A BIRD'S EYE VIEW OF INTERNATIONAL OUTSOURCING: DATA, MEASUREMENT AND LABOUR DEMAND EFFECTS

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ABSTRACT. This paper takes stock of the rapidly expanding literature on international outsourcing. The first part of the paper discusses the appropriateness of different data sources and measures that may be used to document the extent of international outsourcing. In the author's view, input-output tables are to be preferred in most cases, although it is acknowledged that the choice of data and measurement ultimately rests on the specific question at hand. The issues are illustrated using input-output data for the United Kingdom, for the period 1974-1995. The second part of the paper concentrates on the labour-demand effects of international outsourcing. It starts off by describing the basic methodology and subsequently reviews the empirical evidence for a number of industrialised countries. The author concentrates specifically on the impact of international outsourcing on the skill structure of labour demand. While it may be expected that all types of labour suffer from outsourcing, most studies find that unskilled workers bear most of the burden.

JEL Classification: F14; J31.
Keywords: Outsourcing; Fragmentation; Trade; Labour Demand; Wages.

RÉSUMÉ. Cet article fait le point sur la littérature, en progression rapide, consacrée aux délocalisations internationales. L'auteur s'interroge d'abord sur les différentes sources de données et les mesures existantes qui sont utilisées pour appréhender l'ampleur du phénomène et sur leur pertinence pour en rendre compte. Dans la plupart des cas, les tableaux d'*input-output* sont les plus adéquats, mais le choix pour les données et la méthode relève en définitive de la question étudiée. Ces points sont illustrés par l'exploitation des données *input-output* dans le cas du Royaume-Uni pour la période 1974-1995. L'article examine ensuite les effets des délocalisations internationales sur la demande de travail. Après avoir décrit la méthodologie, il passe en revue, de manière approfondie, le cas de plusieurs pays industrialisés. L'étude appréhende particulièrement les conséquences des délocalisations internationales sur la structure de la demande de travail par qualification. Alors que l'on s'attendrait à ce que tout type d'emplois souffre de la délocalisation, la plupart des analyses montrent que ce sont les travailleurs non qualifiés qui en supportent le plus les conséquences.

Classification *JEL* : N13 ; E31.
Mots-clefs : Délocalisation ; fragmentation ; commerce ; demande de travail ; salaires.

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■ INTRODUCTION

In many developed countries international outsourcing has been the subject of an intense debate. This paper takes stock of part of the rapidly expanding academic literature on international outsourcing. In the present context, international outsourcing refers to the purchases of all intermediate inputs from abroad. It may also be referred to as offshoring.[2]

International outsourcing does not represent anything fundamentally new. The intensity of the policy debate, however, crucially relies on two notions. First, international outsourcing is a radical process. It reflects the splitting up of production processes – rendered possible thanks to recent developments in transportation and communication technologies – whereby separate components previously produced in the same location (at home) can now be produced in locations around the world. Secondly, international outsourcing may particularly hurt unskilled workers. When talking about international outsourcing, policy-makers typically think of firms which relocate part of their production to exploit persistent differences in relative factor prices across national borders. While the cost savings that can be realised through such moves may be substantial, policy concerns are raised about the fate of domestic workers employed by these firms. In tandem with the policy debate, a growing body of academic research has developed which analyses the domestic employment effects of international outsourcing.

An important issue in this literature is to what extent workers with varying skill levels are affected differently. Most developed countries have witnessed a sharp deterioration in the position of unskilled workers relative to skilled workers. In some countries (such as the UK and US) this is reflected by a growing wage gap between unskilled and skilled workers, whilst in others this is reflected in the structure of unemployment. To what extent does the increasing importance of international outsourcing explain the deteriorating position of unskilled workers in developed countries?

While the debate is increasingly moving towards the issue of services outsourcing, the present paper is limited to outsourcing in manufacturing industries. Amiti and Wei (2005) show that whilst service outsourcing is growing, it is still very small compared to outsourcing in manufacturing.

The paper starts off in section 2 asking to what extent the data actually reflect the alleged rise in international outsourcing. Which data sources are most appropriate? Section 3 discusses the role of different measures. These issues are illustrated in section 4, by documenting a number of stylised facts on international outsourcing using data for the United Kingdom for the period 1975-1994. The work concentrates on data for the United Kingdom,

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2. Recently attention has been increasingly directed towards understanding the degree of internationalisation in international production networks (see for example Antras and Helpman, 2004). As a result it may be more appropriate to explicitly distinguish between purchases of intermediate inputs from abroad through arm's length arrangements (international outsourcing) and intermediate purchases *via* intra-firm transactions associated with vertical FDI. However, the data used for this study do not allow one to distinguish between those two types of transactions.

as comprehensive internationally comparable data suitable to the analysis of international outsourcing are not available. The data for the UK show that the importance of international outsourcing within narrowly defined industries has been growing progressively since the 1980s. However, in order to assess the potentially negative employment effects associated with international outsourcing, careful econometric analysis is required. Section 5 discusses the main econometric methodology that has been used to evaluate the labour demand effects of international outsourcing, while section 6 reviews the empirical evidence. The evidence is structured by country of study. Finally, section 7 concludes.

