1. International Trade and Agglomeration: An Alternative Framework
2. International Fragmentation and the New Economic Geography

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In the vast array of fields in economics, international trade and economic geography should be neighbors sharing similar interests and preoccupied with a strongly overlapping range of issues.
However, one could say that the scientific telescopes of each specialization had been trained for a long time in different directions. This state of isolation could not last and either an international trade economist would discover that commerce, within or across countries, involves geography; or a geographer would have observed that trade is one of the best examples of spatial displacement.

Paul Krugman was the first to seize the connection in a 1991 Journal of Political Economy paper and has been running with the main idea ever since.
Other trade economists soon saw a new opening and a way of enriching their discipline.
Having “discovered” geography, international trade economists had no hesitation telling economic geographers how their field really should be structured and developed.

As in the case of the “new” trade theory, the breakthrough in the “new” economic geography has come from the application of **increasing returns** to scale, especially in the context of monopolistic competition utilizing the functional form (made famous by Avinash Dixit and Joseph Stiglitz, 1977)

Increasing returns to scale could not alone do the trick of re-orienting the field of economic geography; in addition to increased realism, **transportation costs** have been called in to give the new models an increased complexity in order to generate interesting results.

There is an evidence showing that the global economy does not consist of a single core or even a limited number of centers and peripheries. Instead, the world economy becomes an increasingly, even though not evenly distributed, complex industrial structure spanning not only individual continents but the entire globe. International production networks have emerged in **a manifold of industries and products**: sports footwear, mobile phones, cars, clothing, computers, and furniture to name only a few. While there obviously are agglomeration forces operating in some areas, dispersion of economic activities is also a fact of life. One of the consequences of dis-agglomeration manifests itself in a rapid expansion of international trade in parts and components.

The empirical study by Francis Ng and Alexander Yeats (2001) shows this new phenomenon for East Asia. Between 1984 and 1996 East Asian imports and exports of manufactured components **grew annually between 2 and 3 times as fast as imports and exports of traditional production**. It is highly probable that the trade in parts and components also trumped intra-industry trade.

It has been estimated by Yeats (2001) that recently about 30 percent of global manufactured goods trade takes the form of trade in parts and components. Corresponding numbers for the 1950s and 60s do not exist, but they surely must have been very small indeed. It follows that growth of intra-industry trade must have been outpaced by a new type of trade associated with dis-agglomeration.

The phenomenon of international production networks and trade in parts and components reinforces the importance of transportation costs stressed in the new economic geography.
But what kind of transportation costs - producers-to-consumers or **producers-to-producers**?
It must be the latter in a world where production of a pair of jeans can be broken down into 24 stages and allocated among Pakistan, Mainland China, Hong Kong and Malaysia with more than a dozen border crossings being executed before the final product is shipped off to consumers.
Are producers–to-consumers transportation costs so important as to neglect producers-to-producers transportation costs?
It would seem likely that the industrial landscape generated by our theoretical models look different depending upon which transport links are brought to the fore of the analysis.
Authors claimed that we should advance other explanations of phenomena arising in the common grounds shared by two neighbors – economic geography and international trade.

Two Alternative Scenarios
Authors seek for whether economic growth is accompanied by a greater degree of agglomeration or, instead, by a spread of productive activity or dis-agglomeration.

They leave out of account the question of costs involved in having produced final goods reach the consumer and, instead, enquire about the possibility of breaking an integrated
production process into separate **fragments** that could be located in other areas or other countries. In asking about links among producers instead of between final producers and consumers we also dispense with the need for utilizing the Dixit-Stiglitz utility function to express taste patterns for consumers facing an array of differentiated final goods.

In each of the two alternative scenarios they compare the costs of producing a final commodity when an integrated production location (or firm, IF) is used *as opposed to* having the production process split into two fragments located in different regions or countries, perhaps produced by two different firms.
If such a split occurs, costs of production (neglecting transport costs or other coordinating service link activities) are lowered since it is possible to select locations such that factor prices and/or factor productivities are for each fragment more suited to factor proportions in that fragment.

