THE ECONOMIC GEOGRAPHY OF THE INTERNET AGE

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ABSTRACT

This paper combines the perspective of an international economist with that of an economic geographer to reflect on how and to what extent the Internet will affect the location of economic activity. Even after the very substantial transportation and communication improvements during the 20th Century, most exchanges of physical goods continue to take place within geographically-limited "neighborhoods." Previous rounds of infrastructure improvement always have had a double effect, permitting dispersion of certain routine activities but also increasing the complexity and time-dependence of productive activity, and thus making agglomeration more important. We argue that the Internet will produce more of the same: certain forces for deagglomeration, but offsetting and possibly stronger tendencies toward agglomeration. Increasingly the economy is dependent on the transmission of complex uncodifiable messages, which require understanding and trust that historically have come from face-to-face contact. This is not likely to be affected by the Internet, which allows long distance "conversations" but not "handshakes."

Will the Internet generate a revolution in the economic geography of the 21st century, creating neighborhoods connected not with streams and roads but with wires and microwave transmissions? History, linguistic theory, and economic theory help to answer this question.

The economic geography of the 18th century was much affected by the costs of moving raw materials to production locations where the raw materials could be combined with labor and some capital to make final products. But at the end of the 18th century, home and workshop production were still the rule, and towns and cities were mostly marketplaces and transportation nodes.

A shortcoming of home or workshop production is that most of the capital sits idle most of the time – the hammer and scythe are idle when the spade is used (Leamer, 1999). In the 19th century, the growing importance of mechanization in manufacturing, and hence of physical capital, created pressures to centralize production in factories and in cities where a deeper division of labor allowed capital to operate many more hours during the day. The agglomerations needed to support this division of labor were made possible by great improvements in transportation systems – roads, canals, railroads, clipper ships.

Over the 20th century, improvements in transportation and communication systems allowed increasing geographical fragmentation of production (e.g., Arndt and Kierzkowski, 2001) and increasing global trade in intermediate inputs (e.g., Feenstra and Hansen, 1996). Yet the phenomenon of agglomeration of producers remained quite common. In many manufacturing industries, there still exist clusters of input producers that include both clients and competitors. There are cities specialized in rug making, watch making, and automobile manufacture (Scott, 1988).

Geographical clustering exists for many reasons. Retailing is clustered to save shopping costs for customers. For some types of material production, there are still important transportation advantages to location of the different stages in the division of labor – making the frame, the doors and the wheels, and doing the assembly X at not too great a distance from each other. Even the 20th-

century tendency toward geographical fragmentation of the chain of production was accompanied by the spatial agglomeration of certain parts of the chain, particularly the intellectual/immaterial activities such as accounting, strategy, marketing, finance and legal work. These intellectual activities have increased greatly as a share of value added and are amenable to extremely fine and highly efficient divisions of labor that make it uneconomic for a single firm to employ these specialists on a full time basis. Businesses instead "outsource" many of these functions to specialized firms producing intermediate intellectual inputs.

Since immaterial products can be transported virtually without cost, these intellectual activities are amenable to procurement at a distance : the design in Detroit, advertising in New York and strategy in Chicago. Although the clients of these specialized intellectual firms are sometimes far-flung, their competitors often are not. These specialized firms tend to cluster tightly together in financial "districts" and downtown office buildings, such as Wall Street, the City of London, and the Loop. Furthermore, it is common for specialized immaterial producers to have branch offices in major cities near the location of deployment of the ideas, suggesting that the "shipping" of an intellectual product may be as costly as shipping a tire or an axle.

From this history we conclude that economic progress over the last three centuries has come with an increasingly fine division of labor, physical labor in the 19th Century and intellectual activities in the 20th. But the finer the division of labor, the greater are the coordination needs. Routine coordination of standardized intellectual or physical tasks can be done within "markets" that can be extended geographically with communication technologies. But complex and unfamiliar coordination of innovative activities requires long-term relationships, closeness and agglomerations.

The history of economic geography is thus a story of coordination over space and has been shaped by two opposing forces: (1) the constant transformation of complex and unfamiliar coordination tasks into routine activities that can be successfully accomplished at remote but cheaper locations. (e.g., commodification), and thus an ongoing tendency toward deagglomeration or

dispersion of production; and (2) bursts of innovations that create new activities requiring high levels of complex and unfamiliar coordination, which, in turn, generate bursts of agglomeration (Storper, 1997).

As with previous rounds of innovation in transacting technologies, the Internet offers some of both. It is making routine some coordination tasks ("dumbing down" of computers), but it is also creating a host of new and unfamiliar activities (mass customization). Thus, it creates forces for deagglomeration and forces for agglomeration.

It is widely believed that the Internet will have a more dramatic effect on economic geography than previous rounds of innovation, somehow suspending the force for agglomeration by allowing remote coordination of new and innovative activities. This, we argue, is not likely. Coordination of new and innovative activities depends on the successful transfer of complex uncodifiable messages, requiring a kind of closeness between the sender and receiver that the Internet does not allow. The problem with the Internet is that he cannot look her in the eye through a screen, and she cannot "feel" or "touch" him. It is a medium that may help to maintain relationships, but does not establish deep and complex contacts.

CLUSTERING OF MATERIAL AND INTELLECTUAL ACTIVITY

An examination of historical data on trade in products between countries reveals that the vast and steady improvements in technologies for transacting across space have not eliminated a strong role for geographical proximity. Pure intellectual activities are even more clustered. This suggests that present or future improvements in communication technologies, such as the Internet, also may not eliminate the role of proximity.

Material Production Remains Highly Clustered

Most of the value-added in the goods and services that we consume originates surprisingly close to home. North America is one trading neighborhood. Over the last fifty years, the share of U.S. trade with Canada has held steady at about 20%, while the share of U.S. trade with Mexico has

increased from 5% to 10% (Figure 1). Since 1950, and probably much earlier, Canada has been both the number one destination for U.S. exports and the biggest source of U.S. imports. Mexico, which has always been in the top five U.S. trade partners, 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 to become the number two destination of U.S. exports in 2000, and is edging up to Japan as the second most important source of U.S. imports.

