THE CONTRIBUTION OF SERVICES TO MANUFACTURING INDUSTRY:

Beyond The Deindustrialisation Debate

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Introduction

The purpose of this paper is to examine the contribution that certain services make to value-added in the manufacturing sector. Using input-output tables from the UK from 1990 we explore the relationship between service and manufacturing sectors by utilising a Leontieff approach to measure flows of goods and services from sector to sector, and a production function approach to attempt to show significant relationships between different sectors. The discussion is framed within the debates pertaining to deindustrialisation and post-industrial society.

The increasing prevalence of service sector activity in the world economy is frequently seen in one of two ways: either optimistically or pessimistically. On the one hand the theory of post-industrial society put forward by, for example, Bell (1973) is suggestive of a brave new world where increasing wealth creation has allowed consumers to expand their purchases beyond mere material goods to a whole new realm of useful or luxurious services. For some commentators, on the other hand, (such as Cohen and Zysman, 1987) there are potentially damaging consequences to modern economies due to the uncontrolled expansion of services and the erosion of our manufacturing bases. This is obviously a caricature, but it captures the extreme poles of the debate.

Service sector growth is frequently seen in the context of wealth created by manufacturing sectors. This conception of the service sector has sometimes resulted in services being seen as unproductive laggards with little to contribute in real terms to economic growth or productivity. It has not been until fairly recently that the service sector has been sufficiently disaggregated in economic statistics to allow useful analysis of its constituent parts. This is despite its growing importance - such as the fact that services now constitute over 60% of world output in industrialised nations and around half of all output in developing countries (see Williams, 1997, Table 2.2, p.17).

The more pessimistic ‘deindustrialisation debate’ suggests that the economy has been fundamentally transformed to the detriment of manufacturing output and employment. Some economists (in the US case at least) have actually argued that the proportion of

output accounted for by manufacturing has not in fact shrunk and only the employment level in this sector has declined. If this is the case, then increases in productivity in manufacturing are more than compensation for the loss of jobs and there is probably little to worry about. However, current debates are underway in the US about the unsatisfactory way in which many essential economic statistics are calculated. For example, quality changes are not sufficiently accounted for, and figures are frequently subjected to a number of ad hoc adjustments that have almost certainly led to the overestimation of manufacturing output. If there is a consistent overestimation of manufacturing output as a proportion of GDP then this suggests that there may be a corresponding *underestimation* of output in services. This raises questions about whether services really are laggards with respect to output and productivity.

The figures used for measuring services versus manufacturing output rely on official statistics, although some recalculations are possible using known errors in the calculation procedures. Mishel (1989) attempted to rectify some of the errors and recalculated the figures for the US economy between 1973 and 1987. He showed that the loss of 3 million manufacturing jobs could be completely accounted for by the previously hidden fall in manufacturing output as a proportion of GDP. The official estimates show that manufacturing output appears to be fairly constant throughout the same period at around 22% of all output. Mishel's revised figures show a fall from 24.0% in 1973 to 20.8% in 1987. These figures also suggest that there has been a stronger growth in manufacturing productivity in the 1980s compared with the 1970s, but the outlook remains a pessimistic one for US manufacturing.

In contrast to the gloomier manufacturing oriented economists, Miles (1996) has argued that 'services are increasingly bound up with the activity of all sectors of the economy - "producer services" … show the most rapid growth in services employment' (p.4). Rather than seeing services as a separate and peripheral economic factor mainly producing superfluous consumer products, emphasis is beginning to shift towards looking at services as an integrated part of a potentially dynamic economic system. Thus the distinctions between manufacturing and services can be seen as becoming blurred, especially where knowledge intensive business services (KIBS) are concerned. Manufacturing companies that may once have had their own in-house

business service departments may now be using increasingly specialised professional services from outside. Many of these services were previously hidden in the official statistics within ‘manufacturing’ sectors.

The growth of business services in the UK may in part be because they have been out-sourced by manufacturing firms. This is how Freund *et al*. (1997) put it with regard to the German case (where this has not yet happened to such a great extent):

> It is often stated that Germany has fallen behind in the shift from manufacturing to services and therefore we could easily create new jobs via more services. In fact, industrial production is embedded in a large volume of services, providing the infrastructure for the direct manufacturing activities. In Siemens more than 50% of labour is indirect and could be considered as a service. However, the company is in the category of manufacturing industry and therefore contributes like many other companies of similar profile to production statistics and is not accounted for under services.
> (1997:220.)

