THE ECONOMIC GEOGRAPHY OF THE INTERNET AGE

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ABSTRACT

Will the Internet redefine the "core" and the "periphery," creating a new geography, with neighborhoods connected not with streams and roads but with wires and microwave transmissions? An analogy to previous transportation and communications improvements is frequently made today: the transportation revolution of the 20th century permitted the deagglomeration of much physical production, and the Internet will now permit the deagglomeration of the intellectual and immaterial activities of the economy. But this analogy is faulty, and its historical reasoning inaccurate. In this paper, we first point out that at the end of the 20th Century most exchanges of physical goods take place within geographically defined neighborhoods. Previous rounds of infrastructure improvement always had a double effect, permitting decentralization of certain activities while actually reinforcing the attraction of cities for others. This is because all technologies of economic transactions increase the complexity and timeliness of interactions, making possible new forms of variety and differentiation of outputs. This is then reflected in more complex intermediate divisions of labor, or overall *roundaboutness* of the economy. Many of the transactions required by such an economy are dependent on what we call "handshake" interactions, not mere "conversational" interactions, which are the kind made feasible at a distance by the Internet. Hence, the Internet , all the while permitting the further locational deconcentration of certain routinized activities will also participate in reinforcing the need for urban concentration as the principal means to carry out "handshaking" in the complex, variety-based parts of the economy whose development it will encourage.

INTRODUCTION

Economic geography has experienced fundamental changes over the last three centuries. Are we about to experience yet another geographic revolution? Will the Internet redefine the "core" and the "periphery", creating a new geography with neighborhoods connected not with streams and roads but with wires and microwave transmissions?

The economic geography of the 18th century was marked by the effort to find ways to move raw materials from fixed source points to optimally selected production locations where the raw materials could be combined with labor and some capital to make final products. But at the end of the century, home and workshop production were still the rule, and towns and cities were mostly marketplaces and transportation nodes. The problem with home or workshop production is that most of the capital sits idle most of the time – the hammer are scythe are idle when the spade is used(Leamer, 1999). In the 19th century, the growing importance of physical capital in manufacturing created pressures to centralize production in factories where the division of labor allowed capital to operate many more hours during the day. The agglomerations needed to support a fine division of labor were made possible by great improvements in transportation systems – roads, canals, railroads, clipper ships.

Over the 20th century, immaterial/intellectual inputs increased greatly in importance in comparison with raw materials, physical labor and physical capital. Initially, this led to a significant growth in headquarters functions, as intellectual and management activities were internalized within major firms. But as these functions became more and more important in the economy as a whole, they developed into specialized industries in and of themselves. The appearance of specialized firms and industries producing intermediate intellectual outputs went hand in hand with outsourcing of these services on the part of major firms. It is common now to outsource accounting, finance, legal work and even marketing and strategic functions. Since immaterial intellectual outputs can be transported virtually without cost, they are amenable to procurement at a distance - the design in Detroit, advertising in New York and strategy in Chicago. Yet although the clients of these specialized intellectual firms are far-flung, their competitors often are not. These specialized firms tend to cluster tightly together in financial "districts" and downtown office buildings, bringing to mind Wall Street, the City in London, and the Loop.

The phenomenon of agglomeration of producers is quite widespread, in both material and immaterial production. In many manufacturing industries, there are clusters of input producers, who are both clients and competitors. There are cities specialized in rug making, watch making, and automobile manufacture. Why do clusters exist? Localization economies have many sources. For example, shoe retail is clustered to save shopping costs for customers. For material production, there are tremendous transportation advantages to co-location of the different stages in the division of labor – making the frame, the doors and the wheels, and doing the assembly at not too great a distance from each other. For immaterial production, they are strongly related to being at the center of the action, where specialized talent and "buzz" are important to keeping up with rapidly changing outputs (ideas). This is true of certain forms of science and technology-based material production as well: being close to the latest technological information is key to remaining competitive.

The Internet of course does not change the cost of transporting material, and can have little or no effect on those aspects of economic geography that are strongly shaped by transportation costs. The reason for clustering that is most pertinent to our discussion of the Internet is the exchange of ideas or information, i.e. the transmission of messages. Could the Internet fundamentally alter the economic geography of the immaterial? Will the Internet allow the exchange of ideas over long distances and hence undermine the existence of agglomerations of immaterial and innovation-based producers such as Wall Street, Hollywood or Silicon Valley?

Although the Internet offers some important qualitative improvements in communication, the historical laboratory of the 20^{th} century suggests that the fundamental forces which generate economic geographies characterized by agglomeration and regional specialization will continue to matter. Commerce in goods has been very much affected by distance between buyer and seller even with very substantial reductions in the costs of transportation. Likewise, the communications revolution of the 20^{th} century had little effect on the geographical concentration of higher-order intellectual activities. If anything, it seems to be have created even stronger agglomeration of immaterial commerce, concentrating growth globally inside the United States and concentrating growth within the US on a few regions like Silicon Valley, Austin, and Southern California.

The 20th century laboratory does raise an important question. Why did distance continue to matter so much for material and immaterial commerce even with the dramatic reductions in transportation and communication costs? It must be that both trade in goods and trade in ideas require a substantial amount of face-to-face contact. The Internet might have a very significant impact on economic geography if it allowed communication over long distances those messages that historically have depended on physically bringing people together. Unlike the telephone and the television, broad-band Internet communication does promise to allow inexpensive simultaneous real-time interactive visual, oral, data and written messages.

But does such broad band remote communication serve the same purposes as face-to-face communication? Face-to-face communication, we shall argue, derives its richness and power not just because it allows us to see each others 'faces and to detect the intended and unintended messages that can be sent by such visual contact. Co-presence in the same physical space not only improves that visual contact, but goes well beyond it into what we may call "emotional closeness," the basis for building human relationships. The face-to-face communication metaphor therefore needs to be decomposed into two distinct components: the conversation and the handshake. The handshake is the metaphor for physical co-presence, the conversation is the metaphor for simultaneous real-time interactive visual and oral messages. The Internet allows conversations, but not handshakes. We speculate that handshakes will be at least as important in the 21st Century as in the 20th Century. And we note that air and auto transportation technology have done nothing to decrease the cost of handshakes over long distances for almost 40 years. On the contrary, congestion on the roads and at the airports together with the increasing cost of time have added considerably to the cost of handshakes beyond our local communities and have been a force for further agglomeration of immaterial commerce.

LOOKING BACKWARD: COMMERCE AND COMPETITIVENESS IN THE 20TH CENTURY

We may begin by getting some historical perspective on the role of distance in the economy, referring especially to trade among countries since these data are readily available.

Most trade takes place in neighborhoods

The vast improvements in technologies for transacting across space has not affected a basic fact: trade in products has remained largely a neighborhood activity. Most of the value-added in the goods and services that we consume originates very close to home. **Tables 1 and 2** list the top ten trade partners of the United States since 1950. Canada is always number one. Mexico, which is always in the top five, slipped in the 1960s and 1970s because of inward-looking policies which were only partly offset by the rise in petroleum exports. But following the Mexican liberalization of 1986 and the NAFTA agreement, Mexico surpassed Japan as a destination of US exports in 2000 and is edging up to Japan as a source of US imports.

