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**The Relationships Between Goods-Producing
and Services-Producing Activities in the US Economy:
an Intersectoral Analysis**

by

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1. Introduction

The recent debate on the diffusion of the new information and communication technologies in the US economy has mainly focused on the search for a positive relation between investment in these technologies and the growth of productivity, whether referred to labour or to the “total factor productivity”. The results of researches in this field are not univocal.

Some scholars have reached negative conclusions on the relationship between investment in information technology and productivity growth. Loveman (1988) finds no significant rise in productivity with increase in investment in information technology; a result confirmed by Bailey and Gordon (1988) who conclude that investment in computers has not significantly contributed to the growth of US aggregate productivity. Berndt and Morrison (1995) find a negative correlation between the growth of labour productivity and high-tech investment in US manufacturing industry. Gordon (1999) has claimed that the growth of productivity achieved in computer production remains confined to that industry, with scant effects on the others. In a subsequent study, Gordon (2000) questions the idea itself that the present phase of technological innovation based on information technology can be considered to be a genuine technological revolution, to be likened to previous ones.

Other studies like those of Siegel and Griliches (1992) and Oliner and Sichel (1994 and 2000) conclude, on the contrary, that investment in information technologies did indeed make a crucial contribution to the growth of US aggregate productivity in the 1990s. But the productivity growth is not uniform. Jorgenson and Stiroh (1999 and 2000) make use of disaggregation to 35 sectors and provide estimates of total factor productivity with the aim of calculating the contribution of each sector. They find that this contribution is extremely non-uniform (with 9 sectors having a negative growth rate of total productivity) and warn that this heterogeneity in the sectoral growth makes it hard to attribute the aggregate productivity

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growth to the technological progress achieved in individual industries, as the theories of technology-led growth tend to do.

A recent study by McKinsey Global Institute (2001) confirms that the growth of US productivity in the second half of the 1990s involves very few sectors, viz: computers and semiconductors among the manufacturing industries, trade, both wholesale and retail, security services and commodity brokers and telecommunication services in the tertiary sector.

At microeconomic level, the findings of some studies on the use of computerized technologies (Kelly, 1994; Black and Lynch, 1996; Doms, Dunne and Troske, 1997) suggest that firms making extensive use of information technology record substantial increases in both production and productivity. But it is not clear whether the increased production stems from the increased productivity or vice versa.

Although the result of the various studies do not agree, and sometimes contrast with one another, all seek the relationship between investment in information technologies and productivity growth within a perspective of the production process as a one-way path leading from “factors of production” to consumer goods. Within this perspective, which, as is known, finds expression in the neoclassical production function, the innovation process actually coincides with the growth of productivity of the “factors of production”, which ultimately becomes the starting point in analysis of the innovation process.

Faced with the not very satisfactory results of research into the relation between investment in information technologies and productivity growth, Wolff (2002) has focused attention on the link between the new technologies and the structural change in the US economy. He finds that there is a positive association between the computerization process, measured by the investments for office, computing and accounting equipment, and the changes in the structure of employment, intermediate inputs and, to a lesser extent, the capital coefficients. Comparing this result with those of researches into productivity growth, Wolff concludes that the spread of information technologies represents “a technological revolution that appears to show up more strongly in measures of structural change rather than in terms of productivity” (Wolff, 2002, p. 72).

In his linkage of computerization processes and changes in the composition of employment and intermediate inputs, Wolff establishes a causal connection running from the investment in information technologies to the structural changes, thus emphasizing the most purely technological aspect of the structural change, i.e. that which refers, in particular, to the effects from process innovations.

Two features of recent US experience lead us to consider the aptness of looking at things also from another point of view. The first has to do with the composition of investments and consumption (Tab. 1).

Tab. 1 Personal consumption and gross private fixed investment composition.
USA: 1987, 1992 and 1998

	Personal consumption expenditures			Gross private fixed investment		
	1987	1992	1998	1987	1992	1998
Agricultural products	0,75	0,64	0,59	0,00	0,00	0,00
Minerals	0,01	0,00	0,00	0,07	0,01	0,07
Construction	0,00	0,00	0,00	51,29	45,55	39,38
Manufactured products	23,09	20,01	18,41	39,75	42,86	40,06
- Computer and office equipment	0,11	0,13	0,22	4,57	4,57	4,59
Transportation	7,76	7,44	7,47	1,17	1,48	1,23
Trade	15,80	14,97	14,91	6,87	7,90	7,67
Finance	21,64	22,81	23,38	3,23	3,59	3,49
Services	29,64	33,58	34,33	1,03	2,43	11,39
- Computer and data processing services	0,03	0,06	0,18	0,001	0,44	9,92
Other *	0,35	-0,23	0,09	-3,41	-3,83	-3,29
Noncomparable imports	0,95	0,78	0,82	0,00	0,00	0,00
TOTAL	100,00	100,00	100,00	100,00	100,00	100,00

BEA, Input-output Annual Tables 1987, 1992 and 1998

*"Other" consists of government enterprises and other I-O special industries; for more information see "Appendix A. Industry Classification of the 1992 Benchmark Input-Output Accounts," in "Benchmark Input-Output Accounts for the U.S. Economy, 1992: Make, Use, and Supplementary Tables," Survey of Current Business 77 (November 1997).

