International Trade and Agglomeration:

An Alternative Framework

Ronald W. Jones
University of Rochester

Henryk Kierzkowski*
Graduate Institute of International Studies, Geneva
September, 2003

1. Introduction

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. Alas, 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.

In the event, 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.[1] 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 no doubt that the tools and the analytical machinery developed in the course of the new trade revolution have proved very popular. However, it seems pertinent to ask what purpose is served by applying them to geography. A convincing answer would be that the traditional economic geography framework and the tools it employed were not capable of explaining the existence of some important stylized facts.

Recall that the existence of intra-industry trade and the alleged inability of the traditional trade models to explain this trade, ushered in the "new" trade revolution almost two decades ago. Was there, more recently, a corresponding stylized fact related to economic geography that escaped explanation until the increasing-returns-to-scale artillery was brought in? The question of the agglomeration of economic activities or its opposite could be thought of as requiring proper modeling and explanation. It is not obvious, however, that there is some overwhelming empirical evidence demonstrating clear trends regarding agglomeration (or dis-agglomeration) on a country, regional or global basis. The desire to understand the mechanisms driving these processes may provide sufficient justification for an interest in this subject.[2]

There exists 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 recent empirical study by Francis Ng and Alexander Yeats (200l) 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. The *maquiladora* phenomenon also shows that dis-agglomeration of production takes place in the U.S. – Mexico context. Further north, Canada and the United States had undertaken sharing of production many years ago, especially in the automobile industry. More recently, India has emerged as a powerful attractor for a range of intermediate activities in manufacturing and services. Europe is certainly moving in the same direction.[3]

All in all, 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? Surely 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.[4] 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.

As Peter Neary (2001) has recently commented in discussing the appearance of *The Spatial Economy* (1999) by Masahisa Fujita, Paul Krugman, and Anthony Venables, "New economic geography has come of age." While recognizing its important and numerous contributions, we should advance other explanations of phenomena arising in the common grounds shared by two neighbors – economic geography and international trade.

2. Two Alternative Scenarios

In suggesting an alternative framework for examining whether economic growth is accompanied by a greater degree of agglomeration or, instead, by a spread of productive activity or dis-agglomeration, we alter somewhat the focus provided in the recent work of Krugman and others in order to provide a benchmark comparison. We 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. This function has provided yeoman service in "new trade theory", growth, and political economy in supplying a foundation at the micro level for Chamberlinian monopolistic competition with firms operating in the range in which increasing returns to scale are still found. Increasing returns are essential in our alternative scenario, but they are assumed to take place in what we call *service link* activities such as communication and co-ordination services that are required to establish a functioning network among fragments of *production blocks* that are located in different geographical locations (Ronald Jones and Henryk Kierzkowski, 1990, 2001a). These service activities include (but are not limited to) transportation services, the ones that play such a crucial role in the "new economic geography", albeit assumed there to be of the constant-cost variety. Herein lies a crucial distinction with our alternative: Increasing returns are assumed to reside in service link activities (including transportation) instead of on the factory floor (within production blocks). In section 4 we suggest what empirical work has to say about the nature of service links.

In each of the two alternative scenarios we now present we 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***.

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 chose, 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. (The iceberg analogy was introduced by Paul Samuelson in his 1954 *Economic Journal* discussion of the international transfer problem when transport costs exist.[5]) 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.

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 Y_0. 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 Y_0. 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 Y_0) 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.

In Section 4 we shall dwell more extensively on the nature of the costs of service links, including transportation. There is general agreement that there have been significant technological improvements that have brought about a lowering in the costs of service links. This is especially true of the costs of communication, which now have almost reached the vanishing point. It also holds, to a lesser extent, with the general costs of obtaining information and, as well, costs of transportation between producing regions. The consequences of such downward shifts in these costs in the two alternative settings are profound. In Figure 1, a lowering of the iceberg transportation costs causes the ***(TFO)*** schedule of costs of total fragmented operation to rotate in a clockwise direction

from the initial point on the vertical axis. As a result, the change-over point of output, Y_0, moves to the *right*. In Figure 2, a technologically-inspired reduction in the costs of service links shifts the ***TFO*** schedule downwards, causing the change-over level of output, Y_0, to move to the *left*. The result: In *both* cases the range of outputs in which dis-agglomeration is the preferred mode of production increases. In Figure 1 as output expands the consolidation of production in one location is delayed, whereas in Figure 2 the desirability of fragmented production occurs at an earlier stage of growth.