[Insert Figure 1 here]

North America is not the only trade neighborhood. Table 1 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 the percentage of trade carried out between adjacent countries in 1985. Wood is the most locally-traded commodity, by this measure, with 42.4% of total trade occurring between adjacent countries, followed by printing and publishing. The long-distance products, with less than 20% of trade between adjacent countries, include apparel, footwear, professional equipment and miscellaneous (toys and umbrellas).

[Insert Table 1 here]

Table 1 also shows 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 footwear falls into this long-distance category, and almost as much refined petroleum, tobacco and apparel. This contrasts with about 26% long-distance trade in printing and publishing, and in transportation equipment.

The last three columns of Table 1 report the differences between 1970 and 1985. Although trade relative to GDP grew rapidly during this period, long-distance trade and neighborhood trade in many products grew at similar rates. The exceptions include apparel, “other manufacturing

industries" and tobacco, which did have rising shares of long-distance trade over this period. We thus pose the rhetorical question: what is there about these products that allows them to be traded over increasingly great distances?

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]:

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

Figure 2 illustrates the "force of gravity" on West German trade in 1985. Each point on the graph represents one of Germany's trading partners. On the vertical axis is trade divided by the GDP of the partner [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.

[Insert Figure 2 here]

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 faraway countries have low levels of GDP per capita (Leamer, 1997). 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 3, which displays a measure of distance to global GDP on the horizontal axis and per capita GDP on the vertical axis. In 1960 only Australia and New Zealand were able to escape the force of gravity – being far away but managing to have a high GDP per capita. By 1990, two other countries had also escaped: Singapore and Taiwan. Except for these, there is a very clear relationship between per capita GDP and distance to markets.

[Insert Figure 3 here]

The distance effect of the gravity model captures something more important and more permanent than simple shipping charges. While 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 very powerful. Hummels (1999a) estimates that the average freight costs of U.S. 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. 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 the impact of distance remained unchanged, essentially unaffected by communication and transportation improvements.

Since shipping charges appear not to drive the gravity effect, what does? Hummels (1999c) suggests that part of the answer is perishability, broadly defined. He uses the shift toward more expensive air transport in the last half century, stimulated by a sharp relative decline of air transport costs, to infer the very substantial revealed perishability of traded goods, not just fruits and vegetables, but also computers and high-fashion handbags (it is the "perishable" items that are shipped by air.)

While perishability, obsolescence, fashion changes and impatience are reasons why goods are not shipped slowly over long distances, we emphasize here another reason why commerce is

confined to neighborhoods: the technology for the transmission of complex information has not improved much. This is important because the value of a product is often highly dependent on information about what it will do, how to make it work and whom to talk with when it does not work. While the product may be shipped cheaply over long distances, the accompanying information often needs to be delivered from one person to another. Thus humans remain the containers for shipping complex uncodifiable information. The time costs of shipping these containers is on the rise because of congestion on the roads and in the airports while the financial costs of so doing are also rising due to increases in real wages of knowledge workers who are the human containers.

The four anomalous countries in Figure 3 also help sharpen our understanding. These countries managed to develop high per capita GDPs at great distances from the world's major markets, while other far-away countries with access to the same communication technologies did not become so wealthy. The difference, we suggest, is that the British Commonwealth and other similar institutions facilitated long-term deep relationships over long distances. These relationships create the essential prerequisites of any complex transaction: trust and understanding. These are not the automatic result of transportation and communication technologies.

Furthermore, given that much global trade consists merely of shipping products or components between divisions of the same firm located in different countries X transactions that do not raise the trust and enforceability issues present in arms length transactions X.the persistent distance effect on trade strongly suggests that trust alone is insufficient. What must limit trade, even within distant sister units of the same business entity, is that many information transactions presuppose a high level of mutual understanding. What do you mean when you say you'll do a good job? Do we agree on what is to be done?

Intellectual Aand Innovative Activities Are Also Clustered

The empirical evidence regarding the clustering of intellectual, immaterial production 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 X at least up until now X they remain highly, and even increasingly urbanized and located in proximity to GDP. Financial service 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 (Jacobs, 1960; Pollard and Storper, 1996). Such localized clusters in the informational, intellectual, and innovation-based industries have progressively broadened the reach of their contacts X to other producers in other major localized clusters, and to a widely spread client base X 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.

The Internet economy has produced high densities of dot.com firms in San Francisco, New York, Los Angeles and Seattle, and 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 an "industrial atmosphere," and circular and cumulative advantage from these local external economies. The larger and more globally-linked metropolitan areas are enjoying stronger economic growth than their respective national economies in general, as they reinforce their positions as centers of economic reflexivity: inventiveness, creativity, the management of non-standardized transactions and elements of production and supply chains, i.e., the functions that steer and guide an increasingly elaborate division of labor in modern capitalism as a whole. The economies of these central places are increasingly comprised of core agglomerations of: (a) 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, high technology and research; and (e) power and influence (government, corporate headquarters, trade associations and international agencies).

For immaterial intellectual production, there is great value in being at the "center of the action," where the division of labor can be pursued intensively, where specialized talent and "buzz" are important to keeping up with rapidly changing outputs (ideas) (Jaffe et al, 1993; Almeida and Kogut, 1997; Audretsch, 2000), and where complex but understandable contracts can be written with a glance and sealed with a handshake. In addition, many intellectual outputs are not products that can be dropped at the doorstep, but are services that have to be delivered by one human to another. Value is created jointly by seller and buyer, by coach and student, often involving many hours of direct communication.

Academic office hours, seminars, conferences, and coffees testify to the importance of face-to-face interactions in the production and distribution of new or complex ideas. It is not just union power that has kept the labor-intensive universities operating in more or less the same manner for four centuries. It is the production function itself. While routine learning and training can be done remotely, education is a decidedly up-close and personal activity.

