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In Search of 'Off Shoring': Evidence from U.S. Imports of Services

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Abstract

This paper explores the relationship between imports of services by the United States and the international sourcing of services production activities using a number of different panel data estimators for a number of different categories of services. A conventional import demand relationship is augmented by measures of the activity of foreign-owned affiliates in the US and US-owned service sector affiliates in other countries. There is a clear effect from production relocation on US imports of services. Outward investment in US-owned service sector affiliates is found to have a positive impact on import volumes. This is consistent with what might be expected if one motivation for such investments is to internationally source activities previously undertaken within the United States. Inward investment in the US service sector is found to reduce imports of services, other things being equal, pointing to substitution of trade and investment in services. However, inward investment in non-service sectors is found to stimulate imports of services, indicating complementarity at the aggregate level.

Key words:
Multinationals, foreign direct investment, imports of services, GATS modes of supply, global sourcing, offshoring and international outsourcing, panel data estimation.

JEL Code F14, F21, F23

I. Introduction

There is increasing interest in the analysis of trade in services. Services account for over two-thirds of developed countries' GDP, and cross-border trade in services has increased markedly over the past two decades. Rapid technological advances, especially in information and communication technologies (ICTs), and the liberalisation of national service markets have expanded the range of services that are tradable across borders and the degree to which they are traded. But, despite the growing importance of the services sector, there has been comparatively little econometric analysis of trade in services. Many papers that have analysed services have focused more on the economic determinants of service exports rather than imports. In part this can perhaps be explained by the fact that data on exports of services tend to better and more reliable than those on imports of services, contrary to data on merchandise trade[1]. The research in this paper is intended to help fill this gap by examining the determinants of US imports of services.

The need for more research on the determinants of international trade in services has also become apparent from the increasing policy interest, especially in the US, in the international in- and outsourcing of business activities, often loosely referred to as 'offshoring', 'offshore outsourcing', or even just 'outsourcing'. While this phenomenon is not new – it has taken place in the manufacturing sector for many years – the current interest is raised by it now taking place in the services sector. This has been made possible by technological advances in ICTs. These have made services increasingly tradable (ICT-enabled services) and reduced the constraints on the choice of location for the production of services. The research in this paper examines whether evidence from US imports of services is consistent with the global sourcing phenomenon.

It is important to define the concept of 'offshoring' carefully, as its impact will vary according to the definition adopted. International insourcing takes place through intra-firm sourcing in foreign affiliates and results in affiliated trade in services. International outsourcing[2] occurs where activities are contracted to independent third parties located abroad, resulting in unaffiliated trade in

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[1] This is the result of the way in which these data are collected (due to the particularities of the two kinds of trade): through company surveys rather than from customs records. Data on exports of services are collected from fewer and more specialised firms and hence provide better coverage than the data on imports of services which are drawn from a much larger number of firms. The surveys that are presently used to collect data on trade in services may not cover newer (and smaller) firms that are likely to be importers of computer and information services (see OECD, 2004).

[2] Outsourcing can also take place domestically, but the focus in this paper is on international in- and outsourcing, reflecting the current debate about jobs moving abroad and 'the jobless recovery' (until recently) in the United States.

services. There are, however, no official or internationally comparable data available that measure the extent of this phenomenon[3], and most evidence to date is anecdotal[4].

One way in which the international in- and outsourcing of service activities by US companies should manifest itself in the data is by changes in employment, with certain types of services sector jobs 'moving abroad'. Another is by a return flow of imports of services[5], with the independent foreign companies and foreign subsidiaries both exporting their production back to the country of the contracting or parent company. Thus, that country's imports should increase relative to domestic demand as a result of international production relocation.

Such effects reinforce the wider impact that international production relocation into the United States might have on the demand for foreign-produced services. Pain and van Welsum (2004) show that foreign investment by US-based parent companies has had a significant impact on the volume of service exports from the US. In this paper we also look at whether investment in the US by foreign-owned companies has a significant impact on the volume of service imports into the US.

Our empirical study utilises and extends a traditional import demand model, in a similar way to the augmented export demand model of Pain and van Welsum (2004). We use a detailed panel data set for the United States over the period 1986-2002 and model the determinants of a number of different categories of service imports recorded in the balance of payments data. Using different econometric techniques and controlling for demand and relative prices, the relationship between US imports of services and international production relocation, as measured by sales of foreign-owned affiliates in the US, is found to be sensitive to the precise empirical specification adopted. Moreover, the effects vary for different categories of services and according to the sector in which the relocation is taking place. The results also show that there is an overall positive effect from US affiliate activity abroad on imports into the US, which is consistent with international insourcing.

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[3] The measurement of the offshoring phenomenon is complicated by its nature and would have to take place in the context of company surveys. For example, if (international) outsourcing implicitly refers to activities that were previously carried out within the firm a time dimension is added which begs the question: "When does outsourcing stop being outsourcing?", i.e. at what stage will it be considered as just another (intermediate) purchase the firm makes?

[4] Up-to-date material on articles from the press and academic and policy papers related to the outsourcing debate can be found at: http://www.stern.nyu.edu/globalmacro/cur_policy/outsourcing.html.

[5] For example, Roach (2003) argues that as the US is substituting foreign labour for domestic labour ('the offshore outsourcing' of jobs), this 'global labour arbitrage' is reflected in rising import propensities.

Balance of Payments data on services[6] do not include all the different forms of trade in services set out in the framework of the General Agreement on Trade in Services (GATS). The GATS definition of trade in services is organised by modes of supply: the cross-border supply of services (Mode 1), consumption abroad (Mode 2), commercial presence (Mode 3) and the presence of natural persons (Mode 4). International outsourcing should result in an increase in Mode 1 (and Mode 2)[7] services trade. However, although BoP statistics account for almost all trade under Modes 1 and 2, and provide a partial coverage of Mode 4, they include few Mode 3 transactions (Cave, 2002). Thus, they will not reflect the full impact of international in- and outsourcing on trade in services, broadly defined. We use data on the activities of US affiliates abroad (affiliate sales) to account for production relocation.

International in- and outsourcing is sometimes considered to be a substitute for Mode 4, with jobs moving to workers rather than vice versa. Indeed, as a result of rapid advances in ICTs, certain types of service activities that previously could only be provided on-site, through the presence of natural persons (Mode 4), can now be carried out anywhere in the world and be traded electronically (Mode 1 and 2). However, the relationship between Mode 1 and 2 and Mode 4 is not straightforward and is, overall, more likely to be one of complementarity (see Chanda, 2003, for a discussion). For example, it can be argued that Mode 4 has facilitated international in- and outsourcing by raising awareness in the countries from where the international sourcing originates of the existence of pools of talented workers abroad, and by allowing the establishment of overseas networks and contacts. Moreover, the actual process of international in- and outsourcing often requires the ongoing movement of natural persons in both directions[8].

A relationship of complementarity can also exist between Mode 1 and Mode 3, although Pain and van Welsum (2004), examining the relationship between international production relocation and exports of services, find evidence of considerable heterogeneity across different categories of

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[6] This classification is also adopted in the *Manual on Statistics of International Trade in Services*, agreed to by the United Nations, the International Monetary Fund, the OECD, the World Trade Organisation and the European Commission. See van Welsum (2003a) for a discussion of the definition, classification and measurement of trade in services.

[7] Both Mode 1 and Mode 2 should be considered, as WTO member states have not yet reached an agreement on whether electronic supply (of business process services) should be counted as Mode 1 or Mode 2.

[8] For example, workers may move from the (parent) company in the home country to supervise work and/or train personnel in the foreign country. Equally, workers may move from the foreign country to the home country (from the company to which work has been outsourced to the firm that is doing the outsourcing) to deal with matters such as negotiations or training.

services. Finally, it also argued that there is a complementary relationship between Modes 1 and 2, Mode 4 and Mode 3 (Chanda, 2003).

The structure of the remainder of this paper is as follows. In Section II we provide a review of the existing literature on imports of services and the international in- and outsourcing phenomenon. Section III provides some descriptive statistics and illustrates the potential importance of the phenomenon. Section IV discusses the empirical model and econometric techniques used, and the results are given in Section V. The final section contains some brief concluding comments.

II. Imports of services and the international sourcing of economic activities

Import demand

Most time series studies of import demand have focussed on manufactured goods, using an approach in which final expenditure in the importing economy is allocated across imports and domestically produced goods and services (see Goldstein and Khan, 1985, for an overview). Typically these are viewed as imperfect substitutes, so that import volumes are modelled using a measure of domestic expenditure, the price of the imported commodity and the price of domestically produced substitutes[9]. Additional assumptions about the separability and homogeneity of demand determine the range of competing products for which prices are included and the restrictions that are imposed on the price coefficients[10].

Krugman (1989) argued that these traditional models tend to mis-specify the trade equations as they omit an export supply term, or a varieties term[11]. The standard models were subject to further instability mainly as a result of other missing variables, such as technology indicators and measures

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[9] Under certain assumptions the price elasticities estimated in single equation models may be biased as a result of simultaneity between quantity and prices (see Goldstein and Khan, 1985). Marquez (1994) models volumes and prices in a simultaneous equations model and argues that the way in which US imports tend to be modelled (namely assuming that trade elasticities are autonomous parameters, that there are no cross-price effects or simultaneity biases, and that expenditures on domestic and foreign goods are independent) implies a loss of information.

[10] For example, separability of the demands for manufactures and services would imply that the demand for imported services would depend only on the prices of imported and domestically produced services. Homogeneity would imply equal and opposite coefficients on domestic and import prices.