One of the widely-recognized asymmetries on the international scene is the greater ease of moving commodities and middle products (including physical capital) among countries than it is to move labor. The large international migrations of labor witnessed at the end of the 19th century and beginning of the 20th century seem now a thing of the past, although some migration, both legal and illegal, still takes place. This asymmetry provides the basis for the doctrine of comparative advantage and suggests limits on the degree of international agglomeration that can be expected. Whereas within a country relatively mobile labor can aid and abet a process of agglomeration into a few urban nodes, on a global scale we have witnessed a greater degree of outsourcing of fragments of the production process in a manner reflecting both the Ricardian and Heckscher-Ohlin rationale for the nature of trade. Such dis-agglomeration among countries is encouraged by the increasing returns to scale found in many service link activities as world incomes rise, by the significant improvements in technology in the service area, as well as by a general lowering of regulatory barriers to international trade. With labor relatively immobile between countries, the doctrine of comparative advantage guarantees that no country will empty out as a consequence of the forces of agglomeration.

3. Fragmentation May Encourage Agglomeration and Growth

In the preceding section we have 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!

The argument for such a possibility rests in part on what we have termed the "horizontal aspects of vertical fragmentation" (see Jones and Kierzkowski, 2001b). 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. (Consider the spread in the use of computer chips from computers to a wide range of uses ranging from toasters to automobiles). 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.

The time-honored arguments about labor with certain skills being attracted to a center where a variety of productive activities require such skills seem appropriate in this setting. Alfred Marshall (1890) was an early exponent of the kind of externalities that may emerge when fragments of different industries share somewhat similar factor proportions and types of labor skills are located in the same region. In his words, "The mysteries of trade become no mystery; but are as it were in the air…..Good work is rightly appreciated, invention and improvements in machinery, in processes and general organization of businesses have their merits promptly discussed: if one man starts a new idea, it is taken up by others and combined with suggestions of their own; and thus it becomes the source of further new ideas." This Marshallian view has been picked up by other geographers. Thus, "Economists since Alfred Marshall have argued that cities facilitate the flow of ideas. However, most urban research focuses on the role that the density plays in reducing transportation costs between suppliers and customers (Krugman, 1991). However, Dumais et al. (1997) show that manufacturing firms in the USA since 1970 have not based their location decisions on the presence of suppliers and customers. Instead, firms locate near other firms that use the same type of workers."[6]

These ideas are consistent with a Heckscher-Ohlin basis for trade between countries based on differences in factor endowments and factor requirements in production, even without strong elements of imperfect competition. It would not be difficult formally to model externalities whereby factor productivities in one sector are positively affected by increases in activity of similar factors in other sectors closely related in their input and skill requirements.

The process of agglomeration outlined above presents an alternative to the agglomeration story told by the new economic geography. Perhaps it follows more closely what traditional economic geographers tell us is important. It presents a more complex world in which fragmentation of production results initially in a dispersion of economic activities. However, as a realignment of production patterns takes place within and across countries, the forces of agglomeration once again are in evidence. The addition of these externalities allows the forces of fragmentation and subsequent agglomeration to become engines of growth.[7]

As fragmentation and technical progress take place, the locales in which such pressures for agglomeration occur may change over time. An example of this was provided years ago in Ray Vernon's discussion of the product cycle (1966). At early stages of production a search is under way for the best techniques of producing a new product. In the face of uncertainty, the location of production is guided largely by the existence of labor (and perhaps capital) of a number of different skills. This leads (so Vernon argued) to a locale in an advanced country such as the United States. Eventually things settle down, and a technology requiring relatively heavy use of less skilled labor is formulated. As a consequence, the industry moves to a less developed country in which such labor is relatively inexpensive.