Regions in which labor is relatively inexpensive are used for the more labor-intensive fragment. For example, Nike, in making sports apparel, does the design work in the United States but outsources almost all the actual production activity to firms in Asia. Likewise, the Swedish furniture firm, Ikea, early on sent its actual production activity to Poland and used its Swedish labor force to design the individual pieces.

In both Figures 1 and 2 final output, Y, is shown on the horizontal axis and a pair of total production cost loci are drawn, labeled IF when all activity takes place in a single location with one firm, and OF (outsourced fragments) when the costs in the two separate fragments are added up (production costs only). These two fragments provide the appropriate balance of necessary output for any value of Y.

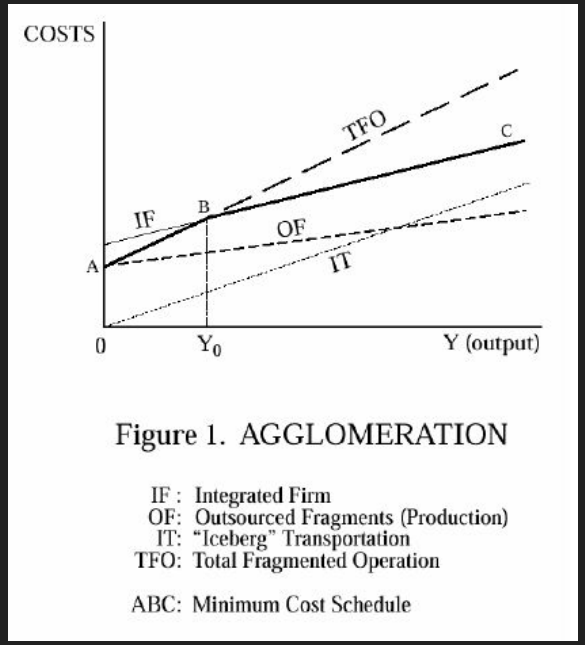

Figure 1. AGGLOMERATION

IF : Integrated Firm
OF: Outsourced Fragments (Production)
IT: "Iceberg" Transportation
TFO: Total Fragmented Operation

ABC: Minimum Cost Schedule

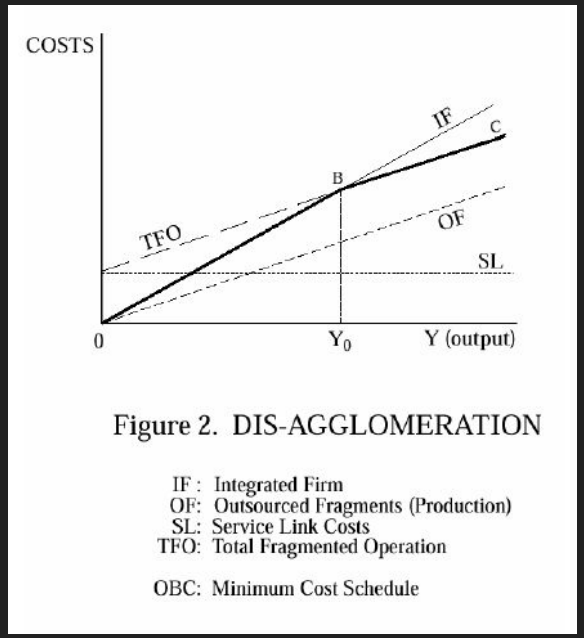

Figure 2. DIS-AGGLOMERATION

IF : Integrated Firm
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SL: Service Link Costs
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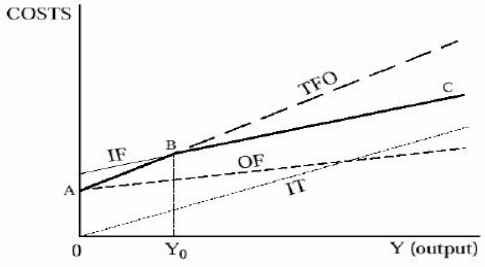
OBC: Minimum Cost Schedule

