Knowledge-intensive services and international competitiveness: a four country comparison

Paul Windrum
MERIT, University of Maastricht
Tongersestraat 49, PO Box 616
NL-6200 MD Maastricht
The Netherlands

and

Mark Tomlinson
CRIC, University of Manchester
University Precinct Centre, Oxford Road
Manchester M13 9QH
UK

The authors would like to thank Pim den Hertog and Brigitte Preissl for their invaluable assistance in accessing national input-output tables for the Netherlands and Germany respectively. Thanks is also extended to Bart Verspagen and Bengt-Åke Lundvall for their comments on earlier drafts of the paper. As usual, all errors remain the sole responsibility of the authors.

Abstract

The nature and consequences of services innovation remains a woefully under-researched topic. The paper calls into question two statements that are frequently repeated in the political-economic discourse on services. The first concerns the suggestion that Germany is a 'services laggard' that needs to restructure its domestic economy if it is to remain internationally competitive. By contrast, the UK is frequently held up as an example of a successfully restructured 'services economy'. The paper draws an important distinction between the quantity of services in a domestic economy and the degree of connectivity between services and other economic activities. The latter, it is argued, is far more important in determining the size of spillovers from services innovation enjoyed within a domestic economy and, hence, to international competitiveness. Particular attention is paid to the role and impact of knowledge-intensive service sectors in this regard. In addition to the UK and Germany, data is drawn from the Netherlands and Japan. Using these four comparative cases we explore the distinction between a high representation of services in the domestic economy, and the innovation spillovers facilitated by a high degree of connectivity between services and other economic sectors within a domestic economy.

Keywords: international competitiveness, knowledge-intensive services, innovation

1. Introduction

Despite its increasing importance in national economies, the contribution of services to national productivity and international competitiveness remains largely unaccounted for by analysts and politicians. As Lundvall and Borrás (1999) observe, "studies of innovation processes and public action on technological development have mainly tended to focus on manufacturing activities. Services have generally been given only marginal consideration" (Lundvall and Borrás, 1998, p.117). Worse, while innovation is recognised as important for national competitiveness and economic growth, services tend to be viewed as innovative laggards that make little or no contribution to either productivity or growth. Service sectors, it is suggested, are primarily technology users which are not innovative in their own right. This view may be justified for some service industries but it is certainly not true in all cases.

A small but growing number of researchers have started to challenge this view. An important focus of their work is the relationship between knowledge-intensive service (KIS) sectors, the changing nature of the innovation process, and the globalising learning economy. This research is located in fields as diverse as innovation studies (e.g. Antonelli, 1998; Windrum, Flanagan and Tomlinson, 1997), management studies (e.g. Blackler, 1995; Quinn, 1992; Reich, 1991; Scarbrough, 1992), science-technology policy studies (e.g. Hauknes, 1997; den Hertog and Bilderbeek, 1998) and regional development policy (Illeris, 1996; Keeble, Bryson and Woods, 1991). Rather than being a separate and peripheral economic factor, services form an integral part of the economic system according to these writers. It is this emphasis on the complementarity between services and manufacturing which distinguishes them from the views put forward Bell (1973), on the one hand, and by Cohen and Zysman (1987), on the other, in the post-industrial society debate[1]. Bell suggested that, as wealth increases, consumers are able to expand their basket of purchases beyond basic material goods to a whole new realm of services. Cohen and Zysman countered that 'manufacturing matters' and that potentially damaging consequences could follow an uncontrolled erosion of the manufacturing base.

The 'new view' of services emphasises how the traditional distinction between manufacturing and services is becoming increasingly blurred. Lundvall and Borrás detect a shift away viewing services as production and consumption 'sectors' to services as 'functions'. This change, they suggest, stems from new insights into the role of knowledge production and distribution in the economy, particularly with respect to new knowledge-based services and the reshaping of existing service activities. Quinn (1992), for example, highlights the role of strategic services in shaping competition and comparative advantages, while Reich (1991) draws attention to the role of 'technological' services and competencies in shaping new industrial

[1] The origins of the tertiarisation thesis can be traced back to Clark (1942) and Fuchs (1968). Lundvall and Borrás note that proponents of the thesis generally employ a stages model of economic history in which the 'service economy' represents the tertiary stage in the development of modern societies. While some writers still hold a tertiarisation perspective, the more modern literature is not limited to this view.

structures and organisational patterns. Illeris (1996) extends the discussion still further, positing the location of 'advanced' or 'high quality' business services as a key factor affecting regional economic growth. In this paper we focus on the interaction between KIS firms and their clients. In addition to the direct transfer of particular knowledges between a KIS firm and its client, *new* knowledge is generated through the interaction itself. If this is the case, then it is possible to detect this interaction in national input-output tables. It is also possible to compare and contrast the degree of connectivity between services and non-services, and the impacts of this connectivity on productivity, across different countries.

2. What are knowledge-intensive services?

The term 'services' covers an extremely diverse set of economic and organisational activities. Some service firms are small, labour-intensive and have low technology inputs. Others are capital-intensive, knowledge-intensive and are major users of information and communication technologies. Market conditions also vary widely. Some service firms operate in highly specialised local market niches, with little or no competitive pressure, while others operate in highly competitive markets. As in the case of telecomms and financial services, the internationalisation of markets may be have been precipitated by a deregulation of national markets. The growth in recorded services in the advanced world economies is not simply due to the outsourcing of activities that were previously conducted in-house by manufacturers (Windrum, Flanagan and Tomlinson, 1997). As knowledge has overtaken material inputs as the key source of value added, so high-tech and highly innovative service sectors have become important to national productivity and competitiveness.

We define KIS firms as private sector organisations that rely on professional knowledge or expertise relating to a specific technical or functional domain. KIS firms may be primary sources of information and knowledge (through reports, training, consultancy etc.) or else their services form key intermediate inputs in the products or production processes of other businesses (e.g. communication and computer services). As well as being users of new technology, some KIS industries are carriers of new technology (e.g. consultancies and training services), while others are themselves integral producers of new technologies - notably the wide range of computer, software, telecomms and telematics services. Here we see a positive feedback between new technologies and new services. New technologies have spawned new service industries that have in turn played a major role in developing these technologies through laboratory, design and engineering activities. Notable examples include the KIS services connected with biotechnology, new materials, environmental technologies, and ICT. Services innovation is therefore important for the economy as a whole. A list of KIS sectors, based on research conducted by den Hertog and Bilderbeek (1998), and Windrum, Flanagan and Tomlinson (1997), is provided in Table 1 below.

Accounting and bookkeeping services Architecture, surveying and other construction services Banking and other financial services Computer and IT-related services (inc. software) Design services Environmental services (e.g. environmental regulation, elementary waste disposal, monitoring) Facility management services Insurance services	Labour recruitment and provision of technical personnel Legal services Management consultancy Market research Marketing and advertising services Press and news agencies R&D consultancy services Real estate Telecommunication services Technical engineering services Technology-related training

Table 1. Knowledge-intensive service sectors

An important feature that distinguishes KIS from manufacturing firms is the type of 'product' they supply and, following this, the role they play in regional and national innovation systems. Whereas manufactured products and processes contain a high degree of codified knowledge (they are a 'commodification' of knowledge), KIS products contain a high degree of tacit ('intangible') knowledge. This point is made by Strambach (1997);

> "Specialised expert knowledge, research and development ability, and problem-solving know-how are the real products of knowledge-intensive services. Given increasing differentiation and the accelerating growth of knowledge and information, indirect effects, like the early recognition of problems and more rapid adjustment to current economic and structural change, can be expected when firms succeed in utilising this external knowledge" (Strambach, 1997, p. 35).