There is another route whereby fragmentation may eventually lead to a greater degree of agglomeration. The international fragmentation of production blocks is only made possible by the use of connecting service links, and it is in these service activities that we have argued that strong increasing returns are found. Just as in the arguments put forth by Krugman and others that increasing returns foster agglomeration, such

agglomeration might be expected within the service sector. Indeed, this seems to be the case in activities such as financial services and insurance. Deregulation should certainly be given much of the credit for allowing more open trade in services, and one of the by-products of international fragmentation and its role in dis-agglomeration is the tendency for activities that provide service links themselves to agglomerate. This is consistent with the observed concentration of many service activities in advanced countries and international outsourcing of production blocks to less developed areas.

4. 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.[8]

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." (p. 263). The evidence from Canadian manufacturing industries provides some support for the opposite view that there are increasing returns to be found in production.[9]

Technological progress in service link activities, including transportation, has been an impressive feature of the past few decades. For example, one can hardly discuss global production without making reference to telecommunications. It is generally accepted that launching telecommunications services involves high fixed costs. By contrast, the marginal cost is miniscule. In a bygone era telephone operators struggled to make speedy connections. Today a user dials a number practically anywhere in the world and is put through immediately. Long-distance transmission of text or images has also become much less costly. Sending production plans from England to Singapore became significantly easier two decades ago with the introduction of Fax technology and DHL. Today it is possible to transmit text and images in living color instantaneously and almost costlessly.

5. Concluding Remarks

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.

If increasing returns are found within each production block, which is our transformation of the Fujita, Krugman and Venables model to consider the outsourcing phenomenon, we argued that if transportation services are required to link two blocks, and if these services exhibit constant returns to scale (as in the iceberg model), larger scales of output will indeed tend to cause production fragments that are initially separated spatially, to agglomerate. However, we also provided an alternative scenario that leads to opposite conclusions, one based on the model we presented initially in 1990. A production process consists of a number of production blocks that can be fragmented and located in different geographic regions of the same country, or can be outsourced to a

variety of countries. The incentive to do so is provided by the different skills or factor combinations required in various fragments and the variety of factor prices and/or factor skills available in different regions or countries. Fragmentation allows a better "fit" for each production block. But extra costs are involved – those of transportation, but also of finance, co-ordination, communication, etc, and we argue that it is in these service link activities that strong degrees of increasing returns and decreasing costs are to be found. To take extreme examples we assumed that production blocks exhibit constant returns to scale, while service link activities are purely of the fixed cost variety, independent of scales of output. This difference in the location of the increasing returns activity is sufficient to lead to the result that eventually as output expands productive activity exhibits dis-agglomeration – a dispersal of productive activity to locations in which Ricardian and/or Heckscher-Ohlin differences among countries provide a better fit for the separate fragments as the scale of production expands.

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.

Finally, we should note that in this, and our previous papers, we have remained relatively silent on such questions as: Will fragmentation take place within the firm or at arms-length in market transactions? Will large firms, possibly multinationals, dominate the process of international fragmentation while small firms are pushed away? These are legitimate and difficult issues, and our silence reflects a lack of comparative advantage.[10]

References

Arndt, Sven and Henryk Kierzkowski, eds., (2001*), Fragmentation: New Production and Trade Patterns in the World Economy*, (Oxford University Press, Oxford.)

Basu, Susanto and John Fernald (1997): "Returns to Scale in U.S. Production: Estimates and Implications," *Journal of Political Economy*, No. 2..

Bennarroch, Michael (1997): "Returns to Scale in Canadian Manufacturing: An Interprovincial Comparison," *Canadian Journal of Economics*, Nov.

Cheng, Leonard and Henryk Kierzkowski, eds., (2002), *Globalization of Trade and Production in South-East Asia*, Kluwer Academic Press, New York.

Dixit, Avinash and Joseph Stiglitz (1977): "Monopolistic Competition and Optimum Product Diversity," *American Economic Review*, 67, pp. 297-308.

Dumais, Guy, Glenn Ellison and Edward Glaeser (1997): "Geographic Concentration as a Dynamic Process," NBER Working Paper # 6270.

Enke, Stephen (1951): "Equilibrium Among Spatially Separated Markets: Solution by Electric Analogue," *Econometrica*, vol. 19, pp. 40-47.

Fujita, Masahisa, Paul Krugman and Anthony Venables (1999): *The Spatial Economy: Cities, Regions and International Trade* (MIT Press).

