We can work it out – The globalisation of ICT-enabled services*

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* The opinions expressed and arguments employed in this paper do not necessarily reflect the official views of the Organisation or of the governments of its member countries. This paper draws on a larger body of work and a longer paper entitled "New evidence on the potential offshoring of ICT-enabled services" which will be published by the OECD.

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Introduction

This paper builds on previous work looking at the share of employment potentially affected by offshoring[1] (van Welsum and Vickery, 2005b, van Welsum and Reif, 2005a,b). To date there are no official data measuring the extent of offshoring so it is necessary to use indirect measures such as data on trade in services, employment data, input-output tables, and trade in intermediates. Evidence from company surveys can also be a useful complement. This paper combines the information from both trade and employment data to examine the relationship between the share of employment potentially affected by offshoring and other economic and structural developments, using some simple descriptive regressions on a panel of OECD economies between 1996 and 2003. In particular, van Welsum and Reif (2005a,b) provided first estimates of the statistical association between the share of employment potentially affected by service sector offshoring, trade in business services and foreign direct investment.

Contrary to popular belief, that analysis did not find any systematic evidence that net outward investment or imports of business services are associated with significant declines in the share of employment potentially affected by offshoring, at least at the aggregate level. Exports of business services were found to have a positive statistical association with the share of employment potentially affected by offshoring, suggesting that increases in demand and production have also raised demand for these types of ICT-using occupations. Other key factors positively associated with the share of employment potentially affected by offshoring were found to be the comparative size of the service sector, the growing share of ICT investment in total fixed investment, and human capital.

It is important to take care with the interpretation of those results though, as they are not drawn from the empirical testing of a formal theoretical model of the underlying structural relationships. Thus, it is not possible to separate out completely the effects from demand and supply side developments. However, the results provide guidance on the statistical associations that are found to exist between the variables included in these descriptive regressions and to this extent can be used to shape further work and analysis, as proposed for the present paper. This includes improvements to the underpinnings of the empirical model, such as the use of separate indicators for services and non-services FDI, and an examination of whether there are differences in the factors affecting different groups of ICT-using occupations, such as clerical and non-clerical occupations. It would also be useful to develop an indicator of business adoption of ICTs to try to control for differences in "the use of ICT" or the "ICT content of occupations" across countries.

Background

To get an idea of the "outer limits" of employment potentially affected by offshoring, van Welsum and Vickery (2005a) calculate the share of people employed who are mainly performing the type of functions that could potentially be carried out anywhere, using data on employment by occupation by industry. The classifications were not harmonised internationally, but the same methodology and rationale were applied to the individual country data sources[2]. As this analysis was carried out in order to obtain an order of magnitude on the share of people employed performing tasks that could potentially be carried out anywhere, no additional assumptions were made as to what proportion of each occupational group was actually likely to be affected by offshoring in practice. Thus, the whole of each selected occupation was then included in the calculations.

Occupations were selected by examining detailed occupational and task descriptions on the basis of the following four criteria, or "offshorability attributes": (i) intensive use of ICTs, (ii) an output that can be traded/transmitted enabled by ICTs, (iii) high codifiable knowledge content, and (iv) no face-to-face

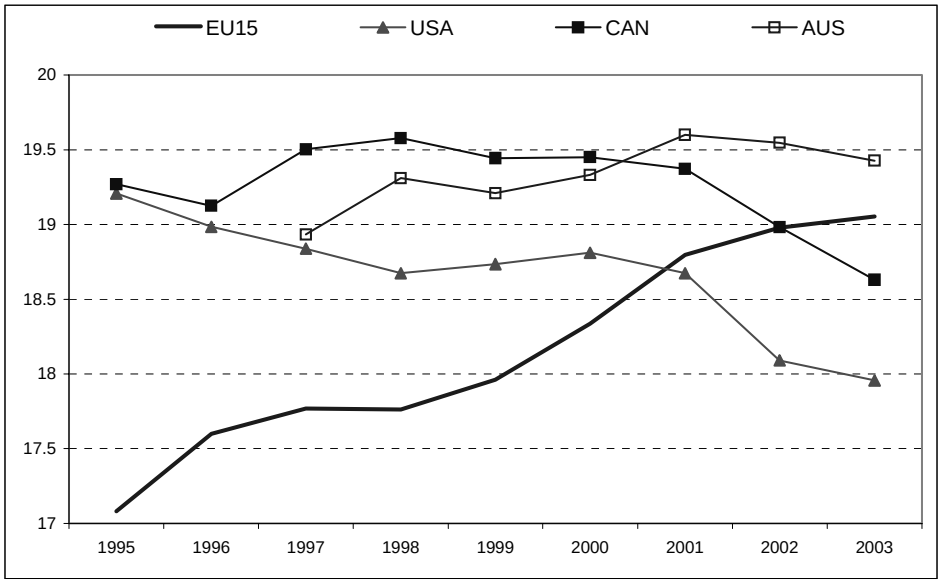
contact requirements. The occupational selections that resulted from this exercise are reported in the Appendix Tables 1 - 4. For further details on the methodological background see van Welsum and Vickery (2005a), van Welsum and Vickery (2005b) and OECD (2004a). This analysis, using occupational data for several OECD countries, suggests that around 20 per cent of total employment carries out the kinds of functions that are potentially geographically footloose as a result of rapid technological advances in ICTs and the increased tradability of services, and could therefore potentially be affected by international sourcing of IT and ICT-enabled services.[3] Nevertheless, as classifications are not harmonised internationally, the levels of these estimates are not directly comparable.

The evolution over time of the share of employment potentially affected by offshoring is illustrated in Figure 1 below. Even though the levels of these shares are not directly comparable, the evolution of the trends is interesting. The share of occupations potentially affected by offshoring in the EU15 increased from 17.1% in 1995 to 19.2% in 2003. For Canada it was more or less flat around 19.5% until 2001, after which it declined to 18.6% by 2003. For the USA the share declined by more than a percentage point from 19.2% in 1995 to 18.1% in 2002[4]. In Australia, the share increased between 1996 and 2001 (except in 1999) but started to decline in 2001.

While it is difficult to draw inferences from these trends without further analysis, since the trends are affected by a multitude of factors, the evolutions shown in these trends are consistent with some casual observations on the ICT-enabled offshoring that is taking place, such as Canada serving as an offshoring location, mainly from the USA, but less so more recently as other locations, e.g. India, have started to emerge. Similarly, Australia possibly also experienced competition for attracting, or keeping, activities that can be sourced internationally from India and other emerging locations in the region. Thus, the declining share in the USA, Canada and Australia towards the end of the period could be consistent with the offshoring of IT-related and backoffice activities (with some "potential offshoring" having become "actual offshoring"), for example, even though this is unlikely to account for all of the decline. Another possible explanation could be a differential pace of technological change with a relatively more rapid adoption and integration of new technologies, leading to relatively more jobs disappearing sooner as they become automated and/or digitised[5]. The increasing share for Europe is compatible with an overall increase in services employment as well as the finding from surveys that European firms tend to offshore within Europe (see Millar, 2002, and Marin, 2004, for example). At least one EU country, Ireland is also a major destination country of offshoring activities from the US (IT-related activities in particular). Other factors could also be important, e.g. cyclical developments and changes in labour supply and labour quality.

