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The Linkages between Open Services Markets and Technology Transfer

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THE LINKAGES BETWEEN OPEN SERVICES MARKETS AND TECHNOLOGY TRANSFER

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ABSTRACT

Services are the main drivers of economic growth in OECD countries and they are becoming increasingly innovative. This study analyses the role of open services markets in the transfer and diffusion of technology from developed countries to developing countries. It first explores how trade in services increases exposure to foreign technologies. The four modes of supply of services, as defined in the General Agreement on Trade in Services (GATS), are closely interlinked with the main channel of technology diffusion identified in the economic literature. The report then investigates how open services markets can reduce the cost of technology transfer and help to build better absorptive capacities in five sectors (business services, telecommunications, financial services, higher education and training, and logistics services). The last part of the study highlights the productivity gains from services trade liberalisation and the technological spillovers inside the receiving economy. The report shows that emphasis should be placed on services in the debate on trade and growth and that services liberalisation in key sectors, which facilitate the exchange of knowledge between foreign and domestic companies, can have a significant impact on technology diffusion.

Keywords: services, open markets, technology, technology transfer, technology diffusion, linkages, spillovers, productivity, growth, trade liberalisation.

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EXECUTIVE SUMMARY

Services are the main drivers of economic growth in OECD countries and are becoming more innovative. As most new technologies emerge in developed countries, developing countries can benefit from international research & development (R&D) efforts through trade. Many studies have emphasised the role of trade openness to foster productivity growth. However, most of these studies overlook the role of services trade.

Part I explores how open services markets increase exposure to foreign technologies. Services are traded through four modes of supply — as defined in the General Agreement on Trade in Services (GATS) — which enable different types of interactions between foreign services providers, and companies and individuals in the domestic economy. Through trade in services, two companies in different countries can get to know each other and decide to trade their technology. Different types of contracts can be signed between the two partners, such as licensing agreements, joint-ventures and strategic alliances. But trade in technology is mainly conducted by developed countries because of many factors, such as the lack of capacity to absorb technology, the inability to pay technology fees, and the existence of certain barriers to trade and investment.

However, there are more informal channels of technology diffusion in relation to trade in services that can benefit developing countries. Demonstration effects define a broad category of interactions where a local firm, in contact with a foreign company, upgrades its technology drawing on what it has learned from the foreign example. Demonstration effects are stronger in open markets because foreign companies can demonstrate the effectiveness of their more advanced technology in the domestic market and create competition with local companies. Services are also inputs which embody new technologies and are used by all types of firms to produce goods or other services. In an open economy, domestic firms have access to the most efficient services providers, hence increasing their productivity.

The last two types of transmission channels studied in Part I involve the movement of factors of production and hence may have a higher impact on the receiving economy. Movements of people triggered by open services markets include labour turnover between foreign and domestic firms and temporary movements of natural persons (Mode 4). Person-to-person contacts and on-the-job training are very important for technology diffusion because what is transferred is more than an idea or a technique. It is also the know-how and tacit knowledge needed by individuals to make full use of the technology. When foreign firms create subsidiaries in the receiving economy, several types of linkages can be created with local firms either as suppliers (backward linkages) or customers (forward linkages), or even as competitors (horizontal linkages). Information and knowledge are likely to flow from foreign services providers to the local economy.

There is a complementary relationship and an overlap between the technological diffusion channels described in Part I. They suggest that, in GATS parlance, all four modes of supply are interlinked and important in technology diffusion, and that it is critical for trade policies to allow foreign technologies to enter the domestic market. Barriers preventing services and service providers to interact with local firms are likely to slow down technology diffusion. It is also generally through the market that the best technologies are selected, not through trade policy incentives which can introduce distortions in the economy.

In **Part II**, the study investigates how open services markets can reduce the cost of technology transfer and help to build better absorptive capacities. The transfer of technology is never costless. First,

there is the direct cost of the transfer. Then, the technology may need to be adapted to the local environment or to suit local consumer preferences. Although services are intangible and the service provider may partly support adaptation expenditures, the cost of technology transfer is as important for services as it is for goods. In fact, service companies report that high transfer costs may prevent them from upgrading their technologies.

Open services markets can reduce the cost of technology adoption. Part II illustrates this by studying five services sectors that play a central role in the process. Business services include a wide range of services that help local firms find solutions to improve their productivity and to adapt foreign technologies to their needs (e.g. computer-related services, professional services, R&D and other business services). Professional services in particular are key, as exemplified by the role of consultancy in the innovation process. Telecommunication services are behind the "IT revolution" that is transforming world trade and production. They are essential for developing countries to take part in global value chains of production and to build a knowledge economy. The third sector studied, higher education and training services, complements the two previous ones. Business services and IT-related services require highly-skilled local talents to make the most of new technologies. New information and communication technologies have changed the learning process and trade in education and training services is now an important way for individuals and firms to access knowledge. Financial services offer another type of innovation that benefits physical capital. In particular, access to finance is important to facilitate investment and trade. Lastly, logistics services, such as port services, are covered in the study because of their importance for the overall efficiency of the economy and the reduction of adaptation costs. Moreover, logistics services define to a large extent the "technology" of the supply chain.

Open services markets significantly increase the absorptive capacity of the economy and their benefit for technology transfer should be stressed in the context of current GATS negotiations where commitments in the strategic sectors of knowledge diffusion remain low, especially for developing countries.

Part III analyses the productivity gains from services trade liberalisation and how open services markets encourage the diffusion of technology inside the receiving economy. There are important methodological issues with respect to the measurement of productivity in services and so far, the evidence collected on productivity gains from services trade liberalisation is scarce. However, key studies already point to potentially high dynamic gains from trade in services which add to the static gains resulting from the removal of trade barriers. Gains are higher than those from the liberalisation of manufactured goods. Another result from the literature is that developed countries show higher gains than developing countries when services trade is liberalised, simply because services represent a larger share of their economy and they benefit more from the dynamic effects.

Technological spillovers between services sectors have not been clearly documented yet, but there is evidence of the positive role of services in facilitating technology diffusion inside the domestic economy, in particular between foreign MNE affiliates and local companies. FDI and Mode 4 (temporary movements of natural persons) have an impact on productivity. Even in the absence of formal contracts or relationships, technology diffuses through the channels described in Part I.

The international transfer of technology can only be imperfectly measured, not least because knowledge flows are invisible. Nonetheless, the evidence already available makes a strong case for open services markets as a catalyst for technological progress and diversification of activities. A virtuous circle can be created where more trade leads to more technology flows and technology leads to more trade because it offers new means of conducting trade and mitigating trade barriers.

THE LINKAGES BETWEEN OPEN SERVICES MARKETS AND TECHNOLOGY TRANSFER

Background

1. Over the past decade, services have been the main driver of economic growth in OECD countries (OECD, 2004a). While the key role of technology in determining productivity growth is widely acknowledged in the manufacturing sector, innovation in services has received less attention, with the notable exception of information and communication technology (ICT) sectors. Services are becoming increasingly innovative and not only in ICT. Other sectors, such as financial or professional services, also play a pivotal role in the knowledge-based economy. Moreover, innovation in services matters for agricultural and manufacturing companies that rely on efficient services to be competitive. Indeed, services trade liberalisation benefits all sectors of the economy besides the services sectors themselves (Konan and Maskus, 2004).

2. Developed countries create most new technologies. In developing countries, foreign sources of technology can account for 90% or more of domestic productivity growth (Keller, 2004). The transfer of technology is therefore crucial for developing countries with limited R&D capacities. As one of the main channels of technology transfer and technology diffusion, international trade can be an important source of growth and development. Technological spillovers represent dynamic gains from trade that are often underestimated because they are difficult to measure and to integrate in trade policy analysis.

3. A large body of literature studies the link between trade openness and productivity growth. Technology transfer has been more specifically studied in relation to trade in goods and foreign direct investment (FDI) in developing countries (OECD, 2002a). But the role of services trade is less well understood even though it may explain much of the increase in productivity resulting from trade openness. The exact channels of transmission are still debated and more studies are needed to better understand the specific role of services.

4. This study relates trade openness and productivity growth by focusing on the role of open services markets in technology transfer. It departs from the narrow trade and productivity analysis to show in a range of sectors how services trade liberalisation can help developing countries to respond better to technological change, build capacity, diversify and become part of the global value chains of world production.

5. International efforts to promote the transfer of technology to developing countries started in the 1980s at the United Nations, when UN members negotiated the International Code of Conduct on the Transfer of Technology. In the mid-1990s, WTO Members incorporated provisions on international technology transfer in the Agreement on Trade-Related Property Rights (TRIPS) and the General Agreement on Trade in Services (GATS). They also established a Working Group on Trade and Technology Transfer in 2001.

6. So far, developing countries have made few commitments in GATS to liberalise services sectors, perhaps in part because the services negotiations have not always been at the top of their agenda. Given the importance of services to build capacity and address the challenges of development, it is important to document the potential benefits of open services markets and how they can facilitate technology transfer in developing countries.

7. Many initiatives from the public and non-profit sector promote the transfer of technology and are essential in the technological diffusion process. However, this study focuses on the voluntary transfer of technology or technology diffusion through trade in services between companies and individuals. It covers

the transfer of technology "on a commercial basis" with an explicit contract involving a fee but also some more indirect channels of technological diffusion through trade.

Definitions and concepts

8. Economists generally define technology as the way resources are combined to produce goods and services. An improvement in technology means that fewer resources will be needed to produce a desired good or service; therefore, productivity is generally used to measure the level of technology[1]. However, one cannot equate technology and productivity because technology also refers to the knowledge of goods and services that can be produced, including new goods that can better serve consumers' needs while maintaining unchanged the amount of resources used in their production (simply because there is a "better combination" of the same resources). Technology also represents a means to deliver products and services. One important consequence of technological change is that more services are now tradable.

9. There is no clear distinction in services between innovations and technologies. Innovation in services is largely "non-technical" (OECD, 2001b) and the productivity of services firms is generally increased through organisational changes. From the point of view of economics, and also from the point of view of companies, an improvement in the production process that aims at better efficiency is indeed a "technology" that firms are willing to acquire. As pointed out in a study on the changing nature of knowledge: "Technology itself has exceeded today the purely technical dimensions of experimental development or laboratory research; it encompasses issues of production engineering, quality, management, marketing, technical assistance, purchases, sales (…)" (Cinterfor/ILO, 1999). However, technology through the adoption of ICT (including hardware and systems) may be key in improving service companies productivity (OECD, 2005a). The 'acquisition of machinery and equipment' is among the top activities reported by innovative services firms in a recent survey (Eurostat, 2004).

10. A technology is "transferred" when a producer learns it and can accordingly modify the production process. Technology transfer can be at the initiative of the owner or requested by a recipient. Most technology transfers occur between willing partners in voluntary transactions (Maskus, 2004). Technology can be transferred between organisations or individuals, or applied in another sector for a different purpose (by the same company or individual). Technology diffusion refers to the spread of knowledge, ideas and know-how between countries, firms and individuals. A transfer of technology is a process that needs to be accompanied by a transfer of knowledge on how to use, adapt or improve the technology. The diffusion of knowledge occurs when individuals and companies become aware of existing and new technologies and this process is included in the scope of this study.

11. There are four major channels of technology transfer in relation to international trade (Hoekman et al., 2004):

1. The first is the transfer of technology on a commercial basis where a firm voluntarily sells its technology and receives remuneration (e.g., licensing fees or royalties). Thus technologies are internationally traded on markets through contracts between firms, licenses, joint ventures or strategic alliances.

1. In growth theory, technology is generally defined as Total Factor Productivity (TFP) –or Multifactor Productivity (MFP)–, which is the residual of output growth not explained by the additional quantities of inputs (labour, capital, human capital) in the economy. It means that production has increased because resources were used in a more efficient way and not because more resources were accumulated. It is a good approximation of technology but TFP may reflect errors and miscalculations in addition to technological change as it is empirically measured as a residual.

2. Trade in goods and services can be a source of technology transfer, although the technology may not be understood, when the technology is embodied in the product. By simply importing better capital goods and technological inputs, the productivity of domestic firms can increase. This use of new technologies can then induce "technology diffusion" spillovers if domestic firms learn the embodied technology of the foreign goods and services they purchased ("demonstration effects").

3. Foreign direct investment is the third channel of technology transfer, especially through establishment of subsidiaries by multinational enterprises (MNEs) with innovative production processes. One expects that the new production processes will disseminate to the local economy resulting in technology diffusion. Spillovers can occur with local suppliers and customers (vertical technology transfer) and also with domestic competitors (horizontal diffusion).

4. Lastly, movements of people are a source of technology transfer or diffusion through the sharing of knowledge between individuals and the experience acquired at work used in different companies (labour turnover). This includes movements of personnel between foreign and domestic firms –in particular local subsidiaries of MNEs–, in addition to the temporary migration of skilled workers who are trained abroad ("on the job training").

12. In GATS, trade in services is decomposed into four modes of supply. Interestingly, this decomposition already shows how trade in services is likely to foster technology transfer or diffusion as GATS modes of supply cover all the channels of technology diffusion described above. Through Mode 1 and Mode 2 (cross-border trade and consumption abroad) services can be intermediates used in the production of goods and other services and their trade can be a source of technological spillovers or simply the technological transfer in itself (a blueprint traded –Mode 1– or some training received abroad –Mode 2–). Many services are traded via Mode 3 (FDI) because they necessitate a commercial presence in the importing country. Mode 4 is the movement of natural persons. It is only a sub-category of the different movements of people associated with technology transfer[2] but it is an important one. Mode 4 involves a temporary migration where the technological knowledge acquired abroad can then benefit the domestic economy when the service provider returns home.

13. The channels of technology transfer are the same in manufacturing and services. However, there are some differences in their relative importance and their degree of use (Cowan et al., 2001). Trade in services has some specificities, such as the intangibility of the output, the closer relationship with customers, or the necessity of a commercial presence or movement of natural persons to supply the service. These particularities make some of these channels more important in services than in manufacturing.

14. A successful transfer of technology between two firms in two countries implies three elements: (1) the existence of the technology developed by the leading innovative firm is known by the firm desiring to "import" it (and this firm is convinced that the technology is useful); (2) the cost of the transfer is reasonable; (3) the transfer will increase the productivity of the receiving economy. This study considers how services trade liberalisation can positively impact each stage of the technology transfer.

2 . Some of these movements are intra-national (e.g., between subsidiaries of foreign firms and local companies, hence with no migration) and others are migrations on a non-temporary basis. There are also movements of consumers (when, for example, a worker receives training in a foreign country) which correspond to mode 2.

PART I: OPEN SERVICES MARKETS CAN INCREASE THE EXPOSURE TO FOREIGN TECHNOLOGIES AND FACILITATE CONTACTS BETWEEN FIRMS

15. The knowledge of available technologies and the desire to acquire them to improve the production process is the first step of any technological transfer. But it means more than the simple awareness of new products and new production methods. Technology transfer is a process with several stages, starting with the identification of a need or an opportunity and a lengthy process of comparison and selection to be sure that the new technology will be useful and will have an impact on the productivity of the firm or on its market opportunities.

16. In a world where travelling and communicating have been made easy by technological progress, it seems odd that international diffusion of technology is difficult and indeed a classical assumption in economic theory is that technology is a public good, available to all countries at no cost. However, empirical studies point to the fact that technology is only partially a public good and that its international mobility is limited (Keller, 2002). Many barriers to technology adoption exist (Parente and Prescott, 2002). One benefit of trade is to ease some of these barriers.