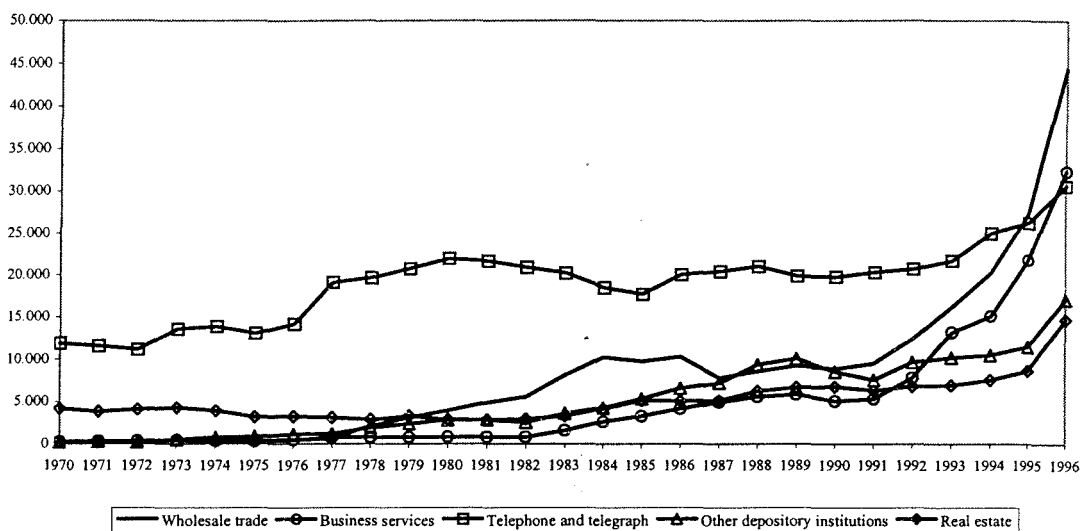
Between 1987 and 1998 the share of investment in computer and office equipment out of the total investment remains constant, whereas there is a large increase in the share of investment in computer and data-processing services, up from 0.001 of the total in 1987 to 9.93 per cent in 1998. The latter figure, largely due to the recent entry of software expenditure in the investment, completely accounts for the rise in the share of investment in services, up from 1.03 to 11.39 per cent. In the same period, the composition of consumption alters in favour of services, whose share of total consumption, from 1987 to 1998, rises from 29.6 to 34.3 per cent.

The second feature to take into account concerns the destination of the investment in information and communication technology (ICT) by industry. From the available data it clearly emerges that in the United States in the decade 1987-1996 such investment was strongly concentrated in a very few activities: telephone and telegraph, wholesale trade,

business services, other depository institution and real estate absorb 50.3 per cent of the mean investment in ICT between 1987 and 1996. Business services and wholesale trade are the most dynamic activities (Tab. 2 and graph 1).

The spread of the new information and communication technologies in the US economy went ahead, then, in close relation with certain of the services-producing activities. This relation has two aspects. On the one hand, as the just-mentioned data show, the services with greatest investment in ICT represented the main source of final demand for the new technologies.

Graf. 1 USA: Investment in ICT by Industry 1970-1996
 (first 5 activities representing 50,3% of the average 1987-1996)
 millions of 1992 dollars
 Source: BEA data processing



It must be borne in mind, on the other hand, that one of the most important and interesting features in the diffusion of information and communication technologies in the US experience concerns the increased possibility offered by such technologies to realize new products, both through organizational improvements — within the firm and in the relations between suppliers and clients — and through the provision of new services to clients. And this has led to rises in productivity (Brynjolfsson and Hitt, 2000). By this means, the new technologies have enabled, and have themselves encouraged, that process of specialization that, together with the modification of the final consumption and the demographic and socio-familial transformations, may be thought to underlie the change in the role of the service

sectors and, in general, in the relationship between goods-producing and services-producing activities¹.

The present work concentrates on the second of these aspects, in the conviction that the outcome of the innovation process is reflected not only in the changes in the structure of the input coefficients but also in the *interdependence relationship* among the various economic activities. In this perspective I propose to examine, with reference to the US economy, the current interdependence relationship between goods-producing and services-producing activities: this from the point of view both of the use of services in the production of goods and of the capacity of propagation of the service sectors within the economic system as compared with what happens for the goods-producing sectors.

To this end in what follows I shall apply the Miyazawa method (Miyazawa, 1976), which enables the study of both the sectoral interdependence within the goods-producing activities and within the services-producing ones, and the effects of the intersectoral relationships between the two sets of activities². In this way, it is substantially possible to identify the different activation effects that, instead, find expression in a single coefficient in the “Leontief inverse matrix” which, as is known, refers to the economic system as a whole. In the analysis I shall use the structural matrices of the US economy calculated on the Input-Output tables at producers’ prices referring to 1987, 1992 and 1998 supplied by the *Bureau of Economic Analysis*.

2. *The partitioning of the structural matrix of the economy*

The first step in the Miyazawa method consists in the partitioning of the matrix of the input coefficients. Let us consider an economic system consisting of n sectors of activity, of which h produce goods and k produce services, with $h > k$. The structural matrix of this economy can be represented as follows:

¹ On these aspects of the recent growth of the US economy see Maione (2001).

² The same method has been used by Caselli and Pastrello (1984) in examining the industry-tertiary integration in Italy between 1965 and 1975, and by Jones (1992) in analyzing the interrelations between goods-producing and services-producing sectors in Canada in 1987.

$$A = \begin{bmatrix} a_{g_1g_1} & \cdots & \cdots & a_{g_1g_h} & a_{g_1s_1} & \cdots & a_{g_1s_k} \\ \vdots & & & & & & \\ \vdots & & & & & & \\ a_{ghg_1} & & & a_{ghgh} & a_{ghs_1} & & a_{ghs_k} \\ \hline a_{s_1g_1} & & & a_{s_1gh} & a_{s_1s_1} & & a_{s_1s_k} \\ \vdots & & & & & & \\ a_{s_kg_1} & & & a_{s_kgh} & a_{s_ks_1} & & a_{s_ks_k} \end{bmatrix}$$

where the coefficients $a_{g_i g_j}, a_{g_i s_j}, a_{s_i g_j}, a_{s_i s_j}$ of matrix A indicate whether we are dealing with a good or a service used as input in the production of a good or a service.