North America is not the only trade neighborhood. **Table 3** indicates the percent of 1970 and 1985 trade between adjacent countries at the two-digit SIC level of aggregation (the data set excludes trade between pairs of non-OECD countries.) The commodities are sorted by 1985 adjacency percentages. Wood is the most locally-traded commodity, by this measure, with 42.4% of trade between adjacent countries. Next is printing and publishing. The long-distance products are at the bottom of this list- apparel, footwear, professional equipment and miscellaneous (toys and umbrellas). Less than 20% of trade in these items took place between adjacent countries.

Also included in Table 3 are the percentages of trade involving island nations (especially Japan and the UK) which cannot have adjacent partners. The third column is the residual which, loosely speaking, is long-distance trade. Over 60% of trade in leather items falls into this long-distance category, and almost as much refined petroleum, tobacco and apparel. But most trade is surprisingly local.

It is not just adjacency that affects trade. One of the great empirical regularities in economic geography is that the greater the distance between any pair of countries, the less they trade with each other. This is measured by what economists call the "gravity model." According to the familiar gravity model of Newtonian mechanics, the force between any two objects is proportional to the product of their masses divided by the square of the distance between them. In economics, the amount of commerce between two points is equal to the product of the economic masses (GDPs) divided not by the square of the distance between them but by distance itself (or some lower power)[1]:

$$Exports_{ij} = a \quad GDP_i GDP_j \,/(DIST_{ij})^{b}$$

Figure 1 illustrates the "force of gravity" on West German trade in 1985. Each point refers to one of Germany's trading partners. On the vertical axis is trade divided by partner GDP: Trade(Germany,j) / GDP(j). On the horizontal axis is the distance between Germany and its partner. Both scales are logarithmic. Distance has a clear effect on the intensity of trade – Germany has close trade links with its close neighbors (France, Austria, Switzerland, the Netherlands etc.) but does not trade much with far-away Asia.

Table 4 uses the estimated gravity model to determine how far apart Belgium and the Netherlands would have to be moved to reduce their trade by 10%, 50%, and 90%, respectively. These countries are adjacent, with only 86 miles separating their economic centers. The first additional "epsilon" of separation is enough to eliminate the adjacency effect. This has a significant impact on trade in many products and is enough to reduce trade by 10% in many of the "local" products.

Commodities are sorted in **Table 4** by the mileage needed to reduce trade by 50%. For metal scrap, it is enough to eliminate the adjacency effect. For wood, the adjacency effect plus 26 miles would do the job. The message of this table is that it requires little distance to reduce trade enormously. A thousand miles is enough to eliminate 90% of trade in most items, though not beverages or footwear or paper products or apparel. But 1500 miles does the job for all commodities. This implies that the

[1] The gravity model was first applied in the early days of econometric analysis by Beckerman(1956) who used the model to study intra-European trade. The gravity model was used also by Poyhonen(1963), Tinbergen(1962) and by Linneman(1966). Recent applications can be found in Leamer(1993, and 1997), in Frankel and Wei(1993), Hummels(1999a)

percentage of trade that manages to cross the Atlantic and Pacific Oceans is really quite small. Trade is principally confined to two neighborhoods – North America and Europe.

Proximity is an important source of international competitiveness

Since commerce declines rapidly with distance, closeness to global GDP is an extremely important source of competitive advantage. Countries that are far from global GDP exchange natural resource products or low value-added manufactures for high value-added outputs and these far-way countries have low levels of GDP per capita. The countries that export high value-added manufactures have high per capita GDPs and are overwhelmingly clustered in Europe and North America.

The dramatic effect that market access has on per capita GDP is revealed by Figure 2 which has a measure of distance to global GDP on the horizontal axis and per capita GDP on the vertical axis.[2] In 1960 only Australia and New Zealand were able to escape the force of gravity – being far away but managing to have a decent GDP per capita. By 1990, two other countries had also escaped, namely Singapore and Taiwan. Except for these, there is a very clear relationship between per capita GDP and distance to markets.

The four anomalous countries in Figure 2 help us raise our question: Do these countries have high per capita GDP's because they have technologies that allow them to form handshakes over long distances (like the British Commonwealth)? Will the Internet facilitate long-distance commerce and help to suspend the effect of distance?

Distance cannot be a simple proxy for transportation and communication costs.

Transportation and communication costs have fallen dramatically. **Figure 3** illustrates the substantial drops in freight charges and airline transport costs since 1930 and the dramatic and continuing fall in the cost of telephone calls. Hummels(1999) estimates that the average freight costs of US imports in 1994 were only 3.8% of import value. These rates do not vary enormously across products and they are not high enough to be an important consideration for most long-distance commerce.

Even though there have been very substantial reductions in the cost of communicating at long distance and the cost of shipping goods, the role of distance remains unchanged. Most commerce takes

[2] See Leamer(1997) for a full discussion.

place regionally, not globally. For example, Rose(1999) estimates distance elasticity of –1.09 with a standard error of 0.05 using 1970 data, and a distance elasticity of –1.12 with a standard error of 0.04 using 1990 data. In other words, in that 20 year period of time the impact of distance remained unchanged, completely unaffected by dramatic communication and transportation improvements.

Intellectual and innovative activities are also clustered

As noted, there are large parts of the contemporary economy which are devoted to generating ideas, knowledge, and management of the rest of the economy. Their immediate inputs and outputs are not physical, but immaterial, and their value-adding activity is primarily intellectual. It is therefore tempting to believe that information and communication technologies (ICTs), and especially the Internet, release this part of the economy from the constraints of distance in general and localization or clustering in particular.

The empirical evidence on this question is much more limited than for goods production and trade, in part because there are no widely accepted measures and readily available data which separate intellectual and informational activities from the rest of the economy. But virtually all the descriptive and empirical evidence we have on their locations suggest that -- at least up until now -- they remain highly, and even increasingly urbanized and located in proximity to GDP. Financial transactions industries are highly clustered in big cities, and especially in the triad of New York, London and Tokyo, followed by about a dozen other large metropolitan areas (Sassen, 1991). A handful of American metropolitan areas concentrate the intellectual and innovation-based industries (Pollard and Storper, 1996; Jacobs, 1960). Such localized clusters in the informational, intellectual, and innovation-based industries have progressively broadened the reach of their contacts -- to other producers in other major localized clusters, and to a widely spread client base -- as is suggested by the parallel growth in long-distance telecommunications and travel (Hall, 1998). This is a geography of highly-packed agglomerations which communicate over long distances, not one of dispersal and indifference to distance or proximity. Will the internet diminish the need for dense agglomerations of intellectual workers and firms?

THE JOINT DETERMINATION OF MESSAGES AND RELATIONSHIPS

ICTs create possibilities for transmitting messages, and in so doing they may affect the kind of relationship the parties require to send and receive a given kind of message. Systems of communication can be characterized both in terms of the nature of the information transmitted and in terms of how senders are paired with receivers. Table 5 captures this notion in summary form. The rows in this column refer to the media: written words, spoken words, images and "presence," the latter referring to senses of touch and smell, as well as sixth or higher senses. The columns refer to the nature of the message, contrasting simple codifiable one-way messages, like a stop sign, to complex context-dependent interactive messages such as the claim that "I love you."

