OECD Trade Policy Papers No. 81

The Impact of Services Trade Liberalisation on Trade in Non-Agricultural Products

Hildegunn Kyvik Nordås

OECD

Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development

16-Oct-2008
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English - Or. English

TRADE AND AGRICULTURE DIRECTORATE
TRADE COMMITTEE

Working Party of the Trade Committee

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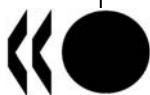
OECD Trade Policy Working Paper No. 81

by Hildegunn Kyvik Nordås

Hildegunn Kyvik Nordås, telephone: (33-1) 45.24.88.90; email: hildegunn.nordas@oecd.org

JT03253101

ABSTRACT

This study finds that trade in services contributes to a broader services supplier base that supports competitiveness in high-technology and high-value added manufacturing. It is shown that with low, but still significant trade costs in services, large countries have a comparative advantage for services-intensive manufactured goods, an advantage that is enhanced if the country also produces intermediate services more effectively or has lower barriers to entry for services suppliers. Countries with superior organisational technology (*using* producer services more effectively) will strengthen their comparative advantage in manufacturing following services trade liberalisation. The impact of services trade liberalisation on trade in manufacturing is non-linear. Until trade costs have reached a threshold level the trade response is quite modest. Consequently, going the last mile of services trade liberalisation, including lowering regulatory barriers, will have the largest impact. Exports of labour-intensive manufactures require a host of supporting services and the need for these services has increased over time due to rapidly changing consumer tastes and growing consumer awareness of health, safety and social standards. In order to support industrial development, developing countries need to focus their services trade policy not only on offensive interests, but also on ensuring that local manufacturers have the best possible access to services. Improving market access in telecommunications and business services; particularly legal services, accounting, advertising and technical consulting services would have the largest impact.

JEL F12, F13, F14

Keywords: services trade liberalisation, general equilibrium, linkages.

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EXECUTIVE SUMMARY

This study analyses the role that intermediate services play in the production, location and trade patterns of manufacturing. The role of services as intermediate inputs is best analysed within the framework of input-output analysis and the study starts by calculating services cost shares in manufacturing using the OECD input-output tables for 1995 and 2000. The cost share varied between 13 and 30% among the 33 countries for which input-output tables are available, and for most, but not all countries the services cost share increased from 1995 to 2000.

A change in the services cost share may be due to an increase in the services intensity in all manufacturing sectors, a shift of resources towards the most services-intensive manufacturing sectors or rising relative prices of services. The two first explanations appear to have played a role, although it is difficult to assess precisely the relative importance of each of them. The relative price explanation, however, seems not to have been important. It is also noted that the services cost share varies substantially within sectors among countries. The variation is largest for office, accounting and computing machinery.

Trade in intermediate services has increased over the past decade, but for most OECD countries cross-border trade is quite marginal compared to total domestic intermediate demand for services. There are some exceptions, however, notably Ireland and Singapore, where imports of intermediate services have increased sharply and account for a large share of domestic demand. At first sight the example of these two countries seems to suggest that there is a large potential for cross-border services trade growth. However, a closer scrutiny of the data reveals that license fees account for the bulk of services trade in these countries, and this includes payment of license fees and royalties by all sectors.

A positive empirical relationship between openness to foreign investment as measured by the OECD FDI restrictiveness index and exports and productivity in downstream manufacturing industries is found. In addition higher business services content is correlated with a higher value to weight ratio, suggesting that services intensity is related to a higher degree of processing, a movement up the value chain and economising on material inputs through better supply chain management.

The second part of the study develops a general equilibrium model which is used for simulating the effect of services trade liberalisation on the interaction between goods and services in production and trade. Under various scenarios a gradual decline in services trade costs is imposed and the impact on trade in goods and services is simulated. A first observation is that the impact of declining trade costs in services is non-linear. Until trade costs have reached a threshold level the trade response is quite modest and consequently structural changes are muted. However, below the threshold, services trade takes off inducing quite significant changes in trade and production patterns.

At high to moderate services trade costs, countries with a diversified services supplier base have a comparative advantage in services-intensive manufacturing. Services-intensity tends to go hand in hand with high technology. But as services trade costs come down below the threshold, the comparative advantage is gradually eroded. The reason is that the services supplier base becomes available to competitors in foreign countries as well, and it is no longer a distinguishing feature of the home country.

The erosion of comparative advantage in services-intensive manufacturing in the larger and more diversified countries is however more than compensated by rising net exports of services. Instead of exporting services embodied in services-intensive manufactures they export services directly. Furthermore, some of these exported services return to the country of origin *embodied in imported manufactured goods*.

An interesting scenario explored is the case where a country has superior organisational technology. Japanese manufacturers have for instance since long been admired for their effective ways of organising production. Such a country would *use* intermediate services more efficiently than its trading partners but is not necessarily any better in *producing* services. With falling services trade costs this country is predicted to offshore tradable services and become a large net exporter of manufactures. Its manufacturing sector will, however, be somewhat "hollowed out".

A further impact of better, cheaper and new services is that services can be substituted for material inputs. Engineering and a host of supply chain management services would for instance reduce unit requirements of material inputs and thus contribute to more environmentally sustainable manufacturing and less waste.

A crucial question is whether services trade liberalisation will reduce services trade costs below the critical level below which services trade would take off. There appears to be numerous natural barriers to trade in intermediate services such as language, culture, technology (both communication technology and organisational technology), and more research is needed in order to establish the trade cost equivalence of natural versus political barriers to cross-border trade in services.

The last section discusses policy implications. For developing countries in particular it is found that they would be better able to exploit comparative advantage in labour-intensive manufacturing in a more open services trade policy environment. Exports of labour-intensive manufactures require a host of supporting services such as marketing, technical testing, legal services and many more. Moreover, the need for supporting services has increased over time, a trend that is likely to continue with rapidly changing consumer tastes and growing consumer awareness of health, safety and social standards. Supportive services requirements may well by far outstrip local capacity. In order to support industrial development, developing countries therefore need to focus their services trade policy not only on offensive interests, but also on ensuring that local manufacturers have the best possible access to services.

Financial services play a particularly important role in allocating capital to sectors of comparative advantage. Labour-intensive sectors such as textiles and clothing are much more dependent on external financing than for instance extractive industries. Therefore access to credit is essential for export diversification. Conversely credit constraints may contribute to continued dependence on natural resources in developing countries. Trade liberalisation in the financial sector, although not necessarily liberalisation of capital flows, should be part of a reform package aiming at reducing credit constraints while strengthening the institutional framework and reducing political risks for investors.

Liberalising trade in other backbone services such as telecommunications and transport may reduce transaction costs both in services and goods trade. It appears that the disadvantage of remoteness if anything has increased over time. It is therefore particularly important for counties that are geographically or economically remote to ensure a favourable policy environment for competitive and state of the art transport and communication services.

The non-linearity of gains from services trade liberalisation that were revealed in the model simulations poses a policy challenge for developing countries. The political economy of reforms suggests that gradual and cautious reforms are politically more feasible than radical reforms. Furthermore, it is

easier to proceed to the next step in a reform process if significant gains from the previous steps can be demonstrated. If gains are slow to materialise, in contrast, the reform process may lose momentum. Therefore it could be a feasible policy option for developing countries to start the reform process by liberalising trade in all modes in services sectors whose state of development constitutes a bottleneck for manufacturers and which are not large employers in the local economy. Examples are telecommunications and business services; particularly legal services, accounting, advertising and technical consulting services. It appears that liberalisation of FDI would have the largest impact.

The non-linearity of gains from services trade liberalisation also has interesting policy implications for high-income OECD countries. Direct restrictions on market access or national treatment of foreign services suppliers may be few in these countries and there may be a sense that there is not much more to be gained from further liberalisation. Our results, if correct, suggest the opposite. The largest benefits are yet to come and stem from deeper integration of services markets, which would involve regulatory reform in particular. It is also clear that free trade in high-volume, low-margin standardised services would help manufacturers in OECD countries stay competitive.

1.   Introduction

1.   Most services play a role in the production and marketing of goods. Business services provide direct inputs into the production of goods; transport, logistics, wholesale and retail trade ease the flow of products between different stages of production and from producers to final customers; R&D helps improve the quality of products and processes; health and education services improve the quality of human capital; while financial services facilitate transactions within and across international borders, channel funds from savings to investment and allocates capital between sectors in the process. This study focuses on the importance of services as a direct input into the production and distribution of manufactured goods, complementing earlier studies that have looked at the role of transport and logistics [TD/TC/WP(2006)3/FINAL] and the distribution sector [TAD/TC/WP(2007)16/FINAL].

2.   The manufacturing process consists of a large number of tasks related to product and process design, processing of physical components, bringing them to the right workstation, fitting them together, and finishing and marketing the final product. The number of tasks appears to have increased over time as products have become smarter and more complex. Not all new tasks can be rationally produced inside the manufacturing firm and an increasing number of tasks are therefore provided by external suppliers. It appears that *new* tasks in particular; e.g. tasks related to entering new markets or complying with new regulation, are largely sourced from outside suppliers. The tasks that are conducted within manufacturing firms in contrast appear to have become increasingly specialized within clusters of related core competencies. Focusing on a narrower band of tasks helps firms improve productivity as they substitute internal economies of scope for economies of scale (Bryson *et al.*, 2004).[1]

3.   The scope for improving productivity through in-house specialisation and sourcing of non-core services inputs from outside suppliers depends on the existence of a diversified and competitive services supplier base. Thus, a local services supplier base can be an important source of competitiveness for manufacturing firms. By the same token a country that hosts a well-diversified services sector is likely to develop a comparative advantage in sectors that use intermediate services intensively.[2] Intermediate services are defined as services that enter the production process and become embodied in the final good Conversely lack of a well-diversified and competitive services supplier base can force manufacturers to produce services in-house, rendering them at a disadvantage both in terms of product quality and costs. In a worst case scenario, lack of access to key services inputs, infrastructure and related transport services may constitute a poverty trap for developing countries, locking them into an industrial structure where they export raw materials while other products are made for the domestic market only.

4.   A key question analysed in this paper is to what extent international trade in servicers can alleviate the disadvantage that manufacturing firms in developing countries encounter due to lack of adequate services inputs.   Would services trade liberalisation bring much needed state-of-the art intermediate services to manufacturers in developing countries?   The second question that will be addressed is to what extent services trade liberalisation in OECD countries with a strong manufacturing exporting sector could strengthen their comparative advantage in high-technology manufacturing? Would lower costs of internationally sourced services help these manufacturers sustain their competitiveness in the face of growing competition from emerging markets?   The third question addressed is how trade liberalisation in services could affect countries that currently enjoy comparative advantage in services-intensive manufacturing based on a strong domestic services sector. It is conceivable that if services become globalised and available to manufacturers everywhere, their role as a source of comparative

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[1]   The process of vertical disintegration in a growing market is nicely described by Schelling (1978).

[2]   We make the distinction found in the trade literature that *firms* are competitive (or not) while *countries* have comparative advantage.

advantage could diminish. However, with open international services market countries with a strong domestic services sector could presumably become important international suppliers of services.

5.   The objective of the study is to assess how a reduction in services trade costs affects the production and trade patterns in manufacturing. One way of reducing services trade costs is to lower or eliminate explicit and implicit barriers to trade in services. Examples of direct trade barriers are restrictions on foreign ownership and other market access or national treatment restrictions on cross border trade, commercial presence or movement of natural persons. In addition there are implicit barriers related to behind the border regulation including licensing procedures, lack of recognition of equivalent qualification and many more. In addition services trade costs can be reduced through investment in communication networks and R&D that reduces communication costs. ICT has for instance made a number of services tradable and has been the major driving force for the rapid growth of cross-border trade in business services. Furthermore trade liberalisation and investment are related as services trade liberalisation may bring in foreign investors in e.g. communication networks. Finally, services are more easily traded if they are standardised. Standardisation is largely driven by the private sector and at least partly motivated by efficiency improvements in international supply chains. Business process offshoring is for instance an example of a sector that has become tradable due to standardisation of the services and the proliferation of low-cost telecommunications services for transmitting them across borders.

6.   The rest of the study is organised as follows: Section 2 provides some background and a synthesis of recent literature. Section 3 presents calculations of direct and indirect services content of production and trade in manufactures, using input-output analysis, followed by econometric analysis of relations between barriers to services trade and performance in manufacturing. Section 4 develops a relatively simple general equilibrium model and uses it for simulating the trade responses to services trade liberalisation while section 5 summarizes and concludes.