Furthermore, many manufacturing industries have transferred the bulk of their production to developing countries and this has also fuelled the relative growth of the service sector in first world countries. As Williams (1997) points out the new international division of labour (NIDL) has resulted in manufacturing being increasingly located in less economically developed countries:

> In this NIDL, the control and command functions are located in a network of global cities in the developed nations whilst physical production is increasingly dispersed into a host of developing countries where new and efficient technology can be allied to lower labour costs.
> (1997:18).

So on the one hand we have a trend towards deindustrialisation in the developed world coupled with growing strength in manufacturing industry in the developing world. The

deindustrialisation debate probably needs to take this consideration on board rather than bemoaning the decline in domestic manufacturing.

If services are to be seen as potential drivers for the economy rather than subordinate to manufacturing then empirical evidence should show that at least some services make a significant contribution to the economy. Can we demonstrate that knowledge and business services' inputs significantly contribute to manufacturing output? The methods employed to do this are expounded in the next section.

Data and Methodology

Two methods of analysis are proposed for exploring the scale and significance of the contribution of knowledge intensive business services to manufacturing. The first of these is to use a modified form of Cobb-Douglas production function. The second is to use Leontieff input-output techniques. Both these techniques are explained below. UK data from 1990 are used in both cases.

A. The production function approach

Two forthcoming studies (one by Tsounis and one by Antonelli) outline and test a production function approach to assess knowledge and business service inputs into the economy. The additional results reported below are meant to be a compliment to, rather than an alternative to their work.

Antonelli (forthcoming) argues that 'development of knowledge within industries is strongly influenced by the network structure of relations among firms'.

Furthermore:

> the capability of firms to generate technological innovation rests upon the continual effort to keep open all the information and communication channels that parallel the flows of goods and to capitalize upon the opportunity to learn. (p.131)

This can be achieved by creating an appropriate organisational environment and developing different forms of co-operation. He assumes that knowledge intensive services provide the major platform for this connectivity and receptivity between sectors. So, as well as in-house R&D etc. as the base of knowledge and performance of firms, he argues that certain services should be taken into account as providers of *essential information and technologies to all other sectors*.

He splits the knowledge-based services into two types: communication services and business services. He expects to see a correlation in the rates of growth in the use of these two types of knowledge-based service and to see the effects of increasing productivity through their use. These data are available through national accounts statistics and input-output tables for a number of European countries using different databases (Italy, UK, Germany and France are included).

His first hypothesis is demonstrated for all five countries. I.e. the use of business and communication services is indeed correlated across sectors, as is their rate of growth.

He then estimates a technology production function for each country. This implies that:

$$\log Y = a + b \log K + c \log L + d \log CBS$$

Y = sectoral value added
K = capital stock estimated from investments
L = labour costs
CBS = inputs of communications or business services
a, b, c, d are coefficients to be estimated

The results show that communication and business services are significant determinants of sectoral output for all the countries (these were included in the model separately due to correlation problems, but both were significant). The units of analysis in these models were the sectors in the input-output tables for the individual years that the tables were available for.

Tsounis (forthcoming) effectively replicated the Antonelli study to some extent using Greek data. Similar results emerged in terms of showing the significant influence of knowledge based services on output.

B. The Leontief framework

However, Tsounis also went further and attempted to measure direct and indirect knowledge intensive business service (KIBS) flows to each sector with the input-output tables using a Leontief framework. This enables flows of commodities and services to be traced from sector to sector. Whether the flow is direct or by a more circuitous route can be ascertained. This has an advantage over production function analysis which only takes *direct* inputs into account.

Technological diffusion is still not very well understood, especially when it comes to flows from one firm or sector to another. The understanding of the nature of these flows is extremely important in order to comprehend the influences of technological advance and knowledge generation in one sector, and how it impinges on another,

through the network of overlapping entities within an economy and the various degrees of interconnectedness between sectors

New technologies and sources of knowledge do not necessarily impact on different sectors in the same way. Knowledge will diffuse at different rates depending on the receptivity of the receiving sector and the ease with which the producing sector can generate useful and generalisable information.

OECD (1996) suggests that there are basically two types of diffusion: disembodied and equipment embodied diffusion. Disembodied diffusion is the 'transmission of knowledge, technical expertise, or technology in a way that does not necessarily involve the purchase of machinery and equipment incorporating new technology' (1996:9). This involves two further notions: research spillovers and absorptive capacity.

Research spillovers are the means by which new technology or knowledge developed by one sector or firm becomes available in one form or another to other entities.