Figure 1 The share of ICT-intensive using occupations potentially affected by offshoring in total employment: EU15[1], USA, Canada, and Australia 1995-2003[2]

(percentages)



Note: 1. 1995 and 1996 exclude Finland and Sweden; 1998 excludes Ireland, and 2003 excludes Denmark, Luxembourg and the Netherlands.
2. Because of classification changes, the number for the U.S. for 2003 is an estimate. Due to differences in classifications the levels are not directly comparable.
Source: Author's calculations and van Welsum and Vickery (2005a), based on EULFS, US Current Population Survey, Statistics Canada and Australian Bureau of Statistics (2004/5).

The offshoring phenomenon does not necessarily have to result in a decline in services employment though. Many existing services sectors have expanded, new services have emerged, and with ongoing technological developments and services trade liberalisation it is likely yet more are to be created. Furthermore, with the elasticity of demand of internationally traded services greater than one (e.g. Pain and van Welsum, 2004; van Welsum, 2004; Mann, 2004), rapid growth in countries such as India and China should also lead to reinforced exports from OECD countries. The offshoring phenomenon itself will also create new jobs in the domestic economy. However, it could be that certain types of occupations will experience slower growth than they otherwise might have done.

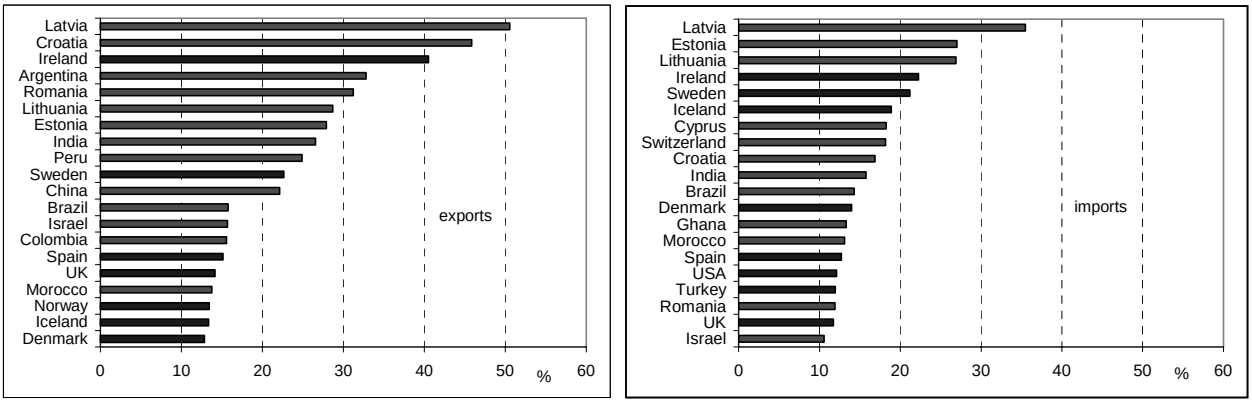
As the trends in Figure 1 are expressed as shares, there are several possibilities to explain changes in these trends. For example, a decline in the share could be explained by an absolute decline in the number of people employed in the categories identified as potentially affected by offshoring. Alternatively, it could be that this selection of occupations is grower at a slower pace than total employment. The relatively slower growth of employment potentially affected by offshoring is in fact what explains most of the declines observed in the trends, except for the US where the absolute number of people employed in the categories identified as potentially affected by offshoring has declined (further details in the Appendix). These observations would therefore tend to support the idea that offshoring may lead to slower growth of employment in occupations potentially affected by offshoring and not necessarily to actual declines in employment.

Examination of data on trade in services (in the categories "other business services' and "computer and information services" reveals that many of the countries often mentioned in the offshoring debate have indeed experienced rapid growth of their trade in those services. However, the exports of many of these

countries are growing from a low base, and many of the countries with strong export growth have also seen strong import growth (Figures 2 and 3 below).

Figure 2 Top 20 export and import growth

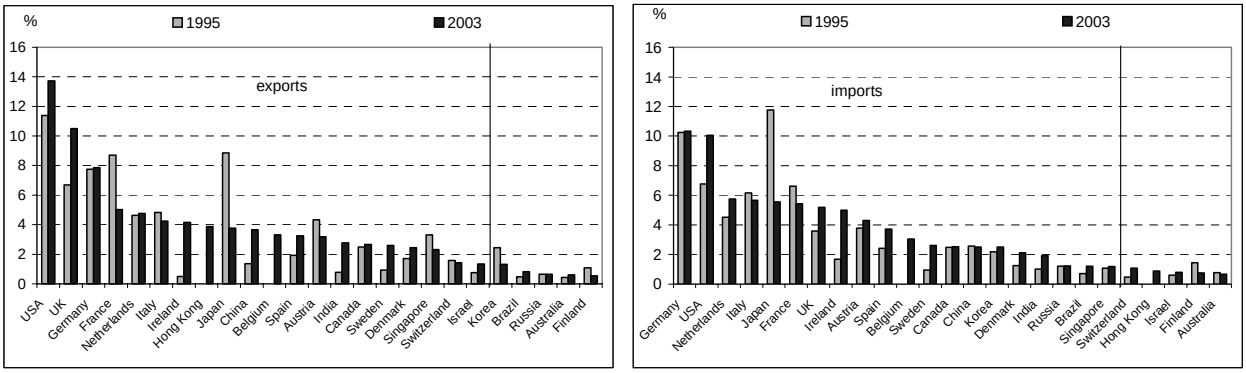
(CAGR 1995-2003)



Source: Authors' calculations based on IMF Balance of Payments Database (August 2005).

Figure 3 Share of the value of reported total[1] exports of other business services and computer and information services, top 20 and selected other countries, 1995 and 2003

Decreasing order of the total reported value share in 2003, percentages



1. The reported total for all countries does not necessarily correspond to a world total. For some countries, such as India, it is not possible to isolate other business services and computer and information services. As a consequence, for India, the category includes total services, minus travel, transport and government services (*i.e.* including construction, insurance and financial services as well as other business services and computer and information services).

Source: Authors' calculations based on IMF Balance of Payments Database (August 2005).