This observation links up with Antonelli's (1988) discussion of the interaction between KIS firms and their clients. Antonelli highlights the link between new information and communication technologies (ICTs) and business-to-business KIS. He argues that the post-war organisational structure of vertically-integrated knowledge generation, founded on an R&D lab, is being replaced by an information exchange market based on real-time, on-line interactions between customers and knowledge producers. New ICTs facilitate a change in the nature of information - its divisibility, processing and communication - and the accessibility and tradability of information[2]. This opens up opportunities for knowledge-intensive business service firms who, Antonelli adds, tend to be the chief advocates and supporters of this emerging information market. Through ICTs, KIS companies interface between a client firm's tacit knowledge base and the wider knowledge base of the economy, improving connectivity and receptivity between the nodes of innovation networks.

[2] The same point has been made by Scarbrough (1997), although Scarbrough's social constructivist interpretation is notably different to Antonelli's technology-centred interpretation.

KIS firms thus acquire special significance as agents who transfer experience and technologies within, and across, innovation networks. They are a 'glue' that holds the expanding learning economy together.

As well as being vehicles of knowledge transfer, KIS firms are engaged in the co-production of *new* knowledge and material artefacts with their clients. This interactive problem-solving is the 'product' that clients wish to purchase. Given the importance of this interaction term, we should not overlook the factors that facilitate successful KIS-client interaction. Qualitative case studies conducted with KIS firms and their clients reveal that the quality of the provider-client interaction depends on the competences of the client as well as the KIS supplier (Windrum, Flanagan and Tomlinson, 1997). In addition to IT proficiency and other technical competences, client firms must be open to new learning contexts. Strambach (1997) suggests that knowledge adoption is facilitated by flexible, decentralised organisation structures and good quality human resource management. Cohen and Levinthal (1990) point out that a firm's absorptive capacity - its ability to assimilate new information - is closely related to its organisational routines, and the diversity (i.e. the level and distribution) of expertise within an organisation. Meanwhile Ciborra (1993) emphasises the match between new knowledge and the practices, beliefs, values, routines and cultures that lie at the heart of the organisation.

3. Recent trends in services

As its title suggests, the primary objective of this paper is to identify the relative contributions of KIS services to national productivity and competitiveness in four different countries; the UK, Netherlands, Germany, and Japan. An important distinction is made between a growing representation of services within one's domestic economy and an increasing level of interconnectivity between services and other economic activities. As we endeavour to show, the latter is far more important for the spillovers of services innovation enjoyed within a domestic economy.

Each of the four investigated in this paper have been selected with this point in mind. The Dutch state has, since its inception, been a predominantly trade and services-orientated economy (Schama, 1987; Parker, 1977). The recent history of services development in the Netherlands thus provides a useful benchmark against which the other countries can be compared. The Japanese economy is similar to the UK economy in that it is founded on a combination of trade and manufacturing. However a distinguishing feature of the Japanese economy is the *keiretsu* system of industrial organisation that has forged close links between services and manufacturing since 1945 (Tomlinson, 1999). Of the three EU countries investigated by the paper, political support for the shift towards a services-based economy has been most pronounced in the UK. In their enthusiasm for a radical restructuring of the domestic economy, certain UK politicians and advisers have adopted the dictum that 'more services are good'. The same dictum has been advocated in Germany since the late 1980s, where it has been

suggested that Germany is a 'services laggard' that must follow the UK example if it is to remain internationally competitive (cf. Freund *et al*, 1997).

The suggestion that Germany is a 'services laggard' is critically appraised in the paper, as is the suggestion that the rapid tertiarisation of the UK economy necessarily means it is benefiting most from services innovation. In this section we outline some general trends in the relative growth of KIS, and of services in general, in each of the four countries. In section 4 we outline a novel approach to estimating the impact of services innovation on national output and productivity. Using this method we report a series of statistical tests conducted on national input-output tables. A first round of tests examine the significance of services in the UK, Dutch, German and Japanese domestic economies while a second round of tests assess the significance of KIS inputs into manufacturing output.

Timeseries analyses of aggregate and sectoral data can prove useful in identifying the general growth trend of services in different national economies. Having said this, one should, as when using any technique, bear in mind the limitations of this particular mode of analysis. In this instance the main concerns are associated with the quality of the published national data, particularly the sectoral classification of services and their aggregation. We are perhaps more fortunate than previous researchers in this regard. National income accounts, and input-output tables have (finally) started to disaggregate service sector data and stopped the practice of aggregating the data into a single category labelled 'services'. This perhaps reflects a diminution of the traditional bias towards manufacturing as services come to play an increasingly important role in the national economy[3].

We begin by considering the national income database provided by Eurostat (Eurostat, 1996). This database offers comparable data sets that enable us to consider the changing contributions of different economic activities to national value added in the UK, Netherlands and Germany in the period 1979-1994. Table 2 provides data on 1979 and 1994 for each main category (the complete tables containing all sub-categories are provided in the appendix). Services are by far the largest contributors to national value added in each of the EU countries being considered. Indeed the share of marketed services (i.e. services that are traded in markets) in national value added increased significantly in the 1979-1994 period, rising from 40.8% to 54.2% (+13.4%) in the UK, from 40.2% to 51.4% (+11.2%) in Germany, and from 48.0% to 57.2% (+9.2%) in the Netherlands. The UK and Germany, starting from a lower initial base than the Netherlands, have experienced a sharper increase in the value added growth of services.

[3] Having said this, the bias towards manufacturing is still evident in national statistics, the recent edition of the UK 'Regional Trends' (ONS, 1997) being a case in point.

	UK		Netherlands		Germany	
	1979	1994	1979	1994	1979	1994
mio ecu						
Agriculture, forestry and fishing products	5 436	13 553	4 094	9 586	12 093	15 148
	1.8	*1.6*	*3.7*	*3.6*	*2.3*	*1.0*
Fuel and power products	25 464	47 204	9 929	16 145	27 028	57 908
	8.6	*5.7*	*9.0*	*6.0*	*5.1*	*3.9*
Manufacturing products	83 470	167 613	19 871	44 997	167 974	365 340
	28.1	*20.2*	*18.1*	*16.8*	*31.5*	*24.6*
Building and construction	17 836	42 727	7 468	14 740	36 957	85 749
	6.0	*5.1*	*6.8*	*5.5*	*6.9*	*5.8*
Market services	121 287	450 050	52 758	152 890	214 361	763 089
	40.8	*54.2*	*48.0*	*57.2*	*40.2*	*51.4*
Non-market services	43 952	109 401	15 782	28 923	74 439	198 718
	14.8	*13.2*	*14.4*	*10.8*	14.0	13.4
Total	297 445	830 548	109 901	267 281	532 851	376 378
	100.0	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*

Table 2. Contributions to national value added, 1979 and 1994: UK, Netherlands and Germany (at 1990 prices).