2.   Background and relations to previous research

7.   The gains from specialisation have been known since Adam Smith described the division of labour in a pin factory in 1776. Later another classical study (Marshall, 1929) pointed out that the degree of specialisation is limited by the extent of the market. It follows that opening up to international trade could extend the market sufficiently to fully benefit from the gains from specialization, particularly for small countries.[3] Expanding variety and improved quality of intermediate inputs have even been shown to be a source of economic growth in its own right (e.g. Young, 1998), while lack of essential services inputs can constitute a serious impediment to economic development (Jones, 2008). Thus, it has been demonstrated that in addition to the usual gains from specialisation, trade in intermediate inputs also reduces the cost of production of final goods and services by providing new, better or cheaper inputs (Markusen, 1989). Subsequent literature has shown that a broader variety of inputs makes it is easier to find suppliers with products that fit seamlessly into the final product. Consequently firms' search costs will be lower (McLaren, 2000).

8.   During the past few decades trade costs have declined significantly and the ratio of international trade in goods and services to world GDP has increased from 24% in 1960 to 54% in 2005.[4] Trade in parts and components (vertical specialisation) accounted for about half of the increase up to the year 2000 (Yi, 2003). Trade in services (as measured in the balance of payments) has grown in tandem with merchandise trade. In fact the ratio of goods trade to services trade has remained at about 4:1 during the entire period. When two variables (trade in goods and trade in services) move systematically together over

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[3]   This was indeed the basis for dynamic gains from trade in the early endogenous growth papers, e.g. Romer (1994).

[4]   Source: World Bank: World Development Indicators (online database).

such a long time period, they are likely to be related. It will be argued in this study that services trade supports trade in goods. Conversely, the absence of adequate supporting services is a severe impediment to trade in goods. Furthermore, with increasingly complex technologies, regulatory environments and consumer demand patterns, there is a growing demand for services that complement and support trade in goods.

9. According to various issues of UNCTAD's World Investment Report the services share of total world inward FDI flows was 67% in 2001-2002, up from 54% in 1989-91. A break-down on developed and developing countries shows that the share was 73% in developed countries compared to 50% in developing countries. The share of services in FDI flows is in other words not far from the share of services in GDP. Turning to stocks, they are somewhat lower, accounting for about 50% of world total in 1990 increasing to about 60% in 2005. For individual OECD countries the share of services in inward FDI stocks varied between 30% in Sweden and 83% in Switzerland in 2001.[5]

Services support trade in goods in three major ways

First, the financial sector has a key role in facilitating specialisation and trade

10. Financial services play a fundamental role in determining trade patterns. Obviously, if a country is to exploit comparative advantage in a particular manufacturing sector, entrepreneurs must invest in that sector. However, industrial sectors vary widely in terms of how dependent they are on external financing (as opposed to financing from retained earnings). In that regard it is interesting to note that textiles and clothing are among the sectors that are highly dependent on external finance, while extractive industries are not (Manova, 2008). And while textiles and clothing is an entry level manufacturing sector in the industrialisation process, extractive industries are related to the so-called resource curse. Credit constraints can thus prevent low-income countries from embarking on an industrialisation process and prolong their dependence on exports of natural resources. Sub-Saharan Africa may be a case in point. But financial development is an important determinant of comparative advantage also in middle-income countries. Countries with a higher level of financial development tend to specialise in industries that depend on external finance more than countries with a weaker financial sector, everything else equal (e.g. Beck, 2002; 2003; Matsuyama, 2005).[6]

11. Having established that the level of financial sector development is an important determinant of comparative advantage, particularly in middle-income countries, the question whether trade liberalisation can improve financial sector performance naturally arises. Empirical evidence suggests that trade liberalisation, including allowing foreign banks to open affiliates or branches in the local economy, could indeed improve financial sector performance (Levine, 1996). Nevertheless, trade liberalisation is no panacea particularly not in the poorest countries (Claessens *et al*., 2001). If the local institutional framework is weak, foreign banks may limit themselves to a few high-margin market segments. Institutional factors such as weak protection of property rights and weak corporate governance then discourage investment in local productive activities, and financial capital tends to flow out of the country (Ju and Wei, 2008). In low-income countries with weak institutions financial services trade liberalisation would have to be complemented by institutional reform if the desired effect on local entrepreneurs' access to investment funding is to materialise.

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[5] Time series data on sales of foreign affiliates in host countries does not exist except for a few countries. Commonly used proxies for commercial presence are stocks or flows of foreign direct investment (FDI).

[6] In high-income countries, in contrast, credit is not constrained and financial development appears not to matter much for industrial structure and trade patterns. In these countries the financial sector is found to follow rather than lead the real economy (Ju and Wei, 2008)

12.   The equity market is another source of finance for investment in productive assets. Lifting restrictions on foreign portfolio investment could be another avenue towards better access to investment funding in middle-income countries. Recent research has indeed found that liberalisation of the equity market increased exports in sectors that depend on external finance disproportionally, everything else equal. Moreover exports increased more in sectors characterised by investments in soft assets that cannot easily be collateralised, e.g. knowledge and computer software. Furthermore, it was found that the impact of equity market liberalisation is stronger in countries in which the stock market was not very active before liberalisation, suggesting that foreign portfolio investment may compensate for an underdeveloped domestic financial system (Manova, 2008).

Second, a broad intermediate services supplier base is a source of comparative advantage and competitiveness

13.   In OECD countries intermediate goods and services account for between half and three quarters of production costs in manufacturing. Of these, services account for a substantial share as noted in Section 3 below. A broad range of intermediate products at the right quality and price can be a source of comparative advantage in the same way as (skilled) labour, relatively abundant capital endowments or natural resources can. Moreover, a number of specialised business services are necessary in order to enter new markets.   Finally, some generic services such as sufficiently sophisticated telecommunications, reliable electricity and finance are necessary in order to use modern capital equipment, including software (which is classified as capital in many countries).

14.   Intermediate services can also improve the efficiency of intermediate goods. For instance the efficient use of a sheet of steel in the shipbuilding industry depends on good engineering, which minimises waste. In this case, up to a point, increased engineering inputs reduce the need for steel inputs. Supply chain management services also improve productivity in manufacturing through a reduction in unit material input requirements. Again more services inputs reduce the need for material inputs. In other cases material and services inputs may be complementary, either due to technology or due to regulation. The most obvious case that comes to mind is the need for frequent laboratory tests related to the use of chemicals in pharmaceuticals, food processing and many other industries.

15.   Intermediate services appear to have become more prominent in the manufacturing process over time, as products have become "smarter" and design has become more important; a development coined dematerialisation of output. The major driving forces behind this are explained in the introduction. Here it is emphasised that services functions, for instance measured by the share of non-production workers in the manufacturing sector, has not declined in the manufacturing sector following the rising share of intermediate services purchased from the market (Pilat and Wölfl, 2005; Miles, 2007). It is therefore argued that services trade is not only a matter of outsourcing services that were previously provided in-house or locally, but more importantly it is a process of adding new tasks that are largely complementary to and supportive of in-house services production in manufacturing firms and their local suppliers.[7]

16.   Two types of broadly defined business models can be indentified in the commercial services sector: high-volume, low margin services; and low-volume, high-margin services. While the former category arises in relatively large markets where services can be standardised and often transmitted electronically, the latter category thrives in markets where customisation and face-to-face interaction are important (Broadberry and Ghosal, 2005). High-volume, low-margin businesses are found in transport, distribution, routine information processing and technical testing, while low-volume high-margin services are found in a number of business services including consultancy, design and R&D. Obviously, it is the former type that can be most easily traded cross-border.

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[7]   See for instance Bryson *et al*. (2004) for a comprehensive review.

17.   Low-volume, high-margin services in contrast largely depend on local knowledge, trust and face-to-face interaction between service provider and customer. Nevertheless, trade is possible through commercial presence. Large consultancies, legal firms, engineering firms, accountants, advertisers and retail banking for instance, typically combine local knowledge and face-to-face interaction with customers in a geographically dispersed affiliate network with a pool of knowledge and generic services from the headquarters (Broadberry and Ghosal, 2005). As already mentioned such services are crucial for manufacturers who want to enter new markets with different regulatory environments, different consumer tastes and different distribution networks. Moreover, local services providers often do not have the expertise to support exporting manufacturing firms. An example illustrates the point; advertising often uses humour to sell products. But humour is very local in nature and nothing falls as flat to the ground as poorly understood humour. Combining the organisational efficiency of international advertising firms with local knowledge is therefore essential for manufacturers who want to enter a new market.

18.   Countries in which low-volume, high margin services are well developed have a comparative advantage for manufacturing sectors that use these services intensively, at least when such services are not easily traded. The manufacturing industries in question are typically dynamic with relatively high rates of innovation. For countries characterised with dynamic interaction between advanced manufacturing and specialised, high-margin services, offshoring of high-volume, low-margin services or tasks could allow them to retain and refine high-technology and skills-intensive functions in manufacturing. Conversely, restricting trade in tasks may encourage the relocation of the entire manufacturing supply chain to low-cost countries (Robert-Nicoud, 2008).[8]

19.   It should, however, be underscored once again that manufacturing and services activities are complementary and develop in tandem. Sophisticated specialised business services will not emerge unless there is demand for them from the local manufacturing sector (Guerrieri and Meliciani, 2005). Nevertheless, restrictions on services trade and rigid regulation could well render services supply lagging behind potential demand; impeding manufacturers' movement up the value chain or into new markets. This can for instance be a problem in fast-growing newly industrialised countries as they run out of comparative advantage for labour-intensive low-technology products.

20.   In a development perspective the trade impact of growing complexity of public and private standards is of particular interest. Not only must manufactured products pass testing and certification in the importing country, but manufacturing *processes* are also increasingly subject to standards. Particularly in the latter case local inspectors and testing facilities are needed, something that can be a significant constraint in poor countries where technical expertise is scarce. Furthermore, potential exporters need to understand technical regulation in potential markets, which can be a tall order even for state-of-the art manufacturers in developed countries (Bryson *et al.*, 2004). Lack of technical expertise conversant in regulation in major markets may become a source of comparative disadvantage, in its own right. A recent study has found that lack of technical expertise has indeed induced developing countries to specialise in sectors that are less subject to technical regulation (Essaji, 2008). For developing countries facing this constraint, allowing free trade, including commercial presence, in the relevant business services could go a

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[8]   It is well established in economic geography that manufacturing is spread geographically in a similar way as demand for manufactures at very high and at very low trade costs of intermediate inputs, while manufacturing tends to agglomerate in the largest markets at intermediary trade costs. Robert-Nicoud shows that offshoring of routine tasks expands the range of trade costs that sustains agglomeration of manufacturing in high-income countries.

long way in compensating for lack of local expertise in this area.[9] By so doing they could unleash potential manufactured exports.

21.   We have seen that trade liberalisation can help compensate for thin local services markets. In addition the possibility to export services may provide sufficient scale for local services suppliers to go international with a high-volume, low margin business model, which would reduce costs for local customers as well. Finally, modern business services require investment in soft assets such as computer software and human capital. These are more difficult to collateralise than tangible assets such as buildings and machinery, and can therefore face more severe credit constraints in countries with underdeveloped financial markets (Manova, 2008). Thus, the financial sector can play a role for the emergence of a local business services supplier base and there may be a chain of causality from financial development to the establishment of essential services input providers and from there to international competitiveness in manufacturing.

Third, services are important determinants of transaction costs

22.   Services are needed in order to search for a suitable supplier or customer, setting up a contract with him, monitoring that contract; and coordinate activities. And of course services are needed for transport, communication and payments related to the exchange of goods. In this regard services facilitate transactions; at a cost. The more effective and efficient transaction related services are, the lower the transaction costs and the more transactions can be undertaken. The degree of specialisation is thus not only limited by the extent of the market, but also by transaction costs.

23.   Transaction costs are important both in domestic and international business relationships, but are probably higher across international borders than within a country. Furthermore in contrast to what is often claimed in the popular debate, transaction costs still increase substantially with distance. Indeed, recent studies have found that the relative importance of distance for trade has increased over time both for goods and services (Egger, 2008; Nordås, 2008) in spite of the ICT revolution and lower transport costs, at least for air freight and travel.[10] This may sound surprising, but it is not unprecedented in history. The building of major transport networks such as railways and highways contributed to centralisation of manufacturing production in the past. Services can play an important role in overcoming the disadvantage of distance. However, it is important to notice that in order to reduce the disadvantage of remoteness, manufacturers in peripheral countries need to reduce transport and transaction costs *more than* their more centrally located competitors.

24.   A symptom of high transaction costs is the fact that so few manufacturing firms engage in international trade. A host of recent studies have found that only a small share of all manufacturing firms export and those that do are larger and more productive than those who do not. Another symptom of high transaction costs is the fact that so many firms that do export only export to a few foreign markets and among those, large markets are preferred.[11] These empirical findings are consistent with high transaction costs since it takes a large and efficient firm to absorb such costs.

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[9]   Technical regulation is largely a result of consumer demand for safer and more environmentally friendly products in the importing countries and is unlikely to go away even with the strict observance of international disciplines on technical barriers to trade.

[10]   Whether or not sea transport costs have come down over time has been subject to some controversy, but the consensus now seems to be that maritime transport costs have not declined significantly since the 1970s.

