D TRADE, THE LOCATION OF PRODUCTION AND THE INDUSTRIAL ORGANIZATION OF FIRMS

Section C has explored the possible reasons why countries trade and highlighted how different modelling approaches, based on comparative advantages or on economies of scale, explain different types of trade: inter-industry trade among different countries and intra-industry trade among similar countries. Traditional trade models and the so-called "new" trade theory models can predict which countries will specialize in the production of certain goods and how many varieties of the same product they will exchange. However, they cannot predict the location decisions of firms. Further, they assume that production takes place within the boundaries of the firm. Therefore, they can neither explain why production is not randomly distributed in space nor what determines the decision of a firm to outsource.

Trade depends on where the production of goods and services takes place and how the production process is organized. Both decisions are internal to the firm. By internalizing the location decision and the organizational decisions of firms into trade models, the new economic geography literature and the recent literature on offshoring provide explanations for two empirical phenomena: the geographical concentration of production in some locations, and the process of international fragmentation of production through the breaking-up of the supply chain. This section examines these phenomena.

Although apparently contrasting, these two phenomena can co-exist. It is not uncommon that firms in certain business lines locate in the same neighbourhood. The pre-existence of a large market that can facilitate the search for the appropriate suppliers or the workers with the appropriate skills can be the reason why firms agglomerate in a certain region. For example, a textile district, a furniture district and so on can be found in the same neighbourhood in northern Italy. This phenomenon can co-exist with a firm's decision to spread different stages of the production process across different countries. For example, firms in the textile business may opt to leave their headquarters and design activities in the north of Italy, while sourcing the manufacturing activity from a foreign firm.

A common denominator in both these phenomena is the role of trade costs. Reduction in trade costs can be an important cause of both agglomeration and fragmentation. But the extent to which they are compatible has not yet been explored in economic literature. On the one hand, the new economic geography literature predicts that a fall in trade costs will lead to an initially greater geographical concentration of production and a subsequent reduction of concentration as trade costs fall to a sufficiently low level. On the other hand, recent theories of fragmentation predict that a reduction in trade costs will lead to greater fragmentation of production, with firms geographically spreading the different stages of their production process. Much in the same way as high trade costs in trading final goods imply that goods are made in the same country where they are consumed, high trade costs associated with parts and components imply that inputs are produced in the same country where they are processed. When trade costs of final goods fall, production and consumption can take place in different locations. Similarly, when trade costs of intermediate inputs fall, different stages of the production process can take place in different places.

This section will present existing evidence on the fall of transport costs and will clarify how widespread the phenomena of agglomeration and fragmentation are and what are their driving forces. In particular, it will explore the implications for patterns of trade and predictions in terms of the intra-firm versus arm's-length trade.

1. FALLING INTERNATIONAL TRADE COSTS

A broad definition of trade costs includes policy barriers (tariffs and non-tariff barriers), transportation costs (freight and time costs) as well as communication costs and other information costs, enforcement costs, exchange rate costs, legal and regulatory costs and local distribution costs. In terms of an *ad valorem* tax equivalent, international trade costs have been estimated to represent 74 per cent and local distributional costs 55 per cent (Anderson and van Wincoop, 2004). This section focuses on international trade costs and reviews the evidence on their evolution over time.

(a) Tariffs

The contribution of tariffs to total trade costs has decreased over time. Tariffs have progressively been reduced since the establishment of the General Agreement on Tariffs and Trade (GATT) in 1948. Estimates based on a sample of developed countries show that the average import tariff fell from approximately 14 per cent in 1952 to 3.9 per cent in 2005. A plausible guess for the tariff average prevailing before the Geneva Round of negotiations (1947) is that "in 1947 the average tariff rate was situated between 20 and 30 per cent" (WTO, 2007c).

Tariffs went down for both developed and developing countries. The formation of the European Union (EU) and the North American Free Trade Agreement (NAFTA) accounted for most of the tariff reductions among developed countries. An important contribution has also been provided by preferential tariff treatment in favour of least-developed countries (LDCs), bringing duty-free access for most of them to major developed countries.

It is worth highlighting that nominal tariff cuts may be reflected in more important reductions in the effectively applied rates in vertically fragmented processes. For a given tariff cut worldwide, the reduction in total trade costs due to tariff barriers is more important the higher the number of times a product crosses the border during its different production stages. For example, if the value added in each intermediate production stage is assumed to be infinitesimally small, a 1 per cent tariff reduction lowers the cost of producing by N per cent, with N being the number of production stages, since between every production stage the intermediate good crosses a border and incurs a tariff.

When the fragmentation of the production process is taken into account, tariff reduction can explain the magnified and non-linear effect of tariff reductions on growth of world trade. In particular, using data for the United States, Yi (2003) shows that tariff reduction can explain over 50 per cent of US growth of world trade between 1962 and 1999.

(b) Non-tariff barriers

Non-tariff barriers (NTBs) represent a large category of import restrictions. They include quantitative restrictions, subsidies, anti-dumping and countervailing duties, customs valuations and standard and technical regulations.

Measuring non-tariff barriers is a hard task. A common method is to construct a measure of the prevalence of NTBs, such as the percentage of tariff lines covered by NTBs. However, this measure does not provide an indication of the degree of restrictiveness of the specific type of NTBs. Estimation of the degree of restrictiveness requires a well-specified economic model (e.g. Kee et al., 2006 and Maskus et al., 2005).

Unfortunately, lack of data does not allow an estimation of the evolution of the degree of restrictiveness of NTBs over time. Data on the existence of NTBs exist, but they have a very narrow coverage and they are hardly comparable over time. A higher number of NTBs over time is more likely to be the result of a better recording of NTBs rather than an increase in the number. The elimination of voluntary export restraints (VERs) during the Uruguay Round (1986-93) and the phasing-out of the quota system in textiles and agriculture by developed countries as well as improved transparency in terms of notification of standards and technical regulation are remarkable achievements and point to a reduced incidence of NTBs.

A branch of the economic literature looks at the so called "border effect" to infer the evolution of trade restrictiveness. In a recent paper, Mayer and Zignago (2005) find that in the 1990s, on average, a country traded around 89 times more within its national borders than with another country. This average figure hides a wide variation of the coefficient of the border effect for trade among developed countries and trade between developed and developing countries. In particular, the border effect is much higher when the exporter is a southern country than when the exporter is a northern country. In the same period, a developed country imported on average 281 times more from itself than from a developing country and 61 times more from another developed country.

Mayer and Zignago also estimate the evolution of the border effects coefficients in the period 1976-99. They find that overall restrictiveness is three times less in the 1990s than it was in the end of the 1970s and that over the same period the level of access to northern markets for a southern country became 17 times

easier. The use of the border effect methodology does not allow identification of whether the remaining difficulties in market access are due to residual tariffs and non-tariff barriers or other factors, such as differences in quality of goods. However, Mayer and Zignago's estimations suggest that tariffs are not particularly important in explaining the fall of the border effect, thus suggesting that the fall in non-tariff barriers may be.

(c) Transport costs

Transportation costs are estimated to be typically higher than tariffs. In 2004, aggregate expenditure on shipping for total imports was three times higher than aggregate tariff duties paid (Anderson and van Wincoop, 2004). A study by the World Bank (2001) shows that for the majority of the United States' trading partners transport cost incidence for exports is higher than tariff costs incidence. For sub-Saharan African countries, this is five times higher.

Transport costs, much in the same way as tariffs, penalize goods produced in multiple stages across different countries, since producers need to pay for moving goods at each stage of the production process. A decline in transport costs will therefore be particularly beneficial for trade in vertically specialized goods.

Acquiring evidence on the evolution of transport costs is surprisingly complex. The problem is mainly lack of data on direct measures of transport costs and difficulties in providing indirect measures of these costs. This arises from changes over time in the type of products traded and in the mode of transport used to move goods around.[1]

A summary of the evolution of transport costs on the basis of the most recent studies is outlined below.

i) Land transport

Land transport consists of road, railways and pipelines. Most trade occurring between countries that share a border takes place via land. Hummels (2007) estimates that 90 per cent of trade between neighbouring countries and the United States occurs via land. Of this, road is the principle mode of transport. Data for the EU also show that road is the most important means of land transport. In Europe, around 72 per cent of trade volumes are shipped through the road network.

Data on the evolution of land transport costs are scarce. Available data suggest that land is the cheapest mode of transport and that this cost has been falling over time. Focusing on the United States, Glaeser and Kohlhase (2003) report a decline in land transport costs across all modes of land transport over the period 1947-99. With regard to transport by road, they calculate that while rising fuel prices and regulations kept prices at their 1947 level until 1985, since the Motor Carrier Act of 1980, trucking costs have been falling by 2 per cent per year, enabling the cost-reducing effect of technological improvements to take place. Figures for railroads show a decline from over 18 cents per ton-mile in 1890 to 2.3 cents in 2000 (in 2001 US dollars).

In a recent paper, Combes and Lafourcade (2005) build an indicator for road cost transport for France over time which takes into account infrastructure, vehicle and energy used, as well as labour, insurance, tax and general charges borne by transport carriers. On the basis of this index, they show that road transport costs strongly declined between 1978 and 1998. Driving factors of this fall were the deregulation (this includes the abrogation of the road compulsory freight rates and licence quotas as well as the insurance tax reforms on freight transport allowances) of the road transport industry and technological progress. Infrastructure investments are found to determine mainly which region took the most advantage of the reduction of costs, rather than the average trend over time.

ii) Ocean transport

Trade among countries without a common border takes place mainly via the ocean. In particular, ocean shipping is the principle mode of transport for bulk commodities (such as oil, petroleum products, iron ore, coal and grain). These represent a large share of trade in terms of weight, but are a small and falling share of trade in terms of value.

Three important technological and institutional changes have lowered shipping costs: the development of open registry shipping (i.e. registering ships under flags of convenience to circumvent regulatory burdens and especially manning costs), scale effects from increased trade and containerization. Standardized

containers allow the use of a multi-modal transport system, without unpacking and repacking.

However, there is no clear direct evidence of a downward trend in ocean shipping prices. A recent study by Hummels (2007) shows that the price index for tramp lines (mainly used for commodities, spot market price, no fix schedules), although showing a steady decline when deflated for the United States GDP deflator, does not show a downward trend when deflated for the bulk commodities price index (a proxy for the *ad valorem* shipping cost). As Hummels stated, this indicates that "while the cost of shipping a ton of wheat or iron ore has steadily declined, the price of shipping a dollar value of wheat or iron ore has not" (Hummels, 2007: 142-143; also see Chart 9).

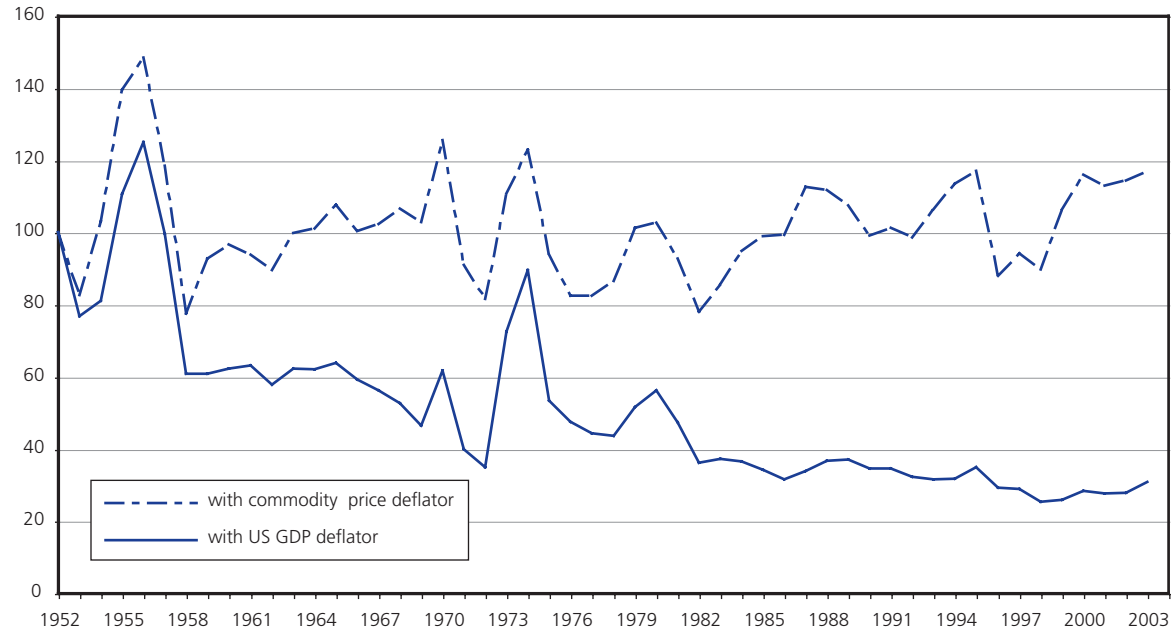
Similarly, liner prices (that is the price to ship general cargoes and various manufacturing products) do not show a downward trend. The liner price index for German imports indicates that prices increased from 1970 to 1985, and some evidence suggests that this increase occurred more broadly than solely in Germany.

The cost-reducing effect of containerization in the 1970s was outweighed by increases in fuel and port costs. But there have been other unobserved quality improvements that have lowered the indirect costs of ocean shipping. Most importantly, shipping times have lowered significantly. There are two reasons for this: first, technological improvements have significantly increased the speed of ships. Second, improved efficiency at the port, mainly due to containerization, has resulted in a reduction in the time required to load and unload ships. When this is taken into account, the quality-adjusted cost of ocean shipping has gone down.

iii) Air transport

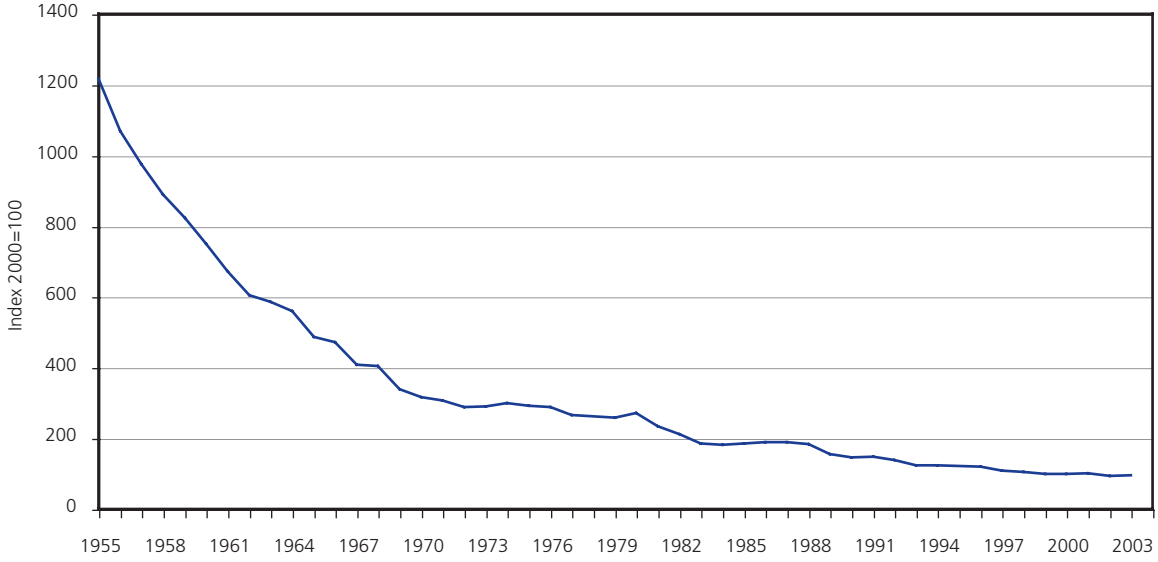
Air transport costs (measured in terms of revenue per ton-kilometre) dropped by 92 per cent between 1955 and 2004 (see Chart 10). The largest drop took place over the period 1955–72 (8.1 per cent annually), the period when the use of jet engines became widespread. More recently, changes in the regulatory set-up also helped to reduce air transport costs. For example, Micco and Serebrisky (2006) show that between 1990 and 2003 the introduction of the Open Skies Agreements (OSAs)[2] reduced nominal air transport costs by 9 per cent and increased by 7 per cent the share of imports arriving by air within three years of an OSA being signed.

Chart 9
Tramp price index



Source: Hummels (2007).

Chart 10
Worldwide air revenue per ton-km



Source: Hummels (2007).

The drop in air transport costs reflected in Chart 10 is due to a large extent to the reduction in the price of long-haul transport. For example, Table 8 shows that in the case of Germany, while the average air price index for six intercontinental destinations (New York, Mexico City, Hong Kong, Tokyo, Sydney and Johannesburg) fell from 96 US$/kg in 1954-56 to below 50 US$/kg in 1997-99, in the same period the average index for the three European destinations (London, Paris and Rome) increased from 95 US$/kg to 106 US$/kg.

As a consequence of the reduction of air transport costs, the share of trade occurring via air has been growing rapidly. Looking at ton-miles shipped, it increased by 11.7 per cent per annum in the period 1975-2004. Air transport represents a significant share of trade values. For the United States, air transport represents a third of its import value and half of the United States' exports outside North America. Similarly high figures are estimated for selected Latin American countries for which data are available (Hummels, 2007).

In particular, air transport tends to be more convenient than ocean transport, especially on long-distance shipments (Harrigan, 2005). Hummels (2007) shows that the marginal cost of an additional mile of air transport is dropping rapidly, thus making the use of air transport more convenient on long haul. In particular, air transport is more likely to be the preferred means of transport than ocean transport for goods with a lower weight/value ratio. One reason for this is that the marginal cost of fuel to lift 100 kilograms into the air is higher than the cost of carrying it on a boat.

iv) Time cost of transport

The time required to export and import a good is an important barrier to trade. In particular, there are two aspects of time that represent a cost for trade. One is the lead time, that is the length of time between placement of an order and receipt of the goods. This depends on the distance between customers and suppliers, the speed of the mode of transport chosen, the type of product, the management of the supply chain and the logistics as well as the type of administrative procedures related to exporting or importing, waiting time for shipment and delays related to testing and certification of goods. A long lead time represents a cost and therefore an obstacle to trade because it raises the costs of uncertainty and variation in demand for the final products. If, for example, future demand for a fashion product has been underestimated, the seller may run out of stock. This has costs in terms of foregone sales and the possibility of losing customers.