THE JOINT DETERMINATION OF MESSAGES AND RELATIONSHIPS

Many messages can be communicated effectively only if the parties "know" each other. Information and communication technologies (ICTs), such as the Internet, create new possibilities for transmitting messages, and in so doing they may affect the kind of relationship the parties must have in order to send and receive a given kind of message. A first step toward understanding the role of relationships in the transmission of information is to classify existing technologies according to the form and content of their messages, as we do in Table 2. The rows in this table refer to the form of the message: 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 content of the message, contrasting simple codifiable one-way messages such as a stop sign, with complex context-dependent interactive messages such as the claim that "I love you." It is the complex, context-dependent messages that require the greatest investments in relationships.

[Insert Table 2 here]

Codifiable information has a stable meaning which is associated in a determinate way with the symbol system in which it is expressed, whether it be linguistic, mathematical, or visual. Generally speaking, codifiable 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. Acquiring the symbol system may be expensive or slow (language, mathematical skills, etc), as may be building the transmission system, but once acquired using it to communicate 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 between "speech" and "language"), particularly what might be called "complex discourse" (Searle, 1969). For example, one can master the grammar and the syntax of a language without understanding its metaphors. This is also true for some mathematically expressed information, and for much visual information. If the information is not codifiable, merely acquiring the symbol system or having the physical infrastructure is not enough for the successful transmission of a message. It also takes mutual trust and mutual understanding. The parties therefore need to "know" each other, or have a broad common background which goes well beyond their direct contact, but the existence of which they can verify through their direct contact, using many forms of communication to do so.[2] The transmission of codifiable information has strong network externalities, since once the infrastructure is acquired a new user can plug in and access the whole network. The transmission of uncodifable information may have very limited network externalities,

since the successful transmission of the message depends on infrastructure that is largely committed to one specific sender-receiver pair by their mutual trust and understanding.[3]

The distinction between codifiable and uncodifiable messages comes up implicitly in the economics literature on "search" goods and "experience" goods (Nelson,1974). A. "search" good has a transparent value – evident upon initial inspection. An "experience" good has a nontransparent value that depends on the user and that is experienced slowly over time. Markets that match faceless buyers and faceless sellers can mediate the exchange of search goods, but the exchange of experience goods requires trust, understanding and long-term relationships, either directly or through third party certification and enforcement. The persistence of the distance effect on global commerce is due in part to the fact that there are comparatively few search goods and comparatively few market-mediated exchanges. Most transactions require long-term relationships. It is no surprise, therefore, that B2B Internet exchange markets are having a hard time surviving.[4]

Understanding and Trust Come from Relationships

The Wall Street Journal headline "Record Sales Drop" might suggest a small problem for the music industry or a much bigger problem for business overall. Coding and decoding this kind of message involves mutual understanding of the context from which the information emerges: incompleteness is overcome by reasoning through analogy and reading between the lines. The infrastructure needed to accurately establish the context can be very substantial and can be very specific to the sender/recipient pair.

The coding and decoding of a contract (a promise) also depends on the context, which establishes the unstated contract contingencies and also the interests of the parties in honoring the agreement.[5] Understanding the context is not enough if the contract requires future actions that are not in the interests of the parties at the time they promise to take them. Then the parties either have to align their interests through internalization (Williamson, 1985) or they have to invest in enforcement mechanisms that create mutual trust.

Trust can come from multi-layered relations between the parties to a transaction that can create low-cost enforcement opportunities (Lorenz, 1992). Trust can be created if reputation assets are put at risk. Trust also comes from the bonds that both parties establish to guarantee the truthfulness of the message. One important economic bond is the time and money costs of co-presence (schmoozing), which can far exceed the direct costs of sending the message. These costs, like advertising expenses (Klein and Leffler, 1981), amount to a forfeitable bond that assures the validity of the message.

Also like advertising, there is a special incentive to continue to invest in the relationship in order to maintain the value of the relational asset that was created by earlier encounters (absent the second date, the value of the first date disappears). This will encourage the formation of relatively few long-lasting deep relationships as opposed to many fleeting shallow ones.

To create a relationship bond, the costs must be substantial and transparent. E-mail, paradoxically, can be so efficient that it destroys the value of the message. The e-mail medium greatly reduces the cost of sending a message, somewhat reduces the cost of receiving the message, and it makes the costs mostly nontransparent. The low costs and the non-transparency greatly limit the value of the relationship bond. Mass mailings are indistinguishable from personalized messages. A return receipt only means that the recipient has opened the message, but the sender cannot be sure that enough attention has been devoted to it to absorb the content. Thus, for complex context-dependent information, the medium is the message. An e-mail declaration of “I love you” is more likely to be a computer virus than a credible promise of good things to follow.

THE EFFECT OF THE INTERNET ON THE CLUSTERING OF INTELLECTUAL ACTIVITIES

The Internet might lead to a substantially different economic geography if it allowed communication over long distances those complex, uncodifiable messages that historically have depended on human closeness. Earlier innovations in communication technologies including print

media, the telegraph, recordings, the telephone and the television have not eliminated the tendency toward geographical agglomeration. But unlike these earlier technologies, broadband Internet communication will soon allow inexpensive simultaneous real-time interactive visual, oral, numerical and textual messages, creating a much more powerful imitation of closeness than has heretofore been possible.

But the imitation does not have all the properties of the real thing.[6] Face-to-face communication derives its richness and power not just from allowing us to see each other's faces and to detect the intended and unintended messages that can be sent by such visual contact. Co-presence – being close enough literally to touch each other - allows visual "contact" and "emotional closeness," the basis for building human relationships.

To help understand the impact of the Internet, the "face-to-face" metaphor thus needs to be separated into two parts: the "handshake" and the "conversation." The "handshake" refers to information exchanges made while in same physical space; the "conversation" refers to interactive long-distance exchanges of visual and oral information. One can have a conversation through 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. Broadband Internet 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 nothing by itself to put a message in the right context, and does not help in understanding. Moreover, an Internet conversation resembles e-mail in that it involves such low levels of costs to sender and receiver that there is there is little relationship bond created by the process.