[11] Krugman (1989) develops a simple model where trade arises as a result of economies of specialisation rather than comparative advantage. He argues that as countries grow they increase the range of their outputs, which allows them to increase their share of world markets without necessitating an adjustment of the real exchange rate. Thus, economic growth is linked to an increase in product variety through an export supply effect. Gagnon (2003a, b) uses Krugman's model to analyse US import demand from different source countries and finds strong support for the existence of such a supply effect. Gagnon also argues that the omission of the export supply or varieties effect may help explain some of the differences in income elasticities found for imports and exports, also known as the Houthakker and Magee (1969) asymmetry.

of international production relocation. There is a long-standing theoretical and empirical literature on the relationship between trade and foreign direct investment, starting with Mundell (1957)[12]. The discussion of the international sourcing of activities can also be included in this context as one form of production relocation.

Pain and Wakelin (1998) demonstrated the importance of including measures of production relocation for models of export demand. A related approach was taken by Barrell and te Velde (2002), who estimated an import demand model including traditional measures of income and relative prices, measures of specialisation and technology, and inward and outward foreign direct investment to capture production relocation effects. This model was estimated for manufactures import demand in 10 European countries over the period 1970-1995. Overall, the sign on the inward stock of foreign direct investment (FDI) was more often negative than positive (which would point to substitution between trade and foreign investment), while the reverse is true for the stock of outward FDI (which would be consistent with global sourcing).

Examples of other studies that include measures of foreign direct investment in the import equation include Fontagné and Pajot (2001), Alguacil and Orts (2002), and Camarero and Tamarit (2003). Fontagné and Pajot (2001) estimate gravity models of bilateral import equations for the US, the UK and France, respectively. They find that for the US higher levels of stocks of both outward and inward investment are associated with greater bilateral imports, evidence consistent both with a complementary relationship between trade and foreign investment and with global sourcing. For the UK, higher levels of outward investment are associated with higher levels of bilateral imports (consistent with global sourcing), while inward investment has the opposite effect (substitution of trade and foreign investment). These results for the UK are reversed for France, with trade and foreign investment acting as complements. Camarero and Tamarit (2003) also include both inward and outward stocks of FDI in their import demand equation for manufactured goods. They estimate import demand as a function of real domestic income, relative prices (of the foreign good compared to the domestic equivalent) and measures of in- and outward investment, in a panel of 13 countries using quarterly data (1981Q1-1998Q3). They find an overall positive and significant effect from the inward stock (complementarity of trade and foreign investment), whereas the sign on the outward stock is more variable though more often positive than negative (consistent with global sourcing). Alguacil and Orts (2002), using a multivariate VAR model, also find a positive long-run

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[12] See Pain and Wakelin (1998), Gestrin (2002) and van Welsum (2003b) for a discussion of the literature on the relationship between trade and foreign direct investment.

effect from inward FDI on total Spanish import demand (complementarity of trade and foreign investment), but they do not include a measure of outward investment. Thus, more often than not, these studies focussing on the manufacturing sector have found evidence that (i) suggests a complementary relationship between trade and foreign investment, overall, and (ii) is consistent with global sourcing.

There are some empirical time series studies of the determinants of US imports of services, modelling imports as a function of domestic income, import prices and domestic prices and various other variables. All show that conventional models of merchandise trade can be applied successfully to trade in services, as argued by van Welsum (2003a). Examples include Huang and Viana (1995), Wren-Lewis and Driver (1998), Deardorff *et al.* (2000), Freund and Weinhold (2002), Ansari and Ojemakinde (2003), and Mann (2004).

Many of these studies find that the income elasticity of demand for imports tends to be greater than for exports[13] (Wren-Lewis and Driver (1998), Freund and Weinhold (2002), Ansari and Ojemakinde (2003), and Mann (2004)), and most also find that the income elasticity of demand for services is above unity[14]. In Huang and Viana (1995) income elasticities are greater on imports than on exports for other private services other than tourism services. Similarly, in Deardorff *et al.* (2000) income elasticities are greater on imports than on exports for the category 'other private services', but the reverse is true for travel, passenger fares and other transportation.

Evidence on relative price effects in the import equations is less conclusive. Freund and Weinhold (2002) and Ansari and Ojemakinde (2003) find that they are larger than for exports of services, but the evidence is mixed in Wren-Lewis and Driver (1998). It is difficult to draw conclusions from the evidence in Deardorff *et al.* (2000), as the estimated elasticities are insignificant in 2 of the 4 categories, nor from those reported in Mann (2004) as the estimated prices elasticities on imports are significant and correctly signed (ranging from -0.2 to –0.6), but those estimated for exports are not.

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[13] This would suggest that the standard result by Houthakker and Magee (1969), who first analysed this asymmetry for manufactured and agricultural goods, also holds true for services (although detailed results suggest that this is true for the category 'other private services' but not necessarily for other categories of services).

[14] Thus, it appears that the results from these relatively recent studies focussing on imports of services are, on the whole, consistent with the findings that have traditionally been reported for manufactured import equations. Goldstein and Kahn (1985) report that most studies have found income elasticities comprised between 1 and 2 (and price elasticities between –0.5 and –1.0).

The findings of Huang and Viana (1995), Deardorff *et al.* (2000), and Freund and Weinhold (2002) raise the possibility of heterogeneous income and price elasticities for different categories of imports, although none of these studies seeks to test this explicitly. Huang and Viana (1995) find that the income effects in particular differ for imports of tourism services and imports of other private services (including royalties). The results in Deardorff *et al.* (2000, Table 1) are less conclusive for imports than for exports, but they find income elasticities comprised between 1 and 3.6, while two of the price elasticities of demand are insignificant (for passenger fares and other travel-related imports). Freund and Weinhold (2002), looking at US import growth over the period 1995-1999, find greater income and price elasticities when looking at business, professional and technical (BPT) services alone (i.e. excluding education, telecommunication and financial services) than when looking at all other private services. In particular, the elasticity with respect to real exchange rate appreciation was 0.76 in the regression for all other private services, and just over unity for BPT services alone; the income elasticities were found to be 1.71 and 1.97 for the same categories, respectively.

Of the studies mentioned above, only Huang and Viana (1995) consider the role of foreign direct investment on import patterns. They find that the stocks of both inward and outward foreign direct investment have a significant and positive effect in the import demand equation for other private services (including royalties and licence fees), with a greater effect from outward investment than from inward investment. Moreover, while the effects are similar to those found for the export equation, the positive effect from outward investment is greater for imports than for exports. These results are consistent with a positive relationship between trade and foreign investment as well as with global sourcing. Finally, Li *et al.* (2003) find an overall positive and significant effect from FDI in insurance services on the volume of intra-industry trade in insurance services. This result is consistent with the idea that multinationals make a positive contribution to trade rather than act as a substitute for it.

The international sourcing of activities: insourcing and outsourcing abroad

Although the international sourcing of activities is currently receiving a lot of attention, the phenomenon has, in fact, existed for many years[15], although essentially in the manufacturing sector.

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[15] For example, Jarrett (1979), in a model of US manufacturing in the 1970s, examines the determinants of US offshore procurement and the international trade linked to it, and looks at the role of multinationals and foreign direct investment. Using data on US related-party imports, he finds that the location of US offshore activity was negatively related to distance from the US (because of transport costs) and positively related to lower relative wages and working conditions (less union influence). Controlling for these factors he also finds a positive effect from FDI on imports.

What is new is that: (i) it is increasingly affecting the services sector, mainly as a result of technological developments, which are increasing the tradability of services and thereby make the locational choices for services firms less restrictive[16]; (ii) the 'offshoring of jobs' now also affects white-collar workers in the services sector[17], as opposed to blue-collar workers in the manufacturing sector previously; and (iii) it increasingly affects highly skilled white-collar workers.

Traditionally, firms have been considered to face two forms of possible organisational strategies: horizontal or vertical integration. Although it has been pointed out (Caves, 1996, for example) that there are many interactions between horizontal and vertical relations, there are few theoretical papers that model the large variety of integration strategies available to firms, such as the various forms of in- and outsourcing. However, recent work by Grossman *et al.* (2003) and Grossman and Helpman (2001, 2002, 2003, and 2004) contributes to the development of a comprehensive framework that encompasses a wide range of organisational possibilities[18].

Furthermore, his findings vary not only by country, but also according to industry characteristics (and the organisational structures of the multinationals operating in the industry).

[16] Roach (2003) argues that IT-enabled globalisation has produced a 'global labour arbitrage', driven by the maturation of offshore outsourcing platforms, e-based connectivity and the imperatives of cost control.

[17] See Brainard and Litan (2004), Kirkegaard (2004), and Schultze (2004) for a discussion.

[18] Grossman *et al.* (2003) examine the joint determination of international trade and FDI in a modelling framework that allows firms to choose from a variety of integration strategies. However, the boundaries of the firm itself are taken as given. The work by Grossman and Helpman (2001, 2002, 2003, 2004), on the other hand, examines how contracting problems interact with differences in relative factor prices and costs, characteristics of the industry and transport costs to determine which activities are outsourced, which remain within the boundaries of the firm and what the location of the outsourcing will be. Grossman and Helpman (2001) model the outsourcing decision (also referred to as the 'make-or-buy' decision) emphasizing the trade-off between (i) the costs associated with running a larger more dispersed firm when production is maintained within the firm (diseconomies of scope) and (ii) the transaction costs associated with outsourcing this production to a third party. These include search and friction costs as well as costs arising from the imperfect contracts that govern the relationships. Grossman and Helpman (2002) develop a model that can be used to analyse where firms choose to outsource: the technologically and legally advanced 'north' or the low-wage 'south'. Outsourcing is, again, modelled as an activity that involves finding a partner, who, in turn, will have to be persuaded to make 'relationship-specific investments' necessary to enable it to satisfy the needs of the outsourcer. The contract governing this relationship is incomplete in the sense that is almost impossible to ensure that the activities will be carried out with the same care as they would have been by the firm itself. This feature is likely to be even more important when looking at services, for which quality often cannot be assessed until consumption or use. Grossman and Helpman (2003) examine the trade-off between FDI and outsourcing, i.e. a firm's decision on whether to produce inputs in a subsidiary or to buy them from foreign suppliers. Finally, Grossman and Helpman (2004) develop a model in which heterogeneous firms in an industry can choose their organisational form as well as the location of their subsidiaries or suppliers. They use this model to examine the impact of falling trade costs on the relative importance of FDI versus outsourcing. This could also be of particular interest for the services sector as trade costs are generally thought to be very low, particularly for services that can be traded and 'transported' electronically. An early empirical study considering some of these issues was Jarrett (1979), examining the choice between international insourcing and international outsourcing and foreign competitors' sales.

