

# Globalization and the Fragmentation of Production

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In recent years there have been many signs of globalization—more open trade, increased levels of foreign investment, *etc.* One feature is that production processes that in the past have been vertically integrated with all production taking place in one locale have increasingly become fragmented, with more labor-intensive production blocks located in countries with lower wages. These outsourced production blocks need to be coordinated by service links of the form of transportation, communication, and various kinds of knowledge. Increasing returns are primarily found in service link activities, and the paper shows how these promote greater degrees of fragmentation of production as income levels rise and trade becomes less impeded. I also show that a developed country that has some unskilled labor-intensive blocks outsourced abroad may not experience a fall in the unskilled wage rate.

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## I. Introduction

I have chosen for the topic of my talk an aspect of globalization. The world's press is full of references to globalization—the extent to which international trade and investment have served to unite most countries of the world, bringing them into a widespread trading network. Recently these connections have borne part of the blame

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for the so-called "Asian Crisis" that included South Korea as well as other "Asian tigers" and Japan. In the United States there are cries from labor groups and politicians that globalization is responsible for the relatively poor performance of unskilled wage rates in the past couple of decades. On the positive side, in the 1970's, 1980's and early 1990's some countries (mostly here in Asia) that were earlier classified as less developed achieved steady high growth rates in large part by following policies aimed at promoting exports instead of earlier failed policies (e.g. in Latin America) pursuing "import-substitution." These latter measures sealed countries off from the benefits of more open trade and condemned consumers to high prices and outputs to be tied to the sluggish growth of local demand.

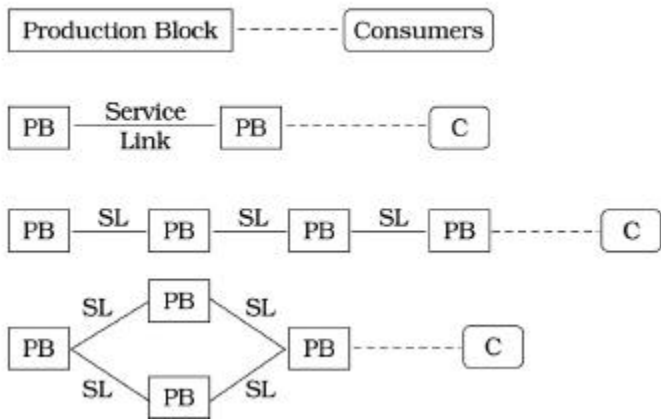
High volumes of international trade, even relative to growing levels of world incomes, are not a new phenomenon. In this century such trade volumes were already high early on, but two world wars and a severe depression reduced trade levels substantially, and it is only at the end of the century that the figure is in the range of much earlier levels. There is a difference, however, in the nature of production leading to such trade. Increasingly, international trade is taking place not in final consumer products, but in intermediate goods, raw materials, producer goods, and goods in process. This reflects the growing degree of international fragmentation in the production process, a phenomenon that allows previously integrated production processes to be separated out into various component parts, with some of these being "outsourced" to other countries. A few years ago a study was made by the Wall Street Journal of the extent of such international outsourcing in the American automobile industry. Parts are obtained from many other countries, so that almost no truly "American" automobile is made. However, which brand of car was made with most parts locally produced in the United States? The answer was surprising, for it was not Ford, or Chevrolet or Chrysler—it was Honda. Of course countries in Asia have long been familiar with such international fragmentation in the electronics sector, or in textiles. In my remarks I wish to explore some of the reasoning that a co-author of mine, Henryk Kierzkowski of the Graduate Institute of International Studies in Geneva, and I have been pursuing in our researches of the past decade.

## II. The Role of the Service Sector in International Fragmentation

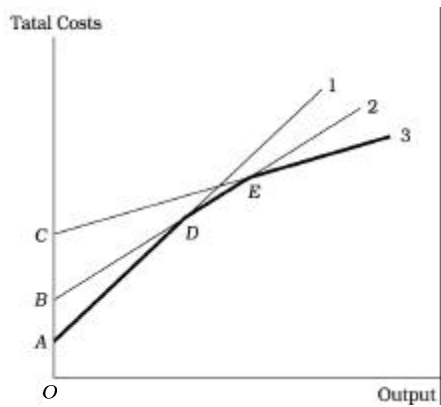
When Kierzkowski and I started work on our project the Uruguay Round of trade negotiations under the GATT was taking place, and one of the key questions had to do with the role of services. Items such as telecommunications, transportation, and banking were not covered by the earlier tariff-cutting rounds and economists were asking themselves about the differences between those commodities that were covered and service activities. Much emphasis was placed on the role of services connecting producers and consumers, *e.g.* the activities of lawyers and doctors. Our point of departure was to consider the role of services within the production process.