This matrix can be broken down into 4 submatrices along the row and the column that separate the goods sectors from the services sectors. In this way two square matrices are obtained — $A_{gg}(h \times h)$ relating to the intermediate uses of goods in the production of goods and $A_{ss}(k \times k)$ relating to the intermediate uses of services in the production of services — and two rectangular matrices — $A_{gs}(h \times k)$ of the intermediate uses of goods in the production of services and $A_{sg}(k \times h)$ relating to the intermediate uses of services in the production of goods:

$$A_{gg} = \begin{bmatrix} a_{g_1g_1} & \cdots & \cdots & a_{g_1g_h} \\ \vdots & & & \\ \vdots & & & \\ a_{ghg_1} & & & a_{ghgh} \end{bmatrix} \quad A_{gs} = \begin{bmatrix} a_{g_1s_1} & \cdots & a_{g_1s_k} \\ \vdots & & \\ \vdots & & \\ a_{ghs_1} & & a_{ghs_k} \end{bmatrix}$$

$$A_{sg} = \begin{bmatrix} a_{s_1g_1} & \cdots & \cdots & a_{s_1gh} \\ \vdots & & & \\ a_{s_kg_1} & & & a_{s_kgh} \end{bmatrix} \quad A_{ss} = \begin{bmatrix} a_{s_1s_1} & \cdots & a_{s_1s_k} \\ \vdots & & \\ a_{s_ks_1} & & a_{s_ks_k} \end{bmatrix}$$

Matrix A can now be rewritten in a partitioned form:

$$A = \begin{bmatrix} A_{gg} & A_{gs} \\ A_{sg} & A_{ss} \end{bmatrix}.$$

The empirical analysis will use the matrices of the US economy with 97 sectors, of which 62 can be classified as goods-producing activities (agriculture, mining, building and manufacturing), 27 as services-producing activities in a broad sense (transport,

communications, trade, finance and insurance, services in the strict sense) and 8 as special industries³.

In the empirical study, the 8 special industries will be eliminated from matrix $A(97 \times 97)$. The matrix of the input coefficients thus reduced will be broken down into the 4 submatrices: $A_{gg}(62 \times 62)$, $A_{ss}(27 \times 27)$, $A_{gs}(62 \times 27)$ and $A_{sg}(27 \times 62)$.

3. *The propagation effects within the goods-producing and within the services-producing activities*

The matrices of the technical coefficients A_{gg} and A_{ss} express the technical relationships within the goods-producing activities and within the services-producing activities considered in isolation, i.e. disregarding the intermediate uses of services in the production of goods and of goods in the production of services. The direct and indirect requirements of goods in the production of goods and services in the production of services are expressed by the coefficients of the following two inverse matrices:

$$B_{gg} = (I - A_{gg})^{-1} \quad (62 \times 62)$$

$$B_{ss} = (I - A_{ss})^{-1} \quad (27 \times 27)$$

The matrices B_{gg} and B_{ss} are called *matrices of the internal multipliers*.

Tables 3 and 4 contain the row sums and the column sums of the coefficients of matrices B_{gg} and B_{ss} respectively. The row sums of matrix B_{gg} can be interpreted as the increase in production of each good needed directly and indirectly to satisfy the increase of a unit of final demand of each good considering the interconnections within the goods-producing activities. The column sums of matrix B_{gg} can be interpreted as the increase in production of the whole system identified by the production of goods with the use of goods alone in order to deal with the increase of a unit of final demand of each industry.

Substantially, the values of the row and column sums express the power of activation of the production of goods on the part of the sectoral interdependences within the goods-producing activities alone. A similar meaning is attributed to the row and column sums of

³ Federal government enterprises, State and local enterprises, Non comparable imports, Scrap and used goods, General government industry, Rest of the world adjustment to final uses, Household industry, Inventory valuation adjustment.

matrix B_{ss} , which express this power of activation considering the interdependences within the services-producing activities.

Comparing the values of the row and column sums of the two matrices, it can be seen that on average the internal multipliers of the goods-producing activities are higher than those of the services-producing activities. With reference to the most recent matrix, average internal multiplier is 1.63 for the set of goods-producing activities (Tab. 3) and 1.44 for the services-producing ones (Tab. 4).

4. *A measure of the degree of independence of the set of the goods-producing activities from the services-producing ones*

The activation coefficients of the inverse matrices B_{gg} and B_{ss} reflect the interdependences between the goods-producing activities alone and the services-producing ones alone respectively. As is known, the activation coefficients of the inverse matrix of the complete economic system, “the Leontief inverse” which will be indicated with $B^* = (I - A)^{-1}$, reflect instead the interdependences between all the economic activities.

Let us indicate by B_{gg}^* (62×62) the partitioning of the Leontief inverse matrix corresponding to the goods-producing activities only and by B_{ss}^* (27×27) the partitioning corresponding to the services-producing activities only. By dividing each element of the matrix B_{gg} by the corresponding elements of the Leontief inverse matrix, we obtain a measure of the degree of independence of each goods-producing activity from the set of services-producing activities. With a similar operation, dividing each element of the matrix B_{ss} by the corresponding elements of the Leontief inverse it is possible to express the degree of independence of each services-producing activity from the set of goods-producing activities.

The indices of independence will be expressed by the following two square matrices:

$$Z_g = B_{gg} ./ B_{gg}^* \quad (62 \times 62)$$

$$Z_s = B_{ss} ./ B_{ss}^* \quad (27 \times 27)$$

where the symbol $./$ indicates the operation of division element by element.