The aim is to extend and improve the underpinnings of the models tested in van Welsum and Reif (2005a,b). Using panel data estimation techniques, those papers attempted to identify those factors that are associated with the share of employment potentially affected by offshoring in total employment for the US, Canada, Australia and the EU15 countries (except Greece, Ireland, Luxembourg, and Portugal)[6] over the period 1996-2003. In the model (see equation (1) below), the share of potentially offshorable employment in total employment (OL) is a function of trade (TRADE), investment (FDI), the industrial structure of the

economy (STRUC), a technology adoption/integration variable (ICT), a product market regulations indicator (PMR), an employment protection indicator (union) and human capital (HK).[7] The choice of variables is motivated by findings from a vast background literature, including studies of the factors determining the overall share of the service sector in the economy, studies of services sector employment, and studies of the effect of trade and technology on employment. See van Welsum and Reif (2005b) for details.

$$OL = f(TRADE, FDI, STRUC, ICT, PMR, union, HK) \quad (1)$$

Ideally, it would have been appropriate to begin with a simple structural model of the factors affecting the relative demand for ICT-using occupations. Using the first order marginal productivity conditions from a (unknown) production function with two types of labour (ICT and non-ICT labour), such a model might be expected to include measures of the relative output and relative wages of ICT-using occupations. Control variables might also be included to pick-up possible differences in the extent of (labour-augmenting) technical progress in the two broad types of occupations. As in the literature on the demand for skilled and unskilled labour, possible controls are indicators for both trade and technology.

Unfortunately, while it is possible to control for output and technology effects directly, data on occupational wages are not readily available in most countries at the level of detail required. Their effect can be captured only indirectly by including a number of variables that can be expected to have an influence on real wages. It should be noted that although it is not possible to estimate a full structural model, the estimates we show are not a pure reduced form model either, since potentially endogenous current dated terms in output and/or trade and technology remain in the model.

New work

The present paper proposes two, and perhaps three, extensions of the existing work:

1. the use of more disaggregated FDI data in a first stage; in a later stage the use of non-FDI indicators, such as affiliate sales, would be desirable even though these data are available for only a few countries
2. breakdown of the dependent variable (the share of employment potentially affected by offshoring) into clerical and non-clerical occupations (as a share of total employment)
3. the inclusion of a measure that controls for differences in the ICT content of occupations across countries

1. Disaggregation of the FDI data

The analysis in van Welsum and Reif (2005b) used a sample of 14 OECD countries: US, Canada, Australia and the EU15 countries except Greece, Ireland, Luxembourg, and Portugal. Using disaggregated FDI data would mean Belgium and Spain also need to be dropped from the sample, leaving a panel of 12 countries. Denmark may also have to be dropped as data are available only for 1999-2002, reducing the panel further to 11 countries.

The OECD FDI data base distinguishes the following sectors.

PRIMARY SECTOR
  Agriculture and Fishing
  Mining and Quarrying
  of which: Extraction of petroleum and gas
MANUFACTURING
of which: Food products
Total textile and wood activities
Total petroleum, chemical, rubber, plastic products
Total metal and mechanical products
Total machinery, computers, RTV, communication
Total vehicles and other transport equipments
SERVICE SECTOR
  Electricity, Gas and Water
  Construction
  Trade and Repairs
  Hotels and Restaurants
  Transports, Communication
  of which: Total land, sea and air transport
Telecommunications
  Financial Intermediation
  of which: Monetary intermediation
Other financial intermediation
of which: Financial holding companies
Insurance and activities auxiliary to insurance
Total other financial intermediation and insurance activities
  Real Estate and Business Activities
  of which: Real estate
  Other Services
UNALLOCATED
TOTAL

As the use of total FDI may distort the estimation results, the use of disaggregated data would be preferred. A breakdown into manufacturing and services FDI is a first step. However, the stock of services FDI is dominated by FDI in types of services that are not necessarily tradable (as in ICT-enabled tradability). Therefore, the effect of FDI in these kinds of services would similar to that of manufacturing FDI and a further disggregation would be preferable. It is difficult to know which category would be most suitable[8] to match the trade categories used (other business and computer and information services), but probably the best approximation would be given by "business activities", which can be obtained by subtracting "real estate" from "real estate and business activities". Unfortunately, this breakdown is not widely available, but "real estate" tends to account for a relatively small share of that category.

The importance of this breakdown is illustrated in the following two tables, showing for in- and outward investment, and for the countries for which the data are available:

- the share of services FDI in total FDI (*svs in total*)
- the share of FDI in real estate and business activities in services FDI (*re+ba in svs*)
- the share of FDI in real estate and business activities in total FDI (*re+ba in total*)
- the share of FDI in business activities in services FDI (*ba in svs*)
- the share of FDI in business activities in total FDI (*ba in total*).

It appears there are a number of breaks and other problems in the (disaggregated) data; these are being investigated.

Table 1 Inward investment shares (%)