17. A peculiarity of services trade is that it involves different modes of supply –as defined in the GATS agreement– which are prime catalysts for technology transfer. More so than trade in goods, the exchange of services can create close contacts between foreign companies with more advanced technologies and local firms desiring technology transfer. Table 1 summarises the different kinds of interactions emerging from the four modes of supply of services trade. This section explores in more detail how these modes can trigger a successful transfer of technology.

18. The exposure to foreign technologies through open services markets can: (1) initiate a partnership between foreign and domestic companies to transfer new technologies; (2) prompt demonstration effects; (3) encourage local firms to use better foreign services as inputs; (4) enable labour turnover and movements of people; and (5) create backward, forward and horizontal linkages.

Table 1. Exposure to foreign technologies through the four modes of supply of services

Mode of supply	Interactions involving potential technology transfer or diffusion (inside parenthesis when they are less likely to occur)
Mode 1: Cross-border supply	Trade in technology High-tech services used as inputs Demonstration effects (Backward, forward and horizontal linkages)
Mode 2: Consumption abroad	Trade in technology (Demonstration effects) (Forward linkages)
Mode 3: Commercial presence	Backward, forward and horizontal linkages Sharing of knowledge Labour turnover Demonstration effects
Mode 4: Presence of natural persons	On-the-job training Sharing of knowledge Demonstration effects

1. Trade in technology and technology transfer contracts between firms

19. The transfer of technology on a commercial basis can be regarded as a service, whether it is through a specific contract specifying how a given technology can be used by the recipient firm or through the supply of a service which is per se an exchange of technology. In this latter case, the service can be both the new technology and the vehicle by which it is transferred. For example, a blueprint for a new product traded through Mode 1 represents a piece of information that may contain the new technology as well as embody its means of delivery. It is also through a service that technology in agriculture or manufacturing is actually transferred. In service sectors, technology transfers often take the form of consultancy or professional services whereby a recipient firm can improve its productivity through the advice of consultants and experts.

20. When a technology is owned by one company who transfers it to another company, the transfer implies not only the diffusion of knowledge but also the transfer of a right to use it. International technology transfers are accomplished through different types of contracts, including licensing[3], joint ventures and strategic alliances[4]. All of these contracts do not imply a technology transfer and some of them may even act as a protection against such a transfer. But when these agreements do foresee a transfer of technology, they will establish how this transfer is to be done and how the innovative firm will be remunerated.

21. Multinationals sometimes buy and sell technologies to maximise returns on their technological assets and secure networks of alliances to access markets through agreements with domestic companies and not only through exports or FDI. For example, it may be less costly to use licensing rather than to sell through a fully owned subsidiary. Strategic considerations, as well as intellectual property rights concerns, influence how companies decide to serve foreign markets and thus result in different outcomes regarding the transfer of technology (OECD, 2004c). Agreements with other firms are also part of strategic decisions to access resources, benefit from better inputs and help to increase the size of the market. Technology transfer can therefore happen for many different reasons as a contract between two firms where each one finds its own advantage.

22. Open services markets facilitate trade in technology at three different levels:

- It is often through trade that companies get to know each other. They can then begin a relationship, sometimes leading to a full agreement of technology transfer. Open services markets multiply the number of contacts between domestic and foreign firms and hence the number of opportunities for trade in technology.

- The transactions implied by such trade are included in the services section of the current account and these transactions are a services trade issue (OECD, 2004c). Liberalising trade in technology can be part of the services trade liberalisation.

- There are services facilitating the transfer of technology on a commercial basis, either directly to match sellers and buyers or to help locate the relevant technology, or indirectly through an environment more conducive to business opportunities.

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3 . Licensing can also be done within firms, especially when they want to keep full control over their technology. However, even these intra-firm transfers of technology can foster technological spillovers inside the domestic economy through demonstration effects or labour turnover, for example.

4 . Mergers and acquisitions can also be added to the list when they are motivated by technological purposes, although there is no “contract” between two firms (two companies become one).

Table 2. Royalties earned and paid by high income OECD countries, 1970 and 2001, US$ billion and percent

	Value (US $ billion)		Share (%)	
	1970	2001	1970	2001
Royalty income earned by OECD countries from:				
High income countries	2.8	71.2	99.7	96.7
Low income countries	0.0	0.02	0.0	0.0
Lower middle income	0.0	0.7	0.0	0.9
Upper middle income	0.0	1.8	0.0	2.4
Sub-Saharan states	0.0	0.02	0.0	0.0
Royalty income paid by OECD countries to:				
High income countries	0.8	63.7	93.0	83.2
Low income countries	0.0	0.1	0.0	0.1
Lower middle income	0.1	6.0	6.6	7.8
Upper middle income	0.0	6.7	0.4	8.7
Sub-Saharan states	0.0	0.1	0.0	0.2

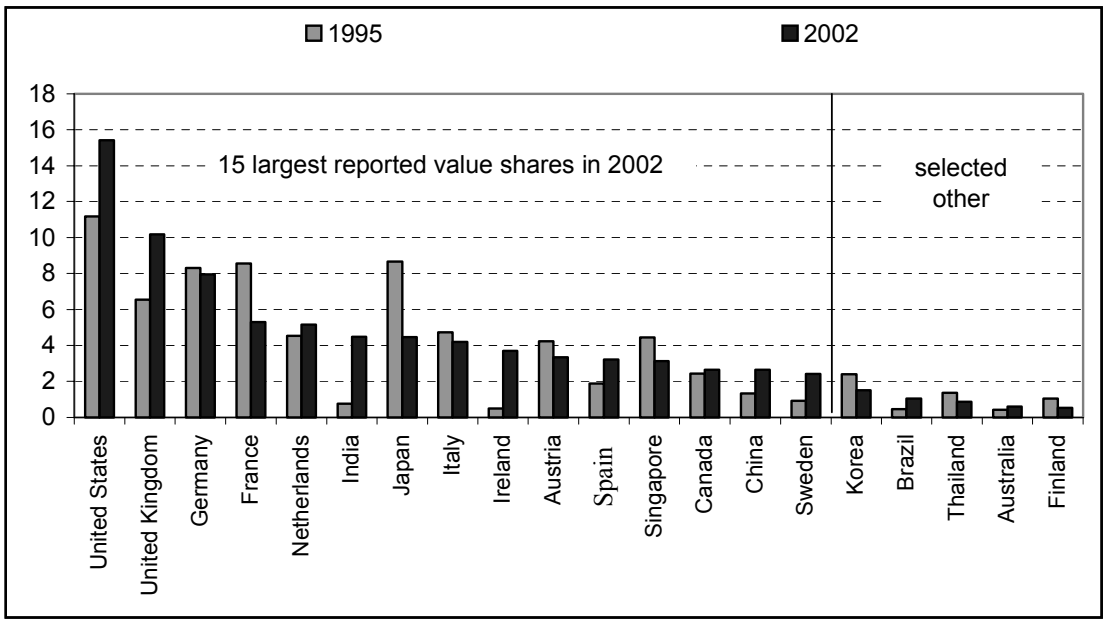
Source : Hoekman et al. (2004)

23. So far, trade in technology is mostly confined to high income countries, as shown in Table 2. Royalty payments give a very rough estimate[5] of the flows of knowledge generated by licensing and other types of arm's-length trade in technology. More than 90% of royalty income passes between OECD countries. Developing countries account only for 3.3% of the royalty income earned by OECD countries. Although the amount implied –2.4 billion dollars– is not negligible, it is clear that it is not through this type of contract that technology can flow from North to South. Very poor countries (such as the Sub-Saharan African states in Table 2) are almost completely excluded from this type of trade in technology. One reason is that they are not attractive recipients to the technology owner. Table 2 seems also to suggest that technology transfer impacts upper and lower middle income countries as they begin to export to developed countries. Their combined share of royalty income has increased from 7% to 16.5% between 1970 and 2001.

24. Lastly, it is very difficult to assess to what extent services trade includes flows that can be regarded as "technology transfer" because the service provided has a direct impact on the production method and organisation of the customer firm (or the human capital of consumers). A very imperfect way to measure it is to look at trade flows in sectors with a potentially high impact on technology diffusion (see Figure 2). Some of these flows reflect consultancy or R&D activities with a direct transfer of knowledge. But even when the aim of the service is not to increase the knowledge of the firm, a technological diffusion can happen through demonstration effects (see next section) or more passively through the use of the "high tech" service as an intermediate input (see section 3). In that sense, data in Figure 2 capture a broader set of interactions that could lead to a direct or embodied technology trade.

5 . Licensing contracts usually provide legal protection of technologies against unauthorized use. As such they exclude technology transfer when the owner controls use by other means, e.g., secrecy..

Figure 1. Exports of other business services and computer and information services in selected countries, 1995 and 2002, share of the value of reported total exports (%)[6]



Source: OECD (2004f), based on IMF Balance of Payments Database (November 2003).

2. Demonstration effects

25. Demonstration effects occur when a local firm in contact with a foreign company upgrades its production method, modifies its organisation, or starts a new activity following the example of a foreign counterpart. There are different levels of demonstration effects, ranging from distant inspiration to full imitation. In this latter case, an issue with intellectual property rights may arise. However, demonstration effects are generally considered distinct from imitation or reverse engineering because they involve a technological change initiated by the local firm and an adaptation of the foreign idea rather a simple copy. In that sense, demonstration effects can be regarded as incentives for local firms to adopt new technologies. Demonstration effects can also occur between different sectors. In that case, there is no competition between the foreign firm owning the technology and the local firm.

26. One can argue that demonstration effects do not require international trade or open markets to happen. Even behind high protectionist barriers, a local company can study what is done by foreign competitors and access to knowledge may be enough to upgrade the production process. Public or non-profit institutions can also establish a link between foreign technologies and local companies to overcome any asymmetry of information. However, trade is often the best channel of technology diffusion. Demonstration effects are more effective via trade because a local company can hesitate to invest in the adoption of a new technology unless it has the proof that this technology can succeed in the local environment and is indeed profitable (Saggi, 2004). Another reason why demonstration effects are stronger in open markets is that foreign companies introduce competition into the local market and technological change becomes imperative for local firms to compete.

6 . Data are reported in current US dollars and are affected by currency movements.

27. Geographical proximity is also important, suggesting that services delivered through Mode 3 or Mode 4 are more likely to initiate demonstration effects. Some technologies are very easy to imitate. As a result, imports of different services are often sufficient to give new ideas to local entrepreneurs and prompt them to change their methods of production. But it is sometimes the contact with the service provider, rather than the service itself, which may inspire the local firm.

28. Case studies point to the fact that it is often after a successful investment by a multinational that a new services activity can be created. It is partially explained by backward and forward linkages created between the subsidiary of the MNE and domestic companies (see section 5). However, many local firms – not just those who have been in a direct trade relationship with the MNE– benefit from the technology transferred, suggesting that "demonstration effects" are an important channel of transmission. A good example of demonstration effects in technology transfer is the retail services sector, especially in Latin America where large foreign retail chains have invested in domestic markets (Box 1). Box 6 also presents evidence on demonstration effects in the Indonesian banking industry.

Box 1. Technology transfers in the retail services market

In the mid 1990s, many of the global players in retailing services expanded their activities abroad. Ahold, Carrefour, MetroGroup and Wal-Mart led this trend.

During the last 20 years the structure of the retail services market changed in Latin America from small owner-operated shops to supermarket chains and shopping centres. In Argentina, Brazil and Chile, supermarkets now account for between half and three-quarters of the food market. Foreign investors have played a leading role in this process. In the first half of the 1990s, large foreign retailers entered into alliances and mergers with local retailers. New technologies and supply chain management techniques were thereby introduced. However, this co-operation did not last long due to cultural difficulties related to company management and the aim of the foreign investors to rapidly increase market shares. Yet, the economic crisis in the region led to increased concentration and foreign market share in the retail market since the local companies were hit hard by the financial crisis.

In the early stages of foreign direct investment, Carrefour introduced the innovation of the hypermarket model to the Brazilian market in 1975. The development of hypermarkets –stores with up to 13 000 square meters of floor space with a wide variety of products and services at lower prices– crowded out much of the smaller supermarkets in the region. However, in Chile local retailers remained competitive by adapting some of the features of the foreign retailers, such as investing in information technology, increasing the size of warehouses, introducing incentive bonuses and flexible working practices. The same happened in Mexico, when three domestic hypermarket chains repeatedly responded to competition from Wal-Mart by changing their purchasing and pricing strategies, introducing new products and investing in computer systems and distribution centres, among others. Wal-Mart introduced new logistics technology for centralised distribution and an aggressive price strategy to Mexico which was adopted by leading domestic companies in response to the increased competition. While Wal-Mart is still today the largest retail company in Mexico, home-grown companies such as Soriana, Comercial Mexicana, Gigante or Chedraui are competitive and are investing to expand their market share. In 2005, Chedraui acquired 30 retail stores from Carrefour, the world's second largest retailer.

Foreign retailers also imposed quality requirements and standards on their local suppliers to improve. Ahold, a Dutch retailer, instituted a supply improvement program for its vegetable suppliers in Thailand to ensure consistent supply and efficient operation. McDonald's represents another example of technology transfer to local suppliers. It is not a retail company, but an important player in the food processing industry, more specifically in fast food. McDonald's requires adherence to certain standards by its local suppliers. In Argentina, more than 80% of McDonald's basic food products are sourced locally and McDonald's engages long-term contracts with its supplier once they have agreed on standards regarding employment, food processing and preservation among others. Furthermore, McDonald's transfers its international know-how to its supplier and, as a result, being a supplier to McDonald's is often considered as an indication of quality and reliability.

Source : Boselie, 2002; Palmade and Anayiotas, 2004; OECD, 2004h; Green and Tozanli, 2001 in UNCTAD, 2001; International Herald Tribune, 2004 in UNCTAD 2004a; McKinsey, 2003.

3. Services as inputs which embody new technologies

29. Services can also be used as inputs in the production of goods and other services. They can embody a new technology and their use can have a direct impact on the productivity of firms in the importing country. Dynamic gains from services trade liberalisation are often modelled through flows of intermediates embodying the foreign technology (see Part III). Any service can potentially include new technologies that are cheaper or more efficient, thus helping the importing company to improve its productivity. For example, telecommunications services enable firms to benefit from the technology of their service provider with no need to have a specific knowledge of the technologies involved.

30. There is a straightforward link between the liberalisation of services trade and the increased number of opportunities for domestic companies to source imports of intermediates from the most efficient service providers. The use of these services with more advanced technologies is already an improvement in the production process of the receiving country even if the domestic company is not fully aware of the type of technology embodied. Further gains can be found in demonstration effects when the importing company understands the technological information embodied in the service and starts to draw upon this new knowledge to improve its productivity. But the use of more efficient inputs can already be interpreted as a technology transfer, although very passive[7].

31. In the case of FDI (Mode 3), foreign service providers may use goods and other services imported from their country of origin. This is often how a new technology enters a country for the first time. As previously noted with demonstration effects, there could be some information asymmetries as subsidiaries of MNEs often know the service providers with the most advanced technologies. MNEs gain some advantage over their competitors through a network of suppliers and by sourcing imports in the most efficient countries. FDI can help domestic companies to know where to source their intermediate inputs and efficiency gains can be obtained only in the context of open markets where there is no barrier for local producers to access the same efficient intermediates than MNEs.