If, for example, the production of the good i were completely independent of the set of services-producing activities, the activation coefficients of the i -th row of matrix B_{gg} would

be identical to the corresponding row of matrix B_{gg}^* so that the indices appearing in the i -th row of matrix Z_g would all be equal to 1. As the dependence on the set of services-producing activities increases, the value of the indices of matrix Z_g diminishes. In a similar way, as the dependence of the services-producing activities from the set of goods-producing activities increases, the value of the indices of matrix Z_s diminishes.

In order to establish the degree of independence of the production of goods from the set of services-producing activities and of the production of services from the set of goods-producing activities it is therefore necessary to examine the elements of the rows of matrices $Z_g(62 \times 62)$ and $Z_s(27 \times 27)$ respectively.

Tables 5 and 6 contain the mean values of the indices, calculated on the rows of these two matrices. In the tables the mean value of the indices per individual product is reported in decreasing order on the 1998 value. The first conclusion we can draw from examining the data is that, on average, the production of goods is more dependent on the set of services-producing activities than is the case with the production of services vis-à-vis the goods-producing activities. For 1998, the overall mean index is 0.61 for the set of goods-producing activities and 0.76 for the services-producing ones.

The goods whose production is most independent of the set of the services-producing activities (Tab. 5) register an index ranging between 1 and 0.80, as in the case of tobacco products, building, chemicals, steel, machine tools and glass and stone products. At the bottom of the list we find the production of goods more dependent on the set of services-producing activities with a mean index lower than 0.40. This is the case e.g. of food products, electronic components and accessories, audio and video equipment, motor vehicles, computers and ordnance and accessories.

As regards the production of services (Tab. 6), 17 out of the 27 activities belonging to this set show an index ranging between 1 and 0.80. Only the healthcare services, in 1998, record an index below 0.40.

The indices of interdependence have been calculated also for 1987 and 1992. Since the coefficients of the structural matrices used for the data processing are obtained from the input-output tables at current prices, the quantitative comparison between the three years could be affected by the modification of the relative prices among the various sectors⁴. In consideration of this, here and later on, I shall not refer to the percentage variation of the

coefficients among the three years. However it is possible to verify that the results relating to 1987 and 1992 are in agreement with those found for 1998. The mean index for the set of goods-producing activities is 0.64 in 1987 and 0.60 in 1992. Likewise, in the case of services the mean index is 0.74 in 1987 and 0.75 in 1992 (Tab. 6). The last column of Tables 5 and 6 contains the mean value of the indices calculated over the three years.

5. *The intersectoral relationships between the set of goods-producing activities and that of services-producing activities.*

One interesting feature of Miyazawa's method is that, by means of the partitioning of the matrix of technical coefficients, it enables one to examine the intersectoral relationships between the set of goods-producing activities and that of services-producing activities. It is useful to start by distinguishing two activation effects. The first is on the inputs and stems from the propagation effects within the set of goods- (or services-) producing activities that activate the use of intermediate services (or goods). The second is on the output: the use of intermediate services in the production of goods and of intermediate goods in the production of services activates the production of services and goods respectively.

These activation effects define the *power of induction*, on the inputs and on the output, that one set of activities has vis-à-vis the other set of activities.

5.1 *The power of induction on the inputs*

Firstly, we shall examine the power of induction that one set of activities exerts on the other set of activities from the input side.

By premultiplying the matrix A_{sg} of the intermediate uses of services in the production of goods by the matrix B_{gg} of the activation coefficients within the goods-producing activities we obtain the matrix, called S_1 , of the intermediate uses of services in the production of goods induced by the effects of propagation within the set of the goods sectors:

$$S_1 = A_{sg}B_{gg} \quad (27 \times 62)$$

With a similar procedure we obtain the matrix, called G_1 , of the intermediate uses of goods in the production of services activated by the effects of propagation within the set of the service sectors:

⁴ Rampa (1986) has emphasized this problem.

$$G_1 = A_{gs} B_{ss} \quad (62 \times 27)$$

Substantially, S_1 and G_1 are the matrices of the coefficients of the effects on the inputs of services and goods, induced, respectively, by the direct and indirect intersectoral relationships within the set of goods-producing activities and within that of the services-producing activities. The row sums of S_1 and G_1 represent the power of induction on the activities receiving the induced effect, while the column sums represent the power of induction of the activities giving the induced effect. Tables 7 and 8 contain the average row sum of S_1 and G_1 and the list of the more important activities receiving and giving the induced effects.

The comparison shows that the induction power on the inputs of services deriving from the intersectoral relationships within the goods-producing activities is clearly greater than that on the inputs of goods deriving from the intersectoral relationships within the services-producing activities: in 1998 the average row sum is 0.72 for the services-producing activities receiving the induced effects from the goods-producing activities [Tab. 7 (a)] and 0.06 for the goods-producing activities receiving the induced effects from the services-producing activities [Tab. 8 (a)]. Among the first 8 receiving services-producing activities for which the induced effect turns out to be higher than the average we find wholesale trade, business services (in particular other business and professional services, except medical and legal, and engineering, accounting and related services), financial activities (real estate and royalties and finance), advertising and motor freight transportation and warehousing. The goods-producing activities giving the induced effects for which the column sum is higher than the average (column sum) in 1998 are 24 and are listed in section (b) of Tab. 7.

Tables 7 and 8 contain the same data also for 1987 and 1992. In this case, too, the data confirm the results found for 1998: the intersectoral relationships within the goods-producing activities have an induction power on the intermediate inputs of the services that is clearly greater with respect to the induction power exerted by the intersectoral relationships within the services-producing activities on the intermediate inputs of goods. Recall that the services-producing activities are relatively more independent than the goods-producing ones.