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Australia	svs in total	51.6	53.5	48.5	44.6	45.3	47.0	50.3	53.7	49.1	43.4	42.0	44.8	55.5	53.0
	re+ba in svs	29.4	30.4	32.6	29.0	28.4	29.5	27.1	22.6	22.4	21.1	20.7	18.7	16.6	16.1
	re+ba in total	15.2	16.3	15.8	12.9	12.9	13.9	13.6	12.1	11.0	9.2	8.7	8.4	9.2	8.5
	ba in svs														
	ba in total														
Austria	svs in total		60.8	58.7	56.5	60.7	65.2	65.0	69.8	72.8	68.5	71.8	73.9	72.1	
	re+ba in svs		29.6	34.8	35.8	38.1	34.3	36.3	34.2	39.7	41.6	38.7	47.6	45.8	
	re+ba in total		18.0	20.4	20.3	23.1	22.4	23.6	23.9	28.9	28.5	27.8	35.1	33.0	
	ba in svs						32.3	33.8	31.9	38.0	39.8	37.5	46.7	44.3	
	ba in total						21.1	22.0	22.3	27.7	27.3	26.9	34.5	32.0	
Canada	svs in total	26.4	57.2	58.3	57.2	58.5	61.7	63.0	61.6	62.5	32.5	26.5	29.7	29.3	28.8
	re+ba in svs														
	re+ba in total														
	ba in svs														
	ba in total														
Denmark	svs in total		72.4			67.8				79.6	86.9	90.6	88.3	84.1	
	re+ba in svs		16.5			23.5				24.5	44.0	64.8	68.1	65.9	
	re+ba in total		11.9			15.9				19.5	38.2	58.7	60.2	55.5	
	ba in svs		15.0			17.4				23.6	42.2	63.6	67.0	64.7	
	ba in total		10.9			11.8				18.8	36.7	57.6	59.2	54.4	
Finland	svs in total	45.2	41.8	37.3	31.2	37.6	39.5	38.8	37.9	45.2	47.3	53.5	58.4	59.8	
	re+ba in svs					11.6	8.9	6.8	9.0	5.6	6.1	15.2	16.9	14.3	
	re+ba in total					4.4	3.5	2.6	3.4	2.6	2.9	8.1	9.9	8.6	
	ba in svs					11.3	8.0	6.6	9.0						
	ba in total					4.2	3.2	2.5	3.4						
France	svs in total	55.4	45.9	59.1	61.0	63.5	60.4	58.1	60.0	58.3	71.7	60.9	81.1	80.6	
	re+ba in svs			2.6	1.8	1.7	2.4	2.9	40.8	34.4	61.2	78.3	63.4	64.1	
	re+ba in total			1.5	1.1	1.1	1.4	1.7	24.5	20.1	43.9	47.7	51.4	51.6	
	ba in svs			1.0	0.4	0.4	0.6	0.6	38.0	31.4	59.9	62.6	51.1	50.3	
	ba in total			0.6	0.2	0.2	0.4	0.4	22.8	18.3	42.9	38.1	41.5	40.5	
Germany	svs in total	63.4	64.1	67.8	72.6	75.5	76.1	79.0	79.3	81.5	84.1	89.6	88.4	88.2	
	re+ba in svs	58.9	55.1	59.2	63.2	67.0	68.7	72.4	72.7	73.4	76.8	83.8	83.7	85.2	
	re+ba in total	37.4	35.3	40.2	45.9	50.6	52.3	57.2	57.7	59.8	64.5	75.1	74.0	75.1	
	ba in svs	56.5	52.5	56.3	60.9	64.7	66.6	70.2	70.9	71.8	75.6	83.3	83.1	84.6	
	ba in total	35.9	33.7	38.1	44.3	48.8	50.7	55.5	56.2	58.5	63.6	74.6	73.4	74.6	
Italy	svs in total	58.3	56.4	55.9	58.3	59.1	58.5	59.7	59.9	59.9	60.3	56.2	56.0	54.0	
	re+ba in svs														
	re+ba in total														
	ba in svs														
	ba in total														
Netherlands	svs in total	43.6	44.6	46.8	52.9	51.3	55.2	53.8	54.9	55.2	62.7	65.8	63.0	62.2	
	re+ba in svs				17.7	23.2	21.7	20.6	20.1	19.9	17.9	16.8	16.8	18.5	
	re+ba in total				9.4	11.9	12.0	11.1	11.0	11.0	11.2	11.1	10.6	11.5	
	ba in svs				3.4	4.8	5.0	3.7	3.7	3.5	3.1	4.5	5.2	5.1	
	ba in total				1.8	2.5	2.8	2.0	2.1	1.9	2.0	2.9	3.3	3.2	
Sweden	svs in total	47.9	37.0	49.5	50.0	45.8	33.0	36.2	42.4	40.4	35.5				
	re+ba in svs														
	re+ba in total														
	ba in svs														
	ba in total														
United Kingdom	svs in total	40.6	41.5	38.6	39.4	42.3	46.6	50.1	56.9	59.0	63.2	67.4	61.0	63.6	
	re+ba in svs					12.3	10.9	10.1	11.8	14.2	9.8	14.7	16.3	17.7	
	re+ba in total					5.2	5.1	5.1	6.7	8.4	6.2	9.9	9.9	11.2	
	ba in svs					11.9	9.6	9.2	10.7	13.0	9.0	13.8	15.2	17.1	
	ba in total					5.1	4.5	4.6	6.1	7.7	5.7	9.3	9.3	10.9	
United States	svs in total	47.1	63.9	64.1	54.7	51.3	51.0	48.6	52.3	49.6	55.8	60.5	62.4	62.4	62.9
	re+ba in svs		2.5	2.3	2.4	8.4	5.6	4.3	5.0	5.8	15.2	14.9	20.2	19.6	22.5
	re+ba in total		1.6	1.5	1.3	4.3	2.9	2.1	2.6	2.9	8.5	9.0	12.6	12.2	14.2
	ba in svs		2.5	2.3	2.4	8.4	5.6	4.3	5.0	5.8	15.2	14.9	20.2	19.6	22.5
	ba in total		1.6	1.5	1.3	4.3	2.9	2.1	2.6	2.9	8.5	9.0	12.6	12.2	14.2

Source: OECD, Direct Investment Statistics Database (2005)

Table 2 Outward investment shares (%)