32. Evidence also shows that MNEs encourage their suppliers to relocate with them. Once in the domestic economy, these foreign suppliers can diversify and offer high quality inputs to the local market (Hallward-Driemeier, 2001).

33. OECD countries clearly show an expansion of knowledge-based market services, defined as post and telecommunications, finance and insurance, and business services (OECD, 2004a). There is evidence of the same trend in developing countries. Many studies have recently emphasised the role of ICT in development (for example UNCTAD, 2004a).

4. Movements of people triggered by open services markets

34. Technology can also be transferred or diffused through the movement of individuals between countries and firms. Individuals with experience in the use of a particular technology can easily use or adapt it in a different country or in a different company. More importantly, individuals can transfer the know-how and tacit knowledge required to make proper use of the technology. That is why movements of people are regarded as an important means of technology transfer and also a complement to other channels of transmission.

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7. Some authors would not call the use of foreign technologies as a "technology transfer" unless the technology is fully understood by the importing company and the firm can use it in its own production process.

35. Two kinds of movements of people are worth looking at in relation to international trade: the movement of people between foreign and domestic firms when workers change their employer (labour turnover) and the international movement of services providers (services trade in Mode 4).

i) Labour turnover between foreign and domestic firms

36. Allowing foreign service providers to access the domestic market creates opportunities for nationals to be employed by a multinational company or its subsidiary and to acquire on-the-job training. The knowledge received in a foreign company can then benefit local companies: the former employees of the multinational can join a domestic company or create their own company. To do this, they have to leave their former job but sometimes it is encouraged by their own company in the case of "spin-offs" (where a parent company sponsors the development of a new technology in a start-up company managed by a former employee).

37. Although the phenomenon is difficult to measure[8], several studies document the role of labour turnover in technology diffusion. In particular, Pack (1992) shows that engineers who left multinationals to join local firms played a key role in the development of Chinese Taipei. Labour turnover was also an important determinant of India's success in the software industry (see Box 11). Industries with a fast pace of technological change are often characterised by very high turnover rates (Saggi, 2004), so the data relating high job shifts to technological spillovers may have a reverse causality. However, case studies clearly show the importance of labour turnover, for example between the Silicon Valley and Chinese Taipei (semi-conductors) or India (software).

ii) Temporary movement of natural persons (Mode 4)

38. Highly skilled workers coming to developing countries to provide services through Mode 4 have an important role in technology transfer. Examples include specialists visiting a plant or consultants providing professional services. Their role is twofold. The service they provide can be in itself a "technology transfer" when they advise the local company to be more productive and to change its organisation. But these contacts between people are also an opportunity for local workers to acquire the "tacit knowledge" that does not come along easily with any other means of technology transfer. It can be costly to send workers to training sessions abroad to learn the use of new technologies. When open services markets allow foreign service providers to spend time in developing countries to directly or incidentally spread their knowledge, there are opportunities for productivity gains and technological improvements at a lower cost.

39. The type of knowledge implied may be different from the traditional analysis of "human capital" where more skilled workers add to the human capital stock of the economy and increase the overall output. The movement of highly-skilled workers is more about the quality of the output and how to introduce new ideas, make creative changes, and build networks and connections (Tang and Wood, 2000). In this sense, it concerns a rather small group of individuals comprising managers, entrepreneurs, designers, engineers, top business professionals who, through punctual visits, can help to improve the production of goods and services. Because their skills are scarce, these people have a high opportunity cost when they travel and work in another country. Mainly located in developed countries, the cost for them to work in a developing country is much higher. Open services markets can help to reduce travel-related costs (air fares, hotel bills), telecommunications costs (as these people will need to stay in contact with their home country) and more generally give highly-skilled workers the quality of services they expect, which can encourage them to work in developing countries. Facilitating Mode 4 services trade is also a prerequisite to benefit from movements of highly skilled workers.

8 . See Part III.

40. Mode 4 movements are also important when they enable developing countries to send their workforce to developed countries for on-the-job training and transfers of know-how through short-term missions and contracts. Temporary workers abroad can be a source of technology diffusion for those who remain at home (Winters et al., 2003). In particular, they can inform the home companies of potential market opportunities and available production techniques. Temporary workers can also help to build a network of contacts and potential partners in future undertakings. When they come back, they can advise local companies on how to be more productive and use their newly acquired skills in the domestic economy.

41. Skilled workers with a high level of education from their home country can particularly benefit from such temporary migrations as they are ready to learn (they have the basic education needed to take advantage of further learning) and can more easily find a job in the host economy. New services firms in developing countries tend to be SMEs which do not have sufficient size to establish a commercial presence (OECD, 2002b). It is in the context of open markets for Mode 4 that these new entrepreneurs can penetrate foreign markets for services.

5. Backward, forward and horizontal linkages between firms in open markets

42. Although backward, forward and horizontal linkages are generally discussed in the context of Mode 3 supply of services (foreign direct investment), it should be noted that these linkages can be generalized to any business relationship involving companies in different countries or a subsidiary established in the host economy. These linkages describe interactions between a given firm and its suppliers (upstream or backward vertical linkages), its customers (downstream or forward vertical linkages) and its competitors (horizontal linkages). These different types are briefly described in this section.

i) Upstream vertical technology transfer

43. Upstream vertical technology transfers are those between a foreign firm –generally a MNE– and local suppliers. For example, a MNE that has established a subsidiary in the recipient country can either import its inputs from home country suppliers or source them locally. The choice of local suppliers with little experience in the production of the desired inputs and a need for technological upgrading can be motivated by efficiency considerations (cost, delivery time) and influenced by trade and investment barriers. It is in the interest of the MNE or its affiliate to have the best inputs with the best technologies available so that any transfer of technology with suppliers is likely to be encouraged and it is generally in the context of open markets that such transfers happen (Moran, 1999).

44. It is not uncommon for MNEs to become actively involved in the technological upgrade of their suppliers (see Box 2). For example, MNEs can organise worker training and provide technical information by allowing visits to their factories and contacts with their engineering staff (Saggi, 2004). A pre-requisite for the development of such vertical technology transfers is the capacity for local companies to absorb the foreign technology and quickly supply the type of goods or services that the MNE requires.

45. More generally, local companies can learn from client firms located abroad, especially when they are MNEs in high income countries. Contacts with customers give the firm the knowledge of the market: how to design products that appeal to the consumer. Fafchamps et al. (2002) provide evidence of market learning in the Moroccan manufacturing sector. Figure 3 reports the results of an innovation survey in the European Union, Iceland and Norway across 60,000 companies (Third Community Innovation Survey - CIS3). When asked to mention highly important sources of information for innovation, 31% of services companies cited customers and clients. Although the survey gives no indication as to the international or local origin of these customers, it highlights the importance of client firms as providers of information.

Box 2. Vertical technology transfers through FDI: MNEs transferring services technologies to improve the capabilities of their local suppliers

The wholly-owned subsidiary of LG Electronics in India is transferring technology to its local suppliers to involve them more closely in the production process of the Indian affiliate and to foster their development. Technologies transferred from the Korean parent company include statistical systems for quality and productivity analysis to help them with process redesign, re-engineering and direct online supply. Suppliers are provided with data otherwise hard to access for local companies and innovative changes for quality improvements. Some selected vendor employees can visit overseas plants, participate in LG's training and are instructed in e-commerce techniques.

The automotive industry in South Africa is also an example of vertical technology transfer of services technologies. Liberalisation and reforms in South Africa have been undertaken since the early 1990s, and especially the end of apartheid and economic sanctions in 1994 has opened South Africa to FDI. Auto assembly plants and the components industry have attracted large flows of FDI and foreign ownership increased through acquisitions and reinvestments from companies in Japan, Europe and the United States. The capabilities of local suppliers were improved through targeted FDI, especially in management and operations and technological spillovers such as human capital, organisational development and access to international export markets took place. For example, the transfer of management skills led to improvements in efficiency of local operations. Technological advances diffused among the domestic companies and led to improvements in product design and production techniques.

Another example of developing local suppliers' capacity is Unilever in Vietnam. Unilever provides training programmes, analytical methods and best practices to its major local suppliers. Furthermore, Unilever defines quality standards and helps local suppliers to set up the required technology input to fulfil these standards. Training provided also includes inspection and testing methods and, where needed and appropriate, financial support is provided. For example, the company Quang An I became a supplier of Unilever in Hanoi for plastic bottles in 1997. Unilever provided staff training and established quality standards, sampling procedures and analytical testing methods for the company to raise its capabilities.

Important in these examples is not only the fact that the local suppliers upgraded their skills and capabilities to fulfil the requirements of these MNEs, but also that local suppliers were able to enter into new contracts with other international companies and to enter international export markets. MNEs are very active in transferring services technologies to improve the capabilities of their local suppliers. Even when the final product is a manufactured good, what is transferred is advanced technology for services, such as management skills or quality and testing standards which are essential for an efficient production process. Such transfers are key for a successful diversification in services later on, as exemplified by India (see Box 7 & 11).

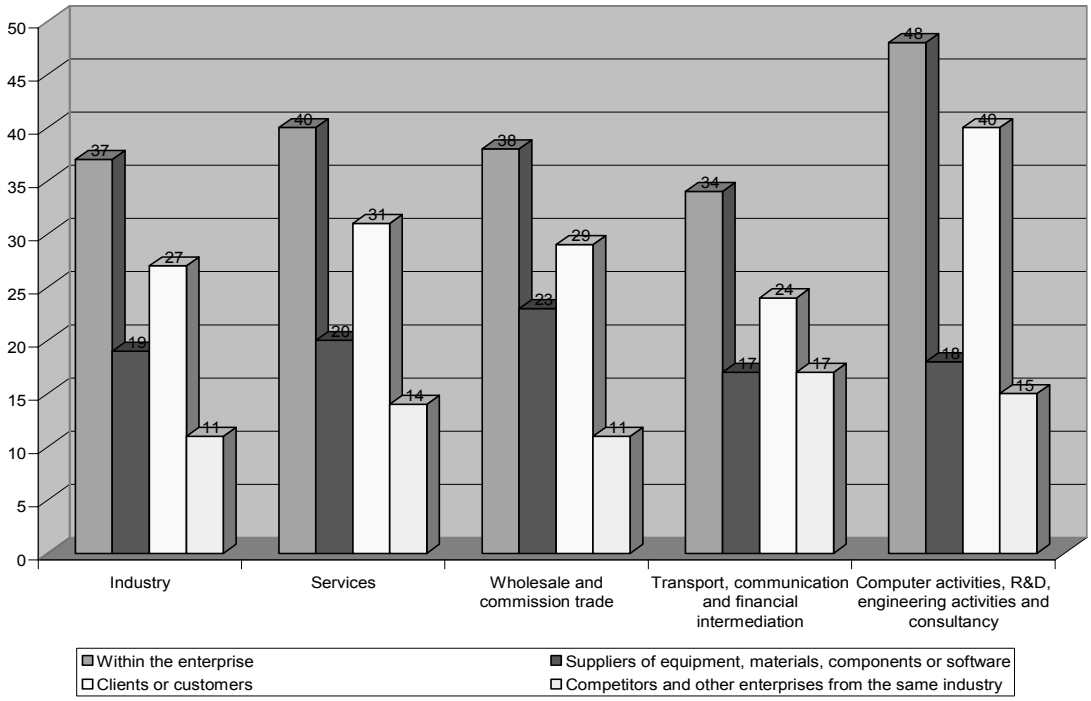
Source : Kalyankar, 2000 in UNCTAD, 2001 and Unilever, 2001 in UNCTAD, 2001; UNCTAD, 2003; OECD, 2005b; Barnes, 2000.

46. The way local companies learn from their customers abroad is known as "learning by exporting". Exporting firms generally have a higher productivity than non-exporting companies. A simple explanation could be that foreign markets are more competitive and that only the most productive firms can export. Another hypothesis is that exporting companies obtain knowledge from abroad.

47. While there is little evidence so far to confirm technology acquisition through exporting, two recent studies support the learning hypothesis in the case of developing countries. Blalock and Gertler (2004) find that in Indonesia there is a jump in productivity of about 2% to 5% when companies start to export (controlling for any self-selection effect where only productive firms export). Van Biesebroeck (2003) studies nine Sub-Saharan African countries and finds evidence of learning by exporting. Exporting companies are not only more productive, but they also have a higher productivity growth rate, a higher capital-labour ratio, invest more, introduce new technologies more often and are more likely to have a formal training program for employees.

48. Rhee & al. (1984) mention that foreign buyers played an important role in the development of Korea's exports through information on production techniques and technical specifications, visits of the plants by technical staff of the foreign buyers and feedback on the quality and performance of the products.

Figure 2. EU Innovation Survey (CIS3): Proportion of enterprises with innovation activity citing selected sources of information for innovation as highly important, 1998-2000 (%)



Source : Eurostat (2004)

ii) Downstream vertical technology transfer

49. Knowledge can also be transferred downward between a foreign firm and its local customers. Looking again at Figure 3, suppliers of equipment, materials, components and software are cited by 20% of services firms as a highly important source of information for innovation.

50. Learning as a customer of a foreign company should be even more important in the case of services. In contrast to goods trade, a characteristic of services trade is that the customer is more involved in the "production process". The consumer often participates in the preparation of the service from the early stages of defining his or her needs, and then tailors the solution he or she seeks (e.g., consultancy, accountancy, legal services –generally all business services). In this process, both the foreign and local firms learn and can use that knowledge to improve their productivity. Because the MNE can have an interest in the transfer of technology to its customers, more active measures can be taken to encourage technology diffusion. The success and technological upgrading of its customers can create new market opportunities for a MNE.

iii) Horizontal technology transfer

51. Horizontal technology transfers seem less likely because it is rarely in the interest of a firm to encourage its competitors to upgrade their technologies[9]. It is precisely the advantage of the affiliate of a foreign company in the domestic market to have more advanced products. However, some FDI flows are "efficiency-seeking" and target exports to the home country of the parent company or to third party countries. In that case, the subsidiary may benefit from the emergence of local competitors. A larger number of companies in the sector can attract new suppliers and give rise to external (sector-level) scale economies. There could be no additional competition for MNEs subsidiaries if local companies cover only the domestic market.

52. Evidence on horizontal technology transfers is very mixed, but there are externalities for competitors associated with the presence of foreign companies without any concrete interaction between the foreign firm (or its affiliate) and local companies (Saggi, 2004). In particular, the downstream and upstream technology diffusion can benefit local competitors who have access to better inputs and more knowledgeable customers. Indirectly, the vertical technology transfers also diffuse horizontally and spillovers are likely to be observed in other sectors for the same reasons.

53. In the EU Innovation Survey (CIS3), information from competitors is less often cited as highly important for innovation, but still 14% of services firm cite it (Figure 3). It is ranked before other answers (not represented on Figure 3) such as universities or other higher education institutes (8%) or government or private non-profit research institutes (3%).

6. Trade policy implications

54. The diversity of technological diffusion channels seems to make it possible for technology to flow even if barriers are imposed. Firms have many strategies to acquire foreign knowledge and the exposure to foreign technologies takes many forms. However, differences in productivity and technology are strong between developed and developing countries. And these differences translate into important differences in terms of income and GDP per capita. World income convergence or divergence is still subject to debate. One should keep in mind that only a small share of technology is transferred through trade and leader countries spend more on R&D which tends to increase their technological edge relative to lagging countries. There are examples of catching up and "leapfrogging", but globally there is a weak evidence of convergence.