[11]   Bernard *et al*. (2007) report that only 4% of all US firms and 18% of manufacturing firms exported in the year 2000. Muûls and Pisu (2007) find that in Belgium, 21% of all firms exported in 1996, declining to 15% in 2004. They explain the decline in the share of exporting firms by market concentration in manufacturing where

25.   Trade in services can again play a role in improving cost effectiveness of transactions-related services such as for instance telecommunications. Box 1 presents a case study.

Box 1. Trade liberalisation in telecommunications and trade in goods: the case of Tunisia

The impact of trade liberalisation in telecommunications depends largely on the market structure in the liberalising country before and after liberalisation. The impact of allowing one foreign provider into the Tunisian market is analysed under two different scenarios: i) the new entrant competes with the incumbent telecoms operator; ii) the new entrant colludes with the incumbent. If the foreign entrant has lower costs than the incumbent and repatriates profits, telecoms output is estimated to increase by 53%, household welfare would increase by about half a percentage point, while total merchandise exports would increase by 7% and imports by 3.3%. If the foreign entrant forms a cartel with the incumbent, in contrast, telecom output would increase by about 8.5% only and if profits are repatriated, there would be no welfare gains for households. Nevertheless, even in this case international trade would increase, although only by about 1%.

Source: Konan and van Aasche (2006). The results are derived from a CGE model for Tunisia.

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26.   To summarise this section, services trade liberalisation can enhance trade in manufactures in three fundamental ways:

- Liberalisation in financial services helps improve entrepreneurs' ability to finance investments in manufacturing sectors in which their country has a potential comparative advantage, particularly in middle-income countries. Labour-intensive industries typically depend on external finance and credit constraints can be a serious impediment to exploiting comparative advantage in relatively labour-abundant countries;

- Liberalisation in services trade can help manufacturers access crucial intermediate services needed for entering new markets and new products. Of particular importance to developing countries are technical, legal, accounting and marketing services.

- Liberalisation in key backbone services such as transport, telecommunication, logistics and supply chain management can help reduce trade-related transaction costs for goods and services. This is particularly important for economically and geographically remote countries that need to reduce transaction costs more than centrally placed countries as there are signs that the disadvantage of remoteness is increasing.

3.   How goods and services are linked in production and trade

27.   Distinguishing between goods and services is not as straight forward as it used to be. Classifying firms into one category or the other can in some cases be difficult as many well-established manufacturers have shifted production towards services. Well-known cases are IBM who has sold its production of personal computers and focussed on computer services and mainframe computers. General Electric has become an important financial services provider and the same goes for major car manufacturers (Cage and Lesher, 2005). Furthermore, goods and services are often complementary in consumption and are sold as a package where sales of a good represent a first step in a long-term customer relationship where the tangible product constitute a vehicle for services delivery.   The most obvious example is mobile telecommunications where the mobile handset is sold for a symbolic price if the customer signs up for a

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most exporting firms are found in combination with new entry of small non-exporting firms in the services sector.

contract on mobile services. Another example is the iPod which is a vehicle for buying music from I-Tunes. Royalties and license fees are also a trade category that is appropriately classified as a service. Payments for use of foreign intellectual property in all sectors are covered, for instance if a local brewery in Norway pays e.g. Carlsberg for producing its branded beer.

Exploring the linkages using input-output analysis: Services are increasingly embodied in manufactured exports

28.   An extensive analysis of backward and forward linkages focusing on the relations and differences between business services and manufacturing was provided in TD/TC/WP(2006)32/FINAL. This study will not repeat the linkages analysis done in the previous paper, but rather build on the insights from it and focus on the linkages between services and manufactures in international trade.

29.   The previous study found that the business services sector in most OECD countries shows significantly stronger forward linkages than the average forward linkage in the manufacturing sector, and the linkages are dispersed among a broad range of downstream industries. In contrast, all of the developing countries studied showed stronger forward linkages in manufacturing as compared to the business services sector, and the linkages were less dispersed among other sectors. Thus it appears that a relatively less developed business services sector is a characteristic of developing countries. It was further suggested that the gains from trade in business services come primarily from access to a broader and more specialized supplier base than the domestic economy can sustain in small OECD and developing countries. In the largest OECD countries, gains from trade in business services were found to stem mainly from lower costs of imported services.

30.   Intermediate services inputs accounted for between 13 and 30% of total industry output, or total costs, in the manufacturing sector in the year 2000 in the countries included in the OECD input-output database, as depicted in Figure 1. Ireland clearly has the most services-intensive manufacturing sector, followed by Sweden, Italy and the United States. At the other end of the spectrum are China, Brazil and Hungary. The top nine countries have experienced an increase in the cost share of services in the manufacturing sector, while South Africa, Hungary and Canada have experienced a significant decline.

31.   There are many possible explanations for changes in the cost share of services in the manufacturing sector. One possibility is outsourcing of services to outside suppliers, in which case outside services suppliers replace in-house value added in the manufacturing firm.[12] In order to investigate this explanation, the services inputs to value added ratio is estimated and the results for the two years compared. The result is depicted in Figure 2. Belgium had the highest ratio in 2000, followed by Ireland, Japan and Italy. The increase in the services share for these economies may thus be partly due to outsourcing. By the same token the decline in the services share of gross output for Canada and South Africa corresponds to a decline in the services ratio to value added, suggesting that in-house services production may have become more important in these countries.

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[12]   In the general equilibrium model developed in the next section, the elasticity of substitution between value added and intermediate services captures the ease at which services or tasks can be outsourced.

Figure 1. Intermediate services share of industry output, total manufacturing, 1995 and 2000
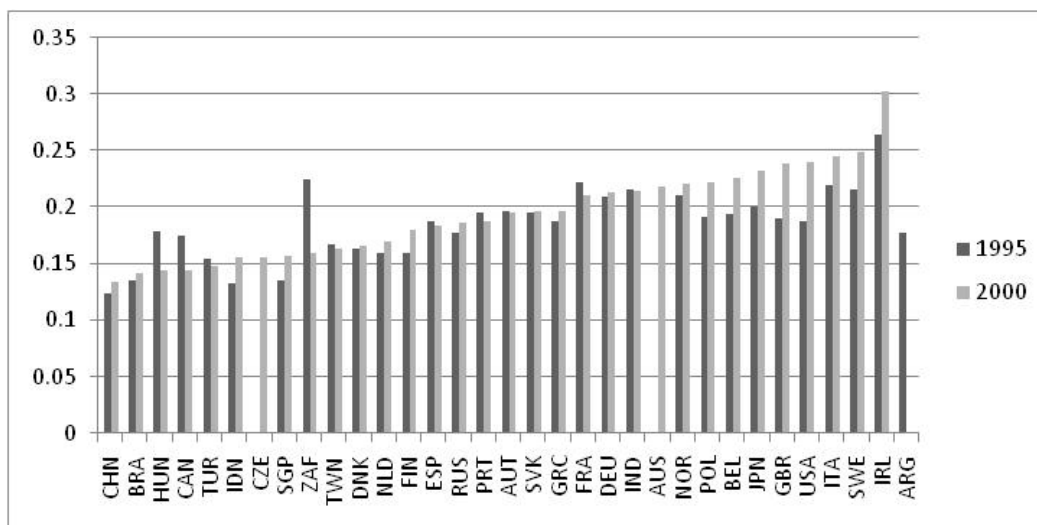
Source: Calculated from the OECD input-output database.

Note: Data for Australia is from 1998/99, Greece and Portugal 1995 and 1999, Hungary and Ireland 1998 and 2000, India 1993/94 and 1998/99, Turkey 1996 and 1998 and South Africa for 1993 and 2000.

Figure 2. Intermediate services to value added ratio, total economy
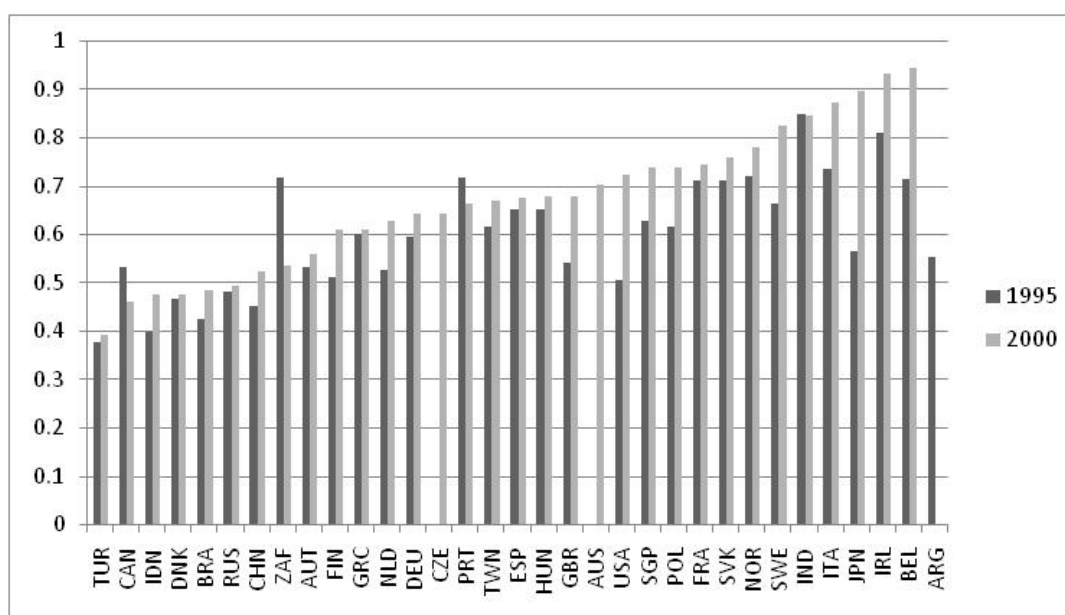
Source: Calculated from the OECD input-output database.

Note: Data for Australia is from 1998/99, Greece and Portugal 1995 and 1999, Hungary and Ireland 1998 and 2000, India 1993/94 and 1998/99, Turkey 1996 and 1998 and South Africa for 1993 and 2000.

32.   A second possible explanation is a change in industrial structure and thus changes in the relative importance of services-intensive industries. In order to assess developments in the services intensity of individual manufacturing sectors, the services to value added ratio was calculated for all manufacturing industries for the two periods. Figure 3 depicts the average value for all OECD countries by sector for the two years, while Figure 4 depicts the median, together with the minimum and maximum for the year 2000.

Figure 3. Average intermediate services/value added ratio by sector, 1995 and 2000
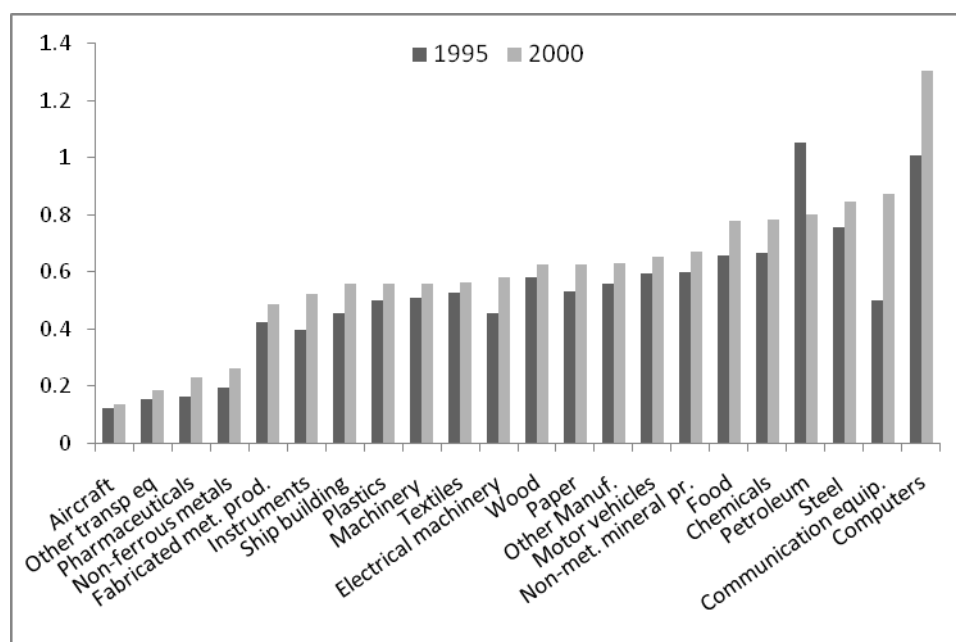
Source: Calculated from the OECD input output database

33.   It is noticed that the average services intensity of all manufacturing sectors, except petroleum refining, has increased during this 5-year period. On average the most services-intensive manufacturing industry in 2000 was computers and office machinery, followed by communication equipment and perhaps surprisingly, steel, chemicals and food. The relatively high service intensity in food and chemicals could, however, reflect the fact that these two sectors are among the sectors most subject to technical regulation and product differentiation. As discussed in the previous section, regulation and product differentiation is a source of business services demand.