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Australia	svs in total	48.7	50.9	40.6	36.4	38.7	35.1	35.3	40.0	28.5	33.4	25.9	28.6	44.7	40.7
	re+ba in svs	8.2	7.6	6.5	2.1	4.6		7.2	6.8	7.6	4.8	4.7	6.6	14.3	18.4
	re+ba in total	4.0	3.9	2.7	0.8	1.8		2.5	2.7	2.2	1.6	1.2	1.9	6.4	7.5
	ba in svs														
	ba in total														
Austria	svs in total	64.0	62.4	63.7	68.1	68.8	69.9	72.8	73.5	74.0	73.3	75.3	73.5	79.3	
	re+ba in svs	48.8	52.6	48.3	41.6	41.9	38.6	44.8	43.1	44.5	45.9	50.6	47.0	44.4	
	re+ba in total	31.2	32.8	30.8	28.3	28.8	27.0	32.7	31.7	32.9	33.6	38.1	34.5	35.2	
	ba in svs						34.9	40.9	35.2	34.1	35.5	42.1	38.6	37.2	
	ba in total						24.4	29.8	25.9	25.2	26.0	31.7	28.3	29.5	
Canada	svs in total	37.4	74.0	72.3	71.6	71.8	70.4	69.5	69.4	70.5	45.1	45.9	50.4	54.4	53.1
	re+ba in svs														
	re+ba in total														
	ba in svs														
	ba in total														
Denmark	svs in total		66.8			61.9				70.6	73.1	79.7	78.7	75.5	
	re+ba in svs		25.8			42.5				62.8	64.9	74.4	72.0	69.1	
	re+ba in total		17.2			26.3				44.3	47.5	59.3	56.6	52.1	
	ba in svs		19.2			36.2				61.2	63.9	73.9	71.3	68.2	
	ba in total		12.9			22.4				43.2	46.7	58.8	56.1	51.4	
Finland	svs in total	27.4	27.1	16.7	14.6	14.5	10.4	8.9	5.8	14.1	14.2	26.6	26.8	21.9	
	re+ba in svs					5.8	15.1	3.5	-6.6	-2.4	4.5	10.2	9.0	16.3	
	re+ba in total					0.8	1.6	0.3	-0.4	-0.3	0.6	2.7	2.4	3.6	
	ba in svs					5.7	5.1			-1.2	5.1				
	ba in total					0.8	0.5			-0.2	0.7				
France	svs in total	49.5	52.8	53.4	54.8	56.0	56.0	57.0	56.2	58.6	60.5	73.2	81.3	81.3	
	re+ba in svs			1.2	0.6	0.6	0.1	31.5	31.8	24.1	21.6	45.6	53.3	51.4	
	re+ba in total			0.7	0.3	0.3	0.1	17.9	17.9	14.1	13.1	33.4	43.3	41.8	
	ba in svs			0.2	0.1	0.1	0.0	29.4	29.8	22.3	20.1	43.2	51.6	49.4	
	ba in total			0.1	0.1	0.1	0.0	16.7	16.8	13.1	12.2	31.7	41.9	40.2	
Germany	svs in total	65.9	65.3	66.2	67.2	66.1	67.6	68.5	68.2	65.7	72.4	75.4	79.8	80.1	
	re+ba in svs	42.6	42.3	40.7	42.0	40.4	42.0	43.1	45.3	46.3	55.5	57.3	53.3	58.0	
	re+ba in total	28.1	27.6	26.9	28.2	26.7	28.4	29.5	30.9	30.4	40.2	43.2	42.6	46.4	
	ba in svs	39.3	40.0	38.4	39.9	38.3	40.0	41.2	43.4	44.0	53.5	55.7	51.8	56.3	
	ba in total	25.9	26.1	25.4	26.8	25.3	27.1	28.2	29.6	28.9	38.7	41.9	41.3	45.2	
Italy	svs in total	58.2	59.6	62.0	64.5	64.1	64.8	64.3	63.5	65.2	60.3	62.3	59.3	57.6	
	re+ba in svs														
	re+ba in total														
	ba in svs														
	ba in total														
Netherlands	svs in total	41.7	43.2	43.9	47.3	49.5	49.5	48.0	48.7	51.9	53.5	56.5	55.5	55.6	
	re+ba in svs				21.8	20.3	19.2	18.2	17.3	17.8	15.3	14.3	15.3	15.8	
	re+ba in total				10.3	10.1	9.5	8.7	8.4	9.2	8.2	8.1	8.5	8.8	
	ba in svs				3.0	2.7	2.9	2.7	2.6	3.7	3.6	4.1	4.9	4.1	
	ba in total				1.4	1.4	1.4	1.3	1.3	1.9	1.9	2.3	2.7	2.3	
Sweden	svs in total	31.2	31.1	31.8	38.9	33.3	31.7	27.7	27.0	26.0	29.5				
	re+ba in svs						5.3	7.4							
	re+ba in total						1.7	2.1							
	ba in svs														
	ba in total														
United Kingdom	svs in total	39.9	42.3	40.7	42.1	42.4	40.1	42.5	46.7	46.3	51.8	63.9	57.0	62.5	
	re+ba in svs					26.8	23.1	25.0	20.4	19.3	15.9	13.6	10.6	10.2	
	re+ba in total					11.4	9.3	10.6	9.5	8.9	8.3	8.7	6.0	6.4	
	ba in svs					23.5	19.8	22.5	18.3	17.5	15.3	12.8	9.5	9.3	
	ba in total					10.0	8.0	9.6	8.5	8.1	7.9	8.2	5.4	5.8	
United States	svs in total	46.9	48.1	50.0	53.4	49.2	55.2	56.0	58.3	60.4	67.0	68.3	72.0	73.3	73.3
	re+ba in svs	2.7	2.0	3.2	3.3	6.7	6.0	6.8	7.6	7.0	44.9	47.0	49.8	51.9	51.8
	re+ba in total	1.3	1.0	1.6	1.8	3.3	3.3	3.8	4.4	4.2	30.1	32.1	35.9	38.1	37.9
	ba in svs	2.7	2.0	3.2	3.3	6.7	6.0	6.8	7.6	7.0	44.9	47.0	49.8	51.9	51.8
	ba in total	1.3	1.0	1.6	1.8	3.3	3.3	3.8	4.4	4.2	30.1	32.1	35.9	38.1	37.9

Source: OECD, Direct Investment Statistics Database (2005)

2. Breakdown of the dependent variable

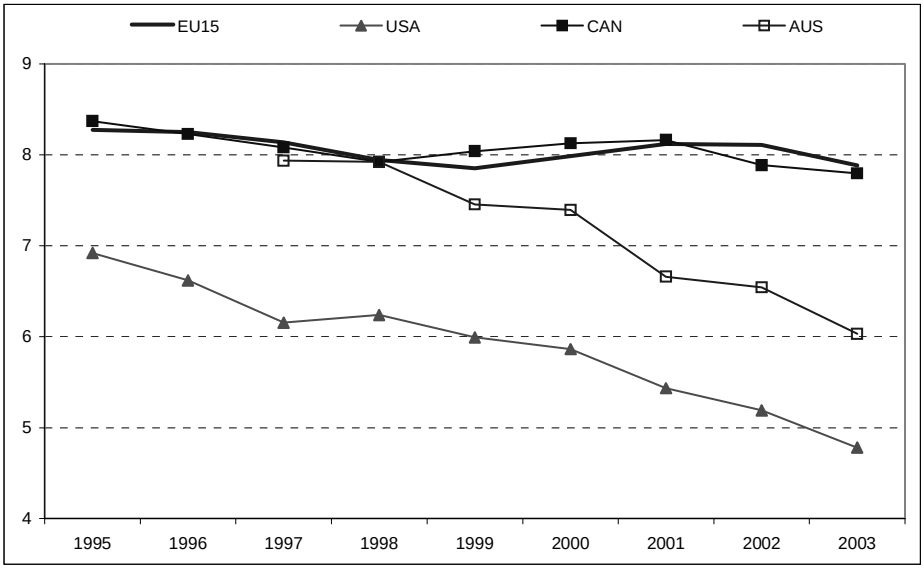
As offshoring and technology may have a different effect on workers with different types of skills (e.g. Autor *et al*, 2003), the share of employment potentially affected by offshoring is broken down into two sub-categories: clerical and non-clerical occupations potentially affected by offshoring (Figures 4 and 5). This is important as the clerical group includes the types of jobs that can be substituted for by ICTs (through the digitisation and/or automation of certain tasks and types of codifiable knowledge) so differential pace of adoption and integration of technology can have a different effect across countries.

Looking at the share for each country at the beginning and end of the respective available data periods it can be seen that for the US and Australia, and Canada to a lesser extent, there is an obvious decline. This is consistent both with the destruction of these types of jobs as a result of technological advances and with the offshoring of backoffice activities. For the EU15 countries the evidence is more mixed. In some countries a decline in the share can be observed (Austria, Belgium, Germany, Finland, France, Ireland, Netherlands, Portugal), but in other countries there is an increase (Denmark, Spain, Greece, Italy, Luxembourg Sweden and the United Kingdom). It is likely that there are different explanations underlying these evolutions, for example the varying importance of the size of the public sector and the services sector in the economy, and the differential pace of technology adoption and integration. However, it also means that while there are many reports about clerical type occupations being offshored, in some countries at least more still are being created at home.