The virtual world of the Internet has no physical neighborhoods, no Starbucks where like-minded people bump into each other for serendipitous handshaking in communities defined by

cultural affiliation, language, ideology, desire, mutual identification, and other powerful forms of bonding. If such relationships are important to 21st century capitalism, then the Internet is unlikely to eliminate the need for physical co-presence.

However, unlike e-mail, the costs of this Internet conversation are transparent – one can "see" the time expended by the other party – which is necessary for the creation of the bond. It is possible, but unlikely in our opinion, that there will be Internet teas and cocktail hours, with far-flung parties to the apparently casual conversation making the critical investment in their relationships (chat rooms do not serve this function, because the participants are anonymous). Therefore, the exchange of uncodifiable ambiguous information that depends on a high level of trust and shared context is likely to continue to require a significant amount of co-presence.

Meanwhile, air and auto transportation technologies 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 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. [7]

The Continuing Importance of Relationships

Although the Internet may not do much to facilitate the long-distance communication of complex context-dependent information, it could make these less important. Will the economy of the 21st century be more or less dependent on the kind of complex, context-dependent messages, whose transmission the Internet cannot achieve? Or will most messages become codifiable, allowing immaterial and material commerce at great distances?

Table 3 helps to answer these questions. The two columns separate products according to the character of information needed to use them. At the left are products that come with codified information in the form of simple and understandable manuals/blueprints/specs, or that embody that information with plug and play features. At the right are products that depend for their

usefulness on uncodifiable information.

[Insert Table 3 here]

New products are constantly entering in the right of this table, and moving to the left. In the 1970s personal computers came with an extensive amount of complex, uncodifiable information about the tasks they could perform and how to get them to do those tasks. Today, these same PCs concentrate on a small range of standardized tasks including word processing, spreadsheets and e-mail. The information needed to perform these tasks is mostly codified in simple instructions expressed in words, drop-down menus and clickable icons.[8]

If the product is standardized, information about its features can be codified and shipped separately from the product in the form of specifications, blueprints, consumer magazines, standards, etc. This allows geographical distance between seller and buyer. If the product is not standardized, its operating features are less likely to be expressed in a codifiable form. The principal way of verifying the product's qualities is then by seeing, touching, feeling or otherwise actually "knowing" the product . This introduces a strong element of hands-on, relational verification of product qualities and thus geographic closeness.

Informational characteristics and the organization of production systems have strong interrelationships. The products in the left-hand column have a high scale of output and a high degree of standardization. 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 X high scale, standardization, routinization and codification of underlying knowledge and information generally permit transactions, whether B2B or B2C, to be carried out over considerable geographical distance.

In the right-hand column of Table 3 are low-volume specialized products and activities. Standardization of the product and routinization of the production process are impeded by

fluctuating markets and rapid technological change. 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 (Jacobs, 1960; Scott, 1993; Feldman and Audretsch, 1999; Duranton and Puga, 2000). This sort of access is not amenable to codification and routinization. Its unpredictability is precisely its raison d’être. Furthermore, in the case of innovation-based activities, much of the information needed to innovate X even if it is science- and engineering-based X 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 (Zucker, Darby and Brewer, 1998). Most importantly, transforming this information into economically useful knowledge involves recombinations and synergies that 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).

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 3. 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.

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 the production system. Greater access to suppliers makes possible new combinations of inputs, which, in turn, modifies the costs of producing a given kind of final output. Transportation technologies, 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 (Fishlow, 1965; Pred, 1966 and 1974; DeVries, 1984; Hall, 1998). Relative city sizes remained stable over the 20th century in the United States (Black and Henderson, 1998), and this pattern of stability (parallel growth in cities) is true of other advanced countries such as Japan and France (Eaton and Eckstein, 1997). Moreover, there is mostly persistence of the same activities in the same cities; only a few industries really change their geographical centers or entirely abandon them, once they are initially locked into a location (Storper and Walker, 1989; Brezis and Krugman, 1997; Henderson, 1998). U.S. industrial location patterns at the three-digit level from the mid-nineteenth century onward have been remarkably stable (Kim, 1995; Dumais et al, 1997). Thus, there is strong evidence that innovations in 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, these innovations have tended to reinforce industrial localization and the consequent growth of cities (Teaford, 1986).

They do this by making feasible transactions that 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 critical. It is thus reasonable to assume that the Internet will increase product differentiation in the economy and

create new forms of complex transactions, even as it simplifies others and permits further spreading out of routinized activities.

Table 4 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 changes are being stimulated by the Internet: (1) increases in product *variety*; (2) increases in the fineness of the division of labor (*roundaboutness)*; and (3) the automation of intermediation/coordination tasks (*disintermediation*).

[Insert Table 4 here]

Increases in roundaboutness[9] often leads to increased agglomeration because the transactions required to link the separate units or sectors are sometimes sensitive to geographical distance, as we argued above. With the advent of the Internet, greater roundaboutness and agglomeration is probable in such sectors as quality and design-driven products, customer-driven manufacturing, parts production, innovation-based manufacturing, new consumer services, entertainment, and intellectual, research and managerial activities. 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 inputs to production. The geography of these new "mass variety" sectors will be determined by whether the input-output relations are conversations or handshakes X some will be far-flung, others clustered.

Disintermediation will come with Internet auctions, online consumer banking and finance, online stock transactions, and online medical advice as well as many information services. Here, a general tendency toward spatial disconnection of products and markets will be found, but the organizers of such far-flung systems will very likely be located in clusters.

Thus the ways that a new ICT 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 will continue to be clustered. This was dominated by material production in the age of increasing physical scale and capital-intensity of 19th century manufacturing. It was later dominated by headquarters functions, and in turn by intellectual and innovation-based producers' complexes. We suggest that the latter, far from having lost their lease on life, are experiencing renewed importance, through the Internet's ability to make possible new specialized divisions of labor in many different activities, and hence to renew the need for handshakes.