34.   The average only tells part of the story, however. Figure 4 shows the variation in services inputs to value added in the year 2000 for each sector. The by far largest variation is found in the computer industry where the services/value added ratio ranks from 0.12 in China to 9.15 in Finland (see note to Figure 4). Other sectors characterised by large differences in services intensity among countries are petroleum refining and communication equipment. Finally it is noted that the distribution is skewed towards a long tail on the high services intensity side. Thus, higher services content in manufacturing in a country can stem from i) a general increase in services intensity across sectors, ii) a shift to more services-intensive sectors or iii) more services-intensive products within a sector.

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Figure 4. Variation in the services/value added ratio by industry, 2000
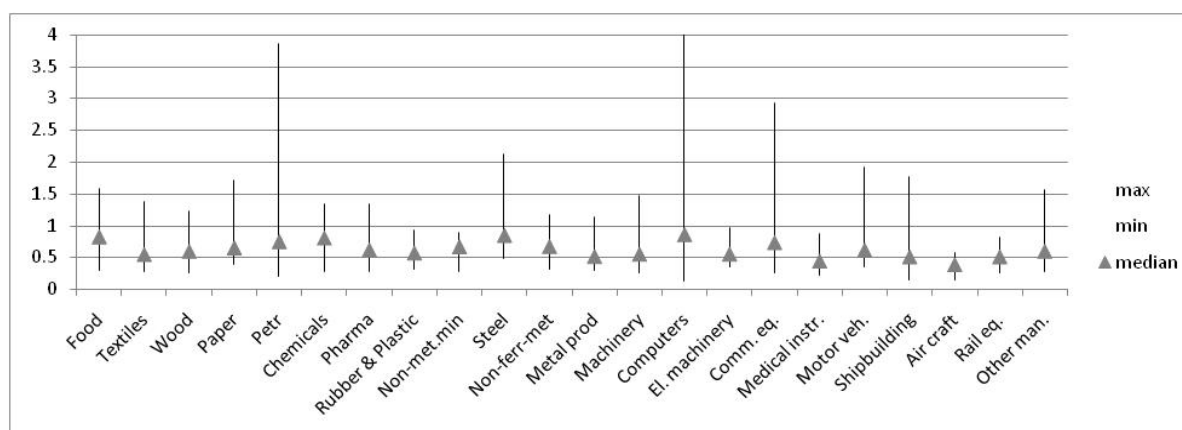
Source: Calculated from OECD input-output database.

Note: The vertical axis is cut off at 4 in order to visualise the variation in other sectors than computers, which exhibit a maximum of more than 9.

35.   A fourth possible source of increasing services intensity in manufacturing is a change in relative prices, e.g. due to lower unit prices of material inputs. The change in the intermediate services price index relative to the intermediate materials price index was calculated from the EU KLEMS database for Germany, Japan, Sweden and the US from 2000 to 2005 and presented in Table 1.

Table 1. Intermediate service price index/material inputs price index 2000 = 1, selected countries

Country	2000	2001	2002	2003	2004	2005
Germany	1	1.012	1.062	1.094	1.091	1.075
Japan	1	0.997	1.010	1.007	0.988	1.033
Sweden	1	1.021	1.056	1.071	1.061	1.046
United States	1	1.018	1.035	1.026	1.002	0.992

Note: Calculated from the EU KLEMS database. The database contains information on value of intermediate goods and services and a volume index, which is used to calculate implicit deflators separately for intermediate goods and services.

36.   From this table it is clear that an increase in the relative price of services inputs has indeed occurred in Germany and Sweden, but in the United States and Japan, relative prices of intermediate goods and services have been rather stable over the period in question. The result thus calls into doubt that the rise in services relative to other sectors is mainly due to rising relative prices as famously argued by Baumol (1967; 2001).

37.   Another measure of the interaction between manufacturing and services in international trade is the services content of manufactured exports. Domestic services value added embodied in manufacturing

exports was calculated as a share of export value for all countries for which data are available in the OECD input-output database. The result is depicted in Figure 5.[13]

Figure 5. Domestic services value added embodied in manufacturing exports, 1995 and 2000
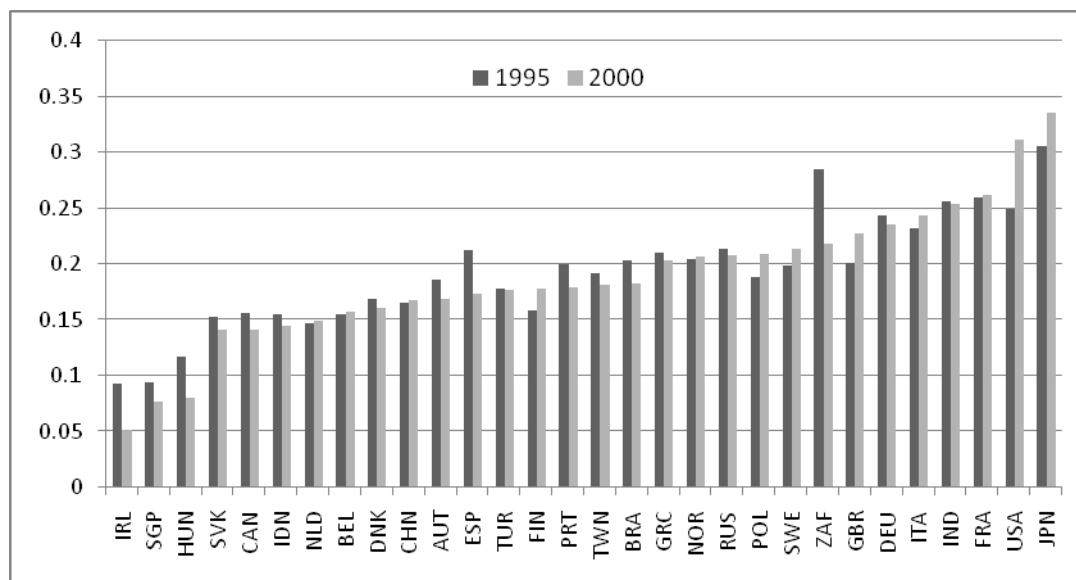
Source: Calculated by author from OECD input-output database.

38.   Japan and USA clearly had the largest domestic services value added embodied in their manufacturing exports, and for these countries the share increased substantially from 1995 to 2000. An in-depth study of the services content of Japanese exports found that the most significant and fastest growing services embodied in exports were R&D services, while embodied financial services were found to be on the decline (Kiyota, 2001).   However, in a number of countries the domestic services value added embodied in manufacturing exports has actually declined over the 5-year period analysed. This may seem surprising, and a possible explanation is that some domestic services value added has been replaced by imports.

39.   Figure 6 plots the domestic services value added embodied in manufacturing against the import share of total services inputs in manufacturing. There is a strong negative correlation between the two variables (shown by the trend line), supporting this hypothesis, and suggesting that imports of services can both complement and substitute for local services. This is particularly noticeable in small, dynamic economies such as Ireland and Singapore where domestic services value added embodied in manufacturing exports constitute a small share of export value, and the share has, moreover dropped significantly from 1995 to 2000. A closer look at changes in industrial structure in these two countries finds that there has been a shift towards more services-intensive industries such as electrical machinery and pharmaceuticals, the latter being the most services-intensive manufacturing industry in Singapore.

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[13]   The domestic services value added share of manufacturing exports is calculated as follows:

$$\mu_s \left[I - A \right]^{-1} X_m / \sum x_m$$

where μ is a row vector where the elements are the value added share of gross output if the sector is a services sector and zero otherwise. The term in square bracket is the inverted input-output matrix and X_m is a column vector where the elements are total exports if the sector is a manufacturing sector, and zero otherwise. The final term divides with total manufacturing exports.

However, for most other countries imported services account for less than 15% of total intermediate services inputs and for more than half of the countries the share is less than 10%.

Figure 6. Domestic services value added embodied in manufacturing exports versus import share of services inputs in manufacturing
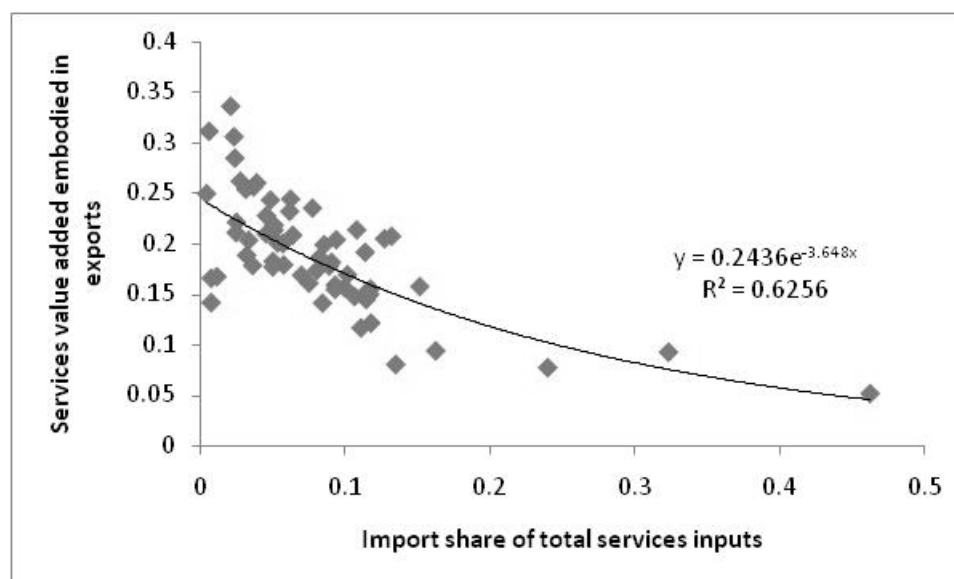
Note: The chart plots the domestic services value added embodied in manufacturing exports as depicted in Figure 5 against the import share of intermediate services in manufacturing for 1995 and 2000. The inserted trend-line is exponential, which is the functional form that gave the best fit.

Business services help manufacturers move up the value chain

Econometric analysis

40.   Turning to the relation between services inputs and the variation in value added within manufacturing sectors, a measure, although not perfect, of the value added in a sector is the value-to-weight ratio of a product. Raw materials tend to have a low value-to-weight ratio, while high-technology products such as semiconductors and pharmaceuticals have a high value-to-weight ratio. This ratio is estimated using Eurostat data on import value and import quantities in kilograms. The result for office machinery (SITC sector 75) and electrical machinery (SITC sector 77) are depicted in Figure 7, where the vertical axis represents the log of export value per 100 kg exported to the EU and the horizontal axis depicts the share of business services in total costs in the sector in question. A trend-line shows a statistically significant upward sloping relation between the two variables.

Figure 7. Value to weight ratio of exports and business services share in total costs
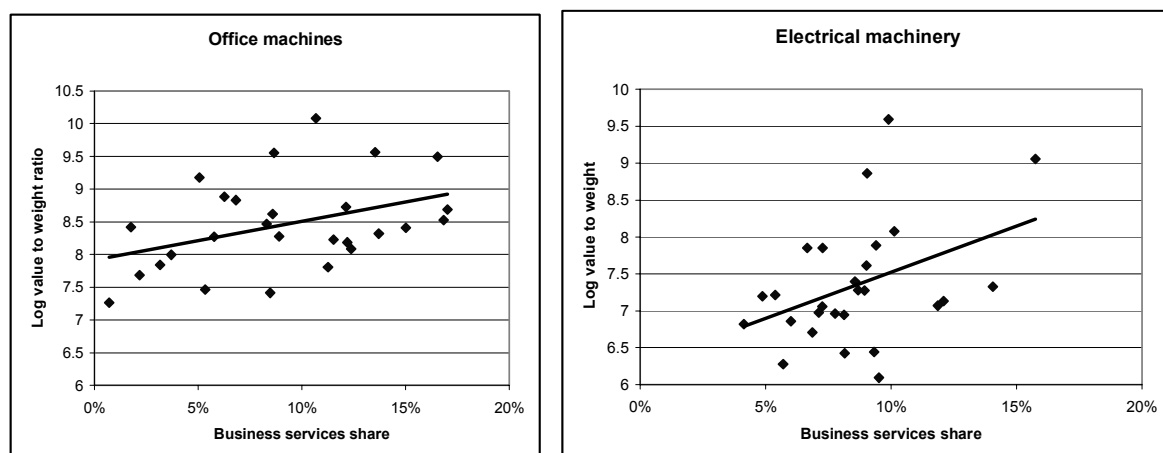
Source: Estimated by author based on the OECD input-output database and Eurostat.