Codifiable information has stable meanings which are associated in a determinate way with the symbol system in which it is expressed, whether it be linguistic, mathematical, or visual. Generally speaking, codified information is cheap to transfer because its underlying symbol systems can be widely disseminated through information infrastructure, thus reducing the marginal cost of individual messages, which in the case of most electronic messages is now close to zero. Acquiring the symbol system may be expensive or slow (language, mathematical skills, etc), as may building the transmission system, but using it to acquire information is cheap.

By contrast, much information is only loosely related to the symbol system in which it is expressed. This includes much linguistic, words-based expression (the famous distinction of "speech" versus "language"), or what might be called complex discourse (Searle, 1969). But this is also true for some mathematically expressed information, and much visual information. In these cases, merely acquiring the symbol system or having the physical infrastructure does not suffice to bring marginal costs of successfully understanding the message down to near zero; in many cases, costs of decoding remain extremely high because other conditions must be satisfied. These are many and varied.

When the formal content of the message is unverifiable and ambiguous, such as the declaration "I love you" or the promise that "You are going to be very happy with this product", the decoding of the message requires trust and context – trust substitutes for verifiability and context allows simple ambiguous messages to communicate complex thoughts.[3] Trust can come from the enforcement options offered by a formal legal system, but the reach of a legal system is impaired by political borders and by ambiguity in the contract. Absent reasonably efficient legal enforcement, trust often depends on reputation effects or on multi-layered relations between the parties to a transaction (Lorenz, 1992) that can create low-cost future enforcement opportunities. Trust also comes from the bonds that both parties establish to guarantee the truthfulness of the message. An important bond is created by the shared costs of co-presence. In a world where time and attention are scarce, copresence is a costly expression of preference that creates mutual indebtedness and that inspires confidence. In contrast, an e-mail declaration of "I love you" is more likely to be a virus then a credible promise of good things to follow. The deep problem with e-mail is that the medium greatly reduces the shared costs of messages, and it makes whatever costs are borne mostly nontransparent. Mass mailings are indistinguishable from personalized messages. Your return receipt only means that I clicked on your message, but you cannot be sure that I have devoted enough attention to it to absorb the content. Here the medium is the message. There is no mutual bond, no credibility.

Further, when the formal content of a message is incomplete, we require dense and multiple understandings of what is being transacted in order to know which of the different possible meanings of the formal content is intended. This usually involves understanding the context from which information emerges: incompleteness is overcome by reasoning through analogy and reading between the lines.

To make our point clear, we suggest separating the "face-to-face" metaphor into two: the "conversation" and the "handshake." We will use the metaphor of the "handshake" to capture communicational relationships suited to messages which involve some combination of uncodifiable tacit information and ambiguity, and hence depend on trust, emotional closeness, shared context, or reputation

[3] The distinction between codifiable and noncodifiable messages is reminiscent of the economics literature on "search" goods and "experience" goods (Nelson, 1970). A "search" good has a transparent value – evident upon initial inspection. An "experience" good has a nontransparent value that is revealed only with experience. Although the economics literature doesn't consider the possibility, an experience good can come with a guarantee that may be both ambiguous and unverifiable. Markets that match faceless buyers and faceless sellers can mediate the exchange of search goods, but the exchange of many experience goods requires trust and long-term relationships. The persistence of the distance effect on global commerce is a symptom of the fact that there are comparatively few market-mediated transactions. Most transactions require long-term relationships.

effects. A "conversation," on the other hand, is an interactive exchange of codifiable information including broadband visual images.

You can have a conversation with a computer, but not a handshake. The Internet is a highly efficient system for the cataloging, accessing and delivery of images such as blueprints and photographs and advertisements. This greatly facilitates the transmission of codifiable visual information. The Internet broadband also promises to support much cheaper teleconferencing which will allow the exchange of some complex context-dependent messages that heretofore were delivered in person. But the Internet does not allow handshakes. Relationships that depend on a high level of trust and shared context for the exchange of uncodifiable ambiguous information are likely to continue to require a significant amount of co-presence.

In addition, the virtual world of the Internet has no neighborhoods, no Starbucks where like-minded people sip coffee. On the Internet there is little possibility of serendipitous handshaking in communities defined by cultural affiliation, language, ideology, desire, mutual identification, and other powerful forms of bonding between people.

Thus to speculate about the emerging economic geography of the Internet age, we pose the question: Will the New Economy be more or less dependent on unverifiable and ambiguous messages, whose transmission the Internet cannot achieve?

THE GEOGRAPHICAL DIMENSION: MESSAGES, PRODUCTION ORGANIZATION AND LOCATION

To respond to this question, two major aspects of the problem must be analyzed: (1) production costs and transactions costs in geographical context; and (2) the effects of more efficient informational transacting on the organization and geography of production.

Transactions costs and production costs in geographical context

In general, economic activity should be located at the place where the combination of production and transactions costs is minimized (Scott, 1988). The two most important aspects of production costs are access to key factors of production (labor, capital, skills, information, natural resources), and the scale of production. Transactions costs refers to the physical and informational linkages between an activity and its production environment: to its labor and product markets; and to upstream and downstream linkages in an input-output system (Williamson, 1985).

Transactions costs depend in part on their geography. Physical transactions over space incur fixed infrastructure costs (building the road) and marginal shipping costs (hauling the product) and marginal time costs (the product spoils enroute) that are influenced by the mode of transport, and the volume (scale) and regularity of the transaction. Informational transactions over space also incur fixed infrastructure costs (laying the cable) and marginal communications costs (talking on the phone) and marginal time costs (the later it arrives, the less valuable the information). There is generally an inverse relationship between these costs and the degree of codifiability of information: Ambiguous unverifiable communications require substantial trust infrastructure and high marginal handshake communication sots.

Physical transactions have two principal dimensions which affect their associated informational transactions: the degree of routinization (linked to volume) and the extent to which information is independent as opposed to being embedded in the physical transaction itself.

Organizational and locational possibilities

Let us consider two extremes of these characteristics, as shown in Table 6. In the left-hand column, there are business activities which have a high scale of output. In general, this is accompanied by a high degree of standardization of the product and routinization of its production activities. This enables simplification of the information required to produce and transact, in the sense that the knowledge and information needed at each step in the process can be codified, set down in blueprints, and hence understood by any sufficiently skilled transacting party.. These characteristics -- high scale, standardization, routinization, and codification of underlying knowledge and information -- generally permit transactions to be carried out over considerable geographical distance. Once "freed up" from requirements of geographical proximity, each part of the production system can then seek out the cost-minimizing locations best adapted to its specific needs.

At the other end of the continuum, consider those activities characterized by considerable uncertainty as to qualities and levels of their output. The sources of such uncertainty in a modern economy are many: the two main sources are naturally fluctuating markets, and rapid technological or knowledge change. They impede standardization of the product and routinization of the production process. They also make it difficult for producers to vertically-integrate the production process. For example, if a clothing manufacturer does not know how fashion will evolve, and therefore what qualities and quantities of output will be needed, it will hedge against uncertainty through subcontracting. In another example of the same forces, if a high-tech firm does not know exactly how the technological state-of-the-art will evolve, it will be reluctant to make large investments in fixed capital. In addition, the innovation process itself generally involves the principle of "many heads are better than one," where access to ideas and talent occurring in other specialized, but closely related parts of the economy, heighten the probability of a successful innovation (Scott, 1993; Duranton and Puga, 2000; Jacobs, 1960; Feldman and Audretsch, 1999). This sort of access is not amenable to codification and routinization. Its unpredictability is precisely its raison d être.