Appendix tables 1-4 illustrate the occupations which have been included as "potentially affected by offshoring", and which of those are considered as "clerical" occupations. The following two graphs illustrate the evolution over time of the share of these clerical occupations and non-clerical occupations in total employment. It is proposed to then run the model (from equation (1)) separately for these two indicators.

Figure 4 The share of clerical occupations potentially affected by offshoring in total employment: EU15[1], USA, Canada, and Australia 1995-2003[2]

(percentages)



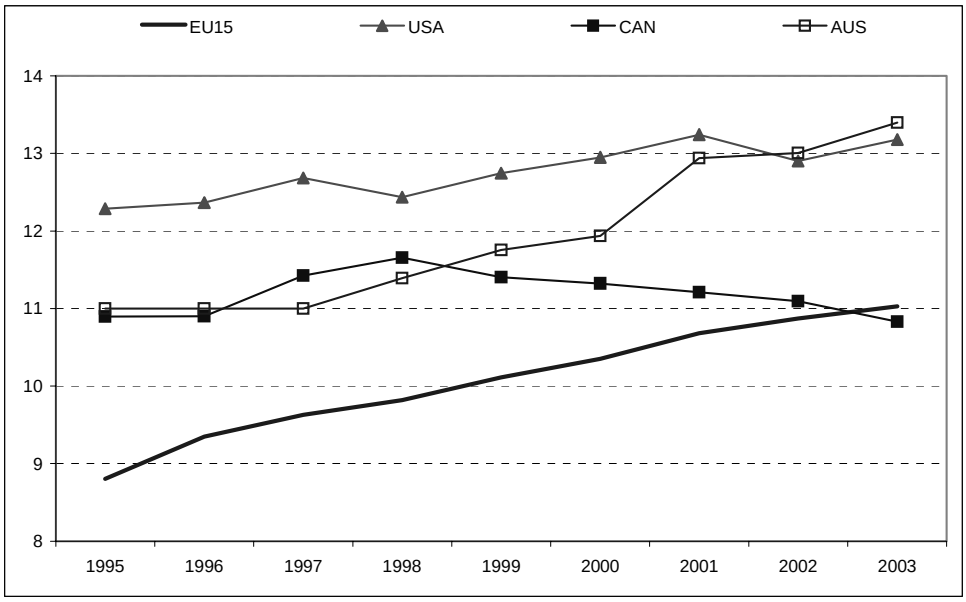
Note: 1. 1995 and 1996 exclude Finland and Sweden; 1998 excludes Ireland, and 2003 excludes Denmark, Luxembourg and the Netherlands.

2. Because of classification changes, the number for the U.S. for 2003 is an estimate. Due to differences in classifications the levels are not directly comparable.

Source: Author's calculations and van Welsum and Vickery (2005a), based on EULFS, US Current Population Survey, Statistics Canada and Australian Bureau of Statistics (2004/5).

Figure 5 The share of non-clerical occupations potentially affected by offshoring in total employment: EU15[1], USA, Canada, and Australia 1995-2003[2]

(percentages)



Note: 1. 1995 and 1996 exclude Finland and Sweden; 1998 excludes Ireland, and 2003 excludes Denmark, Luxembourg and the Netherlands.

2. Because of classification changes, the number for the U.S. for 2003 is an estimate. Due to differences in classifications the levels are not directly comparable.

Source: Author's calculations and van Welsum and Vickery (2005a), based on EULFS, US Current Population Survey, Statistics Canada and Australian Bureau of Statistics (2004/5).

Finally, the following table shows the 3-year averages for the share of clerical occupations in the occupations potentially affected by offshoring.

Table 3 The share of clerical occupations in employment potentially affected by offshoring, three-year averages[1], 1995-2003

(percentages)

	clerical in offshoring		
	1995-1997	1998-2000	2001-2003
Australia	41.9	39.3	32.8
Canada	42.6	41.2	41.8
United States	34.5	32.2	28.1
Austria	44.6	42.5	39.7
Belgium	38.0	36.7	33.2
Germany	49.1	44.8	42.3
Denmark	38.9	38.3	37.6
Spain	55.7	53.3	51.3
Finland	31.6	30.6	26.6
France	42.0	39.9	36.2
Greece	46.6	51.4	51.5
Ireland	22.0	33.0	30.8
Italy	65.8	62.8	61.9
Luxembourg	57.9	51.9	48.6
Netherlands	42.8	39.4	39.7
Portugal	63.8	67.8	62.9
Sweden	30.3	28.8	28.0
United Kingdom	33.8	31.7	32.9

Note: 1. Three years or as many as available. Includes estimates where a full data set was not available. Due to differences in classifications the levels of the shares are not directly comparable between the European and non-European countries.

Source: Author's calculations, based on EULFS, US Current Population Survey, Statistics Canada and Australian Bureau of Statistics (2004/5).

3. Controlling for the ICT content of occupations

This is almost impossible as data are not readily available. It is proposed to look into measures of business adoption of ICTs to construct an indicator of "ICT content". However, these indicators are available only for recent years, so an assumption would have to made that countries' relative positions have not changed over time. Furthermore, it would not be possible to obtain any information at the occupational level, so another assumption would have to be made that the indicator of business adoption of ICTs is valid throughout the economy and across all ICT-using occupations.

Bibliography

Autor, D. H., Levy, F., and Murnane, R. J. (2003), 'The skills content of recent technological change: And empirical exploration', *Quarterly Journal of Economics*, Vol. 118, No. 4 (November 2003), pp. 1279-1333.

Mann, C. L. (2004), 'The US current account, new economy services and implications for sustainability', *Review of International Economics*, Vol. 12, No. 2, pp. 262-276.

Pain, N., and van Welsum, D. (2004), 'International production relocation and exports of services', *OECD Economic Studies*, No. 38, Vol. 2004/1.

van Welsum, D., and Vickery, G. (2005a), 'Potential offshoring of ICT-intensive using occupations', DSTI Information Economy Working Paper, DSTI/ICCP/IE(2004)19/FINAL, OECD, Paris; available at: http://www.oecd.org/sti/offshoring

van Welsum, D., and Vickery, G. (2005b), 'New perspectives on ICT Skills and Employment', DSTI Information Economy Working Paper, DSTI/ICCP/IE(2004)10/FINAL, OECD, Paris; available at: http://www.oecd.org/sti/ICT-employment

van Welsum, D., and Reif, X. (2005a), 'Potential offshoring: Evidence from selected OECD Countries', forthcoming in Susan Collins and Lael Brainard (eds.), the Brookings Trade Forum 2005 on Offshoring white-collar work – The issues and implications, The Brookings Institution, Washington DC.

van Welsum, D., and Reif, X., (2005b), 'The share of employment potentially affected by offshoring: An empirical investigation', DSTI Information Economy Working Paper, DSTI/ICCP/IE(2005)8/FINAL, OECD, Paris, forthcoming.