41.   The positive correlation between value to weight obtained in export markets and the business services content of the product for both office machines and electrical machinery suggest that larger business services content is associated with a higher rung on the quality ladder. It is obvious that electrical machinery is heavier than office machinery and that the trend-lines therefore intercept the vertical axis at different points in the two sectors. In order to further explore the relation between business services content and export value, the value-to-weight ratio obtained in the EU market is regressed on services share of total input.[14] The estimates take into account that sectors are inherently different concerning value to weight and thus focus on the differences between countries *within* sectors. It is found that the share of business services in total costs is strongly and positively related to the value to weight ratio obtained in export markets (using the European Union as the representative OECD market). Thus, a one percentage point higher business services share of total costs is found to be associated with about 5% higher value to weigh ratio. The same regression was also run for the cost share of total services, but here no statistically significant relation to the value to weight ratio was found.

42.   Correlation does not imply causality and it is not argued that an increased services share *causes* an increase in the value to weight ratio. The results rather suggest that a high value to weight ratio goes together with a high services share. A reasonable interpretation, as also argued in Section 2, is that business services are needed to raise value added within a manufacturing sector. By the same token, a shallow services sector appears to be a constraint on moving up the value chain in manufacturing. Conversely, demand for business services from the manufacturing sector creates market opportunities for business services firms.

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[14]   The regression equation is the following: $\ln(value_i / weight_i) = a_i + a_1 \ln(1 + BS_i / GO_i) + \mu_i$ BS represents business services and GO gross output while subscript i indicates sector. a_1 was estimated at 4.7 with standard error 1.5, which implies statistical significance at a 1% level. The number of observations were 305 and the adjusted R2 = 0.77. The regression is run using sector fixed effects, which implies that the intercept is allowed to differ among sectors.

Restrictions on FDI in backbone services impede manufactured exports

43.   Since services related to physical and economic infrastructure (backbone services) are important for the level of transaction costs facing manufacturing firms, it is natural to ask to what extent restrictions on trade and investment in these services sectors affect manufacturing exports. In order to investigate this question the export share of total output in manufacturing was correlated with measures of trade restrictions in services, weighted by the share of the service in question in total manufacturing costs. The measures of trade restrictiveness included in the analysis are the OECD Product Market Regulation index (PMR) and the FDI restrictiveness index developed by Golub (2003).[15] The results show that only the latter index was statistically significantly correlated with trade performance. An increase in the FDI restrictiveness index by one standard deviation from the mean for business services is related to a 5% lower export share of gross output in manufacturing on average. Raising the FDI restrictiveness by one standard deviation in financial services and maritime transport from the mean is correlated with a 3% reduction in the export share of gross output in manufacturing in both cases. Liberalising foreign market access in these backbone services thus appears to enhance exports in manufacturing. The results appear in columns 1-3 in Annex Table A1.

44.   A study of the Czech Republic investigated the interrelationship between liberalisation and reforms in key services sectors on the performance of manufacturing sectors, analysing firm-level data (Arnold *et al*., 2006).   They found that there is a positive correlation between performance of manufacturing firms and the overall progress of policy reform (as measured by the European Bank of Reconstruction and Development in its Transition Report), and the presence of foreign services providers. The study did, however, not find a significant correlation between manufacturing performance and measures of competitiveness in the services sectors. Thus, their study confirms that allowing foreign investment in backbone services is important for manufacturing competitiveness in countries where the local services industry may be weak.

45.   As discussed in the introduction, trade driven by vertical specialisation is particularly sensitive to the cost and quality of logistics and other transaction-related services. A measure, albeit imperfect, of such trade is the share of intra-industry trade in total trade.   The intra-industry trade index for each manufacturing industry included in our sample was calculated and correlated with the PMR and FDI restrictiveness indices in the same way as for export orientation. Only the FDI restrictiveness indicator for business services and maritime transport proved to be statistically significantly correlated with the intra-industry trade index.

46.   As expected, it appears that services play a more important role for intra-industry trade than for exports in general. A one standard deviation increase in the FDI restrictiveness index in business services is associated with a 13% lower intra-industry trade index, while the corresponding relationship between maritime transport FDI restrictiveness and intra-industry trade is a 6% lower index. The results are presented in columns 4 and 5 in Annex Table A1. Other services that were investigated for a possible correlation with the trade performance indicators for goods were telecommunications, construction, air transport road transport and electricity. None of these were statistically significantly correlated with trade performance in the selected manufacturing sectors.

47.   Finally since services are important inputs in the manufacturing process one would expect that services offshoring could improve productivity in manufacturing. Presumably manufacturers would offshore services only when it contributes to higher profits, which implies that offshoring could either lower costs, improve productivity, or both. In order to investigate this possibility, output per worker was

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[15]   See Conway *et al*. (2005) for a description of the PMR indicators.

regressed on imported services inputs as a share of total output value.[16] The results suggest that there is a statistically and economically significant relationship between labour productivity and offshoring of services.[17] Office, accounting and computing machinery is one of the sectors in which offshoring has played a major role in a number of OECD countries. The mean share of imported services in total cost in this sector is 3%, but ranges from 0 to 38%. The regression results imply that in this sector an increase of one percentage point from the mean would increase labour productivity by about 3%. The results are presented in Annex Table 2.

48.   To summarise this section:

- Intermediate services account for between 13 and 30% of total manufacturing costs.

- The share has increased over time in the aggregate, but there is large variation between countries within sectors and within sectors between countries.

- The most likely explanation for an increase in the services share is a general increase in services intensity in all manufacturing sectors, combined with a shift in production towards more services intensive industries and products within industries.

- A higher services share in total costs is associated with higher quality of the manufactured product.

- Foreign investment restrictions in business services, financial services and maritime transport are negatively associated with manufactured exports, suggesting that restricting foreign entry in services impedes the competitiveness of local manufacturers.

- Services offshoring is associated with higher manufacturing productivity and thus improved competitiveness.

4.   Capturing the linkages between manufacturing and services through general equilibrium simulations

How a general equilibrium model can help us understand the impact of services trade liberalisation on trade in goods

49.   A good understanding of the direct and indirect linkages between goods and services in production and trade is necessary for analysing how trade in manufacturing would respond to trade liberalisation in services. Sections 1 to 3 provide such insights. A desirable next step would be to quantify the tariff equivalent services trade barriers, plug these estimates into a model that captures the linkages between goods and services and study how a reduction or elimination of services trade costs would affect trade in manufacturers. Unfortunately, models that capture these linkages hardly exist, and neither do estimates of the barriers to trade in services. Future OECD work aims at filling this gap, but for the time being it is not possible to estimate the impact of services trade liberalisation based on information on current restrictions, post-liberalisation restrictions and precise knowledge on services' contribution to trade costs in manufacturing.

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[16]   As demonstrated in the previous section, there is a large variation among sectors as far as services offshoring is concerned. We therefore controlled for sector fixed effects and also a time trend.

[17]   The lower the demand for labour per unit of output the higher is labour productivity.

50.   Therefore, the approach proposed here is to construct a general equilibrium model that captures the linkages between manufacturing and services from the input-output analysis presented in Section 3. In addition the model captures the gains from expanding services variety through trade. It has been emphasised throughout the study that this could be the most important source of gains from services trade liberalisation. Moreover it is probably the channel through which the impact on trade in manufactures is the most distinct. Unfortunately, this is the channel that computable general equilibrium (CGE) modellers have the biggest difficulties in capturing. In contrast, there is a well-established literature that offers theoretical models that capture the role of services in production and trade as discussed in Sections 1 and 2 of this study. The predictions of these models have been analysed empirically and the main findings have been supported by the data.

51.   This being the case the proposed methodology is to develop a numerical general equilibrium model based on well-established theoretical models. The workings of a general equilibrium model are explained in Box 2, while the models are fully documented in Technical Annex 2. What is important to notice here is that a general equilibrium model captures structural features of an economy very well, while its scale is not important for the results. Therefore, a general equilibrium model of a "model economy" can do a good job in predicting the direction and order of magnitude of likely changes in response to changes in broad policy variable such as overall trade liberalisation. Furthermore, and importantly, it can identify unexpected effects that follow logically from structural features of the economy, but are difficult to pick up from qualitative or econometric analysis. A general equilibrium model is, however, not suited for analysing the impact of changes in detailed regulation. It should also be noted up-front that the model simulations do not offer *forecasts* of the impact of services trade liberalisation for any specific economy or the world economy. It merely offers internally coherent scenarios of the mechanisms set in motion by services trade liberalisation in a typical high-income OECD country.[18] Services trade costs are entered exogenously and services trade liberalisation is modelled as a gradual elimination of these costs.

Box 2. What is a general equilibrium model?

A general equilibrium model balances supply and demand in all markets simultaneously.

What is entered by the modeller:
- Endowments of primary factors of production (e.g. labour and capital);

- Production technology for each sector;

- Demand patterns from each final expenditure category;

- Tax rates, tariff rates and other variables that create a wedge between prices and costs;

- Rules on how tax revenues are spent.

What the model does:
- Allocates the pre-determined primary factors of production to sectors such that:

  – Supply equals demand for each primary factor

  – The marginal return to each factor of production is the same in all sectors. This means that in equilibrium, the last dollar of capital or the last man-hour will earn the same return independently of in which sector it is employed.

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[18]   The share parameters in production and expenditure are presented in the technical annex. It turns out that these are quite similar for high-income OECD countries.

- Allocates output to final demand categories such that output in each sector is equal to total demand for its product.

- Calculates government revenue and its allocation. When government expenditure is not the focus of the analysis, it is typically assumed that government revenue is given back to consumers as a lump sum. What is of interest is the effect that taxes have on relative prices.

Some key features

- The key to balancing all markets at the same time is prices. Supply is an increasing function of prices, while demand is a falling function of prices. All prices are set simultaneously in order to balance supply and demand.

- The model determines relative prices only. The modeller therefore chooses a numeraire (often the wage rate of unskilled labour) and all other prices are determined relative to this numeraire.

- Because what matters in a general equilibrium model are relative prices and quantities, the modeller can choose the scale of the model. This is convenient because the modeller can work with expenditure shares in the expenditure function (i.e. the share of total income spent on each product category) and factor shares in production (i.e. labour, capital, material inputs and services inputs share of total production costs).

Key parameters are elasticities of substitution. These determine how factor demand and demand for goods and services respond to changes in relative prices and thus how much of an economic impact a change in e.g. trade policies will have.

52. Two versions of a general equilibrium model are developed in order to focus sharply on the channels through which services support trade in goods discussed in Section 2. The first version analyses the role of services in shaping comparative advantage in manufacturing. The second version focuses on the interaction between outsourcing of intermediate inputs – what has been coined vertical specialisation; and offshoring of services.

53. The models are used for simulating the impact of reducing services trade costs under different assumptions about the trading partners. In the first scenario, the two countries are symmetrical in all respects. The only source of gains from trade in this case stem from deeper division of labour. This is a benchmark scenario, while all the other scenarios introduces asymmetries between the two trading partners and simulate how various sources of differences between countries play out in changing patterns of trade and production as services trade costs come down. The scenarios run are the following:

- The home country is 20% larger than the foreign country (i.e. its endowment of primary factors of production is 20% larger);

- The home country is 20% more efficient in producing intermediate services (e.g. it needs 20% less primary inputs per unit of intermediate services produced),

- The home country is 20% more efficient in using intermediate services. This captures superior organisational technology such as better supply chain management and better ways of organising production. A given bundle of intermediate services contributes 20% more to the production of final goods in the home than in the foreign country in this scenario.

- The home country has 20% lower barriers to enter the intermediate services sector. A firm must incur various costs in order to set up production of a service. The firm must for instance invest in

innovation in order to develop its niche product, and it must comply with regulation both in its home market and in the foreign market.[19]

54.   All four scenarios are presented for the first model, while for the second model only the first scenario is presented, since this model is not concerned with comparative advantage in final output sectors. Tables 2 and 3 present the results in terms of percentage changes from very high pre-liberalisation services trade costs to free trade in services.[20]   Since natural barriers to trade in intermediate services can be significant (e.g. differences in language, culture, the business environment and the fact that face-to-face interactions are necessary to various extents), a realistic assumption is that trade liberalisation will reduce, but not eliminate trade costs.[21]   Therefore the development path from prohibitive trade costs to zero trade costs is interesting as well. The results are sensitive to assumptions about elasticities, but the qualitative results are robust to the full range of elasticities found in the literature.[22]

55.   An interesting result from all the scenarios is that the gains from liberalisation are not linear. There are for instance much smaller gains from reducing trade costs from 300 to 200% than from 30 to 20%.   In all of the scenarios run with the first model, the gains from going the last mile of trade liberalisation, reducing trade costs from 20% to zero account for between a third and half of the total gains in productivity and GDP per capita.   This would for instance imply that the European Union's services directive could have a significantly larger impact on intra-EU trade in goods and services than services trade liberalisation undertaken hitherto.   In contrast developing countries that are cautious of possible adverse effects of committing to services trade liberalisation in the GATS or regional agreements need not worry as it appears that the impact would not be large, adverse or otherwise, unless the commitments are relatively radical.   Bearing in mind the many natural barriers to trade in services, getting trade costs much below 15% -10% may not be realistic unless liberalisation also aims at harmonising regulation.