In all these circumstances, there are varying combinations of small-scale, lack of routinization, and cognitive complexity in the informational transactions necessary to carry out the physical transaction. Both types of transaction therefore become relatively expensive on a unit basis. In the case of innovation-based activities, much of the information needed to innovate -- even if it is science- and engineering-based -- cannot be entirely codified, at any cost. Much of it is available only through access to the right persons, often few in number, who are working in a given problem area. Most importantly, transforming this information into economically-useful knowledge involves recombinations and synergies which are often complex and qualitative. Marshall, in writing about the textile districts of Lancashire in the 19th century, alluded to this information-sharing process with his famous phrase, "the secrets of industry are....in the air" (Marshall, 1919). Put another way, these transactional relations are not amenable to complete contracting, and they depend on human relations, involving combinations of social networks, trust, interpretative communities, and reputation effects (Lorenz, 1992). Geographical proximity can become a positive advantage when it enables transacting parties to build networks, trust, common interpretations, and reputations. There are many different forms and scales at which such geographical concentration may be observed, from the tight locational clusters such as are found in the garment district of downtown Los Angeles or the jewelry district in Antwerp, to bigger spaces such as Silicon Valley, or "clustering" at the level of a major region (e.g. the auto parts industry in the Upper Midwest). The precise scale of clustering depends on the nature of the transactions at hand and the technologies and organizational means to carry them out.[4]

REDUCTIONS IN SPATIAL TRANSACTIONS COSTS NEED NOT DEAGGLOMERATE PRODUCTION

Technological innovations in transacting, such as the substitution of the Internet for other means of carrying out transactions, can push the outcomes in both directions in Table 6, one that tends to disperse economic activity but another one that tends to concentrate. First, as transportation and communications become better and cheaper, locations formerly foreclosed become economically feasible and activities are freed to relocate according to a field of redefined comparative advantages. They expand the geographical reach of previously existing, usually standardized, activities. (Arndt and Kierzkowski, 2000; Jones and Kierzkowski, 2000)

[4] Transactions requiring physical co-presence involve a second possible tradeoff: location of the activity versus location of persons caught up in handshake contact, through travel. The need for phyical co-presence can be met either through locational proximity of the activities, or by using another technology of transacting -- transportation -- to bring people together. In fact, over the last 20 years, business travel has grown just about as rapidly as electronic transactions (Hall, 1998). The relative merits of each depend on the quantities of physical co-presence required, the marginal costs in time and transportation of each contact, and the spontaneity, regularity and formality of such contacts. At the moment, we know little theoretically or empirically about the relative merits of, say, occasionally bringing people together and then allowing them to relate via internet and phone the rest of the time, as opposed to giving them the possibility of immediate, low-cost face-to-face encounters on short notice, via geographical proximity.

But the second order changes induced by new transportation or IC technologies may reinforce the power of agglomeration. One of the great parables of modern economics is, of course, that "the division of labor is limited by the extent of the market." (Smith; 1776; Young, 1929, Stigler, 1951). In a dynamic framework, there are important feedbacks between technologies of transacting, and what is made (product differentiation), how it is made (production organization), and the geography of this modified production system. Greater access to suppliers makes possible new combinations of inputs, which, in turn, modify the costs of producing a given kind of final output. Transportation, in other words, can strongly influence the scale and division of labor in production.

There is substantial, if fragmentary evidence of these feedbacks from previous rounds of infrastructure development (Pred, 1966, 1974; Fishlow, 1965; DeVries, 1984; Hall, 1998). Physical transport infrastructures such as the canal system, the railroads, and the Interstate Highway System, and informational infrastructures such as the postal service, the telegraph, and the telephone, have not brought about the end of the urbanizing tendencies of modern capitalism; quite the contrary, they tend to reinforce urbanization (Teaford, 1986). They do this by making feasible the transactions which open up new, specialized sectors in the economy, where time and product differentiation are essential. This in turn heightens the complexity of B2B and B2C transactions in those sectors, and makes face-to-face contact central. It is thus reasonable to assume that the Internet will heighten product differentiation in the economy and re-create new forms of complex transactions, even as it simplifies others and permits further spreading out of routinized activities and contributes to the long-term spread of GDP over wider geographical scales.

Table 7 suggests, by way of examples, this double-edged geography of the Internet age, with its tendencies toward specialization and agglomeration, on the one hand, and spreading out on the other. Three principal organizational effects can be detected (and these effects are not mutually exclusive): increases in product *variety* through *recombination* of inputs; increases in *roundaboutness* of the organization of production, through *disintegration* of intermediate production; and increases in *fragmentation* of connections between purchaser and producer, or what is coming to be known as *disintermediation* of value chains. Greater roundaboutness, leading to persistence of agglomerations, is probable in such sectors as quality and design-driven products, customer-driven manufacturing, parts production, innovation-based manufacturing, new consumer services, entertainment (radio streaming, complex supply chains, links and exchanges between providers), intellectual, research and managerial functions. Greater variety through recombination of more varied inputs which are sourced from longer distances (with more sophisticated and faster integration and inventory control) is likely in many standardized manufacturing markets, designer retail, consumer-driven manufacturing and parts, engineering and conception, new consumer services (customized take-out food, internet-ordered home repair), and intellectual, research and managerial functions. The geography of these new "mass variety" sectors will be determined by whether the input-output relations are conversations or handshakes -- some will be far-flung, others clustered. Disintermediation will come about in such sectors as internet auctioning , consumer banking and finance, medicine, and many services(auction, clearinghouse model). Here, a general tendency toward deconnection of products and markets will be found, but the organizers of such far-flung systems will very likely be located in clusters, and they are likely to earn significant new economic rents.

As can be seen, the ways that a new ITC such as the Internet, interacts with production and its geography are many and varied. There appears to be no single new business model that it creates, but complex feedbacks to specialization and divisions of labor within and between sectors. In general, however, the activities which depend on handshaking and hence on geographical proximity are those which resist full commodification and hence generate economically-significant rents. This was dominated by material production in the age of increasing physical scale and capital-intensity of manufacturing; later, it was dominated by headquarters functions, and in turn by intellectual and innovation-based producers' complexes. We suggest that these latter, far from having lost their lease on life, are experiencing renewed importance on the Internet, through the latter's ability to make possible new specialized divisions of labor in many different activities, and hence to renew the need for handshakes.