If production is split between two fragments located in different areas, these fragments must be brought together and coordinated, thus incurring extra costs of transportation, communication, and obtaining knowledge of where best to locate the fragments.
These service link costs tend to be higher if fragments are located in different countries than if they are merely placed in different regions of a single country. Where Figures 1 and 2 differ is in the kind of activity in which increasing returns are found.
Figure 1 characterizes our version of the assumptions made in the Fujita, Krugman and Venables model, in which increasing returns are found within production blocks. The simple way of modeling such increasing returns is to combine fixed costs (along the vertical axis) with constant marginal costs (shown by the slope of the total cost curve), leading to the rising IF and OF loci in Figure 1.
Note that with two regions from which to choose, the costs of production along OF are everywhere lower than along the IF-locus if production is positive.
Following their treatment we assume that the entire costs of linking the two fragments together is in the form of transport costs between fragments where the so-called iceberg model of such costs is used.



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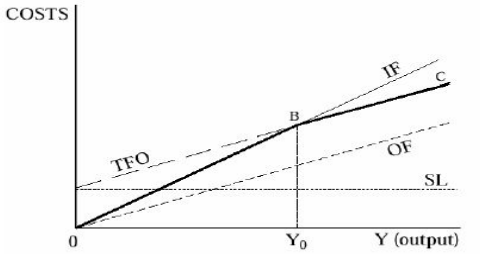

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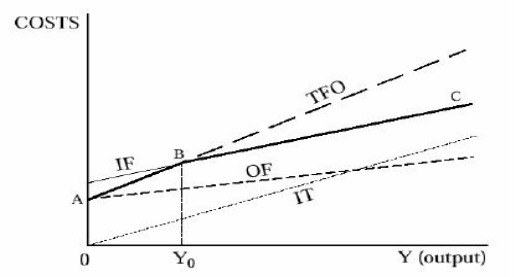
In that scenario, a unit of output exported from one locale will arrive at a different locale diminished in size, much as part of an iceberg would melt if transported from one region to another. The crucial aspect to notice is that this makes transportation a constant-returns-to-scale activity – doubling the output transferred between locations will double the loss eaten up in transport. There is no doubt that such an assumption is useful in avoiding separate activities whereby factors of production are combined to produce the services of transportation. However, it introduces a form of service link in Figure 1 not matched in Figure 2's alternative. The TFO (total fragmented operation) costs are found by adding the OF locus to the ray from the origin representing transportation costs.



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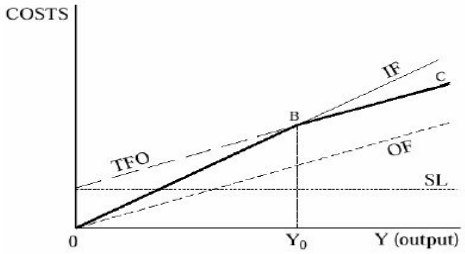

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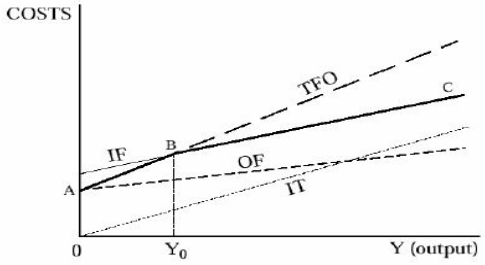
In the alternative portrayed in Figure 2, constant returns to scale are assumed both for the integrated production block (IF) and for the costs (production only) of the combined activities for the separate production blocks (OF), which are lower because each fragment is located in an area in which there is a better match among factor prices, technology, and factor proportions. Service link costs are required in order to co-ordinate the outputs of the separate fragments, and we make the extreme assumption that all such costs are constant regardless of the scale of activity. Thus the TFO cost schedule is a shifted-up version of the OF locus.