Source: Eurostat (1996)

The picture for market services contrasts sharply with that of manufacturing. In the Netherlands the contribution of manufacturing to national value added fell from 18.1% in 1979 to 16.8% in 1994 (-1.3%). By contrast, the contribution of manufacturing in German national value added fell from 31.5% to 24.6% (-6.9%) in the same period. Yet even this sizeable change cannot match the (much more widely publicised) change in the structural composition of the UK economy. There the manufacturing contribution to value added fell from 28.1% in 1979 to 20.2% in 1994 (-7.9%)!

Manufacturing is not the only category whose contribution to national value added declined between 1979 and 1994. Indeed the relative contributions of *all* categories except market services has declined in each country. The data suggests a tertiarisation of these three EU economies since 1979. Tertiarisation appears to have been least pronounced in the Netherlands. Having said this, we note the much higher starting base of services in the Netherlands. Furthermore, the services contribution to national value added is higher than the UK and Germany. Tertiarisation appears to have been particularly rapid in the UK, lending support to the suggestion that the UK has become a 'service economy' - or, more accurately, a 'services-dominated economy'. Perhaps the most surprising findings are those for Germany, where the degree of tertiarisation appears to have been almost equal to that experienced in the UK. The oft-noted claim that the German economy is a 'services laggard' is certainly not supported by the national income data.

Examining the sub-categories of market services listed in the Eurostat data sets produces some other interesting findings. The KIS sectors identified in Table 1 are present in three Eurostat sub-categories: 'communication services', 'finance and insurance services', and 'other market services'. The data on these sub-categories is presented in Table 3 below[4]. Of all the marketed services listed by Eurostat, 'finance and insurance services' and 'other market services' have contributed most to the tertiarisation of the UK, German and Dutch economies. Adding these to 'communication services', the combined contribution of KIS firms to national value added has risen from 29.5% to 37.5% (+8%) in the Netherlands, from 22.1% to 34.7% (+12.6%) in the UK, and from 24% to 36% (+12%) in Germany. As before, the Netherlands began from a higher initial base and, while experiencing a slower rate of growth, continues to have the highest concentration of these service activities. The data suggests that KIS growth has been most pronounced in the UK. The Eurostat data suggests that the growth of KIS in Germany has paralleled that of the UK. Indeed the data indicates that the contribution of KIS to national value added are actually *higher* in Germany than in the UK.

	UK		Netherlands		Germany	
	1979	1994	1979	1994	1979	1993
	mio ecu					
Communication services	6 421	21 487	2 110	5 874	12 318	32 449
	2.2	*2.6*	*1.9*	*2.2*	*2.3*	*2.3*
Credit and insurance services	8 005	53 280	5 117	14 411	23 563	83 499
	2.7	*6.4*	*4.7*	*5.4*	*4.4*	*5.9*
Other market services	51 082	213 550	25 165	79 928	92 281	394 233
	17.2	*25.7*	*22.9*	*29.9*	*17.3*	*27.8*
Combined contribution	65 508	288 317	32 392	100 213	128 162	510 181
	22.1	*34.7*	*29.5*	*37.5*	*24.0*	*36.0*

Table 3. Contribution of knowledge-intensive service sectors to national value added: UK, Netherlands and Germany (at 1990 prices).

Source: Eurostat (1996)

Given the highly aggregated nature of the data sets, there is little more that can be done with the Eurostat national income accounts. We therefore turn to data provided by national input-output tables. National input-output tables are a particularly useful source for identifying the extent to which knowledge-intensive services, and indeed services in general, are integrated within a domestic national economy. In section 4 we analyse the input-output tables provided by the respective national statistical offices. Before that, we again make use of comparable data sets, this time provided by the OECD (OECD, 1995), to draw an initial set of cross-country comparisons. Once again we focus on services categories that contain a high representation of the KIS activities identified in Table 1,. In the OECD tables these are, respectively, 'communications' (ISIC 72), 'finance and insurance' (ISIC 81 and 82), and 'real

[4] Unfortunately Eurostat does not provide 1994 data on these categories for Germany. Therefore we list the 1993 data for Germany.

estate and business services' (ISIC 83)[5].

Figure 1 plots the share of KIS sectors as a percentage of intermediate inputs to all domestic sectors in the UK, Germany, Netherlands and Japan. Two points are of particular interest here. Firstly, while the OECD tables do not provide data for Germany prior to 1980, the representation of KIS in Germany was much higher than the UK, Netherlands and Japan between 1980 and 1990. Once more this brings into serious doubt the suggestion that Germany is a 'services laggard'. Secondly, there is a striking difference between the relative growth of KIS across the four countries. The Netherlands initially started from highest base but have experienced the slowest relative growth in KIS sectors. The most striking change has been in the UK, where KIS appear to have been growing at an exponential rate between 1970 and 1990. By contrast the Netherlands, Germany and Japan have experienced a more gradual (linear) growth in KIS. This finding supports the claim that the UK underwent a radical restructuring of its domestic economy during the 1980s.

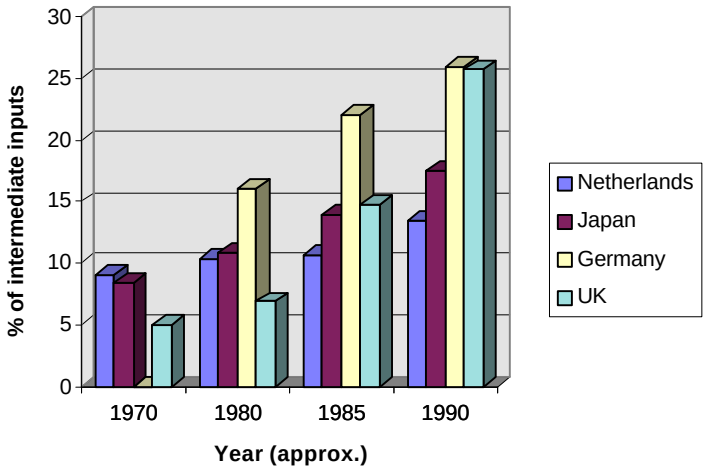

Figure 1. Knowledge-intensive service sectors as a percentage of intermediate inputs to all sectors

Source: OECD (1995)

Widening the analysis to include all services categories, one can examine the extent to which service activities are inter-linked with the rest of the domestic economy. Analysing the changing shares within and between sectors over time provides an important insight into the comparative evolution of different economic systems. Here we shall simply distinguish between services and non-services (agriculture, construction and manufacturing) in each of the four counties (Table 4 below).