Absorptive capacity is the propensity of a firm to effectively absorb the potential available through exposure to embodied or disembodied diffusion.

If we think of an economic system as a set of interlaced sectors in a network then the nodes of the network must be analysed to assess the degree to which sectors can interact with each other. As it may be the case that knowledge generated in one sector does not take a direct route to the receiving sector, but flows through one or several intermediary channels, the Leontief approach is particularly apt. Thus the network analogy of the economy is extremely useful in this context.

The Leontieff approach depends on the analysis of input-output tables which detail the levels of consumption and production of goods and services from all industries to all other industries. Such tables are compiled by government statisticians typically every 5 years. In principle the tables provide a resource for tracing the pathways through which knowledge and/or technology originating in one sector or sectors diffuses (via

consumption) to other sectors. Input-output tables are not without their problems, but they are the only real coherent source of information for the analysis of flows and interconnections between sectors. Some advantages and disadvantages are outlined below:

Some advantages of input-output tables:

- They can simultaneously take account of supply and demand factors thus overcoming some of the one-sidedness of supply-push and demand-pull approaches.

- Indirect as well as direct flows from sector to sector can be estimated.

- Similar sectors, and the extent to which sectors are interconnected, can be revealed.

Some disadvantages:

- Sectoral output is treated as homogeneous. Thus if a million pounds worth of goods are transferred from A to B and a million pounds worth from A to C, then B and C are assumed to have received the same amount of knowledge, technology or whatever from A.

- A sectors R&D and technology/knowledge is assumed to be embodied in its output.

- Tables are only available for certain time points (usually at least 5 years apart), and sectoral definitions change over time, making comparisons difficult.

- Disembodied spillovers are not necessarily captured.

More formally in a Leontief input-output system essentially if vector **s** represents direct knowledge based business services inputs per unit of output, then it can be shown that:

$$\text{direct + indirect KIBS inputs} = \mathbf{s}^{T} (\mathbf{I} - \mathbf{A})^{-1}$$

(for 1 unit of output)

Where **I** is the identity matrix and **A** is the matrix of input-output coefficients. (See Leontief, 1986). This is the model used by Tsounis (forthcoming) and which we attempt to replicate using UK data.

Using Greek input-output tables for 1980 and 1988 Tsounis calculated the direct and indirect KIBS inputs per unit of output for each sector and reported them. However, the results seem far from clear or conclusive. The top 10 users of KIBS in 1988 for instance included the drinks sector, the leather goods sector, the perfume sector, paper and board. More predictable ones included pharmaceuticals and finance. The results are not easy to interpret. An investigation using UK tables is presented below which gives potentially more comprehensible results.

The UK input-output tables for 1990

The ONS input-output tables for the UK in 1990 (ONS, 1995) have several advantages over the tables used by Antonelli and Tsounis. For instance, they have a much more detailed sectoral breakdown of services as well as manufacturing. This results in a total of 123 sectors (including services) and their interconnections. We now turn to the replication and expansion of the Antonelli and Tsounis studies with this more detailed dataset.

Rather than just collapsing all the categories of knowledge based business services together in the production function analysis, each one is added to the production function model *separately*. This allows us to assess the *relative* impact of each on value-added in the manufacturing sector. Note that here only manufacturing sectors (including utilities and construction) are included in the models as the aim is to explore the extent to which knowledge based services are drivers of manufacturing output. In contrast Tsounis and Antonelli included all sectors in their models. The impact of services on other services is not really relevant to a discussion of deindustrialisation and is thus not pursued here.

The data in the following models were provided by input-output tables for 1990 (ONS, 1995) for the labour costs, value-added and knowledge and business services inputs; fixed capital stocks were derived from the Census of Production for 1990 (note that the census and the input-output tables do not have identical sectoral components so a small number of sectors had to be collapsed, thus losing some detail). We now present the results of applying the two methods described.

A. Results from the production function approach

The results of the basic production function models using capital, labour and communication and business services are shown in table 1. Communication and business services (CBS) here are comprised of the following sectors:

Banking and finance
Insurance
Auxiliary financial services
Estate agents
Legal services
Accountancy services
Other professional services
Advertising
Computing services
Other business services
Postal services
Telecommunications

Table 1 Basic production function models for UK manufacturing 1990

	Basic Cobb-Douglas function	Modified function including CBS
Constant	0.465 (0.241)	0.550* (0.234)
K	0.118* (0.059)	0.055 (0.061)
L	0.876** (0.066)	0.734** (0.080)
CBS		0.228** (0.081)
Adj. R-square	0.91	0.92
F	361.5**	267.0**

* - significant at 5%
** - significant at 1%

Standard errors in brackets.