Appendix

Appendix Table 1. Europe: Occupations potentially affected by offshoring

3 Digit ISCO-88
123: Other specialist managers
211: Physicists, chemists, and related professionals
212: Mathematicians, statisticians and related professionals
213: Computing professionals
214: Architects, engineers, and related professionals
241: Business professionals
242: Legal professionals
243: Archivists, librarians, and related information professionals
312: Computer associate professionals
341: Finance and sales associate professionals
342: Business services agents and trade brokers
343: Administrative associate professionals
411: Secretaries and keyboard-operating clerks
412: Numerical clerks
422: Client information clerks

Note: Occupations in shading have been classified as clerical.
Source: van Welsum and Vickery (2005a), based on EULFS (2004).

Appendix Table 2. United States: Occupations potentially affected by offshoring

CPS categories			
accountants and auditors	23	Archivists and curators	165
underwriters	24	Economists	166
other financial officers	25	Urban planners	173
management analysts	26	Authors	183
architects	43	Technical writers	184
aerospace engineer	44	Editors and reporters	195
metallurgical and materials engineers	45	Air traffic controllers	227
mining engineers	46	Computer programmers	229
petroleum engineers	47	Tool programmers, numerical control	233
chemical engineers	48	Supervisors and Proprietors, Sales Occupations	243
nuclear engineers	49	Insurance sales occupations	253
civil engineers	53	Real estate sales occupations	254
agricultural engineers	54	Securities and financial services sales occupations	255
Engineers, electrical and electronic	55	Sales occupations, other business services	257
Engineers, industrial	56	Supervisors, computer equipment operators	304
Engineers, mechanical	57	Supervisors, financial records processing	305
marine and naval architects	58	Chief communications operators	306
engineers, n.e.c.	59	Computer operators	308
surveyors and mapping scientists	63	Peripheral equipment operators	309
computer systems analysts and scientists	64	Secretaries	313
operations and systems researchers and analysts	65	Typists	315
Actuaries	66	Transportation ticket and reservation agents	318
Statisticians	67	File clerks	335
Mathematical scientists, n.e.c.	68	Records clerks	336
Physicists and astronomers	69	Bookkeepers, accounting, and auditing clerks	337
Chemists, except biochemists	73	Payroll and timekeeping clerks	338
Atmospheric and space scientists	74	Billing clerks	339
Geologists and geodesists	75	Cost and rate clerks	343
Physical scientists, n.e.c.	76	Billing, posting, and calculating machine operators	344
Agricultural and food scientists	77	Telephone operators	348
Biological and life scientists	78	Bank tellers	383
Forestry and conservation scientists	79	Data-entry keyers	385
Medical scientists	83	Statistical clerks	386
Librarians	164		

Note: Occupations in shading have been classified as clerical.
Source: van Welsum and Vickery (2005a), based on US Current Population Survey.

Appendix Table 3. Canada: Occupations potentially affected by offshoring

SOC91 Canada			
A121	Engineering, Science and Architecture Managers	C012	Chemists
A122	Information Systems and Data Processing Managers	C013	Geologists, Geochemists and Geophysicists
A131	Sales, Marketing and Advertising Managers	C014	Meteorologists
A301	Insurance, Real Estate and Financial Brokerage Managers	C015	Other Professional Occupations in Physical Sciences
A302	Banking, Credit and Other Investment Managers	C021	Biologists and Related Scientists
A303	Other Business Services Managers	C031	Civil Engineers
A311	Telecommunication Carriers Managers	C032	Mechanical Engineers
A312	Postal and Courier Services Managers	C033	Electrical and Electronics Engineers
A392	Utilities Managers	C034	Chemical Engineers
B011	Financial Auditors and Accountants	C041	Industrial and Manufacturing Engineers
B012	Financial and Investment Analysts	C042	Metallurgical and Materials Engineers
B013	Securities Agents, Investment Dealers and Traders	C043	Mining Engineers
B014	Other Financial Officers	C044	Geological Engineers
B022	Professional Occupations in Business Services to Management	C045	Petroleum Engineers
B111	Bookkeepers	C046	Aerospace Engineers
B112	Loan Officers	C047	Computer Engineers
B114	Insurance Underwriters	C048	Other Professional Engineers, n.e.c.
B211	Secretaries (except Legal and Medical)	C051	Architects
B212	Legal Secretaries	C052	Landscape Architects
B213	Medical Secretaries	C053	Urban and Land Use Planners
B214	Court Recorders and Medical Transcriptionists	C054	Land Surveyors
B311	Administrative Officers	C061	Mathematicians, Statisticians and Actuaries
B312	Executive Assistants	C062	Computer Systems Analysts
B412	Supervisors, Finance and Insurance Clerks	C063	Computer Programmers
B512	Typists and Word Processing Operators	C152	Industrial Designers
B513	Records and File Clerks	C172	Air Traffic Control Occupations
B514	Receptionists and Switchboard Operators	E012	Lawyers and Quebec Notaries
B521	Computer Operators	E031	Natural and Applied Science Policy Researchers, Consultants and Program Officers
B522	Data Entry Clerks	E032	Economists and Economic Policy Researchers and Analysts
B523	Typesetters and Related Occupations	E033	Economic Development Officers and Marketing Researchers and Consultants
B524	Telephone Operators	F011	Librarians
B531	Accounting and Related Clerks	F013	Archivists
B532	Payroll Clerks	F021	Writers
B533	Tellers, Financial Services	F022	Editors
B534	Banking, Insurance and Other Financial Clerks	F023	Journalists
B553	Customer Service, Information and Related Clerks	F025	Translators, Terminologists and Interpreters
B554	Survey Interviewers and Statistical Clerks	G131	Insurance Agents and Brokers
C011	Physicists and Astronomers		

Note: Occupations in shading have been classified as clerical.
Source: van Welsum and Vickery (2005a), based on Statistics Canada.