In each diagram the cost of the best mode of production is shown by a broken heavy line, with the break appearing at output level Y0 . Do larger scales of output encourage or discourage agglomeration? The contrast between the two scenarios is striking. In Figure 1, the characterized version of the Fujita, Krugman and Venables model with iceberg transportation costs, disaggregated output in two locales is appropriate for small levels of output, up to Y0. Up to this point the costs of connecting the two fragments by incurring transport costs are outweighed by the benefits of lower marginal costs in each fragment, but for higher levels of output it pays to combine all output in an integrated production block subject to increasing returns to scale and thus to obviate the need to pay for transportation. By contrast, in Figure 2 it is a large scale of output (greater than Y0) that encourages dis-agglomeration. With increasing returns found in the service link activities (including the costs of transportation), it pays to outsource the originally vertically-integrated production process into two fragments in different locales especially well-suited to their factor proportions.



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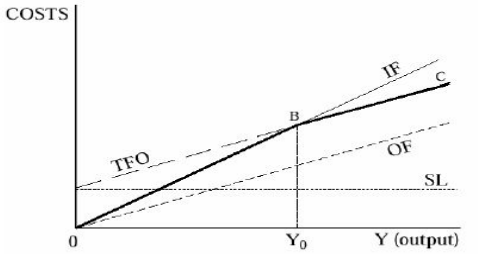

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Fragmentation May Encourage Agglomeration and Growth

In the last slides it was suggested that greater levels of output in an industry tend to encourage a fragmentation of a vertically-integrated production process, with outsourcing reaching even beyond a nation's borders. Suppose such a process is taking place not only in a single sector but also in many industries world-wide. Then it is possible to argue that fragmentation may provide a stimulus to subsequent agglomeration at a global level!

Suppose that in a number of industrial sectors economic growth, technical progress, increasing returns in connecting service-link activities, and deregulation efforts have all conspired to promote a fragmentation, both locally and internationally, of production processes. We assume that some of these fragments more closely resemble each other in an inter-industry comparison than do the original integrated activities. This encourages further technical progress serving to make such fragments even more uniform and useful in a number of different sectors of the economy.

Furthermore, the overall techniques of production (or factor proportions) of such fragments may be rather similar. All this serves to encourage an agglomeration of a new industry producing such fragments for a wide array of sectors both locally and internationally.

Increasing Returns and Technology in Service Link Activities

Where are increasing returns to be found? The crude assumptions that we have made is that they are found exclusively in the service link activities that facilitate a coordination of fragmented production blocks as opposed to constant returns to scale within such blocks. We need not rely on such a stringent dichotomy. Instead, we would argue that the kind of economic activities that are most often associated with increasing returns are ones in which economic information is gathered, where financial aids to trade are obtained, where shipments are insured, where communication between locations far apart are required, and even where transportation activities are involved.

Although some service activities are found within production blocks, it seems difficult to find strong evidence of increasing returns in actual production. In a relatively recent estimate of production functions in the United States, Susanto Basu and John Fernald (1997) have come to the following conclusion: “A typical (roughly) two-digit industry in the United States appears to have constant or slightly decreasing returns to scale” (p. 249) and furthermore “most plants and engineering studies find essentially constant returns to scale.”

Conclusions

Both “old” and “new” geographers have cited many reasons why economic activity is not spread uniformly within a country or, indeed, among countries. Despite the standard economic doctrine of diminishing returns, many reasons can be cited for a “bunching up” of productive activities and residences. Individuals desire to consume services and products difficult to obtain in thinly settled communities (theatre, variety in shopping malls, proximity to friends and relatives, etc.) and externalities are provided by the co-existence in one locale of productive activities requiring inputs of labor of similar skills.

In the “new” economic geography, exemplified by the recent book by Fujita, Krugman and Venables, increasing returns in production and transportation costs of the Samuelsonian “iceberg” variety between consumers and producers are important ingredients in the analysis of agglomeration.