As can be seen here the basic Cobb-douglas function has significant coefficients on both capital stock and labour. However, the expanded function has a significant coefficient on CBS and appears to replace capital as the most significant element besides labour in contributing to manufacturing value added. This implies that, contrary to some of the deindustrialisation theories outlined above, certain business services are highly significant in determining value added output in manufacturing.

As we have included several sectors in the CBS inputs it may be useful to determine if any particular inputs are more influential than others. Table 2 shows several production functions where the CBS variable has been disaggregated into its constituent parts (note that estate agents and auxiliary financial services are excluded as they contribute to very few sectors - i.e. as the logged value of zero is uncomputable most cases are lost).

Table 2 Production function using different CBS inputs

K	.046 (.057)	.109 (.060)	.071 (.059)	.058 (.058)	.124 (.065)	.064 (.059)	.069 (.058)	.122* (.063)	.124* (.060)	.119* (.060)
L	.733** (.069)	.787** (.095)	.806** (.070)	.789** (.067)	.887** (.083)	.814** (.065)	.795** (.067)	.884** (.078)	.834** (.084)	.844** (.102)
Banking	.248** (.061)									
Insurance		.111 (.086)								
Legal			.135** (.048)							
Accounting				.169** (.051)						
Other prof					-.019 (.084)					
Advertising						.139** (.044)				
Computing							.151** (.048)			
Oth business								-.013 (.066)		
Postal									.043 (.053)	
Telecomms										.033 (.081)
Constant	.820** (.235)	.820* (.366)	1.09** (.324)	1.11** (.296)	.426 (.296)	.974** (.280)	1.06** (.297)	.431 (.294)	.662 (.342)	.594 (.404)
adj r-square	.92	.91	.92	.92	.91	.92	.92	.91	.91	.91
F	299**	244**	263**	279**	238**	274**	274**	238**	240**	238*

* - significant at 5%
** - significant at 1%

Standard errors in brackets.

The results in table 2 demonstrate that certain services appear to have a more significant impact on manufacturing than others. The significant ones are banking and financial, legal, accounting, advertising and computing services. The largest coefficient seems to be banking and financial services at 0.248. Insurance, other professional services, other business services, postal and telecommunications services appear to be insignificant inputs for manufacturing output. Thus communications services, peripheral services and insurance appeared to have less impact than other knowledge based business services in the UK manufacturing economy in 1990. This does not mean to say that they are insignificant with respect to other services outputs.

B. Results from the Leontief approach

Moving on to the results of the Leontief approach, the full results of which are shown in appendix 1, here the impact of direct and indirect communications services and business services have been calculated separately from the above formula. These figures show the amounts of the specific inputs required to produce one unit of output. As might be expected from the production function analysis where telecommunications and postal services were not significant, the results here show that direct and indirect flows of communication services inputs are not nearly as large as in other services, although one notable exception in this regard is the insurance sector which shows substantially higher communication service inputs than other sectors.

Table 3 shows the top 20 users of business services in the economy as a whole in 1990. Appendix 2 has the full table.

Table 3 Top 20 users of KIBS in 1990

Insurance
Owning and dealing in real estate
Other business services
Computing services
Renting of movables
Personal services
Estate agents
Other professional services
Legal services
Banking and finance
Air Transport
Ownership of dwellings
Auxiliary financial services
Advertising
Printing and publishing
Accountancy services
Sea transport
Oils and fats
Electronic consumer goods, records and tapes
Distribution & repair of vehicles,filling stations & other goods

It can be seen that most of these are actually services themselves showing that the service sector is in fact heavily dependent and interconnected with itself, but there are some notable additions from manufacturing. Namely printing and publishing, oils and fats, and electronic consumer goods. The top 20 manufacturing users of KIBS are shown in table 4.

Table 4 demonstrates the wide range of manufacturing sectors that have a heavy reliance on direct and indirect knowledge based services inputs. These range from heavy manufacturing sectors such as extraction of metalliferous ores and industrial plant and machinery, to numerous food sectors, and to specialised manufacturing sectors such as pharmaceuticals and instrument engineering. Although the fact remains that the top service user of KIBS (insurance) uses more than twice the volume that the top manufacturing user of KIBS (printing and publishing) uses (0.62 versus 0.27, see appendix 2).