Examining the OECD data yields a number of interesting results. Firstly, the services

[5] The bundling of business services - a significant proportion of which will be business-to-business KIS - with real estate in a single ISIC category is unfortunate. However this is an improvement over the Eurostat category 'other market services', which includes hairdressers and other personal services.

share of total intermediary inputs has increased in all four countries. This is again indicative of a trend towards the tertiarisation of the domestic UK, Dutch, German and also Japanese economies. Second, the strength of this trend is found to differ significantly between the respective countries. Again the data suggests that the trend has been most pronounced in the UK and least pronounced in the Netherlands which, as noted previously, was already a services-dominated economy by the early 1970s. It is the extent to which this change has occurred in the UK which is again so remarkable. In fact the total proportion of intermediate domestic flows accounted for by services (services to services plus services to non-services) *doubled* in the UK, rising from 22.8% in 1968 to 44.5% in 1990! Over the same period, the total proportion of intermediate domestic flows accounted for by services in Japan rose from 23.9% to 38.2%, while the services share of domestic intermediate inputs in the Netherlands rose from 21.0% to 23.1%.

Netherlands			
1972		Services	Non-Services
	Services	11.1%	9.9%
	Non-Services	10.1%	69.0%
1977		Services	Non-Services
	Services	11.2%	9.3%
	Non-Services	8.5%	71.0%
1981		Services	Non-Services
	Services	12.2%	10.4%
	Non-Services	8.5%	69.0%
1986		Services	Non-Services
	Services	12.7%	10.4%
	Non-Services	8.3%	68.5%

UK			
1968		Services	Non-Services
	Services	8.7%	14.1%
	Non-Services	7.7%	69.5%
1979		Services	Non-Services
	Services	11.2%	15.4%
	Non-Services	10.7%	62.7%
1984		Services	Non-Services
	Services	14.5%	13.5%
	Non-Services	11.9%	60.1%
1990		Services	Non-Services
	Services	28.9%	15.6%
	Non-Services	12.8%	42.7%

Japan			
1970		Services	Non-Services
	Services	8.9%	15.0%
	Non-Services	8.4%	67.7%
1980		Services	Non-Services
	Services	11.4%	17.2%
	Non-Services	9.0%	62.4%
1985		Services	Non-Services
	Services	14.1%	17.5%
	Non-Services	9.3%	59.1%
1990		Services	Non-Services
	Services	18.8%	19.4%
	Non-Services	10.7%	51.1%

Germany			
1970		Services	Non-Services
	Services	*Data not*	
	Non-Services	*available*	
1980		Services	Non-Services
	Services	13.2%	15.6%
	Non-Services	10.1%	61.1%
1985		Services	Non-Services
	Services	16.6%	17.4%
	Non-Services	9.8%	56.2%
1990		Services	Non-Services
	Services	20.0%	19.4%
	Non-Services	4.5%	51.1%

Table 4. Intermediate flows of services and non-services (as a % of total): Netherlands, UK, Japan and Germany.

Source: OECD (1995)

Unfortunately the OECD tables do not provide data on Germany for the 1970s. Still, the data provided for 1980 onwards makes for interesting reading. We observed from diagram 1 that the representation of KIS sectors in the German domestic economy was consistently higher than in the other three countries between 1980 and 1990. Examining the data for all the services categories, we find that the services share of intermediary inputs in Germany stood at 28.8% in 1980 - higher than the Netherlands (20.5%), the UK (26.6%) and Japan (28.6). By 1990 the figure stood at 39.4%. This remains second only to the UK which, as the OECD data again indicates, has

experienced an incredibly high degree of tertiarisation. With regards to the German domestic economy, findings drawn from OECD data support, and lend further weight to, the findings drawn the Eurostat data. Both data sets seriously call into doubts the suggestion that Germany is a 'services laggard'. Not only did the national share of services grown significantly between 1970 and 1990 but inter-sectoral flows from services to non-services also strengthened during this period.

The distinction between service to service flows on the one hand, and service to non-service flows on the other, leads to a fourth important finding. Whereas the overall growth of services in intermediary goods can be attributed to growth in both service to service and service to non-service flows in the Netherlands, Japan and Germany, the same cannot be said of the UK. There the share of services to non-services has remained almost constant (rising from 14.1% in 1968 to 15.6% in 1990), with the doubling of the total services share in intermediate transactions almost *entirely* due to the dramatic increase in services to services flows. Starting from the lowest initial base, the service to service share of intermediate flows rose from 8.7% in 1968 to 28.9% in 1990 - an increase of 232%! The share of service to service flows in the UK far exceeds that found in Germany (20.0%), Japan (18.8%) or the Netherlands (12.7%). Given the low level of non-service to service flows indicated by the data, a rather disturbing trend appears to be taking place in the UK. Distinct clusters of service activities appear to be forming. What is more, these seem to have very weak linkages with (equally distinct) clusters of non-service activities. In effect, there appears to be *two distinct islands of economic activity*. This is likely to seriously limit the spillover effects of innovation in knowledge-intensive services. It is to this issue that we turn next.

4. Measuring the impact of knowledge-intensive services on national output and productivity

As previously stated, the central aim of this paper is to examine the extent to which knowledge-intensive services enhance national productivity through their interaction with all other economic sectors. The conventional procedure is to test some form of aggregate production function, usually of a Cobb-Douglas variety, that contains capital and labour inputs. Unfortunately there are both practical and theoretical problems in adopting this approach. To begin with, while data for labour is readily available, obtaining data on the consumption of fixed capital is far more problematic. Furthermore, even if such data were readily available, there are theoretical problems associated with the construction of aggregate production functions containing capital (cf. Harcourt and Laing, 1971; Steedman, 1979).

An alternative course of action is to construct a labour-based production function in which labour interacts with two types of intermediate goods; material and knowledge. As Georgescu-Roegen (1971) observed, the process of production is concerned with the application of labour and knowledge to inanimate matter, subject to the laws of entropy. This approach to the study of national competitiveness is not new of course,

but harks back to Ricardo's original formulation of the theory of comparative advantage (see Taussig, 1939 for a classic treatment of Ricardian international trade theory). Here we formulate two versions of a labour-based production function that will be used to test the national input-output data provided by the Dutch CBS (CBS, 1994), the German SB (SB, 1997) and British ONS (ONS, 1995) respectively. We shall consider the less detailed OECD data for Japan (OECD, 1995). The OECD tables report a total of 35 sectors for the Japanese economy. By contrast, the CBS input-output tables report a total of 92 sectors for the Netherlands, the SB tables a total of 58 sectors for Germany, and the ONS tables a total of 123 sectors for the UK. The KIS sectors reported in the respective data sets are listed in Table 5. Variation is due to differences in the level of disaggregation found in these national data sets.

UK (ONS data)	**Netherlands (CBS data)**
postal services	post and telecomms
telecomms	banking
banking and finance	financial services
aux. finance	insurance
insurance	real estate agencies
real estate agents	letting services
legal services	legal, accounting and business services
accounting	computer services
other professional services	advertising agencies
advertising	general business services
computer services	employ. agencies & recruitment services
other business services	
Germany (SB data)	**Japan (OECD data)**
post and telecomms	communication services
banking and financial services	financial and insurance services
insurance	real estate agencies
real estate agencies	business services
science and culture, and publishing business services	
other business services	

Table 5. KIS sectors recorded in national income-output data

Details of the derivation of the production functions we use is provided in the appendix. We estimate two equations:

$$\log Q = \log A + a_1 \log M + b_1 \log K + c_1 \log L \qquad (1)$$

$$\log Q/L = \log A + a \log(M/L) + b \log(K/L) \qquad (2)$$

where Q is gross output, M is the material (manufactured) input, K is the KIS input, and L is the labour input in each sector. Each country is considered separately. A, a_1, b_1, and c_1 are estimated and provide a measure of the impact of the various inputs on output and productivity. Thus model 1 estimates gross output in each sector as a function of M, K and L, while model 2 estimates a productivity measure (Q/L) that is a function of M/L and K/L.