■ DATA

The increasing international fragmentation of production translates into the rising importance of trade in intermediate products (Feenstra, 1998). Trade in intermediates differs importantly from trade in final goods in the sense that it explicitly takes into account the extent to which firms move production activities abroad. Consequently, relative labour demand is not only affected in import-competing industries, but in all industries that use foreign inputs. Researchers that have attempted to document international outsourcing have therefore typically relied on data on trade in intermediate inputs. The main drawback of focusing on trade in intermediates is that one necessarily ignores the possibility of outsourcing assembly lines.

Broadly speaking, three main sources can be used to document the trend in trade in intermediate inputs: data on outward processing trade (OPT), trade statistics on trade in intermediate goods, and input-output tables.

Outward processing trade (similar to concepts of "foreign trade zones" or "overseas assembly programs") refers to the customs arrangement in which complete tariff exemptions or partial levy reductions are granted in accordance with the domestic input content of imported goods. OPT crucially involves the export of intermediate inputs for further processing abroad, and the re-export of these products back home. OPT data thus provide a rich source of information on international outsourcing, albeit in a somewhat narrow sense. The primary use of OPT data has been to study the determinants of international outsourcing.

Görg (2000), using Eurostat data on inward processing trade (IPT) for EU countries, shows that IPT in the "peripheral" countries of the EU increased from 12% to 24% of imports from the US. Comparative advantage is found to be the main determinant of the sectoral distribution of IPT. Egger and Egger (2001) find that OPT in EU manufacturing increased by 6% per year, for the period 1995-1997. They show that OPT is biased towards import-competing industries, which correspond broadly to the unskilled-intensive industries. Baldone *et al*. (2001) use OPT data to analyse economic integration in the textiles and apparel industry, between the EU and the CEECs. They find that although low wages drive the initial decision to relocate production activities, cultural ties and geographical proximity determine which CEEC is eventually chosen. Using data for the period 1988-1999, Egger and Egger (2005)

find that infrastructure variables, relative factor endowments, and other cost variables are important determinants for the EU's outward processing trade.

In some cases, the classification of trade statistics can be used to infer whether trade in some particular industry concerns trade in intermediate or final goods. The main advantage of this source is the easy accessibility of the data and its comparability across countries. A drawback, however, is that it relies heavily on the at times arbitrary classification of trade statistics. This source has been particularly useful in documenting the changing composition of world trade.

Yeats (2001) uses SITC Rev. 3 trade statistics in combination with OPT data, and finds that trade in intermediates accounts for approximately 30% of total trade in the US. He asserts that this figure may be even higher for developing countries, as these countries have become more and more the focus of outsourcing from developed countries.[3]

The third main source is provided by the input-output tables. In most cases, input-output tables provide the most appropriate source, as they allow one to simultaneously analyse developments across industries and time. Comparisons across industries and over time on the basis of outward processing trade data can be problematic since trade barriers differ across industries and trade arrangements may change over time. For example, of the Europe Agreements make outward processing trade arrangements increasingly redundant.[4] Comparisons across industries on the basis of the classification of trade statistics seems to be difficult to justify, given the different levels of aggregation for different industries. Input-output tables have been used in most analytical work on international outsourcing.

Input-output tables, however, are also subject to a number of shortcomings. First, when focusing on trade in intermediates, it necessarily ignores the possibility of outsourcing of the final production stage such as assembly (Ng and Yeats, 1999). This, however, is a feature which is by definition shared by all data sources that refer to trade in intermediates. Second, the data do not necessarily reflect the relocation of production, as OPT data do. OPT trade explicitly refers to the re-imports of domestically produced parts or components. Imported intermediate inputs from the I-O tables are not subject to this constraint. Third, I-O data do not capture outsourcing when products are not re-imported, but exported to third markets. Recent work on multinationals by Ekholm, Forslid and Markusen (2003) suggests that this might indeed be very important.

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3. Interestingly, Hummels, Ishii, and Yi (2001) observe that the intermediate goods share of imports and exports in OECD trade declined steadily during the period 1970-1992. They obtain a similar picture using either the United Nations Broad Economic Categories classification scheme or the OECD Input-Output database.
4. The **Europe Agreements** were part of the pre-accession strategy of the European Union towards the candidate members from Central and Eastern Europe. Amongst other things, the Europe Agreements aimed to progressively establish a free-trade area between the EU and the associated countries, over a given period, on the basis of reciprocity but applied in an asymmetric manner (i.e. more rapid liberalisation on the EU side than on the side of the associated countries).

■ MEASUREMENT

Broadly speaking, two different measures of outsourcing based on input-output data have been used in the literature. The first measure concentrates on the foreign content of domestic production by taking into account the share of imported intermediate inputs in production. Consequently, the measure has typically been used to asses to what extent workers at home have been substituted by workers abroad, i.e. to evaluate the elasticity of substitution of domestic value-added with respect to imported intermediate inputs. The measure is originally due to Feenstra and Hanson (1996) and captures the essence of international outsourcing, i.e. the firm decision to substitute domestic value-added by foreign production.