The results show that the reliance on KIBS tends to be concentrated in services themselves, but the explanation for the top manufacturing users of KIBS seems to require further investigation. As the results of Tsounis' study suggest, we have to explore further the uses of KIBS by certain manufacturing sectors. For instance, how can we explain the 'oils and fats' sector having higher KIBS use than 'pharmaceuticals'. Perhaps petrochemicals are included in oils and fats and are heavy users of KIBS, or perhaps pharmaceuticals are more heavily dependent on in-house knowledge. Several food industries also seems to be relatively heavy users, but this may be because of advertising rather than knowledge impinging on production processes. Unfortunately we cannot explore these issues with the data used here. Perhaps case studies or company accounts would shed more light on this.

Table 4 Top 20 users of KIBS - manufacturing industry

Printing and publishing
Oils and fats
Electronic consumer goods, records and tapes
Soap and toilet preparations
Miscellaneous foods
Confectionary
Animal feed stuffs
Tobacco
Alcoholic drinks
Sports goods and toys
Soft drinks
Metal doors and windows etc.
Construction
Wood furniture, shop and office fittings
Industrial plant and machinery
Fruit, vegetable and fish processing
Pharmaceuticals
Textile machinery, machinery for other materials
Leather and leather goods
Extraction of metalliferous ores and minerals nes
Domestic electric appliances
Fertilisers
Metal working machine tools
Timber processing and wood products (not furniture)
Instrument engineering

Conclusions

Knowledge based business service inputs appear to be highly significant whether we look at their influence within the services or manufacturing sectors. In fact there is no evidence that these service inputs are less important for manufacturing output than fixed capital. There is therefore a convincing argument that manufacturing sectors in post-industrial societies rely on these services. Rather than the manufacturing base being eroded away, the development of specialised services may in fact be beneficial to manufacturing. The manufacturing versus services dichotomy is then unhelpful. The knowledge based service sector is an integral part of the economic system rather than an 'unproductive' or 'parasitic' laggard.

Freund *et al*. of the Siemens corporation concentrate on the role of IT in manufacturing in the modern age and go as far as calling for the terms 'manufacturing' and even 'product' to be redefined.

> In many cases it is not the product itself the customer is interested in, but the services which can be provided by the product. … The definition of manufacturing has to fall in line with this new understanding. Manufacturing means producing *all* the capabilities the customer wants to find in the product and this understanding covers *all the steps* in the value-adding chain.
> (1997:217, italics in original)

Here it can be seen that there is an acknowledged shift in the perceptions of leading manufacturers about the nature of industrial production. No longer can manufacturing be seen as the fundamental, isolated and superior branch of production in the modern western world (although the complications of third world industrial development remain to be addressed). The existence of other supporting and inextricably linked sectors and modes of activity are crucial. Freund *et al*. continue:

> Furthermore, manufacturing also comprises support systems, namely logistics support. Logistic objects are all kinds of material and physical components *and* all kinds of information necessary or created while pursuing the value-adding chain.
> (*ibid*., p.217, italics in original)

In other words there is already an implicit understanding in western industry that knowledge and information contribute to value-added - as has hopefully been empirically demonstrated in this paper.

The importance of services for manufacturing, especially knowledge based services, has been shown for the UK in 1990. The importance of KIBS for the value added output of manufacturing has also been demonstrated, confirming and reinforcing the work of Antonelli and Tsounis for other EU countries. The bleak outlook of arguments based on a deindustrialisation frame of reference should perhaps be viewed in the more promising light of results such as these. Industrialists have already realised this, perhaps economists should too.

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Appendix 1 Full results of Leontief approach for communication and business services inputs - 1990

N.B. Communications includes postal services and telecommunications sectors; business services includes banking and finance, insurance, auxiliary financial services, estate agents, legal services, accountancy, other professional services, advertising, computing services, and other business services.)