Services trade liberalisation and services as a source of comparative advantage

56.   The first model analyses the impact of services trade liberalisation on comparative advantage in manufacturing and services.   In order to focus sharply on this issue, the relative input shares of capital, labour and materials are kept constant, while the focus is on changes in the relative importance of services in production.   For the sake of realism a non-tradable final services sector (e.g. government services and personal services) accounting for about 50% of domestic expenditure is introduced into the model.

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[19]   See Kox and Nordås (2007) for further discussion on regulatory heterogeneity and barriers to market entry and trade in services.

[20]   The simulations start with iceberg trade costs of 4 (i.e. the import prices is four times higher than the price received by the exporter, or equivalently the exporter must ship four times more services than what eventually arrives at the manufacturing plant of the customer. The services supplier could for instance spend four times as much time and resources on travel and complying with regulation than with the customer). Trade costs are reduced stepwise, by 0.1 for each step until they are eliminated.

[21]   An interesting approach to measuring tradability of services is to analyse its geographical concentration within a large country. If there is a commercial presence of this service in most locations where it is demanded, and thus the service is not traded over long distances domestically, it can probably not be traded easily across national borders either. Jensen and Kletzer (2005) performed such a study for the United States and found that the following services sectors were the most tradable: within NAICS code 51: Other information services, motion pictures and video industries, sound recording industries, software publishing; within NAICS code 52: Securities, commodities, funds, trusts and other financial investments; within NAICS code 54: Scientific research and development services; within NAICS codes 53, 55, 56, 61, 62, 71,72: no sectors

[22]   The higher the elasticity of substitution between individual intermediate services, the more similar are the services to each other and the less are the gains from expanding variety of services.

A benchmark scenario: Symmetry; the trading partners are equal in all respects

57.   In this scenario two identical countries agree to liberalise services trade between them. Initially the services trade costs are so high that imported services are about four times more expensive than locally produced services, and intermediate services are traded only to a limited extent. From this level, services trade costs are gradually eliminated and intermediate services become tradable. As shown in Table 2 below, both countries will gain.   Real GDP per capita would increase by about 5% from the pre-liberalisation scenario to the fully liberalised scenario, and by about 3% if trade costs were brought down to 20% only. The structural changes and mechanisms at work are the following:

- Intermediate services providers in both countries get access to the trading partner's market and start exporting;

- Downstream manufacturers get access to the services supplier base in both countries. Thus, the variety of intermediate services in each country more than doubles (compared to no trade in services) as in addition to market integration, both countries devote more resources to intermediate services production.

- Productivity in manufacturing and production of non-traded final services increases;

- Since the two countries are assumed to have the same technology, the same factor endowments and the same consumer preferences, services trade liberalisation has no effect on trade in manufactures in this scenario.

In conclusion the model exhibits the well-known property that even identical countries can gain from trade due to deepening specialisation.

Home country is 20% larger

58.   In this scenario the two countries are similar in all respects except that the home country is 20% larger than its trading partner (i.e. it has 20% larger endowments of primary factors of production). Having a larger market allows for deeper specialisation and as a result the home country has a broader variety of intermediate services before services trade liberalisation. Consequently, it also has a comparative advantage in the manufacturing sector that uses services the most intensively. However, services trade liberalisation erodes comparative advantage in services-intensive industries and shifts exports away from services-intensive final goods to intermediate services in the large country. The reason is that manufacturers in the partner country get access to the same services supplier base as the home country, and the services supplier base no longer constitutes a source of comparative advantage for manufacturers. What happens during trade liberalisation is that manufacturers in the smaller trading partner experience a large increase in the services supplier base and as a result they catch up with the home country in terms of productivity in services-intensive manufacturing. Their manufacturing exports start to expand, while the home country shifts its exports towards services. The large country becomes more dependent on imports for its final consumption, while the smaller country becomes more self-sufficient in final goods as it imports more intermediate services directly instead of importing them embodied in services-intensive goods

59.   From Table 2 it can also be observed that GDP per capita increases more in the small country. The reason is simply that as trade opens up, the diversity of intermediate inputs increases more in the small country who now can source from the broader services supplier base in the larger country. In sum trade liberalisation induces the following structural changes:

- In the larger home country comparative advantage shifts from services-intensive manufacturing towards services;

- In the smaller trading partner, productivity in manufacturing catches up with the larger trading partner; manufacturers' competitiveness improves and exports of manufactured goods increase.

- GDP per capita increases in both countries, but more in the smaller country.

In conclusion the gains from services trade liberalisation are largest for the *net importer* of services. Thus, for smaller and poorer countries, services trade liberalisation helps improve competitiveness in manufacturing and could trigger a significant boost to manufacturing exports. Again it should be noted that full elimination of services trade costs may not be realistic.

The home country uses intermediate services more effectively

60.   In this scenario the two countries are similar in all respects except that the home country has a better technology for utilising intermediate services or tasks. This could for instance be due to superior organisational technology including better supply chain management. The two countries are equally efficient in producing intermediate services/tasks, however. This is perhaps the most interesting scenario since to our knowledge this scenario has not been analysed in the literature before. We do, however, think it is empirically relevant. Japanese manufacturers, for instance, have since long been admired for their efficient ways of organising production. The results are therefore presented in some more detail as depicted in Figure 8.

Figure 8. Simulation results, home country is more efficient in using intermediate inputs
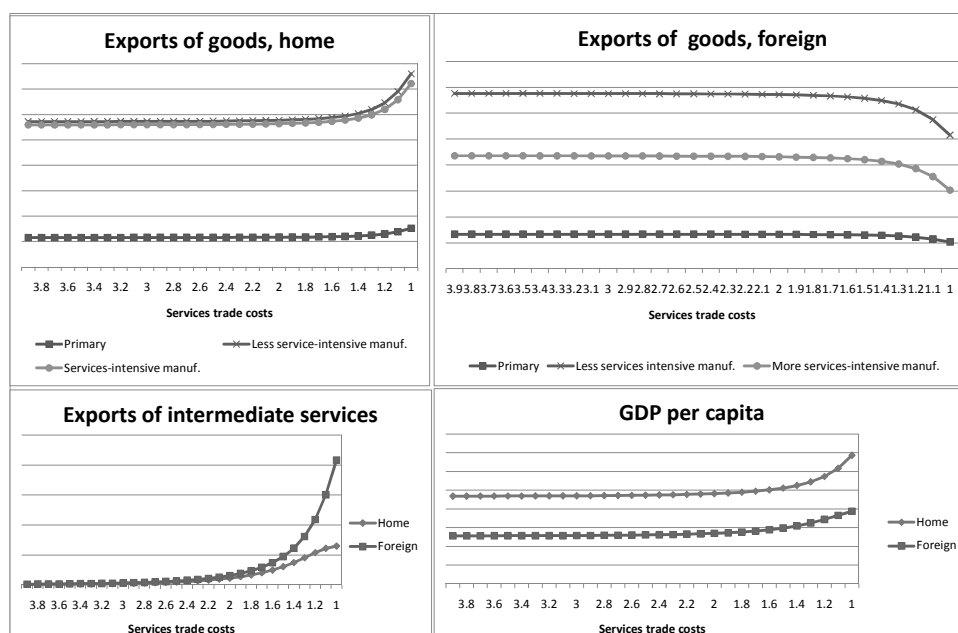
61.   Services trade costs (iceberg) are depicted on the horizontal axis and declines from left to right in the charts. The first thing to notice, which is common for all the scenarios, is the non-linearity of adjustments as discussed above.

62.   The home country's comparative advantage in the services-intensive manufacturing sector is best reflected in its imports (i.e. the foreign country's exports). Import penetration is lower in this sector and the foreign country hence exports less of high-technology, services-intensive manufactures. The reason why the home country does not export more of these manufactures in absolute terms is that expenditure on the output of the services-intensive manufacturing sector is lower than for the less services intensive goods. The expenditure shares are calculated from the input-output tables and are similar in high-income OECD countries. The charts show that services trade liberalisation strengthens the home country's comparative advantage in services-intensive industries, and indeed in all manufacturing sectors.

63.   Since the home country is significantly better at utilising intermediate services, but no better at producing them, its resources are shifted towards the final goods sectors, while the foreign country specialises in intermediate services production following services trade liberalisation. In this case, services trade liberalisation results in a large increase in trade both in goods and services. The home country would specialise in manufacturing and offshore most tradable tasks to its trading partner while retaining a somewhat "hollowed out" but competitive manufacturing sector.[23] This is the only scenario where the welfare gains from services trade liberalisation are higher in the more efficient country.

The home country is more efficient in producing intermediate services

64.   In this scenario the home country has better production technology in the intermediate services sector, modelled as a 20% lower unit labour requirement in the intermediate services sector, while the countries are equal in all other respects. In a similar manner as the scenario where the home country is larger, the home country has a comparative advantage for the most services-intensive good. This time the comparative advantage stems from both a broader variety of services and lower prices for each individual service.[24] With declining trade costs and thus convergence of the price index for intermediate services, this comparative advantage is eroded and the home country turns to exporting services directly rather than embodied in final goods. The foreign country in contrast shifts resources away from its relatively inefficient intermediate services sector towards final goods production and exports. There is a substantial gain in GDP per capita in the foreign country since the price index of intermediate services declines both due to broader variety and due to a lower average price of individual services.

65.   This is probably the most relevant scenario for middle-income countries engaging in services trade liberalisation with high-income OECD countries. Services trade liberalisation would for sure reduce employment and output in intermediate services production in the less efficient producer as local producers would be substituted for more efficient imported services. However, this would allow them to catch up in manufacturing and trigger a sharp increase in manufacturing production and exports. GDP per capita would also increase more in the middle income country than its OECD trading partner, although both would gain.

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23   "Hollowing out" manufacturing has been used to describe the process of outsourcing production of parts, components and services to external firms, leaving fewer operations being performed inside the manufacturing firms.

24   The home country has a broader variety even though it has the same primary factor endowments because it can produce more services with the same factor inputs.

The home country has lower entry costs in the intermediate services sector

66.   Lower entry costs in the intermediate services sector can stem from lower cost of innovation e.g. due to better education, R&D support schemes or it can be due to lower regulatory barriers to entry. Again the home country will have a comparative advantage in services-intensive goods when trade in intermediate services is restricted. The direction of changes following services trade liberalisation is similar to the one where the home country was larger than its trading partner. The scenario is relevant for two countries with different regulatory restrictiveness indices entering a services trade liberalisation agreement. In fact manufacturers in the less liberal countries would to some extent benefit from the more liberal regulatory regime in its trading partner, through accessing its lower cost intermediate services inputs.

Table 2. Simulation results, interaction between trade in intermediate services and final goods

Percent change in key variables following a reduction in services trade costs

	Symmetry	Large		Efficient use		Efficient production		Lower entry barriers	
		Large	*Small*	*Efficient*	*Inefficient*	*Efficient*	*Inefficient*	*Lower*	*Higher*
GDP per capita	5.1	4.1	6.3	5.9	3.8	2.0	5.5	6.0	6.0
Employment share in services	9.4	19.7	-3.7	-34.1	62.8	70.0	-76.0	34.8	-18.2
Change in services variety	118	97	145	106	139	88	112	100	149
Export value									
Primary	0.0	-6.3	6.9	30.8	-22.6	-57.3	49.3	-17.8	15.3
Manuf. 1	0.0	-6.2	6.8	32.9	-23.8	-56.8	8.0	-17.5	15.0
Manuf. 2	0.0	-10.8	13.3	29.0	-30.3	-54.5	62.3	-17.5	16.4
Import penetration									
Primary	0.0	7.3	-6.4	-23.6	26.4	41.2	-42.3	16.2	-16.3
Manuf. 1	0.0	7.2	-6.3	-24.8	28.4	39.9	-41.7	15.9	-16.0
Manuf. 2	0.0	13.7	-10.9	-31.2	24.7	45.0	-35.1	17.4	-16.0

Note: Change in services variety represents the percentage change in number of services varieties available in each country from no trade in intermediate services to full integration of services markets.

Model version 2, interactions between intermediate goods and services

67.   This version of the model focuses on the interaction of trade in intermediate goods and services, or the interaction between outsourcing of production of parts and components and offshoring of services, which is called trade in tasks in recent literature. In order to do so, two primary factors of production, labour and capital are introduced, the latter could include both physical and human capital.[25] As usual when the focus is on one aspect, other aspects are simplified, and final goods are not traded in this model. A justification for such a simplification is that very few, if any goods or services are sourced directly from the foreign supplier without any local inputs added before they reach their final customer. Local importers will usually add some value through packaging, transport, testing, marketing, etc. Since the local value

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[25]   When the number of traded sectors and the number of factors of production is the same in a model, trade and production patterns are unambiguously determined, which is the main reason why an additional factor of production was introduced.

added can be infinitely small, the model need not be unrealistic at all. The details are provided in Technical Annex 2.

