NBER WORKING PAPER SERIES

INCREASING RETURNS AND THE THEORY OF INTERNATIONAL TRADE

Paul R. Krugman

Working Paper No. 1752

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
October 1985

The research reported here is part of the NBER's research program in International Studies and project in Productivity and Industrial Change in the World Economy. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

NBER Working Paper #1752
November 1985

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ABSTRACT

Increasing returns are as fundamental a cause of international trade as comparative advantage, but their role has until recently been neglected because of the problem of modelling market structure. Recently substantial theoretical progress has been made using three different approaches. These are the Marshallian approach, where economies of scale are assumed external to firms; the Chamberlinian approach, where imperfect competition takes the relatively tractable form of monopolistic competitition; and the Cournot approach of noncooperative quantity-setting firms. This paper surveys the basic concepts and results of each approach. It shows that some basic insights are not too sensitive to the particular model of market structure. Although much remains to be done, we have made more progress toward a general analysis of increasing returns and trade than anyone would have thought possible even a few years ago.

Paul R. Krugman
Department of Economics
Massachusetts Institute of
Technology
Cambridge, MA 02139

Since the beginnings of analytical economics the concept of comparative advantage has been the starting point for virtually all theoretical discussion of international trade. The reasons are not hard to find. Comparative advantage is a marvelous insight: simple yet profound, indisputable yet still (more than ever?) misunderstood by most people, lending itself both to theoretical elaboration and practical policy analysis. What international economist, finding himself in yet another confused debate about U.S. "competitiveness", has not wondered whether anything useful has been said since Ricardo?

Yet it has long been clear that comparative advantage -- which I will here interpret loosely to mean a view that countries trade in order to take advantage of their differences -- is not the only possible explanation of international specialization and exchange. As Ricardo doubtless knew, and as modern theorists from Ohlin on have reemphasized, countries may also trade because there are inherent advantages in specialization, arising from the existence of economies of scale. At a logical level a theory of trade based on increasing returns is as fundamental as one based on comparative advantage; at a practical level it is reasonable to argue that economies of scale, if perhaps not as important as national differences as a motive for trade, are at least of the same order of magnitude.

Increasing returns as an explanation of trade has, however, until recently received only a tiny fraction of the theoretical attention lavished on comparative advantage. Again, the reasons are not hard to find. Where the concept of trade based on comparative advantage has opened up broad avenues of research, the attempt to formalize trade based on increasing returns until recently seemed to lead to an impenetrable jungle of complexity. Economics understandably and inevitably follows the line of least mathematical resistance, and so until about ten years ago the role of scale economies was at best a point to be mentioned in passing in most discussions of international trade.

During the last decade, however, several paths have been found through the wilderness. The new literature on increasing returns and trade does not yet have the generality and unity of traditional trade theory, and it may never be tied up in quite as neat a package. We can, however, now provide a far more systematic account of the role of increasing returns in international trade -- and of the way this role interacts with that of comparative advantage -- than would have seemed possible not long ago. The purpose of this paper is to review the new concepts that have made this progress possible.

The central problem in theoretical analysis of economies of scale has always, of course, been the problem of market structure. Unexhausted scale economies are inconsistent with the standard competitive model; the problem of introducing them into trade theory

is thus one of finding departures from that model which are both capable of accommodating increasing returns and tractable. Progress in recent years has been based on three such departures, and this paper deals with each type of market structure in turn.

The first departure from the standard competitive model is the oldest. This is the Marshallian approach, in which increasing returns are assumed to be wholly external to the firm, allowing perfect competition to remain. Marshallian analyses of increasing returns and trade go back to the early postwar period. The early literature on the Marshallian approach, however, seemed discouraging in that even with the simplest assumptions it seemed to lead to a welter of multiple equilibria. Only in the last few years has it become clear that under certain circumstances it is possible to bring order to this complexity.

The second departure is a more recent creation. Less than ten years ago, several trade theorists independently applied formal models of Chamberlinian monopolistic competition to trade. The Chamberlinian approach has proved extremely fruitful, providing a simple tool for thinking about a variety of issues in international economics.

Finally, the Cournot approach to oligopoly has begun to be widely used in international trade theory. Much of this use is in normative analyses of trade policy, which are not the subject of this paper, but some positive analysis of trade has also been based on this approach.

The plan of this paper, then is to discuss in succession recent developments in trade theory based on Marshallian, Chamberlinian, and Cournot approaches to the problem of market structure. A final section concludes with some issues for future research.

The limitations of the paper should be made clear at the outset. The work discussed here is theoretical work aimed at understanding the causes and effects of trade, rather than at providing guidance to trade policy. That is, I am concerned here with why trade happens and what difference it makes, not with what we should do about it. Allowing for the importance of imperfect competition may have major implications for the analysis of trade policy as well, but I leave discussion of these implications to the companion paper by Avinash Dixit. Also, no attempt is made to discuss empirical work, which has in any case so far been quite scarce in this area.

I. The Marshallian Approach

In a sense the Marshallian approach to the analysis of trade under increasing returns goes back to Frank Graham's famous argument for protection (Graham 1923). Explicit general-equilibrium analysis of trade in the presence of external economies began with Matthews(1949), and was continued in a number of papers, including Kemp and Negishi(1970), Melvin (1969), Chacholiades(1978), and

Panagariya(1981). For the most part, however, this literature was not successful in bringing increasing returns into trade theory in a way which seemed to generate useful insights or attract additional research. In particular, the literature did not seem to offer the possibility of a fruitful marriage of increasing returns and comparative advantage as explanations of trade. Ironically, this failure may have been in part because of an excessive loyalty to the techniques of conventional models -- production possibility curves, offer curves, and so on. As it turns out, it is possible to have models in which comparative advantage and Marshallian external economies interact in a clear way, but the development of such models depends crucially on the introduction of new techniques.

The key innovation here was the work of Ethier(1979,1982a), who showed that the analysis of trade in the presence of Marshallian external economies is greatly clarified if we work from the allocation of resources to production and trade rather than the other way around. This may seem like a minor change; but it leads to a thorough revamping of modelling strategy. As we will see, a synthesis of Marshallian increasing returns and comparative advantage comes easily only if we focus on factor prices and the factor content of trade rather than on goods prices and goods trade.

In this section, then, we will focus on the new version of the Marshallian approach, distinguished from the older approach by the way it works from resource allocation to trade. In addition to its direct

usefulness, we will see that this approach provides us with techniques and insights which are directly relevant to the Chamberlinian approach as well.

A. The simplest model

There is a family resemblance between the simplest model of trade based on increasing returns and the basic Ricardian model. In both cases a fundamental principle of international trade can be derived from studying an imaginary world of two countries, two goods, and one factor of production. If the increasing returns model has not had anything like the same influence, it is because there seem to be too many things that can happen. The task of the theorist is to find restrictions which narrow the set of possibilities in an interesting way.

Suppose, then, following the formulation of Ethier(1982a), that the world consists of two countries, each with only one factor of production, labor. To strip the problem down to bare essentials, we assume that the two countries possess identical technology with which to produce two goods. One of these goods, call it Chips, is produced at constant returns at the level of the firm but is subject to positive external economies, so that at the level of the industry there are increasing returns. These external economies are assumed to be country-specific; it is each country's domestic industry rather

than the world industry as a whole that is subject to increasing returns. The other good, call it Fish, is produced at constant returns to scale at the level of both the firm and the industry. We will assume that both Fish and Chips can be traded costlessly.

Now it is immediately apparent that even though both countries start with the same technological possibilities, the existence of economies of scale makes it inevitable that there will be international specialization. To see this, suppose that both countries were to produce both goods. The fact that both were producing Fish would imply equal wage rates. But this would mean that whichever country had the larger Chips industry would have lower cost in that industry; this would presumably lead that industry's relative size to increase still further, reinforcing the cost advantage; and we will have a cumulative process of differentiation between the countries which continues until at least one of the countries has specialized. And as long as one country has specialized, we will have international trade. So the model tells us that increasing returns will, as expected, lead to specialization and trade.