For example, a firm can produce its inputs at home within the firm or outsource their production to other firms located in the home country (domestic outsourcing). It can also decide to produce the inputs within the firm but in its foreign subsidiaries (international insourcing, which requires some form of prior foreign direct investment, FDI, to have taken place), or it can subcontract the production to third parties located abroad (international outsourcing). However, such models tend to apply to manufactured goods, taking into account assembly costs and transport costs – two concepts that lose their significance in the production and delivery of services[19]. There is, as far as we know, no formal analysis modelling the globalisation of the production chain in services sectors.

Nevertheless, data confirm the need for an integrated approach when considering the organisational forms open to the firm. While theory traditionally distinguishes between horizontally and vertically integrated firms, firm-level data show that not many firms fit these two 'extreme' classifications and that many 'hybrid' organisational forms exist (Feinberg and Keane, 2003).

As there are no official data measuring the extent of international sourcing in services sectors, most work to date is anecdotal. Much of the current literature tends to argue that the rapid growth of imports of services reflects the increasing importance of service industries within national economies, technological improvements in ICTs[20] and the ongoing liberalisation of service markets[21]. These factors, combined with ongoing pressures to cut costs and increase productivity to remain competitive in increasingly contestable product markets, have increased the incentives and abilities of companies to engage in the international sourcing of activities, either by insourcing

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[19] Similarly, the 'proximity-versus-concentration' hypothesis (Brainard, 1997; Ekholm, 1998) loses its importance in the case of services that can be traded electronically, although proximity can still be required, or considered an advantage, for the provision of certain types of services.

[20] Grossman and Helpman (2002) suggest that a uniform worldwide improvement in search and investment technologies (technological progress in communications and computer-aided design) has no effect on the volume of outsourcing or its international composition. However, a disproportionate improvement in the search or investment technology of 'the south' would bring about a shift in outsourcing activity from north to south. This model could not only explain some of the global sourcing currently taking place, but could also mean that further outsourcing will take place as developing countries acquire and adapt to new and advanced technologies.

[21] Feinberg and Keane (2003) found that most of the growth in intra-firm trade (between the US and Canada over the period 1984-1995) can be attributed to technological change with tariff reductions playing only a secondary role. Nevertheless, tariff reductions were found to explain a substantial part of the increase in arms-length trade. However, Rose (2003) does not find any evidence that WTO membership encourages trade in services, which could mean that little liberalisation has taken place, or that non-tariff barriers are relatively more important for trade in services.

through foreign subsidiaries or by outsourcing activities to independent foreign companies located abroad[22].

The absence of any reliable official data on the extent of the global sourcing of activities means that empirical evidence of its existence and impact is lacking. We aim to help fill this gap by examining the impact of international production relocation on US imports of services. If international in- and outsourcing are taking place, there should be a return flow of imports from the countries receiving the internationally sourced activities. However, while it is not possible to distinguish the share of imports that results directly from international sourcing from other imports[23], we can examine whether there is a positive effect from the activity of US affiliates abroad in the services sector on US import demand for services, which would be consistent with international insourcing taking place.

III. Some descriptive statistics

As Table 1 below shows, the US is both the largest importer and exporter of commercial services in the world, accounting for 13.3% and 17.4% of (the value of) total imports and exports respectively. Moreover, growth of services imports has been particularly important in the US, as its (value) share increased over time from 10.9% in 1992 to 13.3% in 2002[24] (WTO, 2004).

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[22] The 2004 *Economic Report of the President* by the US Council of Economic Advisors emphasizes the benefits of free trade in services, and considers 'offshoring' as part of increased trade in (ICT-enabled) services. It argues that 'when a good or service is produced more cheaply abroad, it makes more sense to import it than to make or provide it domestically' (p. 229). These arguments are supported by Mann (2003), for example, who argues that allowing this form of globalisation to take place, through the international sourcing of activities in the services sector, is vital for safeguarding the competitiveness of US firms and the performance of the US economy in the future. The globalisation of the production of IT and ICT-enabled services should result in lower prices for ICTs, ICT services, and software applications overall, allowing their more widespread diffusion and use, transforming business processes throughout the economy, and thereby allowing a second wave of productivity growth to occur in the US economy (similarly to the first wave of productivity growth which was generated, in part, by falling prices of ICT hardware). Global Insight (2004) makes a similar point, arguing that offshoring IT software and services will lower costs for business, which will be reflected in lower prices and stronger growth of real incomes. Protectionist pressures could prevent such gains from being fully realised. Mattoo and Wunsch (2004) propose two GATS negotiation scenarios through which protectionism in trade in services could be pre-empted.

[23] Table 4 below contains data that have recently become available from the BEA (Borga and Mann, 2003), showing a breakdown between affiliated and unaffiliated trade for certain categories of services imports. However, this breakdown is not available for all services, and it is not possible to identify the share of imports that directly results from international outsourcing in the unaffiliated transactions.

[24] In contrast, the (value) shares of Germany and Japan, accounting for the second and third largest individual shares, dropped from 10.4% and 9.8% in 1992 to 9.6% and 6.9% in 2002, respectively.

Table 1. World trade in commercial services[1]

Top 20 importers and exporters of commercial services, 2002
(billions of USD and percentages)

Rank	Importers	Value	Share	Rank	Exporters	Value	Share
1	United States	205.6	**13.3**	1	United States	272.6	**17.4**
2	Germany	149.1	**9.6**	2	United Kingdom	123.1	**7.8**
3	Japan	106.6	**6.9**	3	Germany	99.6	**6.3**
4	United Kingdom	101.4	**6.6**	4	France	85.9	**5.5**
5	France	68.2	**4.4**	5	Japan	64.9	**4.1**
6	Italy	61.5	**4.0**	6	Spain	62.1	**4.0**
7	Netherlands	55.7	**3.6**	7	Italy	59.4	**3.8**
8	China	46.1	**3.0**	8	Netherlands	54.1	**3.4**
9	Canada	41.9	**2.7**	9	Hong Kong, China	45.2	**2.9**
10	Ireland	40.4	**2.6**	10	China	39.4	**2.5**
11	Spain	37.6	**2.4**	11	Canada	36.3	**2.3**
12	Korea, Republic of	35.1	**2.3**	12	Austria	34.9	**2.2**
13	Belgium	34.9	**2.3**	13	Belgium	34.9	**2.2**
14	Austria	34.4	**2.2**	14	Ireland	28.1	**1.8**
15	Taipei, Chinese	24.3	**1.6**	15	Switzerland	27.9	**1.8**
16	Hong Kong, China	24.2	**1.6**	16	Korea, Republic of	27.1	**1.7**
17	Denmark	23.6	**1.5**	17	Singapore	26.9	**1.7**
18	Sweden	23.1	**1.5**	18	Denmark	25.5	**1.6**
19	India	21.8	**1.4**	19	India	23.5	**1.5**
20	Russian Federation	21.5	**1.4**	20	Sweden	22.5	**1.4**
	Sum of shares		*74.9*		Sum of shares		*75.9*

Note 1: Commercial services are calculated as total services minus government services and include transport, travel and other commercial services: communication, construction, insurance, financial, computer and information services, royalties and licence fees, other business services, and personal, cultural, and recreational services.
Source: Author's calculations, based on WTO (2004, Table I.7).

The following table shows the breakdown of US imports of services by category (and corresponding GATS classification). In 2002, the category 'other private services' (the sum of the last two categories in the table) accounted for nearly 34% of the total value of US imports of services. This share has increased significantly over time, from 20.3% in 1986 and 25% in 1994. Furthermore, in 2002, intra-firm trade accounted for 46.6% of 'other private services', and unaffiliated transactions for 53.4% (see also Table 4 below).

Table 2. Types of Private Services Imports (percentages)

Category of imports	GATS Classification	Share of Total Services Imports		
		1986	1994	2002
Travel/Tourism	Mode 2: consumption abroad	40.0	37.0	28.3
Passenger fares	Mode 1: cross-border supply	10.0	11.0	9.7
Transportation	Mode 1: cross-border supply	27.4	22.0	18.8
Royalties and licence fees	Mode 1: cross-border supply	2.2	4.9	9.4
Other affiliated business services	Mode 1: cross-border supply Mode 4: presence of natural persons	6.0	10.5	15.8
Other non-affiliated business services	Mode 1: cross-border supply Mode 2: consumption abroad Mode 4: presence of natural persons	14.3	14.5	18.1

Source: Author's calculations based on BEA, *Survey of Current Business*, various years.

Disaggregated data on unaffiliated imports of other private services ('other non-affiliated business services') show that US imports of business, professional and technical (BPT) services grew on average by over 13% per annum over the period 1992-2002 (compared to 7.2% for total services). The following table summarises the evolution of some of the fastest growing categories of BPT imports. It is important to note that these are all mainly ICT-enabled services and fall under the types of services activities that can be sourced internationally. Since these data refer to unaffiliated transactions they will reflect, in part, the international outsourcing of activities. Computer and data processing services experienced the fastest average annual growth over the period 1992-2002 (31%), and accounted for nearly 10% of all unaffiliated imports of BPT services in 2002.