The internet economy itself, where the densities of dot.com firms are far higher in such metro areas as San Francisco, New York, Los Angeles, and Seattle than elsewhere in the presumably homogeneous American space is following precisely the same geographical pattern as all of its innovative forebears: the establishment of a small number of core agglomerations, characterized by strong inter-firm and firm-labor market network relations, the existence of "industrial atmosphere," and evidence of circular and cumulative advantage due to the building up of external economies in those places. In general, the larger and more globally-linked metropolitan areas are enjoying stronger economic growth than the economy in general, as they reinforce their positions as centers of economic reflexivity: inventiveness, creativity, the management of non-standardized transactions and parts of production chains, i.e. the functions that steer and guide an increasingly elaborate division of labor in modern capitalism as a whole. Their economies are increasingly comprised of core agglomerations of (1) creative and cultural functions (including industries linked to this, such as fashion, design and the arts); (b) tourism; (c) finance and business services; (d) science, technology and high technology and research; and (e) power and influence (government; headquarters, trade associations; international agencies). The Internet will probably reinforce the roundaboutness of their divisions of labor and hence of the primacy of face-to-face contact, though it will also probably make possible greater linkages between different localized clusters at very long distances. All present signs are that the metropolitan areas that house these activities, which will be increasingly large and internally polycentric, will be the big "global city" winners of the Internet Age, and that these cities will be increasingly interlinked as the sites of these clusters.

The consumer-service oriented economies of these metropolitan areas could grow in important ways. In the last few decades. these city-regions have adapted their economies to the changing lifestyles of urban residents. One of the great growth sectors has been, of course, the food and beverage (restaurant) sector. Take-out is a growth area. Consider the possibilities for the internet to transform the take-out industry into a mass-customized food preparation industry. We will be able to order customprepared meals from caterers, who will have a supply structure (possibly by being located within, or close to, supermarkets), an on-command cooking staff and facility, and delivery facilities. One suspects that there would be net employment growth as a result of these kinds of market changes. Just the logistics end of internet sales (home delivery) might provide considerable employment generation in urban areas, though it is difficult to speculate about its net effect.

But these cities will certainly lose certain other activities. The decades-long tendency for them to shed routine but mobile production activity in the manufactures will now be extended to much routine intellectual labor functions in other industries, notably the service industries. An illustration of this is architectural services. Architectural firms are *currently* outsourcing production of shop drawings to developing countries such as China and cheaper developed countries such as Australia. Typically, a large construction project, once it has an accepted architectural design and goes through initial engineering stages, will be defined through shop drawings. These number from something like 30-50 for an average house, to tens of thousands for a concert hall or big office building. Australia's labor costs are considerably lower than those of the USA. So, many American firms are contracting their shop drawings with Australian firms, and working with them over the net. But China is getting into the act, too. Highly skilled labor in China can be had for $3.00 per hour. At this price, firms in China working for the world market can afford to have big permanent staffs of shop drawing producers and to work at a large scale, whereas their counterparts in the developed countries bring on and lay off such labor on a project-by-project basis. The real possibility exists of a drop of 50-80% in the labor requirements of many architectural firms. Another possibility is simply outsourcing within the home country, with large-scale shop drawing "factory firms" serving downstream architectural client firms.[5] Such outsourcing is likely to generate important employment changes in the most advanced metropolitan areas. Thus, the products of routine intellectual labor may escape the neighborhood effect. Those developing areas that invest heavily in education and research are likely to become sites for the routine intellectual labor that can now be offshored from developed areas, as in the example of architectural firms we provided above.

[5] source: Paulo Tombesi, University of Melbourne, Faculty of Architecture, interview with Michael Storper, January 2000.

The other regions of developed countries, which today are home to routine production (manufacturing) and services (e.g. back offices), and whose main appeal is a combination of lower labor and land costs and good access to home markets, will very likely evidence mixed effects of the Internet Age. On the one hand, they might become the new logistical platform regions for the massive transactional web of goods exchange that the internet will make possible. They would essentially become the physical supports of the producing and consuming economy, which would require a great deal more hub-and-spoke platform exchange of goods than is currently the case. Insofar as the Internet encourages the further internationalization of manufacturing (facilitating management of operations at a distance), these routine production regions may also benefit as locations of greater foreign direct investment. The pattern of such investments is likely to be closely associated with the geography of final demand, as it has been in the recent past. There will undoubtedly be complex international sourcing of such industries, through intra-industry and intra-firm trade. The Internet will make possible more global brands with -- at least partially -- local production. This is one way in which the neighborhood effect will probably be reproduced in the Internet age.

The Internet may make it feasible for certain types of manufacturing and routine intellectual labor to be more effectively managed at much greater distance than is now the case, both in terms of technical quality, ongoing operation of facilities "on line," and coordination of quantities between far-flung and interconnected units of production systems. Physical infrastructure will be an initial constraint on this (e.g. the road system in Mexico or Eastern Europe). But all in all, non-metropolitan and low-cost regions of developed countries , such as the Intermountain West and the American Southeast, or southern and eastern Europe, are likely to be placed into greater competition from developing countries.

In developing countries, certain very large cities will take their places as platforms for the global transactional economy, and as centers of economic reflexivity, alongside their developed world counterparts. They will also probably gain in competitiveness as manufacturing sites because they will now be more directly connected to worldwide supply chains, with better technological capacities and quality monitoring than is now possible.

In other words, the Internet Age is likely to be highly urban, where global city-regions are the central nodes in world economic geography. The relationship of these cities to their hinterlands will undergo significant change, as we have noted, with the latter no longer serving so much as sites of routine production as sites of flexible logistics. In turn, far-flung physical supply chains will tie developing country cities and regions into developed country cities, through this logistical surrounding tissue. The aggregate effect, on a world scale, is likely to be a confirmation of the existing gravity effect, but with some slow and highly uneven evolutionary tendencies to enlarge its reach, due to the combined effects of more offshoring of routine production and routinized intellectual labor.

This implies a sort of paradox with respect to the economic geography of the Internet Age. Though the Internet probably will allow the development of global brands and of much more elaborate intermediate divisions of labor and trade in intermediate goods, services and information, the overall spread of employment and economic activity and wealth is likely to be determined by much the same forces as before the advent of the net, namely those which induce economic development. It is the geography of economic development in general which will determine the fate of the neighborhood effect, not the Internet in particular.

History and strategy may matter

Whatever relocational forces are created by the Internet, those forces will matter only if they can overcome the inertia created by the built-in advantages of existing systems of locations. These include physical infrastructure and human network relations which are well-organized, institutionalized, and enjoy the advantages of scale. External economies attached to such patterns may make them more efficient than alternatives. Insofar as scale is important to their levels of efficiency, it becomes difficult for alternative locations to break existing patterns, simply because alternatives have to start out at low scale. This can be true even where comparative statics show that an alternative pattern would be more efficient (Arthur, 1989; Krugman and Obstfeld, 1991). A key question to pose of a new transacting technology, then, is whether it can create advantages sufficient to overcome existing external economies and they way they tend to lock-in the winner locations. Overcoming the force of distance involves breaking the force of existing advantages.

Strategy may matter as well as history. Any attempt to sketch out the effects of the Internet on economic geography and national competitiveness are speculative at this point. We are far from knowing what kinds of organizational forms will emerge on the basis of this new technology, and we are far from the "killer application" which will bring the Internet into full, seamless use. Moreover, investments in codification may in some cases reduce the force of existing external economies. Codification does not follow automatically from the existence of a new and cheaper transacting technology, even without the complex feedbacks between transacting, outputs and specialization we have identified above. A good road system is necessary for shipping products over long distances, but without codified procedures for billing and trading, the road system will do little good. For the time being, the Internet has not been accompanied by significant advances in systems of codification. Elementary transactions such as billing were already codified long before the advent of the Internet. Whether large-scale integration of intermediate and final sales, distribution and billing/clearing will be fully codified so as to be able to "ride" on the Internet remains to be seen.