The problem, of course, is that while the outcome must involve specialization and trade, this still allows a number of possible equilibria. A little thought will suggest that there are three different kinds of equilibrium which can result. First, one country might produce both Chips and Fish while the other produces only Fish. Second, both countries might specialize, one in Chips and one in Fish.

Third, one country might specialize in Chips while the other produces both goods. Since it is also possible that either country may take on either role, we seem to have as many as six possible equilibria even in this simplest model.

To sort out this complexity, it is useful to begin by noticing that our first kind of equilibrium, where both countries produce Fish, is quite different from the other two in its implications for factor prices and welfare. As long as both countries end up producing the constant returns good, they will have equal wages, something which will not be true in the other types of equilibrium. Since the countries will have equal wages, it does not matter to their welfare in which country the good is produced. Suppose that we could assure ourselves that the international eauilibrium was in fact going to be of this type, where common production of a constant returns good ensures equal wage rates. Then we might still have two equilibria, in that either country could produce Chips, but these equilibria would have a good deal in common. In each the world output of Chips would be concentrated in a single country; and the volume both of that output and the world output of Fish would be the same across the two equilibria. Further, welfare, not only for the world as a whole but for each individual, would be the same regardless of which country ends up with the Chips industry. Thus the indeterminacy of the model, while not eliminated, would be sharply circumscribed.

Welfare in this case does not depend on which country produces Chips; how does it compare with autarky? A further appealing feature of the equal-wage equilibrium is that it yields a very simple condition for gains from trade. This is that each country gains from trade provided that the scale of the world Chips industry after trade is larger than the scale of the national industry before trade. The reason is that this implies a lower unit labor cost and therefore a lower price in terms of the (common) wage rate. The important points to notice about this crtierion are, first, that it does not depend on which country actually produces Chips, and, second, that it is a very mild condition, likely to be satisfied. Thus we have in a quite simple way captured the idea that it is to everyone's advantage to be part of a larger market.

The relative simplicity of the analysis when wage rates are equalized might lead us to ask whether there is some common ground between this case and the case of factor price equalization in the Heckscher-Ohlin model. In fact there is a common aspect, pinpointed in Helpman and Krugman (1985). In both the Heckscher-Ohlin and external economy models, factor price equalization is a symptom of a deeper aspect of the trading equilibrium, namely that "trade reproduces the integrated economy". By this we mean that the output and resource allocation of the world economy as a whole are the same as they would have been if all factors of production had been located in a single country. Or to put it another way, th equalization of factor prices

occurs when the fact that the world's productive factors are geographically dispersed turns out not to matter.

Once we realize that wage equalization amounts to saying that the integrated economy is reproduced, a technique for analyzing the prospects for wage equalization readily follows. First, construct the integrated economy -- i.e., from tastes, technology, and factor endowments calculate what the allocation of labor between the Fish and Chips industries would have been if labor had been able to move freely between the two countries. Now in order to reproduce the integrated economy, the trading world must be able to achieve the same scale of Chips production. Since external economies are assumed to be country-specific, this means that the world Chips industry of the integrated economy must now fit into one of the national economies with some room to spare.

The implications of this condition are illustrated in Figures 1 and 2. In each diagram the line 00* represents the world endowment of labor. The division of that endowment between the two countries can be represented by a point on that line. Also, in each figure the distance 0Q=Q'0* represents the labor force devoted to Chips production in the integrated economy. The difference between the figures is that in Figure 1 the Chips industry is assumed to employ less than half the world's labor force, while in Figure 2 it is assumed to employ more than half.

It is now straightforward to see what is necessary to allow reproduction of the integrated economy. In Figure 1, splitting the world to the left of Q allows the Chips industry to fit into Foreign at integrated economy scale; splitting it between Q and Q' allows it to fit into either; splitting it to the right of Q' allows it to fit into Home. Thus there is always a trading equilibrium in which wages are equalized. In Figure 2, if the two countries are too nearly equal in size -- the endowment lies in Q'Q -- the integrated equilibrium cannot be reproduced, but otherwise it can.

What this analysis shows is that an equal-wage equilibrium in which both countries produce Fish is not something which is unlikely to exist. Indeed, unless the share of the world labor force devoted to Chips exceeds one-half such an equilibrium always exists, and even then it will frequently exist. So concentrating on the equal-wage case does not mean focussing on a rare event.

Unfortunately, the fact that an equal wage equilibrium exists need not mean that it is the only equilibrium. Suppose, for example, that Foreign is substantially smaller than Home, so that the endowment point in Figure 1 lies to the right of Q'. Then there is an equal-wage equilibrium with the Chips industry concentrated in Home, but there might also be an equilibrium in which Foreign specializes in Chips and has higher wages. We can only rule this out if Figure 1 is the relevant figure and the endowment division lies between Q and Q' -- in effect, if the increasing returns sector is not too large and the countries are not too unequal in size.

An equal-wage equilibrium in which trade reproduces the integrated economy, then, is not the only possible outcome even in this simplest model. It is however a plausible outcome and one which yields appealingly simple results. Thus there is some justification for stressing this sort of outcome. Further, the idea of reproducing the integrated economy through trade provides a natural way to integrate the analysis of scale economies with that of comparative advantage, as we will see shortly.

Before we proceed to the next section, however, we need to ask what has happened to the traditional argument that increasing returns sectors are desirable property, and that the possibility that they will contract as a result of trade is a source of doubt about the gains from trade. The answer is of course that this argument depends on the integrated economy not being reproduced, so that wages end up unequal. Suppose that Figure 2 is the relevant diagram, and that the countries have equal labor forces. Then wages cannot be equal; we will clearly have one country which specializes in Chips and has a higher wage than the other country, which might lose from trade and in any case will not be happy about the outcome. One can argue about whether this situation is more or less realistic than an equal-wage equilibrium; I would argue that it is less realistic, but the main reason for focussing on the case of factor price equalisation, here as elsewhere, is of course that it is so much simpler to work with.

B. Increasing Returns and Comparative Advantage

The model presented above is one in which increasing returs is the only source of trade and gains from trade. This is of course an extreme and unrealistic case, just as is the Heckscher-Ohlin model in which differences in relative factor endowments are the only source. What we would like is a model in which both types of motive are able to operate.

There is a considerable literature on what happens in the 2x2 model when one sector is subject to increasing returns. Contributions to that literature include in particular Kemp and Negishi(1970), Melvin(1969) and Panagariya(1981).

Our discussion of a one-factor model suggests, however, that 2x2 may not be the most productive or even the easiest model to study. The simplifying device we found useful there was a focus on trading equilibria which reproduce a hypothetical integrated economy. We also noted that factor price equalization in constant returns models is also equivalent to reproducing the integrated economy thorugh trade. This makes it natural to look for assumptions which allow reproduction of an integrated economy when there are both increasing returns and differences in national factor endowments.

Suppose that there are some goods which are produced with country-specific external economies, and that there are others which are produced with constant returns. Suppose also that there are two or

more factors of production. Then a little thought will show that in order to reproduct the integrated economy we must be able to do the following: we must be able to distribute the integrated economy's industrial output among countries, using the integrated economy techniques of production, in such a way as to employ fully each country's factors of production; and when we do this each industry subject to country-specific external economies must be concentrated in a single country.

It is immediately apparent that we are very unlikely to be able to distribute industries so as to fully employ all factors of production in each country unless there at least as many industries to distribute as there are factors. Furthermore, increaing returns sectors are not really "fungible"; because they must be concentrated in a single country, they can be reallocated among countries only in a discrete fashion. So to reproduce the integrated economy we basically need to have as many constant-returns sectors as there are factors of production. The minimal model with this property is 2x3: two factors of production and three goods, only one of them produced subject to increaing returns.