Table 3. Growth and shares of selected services within the category business, professional and technical (BPT) services

	ave annual growth 92-02 (%)	growth 92-02 (%)	2002 share of unaff BPT (%)
Accounting, auditing, and bookkeeping services	21.3	588.5	6.7
Computer and data processing services	31.0	1388.7	9.8
Data base and other information services	12.6	227.8	2.2
Management, consulting, and public relations services	17.2	388.9	11.1
Research, development, and testing services	16.5	362.2	9.7
Training services	13.6	257.4	3.4
Other business, professional and technical services	12.8	232.9	2.6

Source: Author's calculations, based on BEA, Survey of Current Business, October 2003, Table 1.

Borga and Mann (2003) provide a breakdown of affiliated and unaffiliated imports for several categories of services for the period 1997-2002, or as available. The following table shows the total amount of imports by category, the share of unaffiliated and affiliated transactions, and the average annual growth rate. The category 'other private services' and in particular its sub category 'business, professional and technical services' have grown more rapidly on average than total private services (12.1% and 10.8%, respectively, versus 6.5%).

Table 4. Unaffiliated and affiliated imports of selected services, 1997-2002

Imports (billions of USD)	1997	1998	1999	2000	2001	2002	ave annual growth 97-02
Total Private Services	**150.0**	**163.6**	**180.5**	**204.7**	**201.6**	**205.2**	**6.5**
Unaffiliated %	83.5	82.7	79.7	79.6	78.2	76.6	*4.7*
Affiliated %	16.5	17.3	20.3	20.4	21.8	23.4	*14.1*
Royalties and license fees	**9.2**	**11.2**	**13.1**	**16.5**	**16.7**	**19.3**	**16.0**
Unaffiliated %	26.3	23.9	20.9	23.9	20.4	21.4	*11.3*
Affiliated %	73.7	76.1	79.1	76.1	79.6	78.6	*17.5*
Other private services	**41.7**	**45.5**	**53.0**	**57.8**	**63.4**	**69.4**	**10.8**
Unaffiliated %	57.7	57.3	51.3	50.2	52.6	53.4	*9.1*
Affiliated %	42.3	42.7	48.7	49.8	47.4	46.6	*12.9*
Financial services	**6.2**	**7.7**	**9.3**	**11.7**	**11.0**	**9.3**	**8.5**
Unaffiliated %	54.3	46.4	36.7	39.1	36.8	39.6	*1.8*
Affiliated %	45.7	53.6	63.3	60.9	63.2	60.4	*14.7*
Business, professional, and technical services	**21.2**	**22.7**	**28.3**	**30.5**	**33.1**	**37.5**	**12.1**
Unaffiliated %	30.2	32.6	29.9	28.8	30.3	28.6	*10.9*
Affiliated %	69.8	67.4	70.1	71.2	69.7	71.4	*12.6*
Computer and information services[1]	**1.6**	**1.9**	**4.5**	**4.2**	**4.5**	**4.2**	**21.8**
Unaffiliated %	48.8	55.5	33.5	38.5	37.1	30.8	*11.1*
Affiliated %	51.2	44.5	66.5	61.5	62.9	69.2	*29.4*
Management and consulting services[2]					2.4	3.8	
Unaffiliated %					33.2	31.2	
Affiliated %					66.8	68.8	
Research and development and testing services[2]					2.3	2.2	
Unaffiliated %					35.4	47.6	
Affiliated %					64.6	52.4	
Operational leasing	**1.1**	**1.1**	**1.2**	**1.2**	**1.2**	**1.0**	**-2.1**
Unaffiliated %	17.4	15.4	14.0	15.3	17.6	19.5	*0.1*
Affiliated %	82.6	84.6	86.0	84.7	82.4	80.5	*-2.6*
Other business, professional, and technical services	**17.3**	**18.1**	**21.0**	**23.5**	**22.7**	**26.3**	**8.8**
Unaffiliated %	24.3	25.6	24.7	23.2	28.8	26.7	*10.8*
Affiliated %	75.7	74.4	75.3	76.8	71.2	73.3	*8.1*

Notes: 1. Includes computer and data processing services and database and other information services.
2. Affiliated transactions in these categories were included in 'other business, professional and technical services' prior to 2001.
Source: Author's calculations, based on Borga and Mann (2003), Table E.

The share of affiliated transactions in the category business, professional and technical services is greater than it is in private services as a whole. Moreover, the value of affiliated transactions has typically risen more rapidly than that of unaffiliated transactions (especially affiliated transactions in computer and information services, with an average per annum growth of 29.4%). This is perhaps because not only can these services be traded electronically, but in many cases these transactions are also more likely to take place in a more secure environment as they happen within

the same company[25]. The faster growth of imports of affiliated services is consistent with the widespread view that international insourcing has grown rapidly.

In the context of trade in ICT-enabled services and the international sourcing of activities in the services sectors, it is interesting to see which countries have experienced rapid growth in their exports of other business services and computer and information services (since any country at the receiving end of the international sourcing of activities should be exporting services back to the country of origin). The following chart shows the average annual growth rate of exports of the sum of other business services and computer and information services[26] (reported values in current US dollars). Exports of countries such as India (as well as Ireland and certain Eastern European countries) are of particular relevance as they are known to be host locations in which international in- and outsourcing has taken place.

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[25] Freund and Weinhold (2002) show that the Internet had a positive effect on US imports of other private services, and its effect is even stronger when looking at business, professional and technical services alone. Moreover, the effect of the Internet variable was greater for imports than for exports of services. These findings imply that the development of the Internet has facilitated imports of services into the US, and they are consistent with international outsourcing taking place in the services sector, resulting in an increased flow of imports of ICT-enabled services into the US. The disaggregated data for business services used by Freund and Weinhold exclude intra-firm trade, and thus reflect international outsourcing but not international insourcing. Freund and Weinhold make the assumption that this will bias their results against finding a strong role for the Internet as many problems related to web-based service provision can be overcome in the shared ownership environments in which intra-firm trade takes place.

[26] It should be noted that this breakdown is not necessarily available for all countries. Moreover, some countries such as India include all services (except travel, transport and government services) in the category other business services. In the case of India this is not likely to pose large problems as the main part of India's services exports is thought to be made up of ICT-enabled services such as business process services and computer and information services. (See also OECD, 2004) Services data collection in some of these countries may also be comparatively poor, which would imply a downward bias in the estimates of the growth of their exports.

Figure 1. Average annual growth of other business services and computer and information services, by country, 1995-2002
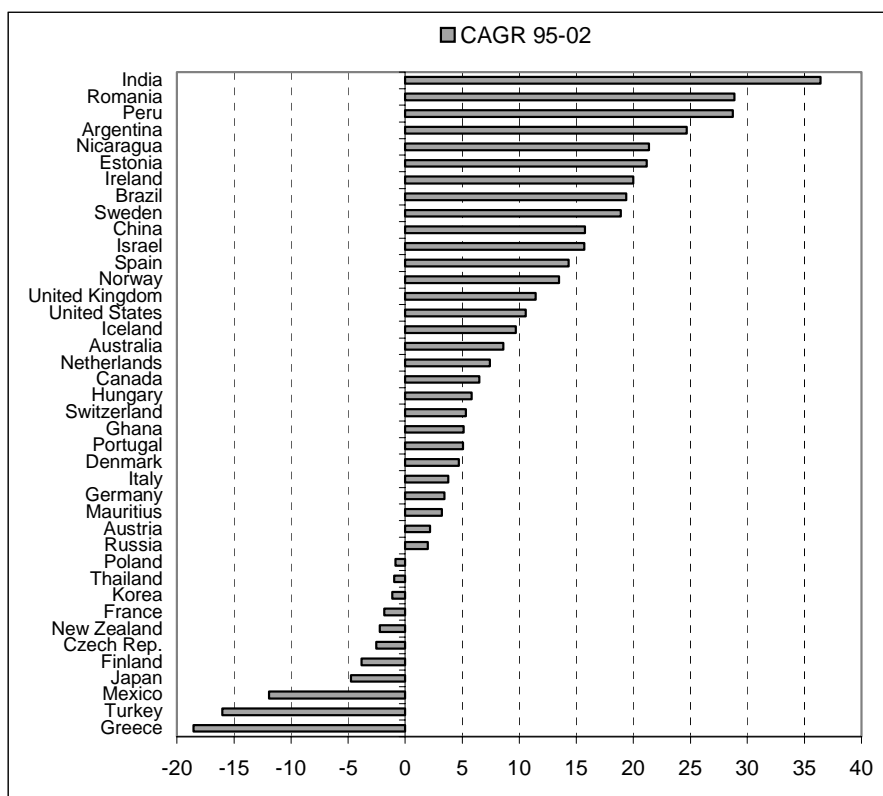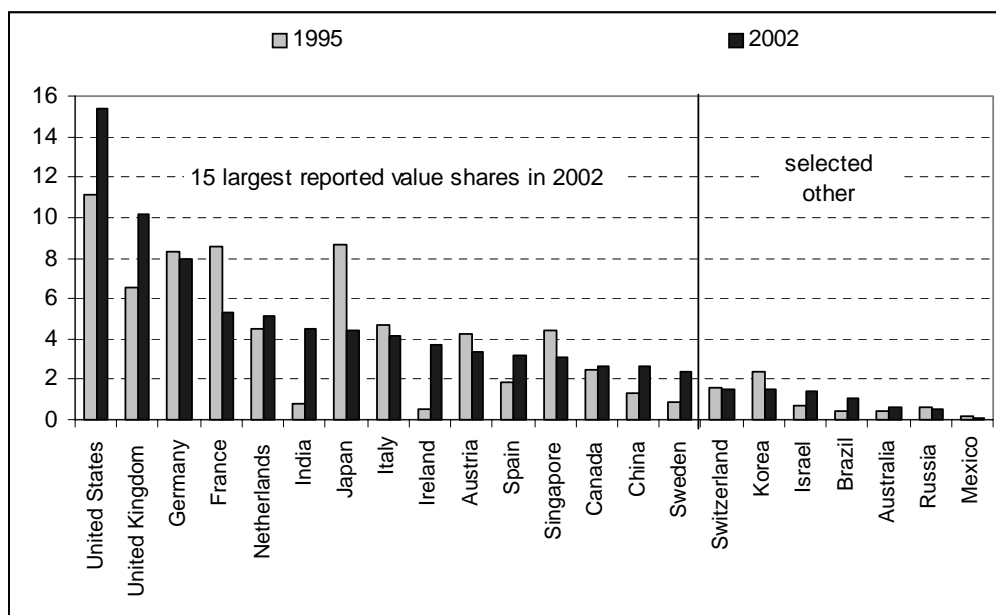

Source: Author's calculations based on IMF Balance of Payments Database (November 2003). Also reported in OECD (2004).