Campa and Goldberg (1997), who use this measure, observe that the ratio of imported intermediates to sales in manufacturing rose from 4% in 1974 to 8% in 1993 in the US, from 16% to 20% in Canada, from 13% to 22% in the UK, but fell from 8% to 4% in Japan.[5] Strauss-Kahn (2003) documents an increase from 10% in 1977 to 16% in 1993 for France.[6]

The second measure concentrates on the foreign content of exports. This measure captures the extent to which the production of a good involves at least two countries and that the good-in-process crosses at least two international borders (importing and re-exporting). It should be noted that in comparison to the international outsourcing measure, which solely refers to imported intermediate inputs, this measure is narrower in the sense that it adds the additional condition that some of the resulting output must be exported. This measure was formulated by Hummels, Rapoport, and Yi (1998) and Hummels, Ishii, and Yi (2001). They refer to the international specialisation in stages of production as vertical specialisation (VS).

Hummels, Ishii and Yi (2001) analyse vertical specialisation using input-output tables for 10 OECD and four emerging market economies, for the period 1970-1990. They find that for the total sample VS accounts for 20% of exports and 30% of the growth in the world exports, in terms of GDP. They observe that this largely reflects increased VS within sectors, rather then structural changes towards more VS-intensive sectors.

Yi (2003) analyses to what extent vertical specialisation may help to explain the growth of world trade. The growth in world trade presents a puzzle, because tariff reductions can neither account for the full extent of the growth in world trade nor the acceleration in the growth rate. As VS by definition involves products that cross several borders, VS might explain why trade liberalisation can have a magnified effect on the volume of world trade. Moreover, trade liberalisation is likely to encourage VS, which might account for the observed increase in the elasticity of exports with respect to a reduction in tariffs. Calibrating a dynamic Ricardian model of vertical specialisation, Yi explains more than half of the increase in US trade since 1962, which amounts to almost double the explanatory power of standard one-stage models.

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5. Campa and Goldberg (1997) conclude that outsourcing occurs within the same broad industry on the basis that the share of imported intermediates tends to be high in sectors where import penetration ratios are high.
6. Although Strauss-Kahn (2003) refers to her measure as one of vertical specialisation she only concentrates on the importance of imported intermediate inputs in domestic production.

Note that the measure for the foreign content of domestic production (outsourcing) and that for the foreign content of exports (VS) are identical at the sectoral level. At the country level, however, the two measures differ as international outsourcing is constructed as an output-weighted average, while VS is an export-weighted average. The aggregate share of VS in exports will exceed the aggregate share of imported intermediate inputs in production when a positive correlation exists between the share of VS in exports and the ratio of exports to output at the sectoral level. Conceptually, the measure proposed by Feenstra and Hanson (1996) emphasises the impact of the fragmentation of domestic production, while the vertical specialisation measure concentrates more on the changing nature of world trade. Although at the sectoral level the choice of measure is trivial, the remainder will adopt the measure of the international outsourcing proposed by Feenstra and Hanson (1996), reflecting the present concern with the domestic employment effects of international outsourcing.

More particularly, Feenstra and Hanson (1999) distinguish between narrow and broad outsourcing.[7] Both measures are expressed as a share of value-added. The broad definition of international outsourcing, captures all imported intermediates from all *n* industries by a given industry *i*, $\sum_{i=1}^{N} O_{ijt}$:

$$S_O^B = \frac{\sum_{i=1}^{N} O_{ijt}}{VA_{jt}}$$

(1)

The broad definition (which corresponds to the column totals of the import-use matrix) was used in their earlier work. The narrow international outsourcing, S_O^N , only includes imported intermediate inputs by a given industry from the same industry (which corresponds to the diagonal terms of the import-use matrix):

$$S_O^N = \frac{O_{i=j,t}}{VA_{jt}}$$

(2)

The narrow definition is preferred by Feenstra and Hanson, as it is thought to come closer to the essence of fragmentation which necessarily takes place within the same industry. The narrow measure of outsourcing seems particularly appropriate at relatively high levels of aggregation (2-digit).[8]

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7. Note that the formal representations are based on import-use matrices (rather than combined-use matrices as in Feenstra and Hanson, 1996, 1999). Feenstra and Hanson combine data on total intermediate purchases with trade data in order to obtain imported intermediate inputs.

8. The distinction between narrow and broad outsourcing as introduced by Feenstra and Hanson (1999) may not be without problems, as it is entirely based on the way industries are classified. From a fragmentation perspective, it may well be the case that industries are classified at an unequal level of disaggregation. Compare, for example, the two following industries: "motor vehicles and parts" and "textiles". Both industries are classical examples where fragmentation occurs. However, "automobiles and parts" is represented in the input-output tables for the UK as one single industry, whereas textiles are made up of 10 different industries. As a result, the narrow measure of outsourcing will not pick up much of the outsourcing in textiles. The broad measure, on the other hand, will be distorted through the inclusion of packaging and raw materials.

■ INTERNATIONAL OUTSOURCING IN THE UNITED KINGDOM

In order to illustrate the discussion on data and measurement in the section above, a number of stylised facts on international outsourcing are documented using data for the United Kingdom, for the period 1975-1994. This reseach concentrates on data for the United Kingdom as internationally comparable data suitable to the analysis of international outsourcing are not available. Input-output tables are used as they provide the most appropriate source to analyse the importance of international outsourcing, across sectors and over time.