55. As a result, all of the technological diffusion channels described in Part I are important. There is also an important complementary relationship between them (and an overlap). Movements of people are part of the linkages between firms or included in technology transfer contracts. Demonstration effects can occur when people move or through the imports of services used as inputs. Vertical technology transfer (with suppliers) and the purchase of services embodying new technologies are not very different in the case of services, although the business relationship and the service provided are not clearly distinguished. In terms of trade policy, these complementarities mean that technology transfer can happen if the different channels of technology diffusion are concomitantly used, or in GATS parlance, if all four GATS modes of supply are liberalised. Allowing the commercial presence of a MNE will not have the same impact on technology diffusion if movements of experts and professionals are restricted, if local companies cannot source imports from the same efficient suppliers than the MNE affiliate, or if there is no competition between local and foreign suppliers.

9 . It is sometimes the case when there is a need to create a market of high tech products and one firm cannot do it alone or does not want to take the risk alone. See Brandenburger & Nalebuff (1996).

56. Based on the analysis of the different interactions between firms involving trade in services, the following points can be emphasized to define a trade policy conducive to technology diffusion:

- Foreign technology should be free to enter the domestic market, as it is only when a given technology is used in the local environment that it becomes desirable to acquire. It should be stressed that new technologies are not desirable because they are fancy, but because they can decrease production costs, improve the quality and variety of products and services offered, and please consumers. Services trade barriers that prevent the availability of foreign technologies in the domestic market are detrimental to technology transfer. The provision of a service through commercial presence or as a cross-border trade may be different in terms of potential diffusion of technologies.

- Barriers to FDI have perhaps the most negative impact on technology diffusion. Technological spillovers are more likely between MNE subsidiaries and local companies than between companies located in different countries, especially in the case of services. Services are intangible and their "technology" is less easily transferable from country to country through cross-border trade.

- People are essential in the transfer of technology. They can transfer the knowledge necessary to use the technology, advise on the best technologies available, and learn in one company and transfer their knowledge to another one. Mode 4 should therefore be considered as an important dimension of services trade liberalisation and its impact on technology transfer. However, encouraging the movement of labour (both at home and abroad) goes beyond trade policy as it also deals with labour and migration policies.

- Market opportunities should be encouraged as technology is not an end but a means to becoming more productive and creating new products or services. Trade policy should increase market opportunities in three ways: by not introducing distortions into the economy or creating an anti-export bias; by allowing domestic producers to source their imports from the most efficient countries; and by facilitating trade. Incentives to innovate through trade policy should be used with caution as information on market opportunities comes more easily from firm interactions than through constraints on trade flows.

- The complementary relationship between technology diffusion channels suggests that any form of regional integration with the free movement of goods and services as well as people and capital is likely to accelerate the pace of technological diffusion among countries. Empirical studies also show that regional integration increases the probability of coming into contact with, and learning from, neighbouring country's experience (Perkins and Neumayer, 2004; Milner, 2003). There are positive regional contagion effects as the rate of regional technology adoption influences within-country diffusion. Regional integration is particularly important for latecomers to accelerate the diffusion process. There is evidence on technological spillovers in both North-South and South-South regional agreements (Schiff et al., 2002).

PART II: TRADE IN SERVICES CAN REDUCE THE COST OF TECHNOLOGY TRANSFER AND HELP TO BUILD BETTER ABSORPTIVE CAPACITIES

57. Technology diffusion does not occur as an automatic consequence of the presence of others' knowledge in the receiving economy; it also requires that the recipient possess the ability to absorb and adopt the technology (Kinoshita, 2000). Once a firm is willing to change its technology due to the various interactions it had with foreign service providers, as described in part I, the actual transfer will first imply some costs. These costs can prevent the diffusion of technology when the benefits of productivity improvement seem low in comparison to the transfer costs. Often the technology will not be ready to be used without some adaptation to local needs or to local constraints, incurring new costs. It is also important to have the people and knowledge in the receiving economy to "absorb" the new technology, which means not only to know how to use it but also to know how to adapt and diffuse it.

58. Section 1 details the different types of costs faced by a firm that has decided to improve its production process or to start to produce new goods or services and their specificity in the context of services. Section 2 highlights how open services markets can play a role in reducing these costs in selected sectors (business services, telecommunications services, financial services, higher education and training services, logistics services).

1. The cost of technology transfer

59. The transfer of technology is never costless. Besides the payment which could be made to acquire the new technology, its adoption in a different country will imply additional costs (Ruttan, 2001):

- Transfer cost, i.e., the direct cost of the transfer (e.g., engineering costs associated with the transfer of process design, cost of the capital equipment required by the new technology).

- Adaptation cost, in particular engineering costs to take advantage of local inputs (e.g., lower labour costs) and raw materials, or to adapt the technology to local needs and consumer preferences.

- Training and debugging expenditures.

60. The costs vary according to the type of technology transferred and the experience of the local firm. A transfer of technology can imply large R&D costs when there is a real need to adapt the technology to the local environment and resources. When the technology is completely new for local firms or when there is some "tacit knowledge" to acquire to fully use it, training and debugging costs can also be large.

61. The following typology is used in manufacturing sectors to distinguish different types of technology transfers according to their sophistication and the costs involved (Ruttan, 2001):

- Material transfers are the easiest to make; they imply the simple import of materials such as seeds or machines, or in some cases entire "turn-key" factories. There will be no local adaptation of the technology borrowed.

- The transfer of design is the second type, through blueprints, formulas, handbooks and other means. Some knowledge is necessary to properly understand the technology and there will typically be engineering costs associated with the transfer. Such a transfer can take the form of "reverse engineering", where the foreign equipment is imported to be studied and reproduced. But even when a full blueprint is provided, there is generally some cost to start to use the new technology.

- Finally, the third type of technology transfer is the transfer of capacity. It involves the transfer of scientific knowledge and technical capability to use, adapt and develop the new technology. It includes not only the skills and competencies necessary to use scientific and technical information, but also the "tacit knowledge" that cannot be transferred through materials or designs. This last type of technology transfer is costly because it requires local education and R&D capacities.

62. Although services are intangible, "material transfers" may occur in the context of service-sector technology. There are services where the consumer can benefit from a new technology at a very low cost. For example, in IT sectors a company can acquire very advanced telecommunications systems thanks to the technology of its service provider with a minimal cost to know how to use it. Internet banking or Internet shopping involve technologies such as secure data transaction systems that can be categorised as "material transfers". Human resource services are another example. They involve very sophisticated recruiting methods while the "product delivered" is a list of the best profiles for the position advertised. The firm can then benefit from higher human capital with no specific cost to upgrade its own human resources capacity. Many business process outsourcing (BPO) services can be included in this category.

63. However, it should be noted that in the case of services, adaptation costs will most of the time be supported by the service provider. It is precisely the service paid in the case of most business services where a firm with no expertise asks for advice and solutions to solve a specific problem. But it does not mean that there is no "adaptation cost". The cost will be part of the commercial transaction and of the service provided. A high cost can prevent the firm from using the new technology.

64. The "transfer of design" in the context of services can be understood as the provision of a service that will enable the firm to internally supply the same service without the assistance of the first provider in the future. Examples include business solutions or software system solutions. There will be some costs to fully take advantage of this technique, as well as training for the people who will use it and the firm will not engage in the transfer if it does not have the resources to adopt the new technology.

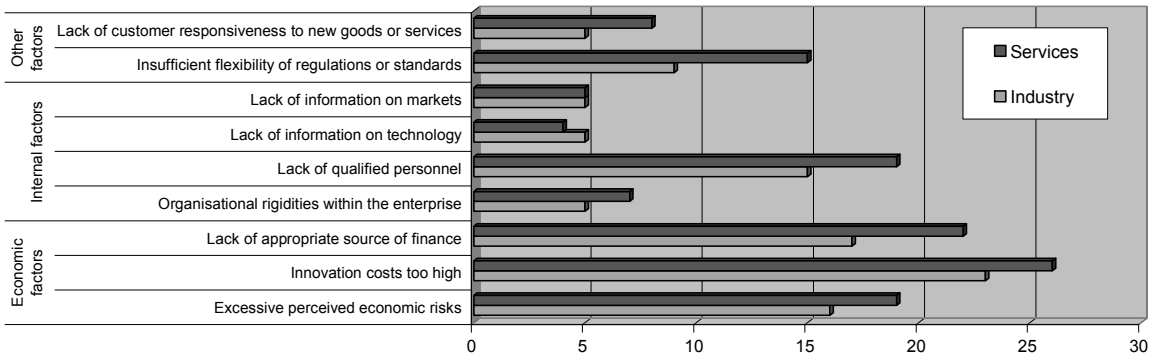
65. Lastly, the "transfer of capacity" is not very different between manufacturing and services sectors. It involves education, training and research & development activities that are services and can be very costly for a company. While software solutions can be implemented in a company to improve its productivity in various departments, it is another degree of technology transfer if the firm acquires the knowledge to design its own software and improve its operability through internal R&D.

66. The cost of innovation appears to be the main obstacle to technological change in companies. The last EU Innovation Survey (CIS3) shows that 26% of innovative services firms cite the cost of innovation as the number one hampering factor explaining why they abandoned an innovation (before other economic factors like perceived risks or lack of appropriate finance, see Figure 4). It is also the factor most cited by manufacturing companies, but with a smaller percentage showing that the cost factor is more important in services.

67. There are still differences in the innovation process between manufacturing and services (OECD, 2001b). Research and innovation in services is generally led by consumer needs rather than by the

development of science and technology per se. R&D activities are more often sourced externally in the case of services, but some convergence can be observed in manufacturing where innovation was in the past mainly done in-house and is more often outsourced now. This convergence can be seen in other characteristics as well; services are catching up in internationalisation, some of them have a short innovation cycle (e.g., computer services) and the impact of innovation on labour productivity has increased in services although it is still lower than in manufacturing.

Figure 3. Results from EU innovation survey (CIS3): proportion of enterprises where innovation activity was highly hampered 1998-2000 (%)



Source : Eurostat (2004)

2. How open services markets can reduce technology transfer costs

68. Open services markets can help to reduce technology transfer costs in manufacturing as well as in services. As the typology discussed in the previous section highlights, it is through services that firms can mainly surmount barriers to technology adoption and acquire the knowledge they need to increase their knowledge. Services trade liberalisation can be a powerful catalyst by making available the kind of services needed (when they are not domestically available) and reducing their costs (by increasing the degree of competition in services markets). This section focuses on the role of specific services sectors to reduce the different kinds of costs described above.

i) Business services

69. Business services, as defined in WTO Services Sectoral Classification (W/120), include several sectors which play a key role in technology transfer at the firm level: professional services, computer and related services, R&D and "other business services". The internationalisation of business services is a major trend of the two past decades, both through exports and FDI. There is now a world market for business services with large firms (mainly from developed countries) internationalising their activity. Markets are, however, very segmented with the coexistence of large multinationals and small firms operating in local markets (Kox, 2001). As there is a wide range of business services, highly specialised small firms can also be internationalised while others provide services relevant only for the national/local market. While access to the knowledge of global companies can be of higher value for domestic firms, the services of local business companies may be as important to adapt new technologies to local needs and constraints and to reduce the costs of technology transfer. Open services markets can therefore help the recipient economy both to increase the access to better knowledge (from global business firms) and to benefit from more efficient local business services (through a higher level of competition in the domestic market).

70. Professional services, a sub-category of business services, are often needed to effect the transfer of a technology both in manufacturing and services sectors. They cover sectors such as legal, accounting, auditing, and engineering services. Exports of professional services are growing at double-digit rates and have reached USD 270 billion in 2002 (UNCTAD, 2004b). For example, the accountancy world market is dominated by a few highly globalised firms, the "big four", with subsidiaries in many countries. Even legal services, traditionally subject to heavy regulation, are now more often internationally traded (OECD, 2004d). The role of consultants in the innovation process is described in Box 3. They can be individuals or employees of the globalised business firms

Box 3. The role of consultancy in the innovation process and its trade implications

Consultants can be considered as key bridging intermediaries across a wide range of users. Their primary role is to transfer expert knowledge from supplier to user. But they are often involved in a learning and catalytic process where they share their knowledge,to help their customers solve problems themselves through a long-term relationship rather than one-off advice. They can improve the transfer of technology in different ways:

- Through a direct transfer of expert knowledge, from the consultant to the firm;
- Through experience sharing, the consultant acting like a bee cross-pollinating between firms, carrying experience and ideas from one to the other; and
- As a single point of contact to access a wide range of specialist services, the consultant helping the customer to select the right people, firms and activities.

It would be more costly for the firm to access technology, experience and information without the assistance of this intermediary.

In the different services classifications used by WTO members, consultancy services are generally mentioned in relation to their sector of activity and different GATS commitments are likely to apply. Different restrictions can constrain the international provision of consultancy services: non-recognition of qualifications or experience, professional practice restrictions, and visa restrictions. As domestic consultants need to network with the relevant international firms and R&D organizations, barriers to trade in consultancy services are detrimental to the development of local business services and not only to foreign providers.

Source : Bessant & Rush (1995)

71. Among professional services, engineering services are particularly important to determine the transfer cost of new technologies (see section 1). Nguyen-Hong (2000) calculated the impact of restrictions to trade on engineering services for 20 economies (Table 3). The price impact gives an estimate of price increases resulting from barriers to establishment and ongoing operations of foreign firms. These barriers create rents for domestic companies and raise service prices above costs. In the last column, the cost impact measures the increases in costs for domestic engineering firms associated with barriers to establishment. Trade restrictions create rents and increase the costs on the domestic market. The results clearly indicate that there are significant price increases in the absence of open services markets (Column 2). Although generally lower, the cost impact (Column 3) can also be relatively important in countries with a high restrictiveness index.

Table 3. Impacts of restrictions to trade in engineering services for 20 economies

	Restrictiveness Index	Price Impact (%)	Cost Impact (%)
Austria	0.39	14.50	6.80
Mexico	0.33	14.20	1.90
Malaysia	0.26	12.00	5.30
Indonesia	0.24	10.20	3.20
Germany	0.28	10.20	2.90
Spain	0.24	8.70	3.90
USA	0.19	7.40	3.80
Sweden	0.17	6.80	0.70
Japan	0.18	6.60	2.20
Canada	0.16	5.30	2.70
Singapore	0.11	5.00	0.80
Hong Kong	0.13	5.10	2.30
South Africa	0.10	3.70	0.70
Netherlands	0.10	3.70	5.20
Australia	0.08	2.80	2.10
United Kingdom	0.07	2.50	1.40
Finland	0.06	2.30	0.70
Denmark	0.04	1.10	0.70
France	0.03	0.90	0.70
Belgium	0.02	0.50	0.70

Source : Nguyen-Hong (2000)

72. While several countries have signalled their interest in liberalising professional services, few commitments have been made. It is at the regional level that some progress towards liberalisation can be witnessed. In particular, the ANZCERTA –a free trade agreement between Australia and New Zealand– has put in place an open market for professionals with mutual recognition of professional qualifications. Professionals registered in one country can practice in the other (with the exception of medical practitioners). Facilitating movements of professionals would be in the interest of many developing countries to benefit from the expertise of foreign professionals and to increase the competitiveness of local professional services (UNCTAD, 2004b).