Of course it should be kept in mind that the exports of some of these countries are growing from a low base, as illustrated by the following figure showing countries' share of other business services and computer and information services of the reported total value[27]. It is of interest that the US is the country with the largest share of business and computer services in total reported export values, raising the possibility that many countries may be outsourcing activities to the United States. Nevertheless, from the perspective of US imports, it can be seen that several of the countries discussed in the 'outsourcing debate' have significant shares of other business and computer and information services in their total exports, especially India and Ireland.

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[27] As mentioned above, it is possible that some countries which are important exporters of computer and information services may not have much reliable data on services trade to report to the IMF. Other countries do not report any data to the IMF as they are not members. One example is Bermuda.

Figure 2. Share of total reported value of exports (current USD) of other business services and computer and information services, selected countries, 1995 and 2002

Source: Author's calculations based on IMF Balance of Payments Database (November 2003). (See also OECD, 2004).

As would be expected, several of the countries shown in Figure 2 are also amongst the 10 most important countries from which the US imported services in 2002, as shown in Table 5 below. Two surprising absentees from that table are India and Ireland. Figures 1 and 2 suggest that exports of other business and computer and information services from India have risen rapidly in recent years, but the US import data do not suggest that India is an important supplier[28]. This would suggest that, perhaps, the extent of the 'offshoring phenomenon' to India is not as important in the data as is suggested by the amount of attention it has recently generated. This is consistent with Markusen (2002) who finds that the production for exports, including for exports back to the US, by US affiliates abroad is not mainly located in low-skilled countries. However, outsourcing can also occur by subcontracting activities to independent foreign companies, both by multinational companies and by single plant firms.

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[28] Nevertheless, Arora *et al.* (2001) show that the US constitutes the main market for Indian software exports. Moreover, based on a sample of 90 of the largest software firms in India, they estimate that subsidiaries and divisions of overseas firms account for 15-20% of Indian exports of software.

Table 5. US Imports of services, by type and country, 2002

|	Total services	Travel	Passenger fares	Other transportation	Royalties and license fees	Other private services
Value (millions of USD)						
All countries	205234	58044	19969	38527	19258	69436
Percentages						
10 largest countries	61	52	51	52	82	71
United Kingdom	13	10	16	7	8	20
Canada	9	11	3	9	5	10
Japan	8	5	5	11	26	6
Germany	7	4	8	7	11	9
Mexico	5	12	4	3	1	3
Bermuda	5	1	0	1	7	11
France	5	5	5	3	7	5
Switzerland	3	1	3	1	10	5
Netherlands	3	1	3	3	8	3
Taiwan	2	2	4	7	0	0
Other countries	39	48	49	48	18	29

Note: Countries are ranked by their dollar value of total imports.
Source: Author's calculations, based on Borga and Mann (2003), Table D.

A further indication of the host countries to which activities may be outsourced is provided by the A. T. Kearney (2004) 'offshore location attractiveness index'. This index is based on a qualitative assessment of countries' financial structure, business environment and people skills and availability. It shows India as the top offshore location, because it not only has a good skills base[29], but also offers relatively low (labour) costs. It also has considerable experience, both as an exporter of software and because it has been an offshore outsourcing location for many years, especially in the business process outsourcing market.

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[29] The higher educational system produces many students with strong technical and quantitative skills who are also fluent in English.
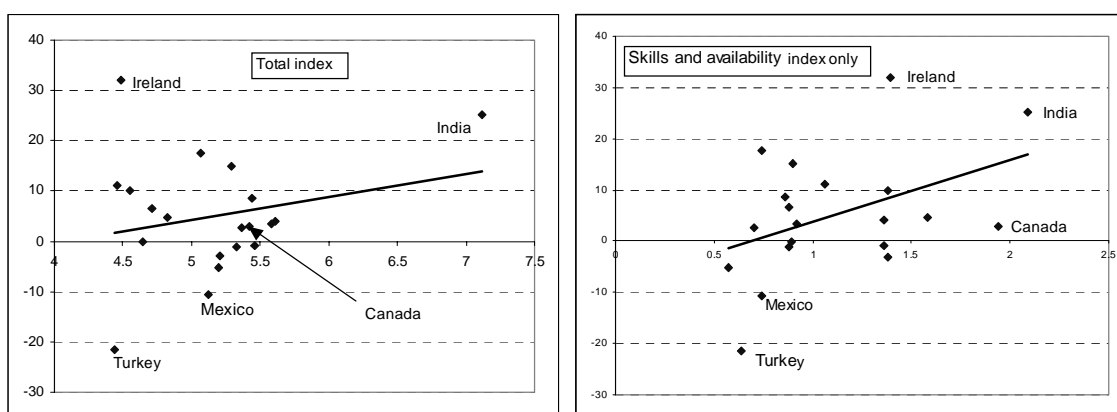
Figure 3. The A. T. Kearney 'Offshore location attractiveness index', 2004
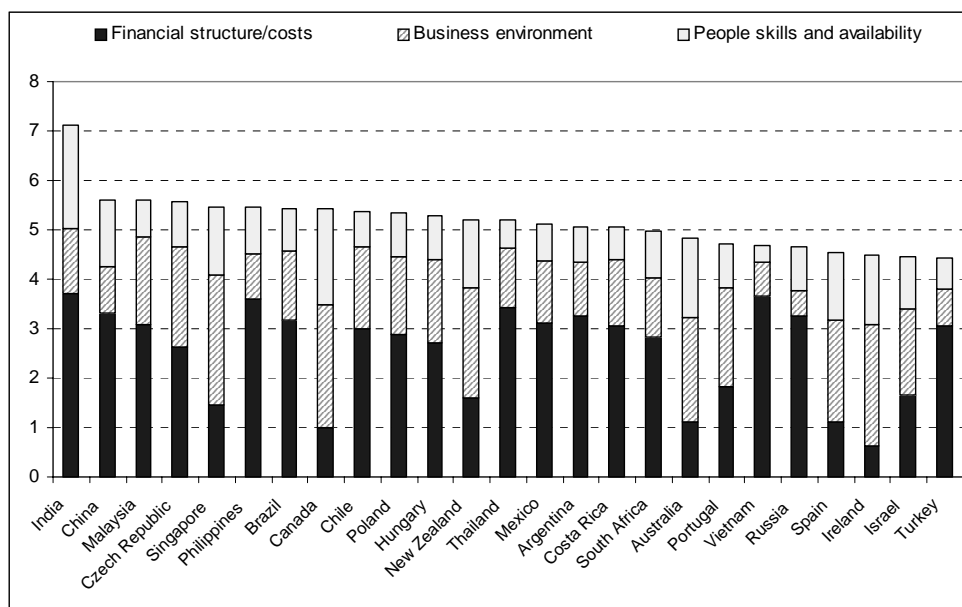
Note: Financial structure is rated on a scale of 1-4, the other two measures both on a scale of 1-3.
Source: A. T. Kearney (2004).

Finally, the following figure shows that, overall, there is a positive correlation between those countries that are considered to be attractive locations for the international sourcing of activities in the A. T. Kearney index and those that have experienced strong growth of exports of other business services and computer and information services, which would be compatible with international sourcing taking place.

Figure 4. Cross-plot of the average annual growth rate of exports of other business and computer and information services and the 'offshore location attractiveness' index

Notes: Average annual growth of exports of other business and computer and information services in percentages on the vertical axis, and A.T. Kearney's 'offshore location attractiveness' index on the horizontal axis. The total index is comprised between 1-8, the skills and availability index between 1-3.
Source: Author's calculations based on IMF Balance of Payments (November 2003) and A. T. Kearney (2004).

In the absence of data directly measuring the extent of the international sourcing of service sector activities, this section has examined some indirect measures and indicators[30]. These are all consistent with the view that international sourcing has become an increasingly important phenomenon. If so, it should be expected to affect time series models of the level and composition of trade flows. The empirical work in the remainder of the paper takes this approach one step further and estimates an augmented import demand model of US imports of services, including a variable capturing outward investment in services. This will allow us to test, albeit indirectly, for possible effects from international insourcing. Unfortunately, it is not possible to test for effects of international outsourcing as it is impossible to distinguish between overall imports of services and those that result directly from international outsourcing.

IV. Econometric Approach and Data Description

The results from Pain and van Welsum (2004) for exports of services, as well as the discussion above, suggest that different factors may influence different types of service imports. Therefore, rather than estimate a single aggregate relationship for total imports of services, we use a panel data set and test explicitly for heterogeneous effects[31]. We use a simple, heterogeneous, partial adjustment panel model of the form:

$$\ln(Y_{it}) = \alpha_i + \beta_i \ln(X_{it}) + \lambda_i \ln(Y_{it-1}) + u_{it}; \qquad u_{it} \approx IN(0, \sigma_i^2) \qquad [1]$$

for each of i=1,…,N groups, over t=1,…,T observations, where X denotes a k*1 vector of independent explanatory variables. The associated long-run coefficients can be derived as $\theta_i = \beta_i/(1-\lambda_i)$. The group-specific intercepts pick up all omitted factors that vary across groups, but not across time. A convenient reparameterisation of [1] is:

$$\Delta \ln(Y_{it}) = \alpha_i - (1-\lambda_i)\left[\ln(Y_{it-1}) - \frac{\beta_i}{1-\lambda_i}\ln(X_{it})\right] + u_{it}$$

$$= \alpha_i - \gamma_i\left[\ln(Y_{it-1}) - \theta_i \ln(X_{it})\right] + u_{it} \qquad [2]$$

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[30] Other indirect measures could be obtained from looking at employment data, input-output tables and trade in intermediates.