Specifically, the data on imported intermediate goods are obtained from the United Kingdom Input-Output Analytical Tables (I-O ATs), which are compiled approximately every five years by the Office for National Statistics (ONS). The I-O ATs are derived from the Input-Output Supply and Use Tables (I-O SUTs) which were compiled approximately every five years until 1991 and annually from 1992 onwards.[9] The I-O tables are consistent with the National Accounts. Importantly, the I-O ATs distinguish between intermediate purchases from domestic suppliers ("domestic use matrix") and imported intermediate purchases ("import use matrix").[10]

Compared to Feenstra and Hanson (1996, 1999), who employ combined-use matrices, in combination with trade data, using import-use matrices has the advantage that outsourcing is no longer driven by increased import penetration of all goods. Increased import penetration refers both to trade in intermediates and trade in final goods. A measure of outsourcing defined as trade in intermediates may therefore be biased when final goods are included, i.e. the significance of outsourcing may be underestimated when trade in intermediates grows faster than trade in final goods.[11] This remainder of this section describes the significance of imported intermediate inputs in terms of value-added using the import-use matrices from the I-O ATs for the period 1974-1995.[12]

TABLE 1 shows the significance of total imported intermediate inputs for manufacturing and by main supplying sector. The outsourcing debate evolves around the alleged employment

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9. The I-O SUTs provide detailed information on the supply and demand for products in terms of industries. Consequently, the I-O SUTs constitute a rich source of information on the interdependence between industries and institutional sectors.

10. I-O ATs are symmetric by construction, showing the interdependence between either products and products or industries and industries. The present study uses product-by-product tables, which are recommended as the industry-by-industry tables are associated with certain conceptual problems that are not encountered in the product by product tables. The product-by-product tables are also less vulnerable to structural change resulting from mergers and acquisitions or fragmentation of production (ONS, 2002).

11. Strictly speaking, the distinction between imported intermediate inputs and domestic purchases is imputed by the statistical office rather than directly observed. Consequently, the information contained in import-use tables also only provides an approximation to the actual value of imports of intermediates. Nevertheless, one would still expect that these imputations yield more precise information than calculations based on combining combined-use tables and trade statistics.

12. The original data were compiled in three different classifications, SIC68, SIC80, and SIC92. Correspondences were constructed between all three classifications. The large changes in the industrial classification for the UK prevent us from constructing a time-consistent dataset at a more disaggregated level.

effects of international outsourcing of manufacturing products in particular. Moreover, we would expect that these employment effects derive primarily from outsourcing within narrowly defined industries.

Table 1 -   Imported intermediate purchases by UK manufacturing

Year	Imported intermediate purchases from same industry (narrow)	Total imported intermediate purchases	Primary Inputs	Manufacturing inputs	Energy	Services
1974	0.256	0.399	0.010	0.345	0.000	0.044
1979	0.220	0.421	0.061	0.311	0.012	0.037
1984	0.228	0.408	0.055	0.329	0.006	0.019
1990	0.251	0.414	0.039	0.367	0.000	0.009
1995	0.290	0.451	0.028	0.404	0.001	0.018

Note: Imported intermediate inputs are expressed in terms of value-added.

The table shows that imported intermediate inputs by the same supplier industry declined in significance during the 1970s, their importance then increased substantially during the late 1980s and early 1990s, rising from 22% in 1979, to 29% of value-added in 1995. Total intermediate purchases remained fairly constant over the period 1974-1990, but seem to have increased substantially during the first half of the 1990s, growing from 40% to 45% of value-added. The increase in the weight of total imported manufacturing inputs seems to derive entirely from the greater role of imported intermediate inputs from the same industry.

It should further be noted that, in spite of the claims in the popular media, the data do not suggest a major role for international outsourcing of services. Even if international outsourcing of services has increased substantially from 1995 onwards, the point where our data end, the importance of international outsourcing of services in the economy is unlikely to be anywhere close to that of manufacturing, in the near future.[13] These conclusions are in line by those obtained by Amiti and Wei (2005).

TABLE 2 reports the trend in the significance of imported intermediate inputs from the same industry (narrow outsourcing), from other manufacturing industries (differential outsourcing) and from all manufacturing industries including from the importing industry (broad outsourcing) by individual manufacturing industries. The table shows that the importance of international outsourcing differs widely across industries and that a common trend does not exist. The discussion will concentrate on narrow outsourcing as this measure seems to relate most closely to the outsourcing debate.

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13. The importance of services outsourcing, by the whole UK economy (not just manufacturing) as a share of domestic value-added fell from 5.8 % in 1974 to 2.2 % in 1990, and then increased slightly to 3.8 % in 1995.

In 1975, paper and printing, chemicals, wood products, and food, drink and tobacco where the most active outsourcing industries. In 1995, the two most important outsourcing industries were machinery and equipment, and textiles, clothing and leather, none of which were in the top four in 1974. In the machinery and equipment industry, narrow outsourcing increased from 13% to 43% of value-added, whereas narrow outsourcing in the textiles, clothing and leather industry increased from 21% to 43% of value-added.