73. Many studies have emphasized the importance of computer and related services and R&D services in the context of the "new economy", the development of "knowledge intensive business services" (KIBS) and the transformation of the value chain (global sourcing of business process services)[10]. These services are important in facilitating the transfer of knowledge and to reduce the cost of technology exchange. Technological progress in ICT sectors can translate in productivity improvements and costs reductions for firms only through computer and related services such as consultancy related to the implementation of hardware or software. For many companies, including in developing countries, computers and Internet technologies are already in the firm and the issue is now how to make effective use of these new technologies which are "commoditised" but need services to be fully implemented (OECD, 2004a).

74. There are also many opportunities for developing countries to succeed in computer and related services (see Box 11 for the Indian software example). OECD (2004b) has different examples in software and data processing services. Once technology has been successfully transferred, developing countries can

10 . For example OECD (2001b) and OECD (2004a).

become exporters of the technology and related services to other developing countries. Indian IT companies are now service providers for many Asian, Latin American and African countries. It is a process where learning and learning to learn go together and a country can build capacity to become a technology exporter a short time after it was first transferred.

75. Research & development services, another sub-category of business services are at the core of the innovation process. While a large share of R&D activities is still done inside firms, R&D is more often outsourced, including to developing countries. Innovation surveys generally point out that firms rely to a very limited extent on universities and laboratories for the knowledge they require (OECD, 2001b), especially in services where the focus of innovation is mainly on organisation, marketing and customer needs and where basic R&D is less relevant. This is another reason why R&D services matter. Through R&D activities, firms not only develop new products and services but also increase their ability to assimilate and exploit knowledge –that is, their "absorptive capacity" (Cohen and Levinthal, 1989).

76. Lastly, among "other business services" in the WTO classification of services, some related to testing, calibration and quality control are very important, in particular for developing countries when they want to launch exports in new sectors in order to reach the standards of world markets. Bezanson et al. (1999) report in a case study on Vietnam that such services are an important channel for acquiring foreign technology.

ii) Telecommunications services

77. Over the last decade, technological advances in information and communication technologies (ICTs) have profoundly impacted the organisation of world production and trade flows. Services sectors are intensive users of ICTs, in particular industries such as finance, business services and distribution (OECD, 2004f). The introduction of new telecommunications services in a country promotes trade in services. For example, Freund and Weinhold (2002) find that a 10% increase in Internet penetration is associated with about 1.7 percentage point increase in services export growth and 1.1 percentage point increase in import growth. It highlights the role of ICTs as enabler of new services. Their impact can be threefold:

- ICTs reduce the cost of telecommunications services and make profitable services previously too costly to be traded internationally (those relying on telecommunications as a major input), e.g. call centres.

- ICTs create new services activities in sectors previously nonexistent, e.g. Internet services.

- ICTs have an impact on the organisation of firms and value chains by facilitating outsourced activities. They are one of the driving forces behind the development of intra-firm trade and global sourcing.

78. To promote the development of ICTs, many countries have privatised telecommunications monopolies and introduced competition. Different studies have described how these reforms led to significant improvements in performance in developing countries (for example Fink, Mattoo and Rathindran, 2002). It is mainly through technological progress that prices are decreased and a higher teledensity can be attained. But technological progress is linked to the introduction of competition as new entrants provide incentives for incumbent companies to upgrade infrastructures and services. New technologies also increase competition by undermining the segmentation of services (e.g., Internet telephony).

79. Fink, Mattoo and Rathindran (2002) report that over the 1985-1999 period, the penetration of fixed-line telephony in developing countries tripled, from 2.4 telephone mainlines per 100 people to 7.27 mainlines per 100. Mobile telephony almost did not exist in many countries in 1985, whereas by 1999 the number of mobile subscribers was higher than fixed-line subscribers in a significant number of developing countries. FDI has played a major role in the introduction of these new technologies (Qiang and Guislain, 2003). Empirical studies on the spread of the Internet also point to competitive pressures and trade as significant factors in the diffusion of telecommunications technologies (see Box 4).

80. The spread of new technologies in telecommunications is a prerequisite for the development of IT-enabled business services. Davis, McMaster and Nowak (2002) rank the quality and costs of telecommunications services as the third most important factor conditioning the development of IT-enabled business services[11]. They give the example of Fiji, a country where the labour force is skilled and wage costs are attractive, but telecommunications costs are high. Despite a good telecommunications infrastructure, costs of Internet access in 2002 were a hundred or more times higher than equivalent access costs in Australia or New Zealand. Even in comparison with other Pacific Island countries, Fiji's rates were high. The lack of reform and the protection of the monopoly position of telecommunication service providers largely explained this situation (at that time Fiji had only one Internet service provider). Countries that have developed an important IT sector, like India, undertook important reforms in the telecoms sector.

81. Although ICT sectors are the focus of many developing countries wanting to be part of the "IT revolution", it should be noted that telecommunication services are important for any kind of business. Expensive telecommunication services make firms in all sectors less competitive as they lack up-to-date information on prices of goods and services, on business opportunities and availability of new technologies. ICTs can help even small producers to access larger markets and to reduce their transaction costs. A good example is Novica, a global e-commerce company that links artisans in developing countries with international markets through a web catalogue presenting the work of more than 1800 artists (World Bank, 2003). Artisans who work with Novica are free to set the price of their products and earn between 10 and 50 percent more than on their local markets. They sell to wholesale buyers as well as to individuals. Other examples include the access to price information on the Internet for farmers in small villages (Philippines, India). Access to market information is central in the diffusion of technologies since the choice of entrepreneurs to switch to new production techniques or to produce new goods or services rely on a cost-benefit analysis where it is important to assess market opportunities.

82. Wallsten (2003) shows that regulations targeted at the Internet in developing countries are correlated with lower Internet usage, fewer Internet hosts, and higher prices for Internet access. Figure 5 presents evidence on the large discrepancies between African countries in Internet pricing (Sweden at the right of the Figure gives an idea of how these costs compare with OECD countries). The costs are expressed as a share of GDP per capita to reflect what they really represent for users. As noted by Wallsten (2003), countries that regulate Internet services providers prices have higher prices for Internet access.

11 . The first factor that conditions the ability of a country to supply IT-enabled business services is the quality and cost of labour as labour is the largest cost component of any service activity (up to 80%). Linguistic ability is the second factor.

Box 4. The global spread of the Internet

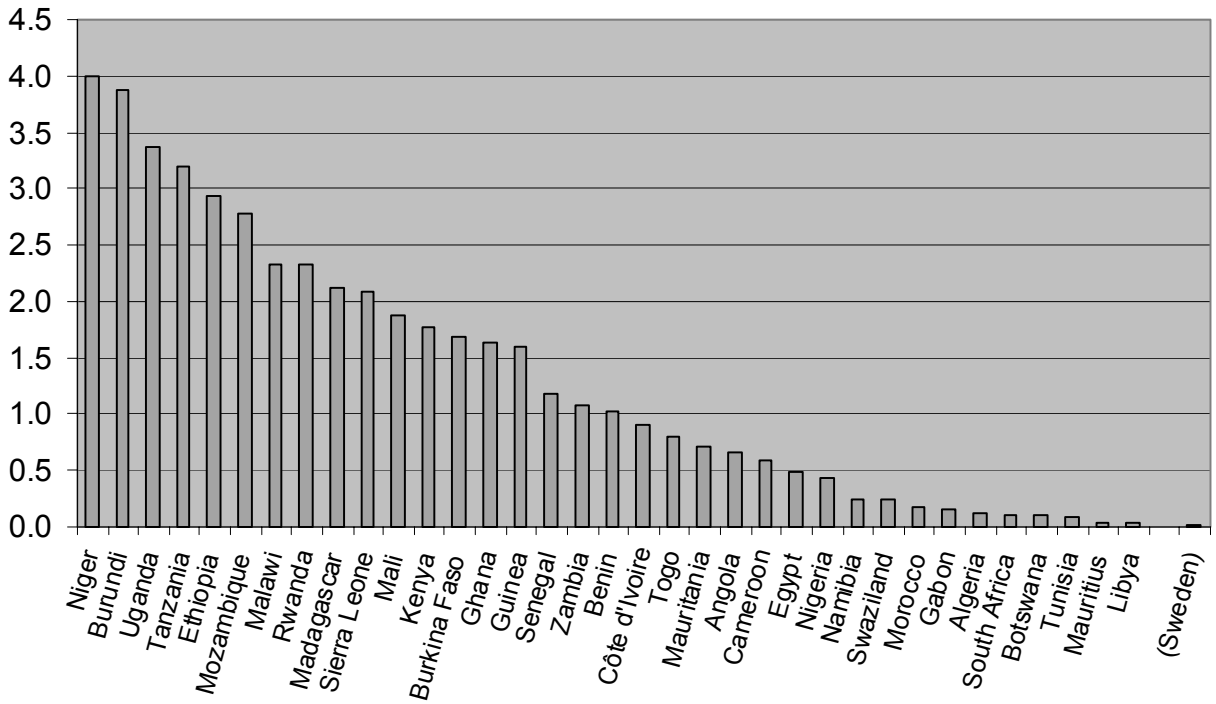
The Internet can be described as a means for spreading information at a very low cost. It reduces both information and transaction costs. The Internet has grown extremely rapidly, but its diffusion has been uneven across countries, raising concerns over an increasing "digital divide". Access to the Internet requires a computer and a telecommunication device but can be offered as a service to any user on a collective basis (e.g., Internet kiosk or public access).

Milner (2003) has collected data on about 190 countries from 1990 to 2001 and has studied the number of countries initiating Internet use each year and the number of Internet users. Initiation is defined as the first year in which at least 0.1% of the population had access to the Internet. Controlling for domestic factors, the empirical analysis shows that the pace of Internet adoption is mainly driven by international diffusion pressures and economic competition. Regional proximity, neighborhood status and trade relations have a significant and positive impact on the initiation of Internet and the number of users. The hypothesis of emulation is also supported by the data. Countries are more likely to adopt the Internet if other countries sharing the same language, religion or colonial experience have more users.

Source : Milner (2003)

83. Telecom monopolies may be tempted to resist technologies that threaten their revenue base. In many developing countries, the pricing and investment in new telecommunication technologies is inadequate. Barriers to foreign competition often prevent the diffusion of technologies with a strong negative impact on economic growth and technology diffusion. In contrast, the introduction of new incumbents and the promotion of more competitive markets help to transfer new technologies. Box 5 provides an example in mobile telephony. Reforms are underway in most countries.

Figure 4. Cost of one year dial-up internet access in Africa as a share of GDP per capita



Source : Hesselmark (2003)

Box 5. Competition in mobile telecoms and the adoption of new technologies

Technology has advanced substantially in recent years in telecommunication services. Especially GSM technology has been adopted by many countries in addition to fixed-line services. In many countries, a second GSM operator has been introduced and given rise to competition and growth in the mobile telecommunications market. GSM competition reduces the price of cellular services. The average price of a call in a market with several GSM operators is 40 to 50 % lower than in markets with only a single provider. When new competitors entered the digital cellular market, the incumbent operators introduced in response to that competition new features, such as caller ID, call forwarding and call waiting as well as prepaid cards. In order to remain competitive and to keep market shares, the domestic companies had to develop new products and offer new services like the entrants to the market. Sometimes the threat of competition is enough to cause the incumbent operator to adopt a series of changes to sustain its market position. For example, when in Morocco the authorities announced that competition in GSM would be introduced in 1999, the incumbent operator began to rapidly expand its GSM network and reduce its tariffs to secure its market share. This case illustrates how competition can initiate demonstration effects to transfer advanced technology in services in an economy.

Source : Rossotto, Kerf and Rohlfs, 1999.

84. Liberalising both trade and investment is important in the telecommunications sector because of the large capital investment required initially to build infrastructures and to allow foreign operators to operate through a subsidiary with more opportunities for technologies to be transferred. Telecoms reforms in developing countries have initiated large investment flows with about two-thirds of investment coming from abroad (Qiang and Guislain, 2003).

85. The liberalisation of telecoms was facilitated by the 1997 WTO Reference paper on basic telecommunications. Many countries used the Reference Paper to accelerate policy reforms and to promote foreign direct investment in telecoms (Cowhey and Klimenko, 2001). Telecoms is the third sector with the highest number of commitments in GATS. However, only 60% of developing countries have commitments in telecoms (Marchetti, 2004). Among countries with commitments, there are also a significant number of restrictive Mode 3 limitations. Qiang and Guislain (2003) also report important remaining barriers to FDI, such as ownership and management controls or the lack of competition policies.

iii) Financial services

86. Financial services entail banking and other financial services and insurance and insurance-related services. There is a specific Annex for financial services in the GATS. It is the second most extensive sector in terms of commitments made by developing countries: 73% of developing and least-developed countries have commitments in the financial sector (Marchetti, 2004). Open financial services markets can facilitate technology transfer, but the trade of financial services can also embody technology transfer.

87. Financial services play an important role in facilitating trade in general and in economic growth. There are many studies on the evidence that finance is positively associated with growth (Rajan and Zingales, 1998, Levine, 2005; in Claessens, 2005). One strong link between finance and growth is that financial intermediaries are responsible for resource allocation and, more crucially, the efficiency of capital allocation. Wachtel (2003) gives an overview of four links between development of financial services and growth. First, the financial sector improves the allocation of resources; second, the financial sector encourages savings; third, economies of scale in financial institutions lower costs; and fourth, financial institutions provide opportunities for risk management and liquidity.

88. Access to better financial services can be increased through open services markets (Claessens, 2005 and Clarke et al. 2003) and therefore is important for international trade in other sectors. Access to

financial services also benefits the domestic financial services and other sectors. Studies show that the entry of foreign banks puts competitive pressure on domestic banks and forces them to lower their costs to become more efficient (Clarke et al, 2003).

89. An important aspect in regard to financial development is the link with specialisation. This is of particular relevance for developing countries since, in order to diversify their economy, special advanced financial tools are needed. Levine (2004) shows that financial arrangements can lower transaction costs and promote specialisation, technological innovation and growth. The study of Svaleryd and Vlachos (2001) finds that the financial sector has a greater impact on the pattern of specialisation among OECD countries than differences in human and physical capital endowment.

90. The banking industry uses a wide range of technologies, such as information technology, telecommunications, and financial product technologies (Northcott, 2004). Studies like the one by Berger examine the effect of technological progress on productivity growth in the banking industry and on the structure of this industry (Berger, 2003). Banks are using financial technologies that embody economic and statistical models to create, for instance, financial derivatives and to improve portfolio management. Information technology is an important tool to collect, process and evaluate data.

91. Technological progress is especially important in the banking sector because of its linkages to other sectors in the economy through financing, deposit, and payments services (Berger, 2003). Economies of scale in bank products and services can be increased by technological progress, for example in cash management, payments processing, and bank office operations (Northcott, 2004). But technological advances can also lead to new products. Progress in IT services leads to the development of online banking and can also facilitate the outsourcing of back office banking activities or financial research services. An example is E-Serve International Ltd., formerly known as Citicorp Securities and Investments Ltd. The company started its operations in India in 1992 and focuses on providing IT-enabled services to the global financial services industry and caters to the needs of companies engaged in banking, insurance, capital markets, mutual funds and e-markets. The services provided include transaction processing, cheque processing, and credit/debit card service to global clients (OECD, 2004b).

92. The study by Christiansen (2001) focuses on recent trends in financial services, with a special view to analysing e-finance as an extension of financial operators' ongoing efforts at client acquisition and retention, product development and cost reduction. He investigates the evolvement of electronic finance and its impact on asset management, brokerage services and mortgage finance, as well as the associated development of new services like electronic bill services. Changes and innovation in technology cannot only lead to the development of new products, but also to a decrease in the costs of banking services, thus lowering barriers to entry and increasing competition. For instance, the use of ATMs and remote banking can reduce the cost of entry since the development of branches network entails large sunk cost (Northcott, 2004).