Running model 1 on 1990 input-output data for the UK, 1993 data for Germany and 1994 data for the Netherlands, we find the estimated coefficients on K, M and L variables to be statistically significant at the 1% level (see Table 6 below). We note that the L coefficient is not significant at the 1% or 5% level for Japan. This may be due to the less detailed nature of the OECD data used for Japan. The estimated coefficients for M and K are particularly revealing. The estimated values on the impacts of purchased intermediate material goods (M) are very similar across UK, Netherlands and Japan. The impacts of intermediate material goods are lower in Germany, although this is made up by the exploitation of KIS, which is second only to Japan. Indeed the estimated values for KIS (K) differ considerably. The estimated coefficient for Japan is far higher than the estimated UK coefficient, with the estimates for Germany and the Netherlands lying between these two. This suggests that, while the Japanese and Dutch economies have lower absolute shares of KIS in national output compared to the UK, they are being exploited more effectively within their respective national economic systems. The German system, with the highest absolute share of KIS in all four countries (Figure 1 above), is also exploiting these more effectively than the UK system.

Coefficient	UK	Netherlands	Germany	Japan
M	0.382 (.031)	0.363 (.038)	0.204 (.058)	0.378 (.028)
K	0.195 (.029)	0.280 (.064)	0.293 (.098)	0.518 (.071)
L	0.387 (.038)	0.301 (.059)	0.328 (.086)	0.113 (.077)
Constant	1.933 (.212)	2.413 (.217)	3.389 (.390)	1.956 (.154)
R^2	.96	.91	.91	.98
N	121	90	56	33
F statistic	822.415	306.408	172.271	605.452

Table 6. Estimated statistics for model 1: UK, Netherlands, Germany and Japan.

Estimating model 2 on the same series of national input-output data for the UK, Germany, Netherlands and Japan we find each of the estimated coefficients on K/L and M/L are statistically significant at the 1% level (see Table 7 below). The productivity patterns suggested by these results add weight to the first set of statistical tests. The estimated coefficients for M/L suggest that productivity due to manufactured inputs is very similar across the four counties, ranging from 0.339 to 0.409. However the estimated coefficients for K/L suggest productivity due to knowledge-intensive services differs greatly between the four countries, ranging from 0.512 to 0.183. The estimated values for Japan, Germany and the Netherlands are much higher than the UK estimate.

Coefficient	UK	Netherlands	Germany	Japan
M/L	0.409 (.026)	0.386 (.036)	0.339 (.574)	0.372 (.024)
K/L	0.183 (.028)	0.302 (.063)	0.289 (.114)	0.516 (.071)
constant	1.681 (.038)	2.048 (.075)	1.725 (.127)	2.027 (.083)
R^2	.72	.71	.58	.91
N	121	90	56	33
F statistic	153.335	104.706	37.063	144.019

Table 7. Estimated statistics for model 2: UK, Netherlands, Germany and Japan.

5. Conclusions

The findings of this paper call into question two oft-repeated statements in the political-economic discourse on services. The first is the suggestion that Germany is a services laggard. Of the countries considered here, services growth in Germany is second only to the UK. What is more, the data suggest that the impact of KIS on German output and productivity is higher than the UK. A second, more general, message which emerges is the need to distinguish between a general increase in the *representation* of services within a national economy, and the *degree of integration* between services and other economic activities. This is especially clear in the case of the UK. While the UK experienced a remarkable growth of service activities during the 1980s, this has less of an impact on manufacturing and other non-service sectors in the domestic UK economy. Consequently the economy-wide benefits of services innovation are actually lower than in the other countries which we have considered. It is particularly striking that Japan enjoys the highest spillover effects from services innovation, and that this is due to stronger flows of useful knowledge and information from services to other activities. The data suggest that there are now two distinct islands of economic activity in the UK – services and non-services – which have very weak linkages. The situation is very different in Japan, the Netherlands and Germany. If, as other writers have argued, KIS play an important role in linking together different parts of a knowledge economy, then one must ask *what* and *whom* are they linking together?

The aggregate data examined in this paper cannot, in isolation, provide an explanation of why these patterns have emerged. However a number of possible factors are suggested by the data, highlighting the need for further research. For example, lower estimated spillovers from KIS in the UK, combined with the observation that UK services generally appear to be taking on a dynamic of their own, suggests that researchers need to revisit the interface between services and manufacturing. Economic historians of the Industrial Revolution are consistently at pains to point out that the birth of the manufacturing economy in the UK was made possible by the Agricultural Revolution which preceded it. The dramatic gains in agricultural productivity made during the agrarian revolution released the large quantities of

labour necessary for industrialisation to occur. What is more, a close structural relationship formed between manufacturing and agriculture during the early phases of the industrial revolution; a relationship that was beneficial to both parties (cf. Matthias, 1996). The manufacture of improved agricultural implements and the development of new forms of mechanisation improved both the quantity and quality of the agricultural outputs used by manufacturers. The results presented in this paper suggest that a parallel situation may now exist between services and manufacturing. If, as is suggested, these national economies are shifting towards a 'services economy' model, analysts should avoid judging relative success or failure by the degree to which one type of activity replaces another. The findings of this paper suggest that those national economies who are benefiting most from this transition are those which have strong, mutually beneficial, links between services and other economic activities, most notably manufacturing.

This leads us to a further issue requiring investigation: the manner by which different organisational structures incorporate different inputs into the production process. While the data considered in this paper is highly aggregated, it highlights the extent to which knowledge and material inputs are used differently in the four countries and also the very different levels of interaction between services and manufacturing. This raises some important questions for management policy. Given these differences, a qualitative distinction needs to be drawn between the way in which client firms consume and exploit KIS services. We know, from various studies, that quite different networking cultures are to be found in different countries (e.g. Lundvall, 1992; Nelson, 1993). Given the higher levels of productive interaction identified in the Japanese data, analysts should consider those factors that distinguish it from the UK, Germany and the Netherlands. As Tomlinson (1999) points out, there is a well-established tradition of highly integrated networks in Japan - the *keiretsu* form of industrial organisation – that is frequently cited as being an important source of Japanese competitive advantage. These co-operative networks, which typically contain a range of manufacturing and service firms, appear to facilitate a high return to the consumption of KIS. This suggests that managers elsewhere should look carefully at the way in which they interact with their KIS providers. The effective consumption of intangible services requires the adoption of a process-orientated perspective in which close interaction is fostered with the service provider. In addition to complementary knowledge and technical competences, the quality of interaction depends on the practices, beliefs, values, routines and culture of the client organisation. If the use of these KIS services is to be encouraged then trust must be built up across the client organisation. Herein lies an important research agenda to be addressed in future work.