[31] See van Welsum (2003b) for a more detailed discussion of various panel estimators and model selection criteria than the review in this section.

This non-linear formulation permits a direct estimate of the long-run parameters of interest. If the slope parameters are homogenous, then consistent estimates (as $T \to \infty$) can be obtained from the standard one-way fixed effects model:

$$\Delta \ln(Y_{it}) = \alpha_i - \gamma \left[\ln(Y_{it-1}) - \theta \ln(X_{it}) \right] + w_{it}; \qquad w_{it} \approx IN(0, \sigma^2) \qquad [3]$$

This model imposes both common slope parameters and common error variances across groups. Both sets of restrictions can be tested. If the restrictions do not hold, then the fixed effects model will provide inconsistent parameter estimates, even as $T \to \infty$ (Pesaran and Smith, 1995; Pesaran *et al.*, 1999).

In the presence of heterogeneity bias, there are a number of possible approaches. One option is to use the mean group estimator, estimating [1] separately for each of the N groups and deriving consistent parameter estimates by averaging the parameters across groups[32] (Pesaran and Smith, 1995). However, the resulting estimates may not be particularly efficient especially if either T is small and a large number of explanatory variables are included, or if there are some commonalities between at least some parameters and/or variances across groups.

An alternative is to use the pooled mean group estimator proposed by Pesaran *et al.* (1999). This estimator allows the intercepts, the short-run coefficients and the error variances to vary across panel groups, but imposes common long-run coefficients[33]. In this case [2] becomes:

$$\Delta \ln(Y_{it}) = \alpha_i - \gamma_i \left[\ln(Y_{it-1}) - \theta \ln(X_{it}) \right] + u_{it} \qquad [4]$$

An alternative model is a pseudo pooled mean group model with common group variances and long-run parameters:

$$\Delta \ln(Y_{it}) = \alpha_i - \gamma_i \left[\ln(Y_{it-1}) - \theta \ln(X_{it}) \right] + w_{it} \qquad [5]$$

For models [4] and [5] only estimates of the dynamic parameter(s) (γ_i) are obtained by averaging across the individual group estimates. In both cases, intermediate versions of the models are

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[32] Thus, the mean group estimator is obtained as follows: $\bar{\beta} = \dfrac{\sum \hat{\beta}_i}{N}$.

[33] Pesaran *et al.* (1999) justify this approach by arguing that the short-run parameters are more likely to be heterogeneous in panel time series than the long-run parameters, which ultimately are tied down by factors such budget or solvency constraints, arbitrage conditions, or common technologies.

possible, with common coefficients or variances imposed on sub-groups within the panel. It is also possible to estimate [2] with common variances imposed, but heterogeneous short and long-run parameters. As there are grounds for believing that the relationship between service imports and international production relocation may vary for different types of imports, we use such estimators below. Any restrictions imposed can be tested using a likelihood ratio (LR) test against the mean-group model, since this does not impose either common coefficients or common group variances[34].

The models set out above assume that all of the time-varying factors common to each group are captured by the set of time-varying explanatory variables in the vector X_{it}. To test this, it is possible to augment some of the models with time dummies. For example, in this case [3] could be re-written as a two-way fixed effects model:

$$\Delta \ln(Y_{it}) = \alpha + \omega_i + \omega_t - \gamma \left[\ln(Y_{it-1}) - \theta \ln(X_{it}) \right] + w_{it} \qquad [6]$$

where ω_t denotes a dummy variable that is equal to 1 at time t and zero in all other periods. To avoid perfect colinearity [6] has to be estimated subject to the restrictions that[35]:

$$\sum_{i=1}^{N} \omega_i = \sum_{t=1}^{T} \omega_t = 0 \qquad [7]$$

An equivalent extension can be made for the pseudo pooled mean group model [5]:

$$\Delta \ln(Y_{it}) = \alpha + \omega_i + \omega_t - \gamma_i \left[\ln(Y_{it-1}) - \theta \ln(X_{it}) \right] + w_{it} \qquad [8]$$

We estimate versions of [1], [2], [5], [6] and [8] for a panel of different categories of private services imports measured at constant prices.

The dependent variable is specified as the share of each category of imported services (travel – calculated as the sum of travel and passenger fares, other transportation, royalties and licence fees, other affiliated services and other unaffiliated services) in final domestic demand in the United

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[34] We also make use of the Schwartz Bayesian Criterion (SBC) when comparing models. The SBC is calculated as $SBC_m = MLL_m - \left[0.5 * k_m * \ln(NT) \right]$, where MLL_m is the maximised value of the log-likelihood function for model m, k_m is the number of freely estimated parameters, and NT is the sample size. Thus, it penalises the estimation of additional parameters. The number of free parameters in our calculations of the SBC includes the number of variances. This is of particular importance for panel models where either 1 or N variances may be estimated. Models that maximize the SBC will be preferred.

[35] It is also necessary to discard any variables in X that vary over time, but not across panel members.

States[36]. This is conventional in many import demand models, such as the so-called 'Armington' model in which the relative market shares of domestic and foreign goods are related to their relative price via the elasticity of substitution (Reinert and Roland-Holst, 1992; Blonigen and Wilson, 1999). As we use a logarithmic model, a unit elasticity of demand is implicitly imposed both in the long-run and the short-run. Although this elasticity is lower than that found in several other empirical studies of US service imports (Section II), experiments with a mean group model in which these restrictions were relaxed suggested that both constraints are accepted by the data[37]. Implicitly, the remaining factors in the model therefore provide an explanation for fluctuations in the aggregate share of service imports in US domestic demand over time.

The vector X_{it} comprises five separate variables – the relative price of imported services, the (constant price) stock of R&D performed in foreign countries relative to that performed in the US, the volume of sales in US-owned service sector affiliates outside the US, the volume of sales in all foreign-owned affiliates located in the US and the volume of sales in foreign-owned service sector affiliates in the US. All the variables used are in logarithms, with the R&D and affiliate sales variables lagged by one year[38]. The affiliate sales data are produced by the Bureau of Economic Analysis in US dollars and are converted into constant prices by deflating using the US GDP deflator. Inclusion of separate terms for total and service sector affiliate sales[39] is a convenient way of testing for differential effects between service and non-service sector affiliates[40].

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[36] It is important to note that since we use balance of payments data our data set of service imports does not include the sales of US-owned foreign affiliates abroad (Mode 3 of services trade under GATS). This is also true of all the other studies of US service imports cited above in Section II.

[37] The long-run output coefficient from the mean group estimates was 1.308 (standard error 0.449) and the short-term coefficient was 1.006.

[38] The basic model was also augmented by an outlier dummy to prevent an individual observation from having a significant influence on the remaining parameters. This is discussed further below.

[39] A new industry classification system, the NAICS, was introduced during the data period. We use a category 'services' which is, in the old system of classification (SIC), equal to the sum of finance, insurance, real estate, and other services. The closest approximation of this constructed aggregate in the new classification system is given by the sum of information, finance, real estate and professional, scientific and technical services. We have used the data from the old classification until 1999, and interpolated the level forward from 1999, using the growth rates of the aggregate obtained from the new NAICS classification.

[40] Suppose we wish to test for differential effects from service sector affiliate and non-service sector affiliate sales, denoted *AFFS* and *AFFN* respectively (where *AFFS+AFFN = AFFT*). We can write:

$$\alpha \ln(AFFT) = \alpha_1 \ln(AFFS) + \alpha_2 \ln(1+AFFN/AFFS)$$

$$= (\alpha_1 - \alpha_2) \ln(AFFS) + \alpha_2 \ln(AFFT)$$

$$= \beta \ln(AFFS) + \alpha_2 \ln(AFFT)$$

The hypothesis of equal effects from sales in both sectors implies the testable restriction that $\beta=0$.

The relative price of imported services is measured using the deflator for each category of imports of services as reported in the US National Income and Product Accounts (Table 4.2.4) relative to the deflator for US personal consumption of services. A priori, it is to be expected that a rise in the relative price of imports should reduce the US demand for foreign services. The time series profile of relative prices for each category of services is shown in Figure 5 below[41]. The relative price of all types of imported services has shown a tendency to decline over time, with the rate of decline being relatively rapid for other private services and, to a lesser extent, travel and passenger fares.

Figure 5. Relative service import prices (2000=100)
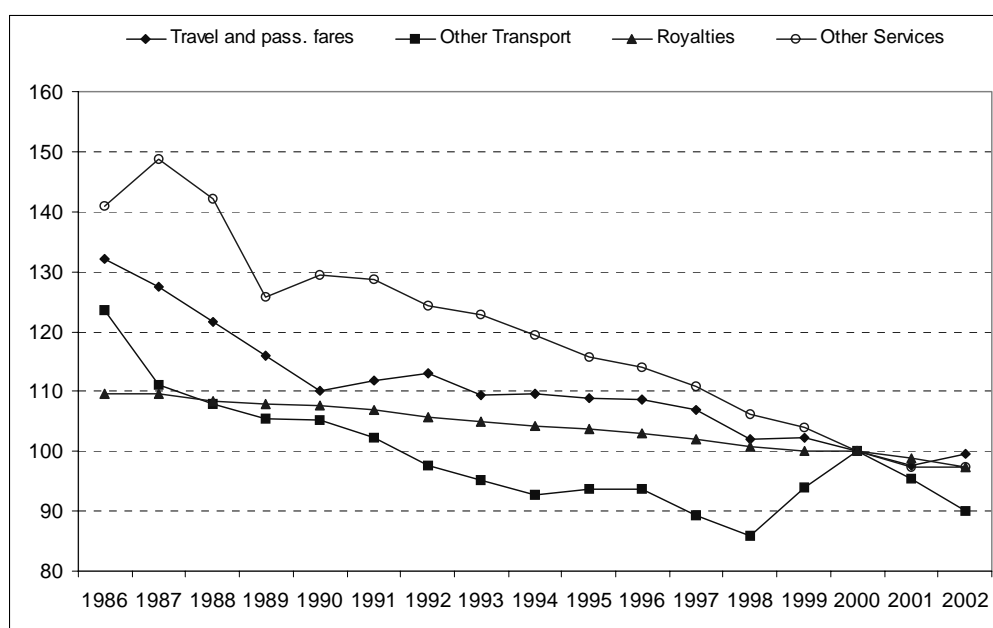
Source: US National Income and Product Accounts.