93. Financial services markets have been liberalised during the last decades in several countries and foreign direct investment in financial services has increased. In developing countries, the stock of FDI in financial services grew 1.5 times between 1990 and 2002 to USD 250 billion (UNCTAD, 2004a). Until the early 1990s, banking markets in Latin America were highly regulated and foreign investment was very low (McKinsey, 2003). Liberalisation and deregulation activities in the banking sector in the 1990s removed barriers to entry in the market. Key international banks investing in Latin America include BBV, BCH, Santander of Spain, Citigroup and HSBC (McKinsey, 2003). In 2002, international financial institutions controlled between 25% and 80% of banking sector assets in Brazil, Argentina, Chile, and Mexico (McKinsey, 2003). Developing country exports of financial services often take the form of joint ventures or subsidiaries of companies based in OECD countries that deliver financial or insurance services to the parent company but are also exporting these services to other developing country markets (OECD, 2004b).

94. As can be seen in the example of the Indonesian banking industry (Box 6), technology transfer in the financial services sector can occur through demonstration and imitation effects and then diffuses in the domestic market to other firms. Turkish banks also began to imitate know-how in planning, budgeting and management information systems and electronic banking techniques after large foreign banks entered the market (Denizer, 2000 in UNCTAD, 2004a).

Box 6. Technology transfer in the Indonesian banking industry

Foreign banks were present in Indonesia since 1968 when a basic banking law was declared, but limits on their operations did not allow them to increase their market share. The government had a significant influence on the structure of the financial sector and segmented the industry into four sectors in addition to the central bank. There were five state-owned banks with the largest share of commercial bank assets in 1987, ten privately-owned banks with foreign exchange licenses, 53 privately-owned non-foreign exchange banks and 11 foreign banks with the smallest share.

Between 1983 and 1988, regulatory barriers between state and private banks were removed by policy reforms. However, services by commercial banks were not enhanced during that time, but stayed mostly limited to taking deposits and giving short-term credits. By 1987, most of the banks engaged in trade finance and consumer finance. Know-how in the financial sector was acquired primarily through informal channels, including monitoring developments in the marketplace and internal efforts to build up organisational capabilities, e.g. training. After the reforms in 1983, competition increased and differentiation in the type and quality of services became more important. Organisational innovations were introduced, the retail and wholesale banking were separated and account officer systems were implemented. These changes led to new opportunities for enhancing product quality and variety, and also required know-how and learning. Training programs with foreign banks were very important sources of product know-how and activities of foreign banks were often imitated. A large number of senior bankers received managerial skills through training at foreign banks.

The most important influence was Citibank. Indonesian bankers referred to its training as the “University of Citibank”, which made large contributions to Indonesian banking. Citibank alumni have assumed senior positions since the 1970s in domestic banks. During the first half of 1989, more than 10% of Citibank’s employees moved to other banks (SWA 1990). Managers learned basic banking knowledge and attained practical experience. The training program entailed three parts. In the first part, new recruits were put in an intensive four-month program in the branch offices of Citibank. Then, on-the-job training followed when trainees moved through the different sectors in the branch. The trainees got further training at the Singapore regional centre after they chose a specialisation. Especially important about this training was to learn how the knowledge was integrated and co-ordinated. Some of the knowledge was codified in operating manuals, which were often taken by managers to their new employers. The most valuable knowledge was tacit, though.

The training program by Citibank had imitation effects as other domestic banks which had benefited from hiring staff from foreign banks built similar management training programs. A large number of their graduates migrated to other Indonesian banks which lead to a further continuation of the diffusion process of technology transfer.

Source : McKendrick (1994)

95. The cost of technology transfer, including transfer and adaptation costs, is also indirectly influenced by the quality and availability of financial services. A closed financial market with high costs of financial services or limited access to financial services can have a negative impact on the capability of domestic firms, especially SMEs, to acquire new technology (e.g. inputs with innovative technology for the production process) in other sectors since new technology can be costly and capital available at low and competitive conditions is needed. Additionally, new types of financial services can be necessary for the transfer of technology in other sectors to reduce the cost of transfer and adaptation. For example, just-in-time production needs special financial tools. In the agricultural sector, where a shortage of finance is among the main problems faced by small farmers, specific types of financial services are also necessary to improve agricultural inputs or to invest in new technologies (e.g. specific loans to fit agricultural activities and to match repayment with production income and diversification strategies to manage the risk inherent to agricultural production).

96. International trade in insurance services has increased in recent years. The average annual change in G7 insurance services exports between 1998 and 2003 was about 18% (OECD/Eurostat, 2005). The insurance companies have changed during the last years and now compete more with banks directly since deregulation allowed the combination of bank and insurance firms. Regarding GATS commitments, insurance and insurance-related services are generally supplied under different modes. Large commercial risks such as maritime and aviation transport are usually insured by highly developed insurance groups via Mode 1 and 2 –although Mode 3 can sometimes be an important means of supplying such insurance services. Individual insurance, like life insurance and other retail type insurance, are mainly provided through Mode 3 (OECD, 2003b).

97. Insurance services can contribute to economic growth. Skipper (1997) names various ways, first insurance services facilitate business by reducing risk and providing more stability in commercial transactions, and they reduce uncertainty for individuals as well. Risk management takes place through pooling which reduces volatility. Insurance services mobilise national savings and through the gathering of information for evaluation of firms and individuals they provide signals to the market about well-managed firms and projects and foster a more efficient allocation of a country's capital. To summarise, insurance services contribute to economic development through providing an enabling infrastructure framework for business activities and for individuals (OECD, 2003b).

98. Technology transfer plays also a key role in the insurance services sector. It uses advanced technology as well, e.g. for risk management, statistical models for the identification and measurement of risk are needed. Although the sale of insurances via the Internet remains low, some companies offer after sale online services or extended services to their customers (Christiansen, 2001). Transfer of technology can basically occur in the same way it does in banking and other financial services. Managerial skills and specific know-how, especially tacit knowledge are important in the insurance sector. Transfer of advanced technology through contracts between firms and labour turnover between foreign and domestic firms are important channels.

iv) Higher education and training

99. In a knowledge-based economy, an educated and skilled population who can create and use technology is crucial. The national education system is the primary source for educating people and giving them the essential knowledge they need. Education services are of a specific nature and should meet public policy objectives. However, there is a growing demand for adult education and training services[12] with a business perspective where international trade can play a role. Trade in higher education and training services can complement the knowledge acquired in the country's education system and can promote the diversity of education to ensure a balance of all the technical and managerial skills needed by firms.

100. Training services are part of most technology transfer agreements because workers and managers have to be trained to make full use of the new technology. In that case, the service is often provided by the firm owning the technology and it will not appear as a separate transaction. The recipient firm will remunerate the seller through royalties or any form of payment specified in the agreement. But the service can be provided by a third party as well. However, firms tend to use adult education and training services with the view to improving their absorptive capacity. By increasing the human capital of people who are going to use the new technology, the company expects some further reduction in the cost of technology transfer in the future. If employees and managers are more familiar with technology in general and more knowledgeable about the different techniques available in their area of work, the shift to new technologies will be easier and less costly.

12 . Training services are very similar to higher education services but are less theoretical and more job-related than academic courses.

101. There is a growing international business in higher education and training services (OECD, 2004b). Regarding higher education, the international movement of students has steadily increased with the development of for-profit cross-border education trade (which also includes the movement of "institutions" as well as students). But this mobility is still driven by "traditional" public or private not-for-profit education institutions (OECD, 2004g). The linkages with technology transfer are indirect but strong. Higher education is important to increase the human capital of the workforce. Countries that recently succeeded in bridging the technology gap have a high level of tertiary education and important flows of students. Not surprisingly, the Asian region is the first supplier of international students with North America and Europe as main destinations. The transfer of technology is less costly when engineers, experts, managers and workers have some international experience and have been trained in the countries that are leaders in the innovation process. These contacts between students through cross-border trade in education can also play a role in initiating a technology transfer as an element of the exposure to foreign technology described in part I.

102. What is often required is some kind of interface between companies and academic research. Technology and science parks are designed to stimulate the flows of knowledge and technology between universities, research institutions and companies. They provide infrastructure and business services to innovative companies that benefit from the proximity with universities and research centres. The success of certain developing countries in high tech sectors is partly explained by technology and science parks (e.g., Bangalore in India, Shenzen in China or Hsinchu in Chinese Taipei).

Box 7. IT training services: Aptech and NIIT

Aptech Worldwide, a company based in India, provides IT training to over 300,000 students and professionals per year via a network of over 3,200 training centres in 52 countries. The company has formed alliances with several universities and educational institutions and has franchises in Korea, Sri Lanka, Tanzania and Kenya. It invites students from all over the world to come to India for training. The company presents itself as the "preferred alternative to University IT education in developing countries".

NIIT, another Indian company, has become a challenger to Aptech (the two companies have an agreement to not disclose who is number one!). It has over 3,800 training centres in 31 countries. Microsoft, Peoplesoft and Computer Associates, some of the leading software companies, are among the company's clients. In Malaysia, NIIT develops multimedia educational material for schools. The company educates individuals and enterprises in developing countries as well as developed countries.

Aptech and NIIT provide a good example of how open services markets can solve the lack of education and training in specific skills, especially for the latest technologies available. The fact that both companies are Indian is also very significant. Trade and technology transfer played a key role in the development of the Indian software industry (see Box 11) and now India specialises in IT sectors and has developed important exports of IT related services. The transfer of technology is really complete now that Indian IT trainers can provide services in developed countries. The specialisation in IT training services also reinforces India's ability to stay a leader in IT services.

Source : OECD (2005c), Aptech and NIIT websites

103. Technology itself is another important factor in the international growth of education and training services. New information technologies have changed the learning process and, as a consequence for trade in services, education and training services can also be provided through Mode 1 (for example, in electronic format). Electronic learning is a new market, but new technologies also created a market for IT training (see Box 7). New IT technologies can impact the three different types of costs associated with technology transfer: the cost of the transfer (an electronic transfer is cheaper), the adaptation cost (easier access to technical information, technology characteristics, local needs) and training costs (e-learning).

104. Education is a sector where few countries have made GATS commitments (education services is the least commited sector after energy services). Only 19% of developing countries have GATS commitments in education (Marchetti, 2004). Among these developing countries with GATS commitments in education, 6 have excluded adult education from their schedule and 12 have excluded "other education services".

v) Logistics services

105. There is no generally accepted definition of logistics services. They cover a wide range of services related to the transportation, handling, storage, delivery and management of goods and services. Logistics services can also be presented as an integrated solution dealing with the management of the entire supply chain, from the supply of raw materials to the delivery of final products to customers. Many companies with large shipping activities outsource the management of their supply chain. As a consequence, the market for Third Party Logistics (3PL) services experiences steady growth.

106. Logistics services can play a decisive role in facilitating trade and improving the productivity of the economy. Their role in technology transfer is multifaceted. As with other infrastructure services, the availability and efficiency of logistics services can attract more foreign companies to the country with potentially more opportunities for technology transfer. Companies with complex supply chains cannot invest in developing countries with limited logistics services. The advantage of cheaper labour could easily be offset by high logistics costs that can represent between 20% and 60% of the value of the products in certain cases. In some countries, logistics costs can be much higher than tariffs and hence constitute important barriers to trade and technology transfer.

107. Moreover, technology is embodied in logistics services. Because of their key role in the organisation of the production process, they can be regarded as a component of what defines the technology of the firm. More efficient logistics services means a more efficient production method with a direct impact on the firm's productivity. Box 8 gives an example of how logistics services can be an essential element of a product or a service, thus increasing its value.

Box 8. Logistics services and cut flowers in Kenya

The consumption of cut flowers is concentrated in a few developed countries, but production is now worldwide. Kenya has emerged as one of the main exporters, producing annually USD 200 million in cut flowers with 94% exported to the European Union. The value of the exports grew by more than 300% between 1995 and 2002 and cut flowers now account for 14% of the country's exports.

It is after a major investment by a Danish company (Dansk Chrysanthemum Kultur – DCK) in the late 1960s that the sector started to grow. DCK experimented with production of different flowers. Other foreign investors entered the market, but also Kenyan firms. The development of the horticultural sector was led by private companies. Due to the perishable nature of the product, co-operative societies were not established for collection and marketing.

The success of cut flowers in Kenya can be explained by the improvement in technology and the continuous upgrade of flower quality to meet European market demand. Logistics services are essential because flowers are highly perishable and cannot be sold if they do not arrive on time or in proper condition. The packing and transportation are equally demanding. Kenyan flowers are mainly sold through the Dutch auctions. They are transported by air freight to the auction where import agents provide services to facilitate the transfer. Then the ground transport is costly and complex. But Kenyan firms (the industry is largely Kenyan-owned) have managed to meet international standards in the context of relatively open markets. Most barriers on flows of resources, technology and skilled manpower were removed in Kenya, partly as the result of overall reforms, but also under the pressure of flower exporters. An important step in the 1990s was the elimination of government interventions in the air freight market.

Today, Kenya's success is a model for other economies in Sub-Saharan Africa, in particular Zimbabwe, Uganda and Tanzania.

Source : Kolavalli and Whitaker (2004) and World Trade Magazine (06/01/2004)

108. Lastly, the adaptation cost of any technology is influenced by the quality of infrastructure services such as logistics. Poor cargo handling or storage services can prevent a technology from being used, especially in services where technology is more often in the process than in the product. Companies must adapt the technology to local conditions, which involves additional costs.

109. Among logistics services, one sector is of particular interest for developing countries: port services. World seaborne trade increased strongly in 2003, reaching 6.17 billion of loaded goods and the annual growth rate reached 3.7 percent in 2003 (UNCTAD, 2004c). Developing countries now have a large share of this market; they are in the top 20 container terminals in the world, which together account for 54.34% of total container shipping (OECD, 2004b).

110. Advances in technology are important in port services to improve productivity and to handle efficiently the increasing turnover of cargo. Modern IT systems help managing operations such as cargo handling and vessel management traffic system in terminals, especially fast loading and unloading times for containers are crucial to minimise the costs of running ships.

111. Co-operation takes place in port services, e.g. a foreign shipping company and a local port operator can form a joint-venture. Close relationships are important, since the transit cost of ships in ports are a major part of transportation costs and the shipping line is also commercially represented in a port (UNESCAP, 2004). Additionally, port operators are supporting shipping lines with customs clearing procedures and documentation facilities (PSA Global Magazine, 2005). Close co-operation between shipping companies, port operators and port authorities can facilitate administrative processes and efficient flow of cargo (UNESCAP, 2004).

112. Furthermore, ports also co-operate with other ports in some regions to co-ordinate port services and to facilitate trade through freight transport. For instance, terminal operators in Hong Kong and ports in South China, especially Shenzhen, have set up joint ventures to establish close linkages (Song, 2000).