National and Regional Competitiveness in the Internet Age

It has been received wisdom in recent years that infrastructure and education are the keys to competitiveness, in addition to the standard ingredients such as correct tax and property rights policies. For backward regions or countries seeking to improve their competitiveness, this formula may actually bear more fruit than ever before, if the Internet brings about a transformation of the geography of routine intellectual labor. Then an educated work force and orderly process of doing business could enable those regions and countries to "leap over" the problem of distance. For the higher order activities of invention, innovation, and management, however, competitiveness may require more than education. There are cultural and relational dimensions to these activities that cannot be replaced by Internet conversations. National and regional competitiveness at this level, then, require "being in the loop" more than ever before in the age of the Internet, and the loop is only partially wired, it is also in the flesh.

Tables and Figures

FIGURE 1: GERMAN TRADE

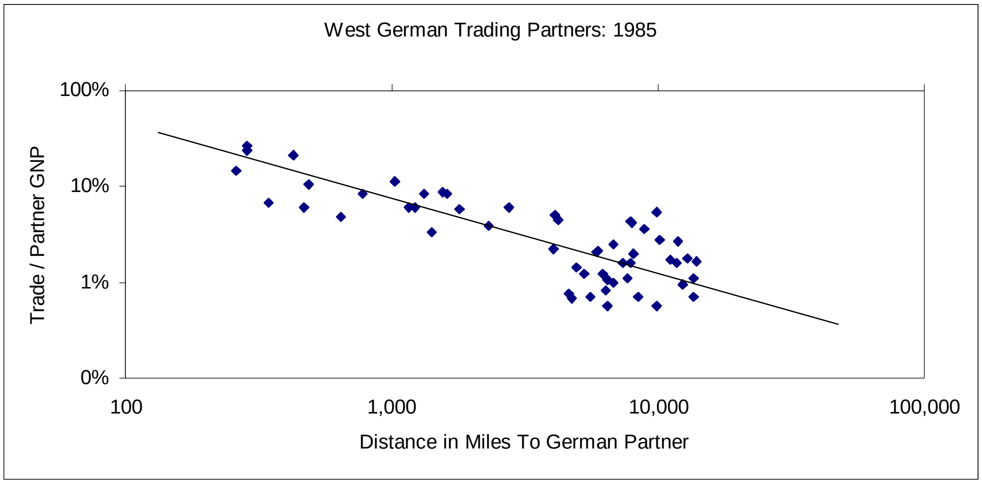
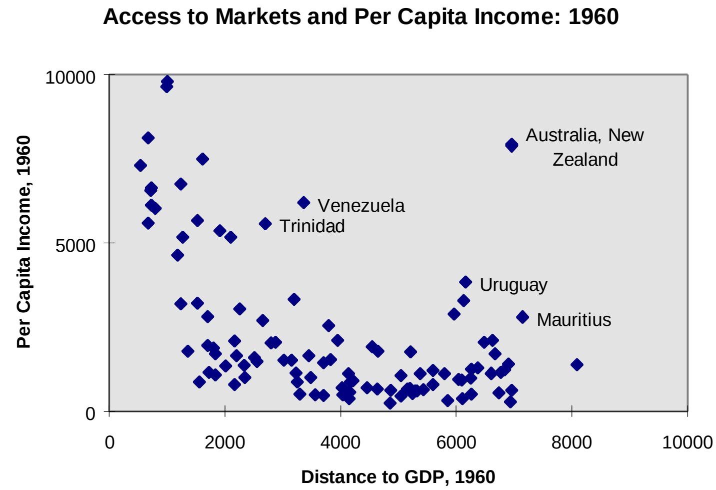
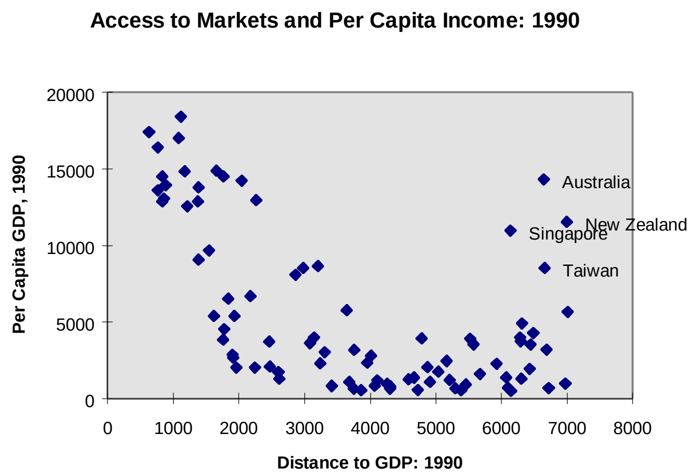


FIGURE 2

Access to Market
and
Per Capita Income: 1960



Access to Market
and
Per Capita Income: 1990



Zoomed View

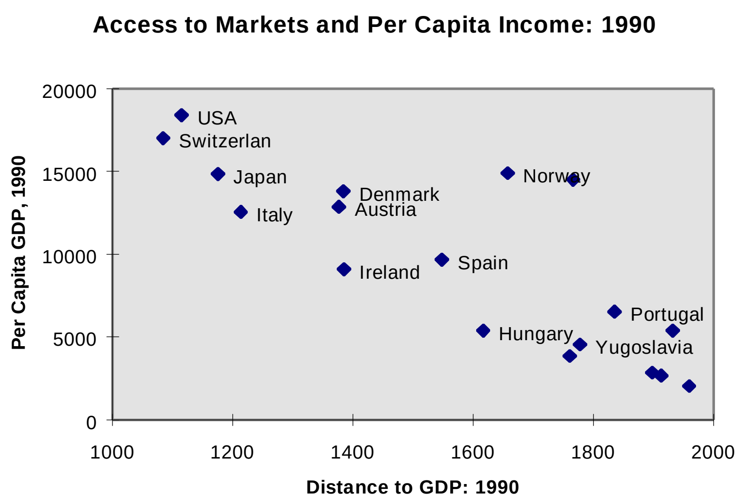
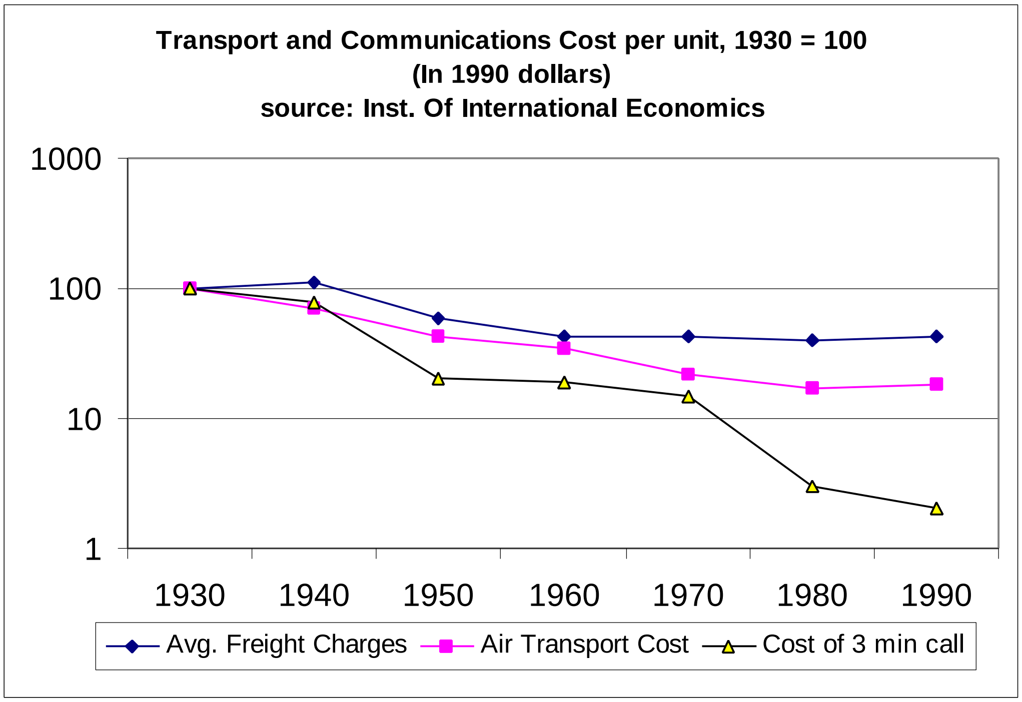