The other aspect of time that represents an obstacle to trade is the variability of delivery time. The more variable the delivery time, the greater the buffer stocks needed to face demand. High variability of delivery time would make it very hard to organize

Table 8
German real air transport prices by destination, 1954-99
(Indices,1954=100)

	Index		Average annual percentage change
	1954-56	1997-99	
Intra-Europe			
Rome	95	105	0.2
Paris	95	111	0.4
London	95	114	0.4
Average of 3 destinations	95	110	0.3
Inter-continental			
Hong Kong, China	97	24	-3.2
New York	95	27	-2.9
Bangkok	97	28	-2.9
Montreal	95	28	-2.8
Caracas	95	36	-2.2
Mexico City	95	37	-2.2
Teheran	97	50	-1.5
Tokyo	97	66	-0.9
Johannesburg	97	73	-0.7
Tel Aviv	98	73	-0.7
Cairo	97	73	-0.7
Sydney	95	72	-0.6
Rio de Janeiro	97	88	-0.2
Average of 13 destinations	97	52	-1.4

Note: Based on outbound (Frankfurt/M.) freight rates in US$ per kg deflated by (WTO) world export unit value index of manufactured goods.
Source: German Federal Statistical Office, Fachserie 17, Reihe 9, various issues and WTO calculations.

"just-in-time" delivery, where inventories are kept to a bare minimum and inputs arrive at the factory only when they enter the production process. "When just-in-time technology is introduced, delayed delivery of a component can hold up the entire production and cause costs that are much higher than the market price of the delayed component. Therefore, no discount can compensate the customer for unreliable delivery time, and firms with high variability of lead time will not be short-listed for contracts that require just-in-time delivery" (Nordas, 2007a: 35).

Direct estimates of the tariff equivalent of time find that each day in transit is equivalent to a 0.8 per cent tariff (Hummels, 2007). Calculated on a 20-day sea transport route (the average for imports to the United States), this amounts to a tariff rate of 16 per cent. This is much higher than the actual average tariff rate. Using gravity models, recent studies find that a 10 per cent increase in time to export reduces trade by between 5 and 25 per cent (see, for example, Hausman et al., 2005; Djankov et al., 2006; Nordas, 2007a; 2007b and Nordas et al., 2006) depending on the sector and export destination.

The ten-fold decline in air shipping prices since 1950 means that the cost of speed has been falling dramatically (Hummels, 2007). This has had two major effects on time as a barrier to trade: first, shipping times have been falling over time. Technological improvements in transport services (jet engines and containerizations) have not only had beneficial effects in terms of cost savings but also in terms of time savings. The average shipping time to the United States declined from 40 to 10 days between 1950 and 1998 (Hummels, 2001).[3] Evaluated at an average cost per day of 0.8 per cent *ad valorem*, the use of faster means of transport is equivalent to reducing tariffs by 24 per cent.

Second, variability of delivery time can more easily be buffered. This is because lower costs for air transport allow a more intensive use of air transport to hedge for market volatility. In addition, advancements in communication technologies have allowed the development of an effective multi-modal transport system. This has helped to reduce both time of delivery and uncertainty of delivery. The use of radio frequency identification tags, the internet and transponders on product packages allows factories and warehouses to keep track of where a product is at any time. Sharing information among terminal

operators, shippers and customs brokers can help manufacturers and logistic contractors to manage the supply chain and fulfil the need of just-in-time delivery (World Trade Organization, 2004).

(d) Costs of connecting people

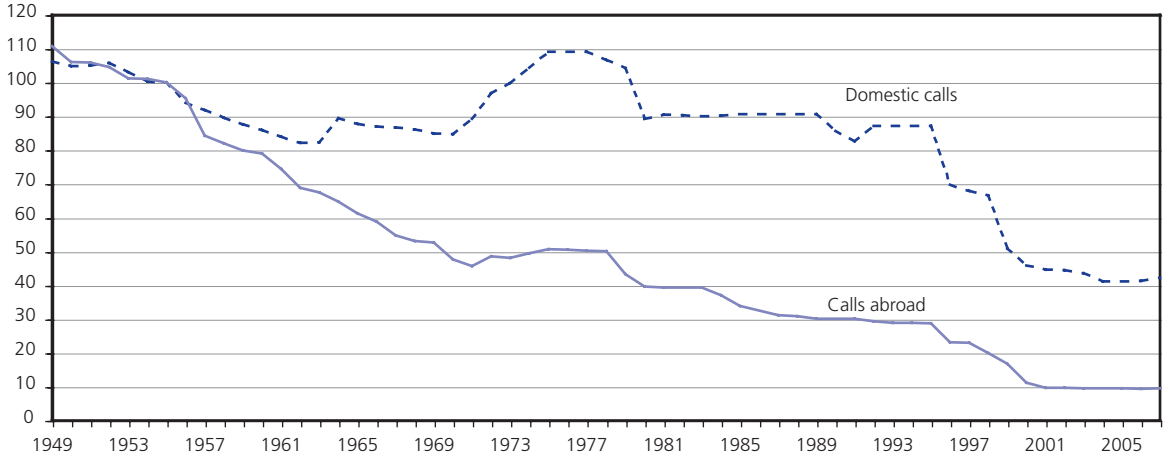
In order to trade, people need to communicate. Traders need to acquire information about profitable international trading opportunities and preferences of consumers. Final good producers need to search for the appropriate supplier. Effective telecommunications provides a low-cost channel for searching, gathering and exchanging information. Inefficient communication is a particularly important barrier in just-in-time production processes, where the logistics of transport modes and time of delivery rely on flow of information.

The importance of effective communication for trade results from a variety of studies. Nearly all estimations using gravity models introduce a variable measuring the ease of communication between countries. Language is a key variable that economic literature is used as a proxy for information costs. Common language helps business because it provides a direct way to communicate. A standard result is that common language promotes trade. English is not more effective than other major languages. However, diversity of languages spoken does boost foreign trade. Importantly, literacy increases trade too (Melitz, 2002).

Effective communication is particularly important for trade in goods of different varieties. From a theoretical point of view, the argument is that differences in manufactured goods in terms of both characteristics and quality limits the scope for prices to convey all the necessary information. Therefore, connections between buyers and sellers are needed to facilitate the flow of information. In this respect, the costs and quality of communication links are likely to be important in determining the ease with which information flows. Using a gravity model, Fink et al. (2005) find that higher communication costs (measured as the average per minute bilateral calling price charged in the importing and exporting country) have a negative effect on trade and that this negative impact is as much as one-third larger on trade in varied goods than on trade in homogenous goods.[4]

Costs of connecting people have been falling over time. First, costs of making international calls have fallen. Chart 8 shows the price of local and international phone calls on fixed lines for Germany from 1949 and 2007. Both have fallen, but the price of calls abroad experienced a more significant drop. Technological developments and regulatory reforms have contributed to a substantial reduction in the costs of telecommunications services. Second, the value of the telecommunications network has increased. Telecommunications is a network service and as such the value of the network for each consumer increases with the size of the network. Technological developments have allowed a much wider diffusion of telecommunications services, thus making the use of the network more valuable. Third, internet access has increased over time. The internet provides a rich source of information as well as a channel for advertising, marketing and searching. Finally, movement of people across countries has increased, as costs of transport have declined.

Chart 11
Prices for domestic and foreign phone calls of Germany, 1949-2007
(1955 = 100 in local currency, at current prices)



Source: Germany, Federal Statistical Office, Fachserie M Reihe 7 and Fachserie 17 Reihe 7 various issues.

To sum up, empirical evidence shows an overall downward trend in trade costs in the last half century. This includes traditional trade costs (such as tariffs and non-tariff barriers) as well as transport and communication costs. This is especially true if quality improvements are taken into account. For example, although there is no clear direct evidence of a downward trend in the cost of transport by ocean, there is clear evidence of a reduction in shipping times (both because of the increased speed of ships and the less time required to load and unload ships). When this is taken into account, the quality-adjusted cost of ocean shipping has gone down. An interesting feature of the fall in transport costs is that in particular costs to distant destinations have fallen the most.

Recent economic literature has stressed the importance of trade costs in determining the patterns of specialization and trade. In the new economic geography literature, the size of trade costs is a major factor in determining where a firm chooses to locate. Furthermore, in the recently developed literature on international fragmentation of production, trade costs have been seen as influencing the choice between outsourcing or in-sourcing, sourcing inputs through intra-firm or arm's-length trade. The next two sub-sections will look at these theories in more detail.

2. GEOGRAPHICAL CONCENTRATION

The discussion of the new trade theory in Section C.3 provided an explanation of the sources of welfare gains from international exchange. Countries that trade are able to benefit from increasing returns to scale in production from the increased variety of products and from increased market competition. The "new" trade theory provides an explanation why countries with similar endowments trade with one another and further predicts that this trade will be primarily intra-industry trade. Although there may be some element of overstatement involved, it could be said that quite apart from the home market effect (a country will export the product for which there is a large demand at home) the new trade theory leaves the pattern of trade – which country exports what – largely undetermined. This is quite unlike the traditional theories of trade, in which the pattern of trade can be readily predicted from the technological characteristics or factor endowments of a country.

In this sub-section, a much more detailed treatment of the home market effect, and other related predictions, together with the available evidence for them will be presented. They will be discussed in the context of a closely related literature - the "new economic geography"[5] – which employs many of the same assumptions as "new" trade theory and provides additional insights about the location of production and hence the pattern of international trade. Apart from the home market effect, the two other predictions about the pattern of trade and the location of production which will be discussed are the magnification effect and the core-periphery proposition. In both cases, falling trade costs are an important starting point in the analysis.

In the magnification effect, the theory envisages that a reduction in trade costs will amplify the home market effect. In the core-periphery argument, the theory foresees that falling trade costs will produce an initial period of divergence, where manufacturing production becomes concentrated in a "core" while a "periphery" specializes in non-manufactured goods. This is brought about by the presence of "agglomeration effects". But agglomeration effects are accompanied by centrifugal forces which promote dispersion. A further reduction in trade costs is expected to reverse this process of concentration, with manufacturing production becoming increasingly dispersed among countries in the periphery.

Given the focus on falling trade costs and the implications for the pattern of production and trade, the discussion below may give a relatively narrow perspective of the new economic geography. Thus it is important to highlight that the theory has been applied to look at a wide range of issues as well. Despite being less than two decades old, the theory has been used to explain major episodes of globalization in history (Crafts and Venables, 2003). Work has also been undertaken to examine how public policy issues, involving trade, tax and regional policies, are likely to be affected by the theory (Baldwin et al., 2003).

(a) New economic geography

Many of the elements of the new economic geography framework are familiar from "new" trade theory. The manufacturing sector produces a wide range of differentiated products. Production of these manufactured goods is subject to increasing

returns to scale. Markets continue to be competitive in that entry of new products continues until profits are driven to zero. Consumers have a preference for product variety. Labour is free to move across economic sectors within a country. There are costs involved in transporting manufactured goods from the producer to the final user or consumer.

In one important branch of this literature, two new elements are added. First, manufacturing firms are assumed to demand variety and this is met through their requirement of intermediate manufactured inputs (Krugman and Venables, 1995). In order to produce the final output, a manufacturing firm requires not only labour but also other intermediate manufactured inputs. This makes the manufacturing sector a large consumer of its own output. There are two sources of demand, therefore, for manufactured goods: demand for final goods by consumers and demand for intermediate goods by firms. This intermediate demand creates forward and backward linkages in the manufacturing sector. The forward linkage refers to the utilization of the firm's output by other firms as intermediate inputs to their own production activity. The backward linkage refers to the provision by other firms of the intermediate inputs required by the first firm.[6] This, as shall be seen later, is the way that agglomeration occurs. Second, the theory allows for a constant return-to-scale sector, which is traditionally called the agricultural sector. Unlike manufactured products, there are no transport costs associated with the production of agricultural goods.[7] Agriculture competes with the manufacturing sector for the available pool of workers.[8]

Some indication of the importance of manufactured intermediate inputs in the manufacturing sector can be gleaned from Box 10 below, which analyzes the input-output structure of the sector in several OECD countries (Canada, France, Germany, Italy, Japan, the United Kingdom and the United States) as well as two emerging economies (Brazil and China).

Box 10
The importance of intermediate goods in manufacturing

The new economic geography assigns an important role to the input-output linkage among manufactured goods in its explanation of agglomeration effects. Some indication of the importance of intra-industry linkages can be seen from the input-output tables of a number of industrial countries (Canada, France, Germany, Italy, Japan, the United Kingdom and the United States) and emerging economies (Brazil and China). The data come from the OECD's Input-Output Database: 2006 Edition (Yamano and Ahmad, 2006). This database contains 48 standardized industry input-output tables (using the third revision of the International Standardized Industrial Classification) based on data for the year 2000. Out of these 48 industries, 22 can be classified as manufacturing (from manufacturing food products and beverages to recycling).

As expected, the role of manufactured goods as intermediate inputs in manufacturing was clearly much more prominent than in the non-manufacturing sector. In the United States, for example, the average share of intermediate manufactured inputs in the output of the manufacturing sector was 35 per cent (see Box table). By way of contrast, the share of intermediate manufactured inputs in the output of the non-manufacturing sector was less than 9 per cent. The ratios are quite similar in the other major OECD countries. In Germany, the ratio was 40.8 per cent in manufacturing to 8.5 per cent in non-manufacturing. In emerging economies, such as Brazil and China, the share of manufactured intermediates in the manufacturing sector was between 40 and 50 per cent.

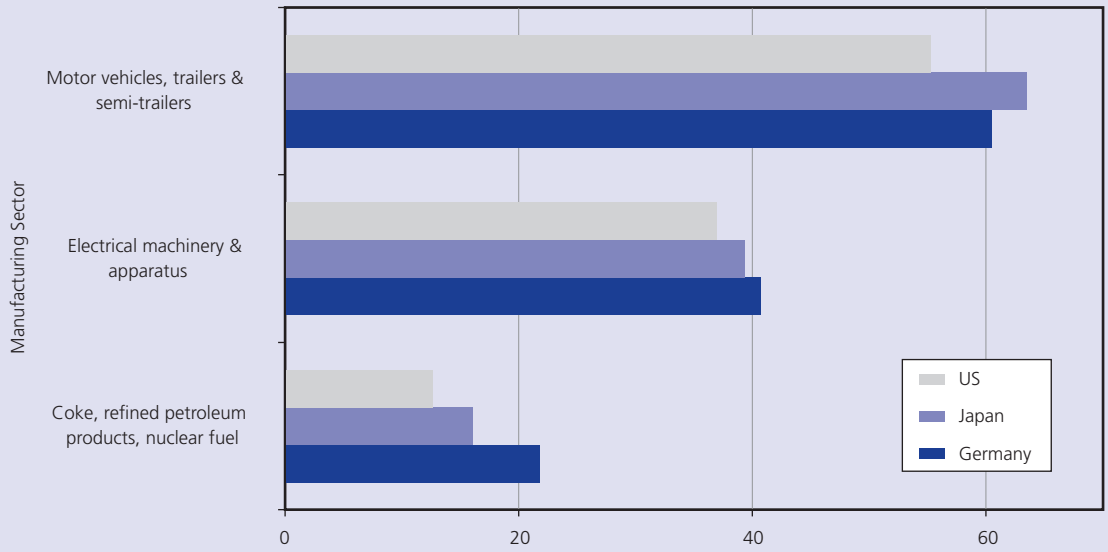
Within manufacturing itself, the sectors with the highest share of use of intermediate manufactured inputs in the OECD countries are motor vehicles (58.6 per cent) and office accounting and computing machinery (54.3 per cent). For the emerging economies, the sectors with the highest share of use of intermediate manufactured inputs were electrical machinery and apparatus (55.8 per cent) and motor vehicles (53.1 per cent). The chart below shows the share of intermediates in selected manufacturing sectors in the United States, Japan and Germany.

Share of intermediate manufactures by sector, 2000

Countries	Manufacturing sector (in per cent)	Non-manufacturing sector (in per cent)
OECD countries		
Canada	40.8	10.5
France	40.8	9.4
Germany	40.8	8.5
United Kingdom	33.8	9.0
Italy	39.7	9.8
Japan	40.5	10.4
United States	34.9	8.9
Emerging economies		
Brazil	38.7	15.2
China	48.3	28.1

Source: OECD Input-Output Database: 2006

Share of manufactured intermediates in output
(Percent)



Source: OECD Input-Output Database: 2006

(b) Home market and magnification effects

The key concern in this sub-section is to examine how falling trade costs are likely to affect the pattern of trade. As was stated earlier, the home market effect predicts that a country will export those goods for which it has a large home market. In effect, the large domestic product serves as a base for exports. It turns out that reduction in trade costs magnifies the importance of market size in determining which country concentrates in producing and exporting manufactured goods.