While, the strong differences in the pattern of international outsourcing, over time and for different industries, may perhaps be surprising, the strong growth of outsourcing in machinery & equipment and in textiles & clothing corresponds well to the anecdotal evidence on outsourcing. It is much less clear what explains the declining importance of trade in intermediates in the food, wood and paper industries. Does the declining importance of trade in intermediates in these industries indicate that processing activities which were formerly conducted abroad are increasingly relocated back home, or does this reflect other structural changes that have occurred concurrently in those industries? It does not seem unlikely that the degree of processing abroad of the components imported in these industries is minimal. Indeed, such imports may well reflect the abundance of natural resources, rather than a desire to save labour costs. To the extent that this is true, it reflects a weakness of trade in intermediates as a measure of international outsourcing.

The wide disparities in the importance of outsourcing across industries raise a number of important issues. First of all, trade in intermediates may not always reflect international outsourcing, or at the very least, it may represent very different types of outsourcing. Trade in intermediates may be related to the availability of natural resources, but may also reflect highly specific knowledge used by specialised suppliers. Second, not all industries are equally suitable to outsourcing. In other words, economic incentives (international cost differences) alone do not explain why firms engage in international outsourcing. Technical obstacles to splitting up the production process or the importance of quality management may make outsourcing an unattractive strategy to reduce costs in some industries.

Future research could be fruitfully directed towards improving our understanding of the divergent outsourcing experiences across industries, and of the determinants of international outsourcing more generally. A useful approach may be to focus on specific industries, both for our understanding of the determinants but also when analysing the consequences of outsourcing. Both the need for industry specific knowledge to explain the observed findings and the heterogeneity across industries favour a more eclectic approach. The second part of the paper will now concentrate on the labour demand effects of international outsourcing.

Table 2 -   Imported intermediate purchases by industry

Manufacturing industry	Year	Value added (Millions £)	Narrow outsourcing	Differential outsourcing	Broad outsourcing
Total machinery and equipment	1974	9 600	0.129	0.008	0.137
	1979	18 721	0.183	0.066	0.249
	1984	26 660	0.218	0.081	0.300
	1990	36 865	0.325	0.142	0.466
	1995	43 097	0.431	0.131	0.562
Food, drink and tobacco	1974	2 534	0.416	0.014	0.430
	1979	6 263	0.242	0.031	0.273
	1984	9 368	0.219	0.066	0.284
	1990	15 916	0.163	0.064	0.227
	1995	18 260	0.134	0.091	0.225
Textiles, clothing and leather	1974	2 474	0.209	0.033	0.242
	1979	4 297	0.254	0.128	0.382
	1984	5 062	0.347	0.114	0.461
	1990	7 344	0.381	0.118	0.499
	1995	7 767	0.428	0.090	0.518
Wood products	1974	611	0.449	0.284	0.733
	1979	1 377	0.436	0.096	0.532
	1984	2 103	0.306	0.153	0.459
	1990	1 860	0.352	0.063	0.416
	1995	1 918	0.219	0.134	0.353
Paper and printing	1974	1 458	0.546	0.056	0.602
	1979	3 623	0.327	0.037	0.364
	1984	6 869	0.295	0.057	0.353
	1990	13 194	0.238	0.048	0.286
	1995	17 582	0.242	0.061	0.303
Chemicals	1974	1 631	0.487	0.368	0.855
	1979	4 007	0.300	0.156	0.456
	1984	7 085	0.313	0.136	0.449
	1990	11 652	0.311	0.062	0.372
	1995	15 311	0.387	0.052	0.439
Rubber & Plastics	1974	690	0.037	0.166	0.202
	1979	1 600	0.079	0.333	0.411
	1984	2 645	0.060	0.390	0.451
	1990	5 194	0.051	0.436	0.487
	1995	6 789	0.056	0.341	0.398
Non-metallic mineral products	1974	1 032	0.019	0.061	0.080
	1979	2 199	0.075	0.076	0.151
	1984	3 245	0.055	0.104	0.159
	1990	4 360	0.049	0.088	0.137
	1995	5 158	0.037	0.082	0.118
Basic metals & fabricated metal products	1974	2 302	0.473	0.341	0.813
	1979	4 243	0.235	0.034	0.269
	1984	6 385	0.177	0.047	0.224
	1990	13 648	0.229	0.051	0.281
	1995	16 124	0.253	0.062	0.315
Furniture and miscellaneous	1974	459	0.049	0.047	0.096
	1979	850	0.101	0.682	0.784
	1984	915	0.054	0.415	0.469
	1990	3 176	0.017	0.379	0.395
	1995	4 857	0.021	0.367	0.387

Note: Imported intermediate inputs from manufacturing by manufacturing expressed in terms of value-added.

■ METHODOLOGY

This section describes the methodology that typically has been used to analyse the impact of international trade and outsourcing on labour demand. Consequently, this method is usually referred to as the factor demand or labour demand approach. The method has been widely used to study the determinants of factor demand. While the methodology has been applied to trade and outsourcing alike, it is arguably more appropriate in the context of outsourcing.