5.2 The induction power on the outputs

The other aspect of the induction power of a set of activities is exerted on production activated by the use of goods and services as intermediate goods. The induction effect on the output of services is expressed by the row coefficients of matrix S_2 obtained by

postmultiplying the matrix of the coefficients of the intermediate uses of services in the production of goods by the matrix of the activation coefficients within the set of services-producing activities:

$$S_2 = B_{ss} A_{sg} \quad (27 \times 62)$$

Matrix S_2 , so obtained, expresses the propagation effects within the services-producing sectors activated by the demand for intermediate services in the production of goods.

From the point of view of the goods-producing activities the induction on the output derives from the intermediate use of goods in the production of services. Matrix G_2 – obtained by postmultiplying the matrix of the coefficients of the intermediate uses of goods in the production of the services by the matrix of the activation coefficients within the set of goods-producing activities – expresses the propagation effects within the set of the goods sectors activated by the demand for intermediate goods in the production of services:

$$G_2 = B_{gg} A_{gs} \quad (62 \times 27)$$

Tables 9 and 10 contain the average row sum of S_2 and G_2 and the list of the more important activities receiving and giving the induced effects on outputs for the three years we are considering.

In this case, too, the activation effects on the output of services deriving from the intersectoral relationships within the goods-producing activities are manifestly greater than the effects on the output of goods exerted by the intersectoral relationships within the goods-producing activities. The average row sum is 0.59 for the services-producing activities receiving the induced effects from the goods-producing activities [Tab. 9 (a)] and 0.08 for the goods-producing activities receiving the induced effects from the services-producing activities [Tab. 10 (a)]. Wholesale trade, business services and finance are the activities for which the induction effect on the output exerted by the set of goods-producing activities is highest [Tab. 9(a)].

5.3 Propagation effects deriving from induction on the outputs: the external multipliers

Turning our attention to the effects on the outputs, it is possible to define exactly the propagation effects deriving from the impulses that return from the set of goods- (or service-) producing activities to the same set through the interdependence between the two sets of activities.

We have seen how the intermediate uses of services in the production of goods activate the output of services (S_2) and how the intermediate uses of goods in the production of services activate the output of goods (G_2). The activation effects on the production of services deriving from the activation of the production of goods exerted by the service activities themselves are expressed by the coefficients of the matrix (E_s) which is obtained by postmultiplying G_2 to S_2 : $E_s = S_2 G_2$ (27×27).

The direct and indirect effects of this interdependence are expressed by the coefficients of the inverse matrix:

$$S_e = (I - E_s)^{-1} \quad (27 \times 27)$$

In other words, the coefficients of the matrix S_e express the dispersion power (or external propagation power) of the set of the services-producing activities deriving from the effects on the output of intersectoral relationships between the two sets of goods and service activities.

With a similar procedure, the dispersion power of the set of goods-producing activities is expressed by the coefficients of the matrix:

$$G_e = (I - E_g)^{-1} \quad (62 \times 62)$$

where $E_g = G_2 S_2$ (62×62).

Miyazawa (1976, p. 61) calls *external multipliers* the coefficients of the matrices that we have called S_e and G_e .

Table 11 contains the average row sum of the elements of the matrices S_e and G_e and the list of activities having a row sum higher than the average in 1998. The data show that the values of the external multipliers of the services-producing activities are greater than those of the goods-producing activities. The average row sum is 1.059 for the services-producing activities and 1.038 for the goods-producing ones. In this case, too, wholesale trade, business services (other business and professional services, except medical and legal, and engineering, accounting and related services), financial activities (real estate and royalties and finance) and motor freight transportation and warehousing are the first five activities with a coefficient greater than the average.

6. Structural change and productivity growth. Conclusions

In the previous paragraphs we analyzed the interrelations between the set of the goods-producing activities and that of the services-producing ones in the US economy, using the structural matrices of 1987, 1992 and 1998. The results of this analysis can be summarized as follows:

- (a) The goods-producing activities have a greater capacity of activation within them, in isolation from the services-producing activities. Considering the system as a whole, the activation coefficients of the goods-producing activities substantially increase. In other words, the presence of the set of the services-producing activities notably raises the growth of production of each good directly and indirectly necessary to fulfil the increase by one unit of final demand. The goods-producing activities are seen to depend on the services-producing activities to a greater extent than the latter depend on the goods-producing activities.
- (b) The induction effects on both the inputs and the outputs of services deriving from the intersectoral relationships within the goods-producing activities are clearly greater as compared with those on the goods by effect of the intersectoral relationships within the services-producing activities. The wholesale trade, financial and business services activities stand out as those most highly activated by the interrelations within the goods-producing activities.
- (c) The dispersion power stemming from the induction effects on the outputs is stronger in the case of the services-producing activities than in the goods-producing activities.

These results are evidence of the central role assumed by the services-producing activities in a modern specialized economy like that of the United States, in which, already back at the end of the 1980s, the transition was fully achieved from a model of division of labour based on the fragmentation of tasks within the productive units to a new model founded mainly on the specialization of those units. From the point of view that most directly interests us here, this transition involved both the creation of specialized activities beyond the traditional productive units — as occurred most importantly in the case of business services — and the modification of the role of the services of wholesale trading, transport and warehousing of goods.

In this framework, the results that have emerged from the analysis enable us not only to conclude that, in general, as Jones (1992, p. 498) has noted for Canada, “producer services

have become the cohesive force that binds the diverse elements of a modern specialized economy”, but also to set the role of services in the process of productivity growth in a different perspective.

Indeed, the strong complementarity between production of goods and service inputs that so clearly emerges from our analysis provides an argument in support of the reasonable hypothesis that part of the increase in productivity in the manufacturing sector, and in general in the production of goods, is due to the increased recourse to activities specializing in the production of services, especially to firms, and in the wholesale trade sector.

Also to be borne in mind is that, as we recalled in the introduction, wholesale trade, business services and financial activities are the sectors that have invested, to a notably greater extent than the rest of the economy, in the new information and communication technologies (Tab. 2 and Graph 1).