Bibliography

Antonelli, C., 1998, Localized technological change, new information technology and the knowledge-based economy: the European evidence, *Journal of Evolutionary Economics*, 8, pp.177-198.

Bell, D., 1973, *The Coming of the Post-Industrial Society*, Heinemann: London.

Blackler, F., Knowledge, knowledge work and organizations: an overview and interpretation, *Organization Studies*, 1995, 16, pp.1021-1046.

CBS, 1994, *Input-Output Tables*, Netherlands Statistics: Voorburg/Heerlen (NL).

Ciborra, C.U., 1993, *Teams, Markets, Systems: Business Innovation and Information Technology*, Cambridge University Press: Cambridge.

Clark, C., 1942, *The Conditions of Economic Progress*, Macmillan: London.

Cohen, S.S. and Zysman, J., 1987, *Manufacturing Matters: the Myth of the Post-Industrial Economy*, Basic Books: New York.

Cohen, W.M. and Levinthal, D.A., 1990, Absorptive capacity: a new perspective on learning and innovation, *Administrative Science Quarterly*, 35, pp.128-152.

Eurostat, 1996, *National Accounts 1970-1994*, Eurostat: Brussels, Luxembourg.

Freund, B., Konig, H. and Roth N., 1997, Impact of information technologies on manufacturing, *International Journal of Technology Management*, 13:3, pp.215-228.

Fuchs, V., 1968, *The Service Economy*, NBER/Columbia University Press: Columbia.

Georgescu-Roegen, N., 1971, *The Entropy Law and the Economic Process*, Harvard University Press: Cambridge, Mass.

Harcourt, G.C. and Laing, N., 1971, *Some Cambridge Controversies in the Theory of Capital*, Penguin: London.

Hauknes, J., 1997, 'Services in innovation systems - Do they have a role to play?', in Miles, I. (ed.), *Services, Innovation and the Knowledge-based Economy*, forthcoming.

den Hertog, P. and Bilderbeek, R., 1998, Innovation in and through knowledge intensive business services in the Netherlands, *TNO-report* STB/98/03, TNO/STB 1997.

Illeris, S., 1996, *The Service Economy - A Geographical Approach*, John Wiley: London.

Keeble, D., Bryson, J., and Woods, P.A., 1991, Small firms, business service growth and regional development in the UK: some empirical findings, *Regional Studies*, 25, pp.439-458.

Lundvall, B-Å., 1992, *National Systems of Innovation*, Frances Pinter: London

Lundvall, B-Å and Borrás, S., 1998, The globalising learning economy: implications for innovation policy, *TSER Programme Report*, DG XII, Commission of the European Union.

Matthias, P., 1996, *Agriculture and Industrialisation: From the Eighteenth Century to the Present*, Blackwell: Oxford.

Nelson, R. (ed.), 1993, *National Innovation Systems: A Comparative Analysis*, Oxford University Press: Oxford

OECD, 1995, *The OECD Input-Output Database*, OECD: Paris.

ONS, 1995, *1990 Input-Output Tables for the UK*, Office for National Statistics: London.

ONS, 1997, *Regional Trends*, Office for National Statistics: London.

Parker, G., 1977, *The Dutch Revolt*, Penguin: London.

Quinn, J. B., 1992, *Intelligent Enterprise*, Free Press: New York.

Reich, R., 1991, *Work of Nations - Preparing Ourselves for 21st Century Capitalism*, Simon Schuster.

SB, 1997, *Input-Output-Tabellen 1993*, Volkswirtschaftliche Gesamtrechnungen, Fachserie 18, Reihe 2, Statistisches Bundesamt: Wiesbaden.

Scarbrough, H., (ed.), 1992, *The IT Challenge: Strategy and IT in Financial Services*, Prentice-Hall: London.

Scarbrough, H., 1997, Making the matrix matter: strategic information systems in financial services, Journal of Management Studies, 34, pp.171-190.

Schama, S., 1987, *The Embarrassment of Riches*, Knopf: New York.

Steedman, I., 1979, *Fundamental Issues in Trade Theory*, Macmillan: London.

Strambach, S., 1997, Knowledge-intensive services and innovation in Germany, *Report for TSER project*, University of Stuttgart.

Taussig, F.W., 1939, *Principles of Economics*, Vol.1, Macmillan: London.

Tomlinson, M., 1999 (forthcoming), 'Information and technology flows from the service sector: A UK-Japan comparison', in Miles, I. and Boden, M. (eds.), *Services, Innovation and the Knowledge-Based Economy*, Cassell.

Windrum, Flanagan and Tomlinson, 1997, Recent patterns of services innovation in the UK, *Report for TSER project 'SI4S'*, PREST: Manchester.

Technical Appendix

In the first version of the labour-based production function we shall assume that labour interacts with intermediate manufactured goods consumed in the production process on the one hand, and knowledge intensive services on the other. Output **Q** is therefore a function of **ML** and **KL**, where **M** is the quantity of intermediate manufactured goods purchased, **L** is the wage bill of the sector and **K** is the quantity of knowledge-intensive services purchased.

$$Q = A\,(ML)^{a}(KL)^{b}$$

rewriting in logs we obtain

$$\log Q = \log A + a\log M + b\log K + c\log L \qquad (1a)$$

where $c = (a + b)$

One can relax the assumption that the interaction of L with M and K is restricted as follows,

assume $Q = A\,(M^{a1}L^{a2})(K^{b1}L^{b2})$

then $\log Q = \log A + a_1\log M + b_1\log K + c_1\log L \qquad (1b)$

where $c_1 = (a_2 + b_2)$

This equation provides the basis for the first model to be estimated. Note that equation 1a is a special case of equation 1b where $a_1=a_2$ and $b_1=b_2$.

One can also extend the analysis of labour interaction to examine the relative productivity gains due to knowledge-intensive services in the different countries under review. The second model to be tested here takes the form of;