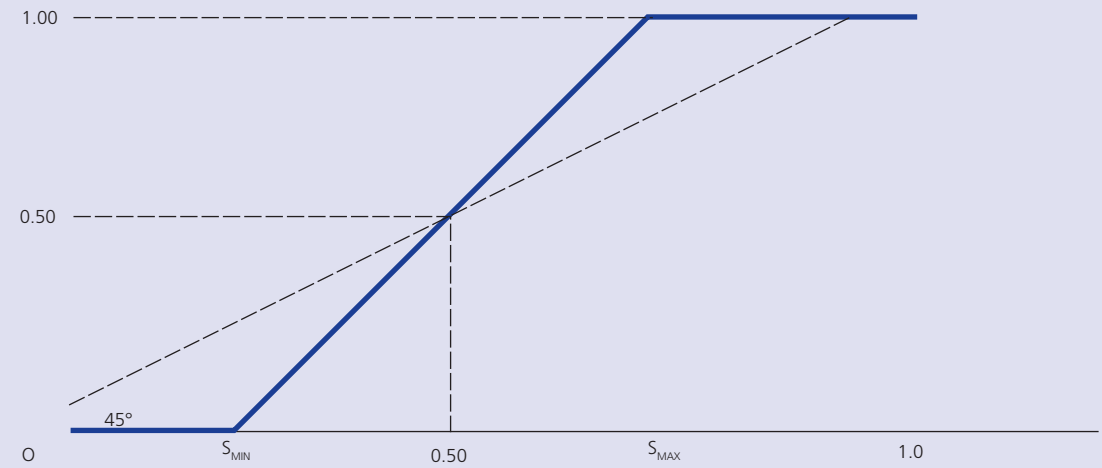
Consider first the home market effect.[9] Imagine two countries (call them Countries 1 and 2), each of which produces two goods: a constant returns-to-scale agricultural product and a differentiated increasing returns-to-scale manufactured product. Labour is the only input used in production and the size of the labour force will be used as a proxy for the size of the economy. The country with the larger labour force is assumed to be the economy with the large home market. For this analysis, the wage rate is assumed to be constant and the same in the two countries.[10] To make things simple, a constant share of income is assumed to be spent on the agricultural and manufactured goods; but in addition, demand for the manufactured product is influenced by consumers' love of variety.[11] Finally, it is assumed that trade is costly for the manufactured good but not for the agricultural product.[12]

The structure of demand is such that output will be the same per firm in each country. By virtue of having similar wages, and given that free entry ensures that price equals average cost, "mill" or producer prices will also be the same in both countries. Because of trade costs, the price paid by a consumer for an imported good will be higher than the price received by the foreign producer.[13]

Equating demand in both countries to the available production of the manufactured good determines the equilibrium number of firms in the manufacturing sector in the two countries. Given that output of each differentiated product is the same, the number of firms in a country corresponds to the size of its manufacturing sector. So for example, if the number of firms in Country 1 is six and the number of firms in Country 2 is four, it would mean that Country 1 produces 60 per cent of global manufacturing output. This turns out to depend on, among other things, the relative sizes of the country (the size of their labour forces). The larger the labour force of a country, the higher is its share of aggregate manufacturing output. In fact, if one country is sufficiently large, it is even possible for all manufactured products to be produced there, i.e. complete specialization in manufactured goods by the large country (Krugman, 1980). Box 11 provides a way of describing the home market effect in terms of the relationship between a country's share in global manufacturing and its relative size.

Box 11
The home market effect

Country 1's share of global manufacturing production



S_L = Labour force in country 1/Total labour force

The horizontal axis measures the size of Country 1 (the size of its labour force relative to the total amount of labour of both countries). The vertical axis measures Country 1's share of global manufacturing output (the number of manufacturing firms in Country 1 relative to the total in both countries). If the relative size of Country 1 equals or exceeds S_{MAX}, it will completely specialize in manufactured goods while Country 2 will specialize in agriculture. If the relative size of Country 1 is less than or equal to S_{MIN}, it will specialize in agriculture while Country 2 will specialize in manufactured products. Within the range given by the interval S_{MIN} and S_{MAX}, the relationship between Country 1's share of global manufacturing output and its size is given by the slanting bold line. The slope of this solid line is steeper than a 45-degree line, which means that whichever country is larger will have a proportionately larger share of manufactured goods. To see this, suppose $S_L = 0.6 < S_{MAX}$. Consequently, Country 1 will have more than 60 per cent of global manufacturing output (at that point the bold line will be above the 45-degree line). Now suppose $S_L = 0.4 > S_{MIN}$. Consequently, Country 1 will have less than 40 per cent of global manufacturing output (at that point, the bold line is below the 45-degree line). This implies that Country 2 will have more than 60 per cent of manufacturing production. Thus, graphically the home market effect is indicated by the slope of the solid line.

How then do reductions in trade costs affect the home market effect? It turns out that a reduction in trade costs will tend to magnify the home market effect. If trade costs are very low, even small differences in the sizes of the two countries can lead to a large concentration of manufacturing in the larger country. This also means that the threshold for complete specialization in manufacturing in the larger country is easier to achieve. In terms of Box 11, a reduction in trade costs increases S_{MIN} while at the same time decreasing S_{MAX}. As a consequence, the slope of the solid line becomes even steeper than before.

Some explanation for the magnification effect can be provided. If, for example, by virtue of the home market, the large country has the lion's share of global manufacturing output, the operation of increasing returns to scale makes manufactured products cheaper in the large country (by reason of its greater size). Even with the cost of transport factored in, it will be able to export manufactured goods to the smaller country. So a reduction in trade costs means that the large country can export manufactured goods to its partner at an even lower price than before. The reduction in trade costs has the effect of amplifying the original advantage it had of possessing a large market.

(c) Agglomeration effects

The fundamental question that theories of economic geography attempts to answer is why economic activity is not randomly distributed across many locations. Instead, many industries tend to be concentrated in certain places or locales (see Box 12). This suggests that there are economic benefits from firms being located in close proximity to one another. These benefits can arise from knowledge spillovers between workers and firms who are in close proximity to one another (Marshall, 1920). Concentrating firms in a single location means workers in that area face less risk of unemployment. This can increase their incentive to upgrade their skills. The presence of a large number of similar firms can lead to the development of specialized inputs tailored to their needs.

Box 12
Geographic concentration: from Bangalore to Wall Street

The extent to which economic activity is concentrated geographically is visible in the way that certain towns, cities or regions become associated with particular industries.

Bangalore, which is located in the province of Karnataka in south-west India, is synonymous with India's information technology (IT) industry. While it makes up only two hundredths of 1 per cent of India's physical area, about a quarter of the Indian software industry is located in Bangalore.[1] The Software Technology Parks (STPs) of India estimates that more than 35 per cent of Indian software exports originate from the state of Karnataka, where Bangalore is located.[2] On the other side of the world, fabled Silicon Valley is the cradle of the IT revolution. Located in Santa Clara Valley in northern California, it was the birthplace of IT giants and innovators such as Hewlett-Packard, Intel, Advanced Micro Devices (AMD), Sun Microsystems, Apple, Adobe, Cisco Systems, Oracle, Symantec, NVIDIA, eBay, Yahoo and Google. The founders of Yahoo and Google had all been students at nearby Stanford University.

The US film industry was synonymous with Hollywood, particularly during its "golden age", which lasted from the end of the silent era in American cinema in the late 1920s to the late 1950s. During the heyday of the big three US automakers (Ford, Chrysler and General Motors), automobile manufacturing was heavily concentrated in Detroit. In the 1920s, all major US advertising agencies had offices in New York City (along Madison Avenue). For at least four decades after the end of World War II, the city of Sassuolo in Italy was the centre of the Italian, and hence global, ceramic tile industry. At its height in the 1980s, before the advent of Spanish and Chinese competition, it was exporting US$ 800 million worth of ceramics annually.[14] New York (Wall Street) is the centre of US, if not global, investment banking.

These examples show that geographic concentration of economic activity occurs as much in services as in manufacturing. In many of these examples too, it is likely that geographic concentration of firms is due to technological rather than pecuniary externalities.

1 Balasubramanyam and Balasubramanyam (2000).

2 Software Technology Parks of India, http://www.blr.stpi.in/perfanalysis.htm#.

Similar to these other explanations, the new economic geography argues that concentration confers benefits not only to the firm which moves to a large market but also to the other firms that are already established there. This is the agglomeration effect. A firm chooses to locate in a particular region because it offers the most profitable venue for conducting its operations. But under certain economic conditions (increasing returns to scale, trade costs, and the existence of input-output linkages among manufacturing firms), this geographic concentration increases the productivity of all the firms located there. Establishing the firms in one place makes their total output larger than if each one had been operating in a different region.

There are two possible ways for agglomeration to occur. One way is through the movement of labour between sectors and geographical regions. But this would apply primarily to agglomeration in the domestic economy since labour is not mobile across national boundaries.[15] The second way in which agglomeration can occur is through the use of intermediate inputs in manufacturing production (Krugman and Venables, 1995). Part of the output of manufacturing firms is sold to other manufacturing enterprises. Manufacturing firms also procure their intermediate input requirements from other manufacturing enterprises. These linkages on the output and input sides allow one firm's better sales and savings in input costs to be transmitted through the whole manufacturing chain.

First, consider the benefits that are likely to arise for a firm that establishes itself in a region with a large market for manufactured goods. Such a market offers a variety of intermediate goods which the firm can use to turn out the final product. The benefit of greater variety shows up as a reduction in the price paid for its basket of intermediate inputs.[16] Since the firm is now geographically close to these suppliers, it also saves on the transport costs of its inputs and further lowers its cost of production. At the same time, the large market makes it easier for the firm to sell more of its final good to other firms. One important by-product of this move to the larger market is that the firm is able to produce at a larger volume than before, thereby driving down its average cost of production because of increasing returns to scale.[17]

But moving to this large market not only benefits this firm. Firms who are already established in the region will also benefit from the first firm's decision to establish itself in the region. The availability of a new product will benefit the already established firms given their demand for variety. The introduction of a new product also reduces the price paid for their basket of intermediate inputs. Further adding to the reduction in production costs is the fact that the new product can be purchased locally, thereby saving on transport costs. A second benefit for the already established firms is the increase in demand for their final output, which will be used as intermediate inputs by the new firm.

Thus, a "virtuous circle" is created by this interaction of input-output linkages, increased variety, saving on transport costs and increasing returns to scale. Agglomeration involves an externality because the decision by the first firm to move to the large market benefits other firms. But the externality is a pecuniary one because the benefit from geographic concentration is transmitted through market prices, which differentiates this explanation from older explanations which emphasize technological spillovers. For most firms, the benefits take the form of a reduction in the price of the basket of intermediate inputs that they require. For other firms, the benefits come from the increase in the demand for their final good.

If there are only agglomeration effects, the virtuous circle that is created by a new manufacturing firm locating to a region with a large market should not end until all manufacturing is concentrated in that locale. But there are centrifugal forces which work against the agglomeration effects. They include changes in factor prices (i.e. the agricultural wage rate) and greater product market competition.

An expansion of the manufacturing sector requires workers to move from the agricultural sector to the manufacturing sector. Given that there are diminishing returns in employment in agriculture, the reduction in labour there increases the marginal product of labour. Since labour markets are assumed to be competitive and there is full mobility between the two sectors, wages must equalize across sectors (otherwise workers would have an incentive to move to the high-wage sector). This means that if manufacturing is to continue to expand, it must pay a higher price to persuade existing agricultural workers to move to the manufacturing sector. This tends to reduce the incentive for further expansion of the manufacturing sector.

A second factor working against agglomeration is the increase in product market competition. Consumers demand variety. While manufactured goods are differentiated and therefore not perfect substitutes, the appearance of a new product should nevertheless lead to a decline in the demand for all other varieties of manufactured goods. This means that further expansion of the manufacturing sector will be more difficult since an enterprise which is considering setting up business will have to expect less favourable market demand conditions for its product. Thus both wage and product market effects counteract the backward and forward linkages, which favour geographical concentration of the manufacturing sector. To consider the effect that any exogenous economic change, such as a reduction in trade costs, will have on the geographical location of the manufacturing sector – whether it will lead to increased concentration or to dispersion – it is necessary to weigh the strength of the agglomeration effects against the wage and product market effects working against it.

Some recent research has been able to quantify these agglomeration effects by measuring the increase in the total factor productivity of already established firms following the entry of a sufficiently large new firm (Greenstone et al., 2008). The effect appears to be statistically significant and economically substantial. On average, Greenstone et al. (2008) estimate that already established firms' output is 12 per cent higher five years after the entry of a new firm, assuming that inputs remain constant. Interestingly, they also find evidence of a relative increase in labour costs, indicating that centrifugal forces are simultaneously set in motion.

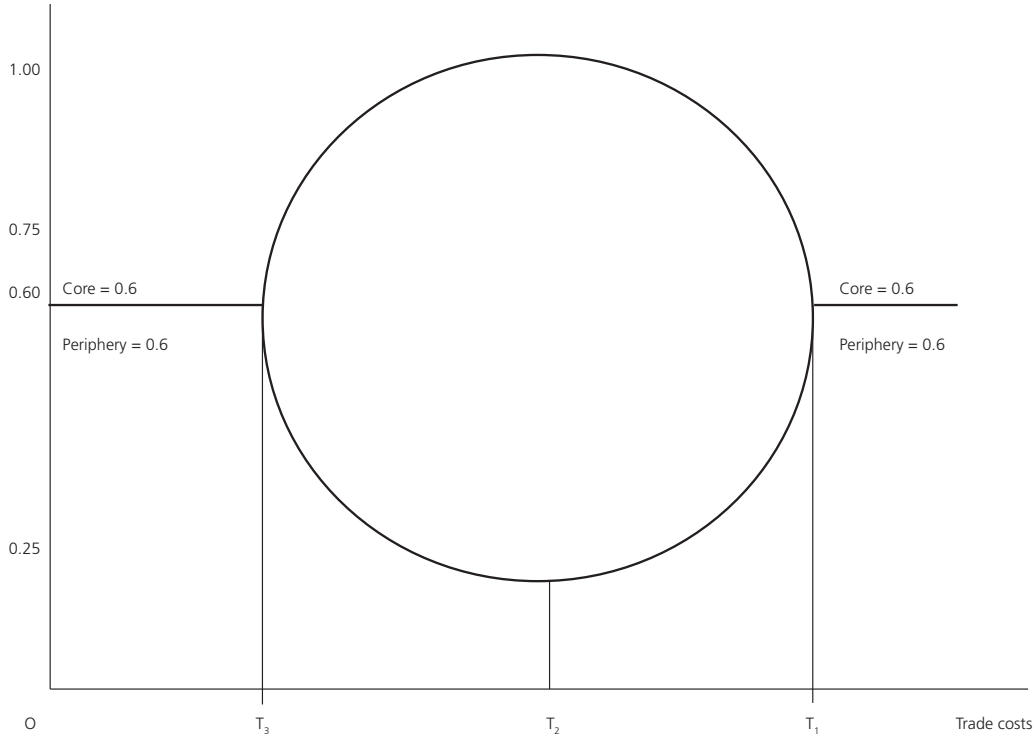
(d) Core-periphery

One key outcome from the interaction of agglomeration effects and centrifugal forces is the core-periphery result. As trade costs fall, there will be an initial phase where agglomeration effects dominate and produce a concentration of manufacturing in the core. But beyond a certain point, continued reduction in trade costs will allow centrifugal forces to emerge. In this second phase, changes in wage rates and greater product market competition in the core counteract and ultimately reverse the agglomeration effects, with manufacturing being dispersed to the periphery.

If initial trade costs are very high[18] – and the home (core) and foreign (periphery) countries are in identical circumstances, producing both manufactured goods and agricultural products – the high trade costs make it economically impossible for the home (core) country to supply the demand of the foreign (periphery) country for manufactured goods. This means that there is an absence of agglomeration effects at this point. However, if technological innovations progressively reduce trade costs, it becomes economically feasible for the home (core) country to supply the foreign (periphery) country. Agglomeration effects operate, with the result that manufacturing expands in the core.

A nearly opposite process takes place in the periphery. Its manufacturing sector shrinks, as manufactured goods are supplied by the core, although manufacturing production does not completely disappear. The reduction in trade costs triggers agglomeration effects in the core and leads to de-industrialization in the periphery. Exports from the core become increasingly dominated by manufactured goods while exports from the periphery are increasingly made up of agricultural products. The expansion of manufacturing in the core requires labour to move from the agricultural to the manufacturing sector. This can only be accommodated through an increase in wages in the core. A wage differential opens up between the core and the periphery which helps maintain some manufacturing in the periphery. If trade costs continue to fall, the forces of dispersion (wage and product market competition) begin to assert themselves to begin a reversal of the core-periphery outcome. At low trade costs, the wage differential between the core and periphery becomes more important in determining the competitiveness of manufactured goods. Thus manufacturing becomes dispersed to the periphery, where wages are lower than in the core.

Chart 12
Share of manufacturing in domestic production of core and periphery



Note: Chart 12 provides a picture of the relationship between trade costs and the concentration of manufacturing (sometimes called the "bifurcation" diagram).[19] Trade costs are measured in the horizontal axis and the share of manufacturing in total output in the core and in the periphery is measured in the vertical axis. At high trade costs (T_1), there is no agglomeration and the share of manufacturing out of total output is the same in the core and in the periphery, at 60 per cent. Once trade costs decline below T_1, agglomeration begins in the core and the periphery is de-industrialized. The share of manufacturing rises to almost 100 per cent in the core while it falls to about 25 per cent in the periphery. A further reduction in trade costs to T_2 leads to the wage and product market competition effects becoming more dominant and reversing agglomeration. At T_3, further reduction in trade costs brings back the original symmetrical outcome.

(e) Empirical evidence

Head and Mayer (2004) provide a comprehensive survey of the empirical literature on agglomeration and trade. In this report, the focus will only be on the home market effect and the core-periphery prediction.

i) Home market effect

The pioneering studies on the home market effect were undertaken by Davis and Weinstein (1999 and 2003a).[20] In general, they provide support for the home market effect, particularly for manufactured goods. Among the more recent studies undertaken to empirically test the home market effect are Lundbäck and Torstensson (1998), Feenstra et al. (2001) and Weder (2003). These later studies continue to find empirical confirmation of a home market effect. The effect is strongest for goods which are differentiated and subject to economies of scale. There is less statistical support for the home market effect with respect to homogeneous goods and goods produced with constant returns to scale.

In most of these studies, real GDP is used to represent the size of the home market, as in Feenstra et al. Weder uses domestic consumption (production plus imports less exports) as a measure of the size of the home market. In the Davis and Weinstein papers, the home market effect is measured by how much domestic demand differs from the pattern in the rest of the world. Lundbäck and Torstensson employ two alternative measures of the size of the home market, which they various call "demand bias" and "national preferences".[21]

The early study by Lundbäck and Torstensson first runs separate regressions for each of the 17 OECD countries in their dataset. Each country regression has 49 observations, corresponding to the number of industries included in the analysis, where the dependent variable is the net exports of an industry and the explanatory variable is either "demand bias" or "national preferences" described earlier. The impact of demand bias on net exports of an industry is positive and significant in only 6 out of 17 country regressions. For three countries, industry demand bias has a significant negative impact on the net exports of these industries. While results for demand bias are unclear, the results for national preferences are more clear-cut. Industries with higher national preferences have significantly higher net exports in all countries. Second, they ran a regression for the pooled dataset of 17 countries. These results confirm the findings from the separate country regressions. Demand bias has no robust significant impact on the net exports of an industry but national preferences with respect to a certain industry significantly increase the industry's net exports.