FIGURE 3 :TRANSPORTATION AND COMMUNICATION COSTS



TABLES

TABLE 1

Top Ten Sources of US Imports, 1950 - 2000
Millions of Dollars

	1950
CAN	2101
BRA	767
CUBA	436
UK	359
VEN	347
MEX	338
COLO	335
??	332
INDIA	278
PHILIP	253

	1960
CAN	3452
JAP	1247
UK	1079
VEN	1031
GER	974
BRA	626
MEX	492
FRA	429
ITA	427
BEL	396

	1970
CAN	11780
JAP	6256
GER	3333
UK	2339
ITA	1408
MEX	1299
VEN	1220
FRA	1007
HK	1004
BEL	741

	1980
CAN	41998
JAP	32972
SAUDI	13469
MEX	12835
GER	12257
NIGERIA	11518
UK	10272
LIBYA	8904
ALG	6881
VEN	5571

	1990
CAN	93,780
JAP	93,069
MEX	30,796
GER	29,010
UK	20,931
KOREA	19,287
CHINA	16,295
FRA	13,593
ITA	13,395
SAUDI	10,733

	2000 (est)
CAN	214,758
JAP	132,036
MEX	119,760
CHINA	80,976
GER	52,758
UK	39,024
Taiwan	35,628
KOREA	34,632
FRA	26,676
ITA	22,512

TABLE 2

Top Ten Destinations of US Exports, 1950 - 2000
Millions of Dollars

	1955
CAN	3383
UK	995
MEX	717
JAP	680
GER	603
NETH	581
VEN	577
FRA	527
ITA	479
CUBA	463

	1960
CAN	3813
UK	1492
JAP	1451
GER	1277
MEX	831
NETH	817
ITA	720
FRA	706
INDIA	642
VEN	567

	1975
CAN	21744
JAP	9563
GER	5194
MEX	5141
UK	4529
NETH	4206
IRAN	3244
BRAZ	3057
FRA	3033
ITA	2869

	1980
CAN	35395
JAP	20790
MEX	15145
UK	12694
GER	10959
NETH	8677
FRA	7485
BEL/LUX	6661
SAUDI	5768
ITA	5511

	1990
CAN	82959
JAP	48584
MEX	28375
UK	23484
GER	18698
KOR	14398
FRA	13652
NETH	13015
BEL/LUX	10448
AUS	9601

	2000 (est.)
CAN	169,890
MEX	96,996
JAP	58,188
UK	39,870
GER	25,452
KOR	24,150
Taiwan	20,094
NETH	19,830
FRA	18,204
Singapore	14,526

TABLE 3

Percentage of OECD trade between adjacent countries, involving island nations, and between other country pairs
(Trade=Exports+Imports)
Commodities Sorted by 1985 Adjacent Trade

	1970			1985			1985 -1970		
	Adjacent	Island	Other	Adjacent	Island	Other	Adj.	Island	Other
	(1)	(2)	(3)	(4)	(5)	(6)	(4)-(1)	(5)-(2)	(6)-(3)
TOTAL	30.6%			27.6%			-3%		
Wood	32.7%	32.7%	34.7%	42.4%	28.2%	29.4%	10%	-4%	-5%
Printing and Publishing	40.4%	32.3%	27.3%	41.0%	32.8%	26.2%	1%	1%	-1%
Paper and Paper Products	35.9%	22.5%	41.6%	37.7%	22.7%	39.6%	2%	0%	-2%
Furniture	50.9%	15.0%	34.2%	37.3%	27.0%	35.7%	-14%	12%	2%
Transport Equip.	41.1%	26.3%	32.6%	36.8%	36.5%	26.7%	-4%	10%	-6%
Misc. Petroleum Products	45.8%	16.5%	37.7%	35.7%	26.5%	37.8%	-10%	10%	0%
Glass and Glass Products	37.1%	23.5%	39.4%	34.4%	30.8%	34.8%	-3%	7%	-5%
Other Non-metallic Min	39.5%	24.0%	36.6%	33.9%	25.0%	41.2%	-6%	1%	5%
Metal Scrap	31.8%	29.2%	39.1%	33.2%	31.9%	34.9%	1%	3%	-4%
Other Food	31.7%	26.8%	41.5%	32.5%	29.9%	37.6%	1%	3%	-4%
Fabricated Metal Products	34.6%	29.5%	35.9%	32.3%	33.1%	34.6%	-2%	4%	-1%
Rubber Products	34.1%	32.8%	33.1%	31.9%	38.1%	30.0%	-2%	5%	-3%
Plastic Products	32.4%	33.0%	34.7%	30.1%	36.8%	33.1%	-2%	4%	-2%
Non-ferrous Metal Basic Ind.	26.7%	31.1%	42.3%	28.9%	32.8%	38.3%	2%	2%	-4%
Industrial Chemicals	27.9%	30.1%	42.1%	27.8%	30.1%	42.1%	0%	0%	0%
Iron & Steel Basic Ind.	33.2%	32.3%	34.5%	26.1%	35.0%	38.9%	-7%	3%	4%
Textiles	30.3%	37.0%	32.7%	25.3%	36.2%	38.5%	-5%	-1%	6%
Food Manf.	19.6%	30.1%	50.3%	23.5%	26.6%	49.9%	4%	-3%	0%
Beverage	26.9%	37.1%	36.0%	23.2%	35.1%	41.7%	-4%	-2%	6%
Other Chemicals	24.7%	30.5%	44.8%	23.1%	36.4%	40.5%	-2%	6%	-4%
Petroleum Refineries	18.2%	29.3%	52.6%	22.9%	22.3%	54.8%	5%	-7%	2%
Machinery except elec.	27.7%	28.6%	43.7%	21.8%	38.2%	40.0%	-6%	10%	-4%
Tobacco	22.2%	27.2%	50.6%	20.0%	21.4%	58.6%	-2%	-6%	**8%**
Pottery, China & Earthware	21.9%	46.8%	31.3%	19.0%	44.4%	36.7%	-3%	-2%	5%
Elec. Machinery	25.2%	33.9%	40.9%	18.9%	46.7%	34.3%	-6%	13%	-7%
Wearing Apparel	28.6%	26.4%	45.0%	18.8%	24.5%	56.7%	-10%	-2%	**12%**
Leather	26.5%	27.6%	45.9%	16.9%	31.2%	51.9%	-10%	4%	6%
Footwear	17.7%	17.7%	64.6%	16.4%	21.7%	61.9%	-1%	4%	-3%
Prof., Scientific, & Measuring	23.4%	37.6%	38.9%	16.4%	48.2%	35.4%	-7%	11%	-4%
Other Manufacturing Ind.	14.8%	46.1%	39.1%	12.4%	41.7%	45.9%	-2%	-4%	**7%**