Along with this, a further element characteristic of the growth of the US economy must be considered. The growth of productivity in the US manufacturing sector is not only particularly high in the industries producing the new information and communication technologies, but is also closely connected with the growth of production — both in general and in the new industries especially (Bonifati, 2002). In this way the services-producing activities that are more closely linked with the production of goods have contributed to the growth in productivity of the new industries also in an indirect way. For they have represented, at the same time, the most important source of final demand for the industries producing the new technologies, in this way supporting their production growth.

The conclusions of this study suggest that the explanation that takes productivity as its starting point neglects the essential fact of the processes of contemporary structural change, i.e. the role assumed by the services-producing activities in the interdependence relationship with the goods-producing ones. The productivity growth in the goods-producing sectors cannot be considered to be independent of this interrelation.

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Tab. 2 USA: Investment in Information and Communication Technologies by Industry*
(in decreasing order on the average value 87-96)

	1987-1996 average (million of 1992 dollars)	percent on the total	average rate of growth 87- 96
Telephone and telegraph	22.576	16,57	4,06
Wholesale trade	16.466	12,09	17,38
Business services	11.699	8,59	18,81
Other depository institutions	10.171	7,47	8,68
Real estate	7.576	5,56	10,62
Electric services	5.596	4,11	0,89
Insurance carriers	5.528	4,06	14,93
Nondepository institutions	5.494	4,03	16,82
Retail trade	4.970	3,65	16,35
Radio and television	4.426	3,25	9,84
Health services	4.291	3,15	8,75
Electronic and other electric equipment	3.751	2,75	13,94
Chemicals and allied products	3.412	2,50	14,36
Other services, n.e.c.	3.097	2,27	14,00
Industrial machinery and equipment	3.001	2,20	9,18
Gas services	1.717	1,26	5,41
Instruments and related products	1.613	1,18	8,17
Transportation by air	1.389	1,02	12,88
Food and kindred products	1.388	1,02	11,66
Printing and publishing	1.350	0,99	12,30
Other transportation equipment	1.160	0,85	7,34
Auto repair, services, and parking	1.049	0,77	6,06
Paper and allied products	914	0,67	8,74
Sanitary services	913	0,67	2,05
Oil and gas extraction	897	0,66	2,41
Petroleum and coal products	866	0,64	14,83
Railroad transportation	863	0,63	9,20
Legal services	798	0,59	7,24
Transportation services	755	0,55	6,62
Nonfinancial holding and investment office	641	0,47	-0,36
Primary metal industries	634	0,47	10,14
Fabricated metal products	559	0,41	10,54
Trucking and warehousing	552	0,41	6,56
Stone, clay, and glass products	545	0,40	7,08
Motion pictures	512	0,38	13,83
Security and commodity brokers	491	0,36	11,21
Agricultural services, forestry, and fishing	465	0,34	7,16
Motor vehicles and equipment	453	0,33	12,46
Rubber and miscellaneous plastics products	410	0,30	17,72
Hotels and other lodging places	333	0,24	7,66
Textile mill products	236	0,17	9,20
Financial holding and investment offices	231	0,17	18,75
Amusement and recreation services	223	0,16	17,99
Water transportation	208	0,15	7,52
Personal services	201	0,15	6,75
Local and interurban passenger transit	168	0,12	-1,27
Miscellaneous manufacturing industries	163	0,12	14,44
Miscellaneous repair services	156	0,11	13,71
Insurance agents, brokers, and service	155	0,11	10,65
Lumber and wood products	151	0,11	15,11
Construction	140	0,10	5,04
Apparel and other textile products	138	0,10	16,19
Pipelines, except natural gas	134	0,10	17,28
Federal reserve banks	131	0,10	20,57
Furniture and fixtures	124	0,09	11,31
Educational services	94	0,07	6,01
Tobacco products	81	0,06	9,29
Nonmetallic minerals, except fuels	56	0,04	10,20
Metal mining	41	0,03	7,85
Farms	21	0,02	4,46
Leather and leather products	20	0,01	13,40
Coal mining	18	0,01	9,34
Total	136.209	100,00	

* ITC investments are defined as investments in: Mainframe computers, Personal computers, Direct access storage devices, Computer printers, Computer terminals, Computer tape drives, Computer storage devices, Other office equipment, Communication equipment, Instruments