Feenstra et al. (2001) employ the gravity equation to test the home market effect. They apply it to three different types of bilateral trade flows: those involving differentiated goods, homogeneous goods and goods in between. They classify goods which are traded in organized exchanges as homogeneous goods. In-between goods are those not traded in an organized exchange but having some quoted "reference price" as, for example, in industry publications. Finally, differentiated goods are those which do not have any quoted prices. A home market effect exists if the coefficient on the exporter's GDP (own income elasticity of exports) is larger than the coefficient on the partner country's GDP. As expected, they find that the home-market effect depends on the type of good. It is stronger for differentiated goods and smaller for goods in the in-between category.[22]

Weder (2003) tries to identify whether there is a home market effect for US and UK manufacturing exports to third countries. He uses data from 1970 to 1987 from 26 industries in the US and UK manufacturing sectors. He finds a significant positive relationship between the relative size of a US or UK industry and relative exports to third markets. Out of 26 manufacturing industries, he identified seven as having high economies of scale. For these seven industries, the relationship between relative home-market size and relative exports is stronger.

ii) Testing the core-periphery hypothesis

This sub-section examines some of the evidence pertaining to the core-periphery hypothesis. Drawing on longer-term international trade and production data, it also presents some data that may have a bearing on this hypothesis (see Box 13).

At the outset, it is not clear to what extent the core-periphery hypothesis is intended as a stylized description of economic history that could artfully be teased out of simple economic models and to what extent it can be tested empirically. In fact, Krugman and Venables (1995) described the core-periphery argument (tongue in cheek) as "history of the world, part one". Second, the diagram above suggests a complex relationship between falling trade costs and concentration. As Head and Mayer (2004) point out, nothing will happen to the concentration of manufacturing after an initial fall in trade costs. It is only somewhere between T_1 and T_2 in Chart 12, for example, that agglomeration takes hold. Thus, linear regressions between some measure of concentration and trade costs may not capture the effect. As a result, numerical simulations have often been employed to see whether reasonable parameter values can replicate the dynamic core-periphery hypothesis. These include the studies by Combes and Lafourcade (2001), Forslid et al. (2002) and Teixeira (2006). But the results of such simulations are of course highly sensitive to the choice of parameter values.

Combes and Lafourcade (2001) develop a multi-region multi-industry economic geography model of France under the assumption of imperfect competition.[23] They lower trade costs in incremental steps of 2 per cent until they have fallen by 30 per cent. They subsequently examine the resulting changes in the regional pattern of the variables. They look only at short-term equilibrium, i.e. the number of plants is kept fixed and no new market entry is allowed. They do not calculate long-term equilibrium (where new firms enter the industry until profits are driven to zero) because of the computational difficulties.

Combes and Lafourcade find that decreasing trade costs reduce the concentration of production for all ten industries. Regarding employment, they find

Box 13
Is there a core-periphery story?

The new economic geography tells a complex story about the thrust of economic development. It predicts that the initial phase of globalization will create a pattern of uneven development, with manufacturing increasingly being concentrated in a core and the periphery being left with primary production. But as globalization continues, manufacturing will subsequently become more dispersed.

The World Bank's Trade, Production and Protection database (Nicita and Olarreaga, 2007) contains information on manufacturing output and value added of about 100 developing and developed countries over the period 1976-2004, although data availability varies by country and year. The table shows the share of the core countries in global manufacturing output from 1976 to 2002 (note that this information differs somewhat from the usual focus of the new economic geography, which is the share of manufacturing in total output in the core and in the periphery). The "core" includes the United States, Canada, Japan, the original six members of the European Community (France, Federal Republic of Germany, Italy, Belgium-Luxembourg and the Netherlands) and Great Britain. Besides total manufacturing output, the table also shows the share of the core in the global output of certain subsets of manufacturing: "basic" manufacturing, iron and steel and wearing apparel. "Basic" manufacturing includes iron and steel, machinery and equipment, transport and professional and scientific equipment (ISIC codes 371 to 385).

Based on the information, it appears to make sense to talk of a core. The group of industrial countries chosen as the core accounted for about 86 per cent of world manufacturing output in 1976. Their share of basic manufacturing was even higher, at 89 per cent. By 2002, their share of world manufacturing output was still about 81 per cent (82 per cent for basic manufacturing). Thus, world manufacturing is heavily concentrated in these industrial countries. Although there has been some decline in the core's share over the past quarter of a century, this decline has been relatively small. This may suggest that the current phase of globalization has not yet resulted in the reversion to greater symmetry that is predicted by the new economic geography. This focus on manufacturing as a whole may, however, hide changes at a more disaggregated level. In the case of iron and steel, for example, the core's share has fallen from more than 70 per cent to just about half of global output. In the case of wearing apparel, the degree of concentration was not very high even back in the mid-1970s.

"Core" share of global manufacturing output, 1976-2002
(Per cent)

Year	All manufacturing	Basic manufacturing	Iron and steel	Wearing apparel
1976	86.4	89.0	72.0	55.0
1980	85.5	88.5	71.3	54.4
1985	86.1	89.3	65.0	55.8
1990	83.8	86.7	70.6	63.9
1995	83.0	85.1	66.9	67.0
2000	81.3	83.3	60.3	62.6
2002	80.6	82.4	54.9	56.7

Source: World Bank Trade, Production and Protection database.

that a 30 per cent decrease in trade costs leads to an equal decrease in the average concentration of total employment. A uniform decline of 30 per cent in trade costs would change the spatial pattern of profits from a one-core (around Paris) to a two-core configuration, with the second core emerging in the north of Lyon. Furthermore, this decrease in trade costs would lead to dispersion at the national scale but to more agglomeration within regions, i.e. within a region, concentration of production and employment tends to increase but at the national level concentration tends to decrease. Hence, in the short term, decreasing trade costs lead production and employment to be more equally distributed across regions but more concentrated within regions.

Forslid et al. (2002) investigate whether the results from two-country new economic geography models hold also in a model with more countries. They calibrate a computable general equilibrium model and simulate the effects of trade liberalisation on the location and concentration of manufacturing industries. A non-linear relationship between trade costs and concentration is observed for industries, with significant increasing returns to scale and important intra-industry linkages, i.e. metals, chemicals, transport equipment and machinery. There is increasing concentration initially as trade costs decline followed by a subsequent reversal as trade costs continue to fall. Four other industries, i.e. leather, food, minerals and textiles, which have a low degree of increasing returns to scale, display a negative relationship between concentration and trade costs. In these industries, initial trade costs prevented sufficient specialization according to comparative advantage, a pattern that is more in line with traditional comparative advantage trade theory.

Teixeira (2006) builds on the methodological approach of Combes and Lafourcade to study the impact of public investments in the Portuguese transport network, which would have reduced transport costs, on the spread of Portuguese industry. He first estimates the structural form of the Combes and Lafourcade model, using data on Portuguese investments in transport infrastructure from 1985 to 1998. The estimates suggested that infrastructure investments led to a reduction in transport costs but not to the dispersion of manufacturing firms. However, when the estimated model was simulated to examine the impact of a planned expansion of the transport network, the predicted outcome was dispersion of industry if transport costs are lowered sufficiently. He concludes that these results are consistent with the core-periphery theory, where reduction in transport costs first promotes agglomeration but eventually leads to dispersion.

Thus, these simulations give differing conclusions about the expected evolution of the core and the periphery. While Forslid et al. (2002) and Teixeira (2006) find a non-linear relationship between trade costs and concentration, Combes and Lafourcade (2001) find a relationship leading to dispersion of all industries. One explanation for the difference appears to be the nature of the industries being studied. The non-linear relationship between trade costs and concentration appears to be stronger for industries with significant increasing returns to scale and strong intra-industry linkages. This is an area of empirical work that is likely to continue to attract considerable research attention in the future.

(f) A summing up

Two rather salient predictions have arisen from this discussion about reduction in trade costs and the location of production and pattern of trade. The first is the home market effect and the other is the core-periphery outcome. There appears to be some empirical substantiation for the home market effect, at least with respect to differentiated manufactured products. But it is less clear as to what extent the core-periphery can be empirically tested and verified. At any rate, global manufacturing continues to be largely concentrated in the OECD countries. It does not appear that the current phase of globalization (and the reduction in trade costs) has resulted in the kind of dispersion predicted by the new economic geography. The picture is bound to be more nuanced when manufacturing is examined at a more disaggregated level. It may be that the concentration-dispersion process has already started in certain manufacturing sectors, such as textiles and clothing, iron and steel, etc. The next sub-section continues to pursue this question concerning the impact of falling trade costs on the location of production. This is examined at the level of the production processes of the firm.

3. INTERNATIONAL FRAGMENTATION OF PRODUCTION

An important phenomenon over the last half century has been the increase in the trade in parts and components, and the related international fragmentation of production accounting for a large part of the superior growth of trade compared with GDP. More recently, firms are no longer only distributing production stages to different locations and importing intermediate goods, they are also "unbundling" office tasks. In particular, those tasks where the North-South wage gap is not justified by an offsetting productivity gap are being offshored. The classic example is the relocation of US call centres to India. This has prompted some economists to talk of a new era of globalization presently unfolding. The reduction of communication costs and the costs of trading ideas are commonly considered to be the causes of this second unbundling.[24]

This sub-section will attempt to clarify the estimated size of these phenomena and recent trends. It will describe how the most recent theoretical economic literature on trade explains firms' decisions to offshore and will identify the driving forces behind the process of internationalization of production. Two case studies, on electronics and on the financial sector, will provide more precise figures on the size of offshoring and what prompts it. The effects of international fragmentation of production on welfare have been discussed in Section B. Its effects on employment and wages are discussed in Section E.[25]

(a) Offshoring of goods and services

The terms outsourcing and offshoring have been used in a number of different ways, both in the public debate and in economic literature.[26] Following the broad definition of the term , outsourcing is defined here as the "acquisition of an input or a service from an unaffiliated company" (Helpman, 2006). Offshoring is the sourcing of input goods or services from a foreign country. This includes sourcing from a foreign affiliate through foreign direct investment (FDI) and sourcing from a foreign non-affiliate through arm'slength contracts. While FDI involves intra-firm trade, arm's-length offshoring involves trade between firms (see Table 9).

A major problem when attempting to measure the magnitude and the trend of offshoring of goods and services is that the definitions shown above do not easily match the officially collected economic data. Therefore, estimates of the pattern and the size of offshoring have to rely on proxy measures.

Systematic empirical analysis of these phenomena are missing due to lack of data. Nevertheless, recent economic literature has highlighted, in general using data for the United States, four major facts. First, both merchandise and services offshoring has rapidly increased in the last two decades. Second, although international outsourcing of intermediate goods is quantitatively more important than services, services offshoring has been increasing at a faster pace in recent years. Third, offshoring has rapidly expanded both via arm's-length trade and via intra-firm trade. Fourth, these trends have been widespread across sectors and types of inputs (Helpman, 2006). As will be seen in the next sub-section, a growing body of trade models have recently been developed to understand these trends.

In this sub-section, empirical evidence will be reviewed. In addition, using the most recent input-output data issued by the OECD, insights into the importance of offshoring by country and sector will be provided.

i) Expansion of offshoring goods and services

International fragmentation of production was already present in the early 1960s. IKEA established production facilities in Poland in the 1970s. Similarly, services offshoring is not a new phenomenon either. "Already in the late 1980s Swissair had moved a lot of its accounting tasks to India; the City of London also turned to India for computer maintenance services" (Jones et al., 2005: 309). However, in the last two decades the expansion of production networks in East Asia and the economic transformation of eastern Europe appear to have significantly intensified these phenomena (Jones et al., 2005).

Available data do not allow the direct measurement of economy-wide offshoring in goods and services. In order to gain insights into the evolution of offshoring, economists draw on proxy measures. Box 14 provides an overview of the measures of international outsourcing commonly used in empirical literature. It highlights the pros and cons of alternative measures and discusses data availability.

Table 9
Source of input goods or services

		Outsourcing	
		affiliate	non-affiliate
offshoring	at home	domestic production within the firm	domestic outsourcing
	abroad	FDI intra-firm trade	international outsourcing arm's length trade

Box 14
Alternative measures of international outsourcing[27]

Economic literature suggests a number of ways in which offshoring may be measured. In this box, offshoring measures are classified in accordance with the relevant database.

A rough measure of offshoring can be obtained using trade data statistics. For manufactured goods, trade in intermediates is commonly used as a proxy measure for offshoring. This is generally done by defining trade in certain product categories (those which have the words "parts" or "components" in their description) as trade in intermediates. For services, trade in "computer and information services" and "other business services" are usually selected as a proxy for offshoring since these categories of services are more commonly demanded by firms rather than final consumers (see, for example, Amiti and Wei, 2005; OECD, 2007d and 2006c; van Welsum, 2004; and WTO, 2005).

Offshoring measures based on trade statistics, regarding goods or services, suffer from the arbitrariness of the definition of product groups. A good or a service might be either final or intermediate depending on the context. For instance, software programmes reported under the category "computer and information services" can be demanded both as final products by consumers and as intermediates by firms. Trade statistics do not allow a distinction to be drawn between these two uses.

An alternative way to measure offshoring is to use input-output tables. The advantage of using these data over trade data is that they allow goods/services used as intermediate inputs to be distinguished from those used for final consumption. However, the availability of input-output tables is limited. For instance, the input-output tables provided by OECD (3rd edition) cover 35 countries and at most two years (1995, 2000).

Economic literature has in general referred to two indexes of offshoring based on the input-output tables. These are:

a) the offshoring index

For a sector i and for a set of inputs (goods or/and services) j, this is defined as:

$$OI_{ij} = \frac{\text{imported inputs j used by sector i}}{\text{domestic + imported non-energy inputs j used by sector i}}$$

That is, offshoring is measured as the share of foreign inputs j in all non-energy inputs j used by sector i. Hence, the more inputs imported by a sector, the higher the index for the sector. A problem related to using this index as a measure for offshoring is that information on imported intermediate inputs by type of inputs and buying sector is required to build this index. This information is, however, not available for all countries. One alternative is to use the index suggested by Feenstra and Hanson (1996) that uses trade shares of a sector as a proxy for the inputs used by the sector. Another problem is that this index of offshoring considers inputs from all industries in the computation of the measure of offshoring. For example, the purchase of foreign steel by a carmaker would be included in the measure of offshoring, even if it would not usually be perceived as offshoring. Alternatively, Feenstra and Hanson (1999) suggest a narrow definition of offshoring. This definition limits the imported inputs in the definition of the index to those falling in the same sector as the importing sector.

b) vertical specialization

For country k and sector i, the index of vertical specialization is calculated as:

$$VS_{ki} = \left(\frac{\text{imported inputs}}{\text{gross output}}\right) * \text{exports of intermediate and final goods}$$

and indicates the value of imported intermediate inputs (goods and services) embodied in exported goods. This index has been introduced by (Hummels et al., 2001) and has, so far, only been used for manufacturing goods.

It is worth noting that this measure only captures a special case of offshoring: the case when the offshored goods are used for production of goods that are then exported. The advantage of using this restrictive definition is that it allows an indication to be provided of the contribution of the growth in vertical specialization to overall

trade growth. Hummels et al. (2001) find that growth in vertical specialization accounted for more than 30 per cent of export growth in most of the OECD countries in the 1970s and 1980s.

A problem with this measure of offshoring is that it is affected by the level of sectoral aggregation of data. Furthermore, it does not take into account when a country exports intermediate goods to another country that uses them as input in the production of export goods (Hummels et al., 2001).

Finally, offshoring measures can be built on the basis of firm-level information. These originate mainly from business surveys that are based on questionnaires or interviews. The main advantage of these types of measures over those based on aggregated data (trade and input-output data) is that they provide very detailed information. For example, these data allow a distinction to be drawn between offshoring through intra-firm and arm's-length trade and indicate whether offshoring is performed as relocation and expansion of production.

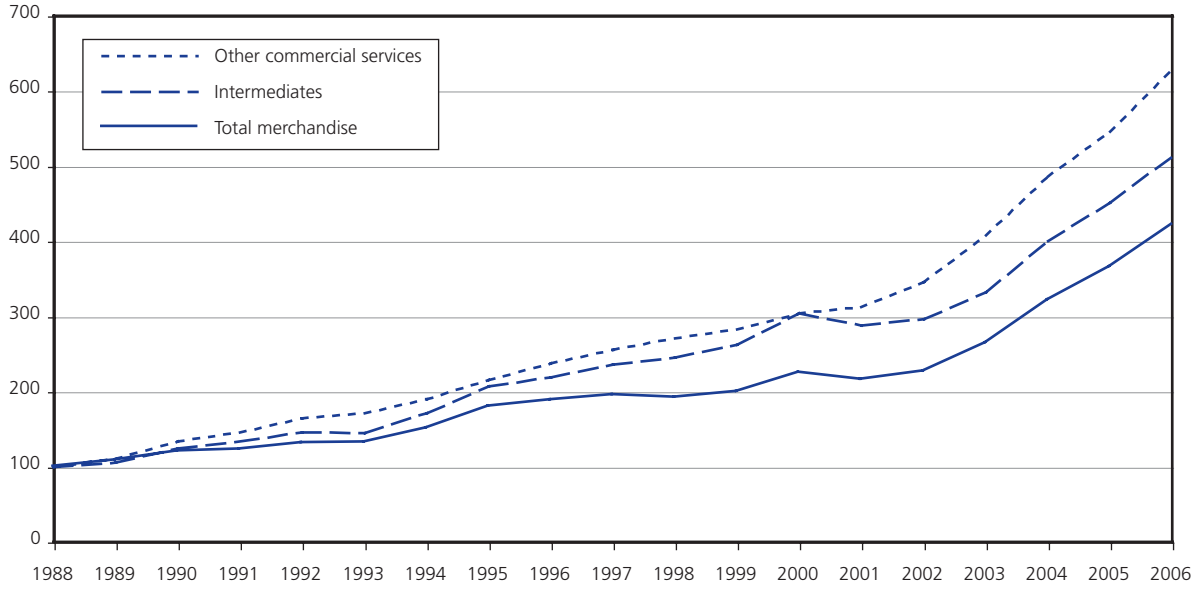
However, firm-level data have a very limited coverage. Surveys usually concentrate only on one country, large firms and one sector. Moreover, the development over time is often not captured by the data. For instance, the Centre for European Economic Research (2005) investigated 4,440 German firms in 2004 and focused on IT outsourcing. The Bureau of Economic Analysis collects data on multinational enterprises in the United States. UNCTAD (2004) gathered information on 100 European firms from the top 500. Moreover, when the survey does not focus on offshoring directly, indirect measures similar to the macro-based measures have to be used, e.g. Görg et al. (2004) uses the ratio of imported inputs by a firm over total wages in the firm.

