-purchase commitment usually invokes a penalty clause, such as a reduction in the trade credits. The essential feature of counter-purchase is the exchange of goods delivered now for goods delivered in the future. From this perspective, counter-purchase is similar to simple barter (contemporaneous exchange of goods), albeit more complicated. Some of our results in the previous section should apply to counter-purchase.

First, making payments in terms of credits that can only be used for future purchases from a prespecified list of local products is essentially a form of exchange control. Hence, the relationship between exchange control and simple barter applies to counter-purchase and a firm will accept counter-purchase requirements if the price is sufficiently attractive. Second, given that Western firms not infrequently have specialized marketing skills or easier access to them, a counter-purchase requirement can be viewed as a form of forward purchase of the Western firm's marketing skills by the local countertrader. The conceptualization of barter as an exchange of bundled goods and services based on comparative advantage is then also applicable to counter-purchase.

Counter-purchase, however, is not identical to simple contemporaneous exchange of goods. Even though the economic incentives may be similar, there are usually other complications. Counter-purchase is, by definition, intertemporal and hence has a forward selling aspect. There is also more uncertainty in counter-purchase because some of the goods on the shopping list may not be available. Moreover, the timing of the purchases is uncertain. The nature of counter-purchase arrangements may facilitate gaming behavior or, possibly, be a result thereof. On the surface our analysis thus appears generally applicable to counter-purchase but, given the unique features noted, explanations for this trading practice warrant further research.

CONCLUSION

We have attempted to explain observed countertrade transactions using the standard tools of economic analysis. While this may be a narrow view, some headway had been made toward moving the discussion from the descriptive to the analytical. For example, we found that contemporaneous countertrade can be the result of attempts to save search costs and transaction costs. Alternatively, it can be viewed as a form of factoring a future receivable.

In the case of intertemporal countertrade, which almost inevitably involves the transfer of complex technology, the root of countertrade is to be found in the high cost of foreign ownership which makes more severe the problems of information asymmetry, of moral hazard, and of decisional time inconsistency. Countertrade is revealed as a contractual resolution to these problems, and it is also a rational substitute for foreign direct investment. As a cost-saving arrangement and, sometimes, as an efficiency-improving, incentive-compatible form of contracting, countertrade is neither an inefficient form of trade nor, as is commonly alleged, is it detrimental to the growth of international business. We conclude that countertrade arrangements may be a rational response of economic agents to environmental constraints and market imperfections; that they do not necessarily represent inefficient economic exchange. Obviously, we do not claim that our analysis has comprehensively explained all manifestations of countertrade, nor do we assert that countertrade can only be explained by the tools of positive economics. Nevertheless, our approach should be seen as a first step towards a more rigorous and general analysis of countertrade. Suggestions for further work include refinement of our hypotheses for empirical testing and formalization of the arguments.

NOTES

1. Counter-purchase is not a major focus of this paper because we do not have a satisfactory general explanation for it. Interested readers may consult a recent paper by John Parsons (1985) that discusses counter-purchase extensively. In general, his analysis is very close to ours.
2. We originally differentiated buy-back according to the degree of standardization of output and analyzed it accordingly. A referee pointed out that the heterogeneity of production technology is the really crucial factor in our analyses. We subsequently revised our discussion of buy-back and gratefully acknowledge the reviewer's insightful comment. See also footnote 7.
3. A review of this problem is provided in MacDonald (1984).
4. Solutions to the problem are discussed in Ross (1973), MacDonald (1984) and articles cited therein.
5. Up to now, the relationship between the quality of the output and that of the technology does not play a crucial role. The argument is applicable to standard output with negligible quality attributes.
6. Analytically, a regressive quantity-sharing contract has the same effect on the firm's quality/quantity choice behavior as a fixed quantity contract.
7. If the output is standard but input productivity is affected by the quality of the technology, the technology supply is a function of the price of output. Either a revenue-sharing rule or an output-sharing rule can influence the technology supply and there is no presumption as to which of these will be the outcome. Conceivably, the output-sharing rule (buy-back) is sometimes, and only sometimes, the outcome. This points out that the relationship between the quality of the output and that of the technology is only one of the sufficient conditions for buy-back, not a necessary one. On the other hand, the unidentifiable quality attribute of the technology is neither a sufficient nor a necessary condition for buy-back.
8. The analysis in this subsection can be illustrated by a formal mathematical model. To preserve the non-mathematical nature of this paper, this is not provided.
9. By assumption the output is not readily useful to other producers.
10. This is an assumption that is realistic for many socialist countries and for some developing countries.
11. As we do not yet have a formal proof of its general validity, this point is conjectural. We also speculate that the buy-back provision contributes to the overall credibility of the countertrade contract.

12. Note that this cost can be the intrinsic internalization cost and/or the cost of political risk exposure. Psychological and economic costs of rendering ownership control arise for the original resource-owner.
13. Recently, there is evidence that some Latin American countries are also actively seeking countertrade.
14. Just as the currency of invoice is negotiable and acceptance of local currency can garner a contract, "invoicing" in goods may hasten a sale.
15. When the currency value deviates from the true market value, the money prices of trading commodities do not necessarily reflect the true market prices. From this perspective, countertrade is a way to adjust the relative prices at which goods are traded when their nominal prices do not reflect their real values. See Adrian E. Tschoegl (1985), p. 2.
16. This point includes Weigand's (1980) argument as a subcase.
17. This bundling suggests some market imperfections. Increased competition and specialization tends to unbundling in competitive markets unencumbered by regulation. The offshore financial markets are a case in point.

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