Sector	communications		business services	
	direct	direct+indirect	direct	direct+indirect
Agriculture and horticulture	0.00804	0.02100	0.04175	0.13799
Forestry	0.00023	0.00676	0.00007	0.05358
Fishing	0.00000	0.01004	0.02944	0.10258
Coal extraction and manufacture of solid fuels	0.00259	0.01106	0.04421	0.11792
Extraction of mineral oil and natural gas	0.00000	0.00603	0.02672	0.07206
Coke ovens, mineral oil processing and nuclear fuel production	0.00089	0.00556	0.01762	0.06087
Electricity production	0.00409	0.01472	0.01597	0.08466
Gas	0.00591	0.01076	0.02541	0.06597
Water supply	0.00864	0.01474	0.04292	0.08336
Extraction of metalliferous ores and minerals nes	0.01500	0.02865	0.06850	0.16748
Iron and steel, and steel products	0.00133	0.01094	0.04589	0.12885
Aluminium and aluminium alloys	0.00165	0.01004	0.05032	0.11832
Other non-ferrous metals (including precious metals)	0.00213	0.00996	0.04649	0.10629
Extraction of stone, clay, sand and gravel	0.01240	0.02483	0.06552	0.15498
Structural clay products	0.00593	0.01415	0.04368	0.10329
Cement, lime and plaster	0.00255	0.01321	0.03675	0.12177
Concrete, stone, asbestos and abrasive products	0.00484	0.01776	0.05018	0.15035
Glass	0.00468	0.01578	0.06628	0.15073
Refractory and ceramic goods	0.00488	0.01478	0.05577	0.12871
Inorganic chemicals	0.00363	0.01354	0.06126	0.13731
Organic chemicals	0.00321	0.01253	0.06067	0.13523
Fertilisers	0.00511	0.01763	0.06715	0.16463
Synthetic resins and plastic materials, synthetic rubber	0.00232	0.01155	0.06070	0.13512
Paints, dyes, pigments, printing ink	0.00728	0.01784	0.07023	0.15302
Specialised chemicals for industry and agriculture	0.00380	0.01248	0.05586	0.12532
Pharmaceutical products	0.00412	0.01408	0.09034	0.16882

Soap and toilet preparations	0.00328	0.01641	0.10641	0.21366
Chemical products nes	0.00215	0.01098	0.05859	0.13426
Man-made fibres	0.00201	0.00974	0.05405	0.11646
Metal castings, forgings, fastenings, springs, etc	0.00389	0.01331	0.05872	0.13541
Metal doors, windows, etc	0.00836	0.02080	0.07978	0.18523
Packaging products of metal	0.00300	0.01326	0.05004	0.14049
Metal goods nes	0.00515	0.01573	0.06674	0.15353
Industrial plant and steelwork	0.00398	0.01457	0.07719	0.17156
Agricultural machinery and tractors	0.00399	0.01407	0.04729	0.13291
Metal-working machine tools	0.00616	0.01754	0.06995	0.16446
Engineers small tools	0.00663	0.01514	0.06193	0.13052
Textile machinery, machinery for working other materials	0.00611	0.01754	0.07563	0.16838
Process machinery and contractors	0.00432	0.01298	0.06567	0.14192
Mining, construction and mechanical handling equipment	0.00484	0.01609	0.05767	0.15621
Mechanical power transmission equipment	0.00691	0.01598	0.05622	0.13167
Other machinery and mechanical equipment	0.00531	0.01552	0.06153	0.14700
Ordnance, small arms and ammunition	0.00286	0.01323	0.05828	0.14615
Office machinery and computer equipment	0.00441	0.01522	0.06854	0.15902
Insulated wires and cables	0.00449	0.01414	0.06070	0.13984
Basic electrical equipment	0.00509	0.01494	0.06015	0.14035
Electrical equipment for industry, batteries, etc	0.00594	0.01652	0.06659	0.15455
Telecommunication etc equipment, electronic capital goods	0.00642	0.01694	0.06936	0.15160
Electronic components and sub-assemblies	0.00671	0.01692	0.07333	0.15352
Electronic consumer goods, records and tapes	0.00560	0.01876	0.11342	0.22044
Domestic electric appliances	0.00462	0.01566	0.07546	0.16551
Electric lighting equipment, etc	0.00440	0.01415	0.05783	0.13702
Motor vehicles and parts	0.00149	0.01057	0.05619	0.13697
Shipbuilding and repairing	0.00415	0.01484	0.06180	0.15175
Aerospace equipment manufacturing and repairing	0.00172	0.00794	0.05023	0.10917
Other vehicles	0.00301	0.01265	0.04859	0.13150
Instrument engineering	0.00837	0.01937	0.07377	0.15979
Oils and fats	0.00220	0.01993	0.08428	0.22670
Slaughtering and meat processing	0.00187	0.01776	0.04397	0.15886
Milk and milk products	0.00147	0.01766	0.04018	0.15656
Fruit, vegetables and fish processing	0.00219	0.01478	0.06780	0.16922
Grain milling and starch	0.00170	0.01626	0.03162	0.13034
Bread, biscuits and flour confectionery	0.00289	0.01383	0.06450	0.15489
Sugar	0.00114	0.01351	0.04524	0.14330
Confectionery	0.00400	0.01770	0.09304	0.20095
Animal feeding stuffs	0.00365	0.01965	0.07495	0.19899