One commonly used proxy measure for the size of goods offshoring is trade in parts and components.[28] Using the classification for intermediates proposed by Yeats (2001)[29], Chart 13 shows data for world trade in total merchandise and trade in parts and component for the period 1988-2006. The chart shows that overall trade in parts and components has increased faster than total merchandise trade. However, this excess growth was stronger over the 1990s and has slowed down in the most recent years.[30]

Regarding services, one economy-wide measure used in economic literature to study offshoring in services is the importing of "computing and information" and "other business services" (which include accounting and other back-office operations), as from the IMF's Balance of Payments Statistics. These categories – especially "other business services" – are chosen because they are mainly demanded by firms rather than final consumers. Therefore, they are a better substitute for outsourcing activities. On the basis of this, Amiti and Wei (2005) show that for the United States and for the United Kingdom evidence supports the view that services offshoring has been rising. For the United States, they estimate that the share to GDP of imports of computing and information plus other business services increased from 0.1 per cent in 1983 to 0.4 per cent in 2003. For the United Kingdom, the share increased from 0.9 per cent to 1.2 per cent in the same period. Similar substitutes are used in other studies. For example, on the basis of the Bureau of Economic Analysis (BEA) classification, Grossman and Rossi-Hansberg (2006a) use imports in business, professional and technical services as a measure for offshoring in the United States.

Worldwide data on the export of "other business services" are available only for a short period of time (since 2000). In order to get an understanding of the evolution over time of offshoring in services, the category "other commercial services" is used as a substitute. The justification for this choice is that "other business services" are an important component of this category. For example, in 2004 "other business services" represented over 50 per cent of the category "other commercial services". Therefore, it can be assumed that the category "other commercial services" capture offshored activities. Data on world trade in "other commercial services" for the period 1988-2006 are reported in Chart 13. The chart shows that "other commercial services" have been growing faster than trade in intermediate goods and that they experienced the fastest growth in recent years, especially since 2000.

Chart 13
Trends in world trade of total merchandise, intermediate goods and other commercial services, 1988-2006



Note: Data are normalized at 100 in 1988. Intermediates are classified as in Yeats (2001).
Source: WTO calculations based on UN COMTRADE and WTO statistics database.

In other words, to the extent that trends in trade in intermediate goods and trade in "other commercial services" are a good proxy measure for offshoring in goods and services respectively, data suggest that in the last two decades both offshoring in goods and services have grown at a faster pace than trade in final goods and that the growth in services offshoring has accelerated since 2000.

Evidence that offshoring has increased for both goods and services can also be inferred using more appropriate measures of offshoring than those based on trade data. However, these measures can in general be calculated only for a limited number of countries and years. For example, measuring offshoring as the share of imported intermediate inputs in the total (non-energy) intermediates used for production (a measure used by Feenstra and Hanson, (1996)), a recent study of the OECD (2007c) finds that between 1995 and 2000 offshoring of both goods and services increased for most of the 14 countries under consideration.[31]

On average, as shown in Table 10, for the 29 countries for which input-output data are available from the OECD, goods offshoring increased between 1995 and 2000, while services offshoring remained stable.[32] In particular, services offshoring appears much smaller than goods offshoring. In 2000, 22 per cent of total intermediate goods used in production (of both goods and services sectors) were imported, while only 3.4 per cent of total services inputs were offshored. Since many services are non-tradable, the smaller figures for services offshoring relative to goods offshoring is to be expected.

Similarly, goods offshoring appears to have also increased when measured in terms of the index of vertical specialization developed by Hummels et al. (2001), a measure of the imported input content of a country's exports. This is a more restrictive measure of offshoring than the percentage of imported inputs over total input, since it only accounts for those imported inputs that are embodied in goods that are exported. Hummels et al. (2001) estimate

Table 10
Worldwide offshoring of goods and services
(Percentage of imported inputs in total inputs)

World	1995	2000
Total	11.2	11.8
Goods	18.8	22.0
Services	3.4	3.4

Source: WTO calculations on OECD Input-Output data.

that between 1970 and 1990 vertical specialization grew by almost 30 per cent on average for the 14 countries under examination and accounted for 30 per cent of world export growth.[33] Calculations covering the period 1995 to 2000 show that vertical specialization increased for nearly all countries in the sample and that vertical specialization accounted for a significant share of each country's export growth (see Table 12 in the next sub-section).

In order to get an idea of the relative importance of offshoring via arm's-length trade and offshoring via intra-firm trade, firm-level data are required. At present, there is no systematic evidence on this. Data on multinational firms for the United States appear to suggest that "the growth of foreign outsourcing by US firms might have outpaced the growth of their foreign intra-firm sourcing" (Antras and Helpman, 2004: 554). Nevertheless, there is also evidence that intra-firm trade has increased as well (e.g. Hanson et al., 2005). For example, Feinberg and Keane (2005) show that sales from a Canadian affiliate to its United States parent firms in terms of total sales of the affiliate and vice-versa almost doubled between 1984 and 1995.

ii) Which countries offshore the most?

Table 11 identifies the five countries that rely the most and the least on imported inputs in their production of output respectively.[34] Figures represent the percentage share of importer inputs over total input – the measure of offshoring used by Feenstra and Hanson (1996) (see Box 14 for more details). Three general patterns emerge from the table.

First, goods are offshored much more than services across all countries. For example, in Ireland 70 per cent of intermediate goods used for production are imported while only 33.4 per cent of services are imported. The percentage gap between goods and services offshoring is even greater for other countries. The relative high shares of services offshoring in Ireland is due to the large payments on fees and licences for software services imports. Second, those countries that offshore more goods typically also offshore more services. For example, Ireland, Belgium and Hungary are present among both the top five offshoring countries in goods and in services, while the United States, China and Japan belong to the bottom five countries for both goods and services offshoring. Third, small countries tend to offshore more than large countries. The top five offshoring countries are all small countries, while the bottom five countries are large. The driving force behind this pattern is that large countries in terms of labour and/or capital abundance find it easier to exploit economies of scale. If different stages of production are characterized by increasing returns to scale, then only large countries are able to exploit them for many stages and sectors, because of their large endowment of capital and/or labour. Conversely, small countries are more likely to concentrate their resources on a smaller number of stages of production and offshore the rest.

Table 11
Goods and service offshoring by country, 2000
(Imported inputs as per cent of total inputs)

Goods		Services	
Top five offshoring countries			
Ireland	70.6	Ireland	33.4
Hungary	63.2	Belgium	14.9
Belgium	57.0	Hungary	14.4
Slovak Republic	54.4	Norway	13.4
Austria	52.7	Czech Republic	13.3
Bottom five offshoring countries			
United States	17.8	Australia	3.9
India	12.7	France	2.8
China	12.6	Japan	2.1
Brazil	10.5	China	1.3
Japan	9.2	United States	0.5

Note: For some countries Input-Output data are not available for the year 2000. These are: Australia (1999), India (1999), Ireland (1998), Norway (2001); where brackets denote the year of the Input-Output table used.
Source: WTO calculations based on OECD Input-Output tables.

In particular, Table 11 shows high figures for goods offshoring for some eastern European countries, notably Hungary and the Slovak Republic. Similar results can be drawn using Hummels et al. (2001)'s index of vertical specialization, a measure of the import content of exports.[35] Table 12 shows this index for the years 1995 and 2000 for the countries for which input-output data are available from the OECD database. Countries are shown in a descending order according to the value of their index in 2000. Three of the top five countries are eastern European countries. The increasing involvement of eastern European countries in production networks is documented in a number of studies. For example, based on a firm-level survey, Marin (2006) shows the importance of vertical FDI and intra-firm trade between Germany and eastern European countries. She estimates that in the period 1996-2000 the share of intra-firm exports in total exports from Hungary, the Slovak Republic and the Czech Republic to Germany was 16, 65 and 40 per cent respectively.

Table 12 also shows the contribution that increased vertical specialization has had on the growth of exports (as a share of gross output) by country. The figures show that between 1995 and 2000 the increase in vertical specialization accounted on average for more than half of the growth in the export/output ratios. For example, in the case of the Slovak Republic, the exports/output ratio increased by approximately 16 per cent between 1995 and 2000. Almost 70 per cent of this increase was due to growing vertical specialization.

Table 12
Vertical specialization (VS) and its contribution to export growth
(Per cent)

Country	Vertical specialization		Export/output change in percentage points	Contribution of VS to export/output change
	1995	2000		
Hungary	52.3	65.0	9.7	146.5
Czech Republic	41.8	53.0	11.1	87.5
Belgium	46.9	52.7	10.7	92.6
Slovak Republic	40.6	49.6	15.9	70.0
Netherlands	40.6	45.6	14.4	69.9
Korea, Rep. of	33.0	41.5	7.9	64.3
Portugal	32.2	41.2	10.0	65.0
Austria	34.6	40.3	11.8	61.8
Spain	30.6	39.9	7.3	68.3
Sweden	32.0	36.2	4.6	79.4
Finland	31.0	35.0	6.6	59.7
Canada	33.8	34.9	0.4	186.6
Poland	21.9	31.5	5.7	64.4
Denmark	30.6	31.4	7.9	37.1
Germany	23.0	29.9	9.9	53.1
Italy	26.2	28.7	3.3	49.7
Great Britain	26.3	26.2	-1.7	28.8
France	22.8	24.5	9.7	28.8
Greece	20.7	21.7	0.8	42.0
Turkey	17.9	21.7	3.9	33.6
China	16.6	21.0	2.1	42.7
Indonesia	17.2	20.6	12.9	25.2
Australia	15.7	17.4	2.6	31.3
United States	12.3	15.1	0.6	66.8
Norway	16.8	15.0	8.4	5.2
India	11.8	14.9	1.6	28.9
Brazil	11.6	14.3	1.3	31.0
Russia	13.2	14.3	9.0	16.6
Japan	9.5	14.0	3.5	28.6

Note: In this table the measure for vertical specialization has been normalized by total country export. For some countries Input-Output data for 1995 and 2000 are not available. These are: Australia (1995,1999), Greece (1995,1999), India (1994,1999), Portugal (1995,1999), Canada (1997,2000), China (1997,2000), Hungary (1998,2000), Norway (1997,2001) and Turkey (1996,1998). Years reported in brackets are those used for the calculations.
Source: WTO calculations based on OECD Input-Output tables.

iii) Sectoral composition of offshoring

At the sectoral level, there are two interesting questions: which sector offshores the most and what type of input or task is offshored the most? Most economic literature neglects the latter. One reason for this is that the data collected are not sufficient to allow specific tasks to be distinguished.

Table 13 reports the top five sectors that offshore goods the most and the top five sectors that offshore services the most.[36] The table shows that the industry that offshores the most is "office, accounting & computing machinery", with 45.6 per cent of goods being imported in 2000. A very high tendency to offshore also emerges in other high-technology sectors, such as "radio, television & communication equipment" and "medical, precision & optical instruments". For all these sectors, offshoring increased between 1995 and 2000. The fact that offshoring is widespread in high-technology industries should not come as a surprise. As will be discussed below, the need for high-quality inputs will affect the choice of the country in which the firm locates as well as the firm's organizational form (integration versus outsourcing), but it does not determine necessarily the decision to offshore.

In general, offshoring of services is smaller than offshoring of goods. This is true for all industries, including services industries. This is not surprising, since many services are non-tradeable.

(b) The economics of international organization of production

In order to understand the recent trends in the world economy, and the increasing outsourcing to low-cost countries such as India and China, it is essential to understand what drives a firm's decision to outsource and offshore. Traditional models of trade that assume that production takes place within the boundaries of a firm cannot explain the complex mix of trade and FDI patterns. A rapidly expanding literature introduces elements from industrial organization and contract theory in trade theory to explain international outsourcing.

There are two types of decisions that a firm has to take concerning intermediate inputs or services. First, a firm has to decide whether it wants to produce inside the boundaries of the firm or outside (in other words, a make or buy decision). Second, in either case, the firm has to decide whether to source the activity domestically or abroad (inshore or offshore). The outcome of these two decisions gives rise to international outsourcing.

With a view to explaining the factors driving the recent development in outsourcing (i.e. the increase in offshoring of services and goods to non-affiliate firms through arm's-length trade), this sub-section reviews the models that explain firms' decision-making, focusing on the factors that explain why firms offshore and, in particular, why they offshore to non-affiliate firms.

Table 13
Industries that offshore most at the world level
(Imported inputs over total inputs, per cent)

	1995	2000
Top five sectors offshoring goods		
Office, accounting & computing machinery	38.0	45.6
Radio, television & communication equipment	27.8	35.8
Medical, precision & optical instruments	26.1	32.9
Electrical machinery & apparatus, n.e.c.	25.3	31.1
Chemicals and pharmaceuticals	28.3	30.1
Top five sectors offshoring services		
Transport and storage	8.9	9.5
Computer & related activities	4.1	4.4
Post & telecommunications	4.4	4.2
Wholesale & retail trade; repairs	3.8	4.1
Other business activities	4.6	3.9

Source: WTO calculations based on OECD Input-Output tables.

i) The decision to offshore

Economic theory provides three main answers to the question as to why firms offshore. One is that offshoring allows the advantage of location to be exploited. That is, firms offshore to take advantage of the fact that some inputs/services are more cheaply produced abroad. Hence, production costs can be reduced. Another reason is that offshoring allows for a smoother workload for the regular workforce by contracting-out some tasks in peak periods. Finally, an offshoring decision may reflect the existence of economies of scale that are available to specialized providers of certain intermediate goods or particular services (Abraham and Taylor, 1996).

There are, however, additional costs related to offshoring. These include costs related to differences between countries (such as the costs of learning laws and government regulations of another country, different languages across countries or different currencies) as well as managerial costs (e.g. monitoring and coordination costs), costs of searching for the appropriate supplier, negotiating costs, etc. The decision to offshore is driven by the trade-off between the advantage of lower production costs and the disadvantage of incurring these other types of costs (be it fixed – that is, independent of the production volume – or variable costs). As will be discussed more extensively in the next sub-section, the relative importance of managerial costs and other costs are the driving factors in deciding whether to offshore at arm's length or through FDI.

A simple model explaining why firms decide to offshore has been developed by Jones and Kierzkowski (1990 and 2001). They provide a very simple explanation for the increasing fragmentation of production. In their model, the traditional law of comparative advantage holds, but it applies at the level of components. It might be the case, they argue, that the various stages of production require different types of technology/skills or they may require inputs in different proportions. In these conditions, the benefit of fragmenting production across countries is that the firm can locate different stages of the production process in the country where there is a relative abundance of the type of skill/input used relatively more intensively in that stage of production. In so doing, the firm can lower costs of production. However, production fragmentation is costly. Separate production stages need to be coordinated and monitored. Furthermore, this implies incurring transportation and communication costs, insurance costs and other connecting services costs.

In this set-up, technological improvements and deregulation can explain the increase over time of international fragmentation, as they reduce the costs of services links. Furthermore, the growth of the world economy has fostered this process. This is due to the fact that as production scale increases, the fixed costs of services can be spread over a larger output, thus implying lower average costs (costs per unit of output).

More recently, in response to the development that firms no longer only locate production stages in different areas and import intermediate goods, but also "unbundle" office tasks, Grossman and Rossi-Hansberg (2006b) have developed a so-called "new paradigm", which puts "task" trade at the centre of the analysis rather than trade in goods. The idea is that, in order to produce a final good several tasks have to be performed. Some of these tasks can be offshored.

As discussed in Section C.1.d, the new paradigm of globalization differs from the previous theory of trade in that it explains trade at a finer level of distinction, that of tasks.[37] The new paradigm theory is based on the fact that international competition takes place at the level of individual tasks performed by a firm (e.g. assembly, packaging, data entry) rather than at the level of industry (as in the traditional comparative advantage theory of trade) or at the level of the firm (as in the recent "new-new" trade theory). The traditional law of comparative advantage holds, but it applies at the level of individual tasks, in the sense that each nation would export the task in which it has a comparative advantage.

An obvious pre-condition for offshoring (and, in general, for outsourcing) tasks is that the production of a particular input or a particular service task needs to be separable and tradeable. In this sense, technological innovation has been a driving force for the recent phenomenon of services offshoring. In fact, recent technological developments, especially in IT, have made it possible to separate geographically an increasing number of services tasks. Basically, services such as accounting, booking, payroll and others that relate to the collection, manipulation and organization of information can be codified, digitalized and separated from other activities within

firms. The possibility to transmit information electronically via the internet, for example, has rendered these services tradeable, thus making them candidates for offshoring. There are, however, tasks that cannot be offshored. One example is the task of cleaning offices.

Grossman and Rossi-Hansberg (2006b)'s model of trade in tasks also builds on two other key assumptions: (i) that offshoring firms can take their superior technology with them; (ii) that this "technology transfer" comes at a certain "offshoring cost" that differs across tasks (that is, technology transfers are easier for some tasks than for others). These two assumptions highlight two other important factors determining trade in tasks: that ideas (the technology used to perform a certain task) need to be transferable and that the cost of offshoring a specific task will partly determine which task to offshore.