The factor demand approach is based on the theory of the representative firm. The idea of the representative firm implies that all firms share the same technology and produce on the same scale. The labour demand approach thus represents a partial equilibrium framework, as it is implicitly embedded in a single sector setting. For the representative firm, labour supply can be considered perfectly elastic so that firms decide on labour demand, for given wages.[14] Consequently, the focus is on analysing labour demand rather than wages. Given wages, firms minimise costs by determining the profit-maximising vector of inputs.[15]

More specifically, firm i's cost function can be represented by $C_i(w_i, x_i, z_i)$, which is a function of factor prices w (for the flexible factors), output and input quantities x (output and fixed input quantities) and some additional demand shifters z, such as international outsourcing. By Shephard's lemma the partial derivatives with respect to factor prices give factor demand, L_D.

$$C_w = L_D(w, x, z) \qquad (3)$$

Factor demand is thus considered to be a function of the prices of flexible factors, fixed inputs and output quantities and some additional demand shifters. Typically, labour is assumed to be perfectly mobile across firms, whereas capital is generally considered to be firm-specific. To the extent that capital is fixed, it is possible to refer to (3) as labour demand rather than factor demand.

Analysing labour demand at the industry level – which most studies on trade and wages tend to do – has two important consequences. Firstly, labour supply may no longer be considered perfectly inelastic, but instead will be upward-sloping. A change in industry-level labour demand may well affect wages, i.e. wages become endogenous. An increase in the demand for labour at the industry level might only be possible when industry-level wages rise sufficiently to induce an increase in the participation rate (labour supply). Secondly, the idea of the representative firm cannot be transposed to the level of the industry, as industries are usually defined on the basis of their technology. Industries, unlike firms, are not supposed to be identical. Allowing for labour mobility across industries in a small-open economy, implies that labour market adjustment following a labour demand shock will occur through some combination of changes in relative output quantities, changes in relative wages and changes in rela-

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14. For this reason a cost-function approach is ideal.
15. The price elasticity of labour demand consists of substitution and scale effects. For cost-minimising firms, this will always be negative, which implies that the labour demand curve is downward-sloping.

tive labour use. At the industry level factor, demand regressions might therefore be viewed as the empirical implementation of the (short-run) specific-factors model in trade theory.[16]

An important difference between the standard specific-factors model and the standard version of the labour demand approach is that the latter takes outputs and wages as given, while in the former, outputs and wages adjust in response to labour demand shocks (in the usual exposition of the model due to a change in relative output prices). This suggests that the presence of outputs and wages on the right-hand side might give rise to simultaneity bias, which ought to be taken into account in the empirical analysis.

The vector z in the cost function usually includes a number of variables that are considered to have contributed to the shift in relative factor demand. Two types of demand shifters have been included. First, demand shifters that account for the factor bias of technological change. These variables change the production technology of a particular industry. Variables that have been used to account for factor-biased technological change are typically based on computer use or R&D intensity. International outsourcing constitutes an alternative source of factor-biased technological change. Second, demand shifters have been included to capture composition effects within industries, in order to explain shifts in relative labour demand. The most common variable in this category is import penetration.[17]

The factor demand approach is neutral with respect to the channel of adjustment. With a perfectly inelastic labour supply, labour markets adjust in response to a labour demand shock by a combination of changes in wages and changes in the output mix. In rigid labour markets, wages and outputs do not adjust fully to clear the labour market. Instead, a relative labour demand shock will be reflected by an increase in unemployment of the factor whose relative demand falls.

When using a translog cost function, the labour demand equation has the labour cost share as the dependent variable, which is both a function of wages and employment. In practice, labour demand shocks are not observed, but instead only the change in relative labour demand after wages *and* employment have adjusted, is observed. Thus, when using a translog cost function it is not possible to differentiate between adjustment through changes in factor prices or through changes in factor quantities. It is not surprising, therefore, that an increase in the relative demand for skilled labour has been interpreted as an increase in wage inequality in economies with flexible labour markets, such as the US and the UK.[18]

Applied economists analysing the impact of a labour demand shock in the presence of labour market rigidities have sometimes replaced the cost shares by relative employment (Anderton and Brenton, 1999; Egger, Pfaffermayr and Wolfmayr-Schnitzer, 2001; Egger and Egger,

16. It should be noted that in the specific-factor model, the number of factors necessarily exceeds the number of goods. The labour-demand curve will therefore be downward-sloping.
17. Recently, theoretical models have been proposed that explicitly account for such composition effects, based on the presence of firm heterogeneity within industries. See for example Jean (2002).
18. The general equilibrium interpretation of the factor demand approach breaks down. By assuming that wages are industry-specific, it is effectively assumed that none of the factors is mobile across industries.

2003; Strauss-Kahn, 2003). This specification solves potential endogeneity problems associated with the wage variables in cost share regressions.

It could be of interest, however, to know how the labour market adjusts in response to changes in relative labour demand. The impact of a change in relative wages in response to a change in relative labour demand due to, for example, outsourcing, could be derived by multiplying the sum of the changes in factor demand across sectors by the aggregate elasticity of substitution, as it is sometimes done in factor content studies.

The impact of international outsourcing on wages in the long-run, however, is best analysed using the so-called mandated wage methodology, which involves implementing the zero-profit conditions. Studies on the long-run wage effects of international outsourcing are presented by Feenstra and Hanson (1999) for the United States, Hijzen (2005) for the United Kingdom and Egger *et al*. (2001) for Austria.

▉ THE EVIDENCE

This section reviews the empirical evidence on a country-by-country basis. Rather than giving a complete overview of the vast literature on international outsourcing, trade and labour markets, this review specifically concentrates on the impact of international outsourcing on the skill structure of labour demand. TABLE 3 at the end of the section presents an overview of the effects of international outsourcing, found in the literature.