In their models, consumer behavior is explicitly modeled with the aid of the Dixit-Stiglitz utility function allowing a love of variety among commodities of the same general type, leading to a Chamberlinian form of monopolistic competition. At the outset of our paper we have taken liberties with this setting, concentrating instead on the costs of connecting fragments of a production process that can be outsourced, perhaps to other countries, and leaving final consumers aside. The crucial issue is where are the increasing returns found – on the factory floor (i.e. within the production unit) or among the services required to link disparate fragments of the process.

Conclusions (countinues)
Recent decades have witnessed profound productivity improvements in service links, whether of the transportation variety or in other service activities. The changes in communication costs have probably been the most significant in lowering the service costs required to co-ordinate spatially separated production fragments. We have argued that such changes have encouraged dis-agglomeration both in the modified Fujita, Krugman and Venables scenario as well as in our model of international fragmentation.

A melding of the two strands of argument concerning agglomeration was suggested in that international fragmentation of economic activity, promoted by larger scales of output and technological progress reducing the costs of service links, may lead to a subsequent agglomeration of fragments from different industries, fragments that nonetheless require similar relative quantities and qualities of productive inputs. This can eventuate in a re-alignment of the location of production, with encouragement for further technological progress and externalities that serve, as well, to promote economic growth.

Thanks

https://www.youtube.com/watch?v=o_LterrT_Fw

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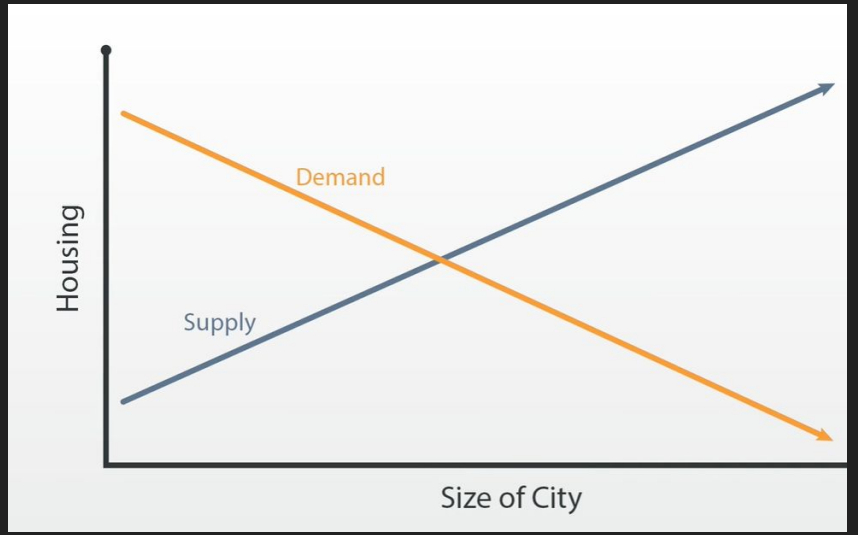

2. International Fragmentation and the New Economic Geography

Ronald W. Jones
Henryk Kierzkowski
2003

2 decades ago, Peter Neary (2001) remarked that, “Economic Geography has come of age.” Several years later we witnessed a newly published volume by Richard Baldwin and associates (2003), and 4th volume of the Handbook of Regional and Urban Economics.
Most of this literature pays special tribute to the pioneering article and book by Paul Krugman (1991a, 1991b), as well as Anthony Venables (1996), and the detailed book, **The Spatial Economy**, by Masahisa Fujita, Krugman and Venables (1999).

This book pays special attention to the so-called Core-Periphery model laid out in the earlier Krugman contributions, and to the central issue in this body of theory, i.e. the phenomenon of agglomeration of economic activity. Much of the effort in newer articles and chapters, including the Neary survey, is devoted to coming to grips with
problems presented by the core-periphery account. As Baldwin, et. al., attest, “**This model ….. has the unfortunate feature of being astoundingly difficult to work with analytically.**” (2003, ch. 1, p.2).