One factor that determines how easily the technology to perform a certain task can be transferred is the degree of standardization of the task. Standardization of some tasks has been a factor driving increased offshoring. For example, the development of specialized software to handle accounting tasks has allowed workers to follow routinely a set of instructions for certain tasks. In other words, it has allowed the easy transfer of technology for accounting purposes. Similarly, automation has been a driving force in the development of a production network in the automotive industry. However, there are some tasks (most likely the "core" tasks of a certain industry) that need to be customized to the user. These tasks are less likely to be offshored. In line with this argument is the evidence on the distribution of tasks that are performed in the United States. Since 1970, the input of routine tasks (that is, tasks that require the repetition of a set of procedures that can be codified) in the US economy (measured relative to the distribution in 1960) has been falling, while that of non-routine tasks (defined as tasks for which proximity is more important)[38] has been rising. This is exactly what is to be expected if routine tasks can be offshored (Grossman and Rossi-Hansberg, 2006b).

ii) Offshoring: arm's-length transactions or vertical FDI?

The models discussed above explain why it may be beneficial to separate production stages across countries, but they do not explain whether firms should source their inputs through vertical FDI or through arm's-length contracts. A growing body of economic literature addresses this issue and provides the micro-foundations for trade in intermediate goods and trade in services.[39]

Embedding elements of contract theory into trade models, recent literature has provided some new insights into what determines firms' decisions on whether to outsource or to integrate and whether to offshore. This two-dimensional problem yields four possible outcomes: producing intermediate goods or services within the boundaries of the firm, purchasing them from a domestic unaffiliated firm (domestic outsourcing), importing intermediate services from an affiliated firm (intra-firm trade), and importing intermediate goods or services from an unaffliliated company located abroad (international offshoring). Table 9 represents these four possible outcomes.

One factor affecting a firm's decision to outsource is the "thickness" of the market. As Grossman and Helpman (2002) highlight, firms' decisions to outsource depend on the trade-off between the higher production costs associated with running a large and less specialized organization and the costs of searching for the appropriate supplier and dealing with contracting issues associated with outsourcing. In the case of vertical integration, where all tasks are carried out within the same firm, production costs are higher for two reasons. One is that firms incur "diseconomies of scope" because costs of coordination and monitoring increase with the size of the firm. Another reason is that vertically integrated firms do not benefit from the learning associated with specializing in one single activity.

On the other hand, specialized firms may be able to produce at lower costs, but they have other disadvantages. One of these is that the final good producer that outsources the production of a specialized component has to face the costs of searching for a supplier that will deliver the agreed quality and quantity of inputs at the agreed time.[40] If not, the production process may suffer delays or the firm brand name may lose prestige. If the market is large ("thick"), the probability that a firm finds the appropriate match is higher and if the supplier fails to deliver, the easier it is for the outsourcing firm to find an alternative solution. Therefore, outsourcing is more likely to succeed, the larger the industry and the larger the overall economy.[41] In particular,

extending the model to a two-country world (the North and the South), Grossman and Helpman (2005) show that outsourcing in the South increases relative to outsourcing in the North when the size of the South increases.

Another important factor in determining whether to integrate or outsource and where to offshore is the quality of the institutional framework (Grossman and Helpman, 2003 and 2005). The quality of institutions matters because the contract between the final good producer and the supplier of the intermediate good in the arm's-length relationship needs to be enforceable. If not, the risk of outsourcing may be too high.

To understand this, consider the relationship between a producer and a supplier. Once the final producer has found a supplier, the latter may need to make an investment (new skills, new equipment, new product development) in order to customize the input to the needs of the final producer. When the investment required is relation-specific, that is it has little value outside this particular transaction, the final good producer may "hold-up" the supplier.[42] That is, once the supplier has made the investment, the buyer may breach the initial terms of the agreement and offer a lower price for the input. Since inputs are customized to a specific final producer, they do not have a market outside the contractual relationship. Hence, the supplier has a very weak bargaining position once an agreement has been signed.[43] Anticipating the possibility that the final good producer may breach the contract, the input supplier will under-invest. This under-investment raises the cost of producing the final good.[44] As a consequence, the more important the "hold-up" problem, the less likely is the possibility of outsourcing.

How does the quality of the institutional framework affect the decision to offshore? If institutions are good, suppliers are able to enforce the contract, at least for the part of the surplus[45] that is verifiable. This makes it less likely that the supplier will under-invest, thus making international outsourcing more likely than FDI (Grossman and Helpman, 2003). In a model with different types of firms and with varying types of possible contracts across industries and countries, Antràs and Helpman (2007) show that better institutional frameworks for contracting in the South increase the likelihood of offshoring, but may reduce the relative prevalence of either FDI or foreign outsourcing. In particular, the quality of institutions will determine in which country a firm chooses to offshore (Grossman and Helpman, 2005). In countries with a good quality of institutions, there will be less under-investment. Thus, the costs of producing customized intermediate inputs will be lower than in countries with a poor institutional environment.

Empirical evidence supports these predictions. Using US imports data for 1998, Levchenko (2007) shows that the institutional framework helps to determine a country's comparative advantage. In particular, countries with better institutions have a comparative advantage in goods with a complex production process that depend on strong institutions. These are goods that may be produced through a large number of production stages. He finds that the share of US imports in goods with complex production processes increases by 0.23 when a country improves institutional quality from the bottom 25 per cent to the top 75 per cent level.

It is worth noticing that the "hold-up problem" matters most when the intermediate input is specifically designed to match the need of a single final good producer.[46] Clearly, the more generic the input, the less risky it is for both the final good producer and the producer of the intermediate input to enter into a contractual relationship. Hence, standardization facilitates outsourcing. The institutional framework matters, in particular, for the production of non-standardized inputs. Therefore, countries with a good institutional environment have a comparative advantage in the production of intermediate goods that require a specific investment (less standardized products) by the supplier to customize the product to the needs of the producer of the final good.[47] Empirical evidence supports this prediction. In a recent paper, Nunn (2007) shows that countries with better contract enforcement specialize in industries that rely heavily on relationship-specific investments.

The choice between integration and outsourcing also depends on the factor-intensity of the industry. Distinguishing between capital-intensive sectors and labour-intensive sectors, the model built by Antràs (2003) predicts that vertical integration is the preferred form of sourcing intermediate inputs for capital-intensive sectors, while arm's-length trade is the preferred option for labour-intensive sectors. The reason is that in capital-intensive sectors, the relation-specific investment of the producer is more important. Thus, the producer will choose to integrate in order to keep a higher share of the profits and to get the

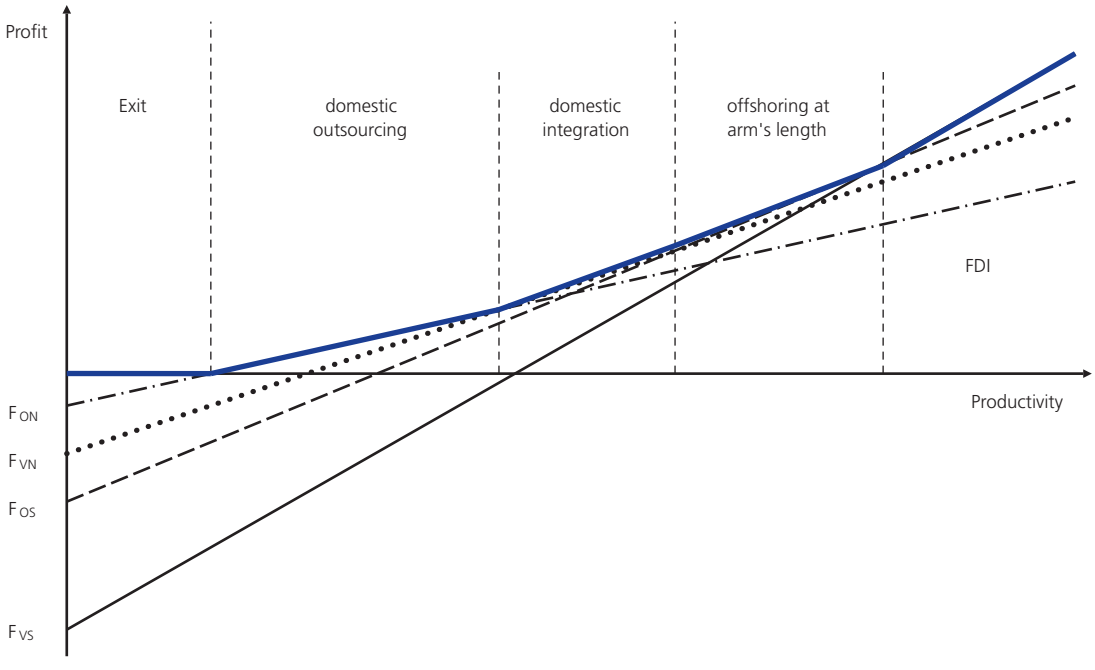
right incentive to adequately invest in the relationship with the supplier. The evidence supports theoretical predictions. In particular, for the United States, Antràs (2003) finds a positive correlation between intra-firm trade and capital intensity. Similarly, in a recent paper, Nunn and Trefler (2008) find that the intra-firm trade is higher in skill- and capital-intensive industries than in unskilled sectors.

Combining differences in requirements for investment across sectors and differences in productivity across firms within a sector, Antràs and Helpman (2004)[48] show how firms' decisions to integrate or outsource vary with the level of technology of the firm. In their model, the trade-off between vertical integration and outsourcing is driven by the trade-off between "hold-up" problem-related costs and the fixed costs of the particular type of organization. In particular, they assume that fixed costs are higher under vertical integration (where the firm incurs high managerial costs) than under outsourcing (where there are search costs) and that offshoring has higher fixed costs than domestic sourcing (e.g. search costs for a supplier are higher when the supplier is located abroad due to differences in languages, need to acquire knowledge about the laws and practices and so on).

Under this cost structure, they show that in sectors where the production of the final good is component-intensive, outsourcing prevails over vertical integration. On the other hand, in sectors where the final good producer provides headquarters-intensive services, all four organizational forms can co-exist. The prevalence of one form over another depends on the distribution of productivity across firms within the sector. In particular, in decreasing order of productivity, the most productive firms will engage in FDI, firms with a medium-high level of productivity will offshore internationally, firms with a medium-low level of productivity will integrate all activities within the firm, with no outsourcing. Finally, the least productive will either be driven out of the market or will outsource in the domestic market.

Chart 14 shows the profit profile of firms depending on their productivity under alternative organizational structures. The chart is based on a specific assumption of ordering the fixed costs, whereby fixed costs of vertical integration are higher than fixed costs of offshoring and fixed costs in the North are less than in the South.[49] Assuming that variable costs are lower abroad because of lower wages, profits increase faster (lines are steeper) when inputs are produced abroad rather than at home. Furthermore, profits increase faster (lines are steeper) under vertical integration than under outsourcing, irrespective of the location. This is because under outsourcing the final good producer

Chart 14
Vertical integration or outsourcing options for a headquarter-intensive firm located in the North



Source: Antràs and Helpman (2004: chart 4).

has to leave a larger part of the profits to the supplier in order to provide the supplier with the incentive to invest in the relationship. Firms will choose the type of organization that maximizes their profits. The bold line represents the profit-maximizing frontier. It shows that only highly productive firms engage in offshoring. In addition, distinguishing between offshoring and non-offshoring firms, within each group, outsourcing is chosen by the less productive firms.

Some interesting results emerge from this model. For example, the larger the wage gap between the home and the foreign country, the larger the share of firms that will choose to offshore. This is because a large wage gap will make it easier to cover the fixed costs of offshoring. By the same token, the lower the trade costs, the higher the offshoring (both at arm's length and through FDI). This implies that whatever factor reduces trade costs also increases offshoring. Therefore, the better the infrastructure in the two countries (the offshoring country and the country hosting the offshored activity), the higher the offshoring. Also offshoring will be higher in sectors where trade costs are lower (that is, those with a higher weight-to-value ratio). The greater the dispersion of productivity across firms in an industry and in sectors with higher component intensity, the higher the offshoring as well. Finally, an average increase in firms' productivity or a lowering of fixed costs for offshoring will also lead to more offshoring (e.g. a reduction in the time required to start up a business).

In another paper, Antràs (2005) shows that the relative prevalence of outsourcing and vertical integration, domestically or abroad, depends on the product cycles. In particular, all parts of the value chain of a new product are produced domestically. Over time, the production of components is offshored to subsidiaries, and components are imported through intra-firm trade. As the product matures, components are manufactured abroad and imported at arm's length.

It is worth highlighting that theoretical predictions over the prevalence of the various forms of organization for a firm depend on the specific assumptions of each trade model. A different hypothesis from that in Antràs and Helpman (2004) as to the ranking of fixed costs would lead to different patterns. Similarly, Grossman and Helpman (2004) build on a model where agency problems arise from managerial incentives[50] rather than incomplete contracts. They predict a completely different pattern regarding the organization of firms. In this model, firms with the lowest and the highest productivity levels outsource, while firms at an intermediate level of productivity vertically integrate. Empirical evidence is needed to ascertain the strength of these alternative theories.

iii) Barriers hindering entry to international production networks

On the basis of the literature reviewed above, two factors can be singled out as those driving the process of international fragmentation of production. These are: (i) the decline in the absolute costs of trading goods and services. These include the reduction in tariff rates, lower transportation and communication costs and the reduction in the time required to exchange goods; (ii) the lower managerial costs of offshoring. These include costs of searching for the appropriate supplier as well as the costs of monitoring and coordinating domestic and foreign activities. Recent advances in telecommunications technology have helped to lower these costs.

Although international trade costs have declined, there are country-specific costs that may hinder a country's participation in international production networks and services offshoring. Since vertical specialization can be a source of technology transfer and a channel for companies in developing countries to enter new export markets, it is important to understand what factors can limit the chances of a country entering these networks.

The offshoring literature reviewed above has highlighted – together with the traditional factors of comparative advantage, such as factor prices, skills availability and the tax regime – new sources of comparative advantages that determine where a firm chooses to offshore. These include the quality of the institutional framework in enforcing contracts, the size of the market (which determines how easy it is to search for appropriate suppliers) and any factor that reduces the cost of offshoring (e.g. a reduction in the time to start up a business).

Table 14 shows the characteristics of high-income, middle-income and low-income countries in terms of some of these factors. In particular, the table reports indexes for: (i) the quality of transport infrastructure (a major factor in determining transport costs);[51]

Table 14
A cross-country comparison of some determinants of offshoring costs

	High-income countries	Middle-income countries	Low-income countries
Quality of transport infrastructures			
Quality of airport, Index 0-7 (2005)	5.9	4.2	3.3
Quality of port infrastructure Index 0-7 (2005)	5.5	3.5	2.9
Paved airports per 1000 sq km (2006)	2.6	1.2	0.1
Quality of communication infrastructures			
Telephone mainlines, per 1,000 people (2005)	499.6	210.1	36.7
Mobile phone per 1,000 people (2005)	837.8	376.7	76.5
Internet users per 1,000 people (2005)	523.4	114.3	44.0
Faults, per 100 fixed lines (2005)	8.4	16.8	40.5
Quality of institution for doing business			
Rule of law, index between -2.5 and 2.5 (2006)	1.2	-0.2	-0.9
Time to enforce a contract, days (2006)	548.2	629.1	625.0
Procedure to enforce a contract, number (2006)	34.2	38.2	40.8
Cost to enforce a contract, % of claim (2006)	20.0	28.7	53.6
Time-related barriers			
Time to start a business, days (2006)	22.2	51.3	58.3
Time to deal with licence, days (2006)	162.6	217.7	265.0
Export documentations, number (2006)	4.8	7.2	8.6
Time for export, days (2006)	11.3	25.0	41.0
Time for import, days (2006)	12.9	29.3	49.6

Source: WTO calculations based on World Bank Doing Business Database (2006), Governance Database (2006), World Development Indicator (2006); ITU (2007) World Telecomunication ICT Indicators; Global Competitiveness Report (2006) and CIA Factbook (2006).

(ii) the quality of communication and information technology infrastructures (a major component of trade costs); (iii) the quality of the institutional framework (since the quality of the legal system is essential to guarantee enforcement of contracts and the rule of law); and (iv) time-related barriers (the lengthy procedures required to start up a business as well as long waiting times at the border being likely to impede entry into production networks).[52]

Table 14 shows that low-income countries are at a big disadvantage in terms of the quality of infrastructure and time-related barriers. As suggested by the economic literature on offshoring, this is likely to limit their participation in production networks despite their advantages in terms of factor prices. Section F.2 discusses the action that could be taken to remove some of the obstacles to entering production networks. These include national policies as well as international co-operation.

(c) Case studies

While there is extensive theoretical literature on the fragmentation of production, rigorous empirical studies in this area are difficult to find. This section, therefore, helps to clarify the relevance of these theories by examining certain industries where fragmentation of production is particularly prevalent – namely, in the electronics sector and financial services.

i) Electronics

This section explores the implications of recent economic research on fragmentation to help us understand the forces shaping the production process and trading patterns in electronics. According to Table 14, a number of electronics sub-sectors are some of the most fragmented manufacturing industries.

Much of this section focuses its discussion on one particular electronics product – a laptop computer. Its production process exhibits many interesting features that illustrate the changing nature of offshoring within the electronics industry more broadly. While describing how this particular product is intertwined with the fragmentation phenomenon, some of the characteristics that differentiate the electronics sector from other manufacturing sectors are also examined. Such an analysis sheds light not only on the more fundamental forces driving the fragmentation process, but also ultimately its limitations.

What makes the production of a laptop computer an interesting case study to examine? By many accounts, the production of a laptop is the epitome of the fragmentation process.[53] First, creation of the final good requires various components, such as semi-conductors, a hard drive, motherboard, memory and display panels, that are frequently designed, produced and assembled in different locations, potentially in different countries, by firms with differing types of contractual arrangements with the end-good producer. Second, such a product is interesting to study because, in many instances, firms have established a sales process in which they permit and even encourage (through price incentives) the customer to create a highly specialized "made to order" product. This feature will highlight the sensitivity of this product to the increasing importance of "timeliness", i.e. the difficulty that firms have to hold a large inventory. This is increasingly being recognised by economists as a new factor driving fragmentation.