THE GEOGRAPHY OF THE NEW ECONOMY

The Internet will probably reinforce the roundaboutness of production and hence of the importance 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 (Scott, 2001).

The consumer service oriented sectors of these metropolitan areas will likely grow in new ways, continuing to adapt to the changing lifestyles of urban residents. One of the great growth sectors has been food and beverages(restaurants), including take-out, which is one more step in the increasingly fine division of urban labor. The Internet may transform the take-out industry into a mass-customized food preparation industry. We will be able to order custom-prepared 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.

But these cities will certainly lose some 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 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 large office building. Australia's labor costs are considerably lower than those of Europe or the United States. So, many U.S. 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 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.[10] 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 economies that invest heavily in education and research are likely to become sites for the routine intellectual labor that can now be moved offshore from developed areas, as in the example above.

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 experience mixed effects in the Internet Age. On the one hand, they might become the new logistical platforms for the massive transactional web of goods exchange that the Internet will make possible. Insofar as the Internet

encourages the further internationalization of manufacturing (facilitating management of operations at a distance, for instance), 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, generating growth in intra-firm trade in goods and increased information flows. The Internet will make possible more global brands with X at least partially X 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. The absence of adequate physical infrastructure will be an initial constraint on this (e.g., the state of the road and/or telecommunication systems in Mexico, India 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 with 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, as highly skilled technical and managerial labor there is brought into closer operational contact with their homologues in the global city-regions of developed countries. Developing countries 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 but 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, will confirm the existing gravity effect, but with some slow and highly uneven evolutionary tendencies to enlarge its reach, due to the combined effects of more transfer offshore of routine production and routinized intellectual labor.

History Will Matter:

Whatever tendencies to relocation 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 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 existing advantages.

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.[11] This formula may actually bear more fruit than ever before, if the Internet brings about a transformation of the geography of routine intellectual labor, as we have suggested. Then an

educated work force and orderly process of doing business could enable less developed 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, as is indicated by the limited number of “faraway” countries who have overcome the force of gravity. These cases, whether the older Anglo-Saxon ones (New Zealand and Australia) or the more recent ones (Taiwan, Singapore and, increasingly, Ireland) strongly suggest that there is a long and difficult, though not impossible, process of creating the relational networks necessary to become part of the world core. The Internet may be a handmaiden of this process, but it will not bring it about in any automatic way; its effects will depend on a wide array of institutionalized human network-building processes. In this light, national and regional competitiveness in the age of the Internet will require “being in the loop” more than ever before, and the loop is only partially wired; it is also in the flesh.

CONCLUSION

Combining the perspective of an international economist with that of an economic geographer, we have analyzed the historical role that information and communication technologies have had on the location of economic activities, noting that they have always both reinforced agglomeration and urbanization, but also permitted dispersion of economic activity. We have given this history a theoretical interpretation that may help clarify some of the likely impacts of the Internet on the economic geography of the 21st century. In so doing, we have raised a large number of questions whose answers call for additional theory and empirical analysis by international business scholars.

ENDNOTES

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

[2] This notion has a long history in the social sciences. Michael Polanyi (1966:4) noted that “we know more than we can tell,” suggesting that tacit knowledge is deeply rooted in action, commitment and context. Bateson (1973) refers to the “analogue” quality of tacit knowledge: communication between individuals that requires a kind of parallel processing of the complexities of an issue, as different dimensions of a problem are processed simultaneously. Tacit knowledge can often only be successfully communicated as metaphor (Nisbet, 1969), but metaphors are highly context-dependent (Lakoff and Johnson, 1980).

[3] Relationships may have externalities (Kogut, Shan and Walker, 1993; Nonaka, 1994; Storper, 1997).

[4] Tedeschi (2001) reports the situation as follows: “Earlier this year, Forrester Research, the Internet consulting firm, predicted that the universe of business-to-business e- marketplaces would shrink to a mere 180 in the next two years, from 1,000 or more today. It was a bleak forecast, but one that surprised few who had watched such sites search in vain for customers in 2000.” He goes on to quote one industry participant who states that, “Most of the business-to-business marketplaces… were created with the premise that if a corps of powerful buyers in a given market gathered on one site, the suppliers would come running — even if that meant the suppliers had to engage in auctions in which they underbid one another for the right to sell their wares. But attributes that go beyond price, like quality, service, the stability of the brand, warranties — all the things suppliers build around their products — marketplaces haven't allowed them to offer.”

[5] Knowing what the intentions of another actor are enable us to decode the practical consequences of what they are expressing to us (Husserl, 1968). Speech and action are tightly interrelated, but speech does not automatically reveal to us what another person intends to do (Searle, 1969).

[6] Searle (1969) and Austin (1962), in their notion that “language is behavior” provided the basis for showing precisely the limits of strictly conversational interactions: real dialogue, they suggested, is a complex socially-creative activity. Sociologists such as Goffman (1982) and Garfinkel (1987) have shown that complex interaction involves a linguistic and visual “performance,” which they liken to being on stage, playing a role, where the visual and corporeal cues are at least as important to knowing what is being "said" as the words themselves.

[7] The need for physical co-presence can be met either through locational proximity of the activities, or by using another technology of transacting X transportation X 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.
This brings to mind the software industry which had been moving routine tasks offshore, while keeping the specialized customer-specific tasks in the hands of large focused firms in developed countries (e.g. Scient, Siebel, IBM, etc.) More recently, the Internet has allowed a hybrid model in which designers and architects are spread around to world and do the hand-shaking with customers, while being backed up by a large team of software engineers and programmers in places like Bangalore, India.