Appendix Table 4. Australia: Occupations potentially affected by offshoring

ASCO 4-digit	
1221 Engineering Managers	2521 Legal Professionals
1224 Information Technology Managers	2522 Economists
1231 Sales and Marketing Managers	2523 Urban and Regional Planners
1291 Policy and Planning Managers	2534 Journalists and Related Professionals
2111 Chemists	2535 Authors and Related Professionals
2112 Geologists and Geophysicists	3211 Branch Accountants and Managers (Financial Institution)
2113 Life Scientists	3212 Financial Dealers and Brokers
2114 Environmental and Agricultural Science Professionals	3213 Financial Investment Advisers
2115 Medical Scientists	3294 Computing Support Technicians
2119 Other Natural and Physical Science Professionals	3392 Customer Service Managers
2121 Architects and Landscape Architects	3399 Other Managing Supervisors (Sales and Service)
2122 Quantity Surveyors	5111 Secretaries and Personal Assistants
2123 Cartographers and Surveyors	5911 Bookkeepers
2124 Civil Engineers	5912 Credit and Loans Officers
2125 Electrical and Electronics Engineers	5991 Advanced Legal and Related Clerks
2126 Mechanical, Production and Plant Engineers	5993 Insurance Agents
2127 Mining and Materials Engineers	5995 Desktop Publishing Operators
2211 Accountants	6121 Keyboard Operators
2212 Auditors	6141 Accounting Clerks
2221 Marketing and Advertising Professionals	6142 Payroll Clerks
2231 Computing Professionals	6143 Bank Workers
2292 Librarians	6144 Insurance Clerks
2293 Mathematicians, Statisticians and Actuaries	6145 Money Market and Statistical Clerks
2294 Business and Organisation Analysts	8113 Switchboard Operators
2299 Other Business and Information Professionals	8294 Telemarketers
2391 Medical Imaging Professionals	

Note: Occupations in shading have been classified as clerical.
Source: van Welsum and Vickery (2005a), based on Australian Bureau of Statistics.

Appendix Box 1. Detailed analysis of the US occupational data

Looking at the year-on-year change in the occupational data for the US (1995-2002) at the level of the individual occupations shows:

- All of the occupations selected as potentially affected by offshoring experienced at least one year-on-year decline.
- 45 out of the 67 occupations included in the US selection experienced an absolute decline between 2001 and 2002, as did the overall selection of occupations potentially affected by offshoring and total employment.
- The overall selection of occupations potentially affected by offshoring experienced 3 absolute declines between 1995-2002; to compare the individual occupations against the overall selection, the following 47 occupations experienced **at least** 3 absolute declines:

Accountants and auditors	23	Urban planners	173
Architects	43	Authors	183
Metallurgical and materials engineers	45	Technical writers	184
Mining engineers	46	Editors and reporters	195
Petroleum engineers	47	Air traffic controllers	227
Engineers, electrical and electronic	55	Computer programmers	229
Engineers, industrial	56	Supervisors and Proprietors, Sales Occupations	243
Engineers, mechanical	57	Insurance sales occupations	253
Marine and naval architects	58	Real estate sales occupations	254
Engineers, n.e.c.	59	Supervisors, computer equipment operators	304
Operations and systems researchers and analysts	65	Computer operators	308
Actuaries	66	Peripheral equipment operators	309
Statisticians	67	Secretaries	313
Physicists and astronomers	69	Typists	315
Chemists, except biochemists	73	Transportation ticket and reservation agents	318
Atmospheric and space scientists	74	File clerks	335
Geologists and geodesists	75	Payroll and timekeeping clerks	338
Physical scientists, n.e.c.	76	Billing clerks	339
Biological and life scientists	78	Cost and rate clerks	343
Forestry and conservation scientists	79	Telephone operators	348
Medical scientists	83	Bank tellers	383
Librarians	164	Data-entry keyers	385
Archivists and curators	165	Statistical clerks	386
Economists	166		

The estimates for 2003 show a further absolute decline in the selection of occupations potentially affected by offshoring.

[1] Under the definition of offshoring adopted in this paper, offshoring includes both international outsourcing (where activities are contracted out to independent third parties abroad) and international insourcing (to foreign affiliates). The cross-border aspect is the distinguishing feature of offshoring, i.e. whether services are sourced within the domestic economy or abroad – not whether they are sourced from within the same company or from external suppliers (outsourcing).

[2] The European data are Labour Force Survey data provided by Eurostat. The occupational classification system in those data is the ISCO – International Standard Classification of Occupations, and NACE – the industrial classification system of the European Union – is used for sectoral classification. For the US, data from the Current Population Survey were used. The Current Population Survey collects information on both the industry and the occupation of the employed and unemployed. However, beginning with data from January 2003, the 1990 Census Industrial Classification System was replaced by one based on the North American Industry Classification (NAICS), and the 1990 Census Occupational Classification was replaced by one derived from the U.S. Standard Occupational Classification (SOC). Further information is available on the Web site of the U.S Bureau of Labor Statistics at: http://www.bls.gov/opub/hom/pdf/homch1.pdf (accessed November 2004): Chapter 1: Labor Force Data derived from the Current Population Survey. For Canada Labour Force Data provided by Statistics Canada were used. The occupational classification is in SOC91. For Australia data from the Labour Force Survey provided by the Australian Bureau of Statistics were used. The occupational classification is in Australian Standard Classification of Occupations (ASCO) second edition.

[3] Other studies have taken a similar approach. For example, Bardhan and Kroll (2003) produced estimates of 11% of total employment in the USA in 2001 as potentially affected by offshoring, and Forrester Research, as reported by Kirkegaard (2004) up to 44% of total employment. The differences in these estimates can be explained by the selection criteria that are applied to the occupational data. Thus, Bardhan and Kroll (2003) only included occupations in which at least some offshoring was already know to have taken place yielding a more conservative estimate of the share of employment potentially affected, whereas the Forrester study used less detailed occupational categories resulting in a larger estimate of jobs potentially affected.

[4] The number for 2003 (just under 18%) is an estimate as both the occupational and industrial classification systems were changed in 2003 in the U.S.

[5] A parallel can be drawn here with some of the work undertaken by Autor *et. al.* (2003) and Levy and Murnane (2004). These authors argue that the tasks most vulnerable to being substituted by technology are those where information processing can be described in rules. If a significant part of a task can be described by rules, this increases the likelihood of the task being offshored, since the task can then be assigned to offshore producers with less risk and greater ease of supervision.

[6] These countries were excluded from the sample because of a lack of data.

[7] Even though GDP per capita is a variable found to be an important determinant of the share of services sector employment (Messina, 2004) it is not used here. In a time series context it does not make sense to include the level of GDP per capital in a regression of a bounded variable. The first difference of GDP per capital was found to be insignificant. This is not necessarily surprising as the countries in sample all have relatively high levels of GDP per capita, so over the sample period (1995-2003) this variable is not found to have an impact on the share of employment potentially affected by offshoring. Nevertheless, with the exception of Austria, the countries with a relatively low share of employment potentially affected by offshoring were also those with the lowest levels of GDP per capita. The role of productivity growth is also not considered here. It is sometimes argued that the decline in certain types of employment, or the lack of new jobs (the jobless recovery), is the result of important productivity increases, but Baily and Lawrence argue that this is a mistake and that while productivity may have played some role, it should not be considered a fundamental cause. Time dummies pick up common cyclical effects

[8] "Real estate and business activities" represents section K of ISIC 3 (minus if available "of which real estate"), but the connection is loose between service products and service activities determined for large enterprises. Business services can be provided internally within multinationals with main activities elsewhere, e.g. in manufacturing.