Many computer firms that make laptops (e.g. Dell, IBM/Lenovo, etc.) have developed internet sales techniques which allow customers to tailor the design of their computers to their specific tastes or needs. The firm, therefore, has an important role at the beginning and end of the production process – e.g. designing the overall product as well as marketing (advertising, sales) it to end-users. One implication of accommodating customized demand, however, is that the producer becomes constrained in its ability to hold available inventory. Nevertheless, this level of customer demand would not be possible but for advances in telecommunications and information technology.

Many of the steps in the production of the laptop take place via a fragmented production process – e.g. the motherboard may be produced in Japan, the hard drive in Singapore, the memory in the Republic of Korea, the display panel in Chinese Taipei, the microprocessor in Malaysia, etc. – and everything is assembled into a recognizable computer in China. Economic research has documented a number of patterns in the production process and can help to explain the rationale for the fragmented approach and its implications.

First, consider the basic relevance of the decline since 1957 in air transport costs, as described earlier. This is likely to have substantial implications for an industry such as electronics for a number of different reasons. First, while the cost of air transport has fallen, for any given weight of the product being transported air shipment is still much more expensive than ocean shipping. One implication of this is that the first products that would be cost-effective to ship by air once air transport prices start to decline would be lightweight products with high unit values.[54] Many electronics products fall into this category, including laptop computers. Second, the reduction in air transport costs may affect the production process for goods for which "timeliness" is important. In particular, Hummels (2001) documents a premium that customers appear willing to pay to receive products quickly by air.[55] The reduction in air transport costs not only helps explain why products such as laptop computers might be traded (imported and exported) internationally, but it can also help to explain why the production process has become so fragmented.

Consider again the full process by which laptops are produced and consumed as well as the model of Evans and James (2005), who argue that time is an important factor influencing global specialization and trade.[56] Time is valuable because it allows retailers to respond to fluctuations in demand without holding large quantities of inventory. Evans and James predict that products where timely delivery is important will be produced near the source of final demand. While this would appear to run counter to the example of the laptop computer, for which consumers are located primarily in the United States or Europe while production takes place largely in South East Asia, a closer inspection suggests that this is not necessarily the case.

With the availability of air transport reducing the timeliness factor for trade between the consumer markets and South East Asia, the source of almost-final demand (assembly of components) need not be in close proximity to consumer demand. Nevertheless, even with air shipping, the need for timeliness between the assembly needs and the production of component inputs may drive the localization of production of those components to be within an accessible distance. Indeed, in a related paper, Harrigan and Venables (2006) show that the need for timeliness leads to a geographical clustering of economic activity. If final assembly takes place in two locations and component production has increasing returns to scale, component production will tend to cluster around just one of the assembly plants.

In addition to the reduced cost of air shipping, there may also be "quality improvements", although these

are more difficult to measure accurately. Nevertheless, in addition to a reduction in average shipping time, improvements in reliability might be measured via a reduction in the variance of shipping times. Technological innovations, such as improvements in methods for handling cargo, may also allow more sensitive products to be shipped internationally in addition to improvements in insurance coverage. Furthermore, there have also been substantial innovations in the telecommunications sector which allow greater fragmentation in the production process. For example, widespread adoption of bar codes and digital scanning results in less costly tracking of components and permits greater distance between different stages of the production process. So the production and assembly of the motherboard, hard drive, display panel, memory and microprocessor for a laptop need not all take place on a single factory floor – in fact, their production can take place at different factories in different countries at different times. Again, such innovations allow producers of intermediate goods and assemblers to hold smaller amounts of inventory. This is particularly important for products that rapidly depreciate in value.

Given the substantial differences in transport costs across countries, there is likely to be a role for the public sector in influencing how transport costs affect the fragmentation of the electronics industry.[57] For example, some of the improvements in the quality and cost of air shipping as an alternative to ocean shipping involve not only technological innovations in the manufacture of aircraft, but also improvements in logistics, public infrastructure and regulatory conditions. In the context of air shipping, important factors include customs clearance delays (trade documentation), the quality of adjoining transport links (such as road haulage and rail) as well as airport efficiency and openness to trade (for example, the number of airports with paved runways capable of accommodating cargo airplanes). Finally, for a fragmented process such as the production of laptops, it may also be important for the country to have reliable access to e-business networks as well as "electronic data interchange" between producers and freight-forwarding companies (Carruthers et al., 2003).

When it comes to understanding the fragmentation of the production process for a product such as a laptop computer, separate from the question of transport costs is the issue of contractual relationships between firms involved the production process. Specifically, are they subsidiaries of a multinational firm, or are these arm's-length transactions occurring between suppliers and buyers? Are these long-term and/or repeat contracts, or are these components purchased from a spot market?

While a laptop computer can be relatively customized by the consumer, he/she is typically asked to choose from an available menu of parts and components when designing the computer's specifications. It is frequently the case, however, that these components tend to be standardized inputs. Thus, as in Antràs (2005), more arm's-length trade is expected than intra-firm trade in this sort of sector. He shows that as a result of contractual difficulties, goods are initially manufactured in the North, where product development takes place. As the goods become more standardized, the manufacturing stage of production is shifted to the South to take advantage of lower wages. The organization of the production process is also affected by incomplete contracts. The model gives rise to a new version of the product cycle in which manufacturing is first shifted to the South to subsidiary firms, and only at a later stage to independent firms in the South.

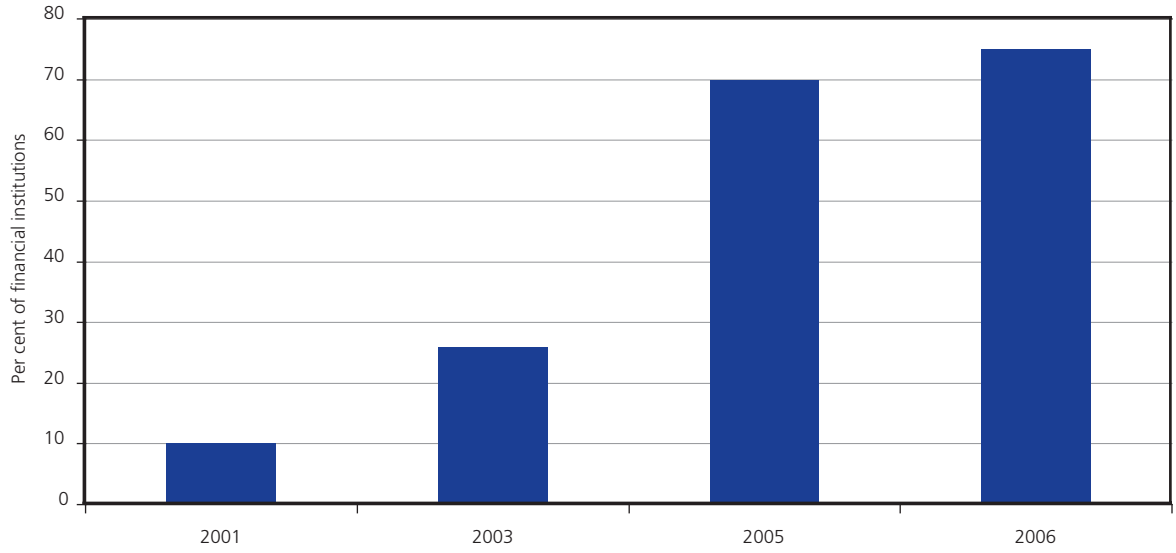
In another empirical study, Kimura and Ando (2005) show that the share of arm's-length trade has increased at the expense of intra-firm trade within Japanese multinationals in East Asian countries over time. While this trend is observed for all machinery sectors, it is much stronger for the electronics sector. Clearly, as electronic goods become standardized, contractual difficulties arise less often, and arm's-length trade with specialized producers becomes more efficient.

ii) Financial services

The financial services sector ranges from the basic provision of retail banking services (e.g. small-scale borrowing and lending, credit cards) to the provision of more sophisticated and longer-term borrowing and lending (mortgages, long-term investment vehicles) to various forms of insurance services (life, accident and property) as well.[58]

There is little information about the extent of global offshoring by financial institutions. Whatever information is available comes primarily from international consulting firms that follow offshoring trends in the financial sector. This serves as the principal source of information for this sub-section.[59]

Chart 15
Per cent of financial institutions with offshoring operations



Source: Various issues of Deloitte Touche Tomatsu's Global Financial Services Offshoring Report.

As Chart 15 indicates, in 2006, over 75 per cent of major financial institutions had offshore activities, compared with less than 10 per cent in 2001. This dramatic expansion is matched by the equally large growth in offshore staffing. The latest annual survey by Deloitte Touche Tomatsu estimates that financial institutions employ an average of 2,700 offshore staff compared with 150 only four years ago.

Offshoring continues to be led primarily by US and UK financial institutions, but with other European financial institutions showing increasing interest. The main activities offshored are those involving the use of IT, lower value-added activities (such as payroll) and lower value-added contact with customers (such as scripted outbound sales calls). But offshoring has spread across nearly all business functions, with significant growth in transaction processing, finance and various aspects of human resources activity. Even activities requiring specific skills, such as financial research and modelling, have the potential to be ultimately offshored as well. In 2003, two-thirds of activity offshore was IT-related. However, by 2006, over 80 per cent of offshore activity involved a full range of business processes.

The main reason for offshoring in the financial services sector is to reduce costs. Offshore labour is often both affordable and highly qualified, enabling companies to reduce costs while maintaining or even improving the quality of the services they provide to clients. The latest Global Financial Services Offshoring Report by Deloitte estimates that offshoring is saving the financial services industry an estimated US$ 9 billion per annum, up from around US$ 5 billion one year ago.

But this is not the only advantage provided by offshoring. Offshoring operations also give financial firms greater flexibility in their staffing so that they can respond to changes in market conditions. For financial services firms, it is often easier to alter the size of operations offshore than it is to make adjustments to the domestic workforce. Finally, cross-border mergers and acquisitions, where Western financial institutions take equity stakes in emerging market banks, naturally lead to an expansion of offshoring activity (Deloitte Touche Tomatsu, 2006).

India remains the prime location for offshoring, with around two-thirds of global offshored staff employed in the sub-continent. A number of other countries have also attracted offshoring activity. These include South Africa, Malaysia and the Philippines, where financial institutions can find the necessary skills and work quality. These countries have large pools of young, educated, technologically competent and English-speaking workers. There are a large number of graduates with finance, accounting, or management and information technology backgrounds, who are ideally suited to offshoring work in the financial sector. China's role in offshoring is less clear.

Deloitte's latest report states that China is becoming a more important destination for offshoring, with one-third of financial institutions having back-office (mainly IT) processes in China. However, a PriceWaterhouseCoopers (2005) report on offshoring in the financial sector states that China has yet to gain extensive ground, partly due to its relative lack of English-language skills and partly because of concern about its laws on intellectual property and data protection.

Offshoring is not without its risks and costs to financial institutions. For example, there is the risk of a political backlash at home because of domestic job losses. In the United States, a number of bills at both the state and federal levels have been proposed to place restrictions on offshoring practices. This is a risk that is not unique to financial institutions but one common to all firms that offshore part of their operations abroad. But a risk that ranks quite high for financial institutions concerns the need to ensure the confidentiality and integrity of financial information. Because of the cross-border nature of the transactions, offshoring has the potential to transfer risk, management and compliance to third parties that may not be subject to the same set of laws and regulations as those applied in the country where the financial institution is domiciled. This has been recognized as an important or systemic source of risk to the extent that the Bank of International Settlements (BIS) has proposed a set of principles to provide "specific and focused guidance" to financial institutions' outsourcing and offshoring activities. Finally, explosive growth in offshoring may put pressure on wages and other costs in countries such as India. Closely connected to rising labour costs are high turnover rates, which can affect the quality of offshore operations. These issues can halt the further expansion of offshoring.

Many basic features of the financial services sector, as described above, confirm earlier predictions of trade patterns based on comparative advantage and increasing returns to scale. For example, large exporting firms in more developed economies with an abundance of skilled labour (as well as a well-developed infrastructure and regulatory environment to deal with potential problems inherent in financial services) provide skill-intensive services to customers in other countries. To the extent that the exports are clustered in other developed economies (intra-industry trade), this may highlight the role of increasing returns to scale models and product variety and differentiation, but also the possible importance of issues of diversification across markets to reduce industry-specific risk.

Nevertheless, as in the electronics industry discussed earlier, the provision of many types of financial services products are increasingly fragmented in a way that has the potential to allow not only outsourcing, but offshoring as well. The result is that many parts of the production process that used to take place within the "bricks and mortar" of a financial institution no longer need to be. Furthermore, certain tasks are outsourced to other firms at arm's length. That firm may be located in a different country with a comparative advantage in that particular component of the financial service product that is being provided to customers.

The following discussion of the role of fragmentation and offshoring in the financial services sector focuses on two sub-industries – retail banking and insurance services. It provides examples to highlight the different forces that are shaping the changing provision of financial services. Furthermore, while the amount of activity being offshored is difficult to measure, there are a number of particular areas where offshoring is occurring within financial services. This activity has been prompted by a number of factors, such as technological innovation and automation, telecommunications innovation and improvements in infrastructure, the forces of concentration as well as comparative advantage and increased trade liberalization in services.

Retail banking

Retail banks provide customers with the ability to save and borrow through services such as current accounts, savings accounts, and credit and debit card accounts, etc. Within the overall financial services sector, innovations associated with improvements in computers and digitization of data and IT have largely changed how many basic retail banking services are provided. An obvious example is the increase in the automation of retail banking services as banks replace a relatively low-skilled position of bank tellers with automated teller machines (ATMs) that allow customers to deposit and withdraw cash and other forms of payment.

Nevertheless, such technological innovations frequently have a more complex affect on the structure of institutions. By studying the changing demand for labour within a large bank, Autor et al. (2002) illustrate how a particular technological innovation – image

processing of cheques - can have complex effects on the structure of firms within the industry. They find that image processing led to computers taking the place of deposit-processing (low-skilled) jobs in part of the bank. In the jobs that remained, workers were required to have the ability to develop specialist skills. In another part of the bank, the exceptions-processing jobs became increasingly complex, increasing the demand for labour with particular sets of skills. The way that technological innovation increases the demand for labour skills turns out to be inherent in many of the changes taking place within the retail banking sector.[60]

Other technological innovations are also affecting how services are provided, leading to substantial fragmentation of the delivery process.[61] For example, customer services have been transformed from a situation whereby a customer might drop into a local bank or telephone for information about the status of their account to a "call centre model". Customer service questions and answers for a set of relatively standardized products have been outsourced to employees at a centralized facility. Because the products are relatively standardized, the service can be relatively standardized as well, without requiring specialist (face-to-face) customer interaction. Furthermore, it can be located somewhere that will allow it to take advantage of lower costs – e.g. labour and capital infrastructure costs. Recent innovations in IT and the lower cost of telecommunications have resulted in a model where call centres can be subsequently offshored as well.[62]

Nevertheless, there is some expectation that additional technological innovations will further affect the nature and scope of services provided by call centres. For example, just as the ATM made the basic functions provided by bank tellers redundant (e.g. accepting and distributing cash and payments), improvements in voice recognition software and the digitization of information will also change the nature of the call-centre provider. For simple or routine customer questions (e.g. account balance, latest transactions, etc.), software can be developed to allow a customer's question to be answered by a computer – with access to a database of customer-specific information – at a lower cost than a low-skilled worker. This is already the case in a number of countries in which electronic banking is already replacing a number of the services recently provided by call centre operators, which before that were provided by ATMs, and before that by bank tellers.

The implication for the call centre industry is that the service jobs that remain may only be the most complex (i.e. those which cannot be automated). This may significantly affect the demand for call centre services – leading to an overall reduction in staff numbers or at least to a demand for workers with the skills necessary to process the complex problem-solving jobs that remain after digitization and computerization have handled the rest.

As financial services firms continually automate their products as well as their customer support for such products, they also increasingly demand skilled labour in the form of computer software and hardware talent. Increasingly, there are IT firms willing to provide such services offshore, further ensuring the international fragmentation of the financial services sector.

Automation, call centre activity and electronic banking may be particular to the retail banking industry. Nevertheless, similar to many other industries seeking to focus on their core areas of competence, retail banks may also outsource many other business tasks, such as payroll, human resources and accounting. While these aspects of retail banking are less visible to customers, they are just as much part of the industry.

Insurance

Insurance is another area of financial services that is facing changes brought about by new possibilities of fragmenting the production process. Unlike retail banking, which relies on relatively low-skilled labour, computer software and standardized products that do not require much customization to meet customer needs, the insurance sector involves products that are more highly customized and which require higher-skilled workers.

The insurance market is being affected by the ability to fragment part of its services.[63] Certain services can be automated, as products are sufficiently standardized. For example, in many areas of the United States, auto-insurance providers can offer customer-specific quotes electronically via the internet. A potential customer will provide the relevant information, and the insurer will cross-check key parts of the information provided by accessing other databases (e.g. credit agencies, law enforcement, etc.). Based on computer software and regulatory demands, insurance companies decide whether to offer insurance as well as the terms

and the price of the insurance. As noted in retail banking, where business is conducted over the internet, there is the possibility to fragment this part of the service (whether it be hand checking facts or using computer software), and to offshore it to a remote location.

However, while this approach is increasingly adopted in certain areas of the insurance industry for relatively standardized products or services, other areas are less suited to this type of fragmentation. For example, the provision of other forms of insurance services requires substantial customization and is sufficiently complex to make offshoring less feasible. Nevertheless, this too may change in the face of continued improvements in telecommunications infrastructure (e.g. video conferencing) and harmonized legal environments (e.g. the ability to sue for breach of contract in other jurisdictions) etc.

Box 15
Implications for developed and developing countries of financial services offshoring

Financial services, and especially higher-end services such as insurance, are products that are likely to be closely linked with a high income (in other words, luxury goods). In this case, international demand is expected to increase as more countries improve their economic development and seek to engage in more sophisticated risk-management – both at the country level and at the individual level within these economies.[64] Demand for many insurance products – e.g. life, health, and property and accident - is likely to increase as incomes increase and for demographic and other reasons.