Glaeser, Edward L. (2000), "The New Economics of Urban and Regional Growth" in Gordon L. Clark *et al*., *The Oxford Handbook of Economic Geography*, (Oxford University Press, Oxford.)

Jones, Ronald W. and Henryk Kierzkowski (1990): "The Role of Services in Production and International Trade: A Theoretical Framework," ch. 3 in Jones and Anne Krueger (eds.): *The Political Economy of International Trade* (Blackwells).

Jones, Ronald W. and Henryk Kierzkowski, (2001a), "A Framework for Fragmentation" in S. Arndt and H. Kierzkowski (2001a).

Jones, Ronald and Henryk Kierzkowski, (2001b), **"**Horizontal Aspects of Vertical Fragmentation" in L. Cheng and H. Kierzkowski (2001b).

Krugman, Paul, (1991), "Increasing Returns and Economic Geography", *Journal of Political Economy*, 99:3, pp. 483 – 99.

Marshall, Alfred (1890), "Principles of Economics" Book Four: *The Agents of Production: Land, Labour, and Capital and Organization*, Chapter 11, "Industrial Organization Continued. Production on a Large Scale" available on the Internet at: http://www.marxists.org/reference/subject/economics/marshall/bk4ch11.htm

Martin, Ronald and Peter Sunley, (1996) "Paul Krugman's Geographical Economics and its Implications for Regional Development Theory: A Critical Assessment" *Economic Geography*, pp. 259 – 292.

Neary, J. Peter (2001), "Of Hype and Hyperbolas: Introducing the New Economic Geography", *Journal of Economic Literature*, June, pp. 536 – 561.

Ng, Francis and Alexander Yeats, (2001), " Production Sharing in East Asia: Who Does What for Whom and Why?" in Cheng and Kierzkowski (2002).

Ohlin, Bertil, Per-Ove Hesselborn and Per Magnus Wijkman (eds.), (1977): *The International Allocation of Economic Activity* (The Nobel Foundation).

Porter, Michael E. (2000) "Locations, Clusters, and Company Strategy" in Gordon L. Clark et al., *The Oxford Handbook of Economic Geography*, Oxford University Press, Oxford.

Samuelson, Paul A. (1952): "Spatial Price Equilibrium and Linear Programming," *American Economic Review*, 42, 3, pp. 283-303.

_____ (1954): "The Transfer Problem and transport Costs: The Terms of Trade when Impediments are Absent," *Economic Journal*, 62, pp. 278-304.

Sheppard, Eric (2001), "How economists think: about geography, for example" in Critical Forum, *Journal of Economic Geography*, 1, 2001. Review of Fujita, Krugman and Venables (1999).

Sunley, Peter (2001),"What's behind the models? " in Critical Forum, *Journal of Economic Geography*, 1, 2001. Review of Fujita, Krugman and Venables (1999).

Urban, Dieter (2001) "The special economy: one new economic geographer's view" in Critical Forum, *Journal of Economic Geography*, 1, 2001. Review of Fujita, Krugman and Venables (1999).

Vernon, Raymond (1966): "International Investment and International Trade in the

Product Cycle," *Quarterly Journal of Economics*, 80: pp. 190-207.

Wan, Henry, Jr. (2001): "Function vs. Form in the Fragmented Industrial Structure: Three Examples from Asia Pacific Experience", in Cheng and Kierzkowski (2002).

Yeats, Alexander, (2001), "Just How Big is Global Production Sharing?" in Arndt and Kierzkowski (2001*).*