Box 9. Technology transfer between port operators through FDI

The PSA Corporation Ltd. is a global leader in the port and terminal business with investments in 18 port projects in 11 countries - Singapore, Belgium, Brunei, China, India, Italy, Japan, Netherlands, Portugal, South Korea and Thailand and is headquartered in Singapore. The PSA group operates the world's largest transhipment hub, PSA Singapore Terminals. It provides shippers a choice of 200 shipping lines with connections to 600 ports in 123 countries. PSA Singapore Terminals handles 17% of the world's total container transhipment throughput and 6% of global container throughput. In April 2003, PSA invested in ESCO, a partly Japanese-owned company that operates a terminal and Container Depot of the Laem Chabang Port on the eastern seaboard of Thailand, recently developed by the Thai government with development aid from Japan. ESCO has implemented advanced IT systems to offer the highest standards, and is also building on human development. ESCO is often sending its Thai staff overseas for training at other ports in Japan, Singapore or Chinese Taipei to make sure that the same level of service of the PSA group is offered as well in Thailand.

Source : OECD 2004b; www.singaporepsa.com, PSA Global Magazine, 2005.

3. Trade policy implications

113. At the country level, the "absorptive capacity" refers to the ability of the domestic economy to assimilate foreign technologies and develop subsequent research. The five services sector described in this section have a pivotal role in increasing the absorptive capacity of the economy. Business services go together with education and training services to provide the country with skilled professionals who can rapidly assimilate foreign technologies and adapt them to the local environment. Consultants and

employees of business services firm need to be trained and technology can be more efficiently transferred to the domestic economy if they are local talents rather than expatriates.

114. Telecommunication services and business services are associated to create new activities, like e-business or business process outsourcing services, transforming the way goods and services are produced and sold. IT-related activities require further education and training services to take part into this process. Financial, logistics and business services represent the kind of services supporting manufacturing activities and other services. No foreign company with more advanced technology will enter the domestic market if it cannot efficiently trade its products or find advice on how to cope with local constraints.

115. Business services, telecommunications, financial services, education and training, and logistics services can together make the domestic economy more attractive to foreign companies. Part II also demonstrated that these five sectors act as facilitators for technology transfer and reduce the cost of technology adoption. Hence these sectors should be considered strategic in services trade liberalisation and more emphasised in current negotiations.

116. Among the main barriers to technology transfer in the different sectors presented, a few can be stressed as particularly detrimental.

- Business services: Barriers regarding the recognition of professional degrees, especially for engineering services, and restrictions on Mode 4.

- Telecommunication services: Barriers to investment (Mode 3), the lack of IT infrastructure, lack of competition policies or no foreign competition for certain technologies.

- Financial services: Regulatory measures that limit the offer of certain financial services by foreign entities, limitations regarding FDI (Mode 3) and the movement of natural persons, non-recognition of professional degrees. Barriers can also exist if there are restrictions for non-resident suppliers of insurance services to serve the market on a cross border basis (Mode 1) and if there are limitations on the electronic transmission of financial services.

- Higher education and training services: Barriers regarding recognition of professional degrees; restrictions concerning the establishment of training or school centers and more generally regarding the movement of natural persons.

- Logistics services: Barriers on Mode 3 preventing the establishment of foreign companies; cumbersome and non-uniform regulations preventing multi-modal services and the integration of the supply chain.

117. Both Mode 3 and Mode 4 of the GATS are important. Mode 3 allows global business firms to access the local markets. And Mode 4 encourages the movement of professionals in both directions: through highly skilled experts with "technology frontier knowledge" from developed countries to developing countries and skilled but inexperienced experts from developing countries to developed countries.

PART III: PRODUCTIVITY GAINS AND TECHNOLOGICAL SPILLOVERS CAN BE INCREASED BY SERVICES TRADE LIBERALISATION

118. Once a technology has been transferred or diffused, the receiving country can expect productivity gains and spillovers into different sectors. The transfer can already be considered as successful if the receiving firm gains and is more productive. But spillovers are externalities which can extend the gains to other firms, other sectors and even the whole economy. Although results may vary, empirical studies highlight huge potential gains from services liberalisation. Among them, technology transfer emerges as one of the more positive outcomes because it fosters an endogenous growth process whereby trade and technology create a virtuous circle. In this cycle, more trade means more technology and more technology increases trade opportunities, resulting in higher income per capita at the end.

119. There is a rich literature on productivity gains and subsequent technological spillovers from trade liberalisation in goods. Yet studies on services are scarce. This section presents and analyses the main studies. Despite the lack of comprehensive data on services trade and some methodological concerns, empirical evidence tends to confirm the positive relationship between open services markets and technology transfer. More importantly, the evidence suggests the kind of channels that are key for technology diffusion.

120. This part of the study considers how –through technology diffusion– one can expect gains from services trade liberalisation (section 1) and how open services markets can facilitate the diffusion of knowledge from domestic companies (either subsidiaries of foreign MNEs or local companies which acquired the foreign technology) to the rest of the economy (section 2).

1. Productivity gains from technology transfer through services liberalisation

i) Methodological issues

121. Dynamic gains from trade liberalisation are difficult to measure for goods. For services, it is even harder to calculate good estimates of producivity gains from trade. Two kinds of data are needed, both of which exhibit many methodological problems[13].

- Data on the level of liberalisation in services. Services barriers to trade are not easily quantifiable and trade agreements such as the GATS or RTAs do not necessarily provide meaningful information on the degree of openness as GATS and RTA commitments do not necessarily reflect the actual openness of an economy. Domestic regulation may also be a determinant of market access for services and the comparison of different regulations in different countries can be done only through imperfect indices of restrictiveness or indirect measures such as price-cost margins.

- Data on productivity in services. Services are intangibles which are produced essentially through labour. Neither the input nor the output is easily quantifiable. Some authors even refer to services as the "unmeasurable" sector. Data collected show that in some services sectors productivity

13 . Methodological issues are presented in OECD (2003a).

growth rates have been very low or even negative. It is not clear to what extent these trends are true or, alternatively, the result of measurement bias. Various studies incline towards an under-estimation of services productivity[14].

122. These methodological issues explain why few authors have undertaken trade and growth analysis in services sectors and why the results of current studies should be treated with caution. It is only through the collection of more reliable data that the relationship between open services markets and productivity growth can be definitively assessed.

123. Moreover, a correlation between services trade liberalisation and an increase in productivity, as found in many studies focusing on goods, would not be solid proof of the linkages between trade liberalisation and technology transfer. Trade liberalisation can increase productivity only by providing a more competitive environment that creates incentives for companies to be more efficient without any transfer of technology. It is important to include technology in the analysis.

124. However, technology is in itself an elusive concept in economics and is measured as a "residual". The concept of "Total Factor Productivity" (TFP) –or Multifactor Productivity (MFP)– comes from growth decomposition analysis where technology is defined as the share of the growth rate still unexplained when other factors of production have been taken into account (what is left when the contribution to the growth rate of labour and capital has been worked out). Thus TFP measures are always to be interpreted with care because any error in the decomposition analysis will be reflected in this variable.

ii) What has been done so far to establish a relationship between trade openness and growth

125. Several studies have emphasised how trade openness fosters growth (see OECD, 2001a for a review). New evidence can be found in Wacziarg and Welch (2003) and Lee et al. (2004). But empirical studies studying the relationship between trade openness and long-run growth have focused mainly on goods. When services are included, it is generally as an aggregate of trade with both services and manufacturing sectors. Barriers to trade in services are rarely incorporated in the different openness indicators used in the literature[15].

126. Since the pioneering work done by Sachs and Warner (1995), and despite the sharp criticisms made by Rodrik and Rodriguez (1999), evidence has been collected in cross-country studies on the globally positive relationship between trade openness and growth. What remains unclear is the causality relationship. Does trade promote growth? Or does growth create trade[16]? The debate initiated by Rodrik and Rodriguez also points to the specific role of trade policies in the relationship. Rodrik and Rodriguez argue that trade openness may be correlated with good governance and good macroeconomic policies. Thus what really matters could be policies other than trade liberalisation. In this debate, the question of trade in services has not been discussed.

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14 . A comprehensive analysis of issues when measuring productivity in services can be found in Wölfl (2003).

15 . For example, the Sachs-Warner index was discussed in many papers. It defines trade openness through five criteria: average tariff rates of 40% or less, non-tariff barriers covering less than 40% of trade, a black market exchange rate depreciated by less than 20%, no socialist economic system, and the absence of state monopoly on major exports. A country is defined as "open" when it displays the five characteristics. The two first criteria refer only to trade in goods. While barriers in services can influence the third one, it is clear that trade in services is not considered as an important factor in the Sachs-Warner definition of openness.

16 . Deeper econometric analysis suggests that when controlling for the effect of growth on openness, openness still has a positive effect on growth (Lee et al. 2004). Frankel and Romer (1999) with another approach also establish that trade causes growth.

127. Once one can demonstrate a positive relationship between trade openness and growth, the next step is to isolate the specific role of technology. Dynamic gains through technology diffusion only represent a part of the overall welfare gains from trade. Among dynamic gains, technology transfer is only one of the potential linkages between trade and growth, which can include market size considerations (trade promotes scale economies) or the influence of government policies (trade openness can encourage countries to adopt better macroeconomic policies).

128. Different approaches have been used to isolate the specific contribution of technology transmission. Wacziarg (2001) made an interesting decomposition of the dynamic gains from trade. His study provides strong evidence of the positive impact of trade on growth. The most important channel of influence is through the domestic ratio of investment that is raised by trade. It explains 63% of the total gains, followed by technological transmissions proxied by FDI flows (22.5%). Again, the study lacks any consideration of services. Wacziarg seems surprised by the weak contribution of technology when it is proxied by the ratio of manufactured exports in total merchandise exports. It would be interesting to include services exports and to see how it changes the results as technology today is more and more evident in the services sector.

129. Another common approach analyses technological spillovers from trade by relating R&D stocks and trade flows. R&D measures the input of the technological process (the money spent in research and development) while other approaches based on capital or IT goods try to measure the output of technology (the high tech products). Coe and Helpman (1995) began investigating how foreign R&D stocks impact the domestic economy through imports. They find evidence for significant international technological spillovers. When countries trade with other countries having a higher R&D stock, they benefit from an increase in their productivity as an externality.

iii) Investigating the relationship between services trade liberalisation and growth

130. A first attempt to look at the specific role of services in the trade and growth relationship can be found in sectoral or country studies. The methodological issues previously discussed seem to have discouraged authors from making cross-country and cross-sectoral analysis as it was previously done with trade in goods.

131. At the sectoral level, Mattoo, Rathindran and Subramanian (2001) offer some insights into the dynamic gains from services trade liberalisation in two sectors: basic telecommunications and financial services. Services openness measures are used in a cross-country growth regression similar to the one realised by Sachs and Warner (1995). The study provides evidence of a significant impact of services trade liberalisation on long-run growth. Countries with a fully open telecom and financial services sector grow an average 1.5 percentage points faster than other countries. The result is stronger for the financial sector. This study clearly shows that there are dynamic gains from services trade liberalisation and it would be interesting to continue the analysis with more sectors and a more refined liberalisation index. Yet there is no indication with this approach to what extent the dynamic gains reflect technology diffusion through trade. It is through the identification of different channels and a decomposition similar to the one done by Wacziarg (2001) that it would be possible to assess the technology factor in such dynamic gains.

132. At the country level, a study on Korea (Kim and Kim, 2003) analyses the relationship between services trade liberalisation and productivity growth rates (TFP) in the services sectors. The authors find that TFP growth rates are higher in the distribution sector which has been liberalised and has received large inflows of FDI in the 1990s. This kind of evidence is not enough to say whether services liberalisation is at the origin of the productivity improvement or if it is related to technology transmission. However, the methodology is interesting and could be extended to a broader set of countries. Kim and Kim (2003) also look at the contribution of services liberalisation to manufacturing as another benefit of services openness.

Some manufacturing sectors that use more services as inputs (as shown in input coefficients of services in selected manufacturing sub-sectors) have a higher TFP growth rate, but no clear pattern emerges from the data. This approach could also be subject to further analysis in a more systematic way in a sample of countries[17].

133. Only one empirical study examines the impact of services trade liberalisation (all sectors) on growth with a dynamic panel approach and with a large number of countries (sample of 82 countries). Li, Greenaway and Hine (2003) investigate the relationship between imports of services and real GDP per capita growth. They choose to look at GDP growth rates rather than productivity growth rates (as measured by TFP) to avoid bias and other problems with productivity measurement in services. By doing so, they also make their analysis more ready for comparison with other trade and growth studies focusing on goods. The drawback of this approach is that they have to explain GDP growth (which is not only the result of trade) and introduce variables such as the human capital, which have their own limitations.

134. Li, Greenaway and Hine (2003) use the ratio of both trade in services to GDP and trade in manufacturing to GDP as explanatory variables to assess the respective contribution of trade in services and trade in manufacturing to the growth rate. Their results are mixed. For developed countries, there is a significant positive impact of services trade liberalisation on growth. However, for developing countries the relationship is negative. There are different ways to explain these results. Services represent a larger share of GDP and trade in developed countries, so the impact of technology diffusion through services is logically higher than in countries with very few services trade flows. Perhaps services are a more important channel of technology diffusion in economies heavily concentrated in services. Another explanation is the difference in the services traded. The authors do not have enough data to confirm this hypothesis, but they show that in developed countries where imports of services are available for different sectors, there is a strong positive correlation between business services trade and growth and a negative correlation for transport and tourism. In developing countries, to the extent that services imports are mainly in transport and tourism rather than in business services, the negative correlation makes sense. Unfortunately, there is no data to check this. It would be a very interesting conclusion from the empirical analysis if the positive result for business services was confirmed in a larger sample of countries. It would indicate that technology transfer contributes to the positive growth effect of trade, as this sector studied in part II is clearly a sector with a high potential for technology diffusion.

iv) Results from Computable General Equilibrium studies

135. CGE modelling has been widely used to assess gains from services trade liberalisation (see OECD, 2003a for a review). Based on input-output tables covering a large number of sectors, these models are useful to assess the economy-wide effects of services trade liberalisation. But they are not growth models and therefore cannot endogenously determine changes in total factor productivity over time (Hertel et al., 1997). However, there are several ways to include dynamic effects in a CGE framework[18].

136. In OECD (2004e), an input-output analysis is conducted to assess the downstream linkages of services trade liberalisation (including partial FDI and temporary movements of natural persons). Domestic barriers to trade affect the cost of services that are used as inputs in other sectors. When barriers are removed, not only will liberalised services be cheaper, but the model can also explain how these cheaper services can have flow-on effects to the rest of the economy when they are used as inputs in other sectors. However, flow-on effects only capture one channel of transmission of technology, i.e. service inputs

17 . The relationship between FDI in manufacturing and trade in services is also examined in OECD (2005d).

18 . In theory, technical change can be added through an exogenous augmentation of output or value-added, a productivity increase of primary factors (labour or capital), cheaper inputs (in particular cheaper imports), or a reduction in transportation costs (Hertel et al., 1997).

embodying new technologies. As studied in part I, several other channels of transmission exist. Such modelling is not adequate to fully convey all the gains from services trade liberalisation and specifically those related to technology transfer. But it does not alter the results: OECD (2004e) finds some very positive effects from services trade liberalisation in the seven developing economies studied. Additional gains in terms of technology transfer would reinforce the benefits from liberalisation[19].

137. It is possible to include TFP increases in a CGE model to take into account technological change. For example, McKibbin and Wilcoxen (1996) use a dynamic CGE model, the Asia-Pacific G-Cubed Model, where productivity changes are incorporated in the analysis through TFP variations. But the increase in productivity is not endogenous; it is exogenously determined by the modeller. The study shows that there are important gains for the Australian economy when TFP increases, both in the Australian services sectors and in world-wide services sectors. But the increase in TFP –which could be explained by technology diffusion–, is arbitrarily set and the study should be interpreted as a simulation exercise in which the gains computed are those which would occur in a consistent multi-sector multi-country framework if trade (or any other factor) was increasing the TFP in services. Dynamic CGE modelling is certainly the future of trade analysis. But unless technology is in one way or another endogenously incorporated in models (with TFP increases based on empirical data related to knowledge flows), there will be no strong lessons from such models[20].