Imagine, then, that we have a world in which there are at least as many constant returns industries as there are factors, plus some increasing returns industries, and that trade reproduces the integrated economy. Then we of course have factor price equalization. What else can we say about trade?

The first thing we can say is that there will be specialization due to economies of scale: every increasing returns sector will be concentrated in a single country. Thus even if every country had the same factor endowment, there would still be specialization and trade due to scale economies. As in the case of the one-factor model, this specialization will in general have an arbitrary component: each increasing returns industry must be concentrated in a single country, but which country it is concentrated in may be indeterminate.

Despite this indeterminacy, in an average sense there will be a relationship between factor endowments and the pattern of production and trade. A country with a high relative endowment of capital must on average produce a capital-intensive mix of goods, although it may produce some relatively labor-intensive ones. I.e., the factor content of a country's production must match its factor endowment. On the other hand, if countries spend their income in the same way, all countries will consume the same mix of goods, and thus the same mix of factor services embodies in those goods. It follows that countries will be net exporters of the services of factors in which they are abundantly endowed, and thus that in an average sense the factor proportions theory of trade will hold.

The next question is that of gains from trade. Clearly there are now two sources of potential gains from trade: specialization to take advantage of differences in relative factor endowments and specialization to achieve larger scale of production. The usual

analysis of gains from trade, with its discussion of the enlargement of each nation's consumption possibilities, does not carry over easily into an increasing returns world where the pattern of production and trade may well be indeterminate. We have just argued however that factor prices and the pattern of trade in factor services will still be determinate if we have factor price equalisation, so we might suppose that the issue of gains from trade might also be resolvable if we focus on factors rather than goods. And this is in fact the case.

What we can establish is the following: After trade a country will be able to afford its pre-trade consumption provided that the world scale of production of increasing returns goods is larger than that country's national scale of production before trade. (The scale need not be larger in all industries; roughly what is needed is that on average world industries be larger than pre-trade national industries would have been. For an exact statement see Helpman and Krugman(1985)). Thus our criterion for gains from trade in the simplest model has now become a sufficient -- not necessary -- condition for gains in a more elaborate model. The reason it is only a sufficient condition is, of course, that there are now additional gains from comparative advantage which will occur even if scale gains should somehow fail to materialize.

To understand this condition, consider a country which uses two inputs, capital and labor. Let us first imagine that all industries operate under constant returns. In Figure 3 we show the unit isoquant

for some industry as II. The line AA represents pre-trade factor prices. Thus OX is the vector of pre-trade inputs per unit of the good. Now suppose trade is opened, and that factor prices are equalized across countries. Then the new factor prices will be different from before, say TT. This change in factor prices is immediately a source of gains from trade. The reason is as follows. Before trade, the economy used OX to produce each unit of the good. After trade, however, the income of a smaller vector of resources, OY, is now sufficient to buy one unit of the good. Since this must be true for every good, the economy can now earn enough to purchase its pre-trade consumption and still have resources to spare.

Suppose now that some goods are produced with economies of scale. Provided that the scale of an industry after trade is larger than in the country before trade, the effect will, as in Figure 4, be to shift the unit isoquant inwards. This will add to the gains from trade. If there were no scale change, OY resources would be needed to purchase a unit of the output; so OX-OY can be thought of as the comparative advantage component of the gains from trade. Scale effects, however, will generally shift the isoquant in (not necessarily for our country, but for the country where the good is produced, which is all that matters). The result will be to lower the resources needed to purchase the good still further, to OZ, so that OY-OZ can be thought of as the scale economy component of the gains from trade.

Obviously if scale effects run the wrong way, so that isoquants shift out, the effect will be to offset the comparative advantage gains and perhaps produce losses from trade. However, since the scale comparison is one of national scale before trade with world scale after trade, there is a strong presumption that scale effects will generally be a source of gains over and above those from comparative advantage.

C. The external economy approach: summary

Recent work has shown that when the Marshallian external economy approach to increasing returns is looked at in the right way with the right assumptions, a clear and appealing story about trade emerges. The essential requirements to get this story are the willingness to assume that a trading world reproduces the aggregate outcomes of a hypothetical perfectly integrated economy -- with factor price equalization as one of the consequences; and a willingness to focus on net trade in factor services rather than on trade in goods, which is typically indeterminate. Given these concessions, we are able to describe a world economy in which both factor proportions and scale economies contribute to international trade, and in which both are sources of gains from trade. In particular:

(i) Although there is typically some indeterminacy in the precise pattern of trade, in an average sense factor proportions theory continues to hold. Countries will be net exporters of the services of factors with which they are abundantly endowed.

(ii) At the same time, the trading economy will be characterized by geographical concentration of each industry subject to country-specific increasing returns. This concentration will be an independent source of trade, and would require trade even if factor endowments were identical.

(iii) The opportunity to exchange factor services at prices different from those which would prevail in the absence of trade will lead to gains from trade for all countries.

(iv) These gains will be supplemented by additional gains if the world scale of production in increasing returns industries, wherever they may be located, exceeds the national scale which would prevail in the absence of trade.

II. The Chamberlinian Approach

The 1970s were marked by substantial progress in the theoretical modelling of imperfect competition. Among the approaches developed by industrial organization theorists was a revival of Chamberlin's "large group" analysis of competition between similar firms producing differentiated products. This analysis, once put in the form of fully specified general equilibrium models, could be applied in a straightforward way to international trade, where it has proved a flexible tool of analysis.

The basic Chamberlinian idea is that one can think of at least some industries as being characterized by a process of entry in which new firms are able to differentiate their products from existing firms. Each firm will then retain some monopoly power, i.e., will face a downward sloping demand curve. Given economies of scale, however, this is not inconsistent with a situation in which entry drives economic profits to zero. Thus Chamberlin's vision was of an industry consisting of many little monopolists who have crowded the field sufficiently to eliminate any monopoly profits.

The limitation which prevented much use of this approach in international trade theory before the 1970s was the absence of any rigorous treatment of the process of product differentiation. In the 70s, however, two approaches to this problem were developed. The first, identified with the work of Dixit and Stiglitz(1977) and Spence(1976), imposed the assumption that each consumer has a taste for many different varieties of a product. Product differentiation

then simply takes the form of producing a variety not yet being produced. The alternative approach, developed by Lancaster(1979) and used by Salop(1987), posited a primary demand not for varieties per se but for attributes of varieties, with consumers differing in their preferred mix of attributes. Product differentiation in this case takes the form of offering a variety with attributes different from those of already available.

For some purposes the differences between these approaches are important. For international trade theory, however, it does not matter much which approach is used. The important point is that both approaches end with an equilibrium in which a number of differentiated products are produced by firms which possess monopoly power but earn no monopoly profits. This is all we need to develop a remarkably simple model of international trade.

A. The Basic Model

Essentially very similar Chamberlinian models of trade may be found in papers by Dixit and Norman(1980), Ethier(1982b), Helpman(1981), Krugman(1979,1981), and Lancaster(1980). A synthesis approach is given in Helpman and Krugman(1985), and I follow that approach here.

Consider a world consisting of two countries, Home and Foreign, endowed with two factors of production, capital and labor, and using

the same technology to produce two goods, Food and Manufactures. Food is simply a homogeneous product produced under constant returns to scale. Manufactures, however, is a differentiated product, consisting of many potential varieties, each produced under conditions of increasing returns. We assume that the specification of tastes and technology in the Manufactures sector is such that it ends up being monopolistically competitive; beyond this the details do not matter.

As in our analysis of the Marshallian approach, the trick in analyzing this model is to start by constructing a reference point, the "integrated economy". That is, given tastes and technology, we find the equilibrium of a hypothetical closed economy endowed with the total world supplies of capital and labor. The key information we need from this calculation is the allocation of resources to each industry and relative factor prices. This information is shown in Figure 5. The sides of the box represent the total world supplies of capital and labor. The vector OO = O*O' is the allocation of resources to Manufactures production in the integrated economy; QO* = O'O is the allocation of resources to Food; the slope of WW is relative factor prices. As drawn Manufactures is more capital-intensive than Food, but this is not important.