Table 3. Simulation results, interaction between intermediate goods and services

Percent change in key variables following a reduction in services trade costs

		Large	
	Symmetry	*Large*	*Small*
GDP per capita	9.3	8.0	10.8
Labour share in GDP	-0.1	0.0	-0.3
Cost share of services	6.7	5.8	7.8
Cost share of goods	-2.3	-2.1	-2.7
Exports of goods	-2.2	-0.3	-4.7
Goods variety	-2.6	-2.6	
Services variety	112.7	91.2	139.2

68.   Services trade liberalisation in this model results in:

- a large increase in services variety in both countries (compared to no trade in services);

- resources are shifted from production of intermediate goods and final goods and services towards intermediate services, and the cost share of services in manufacturing increases;

- the economy uses material inputs more effectively and overall productivity increases, as reflected in a higher GDP per capita;

- income distribution between labour and capital is not much affected;

- the impact of services trade liberalisation is largest in the smaller country.

The small country result is simply explained by the fact that market integration would open a larger market for both exports and sourcing of imports for a small country. This is consistent with the well-established result that small countries are more open than large countries when openness is measured as total trade over GDP.

69.   To summarise this section it has been demonstrated that:

- services trade liberalisation can potentially result in relatively large structural changes, but the largest impact occurs when services trade costs are reduced from a relatively low level to zero;

- when manufacturing technologies vary between sectors within countries, but not between countries within sectors, then services trade liberalisation would result in a shift in comparative advantage from services-intensive manufacturing to services in large countries, lightly regulated countries and countries with a more efficient intermediate services sector, while smaller, more heavily regulated and less efficient services producing countries would become net exporters of manufacturers and net importers of services. All countries would gain from services trade liberalisation, but the net services importers would gain the most;

- countries that are more efficient in organising manufacturing would strengthen their comparative advantage in manufacturing following services trade liberalisation;

- intermediate services would substitute for material inputs, contributing to further "dematerialisation" of output and less waste, and thus a more environmentally sustainable production structure.

5. Policy implications

70. This paper has analysed the interrelationships between services trade liberalisation and trade in manufactured goods. The major findings are that services on average account for between 13 and 30% of total costs in OECD manufacturing industries, but the variation between industries is large, giving rise to comparative advantage based on the depth and sophistication of the intermediate services sector. Services are found to support trade in manufacturing through providing knowledge about foreign consumer tastes, regulatory environments, access to foreign distribution channels and establishing and monitoring contracts with foreign suppliers or customers. Demand for supporting services grows with the complexity of manufacturing technology, the degree and complexity of product market regulation and the proliferation of private product standards and not least private process standards.

71. Services trade liberalisation affects trade in manufactured goods through three channels. First, services trade liberalisation may change comparative advantage in manufacturing industries. Comparative advantage in manufacturing would be strengthened in countries where manufacturers have more efficient ways of organising production. A country with superior organisational technology will thus experience offshoring of intermediate services and a revival of manufacturing, albeit somewhat "hollowed out", following falling trade costs in intermediate services.

72. In countries where comparative advantage for services-intensive manufacturing is based on a strong services supplier base only, however, comparative advantage would shift towards services. In these countries substantial services trade liberalisation would induce a shift from exporting services embodied in services-intensive manufactured products to exporting stand-alone services to manufacturing firms abroad; of which some would re-enter the home market embodied in imported manufactured products.

73. Developing countries would be better able to exploit comparative advantage in labour-intensive manufacturing following services trade liberalisation as exports of these goods require a host of supporting services inputs, including marketing and technical testing. The need for supporting services inputs has increased over time, a trend that is likely to continue with rapidly changing consumer tastes and growing consumer awareness of health, safety and social standards. Developing countries therefore need to pay much more attention to the services markets in order to support and facilitate industrial development. Thus, services trade policy need not only focus on offensive interests in services sectors, but also on ensuring that local manufacturers have the best possible access to services.

74. Second, financial services play a particularly important role in allocating capital to sectors of comparative advantage. Trade liberalisation in financial services may help developing countries with weak financial markets to exploit their comparative advantage in labour-intensive manufacturing as well as in standardised labour-intensive services. These sectors are more dependent on external financing than e.g. extractive industries. A weak financial services sector may therefore contribute to continued dependence on exports of raw materials in low-income countries. It is not argued that low-income countries could diversify their export base by liberalising the financial sector alone. Nor is it argued that they should open their capital account on the balance of payment before they have the institutional capacity to regulate and oversee financial markets. But access to credit is essential for export diversification and trade liberalisation in the financial sector should be part of a reform package aiming at strengthening the institutional framework and reducing political risks for investors.

75.   Third, services trade liberalisation may reduce transaction costs for exporters. Liberalising backbone services such as telecommunications and transport reduces transaction costs both in services and goods trade. It is particularly important for geographically and economically remote countries to mitigate the possibly growing disadvantage of remoteness through competitive and state of the art transport and communication services.

76.   The study presents robust evidence that services intensity is associated with higher rungs on the manufacturing value added ladder. Further it is found that restrictions on foreign direct investment in key backbone services constitute an obstacle to manufacturing exports in general and intra-industry trade in manufactures in particular.   Finally model simulations suggest that the gains from services trade liberalisation are potentially large, but appear to materialise only after substantial reductions in services trade barriers.

77.   The non-linearity of gains from services trade liberalisation seems to have support in previous research when reassessed in the light of our findings. Studies analysing the originally proposed European services directive for instance, find that intra-EU services trade could increase by 30-60% following the implementation of the services directive (e.g. Kox and Lejour, 2006). This is much more than services trade growth following the introduction of the internal market in 1994. If the predictions are correct, it supports our finding that going the last mile of services market integration has the strongest impact.

78.   The non-linearity of gains from services trade liberalisation, if correct, poses a policy challenge for developing countries. The political economy of reforms suggests that gradual and cautious reforms are politically more feasible than radical reforms. Furthermore, it is easier to proceed to the next step in a reform process if significant gains from the previous steps can be demonstrated. If gains are slow to materialise, in contrast, the reform process may lose momentum. On the other hand, popular opposition to liberalisation may lose momentum as well. Therefore it could be a feasible policy option for developing countries to start the reform process by liberalising trade in all modes in services sectors whose state of development constitutes a bottleneck for manufacturers and which are not large employers in the local economy. Examples are telecommunications and business services; particularly legal services, accounting, advertising and technical consulting services. It appears that liberalisation of FDI would have the largest impact.

79.   The non-linearity of gains from services trade liberalisation also has interesting policy implications for high-income OECD countries. Direct restrictions on market access and national treatment of foreign services suppliers may be few in these countries and there may be a sense that there is not much more to be gained from further liberalisation. Our results suggest the opposite. The largest benefits are yet to come and stem from deeper integration of services markets, which would involve regulatory reform in particular. It is also clear that free trade in high-volume, low-margin standardised services would help manufacturers in OECD countries stay competitive.

80.   A further impact of better, cheaper and new services is that services are substituted for material inputs and thus contribute to dematerialisation of manufacturing. In particular, better engineering, design and supply chain management help economise on material inputs and contribute to more environmentally sound manufacturing.

81.   Finally, the potential gains from services trade liberalisation depend crucially on how far trade liberalisation actually reduces services trade costs. It is argued in the study that reducing services trade costs to zero would probably require radical reforms, perhaps going as far as the initially proposed services directive in the European Union in 2004. This proved to be politically infeasible in the European Union and the same probably goes for other regional trade agreements, let alone the GATS. Much more research is needed to quantify regulatory barriers to trade and to improve our understanding of the natural barriers to

cross-border trade in services. Before such estimates are available the best that we can do is to develop scenarios of the type that are presented in this study. While designed to provide useful insights, they are not forecasts of the impact of a specific services trade liberalisation policy.

82. To conclude, this study has shown that policy makers need to look beyond the liberalising sector when assessing the benefits from liberalisation. It should be borne in mind that even if there are adjustment costs such as job losses in liberalised services sectors in developing countries, there are also a host of missed opportunities from maintaining the restrictions.

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TECHNICAL ANNEXES

Technical Annex 1. Regression results

Export performance in manufacturing and trade restrictions in services

The first regression explores how export orientation in manufacturing industries is related to trade restrictions in services, running the following regression:

$$\ln(X_i / GO_i) = b_i + b_2 \ln gdpcap + b_3 (S_j / GO_i) SR_j + \mu_i$$

X_i indicates exports, S_j indicates services sector j ($j=$ business services, financial services, maritime services) and SR_j the FDI restrictiveness index in the service sector in question. The results are presented in columns 1-3 in Table A.1.

The second regression explores how intra-industry trade is related to trade restriction in services:

$$\ln((X_i + M_i) - |X_i - M_i|_i / (X_i + M_i)) = b_i + b_2 \ln gdpcap + b_3 (S_j / GO_i) * SR_j + \mu_i$$

where M_i indicates imports and the right-hand side the intra-industry index.

Table A1. Regression results, services and services investment restrictions

Left hand side variable	Export share			Intra-industry trade	
	Business services	*Finance*	*Maritime services*	*Business Services*	*Maritime services*
Ln GDP per capita	0.16***	0.16***	0.12***	0.16***	0.11
	(0.04)	(0.04)	(0.05)	(0.09)	(0.09)
Ln(1+share business services)				2.6**	
				(1.2)	
FDI restrictiveness index	-10.3**	-10.5*	-30.0*	-27.7***	-68.5**
	(4.8)	(6.2)	(16.4)	(9.0)	(31.5)
Sector dummies:	Yes	Yes	Yes	Yes	Yes
N	237	245	237	237	237
Adjusted R^2	0.34	0.33	0.33	0.21	0.19

Note: Standard errors in parenthesis, ***, ** signify statistical significance at a 1 and 5 level respectively. Columns 1-3 depict the correlation between the export share of gross output by sector and the FDI restrictiveness index, weighted by the share of the service in question in total cost, while the last two columns correlates intra-industry trade with the weighted FDI restrictiveness index.

Table A2. Regression results, services trade and productivity (conditional labour demand)

	(1)	(2)
Wages	-0.77***	-0.40***
	(0.04)	(0.14)
Price of materials	0.50*	0.43***
	(0.29)	(0.16)
Capital stock	0.14***	0.14*
	(0.03)	(0.08)
R&D	0.64*	0.99**
	(0.39)	(.42)
Output	0.82*	0.18**
		(0.08)
Services Offshoring	-3.31**	-3.72***
	(1.61)	(1.27)
Sector fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
N	401	194
Adjusted R²	0.97	0.42

Note: Standard errors in parenthesis, ***, **, * signify statistical significance at a 1, 5 and 10 level respectively. Column 1 presents results using ordinary least squares while the second column presents the results of using first differences.

Technical Annex 2. The general equilibrium models

Model 1. Interaction between trade in final goods and intermediate services.