What are the potential implications from fragmentation and offshoring for the financial services industry for developed and developing countries?[65] It is difficult to predict with any degree of precision the net effects of this sort of increased trade within financial services firms (in terms of subsidiaries across borders or through arm's-length offshoring arrangements), especially in the face of changing demand conditions. On the consumer side of the transaction, financial services customers stand to gain through either lower prices (associated with lower input costs resulting from fragmentation of the production process and each task being undertaken where cost is lowest) and increased access to various products (e.g. 24-hours-a-day, seven-days-a-week access to financial accounts or information).

On the supply side, the forces of trade within the financial services sector are likely to be dominated by the same sorts of forces that affect trade in other areas of the economy – the resources and technology at the disposal of economies, which shape comparative advantage, as well as agglomeration effects that may affect industry concentration through external economies of scale. There are, however, also important implications for the patterns of international trade in financial services as technology innovations and other infrastructure improves, allowing more stages of financial services provision to be fragmented. Nevertheless, from the examples noted above, comparative advantage is still expected to play a dominant role in affecting trade flows: e.g. low-skilled tasks will be offshored to countries where low-skilled labour is abundant; and high-skilled tasks will be allocated to locations in which high-skilled labour is abundant.

However, there are a number of other important conditions for countries to take part in this sort of financial services production network. For tasks requiring language skills (e.g. spoken English if the call centres are serving customers in the United States and the United Kingdom; French if the customers are in France, etc.), is there a sufficient language capacity in the local population? Second, is there sufficient investment in fibre optic networks and other IT hardware (as well as reliable electricity) to connect workers to the internet? Third, recent research has focused on the importance of the institutional framework for international trade, especially as there may be barriers resulting from the incompleteness of contracts. To this end, does the country provide sufficient enforcement of intellectual property rights (for more sophisticated financial services products) as well as enforcement of data privacy and security concerns?

4. CONCLUSIONS

Empirical evidence shows that production is concentrated in some geographical areas and that there is an increasing tendency for firms to source inputs and services internationally. Trade patterns depend on where production takes place and how firms organize their production chain. But traditional trade theories do not tell us anything about how firms choose where to locate and assume that production takes place within the boundaries of the firm. Therefore, these conceptual frameworks can explain neither geographical concentration nor the breaking up of the production chain.

This section aimed to provide an understanding of how firms choose where to locate production and how to organize their production processes, with a view to predicting patterns of trade. Recent economic research has focused on these issues and has highlighted that the overall downward trend in trade costs (tariffs as well as non-tariff barriers, including transportation and communication costs) can be a crucial factor for both phenomena: the agglomeration of production in some locations and fragmentation of the production process. The extent to which these two phenomena are compatible is not yet clarified in trade literature.

There are three important predictions about the pattern of production and trade that are associated with the new economic geography literature. First, a country will export products for which there is a large demand at home (home market effect). Second, a reduction in trade costs will amplify the home market effect (magnification effect). Finally, falling trade costs will produce an initial period of divergence among countries, with manufacturing production becoming concentrated in a "core" while the "periphery" specializes in non-manufactured goods (core-periphery effect). However, a further reduction in trade costs will eventually reverse this process, with manufacturing production becoming increasingly dispersed among countries in the periphery. There is some empirical evidence in support of the home market effect in manufactured products. But, it is less clear to what extent the core-periphery predictions are supported by data. Overall, manufacturing continues to be concentrated in OECD countries, but it cannot be excluded that at a more specific level (for example, in textiles and clothing, or iron and steel) the concentration-dispersion process has started.

Recent economic literature on fragmentation has also looked at the impact of falling trade costs on the location of production, but it has focused on the location of different production stages. In particular, this strand of literature predicts that a reduction in trade costs leads to greater fragmentation of production, with firms spreading the different stages of their production process to different locations. When trade costs associated with intermediate inputs fall, different stages of the production process can take place in different places, thus taking advantage of comparative advantage. Trade costs are only one factor determining the decision to fragment production. The likelihood of offshoring is higher in the case of standardized tasks. In addition, countries with a good-quality institutional framework, good-quality infrastructure, flexible administration (for example, short times to cross the border or to set up a business) as well as "thick" markets are more likely to be selected as source countries for offshoring.

No systematic evidence exists on the factors determining fragmentation. But sector-level case studies of electronics and financial services support the relevance of the theories described above. Data on quality of infrastructure, the institutional environment and administrative costs indicate that low-income countries are poorly placed to participate in production networks, despite their advantage in terms of costs. Some economic policies that may help to overcome these obstacles are discussed in Section F.

TECHNICAL APPENDIX

Indices of offshoring

This appendix shows the formulas used to calculate the indices of offshoring presented in Section D. An explanation of these indices is provided in Box 14. Hereafter, subscript *c* stands for country, *i* indicates the industry which imports a certain input and *j* is the input which is imported.

- Figures for offshoring at the country level reported in Table 11 were calculated as:

$$OI_c = \frac{\sum i \sum j \text{ (imported inputs } j \text{ by industry } i)}{\sum i \sum j \text{ (domestic + imported inputs } j \text{ by industry } i)}$$

Goods offshoring at the country level is measured as the ratio between the sum of inputs imported by all industries and the total inputs used by all industries. Services offshoring at the country level is calculated analogously by using service inputs instead of goods inputs. In order to compute the aggregate measure of world offshoring (as in Table 10) the summation is also made over countries. Hence, world offshoring is calculated by dividing the overall sum of imported non-energy inputs used by all industries and all countries by the sum of domestic and imported non-energy inputs.

- Vertical specialization (VS) indices reported in Table 12 are calculated as:

In matrix algebra's term, VS at the country level is calculated as:

$$VS = uII\,(I - DI)^{-1}\,X$$

where u is a $1xn$ vector of 1's, II is the nxn imported input coefficient matrix, I is the nxn identity matrix, DI is the nxn domestic input coefficient matrix and X is the $nx1$ export vector and n is the number of industries. Vertical specialization is a scalar in current values of the respective currency.

- Contribution of the change in the VS to the change in the export-output ratio

The percentage change in the export-output ratio between 1995 and 2000 is decomposed into a VS component and a remaining unexplained component.

$$\Delta \frac{Exports_t}{Output_t} = \Delta \frac{VS_t}{Output_t} + \Delta \frac{(Exports_t - VS_t)}{Output_t}$$

$$\text{where } \Delta Z_t = Z_t - Z_{t-1}$$

The percentage contribution of VS to the change in the export-output ratio is:

$$\%\ contribution\ of\ VS = \frac{\Delta \dfrac{VS_t}{Output_t}}{\Delta \dfrac{Exports_t}{Output_t}}$$

- Figures for offshoring at the industry level reported in Table 11 were calculated as:

$$OI_i = \frac{\sum c \sum j \text{ (imported inputs } j \text{ by industry } i)}{\sum c \sum j \text{ (domestic + imported inputs } j \text{ by industry } i)}$$

World industry offshoring measures how much an industry "offshores" its goods or service inputs respectively. It is calculated by taking the sum of imported non-energy goods inputs by an industry i and by all countries and dividing it by the sum of domestic and imported non-energy goods inputs used by the respective industry i at the world level.

Endnotes

1 For a review of alternative measures of transport costs see WTO (2004) Box IB.3.

2 Estimates are based on OSAs signed by the United States.

3 The shipping time is the weighted average of ocean shipping and air freight.

4 A similar result is obtained by Tang (2006).

5 Fujita et al. (1999) provide one of the most complete treatments of this literature. A more sceptical treatment can be found in Neary (2001). A key question about this literature has been to what extent its claims are really new and not a rediscovery of propositions in "old" economic geography. One interesting insight provided by Ottaviano and Thisse (2004) is that what is new about the new economic geography is that is has framed many of the old ideas within a general equilibrium framework. This has therefore made those ideas more amenable to empirical scrutiny and policy analysis.

6 The terms "forward" and "backward" linkages were first employed in Hirschman (1958).

7 In contrast, there is no transport costs involved for agricultural goods. Davis (1998) includes an analysis of what happens if transport costs also apply to agricultural goods. He argues that if differentiated and homogenous goods have identical transport costs, the home market effect disappears.

8 In some variants of the New Economic Geography, each sector has a factor of production specific to it – peasants in agriculture and workers in manufacturing. See Krugman (1991).

9 This explanation closely follows (Helpman and Krugman, 1985; Krugman, 1980).

10 This assumption will be relaxed in the discussion of the core-periphery proposition.

11 Preferences are such that the consumer maximizes a two-level utility function. The top level is a Cobb-Douglas utility function involving the agricultural and manufactured goods. The lower-level or sub-utility function involves the manufactured good only. Since the manufactured good is differentiated, the lower-level utility takes the form of a Dixit-Stiglitz function.

12 Trade costs take the form of "iceberg" costs. τ ($\tau > 1$) units of a manufactured good are exported to one's trade partner but only 1 unit finally arrives at the point of destination. The difference (τ -1) is the cost of the resources needed to transport the product internationally, which "melts" away.

13 If pij is the mill price of the manufactured good produced in i and exported to j, consumers in j will pay a price equal to τpij.

14 Porter (1990).

15 Fujita et al. (1999) describe this assumption of labour immobility as the "defining characteristic of 'nations' ".

16 As is typical in this literature, the price of a firm's basket of intermediate inputs has the form of a constant elasticity of substitution (CES) price index. This price index is decreasing in the number of varieties of intermediate inputs.

17 Note that in much of the literature on the new economic geography, constant elasticity of substitution (CES) utility functions are often assumed. One consequence of this is that firms do not increase their scale of production as a consequence of trade liberalization. All the welfare gains of liberalization come from the availability of more varieties. See Krugman (1980).

18 This discussion follows the core-periphery mechanism described in Chapter 14 of Fujita et al. (1999)

19 The precise shape of the bifurcation diagram depends on what values of the parameters are assumed.

20 It may be important to stress the methodological point made by Head and Mayer (2004) that in a world with more than two countries it is not clear how one defines the home-market effect.

21 "Demand bias" is measured by the expenditure share of the country for a good relative to the world expenditure share for that good. "National preferences" (or demand bias at the industry level) is based on the difference between the domestic market share of an industry and its expected domestic market share. Domestic market share at the industry level is defined as the ratio of (production-exports) to (production-export-imports). In order to compute the expected domestic market share, a regression of domestic market shares on world market shares is performed.

22 Interestingly, it is even reversed for homogenous goods.

23 Specifically they assume firms act as Cournot players. This means that the firm decides on the profit-maximizing level of its output taking its competitors output decisions as given.

24 Baldwin (2006a) refers to this phenomenon as the second "unbundling". Whereas, the first unbundling is the separation of production and consumption that has characterized the latter half of the 19th century, that economic historians have linked to the technological improvements in ocean and land shipping – steam ships and railroad – have been the principal determinant.

25 For an overview on services offshoring also see WTO (2005).

26 In a previous WTO Report (2005) outsourcing was defined as the "the act of transferring some of a company's recurring interval activities and decision rights to outside providers, as set in a contract". Offshoring, in particular, referred to the case when the outside provider was located abroad. A similar definition is used by the OECD (2007c). This definition involves a management decision to substitute a product/service produced in-house by an imported product/service. In the present Report we opted for a broader definition of offshoring. The reason is that this is the definition adopted by the most recent theoretical literature on offshoring, and because it allows a relatively easier concordance with the statistical data.

27 For further details on the calculations of the alternative measures of offshoring used in this report the reader should refer to the Technical Appendix

28 See, for example, Yeats, 2001; Hummels et al., 2001 and Ng and Yeats, 2003.

29 In Yeats (2001)'s classification trade in intermediates comprises all 3- or 4-digit SITC Rev.2 categories that contain the word "part" in their name.

30 Using a different classification for intermediate goods (the Broad Economic Classification scheme of the UN), Nordas (2007a) finds that the share of intermediates remained approximately constant between 1996 and 2004. Similar patterns are also found by Hummels et al. (2001).

31 Austria, Belgium, China, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Spain, Sweden, United Kingdom, United States.

32 Details about the calculations of the various offshoring measures used in this report can be found in the Technical Appendix.

33 These are Australia, Canada, Chinese Taipei, Denmark, France, Germany, Japan, Korea, Ireland, Italy, Mexico, Netherlands, United Kingdom, United States.

34 The figures for offshoring calculated in this Report may differ from those calculated in a recent study of the OECD (2007c), using the same dataset. Deviations in estimated figures for offshoring are in part due to the fact that in this Report the inputs from "Agriculture, hunting, forestry and fishing" are considered as goods inputs, while this is not the case in the OECD study. Furthermore, we classify inputs from "Coke, refined petroleum products and nuclear fuel" as energy inputs.

35 For details on the calculations of this index refer to the Technical Appendix. Also see Box 14 for an intuition about what the index intends to capture.

36 Energy sectors are excluded from the calculations.

37 See Section E.1 for the analysis of the distributional effects of trade in tasks.

38 The distinction between routine and non-routine tasks does not correspond to the distinction between skilled and unskilled workers.

39 For a review, see Helpman (2006) and Spencer (2005).

40 As will be discussed below, the other disadvantage of outsourcing is the imperfect contracting between the input supplier and the producer of the final good.

41 A similar conclusion can be reached if there is an improvement in the matching technology.

42 The hold-up problem in the context of model of outsourcing is modelled in various papers, including Grossman and Helpman (2002), Antràs (2003) and Antràs and Helpman (2004).

43 This occurs because contracts are incomplete. That is, it is impossible for the parties involved to fully specify the price-quality relationship and make it verifiable by a third party.

44 Nunn (2007) for example assumes that the productivity of inputs increases with customization.

45 Surplus is defined as revenues minus costs.

46 Nunn (2007) for example assumes that customization makes the surplus increasingly less verifiable by third parties (e.g. a court). In turn, this increases the cost of outsourcing due to the hold-up problem.

47 Mitra and Ranjan (2008) notice that the importance of institutions may be overstated as models do not take into account the possibility of repeated interaction between buyers and suppliers.

48 This paper (already briefly introduced in Section C.3.d) builds on the heterogeneous firms model discussed in Section C.3.

49 In terms of chart 14, $F_{ON} < F_{VN} < F_{OS} < F_{VS}$, where subscript N denote the home country and S denotes abroad, V stands for vertical integration and O for outsourcing. In all cases, profits are higher the more productive the firm (positively sloped lines).

50 In this model, the supplier has better incentives under outsourcing, but the final producer has better monitoring opportunities under vertical integration.

51 See for example, Limão and Venables (2001), Nordas and Piermartini (2004) and Micco and Serebrisky (2006).

52 See sub-section D.1 for evidence on the importance of communication and time costs as a barrier to trade.

53 The fragmented production process is a central character, for example, in Friedman (2005). For a discussion of electronics fragmentation in East Asia more broadly, see also Hobday (2001), as well as Akamatsu's "flying geese" model of East Asian economic development.

54 See also Harrigan (2005) who develops an approach in which comparative advantage depends on relative surface and air transport costs that differ across countries and goods. Carruthers et al. (2003: 132) report that while air freight only accounts for about 1 per cent of East Asia's international trade when measured by volume (weight), it accounts for more than 35 per cent by value.

55 More generally, Hummels (2001) estimates a demand for timeliness and argues that falling air transportation costs can then help explain trade growth. He finds that those goods with the highest estimated time sensitivity have exhibited the most rapid growth in trade.

56 While their empirical application of the model is on a sector different from electronics (e.g., US apparel imports), there are intuitive implications for trade in electronics components being affected by some of the same features.

57 See the discussions in Carruthers et al. (2003), Hummels et al. (2001), Limão and Venables (2001) and sub-section (b) above.

58 We will not focus on other forms of financial services such as investment banking, though there is also interesting fragmentation of its production process occurring as well.

59 Deloitte & Touche Tomatsu, for example, has published annual reports on global financial services offshoring since 2003 based on the responses from surveys conducted with a range of financial institutions. This section draws on information from Deloitte & Touche Tomatsu (2007), PriceWaterhouseCoopers (2005), and Basel Committee on Banking Supervision (2005).

60 In the context of international trade in goods, using firm-level data to address a related question, Hanson et al. (2003) examine the substitutability between domestic and foreign workers of US multinational firms. They use [non-bank] data and find that higher sales in foreign affiliates leads, overall, to increased labour demand in US parents: success overseas leads to job gains in the United States. Nevertheless, the effect is not uniform across types of workers,i.e., they find that high-skilled foreign workers complements with US workers (so hiring a high skilled foreign worker is associated with hiring an additional high skilled US worker), while low-skilled foreign workers are substitutes for low-skilled US workers.

61 This section draws on the description of the industry provided in McKinsey (2005b).

62 This lower telecommunications costs is likely the result of a number of factors, such as the Internet serving to increase competition with traditional telephone providers (the result in investment in fibre optic communications as well as innovations such as Voice over Internet Protocol (VoIP) technology).

63 This section draws on the description of the industry provided in McKinsey (2005a).

64 Nevertheless, there may be a number of other structural impediments to this growth in developing countries. For example, UNCTAD (2005) highlights the lack of centralized credit reporting systems in developing countries that is expected to negatively affect demand for provision of financial services, including e-banking.

65 Service industries, such as financial services, have been under real or perceived threat of offshoring job loss in developed economies that has sparked a recent political outcry and media frenzy. See, for example, Friedman (2005), Mankiw and Swagel (2006) and Leamer (2007). Concerns in developed economies include the question of how many high-skilled jobs will be lost (e.g., Blinder, 2006), and whether the essential logic and insights from international economics are now irrelevant (e.g., Samuelson, 2004; Bhagwati et al., 2004 and Deardorff, 2006) in this "new" globalization environment. Jensen and Kletzer (2005) provide evidence from a new approach that attempts to estimate the question of what share of US service sector employment is potentially "offshorable."

While they do find that a number of service sectors are likely tradeable internationally (because they are also traded domestically within the US), they find that the forces of comparative advantage are still at work within the services industry, i.e., they find that in line with US comparative advantage, that "while professional and business services are higher skilled and higher paying than manufacturing in general, tradeable services within these sectors are even higher skilled and higher paying than non-tradable service activities." (p. 18)