The next step is to ask whether a trading economy will reproduce this integrated economy. Let us measure Home's endowment starting from O, and Foreign's endowment starting from O*. Then the division of the world into countries can be represented by a point in the box, such as

E. If we assume that the varieties of Manufactures are numerous enough that we can ignore integer constraints, then it is immediately apparent that trade reproduces the integrated economy as long as the endowment point lies inside the parallelogram OQO*Q'.

Once we have ascertained that the integrated economy's resource allocation is reproduced, we can determine the resource allocation within each country by completing parallelograms. If the endowment is E, Home must devote resources OPm to Manufactures, OPf to Food; the balance of the integrated economy's production of each good must be produced in Foreign. Since there are economies of scale in production of Manufactures, each country will produce different varieties of manufactured goods; which country produces which varieties is indeterminate but also unimportant.

We have now determined the pattern of production; to determine consumption and trade we now make use of factor prices. The line WW has a slope equal to relative factor prices, and thus can be seen as a line along which the shares of Home and Foreign in world income are constant. This means in particular that resources OC receive the same share of world income as OE, and thus that OC/OO* is the Home country's share of world income. Let us now add the assumption of identical spending patterns, and we know that each country will consume embodied factor services in the same proportion as the world supplies. It follows that OC is also Home consumption of factor services, and thus that EC is net trade in factor services. As in the

Marshallian case analyzed above, the precise pattern of trade is indeterminate but the factor content of trade reflects factor endowments.

We can say more, however. Since OC is Home consumption of factor services, it must consume OCm of these services embodied in Manufactures, OCf embodied in Food. This tells us that Home must be a net exporter of Manufactures, a net importer of Food.

Although Home is a net exporter of Manufactures, however, we have already noted that each country will be producing a different set of varieties. Since each country is assumed to demand all varieties, this means that Home will still demand some varieties produced in Foreign. The result will be a pattern of trade looking like that illustrated in Figure 6. Home will import Food and be a net exporter of Manufactures, but it will also import Manufactures, so that there will be "intra-industry" trade. This intra-industry trade is essentially caused by scale economies; if there were no scale economies, each country would be able to produce all varieties of Manufactures itself. Since intra-industry trade arises from scale economies rather than differences between countries, it does not vanish as countries become more similar; indeed, it is apparent that if we shift E toward C the volume of intra-industry trade will rise both absolutely and relatively to inter-industry trade. In the limit, if countries have identical relative factor endowments they will still trade, but all their trade will be intra-industry trade based on scale economies.

The interesting point about this analysis of the trade pattern under monopolistic competition, as it has emerged from a number of years of clarifying analysis, is how little it seems to depend on the details. At a minor level, the differences between alternative formulations of product differentiation clearly make no difference. More important, in a broad sense the analysis is essentially the same as that which we have seen emerges from the assumption that economies of scale are external to firms. The precise pattern of trade is indeterminate, but factor proportions continue to determine trade in an average sense; scale economies lead to concentration of production and to a persistence of trade even when countries have identical factor endowments. As we will argue in a moment, the analysis of gains from trade is also quite similar.

What this suggests is that it is a mistake to lay too much stress on the Chamberlinian assumption per se. The models in this literature make extensive use of product differentiation and are often related to the empirical phenomenon of intra-industry trade, but the issues should be seen as broader. The importance of increasing returns in trade does not stand or fall on the validity of particular interpretations of product differentiation or of two way trade within statistical classifications.

B. Applications and Extensions

Once we move away from the central issue of trade pattern, the conclusions of the Chamberlinian approach begin to become a bit more dependent on particular assumptions. Several areas have, however, yielded results which either look fairly general or are of particular interest. We consider four such areas: the gains from trade, trade and income distribution, intermediate goods, and transport costs.

1. Gains from trade

At first sight it might seem that the analysis of gains from trade in the external economies approach would carry over directly to the Chamberlinian approach as well. In fact, however, the translation is not direct, for two related reasons. First, the relevant scale variable is not the scale of the industry but the scale of production of individual firms, and with entry the effects of trade on this scale are not immediately obvious. Second, trade may lead to extra gains due to an increase in the variety of products available.

What we can certainly say is that a country will gain from trade if after trade both the number of available varieties and the scale of production of each variety are at least as large as before trade. Further, there is a strong presumption that the diversity of products will be larger after trade than before. The problem is one of pinning down what happens to scale.

Here the nature of product differentiation does make a difference. What happens to the scale of production depends (for homothetic production functions -- otherwise still more complications arise) on what happens to the elasticity of demand for individual varieties. With Dixit-Stiglitz preferences, this elasticity is constant; trade offers greater variety but not greater scale (Dixit and Norman 1980; Krugman 1980,1981). With Lancaster preferences, trade is likely, though not certain, to lead to more elastic demand, forcing firms to move further down their average cost curves, so that the advantages of a larger market are reflected both in greater diversity and lower average cost (Helpman 1981).

Again, however, we should not make too much of the details. Both increased scale of production and increased diversity of available products can be seen as gains from scale, broadly defined. This insight is given a more concrete form by Helpman and Krugman(1985), where it is shown that under some assumptions both scale and diversity will move monotonically with gross industry output. This leads to the following criterion for gains from trade: trade is beneficial if the world output of Manufactures is larger than our national output would have been in the absence of trade. The similarity to the criterion for the external economy case should be obvious.

2. Trade and income distribution

We have argued for a presumption that scale economies lead to additional gains from trade above and beyond those resulting from comparative advantage. This seems to be only a quantitative difference. However, it can lead to a qualitative difference in the effects of trade on particular groups within countries. Constant-returns trade models predict very strong income-distribution effects from cahnges in relative prices, so that even though trade is beneficial in the aggregate, individuals who draw their income mostly from factors which are relatively scarce end up worse off as a result of trade. Once we add gains from larger scale, however, it seems possible that everyone may gain from trade.

What makes this an interesting possibility is that it suggests that the effects of trade may depend on its character. If trade is mostly Heckscher-Ohlin in motivation -- which we would expect if countries are quite different in relative factor endowments and there are weak economies of scale -- then the conventional result that scarce factors lose from trade may be expected to hold. If trade is mostly motivated by scale economies -- which would happen if countries are similar and scale is important, and would be associated with a prevalence of intra-industry trade -- we might expect to find that even scarce factors gain.

This insight sounds fairly general. To demonstrate it in any rigorous way is not easy, however. Krugman(1981) develops an example in which there are natural indices of both similarity of countries and

the importance of scale economies, and shows that in fact one can establish a boundary in terms of these two indices between the case where scarce factors lose and the case where they gain. It is possible to establish as a more general proposition that gains for all factors are more likely, the more similar a country's endowment is to that of the world as a whole and the smaller the country is; this is shown in Krugman(1984).

3. Intermediate goods

In several papers Ethier(1979;1982b) has suggested that scale based international trade is more likely to be important in intermediate goods than in final goods. He argues forcefully that the scope for productive differentiation of products and the extent to which even the world market is likely to be too small to allow exhaustion of scale gains is greatest for highly specialized components, capital goods, etc. rather than consumer products.

What difference does this make? The answer is that as long as trade reproduces the integrated economy, as it does in the models of Ethier and Helpman(1985), having trade in intermediate goods rather than final goods does not make much difference at all. The main difference is one of emphasis: it now becomes very clear that the right scale variable to emphasize when we consider the role of scale in producing gains from trade is the size of the world industry after

trade versus the national industry before trade. We have seen that this is probably the right way to think about the issue even with consumer goods trade, but here the point becomes indisputable. The related nuance is that the doubts which occasionally surface about whether an increase in the diversity of consumer goods really increases welfare seem much less reasonable when it is the diversity of lathes or robots that is at issue.