$$Q/L = A(M/L)^{a}(K/L)^{b}$$

which, rewriting in logs, gives

$$\log Q/L = \log A + a\log(M/L) + b\log(K/L) \qquad (2)$$

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
mio ecu																
ECONOMIC ACTIVITIES																
Agriculture, forestry and fishing products	5 436	6 465	8 079	9 031	8 184	10 167	9 196	8 807	9 065	9 339	10 833	11 292	11 410	11892	12 499	13 553
	1.8	*1.7*	*1.8*	*1.9*	*1.6*	*1.9*	*1.6*	*1.6*	*1.6*	*1.4*	*1.4*	*1.5*	*1.5*	*1.5*	*1.6*	*1.6*
Fuel and power products	25 464	36 266	48 498	55 645	59 325	57 251	62 950	44 664	44 332	45 350	46 339	43 163	47 800	45 167	44 908	47 204
	8.6	*9.6*	*10.8*	*11.5*	*11.7*	*10.7*	*10.7*	*8.1*	*7.6*	*6.6*	*6.2*	*5.7*	*6.1*	*5.8*	*5.8*	*5.7*
Manufacturing products	83 470	99 321	111 851	118 870	119 457	126 119	139 309	132 827	139 455	164 527	173 297	166 326	164 024	158 638	156 551	167 613
	28.1	*26.4*	*24.9*	*24.5*	*23.6*	*23.6*	*23.8*	*24.0*	*24.0*	*24.0*	*23.2*	*22.1*	*20.8*	*20.3*	*20.2*	*20.2*
Building and construction	17 836	22 185	25 585	27 374	29 151	31 367	33 484	31 806	35 215	45 270	52 223	51 596	47 986	43 286	39 538	42 727
	6.0	*5.9*	*5.7*	*5.6*	*5.8*	*5.9*	*5.7*	*5.7*	*6.1*	*6.6*	*7.0*	*6.9*	*6.1*	*5.5*	*5.1*	*5.1*
Market services	121 287	152 595	181 432	197 420	209 281	224 421	251 349	250 273	262 711	316 323	352 607	366 732	391 442	398 115	408 332	450 050
	40.8	*40.5*	*40.4*	*40.6*	*41.4*	*42.0*	*42.9*	*45.1*	*45.2*	*46.2*	*47.2*	*48.7*	*49.7*	*51.0*	*52.7*	*54.2*
Recovery and repair, wholesale and retail services	35 337	43 722	50 161	54 990	57 508	61 555	67 271	65 567	67 111	79 654	86 156	88 085	94 194	92 965	92 550	98 324
Lodging and catering services	5 063	6 270	7 202	7 896	8 254	9 561	11 270	11 797	12 924	16 379	18 885	19 375	20 724	20 476	20 397	21 674
Inland transport services	8 169	9 137	10 620	11 096	11 225	12 825	13 990	13 710	14 192	16 861	17 863	18 689	19 579	19 817	18 994	20 402
Maritime and air transport services	3 280	3 640	4 103	4 110	3 903	4 096	4 455	4 400	4 374	4 941	4 943	5 016	5 760	5 655	6 022	6 451
Auxiliary transport services	3 931	4 568	5 683	6 229	6 465	7 421	8 070	7 976	8 997	11 539	13 123	13 314	14 222	13 573	13 894	14 883
Communication services	6 421	8 248	10 346	11 397	11 708	13 064	14 265	14 051	14 570	17 603	18 919	19 208	20 525	20 152	20 058	21 487
Credit and insurance services	8 005	11 163	13 853	15 703	17 177	18 518	22 899	24 130	26 920	35 016	44 408	44 883	41 804	48 535	48 116	53 280
Other market services	51 082	65 849	79 466	85 999	93 042	97 381	109 128	108 643	113 623	134 329	148 311	158 162	174 635	176 943	188 302	213 550
Non-market services	43 952	59 545	73 502	77 630	80 552	84 507	90 114	85 975	90 008	104 381	112 118	113 938	124 492	123 771	113 713	109401
	14.8	*15.8*	*16.4*	*16.0*	*15.9*	*15.8*	*15.4*	*15.5*	*15.5*	*15.2*	*15.0*	*15.1*	*15.8*	*15.9*	*14.7*	*13.2*
General government services	40 308	54 716	67 336	70 846	73 434	76 646	81 183	76 994	80 123	92 042	97 129	99 003	107 295	106 325	95 993	90 209
Other non-market services	3 643	4 829	6 167	6 784	7 117	7 861	8 931	8 981	9 885	12 338	14 989	14 934	17 197	17 445	17 721	19 192
TOTALS OF SECTORS	297 445	376 378	448 947	485 969	505 951	533 832	586 402	554 353	580 786	685 189	747 417	753 047	787 155	780 869	775 542	830 548
	100.0	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*
Imputed output of bank services	9 957	14 142	17 546	19 889	20 260	21 482	21 778	22 174	22 728	27 002	35 494	35 095	30 285	35 009	31 312	38 438
Gross value added at market prices	287 488	362 236	431 401	466 080	485 690	512 350	564 623	532 178	558 058	658 187	711 923	717 952	956 870	745 860	744 230	792 110

Table 1: UK gross value added at market prices by sector, 1979-1994, at 1990 prices

Source: Eurostat (1996)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
mio ecu																
ECONOMIC ACTIVITIES																
Agriculture, forestry and fishing products	4 094	4 291	5 174	5 957	6 274	6 451	6 663	7 580	7 488	7 691	8 852	9 014	9 260	8 996	8 466	9 586
	3.7	*3.7*	*4.2*	*4.4*	*4.3*	*4.2*	*4.1*	*4.4*	*4.2*	*4.2*	*4.5*	*4.3*	*4.2*	*3.8*	*3.3*	*3.6*
Fuel and power products	9 929	11 140	13 157	14 362	16 074	17 400	18 998	14 996	11 797	10 813	11 152	13 122	15 331	14 780	15 806	16 145
	9.0	*9.5*	*10.7*	*10.6*	*11.0*	*11.4*	*11.8*	*8.7*	*6.6*	*5.8*	*5.7*	*6.2*	*6.9*	*6.3*	*6.2*	*6.0*
Manufacturing products	19 871	20 556	20 721	23 087	24 756	26 613	28 014	31 292	32 234	34 762	37 663	39 643	39 660	41 006	42 808	44 997
	18.1	*17.5*	*16.9*	*17.0*	*16.9*	*17.4*	*17.4*	*18.1*	*18.1*	*18.8*	*19.1*	*18.8*	*17.9*	*17.4*	*16.9*	*16.8*
Building and construction	7 468	8 181	7 860	8 047	7 845	7 859	7 839	8 786	9 357	10 589	11 090	11 702	12 074	12 585	13 608	14 740
	6.8	*7.0*	*6.4*	*5.9*	*5.4*	*5.1*	*4.9*	*5.1*	*5.3*	*5.7*	*5.6*	*5.5*	*5.4*	*5.4*	*5.4*	*5.5*
Market services	52 758	56 458	58 969	65 815	71 751	75 276	79 519	89 272	94 863	99 181	106 019	114 371	121 618	131 736	144 217	152 890
	48.0	*48.2*	*48.0*	*48.4*	*49.1*	*49.2*	*49.5*	*51.7*	*53.4*	*53.6*	*53.9*	*54.2*	*54.8*	*56.0*	*57.0*	*57.2*
Recovery and repair, wholesale and retail services	13 554	14 329	14 779	16 414	17 505	18 528	19 969	22 962	24 310	25 213	26 568	28 975	30 149	31 692	33 700	34 479
Lodging and catering services	1 745	1 897	1 969	2 196	2 341	2 501	2 591	2 788	3 019	3 158	3 568	3 929	4 221	4 613	5 314	5 599
Inland transport services	2 672	2 806	2 779	2 871	3 051	3 113	3 411	4 010	4 272	4 454	4 673	4 992	5 315	5 710	11 630	N/A
Maritime and air transport services	1 127	1 205	1 373	1 353	1 420	1 604	1 726	1 630	1 613	1 731	1 865	1 867	2 228	2 291	N/A	N/A
Auxiliary transport services	1 269	1 372	1 437	1 567	1 648	1 737	1 820	2 278	2 352	2 480	2 574	2 697	2 792	3 041	N/A	N/A
Communication services	2 110	2 235	2 338	2 665	2 907	2 996	3 187	3 491	3 638	3 816	4 066	4 372	4 647	5 108	5 577	5 874
Credit and insurance services	5 117	5 498	5 767	6 495	7 583	7 865	8 188	8 739	9 033	9 356	10 416	10 177	10 587	11 640	13 114	14 411
Other market services	25 165	27 119	28 528	32 254	35 297	36 931	38 627	43 374	46 628	48 973	52 290	57 363	61 680	67 650	74 561	79 928
Non-market services	15 782	16 570	16 928	18 688	19 387	19 296	19 633	20 792	21 896	21 855	22 095	23 149	24 085	26 018	28 099	28 923
	14.4	*14.1*	*13.8*	*13.7*	*13.3*	*12.6*	*12.2*	*12.0*	*12.3*	*11.8*	*11.2*	*11.0*	*10.8*	*11.1*	*11.1*	*10.8*
General government services	15 404	16 176	16 520	18 232	18 913	18 808	19 116	20 243	21 291	21 208	21 406	22 415	23 315	25 202	27 230	28 015
Other non-market services	378	393	408	456	474	488	517	550	605	647	689	734	771	816	870	907
TOTALS OF SECTORS	109 901	117 196	122 809	135 956	146 086	152 895	160 665	172 717	177 635	184 890	196 870	211 000	222 028	235 121	253 005	267 281
	100.0	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*
Imputed output of bank services	3 930	4 226	4 644	5 459	6 440	6 528	6 830	7 230	7 247	7 653	7 888	7 980	8 747	9 212	10 703	10 633
Gross value added at market prices	106 074	113 061	118 273	130 629	139 883	146 528	154 099	165 784	170 708	177 595	189 319	203 358	213 668	226 326	242 786	257 114