Source: BEA data processing

Tab. 3 Internal multipliers: goods-producing activities 1998

	column sum	row sum
Livestock and livestock products	2,210419	1,572480
Other agricultural products	1,456019	2,098149
Forestry and fishery products	1,656654	1,254071
Agricultural, forestry, and fishery services	1,368968	1,675013
Metallic ore mining	1,617112	1,504180
Coal mining	1,466862	1,229763
Crude petroleum and natural gas	1,603918	2,739759
Nonmetallic mineral mining	1,300034	1,306892
New construction	1,501409	1,000390
Maintenance and repair construction	1,502037	1,923998
Ordnance and accessories	1,499295	1,000140
Food and kindred products	1,992077	1,927082
Tobacco products	1,264083	1,082169
Broad and narrow fabrics, yarn and thread mills	1,837860	2,478385
Miscellaneous textile goods and floor coverings	1,892375	1,272963
Apparel	1,916053	1,278804
Miscellaneous fabricated textile products	1,815209	1,105090
Lumber and wood products	1,790203	2,209782
Furniture and fixtures	1,582437	1,058640
Paper and allied products, except containers	1,610495	2,414308
Paperboard containers and boxes	1,733093	1,476914
Newspapers and periodicals	1,240772	1,008187
Other printing and publishing	1,401662	1,210059
Industrial and other chemicals	1,603245	4,341039
Agricultural fertilizers and chemicals	1,603759	1,521266
Plastics and synthetic materials	1,719869	2,835338
Drugs	1,263269	1,134762
Cleaning and toilet preparations	1,511118	1,129413
Paints and allied products	1,635272	1,207970
Petroleum refining and related products	2,028329	1,678208
Rubber and miscellaneous plastics products	1,618081	2,829715
Footwear, leather, and leather products	2,060854	1,451149
Glass and glass products	1,489881	1,339265
Stone and clay products	1,403403	1,607594
Primary iron and steel manufacturing	1,518356	4,481314
Primary nonferrous metals manufacturing	1,758214	4,101708
Metal containers	2,208601	1,201323
Heating, plumbing, and fabricated structural metal products	1,610385	1,558279
Screw machine products and stampings	1,584160	1,798881
Other fabricated metal products	1,534323	2,182058
Engines and turbines	1,762429	1,263836
Farm, construction, and mining machinery	1,612963	1,221786
Materials handling machinery and equipment	1,639785	1,080589
Metalworking machinery and equipment	1,419214	1,335860
Special industry machinery and equipment	1,580241	1,158810
General industrial machinery and equipment	1,516099	1,553749
Miscellaneous machinery, except electrical	1,421657	1,729902
Computer and office equipment	1,940132	1,230552
Service industry machinery	1,652370	1,170996
Electrical industrial equipment and apparatus	1,525445	1,691810
Household appliances	1,786801	1,014923
Electric lighting and wiring equipment	1,518389	1,172965
Audio, video, and communication equipment	1,752373	1,182508
Electronic components and accessories	1,607669	2,688133
Miscellaneous electrical machinery and supplies	1,626325	1,147579
Motor vehicles (passenger cars and trucks)	2,097160	1,040505
Truck and bus bodies, trailers, and motor vehicles parts	1,871414	1,513418
Aircraft and parts	1,622157	1,325440
Other transportation equipment	1,648549	1,033074
Scientific and controlling instruments	1,456342	1,304854
Ophthalmic and photographic equipment	1,311710	1,042576
Miscellaneous manufacturing	1,463489	1,112516
Average	1,632950	1,632950

Tab. 4 Internal multipliers: services-producing activities 1998

	column sum	row sum
Railroads and related services; passenger ground transportatio	1,277459	1,115717
Motor freight transportation and warehousing	1,621313	1,389970
Water transportation	1,818317	1,284837
Air transportation	1,435461	1,222753
Pipelines, freight forwarders, and related services	1,549135	1,284308
Communications, except radio and TV	1,475283	1,687799
Radio and TV broadcasting	1,952218	1,041621
Electric services (utilities)	1,209337	1,251171
Gas production and distribution (utilities)	1,385175	1,377759
Water and sanitary services	1,318479	1,161976
Wholesale trade	1,368070	1,467203
Retail trade	1,375257	1,052495
Finance	1,567552	2,084933
Insurance	1,928863	1,596563
Owner-occupied dwellings	1,138193	1,000000
Real estate and royalties	1,247746	2,442030
Hotels and lodging places	1,520509	1,110590
Personal and repair services (except auto)	1,373844	1,136676
Computer and data processing services, including own-account s	1,405852	1,653096
Legal, engineering, accounting, and related services	1,424923	1,890400
Other business and professional services, except medical	1,277932	2,792362
Advertising	1,308898	1,565012
Eating and drinking places	1,315531	1,143793
Automotive repair and services	1,334966	1,302532
Amusements	1,520407	1,808801
Health services	1,371498	1,021279
Educational and social services, and membership organizations	1,450991	1,087532
Average	1,443452	1,443452

Tab. 5 Independence index: goods-producing activities
(average row indices of the matrix Z_g in decreasing order on the 1998 value)