Miscellaneous foods	0.00221	0.01560	0.10419	0.20666
Alcoholic drink	0.00224	0.01515	0.09193	0.19331
Soft drinks	0.00308	0.01559	0.07682	0.18767
Tobacco	0.00083	0.01187	0.12031	0.19458
Woollen and worsted	0.00289	0.01255	0.06221	0.13761
Cotton etc spinning and weaving	0.00260	0.01010	0.05733	0.11660
Hosiery and other knitted goods	0.00432	0.01232	0.06091	0.12627
Textile finishing	0.00382	0.01230	0.05789	0.12463
Carpets and other textile floorcoverings	0.00368	0.01264	0.06653	0.13818
Jute etc yarns and fabrics, and miscellaneous textiles	0.00431	0.01260	0.05671	0.12223
Leather and leather goods	0.00432	0.01648	0.06774	0.16749
Footwear	0.00431	0.01374	0.05393	0.13410
Clothing and furs	0.00478	0.01215	0.06177	0.11914
Household and other made-up textiles	0.00379	0.01203	0.06600	0.13280
Timber processing and wood products (not furniture)	0.00528	0.01681	0.06851	0.16010
Wooden furniture, shop and office fittings	0.00501	0.01681	0.08191	0.18126
Pulp, paper and board	0.00275	0.01180	0.06136	0.13272
Paper and board products	0.00461	0.01448	0.07306	0.15321
Printing and publishing	0.01842	0.03199	0.15155	0.26591
Rubber products	0.00344	0.01208	0.06245	0.12691
Processing of plastics	0.00435	0.01498	0.07386	0.15831
Jewellery and coins	0.00433	0.01348	0.06703	0.13619
Sports goods and toys	0.00707	0.01963	0.08972	0.18803
Other goods	0.00554	0.01519	0.05441	0.13416
Construction	0.00288	0.01683	0.05886	0.18256
Wholesale distribution	0.01399	0.02875	0.08988	0.19621
Retail distribution	0.00668	0.02070	0.07011	0.18109
Distribution & repair of vehicles,filling stations & other goods	0.01572	0.02947	0.11136	0.21752
Hotels, catering, public houses, etc	0.01493	0.02702	0.09050	0.17788
Railways	0.01416	0.02815	0.10401	0.21232
Road and other inland transport	0.00936	0.01990	0.06864	0.15103
Sea transport	0.01418	0.03397	0.10377	0.23846
Air Transport	0.01422	0.03489	0.17039	0.30443
Transport services	0.01443	0.02957	0.09061	0.19490
Postal services	0.03008	0.03804	0.05273	0.10532
Telecommunications	0.05338	0.06436	0.06825	0.13493
Banking and finance	0.04924	0.07008	0.21247	0.32938
Insurance	0.09485	0.13849	0.37653	0.61854
Auxiliary financial services	0.07836	0.09952	0.18976	0.27985
Estate agents	0.04794	0.06953	0.25889	0.39008
Legal services	0.03559	0.05665	0.23474	0.36558
Accountancy services	0.02715	0.04227	0.16876	0.26158
Other professional services	0.01431	0.03213	0.26451	0.38539
Advertising	0.02292	0.03791	0.17029	0.27905
Computing services	0.01775	0.04167	0.30104	0.45742
Other business services	0.01774	0.03809	0.33096	0.49352
Renting of movables	0.00646	0.02972	0.27904	0.42569

Owning and dealing in real estate	0.02908	0.06557	0.37827	0.57731
Public administration	0.00000	0.00000	0.00000	0.00000
Sanitary services	0.00444	0.01087	0.03952	0.08703
Education	0.00732	0.01178	0.03154	0.06578
Research and development	0.00690	0.01210	0.03459	0.07321
Health services	0.00977	0.01616	0.03578	0.07602
Recreational and welfare services	0.01082	0.01982	0.05923	0.12607
Personal services	0.01988	0.04246	0.24804	0.39966
Domestic services	0.00000	0.00000	0.00000	0.00000
Ownership of dwellings	0.00248	0.01982	0.21099	0.29845