The R&D variable is defined as the stock of service sector R&D undertaken in twelve other OECD countries relative to a total service sector R&D stock in the US. This can be seen as a proxy for the variety and quality of foreign-produced services relative to those produced in the US. Empirical studies at the aggregate, product and firm level all suggest that innovation expenditure can affect trade performance (Pain and Wakelin, 1998; Pain and van Welsum, 2004; and Basile, 2001, respectively). In all countries consistent data for the total flow of service sector R&D expenditures were obtained from the OECD ANBERD database and converted into constant prices using national GDP deflators[42]. A benchmark stock was created for 1973 and updated using a standard

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[41] A single price series is constructed for travel and passenger fares; for 'other private services' no separate deflator is available for affiliated and non-affiliated services within this category.

[42] Classification changes mean that it is difficult to obtain consistent time series data for separate service industries.

perpetual inventory model[43]. As shown in van Welsum (2003b) the resulting measure suggests that R&D rose especially rapidly in the US relative to other countries in the early 1990s, and again at the end of the decade.

V. Econometric Results

The properties of the individual equations for each category of service imports are summarised in Table 6. In general, the t-statistic on the equilibrium-correction parameter (γ_i in [2]) is significantly different from zero, suggesting the presence of a valid (cointegrating) long-run solution. Two categories of imports, royalties and other unaffiliated services have larger error variances than the other categories. Inspection of the residuals from these equations revealed the existence of a number of large outliers, inclusion of which could potentially distort the estimated parameters. One option is to deal with these by including separate (1,0) dummy variables for each of these observations. For the unaffiliated services category we include one dummy variable – for 1987. For royalties, this approach was not feasible given the limited number of observations available and the large number of individual outliers. The unrestricted equation had three residuals greater than 9 per cent, in 1988, 1992 and 2000. With royalties included in the panel it was not possible to impose the restrictions required to impose a common variance for all panel members using a likelihood ratio test [LR(4)=10.62; p-value=0.031]. However, a common variance could be imposed for the four remaining categories of services [p-value = 0.274][44]. It was therefore decided to exclude royalties from the rest of the empirical analysis, and just use the four remaining categories of service imports. With annual data from 1987-2002 (T=16), this gives 64 observations in total.[45]

The results from estimating the mean group, pseudo pooled mean group and one-way fixed effects models are reported in columns [X.1]-[X.3] of Table 7. The upper rows of the table report the long-run parameters (denoted θ in equations [2], [3] and [5]). The lower rows report the short-run dynamic adjustment parameter and summary statistics. Fixed effects for each category of imports were included in estimation, but are not reported here.

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[43] Benchmark stocks for country i (S_{i0}) were obtained using the approximation formula [$S_{i0} = R_{i0} / (g_i + \delta)$], where g_i is the average annual logarithmic growth rate of R&D expenditures over 1973-99, δ is the annual depreciation rate, which was assumed be 11 per cent following Carson *et al.* (1994), and R_{i0} is the initial observation on the flow of R&D.

[44] When including the dummy variable for 1987 for unaffiliated services. Common variances across the remaining four categories could still be imposed even without this [p-value = 0.186].

[45] The detailed data on the composition of cross-border trade in other business services are available only from 1986 for the United States. One observation is dropped as the estimated model includes a lagged dependent variable.

It is apparent that the magnitude, significance and, in some cases, the sign of the estimated parameters are very sensitive to the specification of the estimated model. Likelihood ratio tests indicate that the parameter (and variance) restrictions required to move from the mean group to the pooled long-run model are jointly rejected by the data [LR(18)=59.77; p-value 0.0000], as are the further restrictions imposed in moving from the pooled long-run model to the one-way fixed effects model [LR(3)=18.67; p-value 0.0003]. This might suggest that greater weight should be placed on the results from the mean group model. However the SBC statistic is lower for this model than the others, reflecting the larger number of parameters that have to be estimated, many of which are insignificant. This would suggest that, overall, the pooled long-run model is marginally preferable to the other two.

Taking the results from all three models as a whole, two broad features stand out. First, it is clear that a rise in the relative price of imported services has a significant negative effect on import volumes, whilst a rise in the relative quality/variety of foreign services, as measured by the R&D variable, has a significant positive impact. Equivalent effects are found for US exports of services by Pain and van Welsum (2004). Second, it is clear that the international relocation of production affects import patterns. Inward investment in the US service sector is found to reduce the share of domestic demand met through imports of services, other things being equal. This would point to trade and foreign investment acting as substitutes for a given level of demand (contrary to most of the studies reported in Section II which tended to find evidence of a complementary relationship). In contrast, outward investment in US-owned service sector affiliates is found to have a positive impact on import volumes, consistent with what might be expected if one motivation for such investments is to outsource activities previously undertaken within the United States. The strongest evidence of this emerges in the pooled long-run model.

Table 6. Summary Statistics For Individual Import Category Regressions

	$\overline{\textbf{R}}^2$	Standard Error	Log – Likelihood	t-ecm
Travel and Passenger Fares	0.54	4.74%	30.69	-2.39
Other Transportation	0.60	3.10%	37.46	-3.83
Royalties	0.52	7.16%	24.10	-4.15
Other Affiliated Services	0.68	4.98%	29.88	-1.61
Other Unaffiliated Services:				
without dummy variables	0.39	5.29%	28.92	-2.99
with dummy for 1987	0.57	4.43%	32.71	-3.09

Note: t-ecm denotes the t-statistics on the equilibrium-correction term in [2].

Table 7. Determinants of Imports of Services

Dependent Variable: $\Delta \ln(M_{it}/D_t)$ Sample Period: 1987-2002

	[X.1]	[X.2]	[X.3]	[X.4]	[X.5]
	Mean Group	Pooled Long-run	One-Way Fixed Effects	Pooled Long-Run	Two-Way Fixed Effects
Long-run parameters					
Relative Prices	-1.465 (1.5)	-5.469 (7.6)	-4.056 (3.5)	-0.816 (2.5)	-4.258 (3.4)
Relative R&D	0.173 (2.7)	0.238 (1.9)	0.937 (2.8)		
Total Foreign Affiliate Sales	0.553 (1.6)	-0.631 (1.0)	0.445 (0.3)		
Foreign Service Affiliate Sales	-0.327 (2.5)	-0.976 (2.5)	-0.964 (1.0)		
US Foreign Service Affiliate Sales	0.065 (0.5)	0.352 (1.9)	0.351 (0.6)		
Dynamic parameters					
Equilibrium Correction	-0.857 (12.9)	-0.251 (1.9)	-0.182 (2.6)	-0.257 (2.1)	-0.143 (2.0)
Log-Likelihood	130.74	100.86	91.52	100.213	99.45
SBC	62.12	69.67	66.57	46.15	51.63
Time Dummies	No	No	No	Yes	Yes

Notes: heteroscedasticity-corrected t-statistics in parentheses.

The models in the first three columns of Table 7 include a number of variables which vary across time, but not across different categories of services. It is natural to ask whether these variables capture all relevant time-varying factors common to all types of service imports. To investigate this, a set of annual time dummies were added to the pooled mean-group and one-way fixed effect models, as in equations [6] and [8]. The resulting estimates are summarised in columns [X.4] and [X.5] of Table 7. The R&D and affiliate sales variables are not included in these specifications as they vary only over time, but not across panel members, and are therefore perfectly collinear with the time dummies.

Two main points emerge from these additional specifications. First, there continues to be evidence that changes in the relative price of imported services have a significant effect on demand, even though the magnitude of this effect varies considerably across different specifications. Whilst it cannot be excluded that the observed prices of traded services reflect transfer pricing, it does appear that they also contain some information useful for prediction. Second, there appear to be few benefits to be gained from the inclusion of time dummies. Indeed it is of interest to note that the Schwartz Bayesian Criterion (SBC) statistics for [X.4] and [X.5] are considerably smaller than for [X.2] and [X.3], reflecting the greater degree of parsimony in the latter models. The results suggest that the R&D and affiliate sales account for the time variation common to all categories of service imports. This can be seen clearly for the pooled long-run models [X.2] and [X.4]. The likelihoods of these two models are almost identical, indicating that it is not possible to reject the hypothesis that there are no significant differences between the different specifications. A further indication of this is provided by the joint insignificance of time dummies when added to the pooled long-run model [X.2], [LR(11)=11.16; p-value 0.43].[46]

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[46] Only eleven dummies can be added because of the inclusion of fixed effects and the additional need to avoid perfect colinearity with other regressors that vary over time but not across panel members.