We may also note a point raised by Helpman and Krugman(1985): if intermediate goods produced with economies of scale are not tradeable, the result will be to induce the formation of "industrial complexes", groups of industries tied together by the need to concentrate all users of a nontradeable intermediate in the same country. In this case the pattern of specialization and trade in the Chamberlinian world will actually come to resemble the pattern in the Marshallian world we described above.

4. Transport costs

The exposition of the Chamberlinian approach to trade which we have presented is based heavily on the assumption that trade reproduces the integrated economy, with zero transport costs a key element in this assumption. For some purposes this is clearly an annoying limitation. No general integration of transport costs into the Chamberlinian trade model has been achieved, but some work has been done on special cases, with interesting results.

One way to allow for transport costs with a minimum of complexity is to assume that these costs are either zero or prohibitive, so that we get a strict division of industries into tradeables and nontradeables. If we then assume that there are enough tradeable sectors and that countries are sufficiently similar in their factor endowments, we can still have factor price equalization. In this case, however, factor price equalization need not mean that the integrated economy is reproduced; if differentiated products are included in the set of nontraded goods, the fragmentation of the world economy reduces the scale at which these products are produced and the number of varieties available to consumers.

This is a useful observation in itself; it becomes especially interesting when we combine it with some consideration of factor mobility. For if there are nontraded goods produced with increasing returns, this provides an incentive for migration to large economies, a process which will in turn reinforce these economies' size advantage. This point was noted by Helpman and Razin(1980) and elaborated on in Helpman and Krugman (1985), where it is also noted that the incentive is actually for a change in the location of consumption, not production.

The more realistic case where transport costs matter but are not prohibitive is much harder to analyze, except under very specific assumptions about tastes and technology. A very special model is considered by Krugman(1980) and elaborated on by Venables(1985). This

model generates a result which on reflection looks as though it ought to be more general than the particularity of the assumptions might lead one to believe. The result is this: Other things equal, countries will tend to be net exporters of goods for which they have relatively large domestic markets.

The logic of this result is quite simple. Suppose that there is a product which is sold to two locations, and can be produced in either one at equal cost. Suppose further that there are transport costs between the two locations, but that economies of scale are strong enough to assure that nonetheless the product will be produced in only one place. Then the location of production will be chosen to minimize transport costs, and this clearly means producing in the location with the larger market and exporting to the smaller market.

C. Multinationals and Trade in Technology

In addition to allowing a very concise treatment of the role of economies of scale in international trade, the Chamberlinian approach has proved useful as a way of organizing thinking about two related issues which do not fit at all well into perfect-competition trade models. These are the role of trade in technology, on one side, and of multinational firms, on the other.

The reason why trade in technology cannot be treated in conventional models is that investment in knowledge is hard to model

except as a kind of fixed cost, which inevitably leads to a breakdown of perfect competition. Once we have a Chamberlinian setup, however, the issue is straightforward. One simply has firms in one country develop products, then sell the knowledge of how to produce these products to firms in another country, who set thmselves up as monopolistic competitors. A model along these lines was developed by Feenstra and Judd (198?); their analysis makes clearly the point that trade in technology need not be much different in its effects from any trade in which fixed costs play a significant role.

A natural extension of this analysis is to imagine that for some reason licensing or sale of technology is not possible, so that technology can only be transferred within firms. In this case the model of technology transfer can then be reinterpreted as one of multinational firms. A simple model of this type is set forth in Krugman (1980); like the Feenstra-Judd analysis, it suggests that multinational enterprise is more like ordinary trade than one might have supposed.

The identification of direct foreign investment with technology transfer is too narrow, however. A more general approach was suggested by Helpman(1984) and in turn simplified and generalized in Helpman and Krugman(1985). This approach essentially argues that multinational enterprise occurs whenever there exist related activities for which the following is true: there are simultaneously transaction cost incentives to integrate these activities within a single firm and

factor cost or other incentives to separate the activities geographically. Suppose, for example, that there is a two-stage production process consisting of a capital-intensive upstream activity and a labor-intensive downstream activity, and that for any of the usual reasons there are compelling reasons to combine these activities inside vertically integrated firms. Suppose also that countries are sufficiently different in factor endowments that unless these activities are geographically separated there will be unequal factor prices. Then the result will clearly be the emergence of firms which extend across national boundaries.

The main contribution of the new literature on multinational enterprise has probably been to clear away some confusions about what multinationals do. What the new models make clear, above all, is that multinational enterprise is not a type of factor mobility. It represents an extension of control, not necessarily a movement of capital. The key lesson is that direct foreign investment isn't investment.

D. Summary

When it was first introduced, the Chamberlinian approach to the analysis of trade represented a breakthrough. For the first time it became possible to discuss trade issues involving scale economies and imperfect competition intelligibly. At the same time, however, it was

difficult to assess how general were the insights gained from the very special models first presented.

Subsequent work has removed some of this uncertainty. Many of the conclusions of the monopolistic competition approach have proved to be independent of the details of the specification. In fact, as we have suggested, in a broad sense many of the insights carry over to other market structures as well. This realization in a way devalues the Chamberlinian approach -- it should now be seen as one of several useful analytical devices rather than as the alternative to constant-returns trade theory. But the simplicity and clarity of monopolistic competition models of trade insures that they will remain a valuable part of the toolbox for a long time.

III. The Cournot Approach

Our first two approaches to trade under conditions of increasing returns may be viewed as being driven by the desire to focus on decreasing costs as a motive for trade while avoiding as much as possible getting bogged down in issues of market structure. The Marshallian approach preserves perfect competition despite the presence of scale conomies by assuming that these economies are wholly external. The Chamberlinian approach abandons perfect competition but

turns instead to the opposite pole of a world of little monopolists, avoiding the awkward middle ground of oligopoly. As a research strategy, this artful theoretical dodging is wholly defensible, especially given our continuing lack of anything like a general theory of competition among small numbers of firms. Yet we cannot completely ignore the oligopoly issue, especially if we suspect that the interaction of imperfect competition with trade may give rise to important effects missed by these approaches.

There is no general analysis of oligopoly; but even a special analysis is better than none. Some important insights into international trade have been gained by adopting the admittedly unsatisfactory Cournot assumption that imperfectly competitive firms take each others' outputs as given. Much of the usefulness of this approach has come in the analysis of trade policy, discussed in the paper by Dixit; but two themes deserve discussion in this paper. The first of these is the role of trade in reducing monopoly power and increasing competition. The second is the possibility that market segmentation and price discrimination can serve as a cause of seemingly pointless trade.

A. Trade and Market Power

Suppose that there is some industry which in each of two countries contains only a few firms. Suppose also that these firms

compete in a Cournot fashion, so that in equilibrium price will be above marginal cost, by a markup which depends on the perceived elaticity of per-firm demand. Finally, suppose that in the absence of trade in this industry the price of the good it produces would be the same in both countries.

Under perfect competition, allowing trade in this industry would have no effect. With Cournot competition, however, this is no longer the case. If trade is opened, each firm will become part of a larger, more competitive market. It will see itself as facing a higher elasticity of demand, leading it to expand output. Thus industry output will expand, and the price will fall. If the countries are , as described, symmetric, welfare will rise in both due to the reduction in the monopoly distortion. Interestingly, this effect need not be associated with any actual trade in either direction. It is potential foreign trade, which changes the slope of the demand curve, rather than the actual trade flows which exerts the pro-competitive effect.

The possibility of gains from trade due to increased competition has been understood for a long time. It was emphasized in particular by Caves(1974). Early analyses usually assumed however that the move was from pure monopoly to perfect competition; only with the work of Dixit and Norman (1980) was the more reaonable case of a movement from more to less imperfect competition considered, at least formally.