Figure 1 helps to illustrate what we had in mind. Consider a firm producing a commodity at relatively low levels of output in a single location. That is, suppose all output activity takes place within a production block. Admittedly some service activities are included, such as the use of the telephone to contact suppliers, *etc.*, and certainly service activities are required to market the product to consumers. As the firm expands its output, increasing returns to scale, of the type envisaged two centuries ago by Adam Smith, become a possibility. Smith emphasized the importance of specialization and division of labor, whereby, say, two separate plants could be utilized, thus allowing a reduction in the marginal costs of production. For example, automobile batteries could be produced in one location and tires in another. However, extra costs must be incurred to co-ordinate these two production blocks and to provide transportation and communication between them. These we label the costs of service links. Such costs may primarily be of the fixed costs variety, whereby further increases in outputs do not cause the costs of the service link to increase by very much. Figure 1 illustrates that as output levels expand, further fragmentation of the production process can be contemplated, perhaps not even in a linear fashion.

The comparison among the total costs involved in various stages of fragmentation is illustrated in Figure 2. Lines 1, 2, and 3 represent costs at increasing degrees of fragmentation. There are fixed costs of production even utilizing a single production block, such as OA. A switch to a more decentralized production process



**FIGURE 1**  
THE PRODUCTION PROCESS



**FIGURE 2**  
VERTICAL FRAGMENTATION

would be encouraged once output level  $D$  is reached, with higher costs of co-ordinating service links ( $OB$ ) matched by the lower marginal costs of allowing a finer division of labor along line 2. Line 3 is taken to represent the possibility that further fragmentation spills across national borders. On the one hand, productivities, wage rates and land rents tend to differ more across nations than within, so that production blocks that utilize labor in different degrees can be outsourced in locations where costs are lower. However, there are admittedly greater costs of the service links required to connect production blocks in more than one country, and these are indicated by the greater height,  $OC$ . The process suggested in Figure 2 illustrates how expansions in incomes and the scale of output can result in a greater reliance on activities in the services sector and lower marginal costs of production.

If international fragmentation takes place, does this occur under the umbrella of a multi-national corporation? Perhaps, but not necessarily. Instead, the greater knowledge and experience that has been accumulated about conditions in other countries may encourage arms-length transactions whereby the market is utilized between firms. Furthermore, the existence of a greater variety of potential suppliers in world markets makes firms less nervous about the possibility of "being held to ransom" by a single foreign supplier. On the other hand, especially in periods during which technical change is rapid, a firm may be anxious to keep its activities fairly private so as to ensure that its techniques are not imitated, and on these grounds it may prefer to keep the various production blocks under its own direct control.

### **III. Causes of International Fragmentation**

What are some of the reasons why there has been a significant increase in the extent of international fragmentation? Here I consider briefly some of the more important causes:

(1) There have been great increases in levels of production and output, and, as discussed earlier, these scale changes prompt a finer and finer division of labor in order to take advantage of relatively low wage rates for more labor-intensive production blocks and relatively low rents on land and capital in countries in which

these factors are available at low cost and intensively used in production blocks.

(2) Technical progress has lowered the costs of service links. This is probably the major cause of increases in international fragmentation. Consider telephone costs. In the past few decades these costs have been dramatically reduced by the introduction of wireless connections and satellite technology. And the costs of making international calls have been cut by relatively more than calls within a country. The use of FAX machines, electronic mail and the internet have allowed instant communication between agents anywhere in the world at virtually zero cost. These are all part of the "revolution" taking place in internet technology, computers, and telecommunications.

(3) Countries such as the United States have lowered or abolished regulations in some service sectors, such as airline transport. European regulations in telecommunications make it easier for mobile phone users to cross country boundaries than is allowed by regulations in the United States. There is pressure in a number of countries to deregulate banking restrictions. In addition to internal loosening of controls is the increased willingness of countries to reduce barriers to international trade in services, to allow greater foreign penetration into local communications, banking and transportation.

(4) In addition to the moves to deregulate in some of the service activities is the lowering of costs and prices associated with greater competition. This greater degree of competition is spurred not only by rising output levels but also by the accession of more countries into the world trading community.

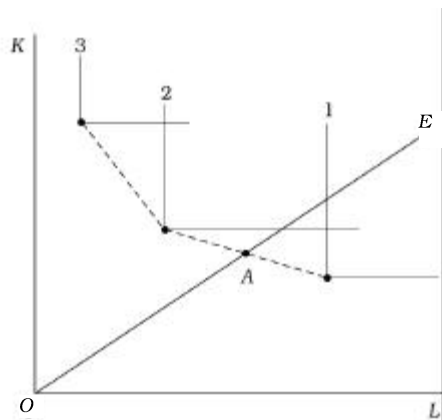
(5) Vertical fragmentation does not just take place in individual sectors of the economy. Technical progress in, say, the communications service link spreads to encourage international fragmentation in a number of sectors. As well, as fragmentation does take place, the individual pieces or types of technology used are revealed to have application in more than one sector. That is, individual production blocks may have more similarity between sectors than would the original fully integrated production activity. What this

suggests is that further technical progress could be made in such blocks to make them even more similar, so that “one size fits all.” A primary example, of course, is in the computer chip sector. Chips were originally designed for use in computers and produced in that sector. Now they are produced in a separate sector and used in a variety of other sectors from autos to toasters. Thus not only does technical progress stimulate fragmentation, but fragmentation is a stimulus to further improvements in technology.