In this paper authors have no intention of adding to these efforts to make the new economic geography analyses more tractable, although we do empathize with the need to simplify the analytics of the issue. Instead, we discuss our alternative framework within which issues such as the agglomeration of economic activity can be understood.

This work, starting with the author's original article in 1990, is supported by the emphasis placed in the theory of international trade on the increasing importance of trade in intermediate goods and goods in process.

Such emphasis is reflected, of course, in the long-standing interest in foreign investment activity. Around four decades ago the importance of international trade in intermediates was recognized by the many contributions to the theory of effective rates of protection. This theory contributed the valuable insight that the production of final commodities often relied on intermediates originating abroad, and that account of such trade should be taken in calculating the effective rate of protection to local productive activity provided by a country's tariff structure.

In an era of intensive international tariff reductions, the theory of effective protection addressed a real-life issue: what is the essential meaning of reductions in tariff walls when industries are interdependent and interconnected in a global economy.

In the early 1980’s the concept of middle products was introduced to incorporate the notion that almost all final commodities make use of a pair of inputs – those available in national markets and those obtained in world markets.

The theory of trade in middle products suggested an explanation of the puzzle by postulating that productive activity within an economy could be separated into two tiers – an input tier wherein labor and natural resources locally found can be combined to produce goods for the world market, and an output tier that combines goods from the world market with local inputs to produce final consumer goods.

The focus of the authors' modeling on fragmentation of production processes is on the possibility of using services to break up a vertically integrated production nexus into separate fragments, which may be located nearby, in the same firm, or at some distance, perhaps in a different country and under the control of different firms. That is, a lowering of the service link costs of connecting parts of a production process may encourage the various parts to be located in geographically separate locales.

Increases in the scale of production might also encourage such fragmentation, for reasons will be mentioned later on. Technically fragmentation could be referred to as outsourcing, although that word is often used to signify removal to a different firm or, in current usage, a removal to a different country. Although in this paper we emphasize international fragmentation, the concept of fragmentation refers more broadly to the possibility that production blocks are separated by distance, which may be within a country. A vertically integrated production process at home might be moved to a foreign locale. This could be termed outsourcing, but it would not come under the rubric of fragmentation.

A crucial difference between the scenario found in the new economic geography literature and that in authors' paradigm of the fragmentation of production processes concerns not the existence of increasing returns, but their location.
In the core-periphery models and variants found in the new economic geography the love of variety embedded in consumer tastes is matched by a symmetric array of producers, each providing a different variety, with markets characterized by Chamberlinian monopolistic competition.
In such equilibria the firm is still at a decreasing cost range of its average cost curve, and this is guaranteed by the assumption that for each firm costs are made up of a fixed cost element and constant marginal costs. (Thus the average cost curve never turns upwards). That is, increasing returns are internal to the plant and firm. Our fragmentation scenario rests on a distinction between production blocks and service links (Jones and Kierzkowski, 1990). In the simplified version of the scenario production blocks may exhibit constant returns to scale. A production process consists of a sequence of such production blocks, which needs to be linked by the services of transportation, communication, and financial inputs.

To these services must be added the general costs of co-ordination and the acquisition of relevant information. In the simplified version of our model these service link activities are assumed to exhibit the kind of strong increasing returns associated with fixed costs that are invariant to scales of output. This makes most sense with communication and coordination activities, but even transportation costs are usually declining with quantities transported. In any case it is in the service link sectors that we assume increasing returns are to be found rather than on the plant floor. And this difference leads to a significant reversal of the view often expressed in the new economic geography literature that increases in the level of economic activity are associated with increased spatial agglomeration of such activity.

The fragmentation paradigm is essentially a dynamic one. We do not attempt to explain why a particular country has the degree of agglomeration of productive activity it has inherited from the past. Instead, we ask what changes can be expected in the pattern of agglomeration by the steadily increasing trend in (i) levels of aggregate income and spending on particular goods, (ii) technological progress in the nature and costs of connecting service links as well as deregulation of service activities both nationally and between countries, and (iii) developments of new technologies for production blocks and the introduction of new products. We take as given that skill levels and productivity of factors of production and other inputs may differ widely from country to country as well as within regions of the same country. Differences in factor endowments and in country regulations and tax patterns often account for the variation in returns to factors found across countries.