Why should there be only a limited number of firms in the industry? The obvious answer is the presence of some form of economies

of scale internal to firms. Once we allow for this, however, it becomes an obvious possibility that the increase in competition due to trade may leave firms unable to charge a markup on marginal cost sufficient to cover their average cost. The result will be exit. Dixit and Norman develop a simple example in which they show that the effect of opening trade in a Cournot market is to lead to a world industry which has fewer, larger firms than the sum of national industries before trade, but in which competition is nonetheless increased. Thus the opening leads not only to a reduction in the monopoly distortion but also to an increase in productive efficiency. Once again, it is the potential for trade rather than the trade flows themselves which do the good work.

The pro-competitive effect of trade is not exactly a scale economy story. It goes naturally with such a story, however, precisely because decreasing costs are the most natural explanation of imperfect competition.

B. Market Segmentation and Price Discrimination

At the beginning of this paper we suggested that trade can always be explained as being due to the combined effects of two motives for specialization, differences between countries and economies of scale. Remarkably, the Cournot approach has actually led to the discovery of a third possible explanation for trade -- although arguably not of

equal importance in practice. This is the possibility that trade may arise purely because imperfectly competitive firms have an incentive to try to gain incremental sales by "dumping" in each others' home markets.

The seminal paper is by Brander(1980). The model envisages an industry consisting of two firms, each in a different country. These firms are assumed to be able to choose separately their deliveries to each national market, and to take the other firm's deliveries to each market as given. Suppose that initially there were no trade in this industry. Then each firm would act as a monopolist, restricting deleveries to the market to sustain the price. There would then however be an incentive for each firm to sell a little bit in the other's home market as long as the price there exceeds the marginal cost. This process will continue until, with symmetric firms, each firm has a fifty percent share of each market.

If the markets are separated by transport costs, the outcome will not be so extreme. Nonetheless, it is shown in Brander and Krugman(1983) that even with transport costs there may be "cross-hauling": two-way trade in the same product. What sustains this trade is the fact that each firm sees itself as facing a higher elasticity of demand on its exports than it does on domestic sales, because it has a smaller share of the foreign than the domestic market. This means that the firm is willing to sell abroad at a smaller markup over marginal cost than at home, making it willing to absorb the transport

cost on foreign sales. Indeed, it is this difference in perceived demand elasticity which drives the determination of the volume of trade: the equilibrium market share of imports is precisely that which makes exporters just willing to absorb transport costs.

This theory of seemingly pointless trade, which is described in Brander and Krugman as "reciprocal dumping", is related in important ways to the traditional industrial organization literature on basing point pricing and cross-hauling (Smithies 1942). What the new models make clear, however, is that despite the waste involved in transporting the same good in two directions, trade can still be beneficial. Against pointless transport costs must be set the increase in competition. Indeed, if there is free entry and exit of firms, it can be shown that the gains from "rationalizing" the industry and increasing the scale of production always outweigh the waste in transport.

C. Summary

The application of Cournot-type models to trade theory leads to new and important insights about international trade. Papers using the Cournot approach have had a fundamentally different orientation from those using the Marshallian or Chamberlinian approaches. Instead of focussing on economies of scale and treating market structure as a supporting player as best, this literature has treated imperfect

competition as the protagonist and used economies of scale mostly as an explanation of the existence of oligopoly.

The payoff from this shift in emphasis is substantial. A new source of potential gains from trade is identified -- namely, the effect of trade in increasing competition (and, if it induces exit, in "rationalizing" production). More surprisingly, a new cause of trade is also identified: interpenetration of markets because oligopolists perceive a higher elasticity of demand on exports than on domestic sales.

The major importance of the Cournot approach, however, lies outside the scope of this paper. This is its versatility and flexibility for the discussion of trade policy. The models we have described under the headings of Marshallian and Chamberlinian approaches mostly depend on the assumption that trade reproduces an integrated economy as a way to make the analysis tractable. Tariffs, quotas, subsidies inevitably break this perfect integration, rendering these models unsuitable. The Cournot approach, however, does not have this problem, and has led to a rapidly growing literature on trade and industrial policy under imperfect competition.

IV. Conclusions

A. What we have learned

Intellectual progress is often hard to perceive. Once new ideas have become absorbed, they can seem obvious and one begins to believe that one always understood them. The ideas that trade can be caused by increasing returns, and that increased scale is a source of gains from trade, are sufficiently simple that the memory of how little these ideas were appreciated even five years ago is fading fast. Thus it is probably worth restating what we have learned.

A few years ago it is probably fair to say that when international economists thought about the role of increasing returns in trade at all, they implicitly thought in terms of a 2x2 model in which one sector is subject to external economies. In this approach scale economies appear as a modification or distortion of comparative advantage, rather than an independent source of trade. The effect of increasing returns is to make it likely, other things equal, that large countries will export goods subject to scale economies. One can find many writings in which the view is taken that this effect is the only possible role of increasing returns in international trade.

What we have now moved to is a far more satisfactory view in which increasing returns are fully integrated into the trade model rather than grafted on to the Heckscher-Ohlin model as an afterthought. The new approaches allow us to understand clearly that decreasing costs are an independent source of both trade and gains from trade, and to have a clear vision of a trading world in which

both increasing returns and differences in factor endowments drive the pattern of specialization and trade.

This shift in view was initially largely brought about by the introduction of new models of imperfect competition into trade theory. With some perspective, however, we can now see that the details of these models are less important than might have appeared at first. What is really crucial for the new view of trade is not so much the particular model of market structure but a change in modelling strategy. The key breakthrough has been a willingness to ask different questions, and be satisfied with a somewhat different answer than we were used to.

Traditionally, trade models have given us a precise description of the pattern of trade in goods. In models where there are important increasing returns, however, a characteristic feature is the existence of multiple equilibria. What we have learned to do is essentially to learn to live with multiple equilibria, by focussing on models where a good deal can be said without requiring that we know the precise pattern of specialization and trade. By concentrating on resource allocation rather than goods production; by looking at trade in embodied factor services rather than in the precise goods in which these factor services are embodied; by noting that it may be more important to be able to show that production will be concentrated somewhere than to say where it will be concentrated, we are able to bypass the complexities that led trade theory to avoid discussion of increasing returns for many years.

To answer a question by changing it is not something to everyone's taste. The payoff here has, however, been remarkable: by what in retrospect seems a minor shift in emphasis, we have greatly enlarged the range of phenomena which our theory can encompass.

B. What needs to be done

The theory of trade under increasing returns is not a finished product. Much work still needs to be done, especially in three areas. These are the following:

(i) Dynamic models: In the real world, many of the advantages of large scale probably take the form of dynamic economies, whether in the form of learning effects or fixed-cost-like R&D. The problem is that dynamic competition in oligopolistic markets may be quite different in character from what static models would suggest, and needs to be studied.

(ii) More realistic models of competition: Not much need be said here. The external economy approach is clearly unrealistic in assuming perfect competition; the Chamberlinian approach relies on fundamentally peculiar cross-restrictions on technology and utility; the Cournot approach is surely far too crude.

(iii) The unreproduced integrated economy: Assuming that trade reproduces the integrated economy does wonders in simplifying the analysis. Now we need to edge our way back into a consideration of

what happens when it does not, especially because of trade barriers and transport costs.

These theoretical extensions are important and needed. What we need even more, however, is to go from qualitative theory to numerical applications. This has always been difficult in international trade. The new work on trade makes it even harder, because once we are no longer assuming perfect competition and constant returns we need far more information to model behavior. In fact, we probably need a whole new methodology for empirical work, possibly mixing case study evidence and even interview results with econometrics and simulation techniques. Still, now that we have an elegant theory, this is the obvious next step.