United States

Berman, Bound and Griliches (1994) are the first to apply relative labour demand regressions to analyse the sources of the widening wage gap. Moreover, their work has received a lot of attention for their analysis of skill upgrading, across and within sectors, by decomposing changes in relative labour demand into changes within and between industries. Although the method used was not new, the simple way in which it was presented and the strong conclusions drawn from it, have rendered it widely popular.

Moreover, they start off by assuming that within-industry upgrading is due to skill-biased technological change (SBTC), and between-industry upgrading from either international trade or defence procurement. As they find that within-industry changes in relative labour demand dominate, they conclude that trade cannot be the predominant source of the increase in wage inequality. Consequently, they propose to use factor demand regressions, as these allow focussing explicitly on the change in relative demand, within industries.

Berman *et al*. observe that in the US, the share of skilled wages in the total wage bill accelerated over time from an annual increase of 0.07% for the period 1959-1973 to 0.21% for 1973-1979 to 0.47% for 1979-1987. They include two indicators of SBTC in the labour demand regressions: investment on computers over total investment and expenditure on R&D. The results indicate that together these measures account for around 70% of the variation in the cost share of skilled labour.

Feenstra and Hanson (1995, 1996) are the first to approach the question of wage inequality from the angle of international outsourcing, while adopting the methodology advanced by Berman *et al.* (1994). Feenstra and Hanson measure outsourcing by imported intermediate inputs, which are obtained by combining disaggregated data on total intermediate purchases from the Census of Manufacturers with international trade statistics.

The regression results do not attribute a significant role for outsourcing in determining relative wages during the 1970s, but indicate that outsourcing has played a major role during the 1980s. Outsourcing is estimated to have accounted for about 30% to 50% of the increase in the skilled cost share in the wage bill. This is considerably more than the proportion explained by their import penetration variable. They argue that this is because outsourcing directly estimates "the extent to which industries move production offshore" (p. 244), i.e. the change in relative labour demand within industries. The different pattern between the 1970s and 1980s might be explained by the dramatic rise in the importance of trade with developing countries in recent years.

Feenstra and Hanson (1999) refine their measure of outsourcing by distinguishing between narrow and broad outsourcing, where narrow outsourcing refers to imported intermediate purchases from the same industry and broad outsourcing refers to all imported intermediate inputs. Feenstra and Hanson prefer the narrow definition, as it is thought to come closer to the real idea of outsourcing which involves shifting parts of the production process abroad. Moreover, the narrow measure excludes packaging and raw materials, intermediate inputs that tend to obscure the real trend in outsourcing.[19]

When re-estimating relative labour demand using an updated dataset and the refined measures of outsourcing, they find that narrow outsourcing is indeed more important in explaining changes in the cost shares than the remainder of imported, intermediate purchases. Total outsourcing accounts for 13%-23% of the variation, and technology for about 8%-32% (the latter being very sensitive to the proxy used). They conclude that both outsourcing and SBTC are important.

United Kingdom

Anderton and Brenton (1999) analyse the impact of outsourcing on wage inequality in the UK, for the textiles and non-electrical machinery industries over the period 1970-1983. They measure outsourcing by import penetration from developed and developing countries respectively. However, they do not consider trade in intermediates, which constitutes the essence of outsourcing, but focus instead on total imports. They argue that outsourcing accounts for about 40% of the increase in wage inequality and one third of the change in the structure of employment in textiles.[20]

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19. Especially because the input-output matrix does not distinguish between imported intermediate inputs and domestically purchased intermediate inputs.

20. It is interesting to note that although both textiles and non-electrical machinery exhibit high levels of outsourcing, the negative impact of outsourcing on unskilled workers in textiles, which is considered to be unskilled-intensive, appears to be larger than in the more skill-intensive, non-electrical machinery industries. This may suggest that both sectors are subject to different types of outsourcing. Outsourcing in unskilled-intensive industries might be predominantly driven by the desire to exploit wage differences across countries, whereas outsourcing in skill-intensive industries may also be motivated by other objectives such as "technological sourcing".

Hijzen *et al.* (2005) re-examine the employment effects of international outsourcing in the United Kingdom, for the period 1982 to 1996. Extending the analysis to the 1990s is considered to be crucial, as outsourcing is predominantly a phenomenon of the 1990s. In order to analyse the employment effects of outsourcing, they adopt the methodology introduced by Feenstra and Hanson (1996) and extend it in two ways.

First, they use more detailed definitions of outsourcing and skills. International outsourcing is defined following its narrow definition, by using import-use matrices of input-output tables for manufacturing industries. Instead of using the manual/non-manual distinction to measure skills, they consider three levels of skills based on the standard occupational classification of workers.

Second, for the econometric analysis, they estimate a system of variable factor demands rather than a single equation of relative labour demand. The key advantage of estimating a system is that inferences can be made both about the absolute and the relative impact of international outsourcing on the demand for different types of workers.