Table 2: Netherlands gross value added at market prices by sector, 1979-1994, at 1990 prices

Source: Eurostat (1996)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
mio ecu																
ECONOMIC ACTIVITIES																
Agriculture, forestry and fishing products	12 093	11 767	12 431	15 042	14 232	14 973	13 902	15 492	14 074	15 806	17 478	17 444	16 224	16 243	14 947	15 148
	2.3	*2.1*	*2.1*	*2.3*	*2.0*	*2.0*	*1.7*	*1.8*	*1.5*	*1.6*	*1.7*	*1.5*	*1.3*	*1.2*	*1.1*	*1.0*
Fuel and power products	27 028	27 020	28 599	32 559	35 226	37 310	38 821	41 399	40 127	41 025	42 651	44 487	48 603	52 737	56 509	57 908
	5.1	*4.8*	*4.8*	*5.0*	*4.9*	*4.9*	*4.9*	*4.7*	*4.3*	*4.2*	*4.1*	*3.9*	*3.9*	*3.9*	*4.0*	*3.9*
Manufacturing products	167 974	171 032	175 398	189 582	208 296	220 306	237 246	270 325	283 610	295 534	310 835	339 603	360 903	367 601	353 452	365 341
	31.5	*30.5*	*29.7*	*29.1*	*29.1*	*29.0*	*29.8*	*30.7*	*30.5*	*30.2*	*29.9*	*29.8*	*29.0*	*27.3*	*24.9*	*24.6*
Building and construction	36 957	41 274	41 387	42 188	45 306	46 194	43 959	48 557	50 588	52 436	56 634	62 749	67 674	76 274	79 880	85 749
	6.9	*7.4*	*7.0*	*6.5*	*6.3*	*6.1*	*5.5*	*5.5*	*5.4*	*5.4*	*5.4*	*5.5*	*5.4*	*5.7*	*5.6*	*5.8*
Market services	214 361	229 441	246 012	276 503	309 880	335 064	351 090	281 328	410 074	438 196	470 975	525 742	589 419	654 550	720 621	763 089
	40.2	*40.9*	*41.7*	*42.5*	*43.3*	*44.0*	*44.1*	*43.3*	*44.1*	*44.7*	*45.3*	*46.1*	*47.3*	*48.6*	*50.8*	*51.4*
Recovery and repair, wholesale and retail services	60 655	61 589	62 830	67 483	74 795	80 694	81 786	88 432	93 867	98 766	103 089	119 231	136 115	142 731	146 743	N/A
Lodging and catering services	7 273	7 822	8 551	9 309	10 024	10 368	10 380	11 682	12 872	13 380	14 504	16 281	17 290	18 485	19 700	N/A
Inland transport services	11 113	11 742	12 266	13 288	14 239	15 275	15 996	16 949	17 893	18 778	20 152	22 084	23 052	24 529	25 397	N/A
Maritime and air transport services	2 713	2 907	3 100	2 312	3 206	3 529	3 809	3 804	8 717	4 182	4 590	4 875	5 119	5 459	5 801	N/A
Auxiliary transport services	4 446	4 804	5 012	5 538	6 048	6 607	6 936	7 303	7 948	8 529	9 326	10 490	11 064	12 189	12 808	N/A
Communication services	12 318	12 430	13 062	14 834	16 225	17 222	17 937	19 549	20 926	22 025	23 612	24 934	27 316	39 241	32 449	N/A
Credit and insurance services	23 563	25 501	29 232	35 622	40 705	42 996	43 869	45 874	46 273	49 065	52 262	55 102	63 617	72 067	83 490	N/A
Other market services	92 281	102 653	111 961	127 120	144 641	158 376	170 381	187 738	206 411	223 478	243 446	272 744	305 846	348 849	394 233	N/A
Non-market services	74 439	80 407	86 268	94 689	102 673	106 885	111 965	123 497	132 449	136 322	140 936	151 401	163 323	178 501	193 704	198 718
	14.0	*14.3*	*14.6*	*14.6*	*14.3*	*14.1*	*14.0*	*14.0*	*14.2*	*13.9*	*13.6*	*13.3*	*13.1*	*13.3*	*13.7*	*13.4*
General government services	63 277	68 209	72 985	79 710	86 119	89 247	93 012	101 927	108 911	111 672	115 169	123 280	132 153	143 758	155 372	158 403
Other non-market services	11 162	12 198	13 283	14 979	16 555	17 638	18 953	21 571	23 538	24 650	25 767	28 121	31 170	34 743	38 331	40 315
TOTALS OF SECTORS	532 851	560 940	590 095	650 563	715 612	760 722	796 983	880 598	930 923	979 319	1039 509	1141 425	1246 045	1345 905	1419 112	1485 953
	100.0	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*
Imputed output of bank services	19 595	21 469	25 172	30 985	35 987	37 563	37 847	39 325	39 714	41 048	42 707	46 918	54 243	61 409	68 339	69 933
Gross value added at market prices	513 256	539 571	564 923	619 578	679 624	723 159	759 136	841 274	891 209	938 271	996 802	1094 508	1191 802	1284 496	1350 773	1416 021

Table 3: German gross value added at market prices by sector, 1979-1994, at 1990 prices

Source: Eurostat (1996)