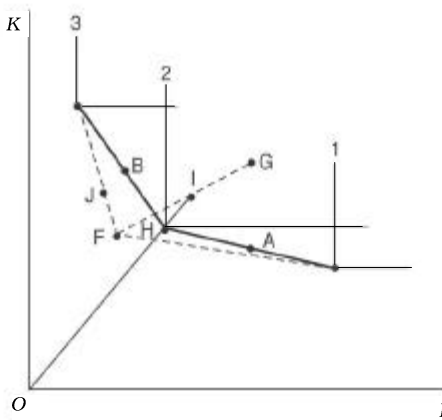
#### IV. Consequences of International Fragmentation

I turn now to some of the potential consequences of international fragmentation. To aid in this discussion I employ a kind of diagram often used to describe trading and production possibilities for an economy producing for the world market. In Figure 3, I have displayed a set of three isoquants for commodities 1, 2, and 3. For convenience these isoquants exhibit rigid technologies—there is for each only a single technique using capital ( $K$ ) and labor ( $L$ ) whereby a given quantity of output can be produced. I assume that in this initial situation all three commodities have a given world price and that the quantities shown have a value of exactly \$1 on world markets. Furthermore, I have drawn straight line (dotted) chords connecting the possible production points, and points on these chords represent allocations of capital and labor between two of the commodities, and their sum is worth exactly \$1. Thus if the country's endowment (supply) of capital and labor is in the proportions shown along ray  $OE$ , point  $A$  would show how \$1 worth of aggregate output is produced in this country, with a fairly even split between commodities 1 and 2. The inner broken-line locus thus shows combinations of capital and labor that will produce \$1 worth of output at world prices. It is called the “composite unit-value isoquant.”

To keep matters simple I shall now assume that (off-stage) there has been some technological improvement in the world such that previously integrated production of the second commodity now results in the possibility of world trade in two separate production blocks, labeled  $F$  and  $G$  in Figure 4. (That is, inputs of capital and labor shown by points  $F$  and  $G$  could each yield \$1 in world markets by producing each of the fragments.) Further to simplify, I



**FIGURE 3**  
A COMPOSITE UNIT-VALUE ISOQUANT

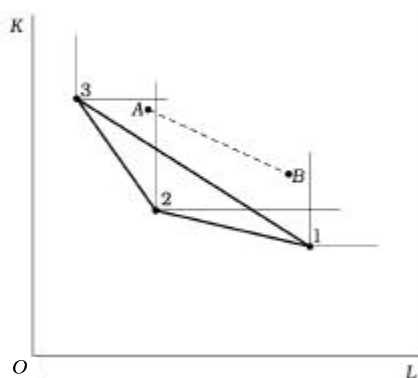


**FIGURE 4**  
THE POST-FRAGMENTATION COMPOSITE ISOQUANT



assume there are no costs of assembly, so that the world now trades just in the separate fragments. The country being portrayed is assumed to have a comparative advantage in producing the capital-intensive fragment,  $F$ , and a disadvantage producing the labor-intensive fragment,  $G$ . That is, relative to productivities in other countries, the home country is not very good at producing the labor-intensive fragment. I further assume that the prices that must be paid to obtain these fragments are such that the convex combination shown by point  $I$  is further removed from the origin than is initial point,  $H$ . The significance? The ratio  $HI/OH$  represents the relative drop in the price of commodity 2. The price fall is a reflection that fragmentation has allowed greater competition in the world market place, with countries now able to specialize more intensively in one fragment or another.