The econometric results suggest that international outsourcing has a negative impact on the demand for workers, and a positive impact on the use of materials. Outsourcing thus reflects substitution of value-added within the firm, to inputs purchased from elsewhere. In their preferred specification, the impact of outsourcing on skilled and semi-skilled labour is statistically insignificant, whereas its impact on the demand for unskilled workers is statistically and economically significant. In their study, unskilled workers consist mainly of industrial plant and machine operators. Hence, it is concluded that international outsourcing is an important component in explaining changes in the skill structure of manufacturing industries in the United Kingdom.

Germany and Austria

Egger and Egger (2003) analyse the causes and consequences of outsourcing in theory and empirically. They develop a simple partial equilibrium model in which outsourcing is driven by a reduction of trade barriers. Outsourcing may lead to an increase in the relative wage of skilled workers, but not relative employment if labour markets are competitive. If, however, labour markets are unionised, outsourcing is expected to both raise wage and employment inequality. Egger and Egger evaluate their model using data for Austria, for 1990-1998. The empirical analysis confirms the predictions of their model. The results indicate that outsourcing to the East accounts for about a quarter of the increase in the employment of skilled relative to unskilled workers.

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20. It is interesting to note that although both textiles and non-electrical machinery exhibit high levels of outsourcing, the negative impact of outsourcing on unskilled workers in textiles, which is considered to be unskilled-intensive, appears to be larger than in the more skill-intensive, non-electrical machinery industries. This may suggest that both sectors are subject to different types of outsourcing. Outsourcing in unskilled-intensive industries might be predominantly driven by the desire to exploit wage differences across countries, whereas outsourcing in skill-intensive industries may also be motivated by other objectives such as "technological sourcing".

Falk and Koebel (2002) present an interesting study in relation to the German context, for the period 1978-1990. Similar to Hijzen *et al.* (2005) they estimate a system of variable factor demands. However, in contrast to other studies on outsourcing, they model international outsourcing as an endogenous event in which outsourcing depends on the vector of factor prices, capital and output. They find that scale effects reflected by output and capital growth are more important in explaining changes in the skill structure of labour demand, than are substitution effects. Particularly, they conclude that the growing importance of imported intermediate inputs is largely due to scale effects and not so much to input substitution.

France

Finally, Strauss-Kahn (2003) analyses the employment effects of vertical specialisation (i.e. outsourcing) in France, using input-output data for the period 1977-1993. Results indicate that outsourcing accounted for 11%-15% of the shift in relative employment, in favour of skilled workers, during the period 1977-1985 and for about a quarter of the shift during the years 1985-1993.

Table 3 -   Summary of empirical literature

Country	Authors	Period	Coverage	Results
United States	Feenstra and Hanson (1996, 1999)	1979-1990	Manufacturing	Total outsourcing explains 13%-23% and SBTC 8%-32% change relative labour demand
United Kingdom	Anderton and Brenton (1999)	1970-1983	Textiles and non-electrical machinery	Low wage imports explain 40% of decline in cost share unskilled & 33 % of employment share in textiles
	Hijzen, Gorg and Hine (2005)	1982-1996	Manufacturing	Narrow outsourcing reduces the demand for unskilled workers, but not for skilled and semi-skilled workers
Austria	Egger and Egger (2003)	1990-1998	Manufacturing	Outsourcing to CEECs explains 25% of change relative employ-ment
Germany	Falk and Koebel (2002)	1978-1990	Manufacturing	Outsourcing is endogenous; rise largely due to scale rather than substitution effects. Scale effects (output and capital growth) drive changes in skill structure labour demand
France	Strauss-Kahn (2004)	1977-1993	Manufacturing	Broad outsourcing (vertical spe-cialisation) 11%-15% of decline cost share unskilled for 1977-1985, 25% for 1985-1993

■ CONCLUSIONS

International outsourcing has been the subject of an intense debate in many developed countries. While part of the increase in outsourcing may reflect scale effects, outsourcing also did increase substantially in terms of domestic value-added in most developed countries. This trend has been particularly important during the 1990s. Furthermore, it has been suggested that outsourcing is spreading from its traditional domain in manufacturing, to service industries.

This paper has discussed the appropriateness of different data sources and measurements. In most cases, input-output tables provide the most valuable source, as that allow measurement of outsourcing which is consistent over time and across industries. However, the ultimate choice often depends on the specific question at hand.

Using input-output data for the United Kingdom, it is shown that international outsourcing has steadily increased since the early 1980s. Moreover, it is clear that the rise in outsourcing reflects the rise in intermediate input purchases within same the industry. Finally, it should be noted that while international outsourcing has gained in importance in aggregate, wide differences persist across disaggregated industries. Care should therefore be taken in generalising trends in outsourcing across industries.

The second part of the paper concentrates on the labour demand effects of international outsourcing. It describes the basic methodology and reviewes the empirical evidence for a number of industrialised countries. Rather than giving a complete overview of the vast literature on international outsourcing, trade and labour markets, this presentation specifically concentrates on the impact of international outsourcing on the skill structure of labour demand.

The majority of studies find evidence of substitution effects between domestic inputs and imported intermediate purchases. While it may be expected that all types of labour would suffer from outsourcing, most studies find that the demand for unskilled workers is particularly affected. Hijzen *et al*. (2005), who consider three types of workers, find that while all workers may see some reduction in their employment opportunities, workers with the lowest skills are affected most strongly.

A. H.[21]

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