138. The most interesting study to date is Robinson, Wang and Martin (1999) where different dynamic features are added to a CGE model. Technology diffusion between developed and developing countries is considered in 10 countries/regions and 11 sectors (of which 6 are services). A first result is that welfare gains are larger when there is a 50% cut in protection in the services sector as compared with the manufacturing sector. But what is interesting is how dynamic gains from technology transfer impact the increase in GDP. Adding dynamic gains significantly increases welfare gains from trade liberalisation and the results are higher for developing countries. For example, in Asia newly industrializing countries (NICs) gains are very important: 4.96% in GDP with a 50% cut in protection in both manufacturing and services. The increase jumps to 7.87% when all dynamic gains from technology diffusion are added (import-TFP link and a 50% cut in shipping costs).

139. The study also offers other interesting results. Firstly, by comparing the results of the liberalisation of services and non-services sectors alone, it is confirmed that services trade liberalisation increases production and exports in all sectors whereas manufacturing liberalisation benefits only some sectors and gains are not uniformly distributed across regions. Secondly, liberalising imports of intermediate and durable manufactures has a limited impact on TFP growth whereas the liberalisation of services intermediate inputs brings larger TFP gains that spread to more sectors through forward linkages.

2. The role of open services markets in the diffusion of knowledge in the domestic economy

140. The previous section presented evidence of an overall positive relationship between open services markets and productivity growth (or per capita GDP growth). As is the case now for trade in goods analysis, research should focus more on the specific channels of technology transmission as described in

19 . Or they would have no effect but they would not reduce the welfare gain already measured since no theory or evidence points to a welfare loss through technology transfer.

20 . A truly dynamic model of trade based on the CGE approach is, however, quite a challenge as it would have to go further than the addition of TFP growth effects. What technology essentially does is to change the structure of production with a specialisation in sectors where the country has a comparative advantage. It means that input/output tables which are at the basis of the analysis would have to be endogenously transformed in the model. There is no solid theory so far that can predict in which sectors a country is likely to specialise in the long run and how it would affect the structure of its production.

Part I to offer evidence of demonstration effects, backward and forward linkages, and technology diffusion through movements of people.

141. This section reviews the main studies collecting data and evidence on these interactions in the case of services with a focus on the diffusion of knowledge inside the domestic economy –that is, once the technology has been transferred to a domestic company, either the subsidiary of a MNE or a local company who has just acquired a foreign technology through a partnership or through any other channel of transmission.

i) Forward and backward linkages through FDI

142. FDI represents the form of trade which is considered the main source of technological spillovers. A review of the available empirical evidence can be found in OECD (2002a) and Saggi (2004). Sectors with a high level of foreign involvement are generally those with higher productivity and faster productivity growth. However, one concern –often raised by developing countries– is that technology may stay in the subsidiary of the investing company and not diffuse to the rest of the economy. Technology transfer between foreign companies' subsidiaries and domestic firms is not automatic and there is still debate on the positive effects of FDI in the host economy. In fact, some studies find negative spillovers. For example, Djankov and Hoekman (2000) find a negative effect of FDI on purely domestic firms in the Czech manufacturing industry. One explanation is that domestic firms could lack the ability to absorb the technologies from foreign firms. The discrepancy in the results from data sets with different countries and different types of firms suggests that one condition for the transfer of technology is the existence of local capabilities.

143. Indeed, several studies point to the fact that without a sufficient absorptive capacity a country will fail to increase its productivity through FDI. The absorptive capacity is generally defined through the stock of human capital (for example in Xu, 2000). No attempt has been made to relate the absorptive capacity to services, but it is certainly an area for future research. Local capabilities can be strengthened by open services markets as described in Parts I and II.

144. Even in the absence of direct technological spillovers between MNE subsidiaries and local firms, externalities may come from the presence of foreign exporters who attract foreign services providers to benefit from better services inputs and better infrastructure. This hypothesis is not easy to test empirically, but some evidence can be found in Aitken et al. (1997). Their study of 2000 manufacturing plants in Mexico shows a positive correlation between the number of exporting Mexican-owned plants and the proximity of foreign-owned exporting plants. These indirect technological spillovers, where the local companies benefit from better inputs thanks to the presence of foreign companies, are perhaps more important than the horizontal diffusion of technology between foreign and domestic firms which is not always corroborated by data. Box 10 provides an example of another approach with CGE modelling to measure the impact of such spillovers.

Box 10. Higher benefits from technological change when marketing costs are lower: A simulation in the Mozambican economy

Marketing costs represent wedges between producer and consumer prices. They reflect storage and transportation costs as well as the financial risk associated with the production. Arndt et al. (1999) indicate that marketing margins in Mozambique in 1995 could make as much as 400 percent of the producer price value for certain agricultural products. These margins are especially high on exports, thus creating a distortion in favour of the domestic market. Poor transportation with many farmers in remote areas makes it difficult for agricultural products to reach domestic and international markets. As a consequence, a large part of the production is not marketed.

Using a CGE model, Arndt et al. simulate the impact on the Mozambican economy of a 30 percent improvement of productivity across agricultural sectors and of a 15% reduction in the marketing margin rates. The two figures are chosen to have a comparable welfare gain when each simulation is run separately. When the two effects are combined (higher productivity and lower marketing costs at the same time), the welfare gain from the improvement of productivity is higher. It means that the positive impact of agricultural technology change on the GDP is amplified when improvements to the marketing networks are concomitantly undertaken. The simulation shows that there is a significant positive effect on relative agricultural export prices and that incentives for agricultural exports improve significantly with this combined implementation of improvements in agricultural technology and marketing networks.

This study confirms the hypothesis that reaping the full benefits of better production technology is possible only through more efficient infrastructure, with competition in financial and professional services reducing the marketing margins. As more foreign trade is created in the process (with producers exporting more and selling less on the domestic market), a virtuous circle can be formed where further technological change will be triggered by these additional trade flows and the country can export more and gain more from trade.

Source : Arndt, Jensen and Tarp (2000)

145. The last study reviewed is Jensen, Rutherford and Tarr (2004) which models the Russian economy after its future accession to WTO with an emphasis on the role of multinational service providers in business services. The country experiences additional gains to liberalisation because the quality-adjusted cost of purchasing business services is reduced. According to the study, the liberalisation of barriers to FDI in services represents 72 percent of the total gains for Russia from WTO accession. These gains are huge because all Russian businesses have an improved access to multinational service providers and more FDI comes. In another paper, the same authors extend this analysis to the telecommunications sector (Jensen, Rutherford and Tarr, 2005).

146. Almost all of the country or firm case studies on technological spillovers in domestic firms are in the manufacturing sector. A good example in services is provided by the Indian software industry (Box 11).

Box 11. The Indian software industry: A successful technology transfer in services

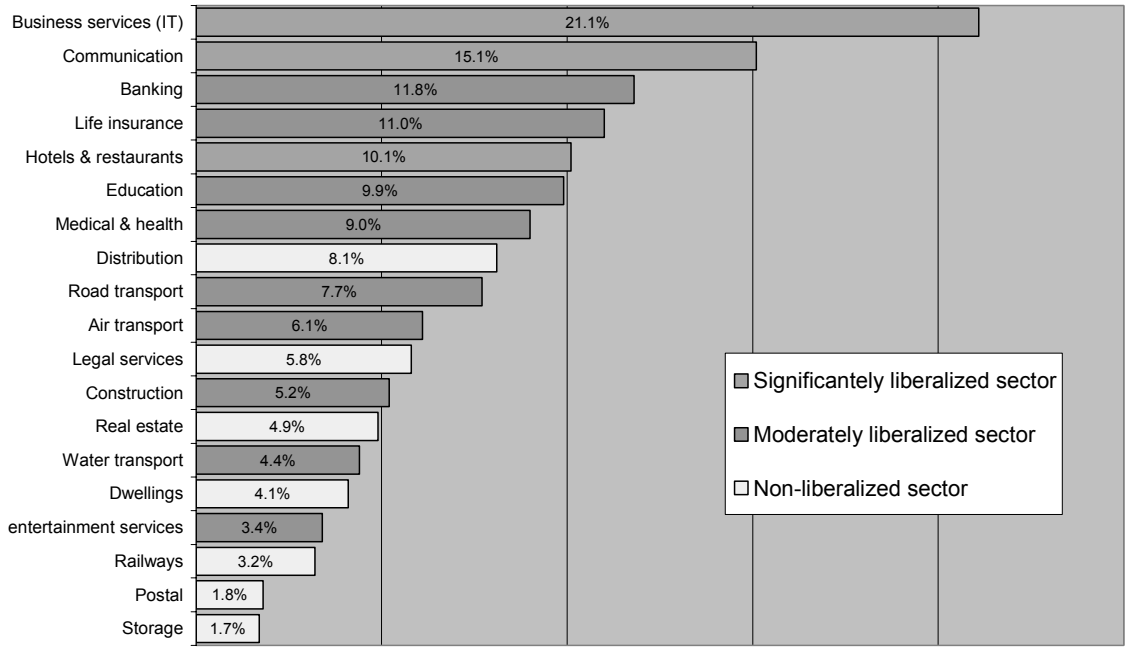
The software industry in India has grown from USD 150 million in 1991-1992 to USD 12.2 billion in 2002-2003. It represents 2.7% of India's GDP and 13% of total exports (40% of services exports). Indian software companies export to many countries with significant market shares in developed countries (mainly in the United States and the United Kingdom). Infosys was the first Indian IT company to list its shares on NASDAQ and has grown by almost 800% over the last five years. There are more than 3000 Indian software companies and a large majority is indigenous. The five largest software companies in India are domestically owned.

How was it possible for India to build in a short time such a strong export sector in a very high tech service industry? The first exporting Indian software company, Tata Consultancy Service (TCS), was created in Bombay in 1974. It formed a joint venture with a American hardware company. An incentive to enter the software market was provided by the government: the permission to import computers was linked to a commitment to develop software for export. IBM was already established in India providing software and hardware but had to leave when its software

industry declined. It released 1200 software personnel on the Indian market, among which many created their own companies. It was when Texas Instruments established a wholly owned export-oriented subsidiary in 1986 that the Indian software industry was really launched. The government of India accompanied the process with a Software Technology Parks Scheme providing a five-year tax-free status for new companies. Soon after Texas Instruments, Hewlett-Packard came to Bangalore in 1989. These foreign investments demonstrated that India had the capacity to be a competitive exporter of software. The country had a very well-educated workforce, skilled engineers and professionals, and a large base of English-speaking graduates. Movements of personnel, demonstration effects and technological spillovers helped Indian entrepreneurs to gain experience in the software industry to set up their own companies.

However, the industry really took off after the 1990s when the Indian economy started to open up. IT services and telecommunications were among the sectors that were the most significantly liberalised in India (see graph below). A liberal regulatory and policy framework encouraged investment by multinationals. The sector was greatly assisted by this wave of reforms: productivity experienced a high growth rate and exports soared. Indeed, as shown in the chart below, there is a clear correlation in Indian services sectors between the growth rate and the degree of liberalisation. Moreover, the growth of the software sector has generated new services exports, as exemplified by Aptech and NIIT, two Indian companies which are now major players in IT training services (see Box 7).

Figure 5. Gains from liberalisation: Growth rates of selected Indian services sectors in the 1990s



Source : Lateef (1997), World Bank (2004) and OECD (2005c)

ii) Technological spillovers through labour turnover and the movement of natural persons

147. Technological spillovers from Mode 4 trade in services have been even less studied than those from Mode 3 (FDI). It is very difficult to measure movements of people between foreign and domestic firms and how they enable technology transfers. However, FDI is often associated with temporary movement of workers from the parent company which enables knowledge flows. And FDI is also the starting point of labour turnover and its potential for technology diffusion. Some spillovers measured in the studies on the impact of FDI on the domestic economy are likely to capture the impact of labour movements rather than capital flows.

148. MNEs generally have strong incentives to upgrade skills of local workers. Even if training is expensive, cost-benefit analysis results in favouring the indigenous employee as compared to what an expatriate would cost to the company. It is also true for managers. UNCTAD (1995) provides evidence on the transfer of managerial skills in Central and Eastern Europe in the 1990s. MNEs in the region trained local managers in general management practices, functional skills and English language. Modes of training included: on-the-job training with new managers paired with the experienced ones, in-house training abroad (in the parent company), internships in other affiliates in other countries of the region, MBA programmes funded by the MNE, after-work classes with tuition reimbursed and public workshops. The development of management consulting firms hiring more and more local talents also contributed to the transfer of management know-how.

149. Gershenberg (1987) also provides evidence on the positive interaction between FDI and labour mobility in the case of Kenya. Kenyan managers employed by affiliates of MNEs received more training on average than managers employed by local firms. Their training included formal instruction (such as seminars and schooling) and training abroad in addition to on-the-job training. The study shows that managers in MNEs were less likely to switch to local companies (MNEs try to reduce turn-over) but when they did, their marginal product was higher and they would go to a local company rather than another MNE. The professional mobility of managers contributed to the spread of knowledge in the Kenyan economy.

3. Trade policy implications and concluding remarks

150. The international transfer of technology can only be imperfectly measured, either through the money spent to acquire foreign technology (royalty payments, R&D expenditures,), the "paper trail" of some innovations (patent citations) or the impact of technology in the receiving country (productivity changes). By definition, knowledge flows are invisible and registered in statistics only indirectly. There is a need for high quality data to collect stronger evidence on technological spillovers from trade.

151. Emphasis should be placed on services in the debate on trade and growth. This study shows that services matter for developing countries as a potential export sector with strong technological content and also as a supportive sector for the rest of the economy. Gains from services trade liberalisation are already higher than those from manufacturing liberalisation without factoring in dynamic gains. When technological spillovers are added, econometric simulations make a strong case for services liberalisation. As evidence is available mainly for developed countries, further analysis is necessary to validate this result for developing countries.

152. Technology diffuses in the receiving economy mainly through linkages between foreign affiliates of MNEs and domestic firms and through the movement of people (either labour turnover between foreign and local companies or the movement of natural persons). Developing countries should therefore emphasise Mode 3 and Mode 4 when they liberalise their services sectors.

153. Open services markets can strengthen capacities to learn, adapt to new technologies and move up the technology ladder. Technology is behind an endogenous growth process where more trade leads to more technology flows and more technology to more trade and growth. Trade facilitates technology diffusion, but technology also acts as a catalyst for trade. Barriers to trade in terms of infrastructure, culture, language or education can be mitigated by technology and technology offers new means of conducting trade.

154. Recent growth performers have been countries with outward-oriented strategies and liberal policies in dynamic export sectors. A general policy recommendation towards openness is sensible, but one should keep in mind that services reforms are complex and resource intensive. Services trade liberalisation

does not consist of the removal of barriers such as tariffs, but in the design of efficient regulations that can allow foreign providers to access the market while maintaining a competitive environment in which public policy objectives are enforced. Trade capacity building is essential to help developing countries address the challenges of services trade liberalisation. An emphasis on key services facilitating the exchange of knowledge between foreign and domestic companies can have a significant impact on technology diffusion while minimising the cost of the reforms.

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