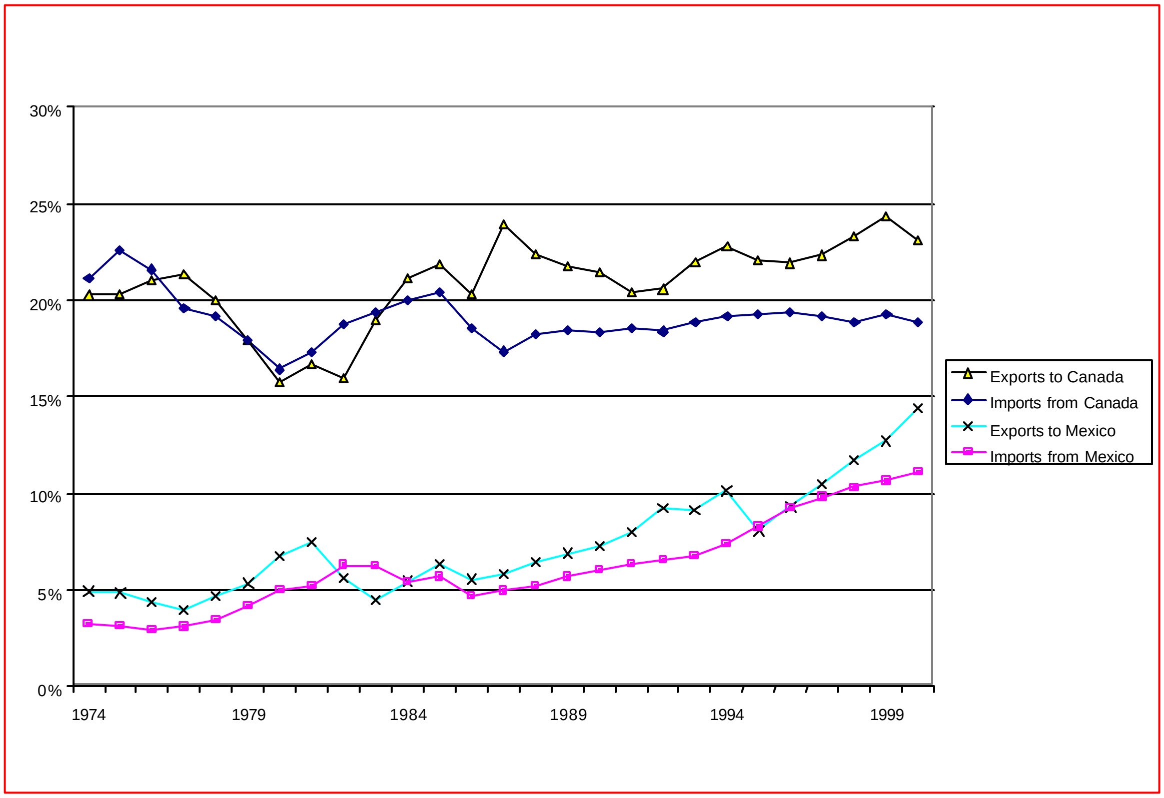
[8] The notion of a progression from unstandardized, innovative products and services to standardized and mass-produced ones, and its impact on the international location of economic activity, has long been present in such notions as the product life cycle (Vernon, 1966). More recently, it has been reinterpreted in informational terms as the general progression from new, tacit and uncodified information to codified and transparent information, brought about by investments in codification. Nonaka (1994) suggests that firms create knowledge precisely through a dialogue between tacit and explicit knowledge. These notions have to be qualified, however, for the cases of industries that remain permanently artisanal or quasi-artisanal, such as the fashion- or design-based sectors.

[9] The classical definition of roudnaboutness comes from Allyn Young (1929). Roundaboutness refers to number of intermediate steps required to generate a final output. A modern economy fragments production into an ever-increasing number of different specialized business units and separate sectors, such that a final product emerges in a "roundabout" way through the combination of intermediate products via transactions between these units and sectors. Roundaboutness is measured, in modern terms, through input-output analysis. The more roundabout the organization of production, the more complex the upstream division of labor or input-output system at hand. Greater roundaboutness often leads to the persistence of agglomeration because the transactions required to link the separate units or sectors are sometimes sensitive to geographical distance.

[10] Paulo Tombesi, University of Melbourne, Faculty of Architecture, in an interview with Michael Storper, January 2000.

[11] See the paper by Oaxley and Yeung in this Symposium.