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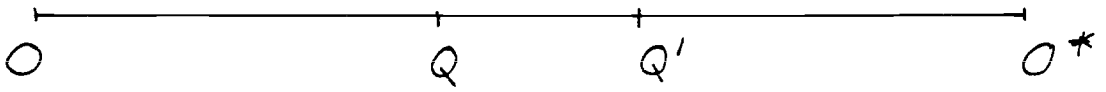


Figure 1

Figure 2

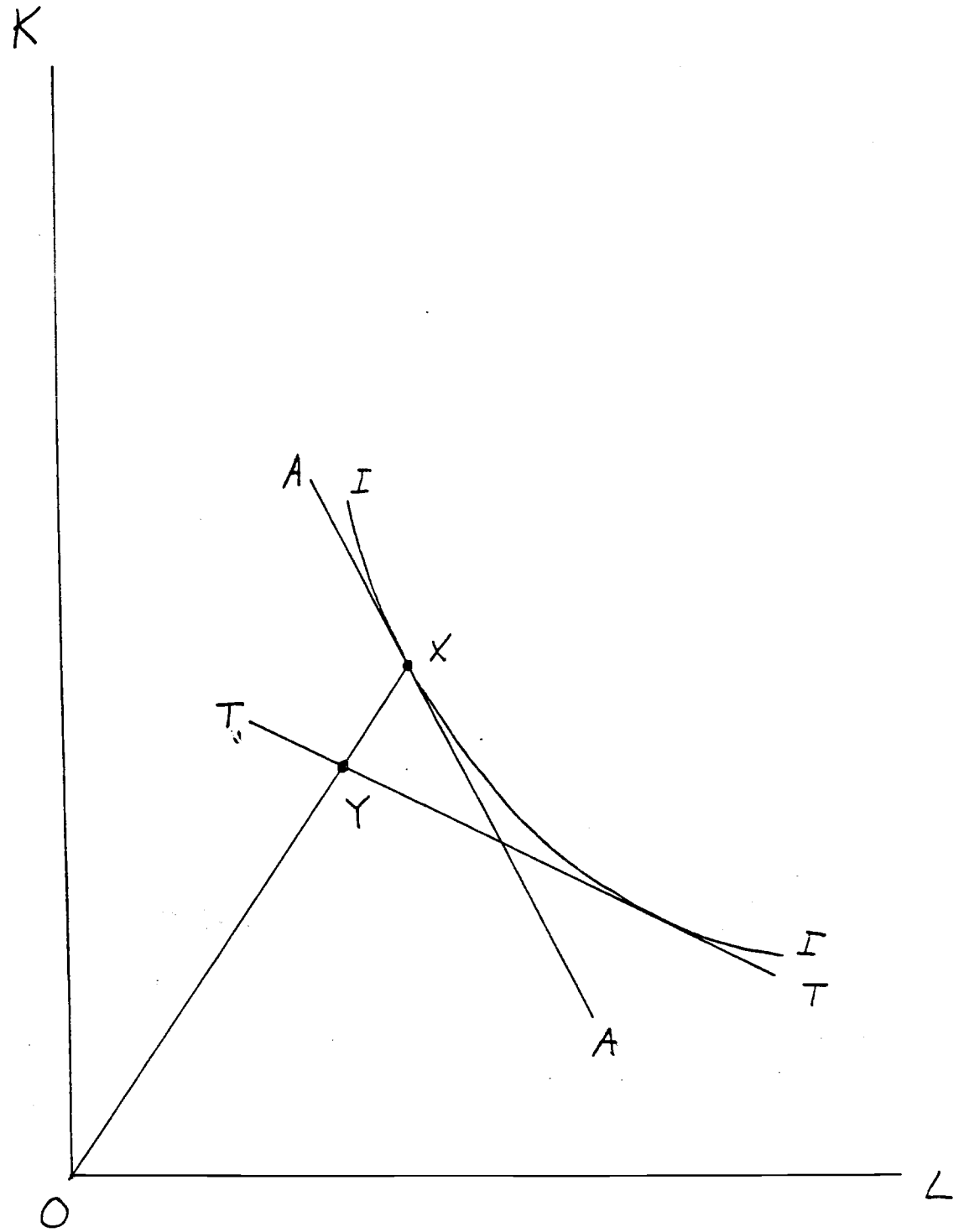


Figure 3

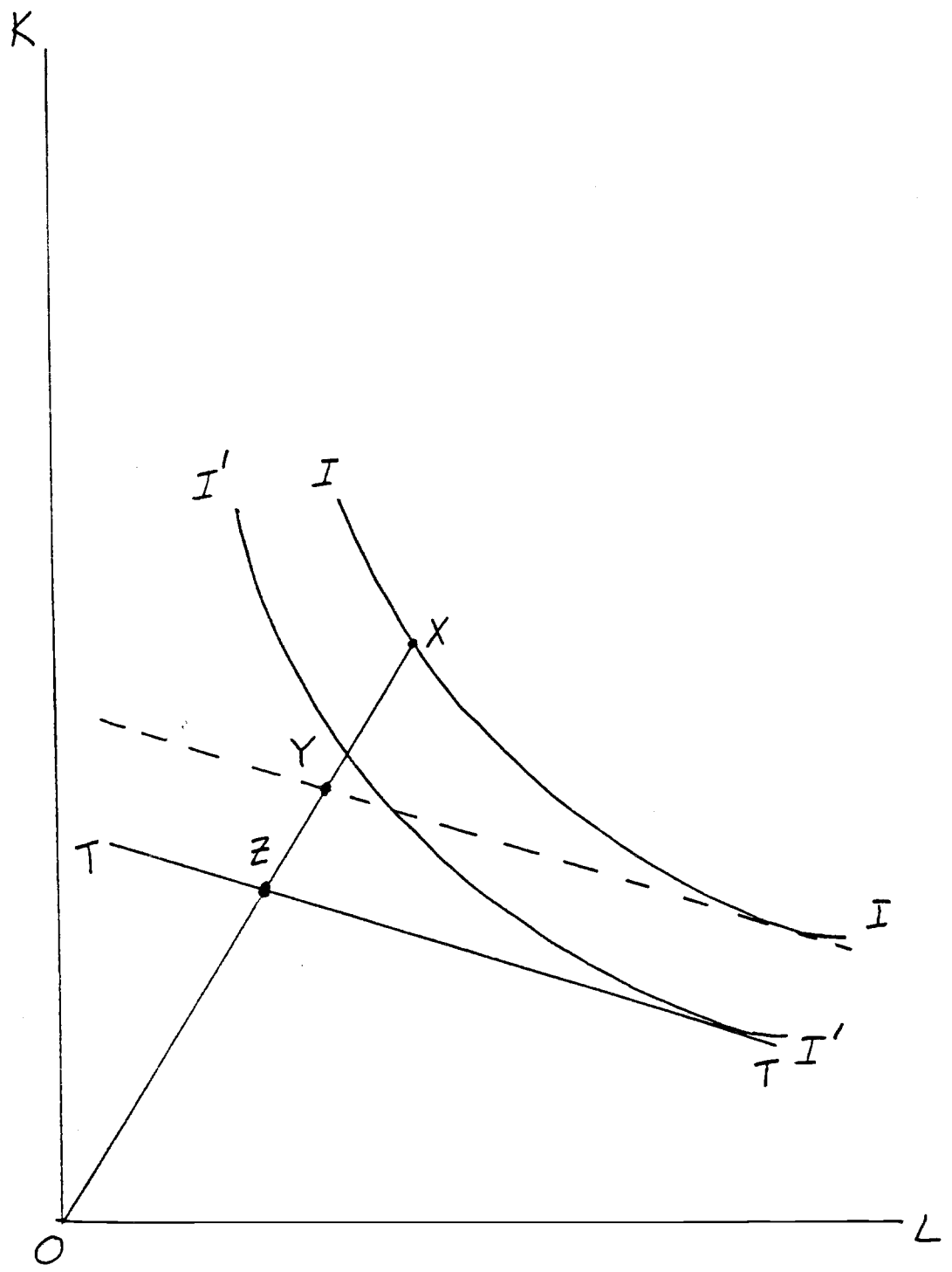