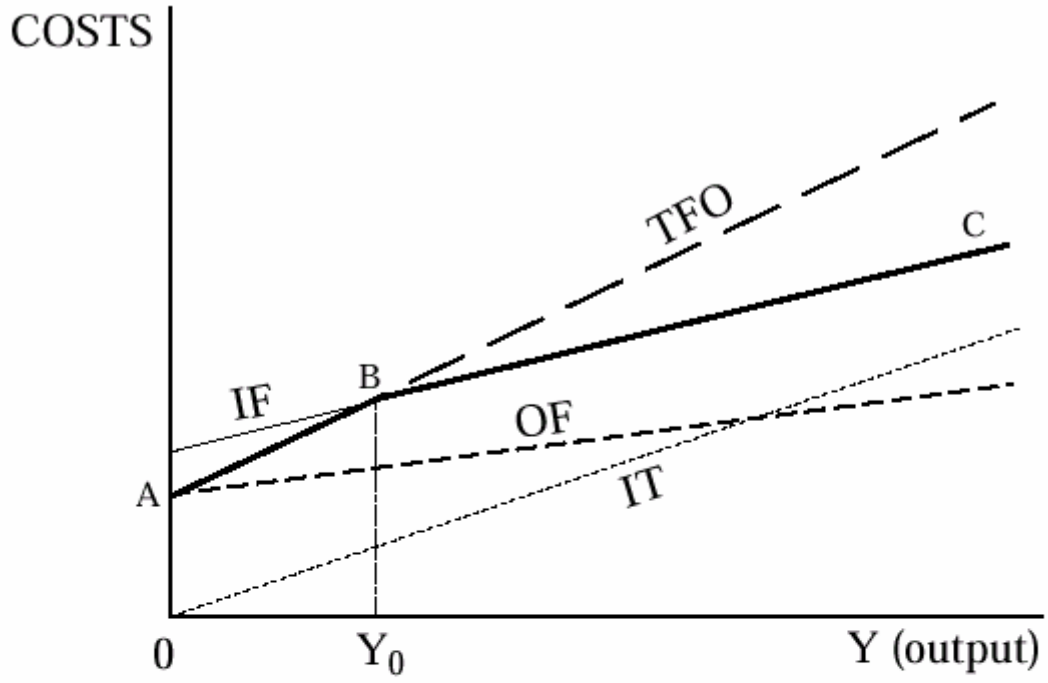

Figure 1. AGGLOMERATION

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

ABC: Minimum Cost Schedule

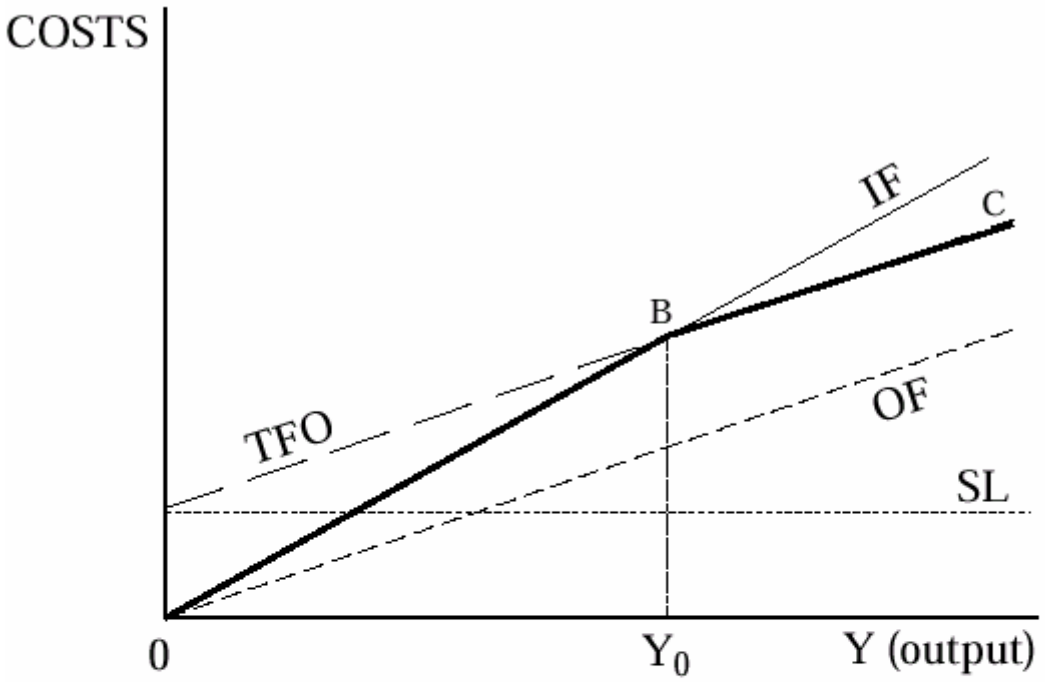

Figure 2. DIS-AGGLOMERATION

IF : Integrated Firm
OF: Outsourced Fragments (Production)
SL: Service Link Costs
TFO: Total Fragmented Operation

OBC: Minimum Cost Schedule

Endnotes

* The authors wish to thank seminar participants in Helsinki and Osaka for valuable comments.