Figure 1U.S. Trade with Mexico and Canada as Percent of U.S. Exports and Imports



Source: Economagic.com

Figure 2

German Trading Partners, 1985

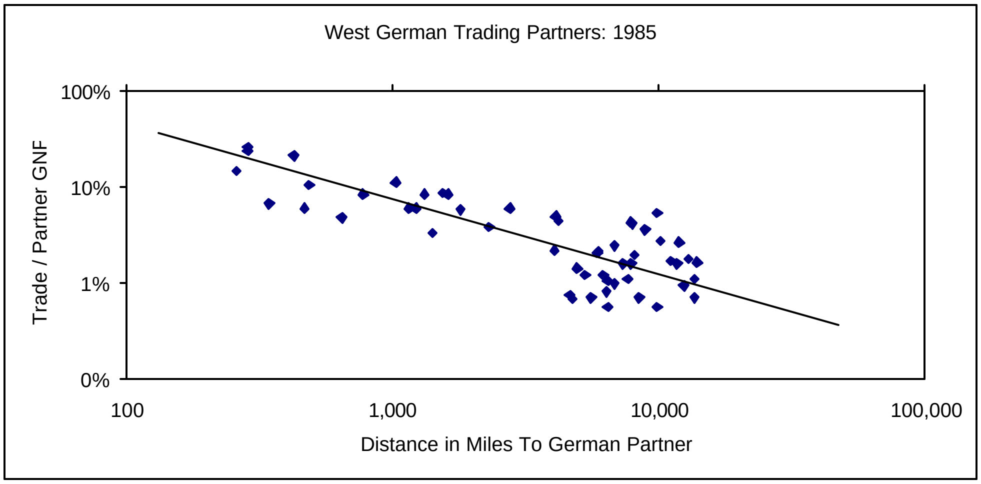
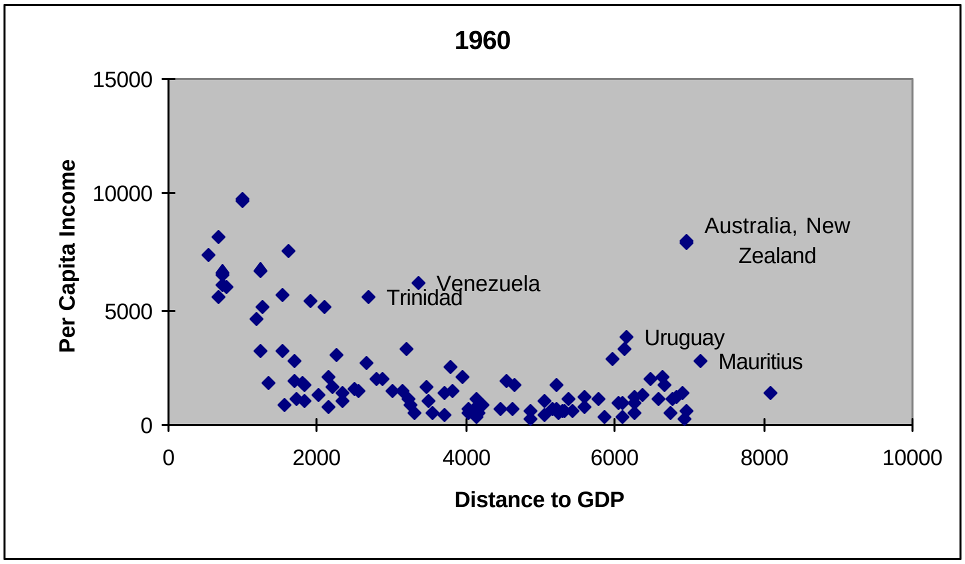


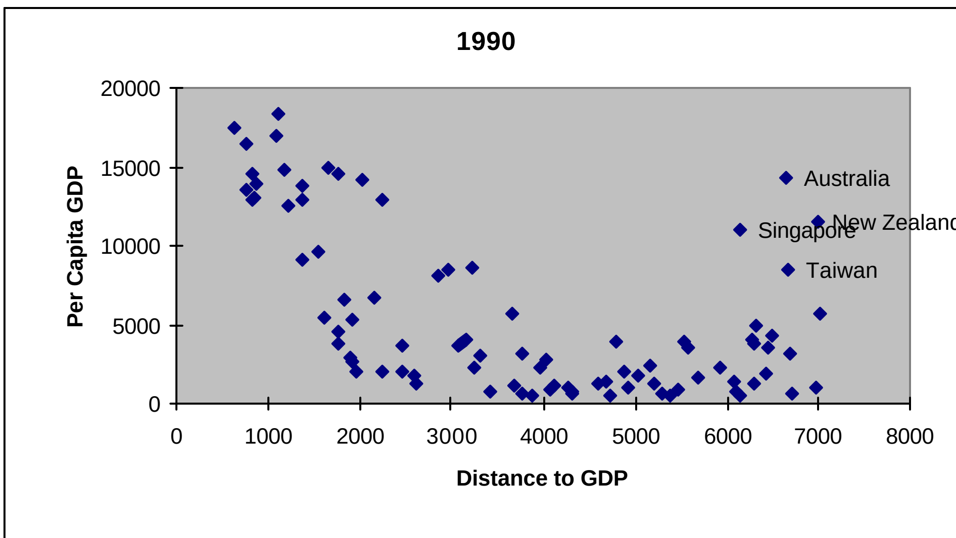
Figure 3

Access to Markets and Per Capita Income, 1960 and 1990

~~1960~~



~~1990~~



~~1990 Zoomed V~~

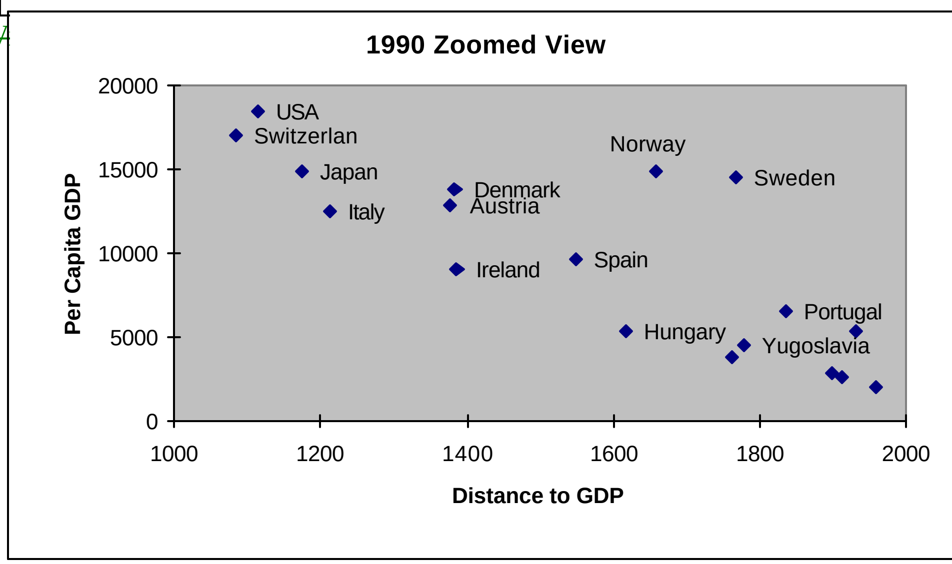


Table 1

OECD Trade (Exports plus Imports) Between Adjacent Countries, Island Nations and Others
(Percent of total trade per category)