Figure 1 is the kind of diagram we have frequently used to illustrate the growth of fragmentation when incomes and demand for output of a product increase. Ray 1 from the origin reveals what the costs of production would be if undertaken in a single production block exhibiting constant returns to scale, while line segment 2 with vertical intercept 0A suggests an alternative process whereby two different domestic locations are selected to take advantage of geographic differences in various factor costs and productivities. The use of these two locations lowers aggregate marginal costs (shown by the slope of A2), but their co-ordination requires service links that are shown by fixed costs, 0A. Such fragmentation only becomes cost-effective if output levels exceed 0D. Line segments 3 and 4 illustrate the increasing possibilities of decreasing marginal costs if a greater degree of fragmentation is introduced with foreign sources enlisted in order to take advantage of differences in international factor prices that lower costs because of differences in factor requirements among the separate fragments. Of course, such international fragmentation raises the costs of connective service links. The integrated minimum cost schedule is shown by the heavy locus, with increases in the degree of fragmentation occurring at output levels D, E, and F. This schedule exhibits increasing returns to scale.

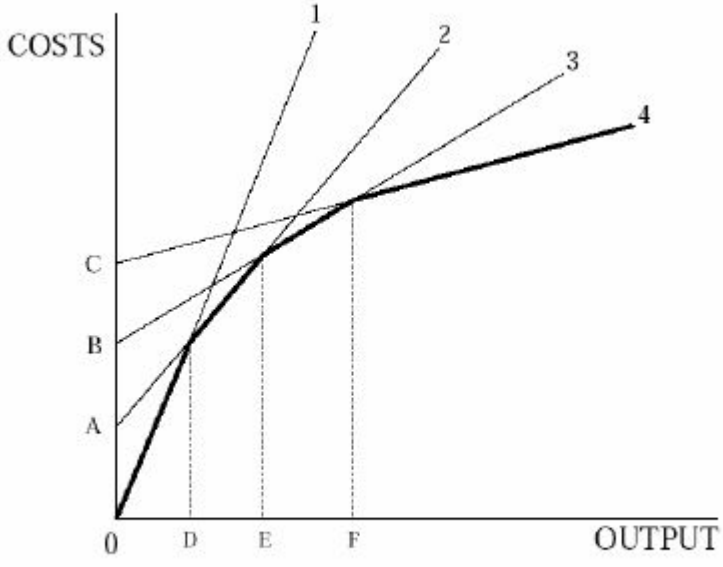

FIGURE 1

We have argued that international fragmentation is best seen in a dynamic context. Apropos of the agglomeration issue, it is possible to argue that increases in the outsourcing of economic activity, whether nationally or globally, may lead to new forms of agglomeration. Production processes when compared across industries often have separate fragments that are more similar from one industry to another than is the integrated whole. That is, fragmentation sometimes leads to a horizontal spread wherein the similarity between fragments across industries promotes technological progress to make fragments even more similar and thus to encourage new forms of agglomeration (Jones and Kierzkowski, 2001). Consider the outsourcing of accounting activities to new firms that may service many sectors. Or, perhaps the most cited case, the use of computer chips not only in computers but also in toasters, laser devices, and in countless productive activities in many industrial sectors.

New economic geography models are becoming popular and indeed can provide much insight about issues concerning the agglomeration and spatial location of economic activity. However, like the proverbial elephant that is being viewed from different perspectives by different observers, the fragmentation paradigm also has much to offer. In a world in which advanced countries are witnessing a reduction in manufacturing activity and a great increase in services, and in which international trade in parts and components is increasing at a significantly higher rate than trade levels generally, much understanding may be gleaned from simple models that stress the importance of service links that provide increasing returns to production processes that spread fragments of the process over several nations.

Thanks