Assuming other commodity prices do not change, it is clear that this country is better off as a consequence of fragmentation. This is reflected in two ways. First, the post-fragmentation composite isoquant, the broken dashed line with a corner at  $F$  in Figure 4, lies closer to the origin, so that in general it takes less capital and labor to earn \$1 on world markets. Second, the price of commodity 2 has gone down for consumers. However, the composite isoquant need not improve after fragmentation. Figure 5 illustrates a situation in which the post-fragmentation unit-value isoquant (connecting points 1 and 3) is inferior to the original isoquant (the broken line 321). What has happened is that fragmentation, and the ensuing greater competition among countries for the separate fragments, has resulted in such a drop in price that the home country can be competitive in neither fragment. An analogy might be useful. Suppose that you get an award when you graduate from university for having the highest grade point average in your class. As you stand at the podium to receive your award, you glance at other members of your class and realize that in every single course that you took there is someone out there who has received a better grade than have you. But each of these classmates also did relatively badly in some other courses. It is because you did relatively well in all classes that your average is the highest. If, instead, separate prizes were given for each course you would be part of the audience. Even though the post-fragmentation composite isoquant in Figure 5 (the chord connecting 3 and 1) is inferior to the earlier 3-2-1 isoquant, if local consumers are heavily biased in their tastes

**FIGURE 5**

A POST-FRAGMENTATION LOSS

towards consumption of the second commodity, fragmentation may yield net benefits for the country.

This diagrammatic illustration of possible gains to a country from fragmentation can also be utilized to discuss the possible impact on the local distribution of income. In the United States there has been much local concern about the fate of unskilled workers relative to that of skilled workers. Adding more productive factors to the “capital” and “labor” inputs already shown makes the analysis somewhat more complicated. To get the point across it is easier to think of the “capital” label as now referring to “human capital.” The slope of the composite isoquant then indicates the ratio of unskilled wage rates to skilled wage rates. For example, consider the situation shown in Figure 3: The ray, *E*, indicating the endowment ratio of skilled to unskilled labor, cuts the isoquant at point *A*, and the slope of the isoquant there is the relative wage of the unskilled. If the country were able to accumulate enough human capital so that it ceases to produce the first commodity and instead produces commodities 2 and 3, the relative unskilled wage rate would rise.

Turn, now, to Figure 4. Suppose endowments are such that initially the country produces a combination of commodity 1 and integrated commodity 2, with \$1 worth of the mixture indicated by

point *A*. After international fragmentation becomes possible, and the country loses its ability to compete in world markets in the labor-intensive fragment, *G* (but does produce the capital-intensive fragment, *F*, along with commodity 1), the relative wage of the unskilled is lowered. This is the scenario feared in some countries, *viz.* that the loss of an unskilled labor-intensive fragment will harm less skilled workers. But Figure 4 suggests that this is not the only possible outcome. Indeed, consider the case of a more advanced economy, initially producing commodities 2 and 3 in proportions shown by point *B*. After fragmentation \$1 worth of world output could be produced with the input bundle shown by point *J*, revealing an increase in the relative and real wage rate of the less skilled. This example is cited to emphasize that the oft-feared outcome of a lowering of the wage rate of unskilled workers if international fragmentation results in the loss of some unskilled labor-intensive activities is not the only one possible. It can easily be seen that at point *J* in Figure 4, more unskilled labor is now employed in the more skilled-intensive fragment, *F*, than was initially employed in integrated activity 2. The effects of globalization on the internal distribution of income are not as obvious as sometimes seems.

## V. Concluding Remarks

In this discussion I have touched on some of the aspects involved as the greater degree of international fragmentation affects real incomes between and within countries. Let me conclude with a few remarks about possible consequences for government policy in the nation state.

One big advantage to developing countries is that as production processes become more fragmented, they may be able to compete in producing some parts of a previously integrated process in which they did not have a comparative advantage, and thereby acquire skills and knowledge about new techniques. The theory of comparative advantage establishes that any country will have some activities in which successful exports can be established, but there is no guarantee that such activities include those in which foreign inputs and sophisticated technology are involved. International fragmentation makes it more possible for parts of such production

processes to be spread around to low-wage less developed areas.

Most governments consider that part of their mandate is to monitor, regulate and control the economic activity of their citizens and residents. This becomes more difficult to do in an age of increasing fragmentation and globalization. The process of development in open economies involves a continual gaining of comparative advantage in some activities and losses in comparative advantage in others as capital accumulation takes place and wage levels rise. Agents that lose in this process will attempt to enlist government aid to minimize such losses and to prevent their industries from dying. This may take the form of trying to control imports of competing goods and foreign investment. In today's markets with greater international mobility of inputs there may as well be the problems posed for governments when industries try to leave the country to establish themselves elsewhere. One aspect of the recent "Asian Crisis" is the revealed speed with which capital can move from country to country, and some countries, such as Malaysia, have resorted to controls to make such movement more "sticky." But underlying all this is the challenge to national governments when their borders become more porous as economic agents can leave the national jurisdiction if more tempting locales are available elsewhere. These forces may lead to more competition among national governments in attempting to attract private economic activity. But they may also lead to solutions such as those found in the European Union where governments attempt to "harmonize" taxes and regulations. Some argue that this is another word for "collusion." There is no doubt, however, that the lowering of costs of international fragmentation of production processes has made it easier for economic activity to arrive and depart any particular national jurisdiction, and this creates dangers as well as opportunities for national governments.

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