Appendix 2 Full ‘league table’ of direct + indirect KIBS - 1990

Direct + indirect KIBS inputs	Sector
0.61854	Insurance
0.57731	Owning and dealing in real estate
0.49352	Other business services
0.45742	Computing services
0.42569	Renting of movables
0.39966	Personal services
0.39008	Estate agents
0.38539	Other professional services
0.36558	Legal services
0.32938	Banking and finance
0.30443	Air Transport
0.29845	Ownership of dwellings
0.27985	Auxiliary financial services
0.27905	Advertising
0.26591	Printing and publishing
0.26158	Accountancy services
0.23846	Sea transport
0.22670	Oils and fats
0.22044	Electronic consumer goods, records and tapes
0.21752	Distribution & repair of vehicles,filling stations & other goods
0.21366	Soap and toilet preparations
0.21232	Railways
0.20666	Miscellaneous foods
0.20095	Confectionery
0.19899	Animal feeding stuffs
0.19621	Wholesale distribution
0.19490	Transport services
0.19458	Tobacco
0.19331	Alcoholic drink
0.18803	Sports goods and toys
0.18767	Soft drinks
0.18523	Metal doors, windows, etc
0.18256	Construction
0.18126	Wooden furniture, shop and office fittings
0.18109	Retail distribution
0.17788	Hotels, catering, public houses, etc
0.17156	Industrial plant and steelwork
0.16922	Fruit, vegetables and fish processing
0.16882	Pharmaceutical products
0.16838	Textile machinery, machinery for working other materials
0.16749	Leather and leather goods
0.16748	Extraction of metalliferous ores and minerals nes
0.16551	Domestic electric appliances
0.16463	Fertilisers

0.16446	Metal-working machine tools
0.16010	Timber processing and wood products (not furniture)
0.15979	Instrument engineering
0.15902	Office machinery and computer equipment
0.15886	Slaughtering and meat processing
0.15831	Processing of plastics
0.15656	Milk and milk products
0.15621	Mining, construction and mechanical handling equipment
0.15498	Extraction of stone, clay, sand and gravel
0.15489	Bread, biscuits and flour confectionery
0.15455	Electrical equipment for industry, batteries, etc
0.15353	Metal goods nes
0.15352	Electronic components and sub-assemblies
0.15321	Paper and board products
0.15302	Paints, dyes, pigments, printing ink
0.15175	Shipbuilding and repairing
0.15160	Telecommunication etc equipment, electronic capital goods
0.15103	Road and other inland transport
0.15073	Glass
0.15035	Concrete, stone, asbestos and abrasive products
0.14700	Other machinery and mechanical equipment
0.14615	Ordnance, small arms and ammunition
0.14330	Sugar
0.14192	Process machinery and contractors
0.14049	Packaging products of metal
0.14035	Basic electrical equipment
0.13984	Insulated wires and cables
0.13818	Carpets and other textile floorcoverings
0.13799	Agriculture and horticulture
0.13761	Woollen and worsted
0.13731	Inorganic chemicals
0.13702	Electric lighting equipment, etc
0.13697	Motor vehicles and parts
0.13619	Jewellery and coins
0.13541	Metal castings, forgings, fastenings, springs, etc
0.13523	Organic chemicals
0.13512	Synthetic resins and plastic materials, synthetic rubber
0.13493	Telecommunications
0.13426	Chemical products nes
0.13416	Other goods
0.13410	Footwear
0.13291	Agricultural machinery and tractors
0.13280	Household and other made-up textiles
0.13272	Pulp, paper and board
0.13167	Mechanical power transmission equipment
0.13150	Other vehicles
0.13052	Engineers small tools
0.13034	Grain milling and starch
0.12885	Iron and steel, and steel products
0.12871	Refractory and ceramic goods

0.12691	Rubber products
0.12627	Hosiery and other knitted goods
0.12607	Recreational and welfare services
0.12532	Specialised chemicals for industry and agriculture
0.12463	Textile finishing
0.12223	Jute etc yarns and fabrics, and miscellaneous textiles
0.12177	Cement, lime and plaster
0.11914	Clothing and furs
0.11832	Aluminium and aluminium alloys
0.11792	Coal extraction and manufacture of solid fuels
0.11660	Cotton etc spinning and weaving
0.11646	Man-made fibres
0.10917	Aerospace equipment manufacturing and repairing
0.10629	Other non-ferrous metals (including precious metals)
0.10532	Postal services
0.10329	Structural clay products
0.10258	Fishing
0.08703	Sanitary services
0.08466	Electricity production
0.08336	Water supply
0.07602	Health services
0.07321	Research and development
0.07206	Extraction of mineral oil and natural gas
0.06597	Gas
0.06578	Education
0.06087	Coke ovens, mineral oil processing and nuclear fuel production
0.05358	Forestry
0.00000	Public administration
0.00000	Domestic services