	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	9.7	-4.0%	-5.3
Printing and Publishing	40.4	32.3	27.3	41.0	32.8	26.2	0.6	0.5	-1.1
Paper and Paper Products	35.9	22.5	41.6	37.7	22.7	39.6	1.8	0.2	-2.0
Furniture	50.9	15.0	34.2	37.3	27.0	35.7	-13.6	12.0	1.5
Transport Equipment	41.1	26.3	32.6	36.8	36.5	26.7	-4.3	10.2	-5.9
Misc. Petroleum Products	45.8	16.5	37.7	35.7	26.5	37.8	-10.1	10.0	0.1
Glass and Glass Products	37.1	23.5	39.4	34.4	30.8	34.8	-2.7	7.3	-4.6
Other Non-metallic Minerals	39.5	24.0	36.6	33.9	25.0	41.2	-5.6	1.0	4.6
Metal Scrap	31.8	29.2	39.1	33.2	31.9	34.9	1.4	2.7	-4.2
Other Food	31.7	26.8	41.5	32.5	29.9	37.6	0.8	3.1	-3.9
Fabricated Metal Products	34.6	29.5	35.9	32.3	33.1	34.6	-2.3	3.6	-1.3
Rubber Products	34.1	32.8	33.1	31.9	38.1	30.0	-2.2	5.3	-3.1
Plastic Products	32.4	33.0	34.7	30.1	36.8	33.1	-2.3	3.8	-1.6
Non-ferrous Metal Basic Ind.	26.7	31.1	42.3	28.9	32.8	38.3	2.2	1.7	-4.0
Industrial Chemicals	27.9	30.1	42.1	27.8	30.1	42.1	0.1	0.0	0.0
Iron & Steel Basic Industries	33.2	32.3	34.5	26.1	35.0	38.9	-7.1	2.7	4.4
Textiles	30.3	37.0	32.7	25.3	36.2	38.5	-5.0	-0.8	5.8
Food Manfuctarues	19.6	30.1	50.3	23.5	26.6	49.9	3.9	-3.5	0.4
Beverage	26.9	37.1	36.0	23.2	35.1	41.7	-3.7	-2.0	5.7
Other Chemicals	24.7	30.5	44.8	23.1	36.4	40.5	-1.6	5.9	-4.3
Petroleum Refineries	18.2	29.3	52.6	22.9	22.3	54.8	4.7	-7.0	2.2
Machinery except elec.	27.7	28.6	43.7	21.8	38.2	40.0	-5.9	9.6	-3.7
Tobacco	22.2	27.2	50.6	20.0	21.4	58.6	-2.2	-5.8	**8.0**
Pottery, China & Earthware	21.9	46.8	31.3	19.0	44.4	36.7	-2.9	-2.4	5.4
Electric Machinery	25.2	33.9	40.9	18.9	46.7	34.3	-6.3	12.6	-6.6
Wearing Apparel	28.6	26.4	45.0	18.8	24.5	56.7	-9.8	-1.9	**11.7**
Leather	26.5	27.6	45.9	16.9	31.2	51.9	-9.6	3.6	6.0
Footwear	17.7	17.7	64.6	16.4	21.7	61.9	-1.3	4.0	-2.7
Prof., Scientific, & Measuring	23.4	37.6	38.9	16.4	48.2	35.4	-7.0	10.6	-3.5
Other Manufacturing Ind.	14.8	46.1	39.1	12.4	41.7	45.9	-2.4	-4.4	**6.8**

Source: OECD Compatible Trade and Production database.
Notes: Columns sorted by Adjacent Trade, 1985. Data include only trade flows with other OECD partners. Ireland and UK are included in “island” nations.

Table 2

Messages

	CONTENT:	
FORM:	**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 3

MESSAGES, TRANSACTIONS AND LOCATION OF STANDARDIZED AND SPECIALIZED PRODUCTS

	MASS PRODUCED,STANDARDIZED PRODUCTS	**SPECIALIZED, CUSTOMIZED AND INNOVATIVE PRODUCTS**
MESSAGES	Codified, transparent	Tacit
DEGREE OF INTERMEDIATE TRANSACTING	Low(high scope economies)	High (low scope economies, high roundaboutness)
DEGREE OF AGGLOMERATION OF SUPPLY CHAIN	Remote/Low agglomeration	Market-centered/ agglomerated
LOCATION OF PRODUCTION/DISTRIBUTION IN RELATION TO MARKETS	Remote	Indeterminate

Table 4

EXAMPLES OF POTENTIAL CHANGES IN THE INTERNET AGE

	MASS PRODUCED, STANDARDIZED PRODUCTS	SPECIALIZED, CUSTOMIZED AND INNOVATIVE PRODUCTS
PRODUCT DIFFERENTIATION OR VARIETY	**Less differentiation/variety:**	**More differentiation/variety:** *design-driven retail; *mass customization (design -your-own car;. some consumer services)
MESSAGES: B2C	**More transparent:** *consumer services (auction/ clearinghouse/search model); *consumer banking, finance;	**More embedded in product:** *mass customization
MESSAGES: B2B	**More codified:** *Internet auctioning and codified intermediation services; * Some medical advice	**More tacit:** *quality,design-driven manufacturing; *dot.com firms *consumer mass customized services; *entertainment products
DEGREE OF INTERMEDIATE TRANSACTING:	**Unchanged or lower (higher economies of scope):**	**Higher (lower scope economies):** *quality, design-driven manufacturing; *mass customization *entertainment prodn *intellectual, research, managerial, engineering functions
LOCATION OF PRODUCTION IN RELATION TO INTERMEDIATE MARKETS:	**More remote/dispersed:** *Some skilled producer services *codified advice & service linkages, e.g. home repair (delivery still localized)	**Market-centered (i.e. agglomerated):** *dot.com firms; * customer-driven manufacturing; * innovation-based manufacturing; * entertainment production; *intellectual, research, management
LOCATION OF PRODUCTION/DISTRIBUTION IN RELATION TO FINAL MARKETS:	**More remote:** *Design-stabilized retailing; *standardized, content-driven retailing (website sales); * electronically-delivered entertainment; consumer banking, finance	**Market-centered:** *design-driven retail (feel,touch needed); *Customer-driven services (e.g.ordered by internet; *complex consumer services

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