Each sector produces a consumption good (Y_j) using labour (L_{Yj}) and a composite (S_j) of intermediate services as inputs. Sectors are indexed j, countries are indexed i and varieties of the intermediate services/tasks are indexed v. Goods or services produces in the foreign country are denoted with a *:

$$(1) \qquad Y_{ij} = \left[\beta_{ij} L_{Yij}^{\rho_{ij}} + (1 - \beta_{ij}) S_{ij}^{\rho_{ij}} \right]^{1/\rho_{ij}},$$

where β is an allocation parameter which indicates how intensively manufacturing sector j uses direct labour and services respectively. The parameter ρ defines the elasticity of substitution between business services and labour ($1/(1-\rho) > 1$). L and S can be interpreted as tasks being performed inside and outside the firm respectively, although L also includes material inputs in this version of the model. The elasticity of substitution can be interpreted as a measure of how easily tasks are outsourced in the sector. Profit maximisation yields the ratio of tasks produced within the firm and outside the firm as follows:

$$(2) \qquad \frac{L_{ij}}{S_{ij}} = \left[\frac{W_i}{P_{iSj}} \frac{1 - \beta_{ij}}{\beta_{ij}} \right]^{1/(\rho_{ij}-1)}$$

And the unit cost function of the representative firm:

$$(3) \qquad C_{iYj} = \left[\beta_{ij}^{1/(1-\rho_{ij})} W_i^{\rho_{ij}/(\rho_{ij}-1)} + (1 - \beta_{ij}) P_{iSj}^{\rho_{ij}/(\rho_{ij}-1)} \right]^{(\rho_{ij}-1)/\rho_{ij}}$$

The composite of services is defined as:

$$(4) \qquad S_{ij} = \left[\left(\sum_{v=1}^{N} \left(H_i I_{ijv} \right)^{(\varepsilon-1)/\varepsilon} + \sum_{v=N+1}^{N+n} \left(HI^*_{ijv} \right)^{(\varepsilon-1)/\varepsilon} \right) \right]^{\varepsilon/(\varepsilon-1)}$$

in which N and n are the number of services in the home and foreign country respectively, I_{ivj} is the amount of business services of variety v used in sector j in country i. The productivity parameter H captures differences in economic fundamentals of technological capability with which intermediates (either produced at home or abroad) are transformed into final consumption goods, and $\varepsilon > 1$ is the elasticity of substitution between any pair of intermediate services. This way of modelling diversified services captures the well-documented fact that the joint inputs of a team of experts in different, but relevant areas of specialisation are more productive than one generalist providing the same number of man-months as the expert team. Thus, the larger the number of local and foreign differentiated services, the more a given quantity of S contributes to the production of Y. The corresponding price index for the S-aggregate equals:

$$(5) \qquad PS_{ij} = \frac{1}{H_i} \left[\sum_{v=1}^{N} Ps_{iv}^{1-\varepsilon} + \sum_{v=N+1}^{N+n} \left(Ps^*_{iv} \tau \right)^{1-\varepsilon} \right]^{\frac{1}{1-\varepsilon}}$$

Communication costs are assumed to be of the iceberg type so $\tau \geq 1$. Cost minimization yields the following spending rule on local and imported tasks (country 1 is the home country), assuming symmetry among intermediate services:

$$(6) \qquad \frac{I_{hh}}{I^*_{fh}} = \left[\frac{\tau Ps^*}{Ps} \right]^{\varepsilon}$$

Each business service or task is produced subject to economies of scale stemming from a fixed cost of developing the task in question. Employment in each service activity is given by:

$$(7) \qquad L_{ilv} = L_{if} + \gamma_i I_{iv} ,$$

where L_f is the fixed cost of inventing the service in question, while γ is the unit labour cost of producing the service variety I_i. With free entry in the services sector, the price of the service will be a mark-up over marginal cost defined by the elasticity of substitution between any two business services or tasks:

$$(9) \qquad Ps = \frac{\varepsilon}{\varepsilon-1} \gamma_i W_i$$

Where W is the wage rate or a composite index of primary and material inputs prices in the numerical version of the model. Using (5), (7) and the free entry condition that ensures that profits are zero, output of the representative business service firm can be calculated to:

$$(8) \qquad I_{iv} = \frac{(\varepsilon-1)L_{if}}{\gamma_i} \quad \forall v$$

It follows from (6), (7) and (8) that employment in each services firm is εL_f. Consumers in both countries are assumed to have Cobb-Douglas preferences:

$$(10) \qquad U_i = \prod_{j=1} C_{ij}^{\sigma_{ij}}$$

Where C_j represents consumption of products from sector j, and implies that consumers spend a fixed share of their income, σ_j, on final output j. It is assumed that final goods are traded subject to a small transport cost and that goods are differentiated according to country of origin (the Armington assumption). This allows trade and location patterns to be determined in a model with one factor and many sectors.

$$(11) \qquad C_{ij} = \left[Y_j^a + Y_j^{*a} \right]^{1/a}$$

where a represents the Armington elasticity. With consumer goods differentiated according to source, producers are able to obtain a mark-up over marginal costs (as given by (3)) as follows: $Py_{ij} = C_{ij} / (1-a)$

Consumers in the home country maximize utility subject to their budget constraint:

$$(12) \qquad Max \prod \left[Y_j^a + Y_j^{*a} \right]^{\sigma_{1j}/a} s.t. \sum_j Py_j Y_j + \sum_j tPy_j^* Y_j^* \leq wL + \frac{1}{1-a} \sum_j Y_j$$

where $t \geq 1$ is the iceberg transport cost. The last term is profits from the final goods sector that are received by consumers. This yields a similar spending rule as for intermediate services inputs as follows:

$$(13) \qquad \frac{Y_j}{Y_j^*} = \left[\frac{tPy_j^*}{Py_j} \right]^a$$

Market clearing conditions in the labour market, the market for business services, the market for final goods and the balance of payments determine the equilibrium of the model and are given as follows:

$$(14) \qquad \sum_j \left(I_{ijv} + \tau I_{ijv}^* \right) = \frac{\varepsilon - 1}{\gamma_i} L_{if}$$

$$(15) \qquad L_i = \sum_j L_{iyj} + N_i \varepsilon L_{if}$$

$$(16) \qquad Py_j Y_j + tPy_j^* Y_j^* = \sigma_j (wL + \sum_j Y_j / (1-a))$$

and similar for the foreign country. The balance of payment condition closes the model

$$(17) \qquad \sum_j tPy_j^* Y_j^* + N^* \tau Ps^* I_{fh}^* = \sum_j tPy_j Y_j + N \tau Ps I_{hf}$$

An analytical solution cannot be found unless stronger restrictions are imposed on the model, but it is possible to solve it numerically. Of interest is how falling costs of trade in services affect production structures, trade in goods and services, and real income for different constellations of the exogenous parameters. For that purpose the model is written in GAMS having three final goods sectors (primary, high services intensive manufacturing and low services-intensive manufacturing) and one non-traded final services sectors. As a benchmark the model is solved for symmetrical countries both in terms of labour endowments, consumer preferences and technology. Next the following scenarios are explored: i) the home country has a 20% larger labour force than its trading partner; ii) the home country is 20% more efficient in its use of intermediate services or tasks (H is 20% higher); iii) The home country is more efficient in producing intermediate services or tasks (γ is 20% lower); iv) The home country has lower entry barriers in the services sector (L_f) is 20% lower. In all scenarios 30 steps are run where τ increases by 0.1 for each step, holding everything else constant. The base line scenario has the following parameter values: $\gamma = L_f = H = 1$ for both countries, $\varepsilon = 5$, $a = 8$, $t_j = 1.01$ for j= 1, 2, 3 and 10 for j = 4. $L = 100$ for both countries. The value of the sector-specific parameters is presented in Table 3. The cost and expenditure shares reflect values in typical high-income OECD countries calculated from the input-output tables.

Table A3. Parameter values for simulation

Sector	σ	β
Primary	0.05	0.8
Less services intensive manufacturing	0.25	0.75
More services intensive manufacturing	0.20	0.6
Non-traded final services	0.50	0.7

Model 2. Interaction between intermediate goods and services.

The production function is a nested CES function with three layers. At the top layer, primary and intermediate inputs are aggregated as follows:

(18) $Y_{ij} = \left[\beta_{ij} VA_{Yij}^{\rho_{ij}} + (1 - \beta_{ij}) M_{ij}^{\rho_{ij}} \right]^{1/\rho_{ij}}$,

where β is an allocation parameter which indicates how intensively manufacturing sector *j* uses primary factors of production (VA) and intermediate inputs (M) respectively. The parameter ρ defines the elasticity of substitution between value added and intermediates $(1/(1- \rho) >1)$. Profit maximisation yields the ratio of tasks produced within the firm and outside the firm as follows:

(19) $\dfrac{VA_{ij}}{M_{ij}} = \left[\dfrac{PVA_i}{PM_{iSj}} \dfrac{1 - \beta_{ij}}{\beta_{ij}} \right]^{1/(\rho_{ij}-1)}$

At the second level, capital (K) and labour (L) are aggregated into value added by a Cobb-Douglas function:

(20) $VA_{ij} = L_{ij}^{\kappa} K_{ij}^{1-\kappa}$

While intermediate inputs consist of goods (Q) and services (S) as follows:

(21) $M_{ij} = \left[\alpha_{ij} Q_{ij}^{\varphi_{ij}} + (1 - \alpha_{ij}) S_{ij}^{\varphi_{ij}} \right]^{1/\varphi_{ij}}$

At the third level intermediate goods and services inputs are distributed on local and imported varieties according to equation (4) for services and for goods by a similar structure:

(22) $G_{ij} = \left[\left(\sum_{v=1}^{N_g} \left(H_i G_{ijv} \right)^{(\lambda-1)/\lambda} + \sum_{v=N_g+1}^{N_g+n_g} \left(H_i G_{ijv}^* \right)^{(\lambda-1)/\lambda} \right) \right]^{\lambda/(\lambda-1)}$

H is as before a productivity parameter reflecting the efficiency of using intermediate inputs. The unit cost function of the representative final goods manufacturing firm is:

(23) $Cy_{ij} = \left[\beta_{ij}^{1/(1-\rho_{ij})} PVA_i^{\rho_{ij}/(\rho_{ij}-1)} + (1 - \beta_{ij}) PM_{ij}^{\rho_{ij}/(\rho_{ij}-1)} \right]^{(\rho_{ij}-1)/\rho_{ij}}$

Where PVA is a weighted average of the wage rate (w) and the user cost of capital (r) as follows:

(24) $PVA_{ij} = \kappa_{ij}^{-\kappa_{ij}} (1 - \kappa_{ij})^{(\kappa_{ij}-1)} w_i^{\kappa_{ij}} r_i^{(1-\kappa_{ij})}$

PM is the weighted average of the price index of intermediate goods and services as follows:

(25) $PM_{iYj} = \left[\alpha_{ij}^{1/(1-\varphi_{ij})} PG_i^{\varphi_{ij}/(\varphi_{ij}-1)} + (1 - \alpha_{ij}) PS_{ij}^{\varphi_{ij}/(\varphi_{ij}-1)} \right]^{(\varphi_{ij}-1)/\varphi_{ij}}$,

and PS is given by (5) replacing, while by the same token PG is given by:

(26) $PG_{ij} = \dfrac{1}{H_i} \left[\displaystyle\sum_{v=1}^{N_g} Pg_{iv}^{1-\lambda} + \sum_{v=N_g+1}^{N_g+n_g} \left(Pg_{iv}^* T \right)^{1-\lambda} \right]^{\frac{1}{1-\lambda}}$

T is the (iceberg) transport cost of intermediate goods between the two countries, and λ is related to the elasticity of substitution between any two intermediate goods in the same way as ε is related to the elasticity of substitution between services.

In this version of the model it is assumed that the fixed cost of entering the market is incurred in terms of an exogenously given capital investment (e.g. R&D or physical investment). Total costs incurred by each firm in the intermediate services and goods sectors are therefore given by:

(27) $TCS_{iv} = rK_{isf} + w\gamma I_{iv}$
(28) $TCG_{iv} = rK_{igf} + w\theta G_{iv}$

Profit maximizing yields mark-up pricing as before in the intermediate services sector (equation 9), while the corresponding procedure for intermediate goods providers yields:

(29) $Pg_i = \dfrac{\lambda}{\lambda-1} \theta_i W_i$

Output of the representative firm is now determined by relative factor prices, as opposed to in the first version of the model where output was determined by the exogenous parameters alone. Output of the representative goods and services firms are given as follows:

(30) $I_{iv} = \dfrac{(\varepsilon - 1)rKs_i}{\gamma_i W_i}$

(31) $G_{iv} = \dfrac{(\lambda - 1)rKg_i}{\theta_i W_i}$

Spending rules on the various inputs in the production function are similar to the previous model, but with a more complex production structure, there are more of them. The spending rule between value added and intermediate inputs are already given by (19). Within the value added aggregate, relative factor demand is given by:

(32) $(1 - \kappa_{ij})WL_{yij} = \kappa_{ij}rK_{iyj}$

Within the intermediate input aggregate, relative demand for goods and services are given by:
(33) $M_{ij} = \alpha_{ij}Q_{ij}^{(\varphi_{ij}-1)}PS = (1 - \alpha_{ij})S_{ij}^{(\varphi_{ij}-1)}PG$

Relative expenditure on intermediate services are given by (6) with the necessary adjustments in notation, while relative expenditure on intermediate goods are given by:

$$(34) \quad \frac{G_{hh}}{G_{fh}^*} = \left[\frac{TPg^*}{Pg}\right]^{\varepsilon}$$

The market clearing conditions for the labour market, capital market and intermediate goods and services are given as follows:

$$(35) \quad L_i = \sum_j L_{iyj} + Ns\gamma I_{iv}$$

$$(36) \quad K_i = \sum_j K_{iyj} + Ng_i Kg_i + Ns_i Ks_i$$

$$(37) \quad \sum_j \left(I_{jhh} + \tau I_{jhf}\right) = \frac{\varepsilon - 1}{\gamma_i W_i} rKs_i$$

$$(38) \quad \sum_j \left(G_{jhh} + TG_{jhf}\right) = \frac{\lambda - 1}{\theta_i W_i} rKg_i$$

The balance of payment closes the model.

The model is run for the following parameter values for the symmetry case:
L=100 for both countries, K=200 for both countries, $\gamma = \theta = Kg = H = 1$ for both countries, Ks = 1.1, $\varepsilon = 3$, $\lambda = 5$, T = 1. A symmetry scenario for T = 1.2 was also explored. It yielded qualitatively the same results as for the symmetric case of T = 1, but with lower trade in intermediate goods and lower GDP per capita.