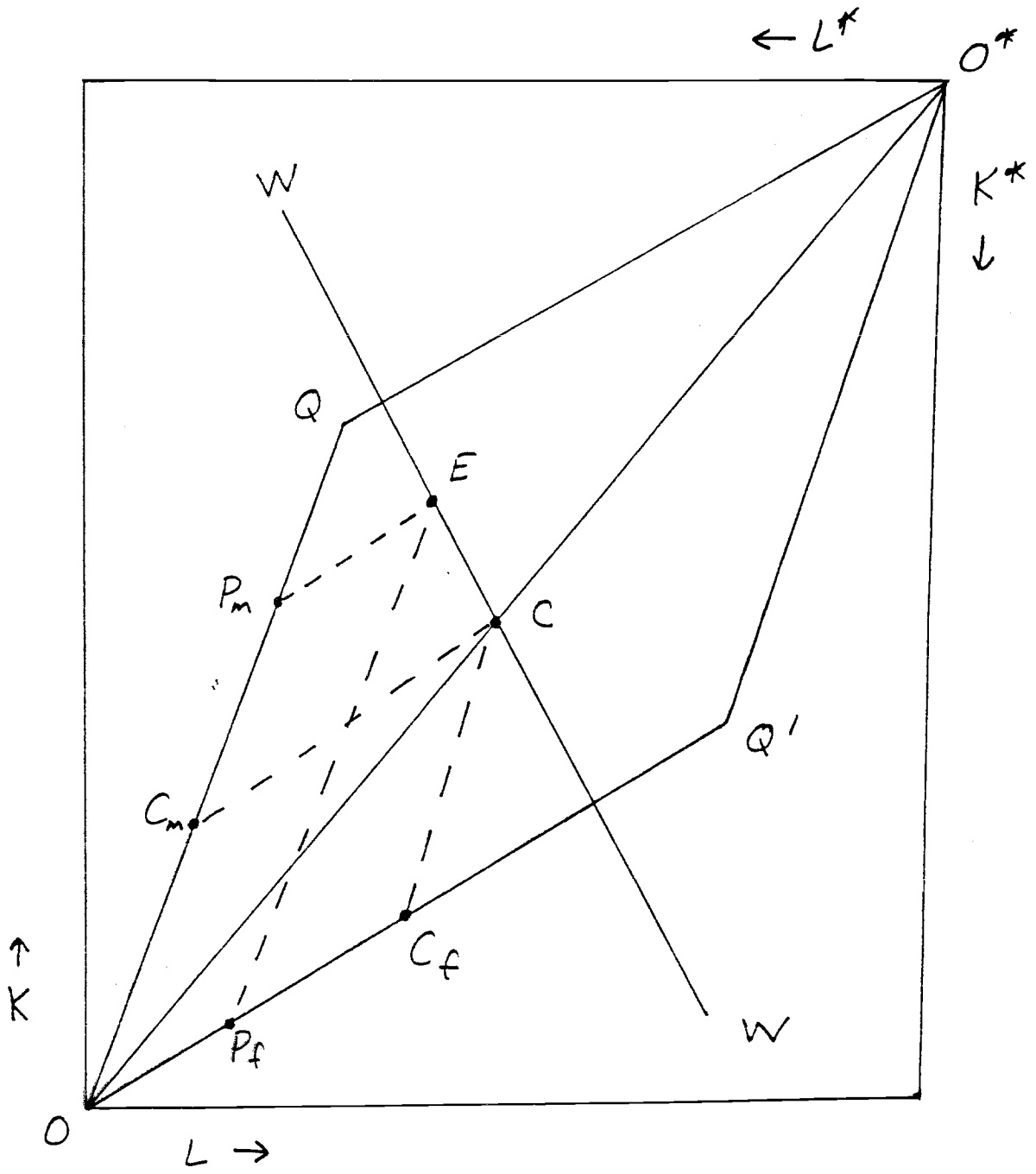


Figure 4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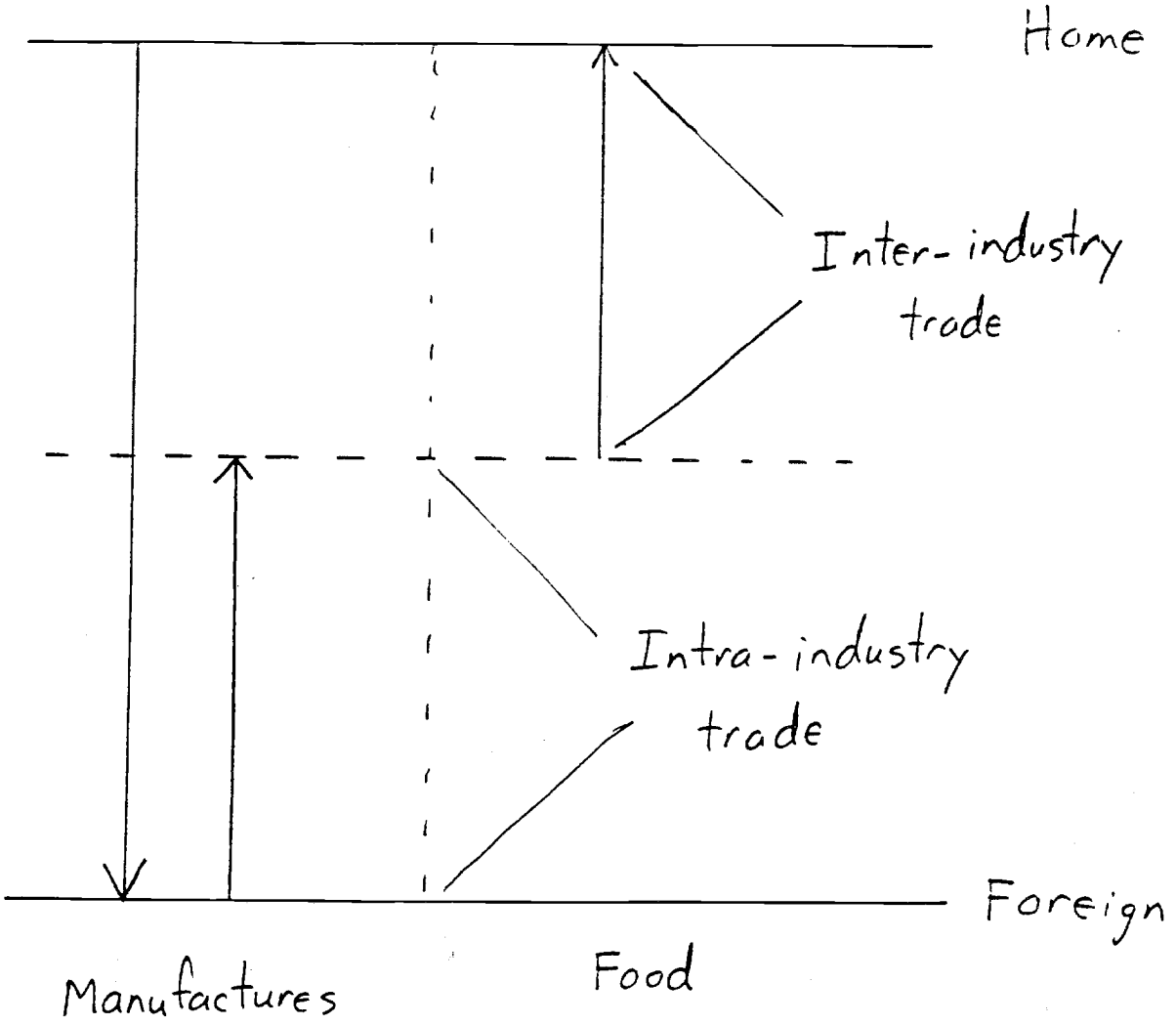
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Figure 6