Date Source: OECD Compatible Trade and Production Database

Notes: (1) Data include only trade flows with OECD Partner
(2) Ireland and UK are included as "island" nations
(3) Table sorted by Column (4)

TABLE 4

Estimated Effect of Distance on International Trade
Distance Percentiles of Trade:1985
Distance that eliminates x% of trade

SECTOR		Percent of Trade 10%	50%	90%
313	METAL SCRAP	86	86	250
324	MISC. PETR. & COAL	86	101	325
341	WOOD	86	112	826
322	TRANSPORT EQUIP.	86	113	436
352	FURNITURE	86	118	373
385	PRINTING	86	129	482
321	POTTERY	86	129	589
355	PLASTIC NEC	86	133	472
369	NON-FERROUS METALS	86	134	562
351	METAL PRODUCTS	86	135	548
371	MACHINERY	86	136	628
383	GLASS	86	142	575
312	FOOD	86	158	1164
323	OTHER MANUF.	86	159	990
314	PETR. REF.	86	161	689
353	TOBACCO	104	162	544
390	LEATHER	86	163	934
311	OTHER FOOD	96	165	723
362	ELECT. MACH.	93	166	819
382	IRON & STEEL	86	168	1132
381	CHEMICALS	105	174	707
372	OTHER NON-METAL	88	184	752
356	RUBBER	110	195	738
361	TEXTILES	144	246	949
342	PROF., SCI., MEAS. EQ.	147	269	1414
332	OTHER CHEMICALS	159	271	1154
384	APPAREL	170	304	1101
331	PAPER	86	313	1721
354	FOOTWEAR	196	399	1491
380	BEVERAGES	240	425	1478

NOTES: Base trade is adjacent countries, 86 miles (Netherlands, Belgium)
Hypothetical trade is for nonadjacent countries, 86 + additional miles apart
The number 86 means that merely eliminating the adjacency effect reduces trade by more than the indicated amount.
Regression model: log(Trade/GNP) = a + b log(g+ DIST) + c
ADJ

TABLE 5: MESSAGES

	Simple Codifiable One-Way Messages	**Complex Context-Dependent Interactive Messages**
Written Words	Instructions, Print Media	Exchange of Letters
Spoken Words	Lecture, Command	Telephone Conversation
Images	Blueprint Photograph	Teleconference
Presence: "Feel"/smell		Handshake
EXAMPLES	Stop Sign	"I love you."

Table 6:

MESSAGES, TRANSACTIONS, ORGANIZATION, AND LOCATION

DEGREE OF PRODUCT DIFFERENTIATION OR VARIETY:		
	Low (standardized, mass)	**High (specialized, innovative)**
MESSAGES (CONTRACTING AND TRANSACTING CONDITIONS):		
B2C: messages to consumers:	**Transparent/ Independent**	**Embedded in product**
B2B: messages between firms/ agents	**Codified**	**Tacit, uncodified**
B2B: DEGREE OF INTERMEDIATE TRANSACTING:		
	Low (high scope (economies)	**High (low scope economies, high roundaboutness)**
B2B: BOUNDARIES OF THE FIRM:		
	Internalization, integration	**Outsourcing, disintermediation**
B2B: LOCATION OF PRODUCTION IN RELATION TO INTERMEDIATE MARKETS: (degree of agglomeration of producers)		
	Remote/Low agglomeration	**Market-centered/ agglomerated**
B2C: LOCATION OF PRODUCTION/DISTRIBUTION IN RELATION TO MARKETS:		
	Remote	**Indeterminate**

Table 7:

EXAMPLES OF CHANGE IN THE INTERNET AGE

DEGREE OF PRODUCT DIFFERENTIATION OR VARIETY:		
	Lower (standardized, mass)	**Higher (specialized, innovative):**
		*designer retail; *customer-driven mfg: "design your own car" =mass customization; *New consumer services; *Intellectual, research, managerial, engineering functions
MESSAGES (CONTRACTING AND TRANSACTING CONDITIONS):		
B2C: messages to consumers:	**More transparent / Independent**	**More embedded in product**
	*consumer services (auction / clearinghouse / search model); *consumer banking, finance; *mass customization; *customer-driven services.	
B2B: messages between firms / agents	**More codified**	**More tacit, uncodified**
	*Internet auctioning and codified intermediation services; *Some medical advice; *Codified advice & service linkages, e.g. home repair (but delivery still localized).	*quality,design-driven manufacturing; *Some skilled producer services *dot.com firms; *customer-driven mfg; *innovation-based mfg; *new consumer mass customized services; *entertainment prodn; *Intellectual, research, managerial, cultural production;

...continued...

(Table 7-continued)

B2B: DEGREE OF INTERMEDIATE TRANSACTING:

	Unchanged or lower (high scope (economies)	**Higher (low scope economies, high roundaboutness)**
		*quality,design-driven manufacturing; *mass customization *parts prodn in standard ized manufacturing; *new consumer services; *entertainment prodn; *intellectual, research, managerial, engineering

B2B: BOUNDARIES OF THE FIRM:

	Greater internalization, integration	**More outsourcing, disintermediation**
		*Internet auctioning; *consumer banking, finance *medical services; *consumer services: clearinghouse/ search/auction process

B2B: LOCATION OF PRODUCTION IN RELATION TO INTERMEDIATE MARKETS: (degree of agglomeration of producers)

	More remote (low agglomeration)	**More market-centered: (high agglomeration)**
	*Some skilled producer services *Internet auctioning and codified intermediation services; *Some medical advice; *Codified advice & service linkages, e.g. home repair (but delivery still localized).	*dot.com firms; *customer-driven mfg; *innovation-based mfg; *new consumer mass customized services; *entertainment prodn; *Intellectual, research, managerial, cultural production;

B2C:LOCATION OF PRODUCTION/DISTRIBUTION IN RELATION TO FINAL MARKETS:

	More remote	**More market-oriented**
	*Design-stabilized retailing; *standardized, content-driven retailing (website sales); * electronically-delivered entertainment; *consumer banking, finance	*Design-driven retail (feel,touch needed); *Customer-driven, services ordered by internet (groceries, catering, etc)

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