Table 8. Illustration of parameter heterogeneity: restricted long-run parameters

	Travel and Passenger Fares	Other Transportation	Other affiliated services	Other unaffiliated services
Relative Prices	-3.383 (6.1)	0	-3.383 (6.1)	0
Relative R&D	0	0.156 (2.9)	0.363 (5.3)	0.207 (3.7)
Total Foreign Affiliate Sales	-0.480 (7.4)	0.480 (7.4)	0.480 (7.4)	1.462 (5.5)
Foreign Service Affiliate Sales	-0.567 (3.8)	0	-0.567 (3.8)	-0.567 (3.8)
US Foreign Service Affiliate Sales	0.229 (5.1)	-0.229 (5.1)	0.229 (5.1)	0.229 (5.1)
Log-Likelihood = 127.23; SBC = 91.87; Standard Error = 3.82%				

Note: Heteroscedastic-consistent t-statistics in parentheses.

**Table 9. Elasticities (per cent; standard errors in parentheses)**

	Travel and Passenger Fares	Other Transportation	Other affiliated services	Other unaffiliated services
Foreign Services Affiliate Sales	-0.643 (0.144)	0.077 (0.010)	-0.490 (0.155)	-0.333 (0.111)
Foreign Non-services Affiliate Sales	-0.403 (0.055)	0.403 (0.055)	0.403 (0.055)	1.228 (0.224)

Note: elasticity of services exports with respect to each type of affiliate sales using results in Table 4. Standard errors in parentheses.

Illustrating the Heterogeneity Issue

The acceptance of common variances for each of the four separate import categories but not common long-run parameters, points strongly to the existence of parameter heterogeneity across the different categories of service exports, as suggested by the profiles of import penetration in Figure 6.

Figure 6. The share of individual services categories in total US domestic demand (constant 2000 prices)
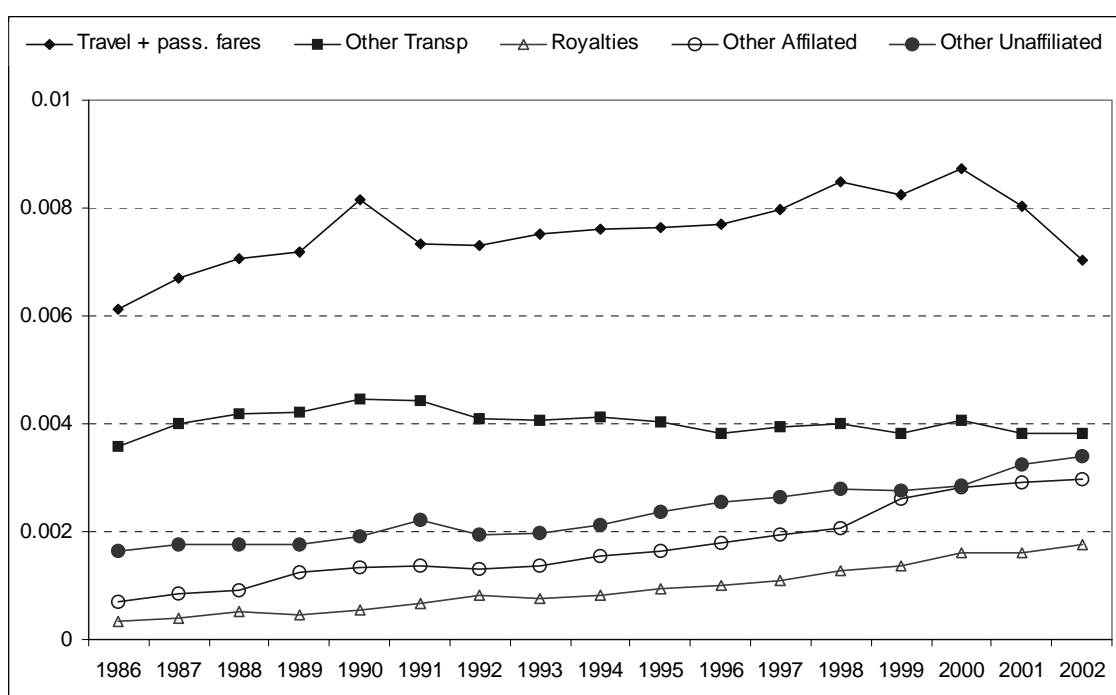
Source: US National Income and Products Accounts.

To illustrate the importance of allowing for parameter heterogeneity we use the pseudo pooled mean group model without time dummies. In the unrestricted version of this model, with common error variances but no common coefficients, a number of the individual parameters were not particularly well-determined, possibly reflecting the small sample size. But there was clear evidence of significant effects from multinational activity on service exports, as the twelve parameters on the affiliate sales variables were jointly significant [LR(12)=103.76].

Although the restrictions required to impose common long-run parameters on the unrestricted model are jointly rejected, it was possible to gain greater precision on the reported parameters by imposing a subset of thirteen data-acceptable restrictions on the long-run coefficients [LR(13)=3.15; p-value=0.997]. The resulting restricted long-run coefficients (or equivalently,

elasticities) are reported in Table 8. A notable feature of this model is that the log-likelihood and the SBC statistics are well above those for any of the models reported in Table 7.

A rise in the relative foreign R&D stock is found to have a significant positive long-run effect on all categories of imports, with the exception of travel and passenger fares, suggesting that product innovations in the service sector ultimately help to raise export levels in the innovating economies. Evaluated using the sample mean shares of each import category in total services imports (as given by the sum of the four categories considered here), the weighted aggregate long-run demand R&D elasticity is 0.11 per cent.

The explanation for the marked differences in the relative import price coefficients found in the different models in Table 7 is apparent in the results for different categories of imports in Table 8. A rise in the US real exchange rate has a significant positive impact on two categories of imports – travel and passenger fares, and, perhaps surprisingly, other affiliated imports, but no significant effect on the other two categories. In these latter categories the relative price coefficients have been set to zero. One possible explanation for this result is that importers of these types of services compete primarily on the basis of product quality (and reputation) rather than price.[47] Weighted across categories of services, the aggregate long-run relative price elasticity in Table 8 is –2.05 per cent. In conjunction with the results reported by Pain and van Welsum (2004) this suggests that US imports of services are considerably more price sensitive than US exports of services. A similar result was also found by Freund and Weinhold (2002) and Ansari and Ojemakinde (2003).

An expansion in the sales of US-owned service sector foreign affiliates is found to have a significant positive impact on the volume of three categories of imported services, but to have an equal and opposite effect on the fourth category – other transportation services. Weighting these together implies that a 1 per cent rise in the volume of affiliate sales abroad generates a 0.12 per cent rise in the volume of US service imports. These results are consistent with the idea of international in- (and out-) sourcing taking place in the services sector, with an implied return flow of exports to the US. Transportation is not especially relevant in this case, as many of these services can be digitised and are traded electronically.

Significant parameters are obtained on the sales of foreign-owned US-based affiliates in each category of imports. In all categories the impact of a change in the sales of service sector

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[47] Another possibility is that they undertake transfer pricing.

affiliates is significantly different from a change in the sales of non-service sector affiliates. This is illustrated in Table 9, which contains the implicit long-run elasticities for affiliate sales in services and non-services, calculated using their shares in total affiliate sales in 2000, along with the associated standard errors[48].

The results illustrate that the relationship between international production relocation into the United States and imports is likely to vary across different types of imports, as well as according to the sector in which relocation takes place.

In three out of four categories a rise in the sales of service sector affiliates will ultimately have a negative effect on imports of services (trade and foreign investment acting as substitutes), with the largest negative effects being found for travel and passenger fares. Only in the case of other transportation services does greater production relocation in the services sector appear to have a positive impact on imports, given market size. In contrast, a rise in the sales of non-service sector affiliates is estimated to have a positive effect on three of the four categories of service imports (trade and foreign investment acting as complements), as would be predicted by models of multinational firms that emphasise the role of headquarter services (Helpman, 1984; Markusen, 2002). This effect is particularly strong for the other unaffiliated services category. Weighted across the different categories of imports, a rise of 1 per cent in the volume of sales by foreign-owned non-service sector affiliates in the US will raise import volumes by 0.14 per cent. A rise of 1 per cent in the volume of sales by foreign-owned service sector affiliates in the US will lower import volumes by 0.41 per cent.

VI. Conclusion

The international sourcing of services production activities is currently receiving a lot of attention. However, there are no official data measuring the extent of the phenomenon or its economic impact. We have examined a number of indirect measures by looking at data on US imports of services as well as exports of countries that are thought to receive much of the sourcing. This evidence is not only consistent with the existence of international in- and outsourcing taking place in the services sector, but also suggests that the extent of such linkages is continuing to rise rapidly.

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[48] The elasticity of exports with respect to service affiliate sales is given by $\alpha_2[\text{AFFS/AFFT}] + \beta$, and the elasticity with respect to non-services affiliate sales is given by $\alpha_2[1-(\text{AFFS/AFFT})]$, where α_2 and β are the long-run coefficients on total affiliate sales (AFFT) and services affiliate sales (AFFS) in Table 4.

We took this analysis one step further in the empirical section by augmenting a traditional import demand model for a number of services categories, as measured in the Balance of Payments, with measures of inward investment in the US and of US investment abroad in the services sector.

The results suggest that the relationship between US imports of services and inward investments in the US, as measured by the sales of foreign-owned affiliates in the US, is sensitive to the precise empirical specification adopted. Controlling for demand and relative prices we found that the effect from inward investment depends on the services category as well as the sector in which the investment is taking place. Overall, the effect from inward investment in the services sector appears to be negative, pointing to substitution between trade and investment, while the relationship with non-service sector investment tends to be positive, indicating complementarity at the aggregate level.

Controlling for these factors we also find a positive effect on the volume of imports of services from US outward investment in services. This is consistent with international insourcing resulting in a return flow of imports into the US. Analysing the effect of international in- and outsourcing in more detail will require further investigation. In the absence of reliable official statistics measuring the extent and impact of the phenomenon, subsequent analysis will need to make use of alternative data sources to complement the analysis of trade data. In particular, occupational employment data may shed further light on the offshoring debate.

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