[1] In the economics literature concern over spatial aspects was expressed earlier by Stephen Enke (1951) and Paul Samuelson (1952). Samuelson remarked, "Spatial problems have been so neglected in economic theory that the field is of interest for its own sake." (p. 284). In 1976 a symposium was held in Stockholm, and the Foreward to the publication of the Proceedings (see Bertil Ohlin, Per-Ove Hesselborn and Per Magnus Wijkman, eds, 1977) commented, "A special aim of the symposium was to bring about an exchange of ideas between economists and economic geographers interested in trade and movements of the factors of production." The "new" economic geography has expanded in leaps and bounds. Even reviews of the existing work have become numerous. Among most comprehensive surveys are: Neary (2001), Martin and Sunley (1996), Sunley (2001), Sheppard (2001) and Urban (2001).

[2] One of the critics of the new economic geography models based on the Dixit-Stiglitz approach takes Masahisa Fujita, Paul Krugman, and Anthony Venables, the authors of *The Spatial Economy* (1999), to task: "While such formal modeling may increase the credibility and popularity of the ideas with the economists, it provides no evidence as to their actual empirical significance and their initial assumptions appear mainly to be made on the basis of modeling convenience rather than with any regard to empirical relevance." See Sunley (2001), p. 136

[3] Interestingly enough, the grand project of a supersonic passenger plane, Concord, conceived primarily by the French and British back in the 1960s could have been one of early examples of dispersion of production across Europe.

[4] The *Economist* of December 27th 2002 reports on a rapid growth of logistic companies operating on a global scale. "So what exactly can smart logistics do for companies? One example is TPG's contract with Ford to service its Toronto factory. This plant produces 1,500 Windstar minivans a day. To keep it running virtually round the clock , TPG has to organize 800 deliveries a day from 300 different part makers. Its software must be tied into Ford's computerised production system. Loads have to arrive at 12 different points along the assembly lines without ever being more than 10 minutes late." But TPG is a

traditional freight company. The new type of logistics company, such as Exel, does much more. It is like the chef of an orchestra. The *Economist* continues: "One of Exel's biggest contracts is with Ford, for which it organizes supplies for seven factories around Europe. Exel also works for Volkswagen in its operations in Spain and Mexico. The factory in Puebla, Mexico, turns out 1,400 new Beetles a day. And Exel helps with Nokia's logistics as well, especially in China and South-East Asia."

5 As a matter of fact, Michael Rauscher has pointed out to us that the grand master of economic geography, Johann Heinrich von Thunen, 130 years previously, described how a horse that transports wheat from the country side to a city market eats a fraction of it *en route*.

[6] Edward Gleaser (2000), p. 84. Others expressed similar views. Martin and Sunley (1996) state on pages 285-6, "…one of the most important limitations of Krugman's geographical economics is his stubborn concentration only on those externalities that can be mathematically modelled, and thus his reluctance to discuss the geographical impacts of technological and knowledge spillovers…..the recent geographical literature has begun to assign key importance to technical change and technological externalities in shaping and transforming the space economy…"

[7] For somewhat similar views see the discussion of "clusters" as providing externalities and influences on productivity growth in Michael Porter (2000).

[8] Alfred Marshall (1890) has this to say about transportation: "A ship's carrying power varies as the cube of her dimensions, while the resistance offered by the water increases only a little faster than the square of her dimensions; so that a large ship requires less coal in proportion to its tonnage than a small one. It also requires less labour, especially that of navigation….In short, the small ship has no chance of competing with the large ship between ports which large ships can easily enter, and between which the traffic is sufficient to enable them to fill up quickly.

[9] Michael Benarroch (1997), p. 1084.

[10] For an informed view, consider Henry Wan, Jr. (2001). He uses the concepts of closed and open networks in discussing relations between subcontractors and assemblers. He argues persuasively, with many examples from Japan, Hong Kong, Korea and Taiwan,

that no unique arrangement should be expected to emerge. Which particular organizational structure is appropriate and most efficient to carry out fragmentation depends on the nature of an industry, the existence of information externalities, the speed of response to global transformation by individual firms and the economy as a whole.