	1987	1992	1998	Average 87-98
Tobacco products	1,000000	1,000000	1,000000	1,000000
Metallic ores mining	0,928437	0,929702	0,930423	0,929521
Industrial and other chemicals	0,931598	0,922861	0,927335	0,927265
Plastics and synthetic materials	0,914849	0,916730	0,917908	0,916496
Nonmetallic minerals mining	0,903234	0,898789	0,897707	0,899910
Rubber and miscellaneous plastics products	0,870326	0,874053	0,875117	0,873165
Primary iron and steel manufacturing	0,882281	0,873857	0,868499	0,874879
Miscellaneous textile goods and floor coverings	0,857673	0,853413	0,864651	0,858579
Miscellaneous machinery, except electrical	0,844567	0,868438	0,863933	0,858979
Other fabricated metal products	0,852579	0,861583	0,858648	0,857603
Primary nonferrous metals manufacturing	0,873982	0,857856	0,855592	0,862477
Paints and allied products	0,839646	0,847854	0,852949	0,846816
Metalworking machinery and equipment	0,868370	0,851357	0,843641	0,854456
Stone and clay products	0,834192	0,848647	0,842146	0,841661
Glass and glass products	0,794324	0,804186	0,820943	0,806484
Broad and narrow fabrics, yarn and thread mills	0,853376	0,789958	0,804550	0,815961
Construction	0,572653	0,785159	0,800431	0,719414
Screw machine products and stampings	0,798294	0,795508	0,799699	0,797834
Paperboard containers and boxes	0,817041	0,819844	0,796793	0,811226
General industrial machinery and equipment	0,817419	0,796579	0,792664	0,802221
Agricultural fertilizers and chemicals	0,719261	0,777563	0,784138	0,760321
Heating, plumbing, and fabricated structural metal products	0,761456	0,768764	0,780339	0,770186
Forestry and fishery products	0,761627	0,780113	0,776930	0,772890
Special industry machinery and equipment	0,825672	0,831837	0,771372	0,809627
Electrical industrial equipment and apparatus	0,807931	0,775765	0,767554	0,783750
Farm, construction, and mining machinery	0,664711	0,753199	0,759429	0,725779
Agricultural, forestry, and fishery services	0,565346	0,724845	0,729516	0,673236
Lumber and wood products	0,777230	0,735960	0,728359	0,747183
Paper and allied products, except containers	0,729760	0,734557	0,728169	0,730829
Metal containers	0,671312	0,719140	0,717466	0,702640
Electric lighting and wiring equipment	0,633091	0,681264	0,692572	0,668975
Cleaning and toilet preparations	0,666851	0,703527	0,692523	0,687634
Other agricultural products	0,595937	0,640260	0,672678	0,636292
Petroleum refining and related products	0,548012	0,613233	0,658734	0,606660
Scientific and controlling instruments	0,677003	0,603917	0,628204	0,636375
Engines and turbines	0,568024	0,499173	0,559952	0,542383
Service industry machinery	0,469431	0,523269	0,556143	0,516281
Materials handling machinery and equipment	0,592554	0,549492	0,526231	0,556092
Miscellaneous electrical machinery and supplies	0,502082	0,492704	0,520572	0,505119
Livestock and livestock products	0,464273	0,437268	0,483494	0,461678
Furniture and fixtures	0,713883	0,430326	0,464330	0,536180
Crude petroleum and natural gas	0,406857	0,452876	0,452647	0,437460
Coal mining	0,405084	0,394310	0,446522	0,415305
Household appliances	0,455604	0,462800	0,430601	0,449668
Miscellaneous manufacturing	0,519137	0,392370	0,429770	0,447093
Food and kindred products	0,395383	0,355225	0,398680	0,383096
Miscellaneous fabricated textile products	0,504943	0,355699	0,381045	0,413896
Electronic components and accessories	0,456882	0,392614	0,364153	0,404550
Ophthalmic and photographic equipment	0,393582	0,311420	0,350253	0,351752
Apparel	0,588324	0,278103	0,343437	0,403288
Footwear, leather, and leather products	0,429161	0,294444	0,322413	0,348673
Audio, video, and communication equipment	0,321953	0,312137	0,319880	0,317990
Newspapers and periodicals	0,564515	0,380129	0,298082	0,414242
Drugs	0,733985	0,315376	0,296855	0,448739
Truck and bus bodies, trailers, and motor vehicles parts	0,274375	0,258264	0,248727	0,260456
Motor vehicles (passenger cars and trucks)	0,292680	0,173785	0,191811	0,219425
Other printing and publishing	0,346632	0,187421	0,170259	0,234771
Computer and office equipment	0,252317	0,190539	0,168951	0,203936
Other transportation equipment	0,190215	0,047177	0,055848	0,097746
Aircraft and parts	0,151841	0,032201	0,032126	0,072056
Ordnance and accessories	0,471308	0,016129	0,016129	0,167855
Average	0,638116	0,599599	0,605418	0,614378

Tab. 6 Independence index: services-producing activities
(average row indices of the matrix Z_s in decreasing order on the 1998 value)

	1987	1992	1998	Average 87-98
Owner-occupied dwellings	1,000000	1,000000	1,000000	1,000000
Computer and data processing services, including own-account s	0,897415	0,884930	0,886015	0,889454
Communications, except radio and TV	0,866125	0,876519	0,878995	0,873880
Finance	0,875041	0,868565	0,871665	0,871757
Amusements	0,816616	0,859164	0,863829	0,846537
Educational and social services, and membership organizations	0,855870	0,846969	0,859027	0,853955
Other business and professional services, except medical	0,845516	0,851427	0,855501	0,850815
Insurance	0,838719	0,843434	0,850135	0,844096
Legal, engineering, accounting, and related services	0,755506	0,842595	0,846162	0,814754
Eating and drinking places	0,869241	0,832947	0,843471	0,848553
Personal and repair services (except auto)	0,881495	0,841408	0,835579	0,852827
Radio and TV broadcasting	0,758936	0,828656	0,831275	0,806289
Hotels and lodging places	0,809097	0,820911	0,826646	0,818885
Air transportation	0,818631	0,813508	0,820778	0,817639
Advertising	0,754620	0,816064	0,816040	0,795575
Automotive repair and services	0,797305	0,804552	0,814066	0,805308
Real estate and royalties	0,824312	0,827154	0,809494	0,820320
Water and sanitary services	0,711987	0,791923	0,790504	0,764805
Electric services (utilities)	0,681334	0,721268	0,743074	0,715225
Pipelines, freight forwarders, and related services	0,657088	0,688594	0,721128	0,688937
Railroads and related services; passenger ground transportatio	0,632151	0,602249	0,637019	0,623806
Gas production and distribution (utilities)	0,602003	0,510641	0,575300	0,562648
Motor freight transportation and warehousing	0,565381	0,573504	0,573585	0,570823
Wholesale trade	0,575948	0,587139	0,566585	0,576557
Water transportation	0,571940	0,526737	0,541140	0,546605
Retail trade	0,573600	0,534658	0,494550	0,534269
Health services	0,037036	0,338878	0,321036	0,232317
Average	0,736034	0,753126	0,758244	0,749135

Tab. 7 The power of induction of the goods-producing activities on the input of services**(a) Services-producing activities receiving the induced effects**(row sum of the elements of S_1 ; activities having a row sum higher than the average in 1998)

	1987	1992	1998	1987-1998 Average
Wholesale trade	4,509267	5,383314	5,466340	5,119640
Real estate and royalties	1,122635	1,419758	1,961304	1,501232
Other business and professional services, except medical	1,046466	1,481522	1,863273	1,463754
Motor freight transportation and warehousing	1,328357	1,656567	1,786872	1,590599
Electric services (utilities)	1,764088	1,633202	1,228715	1,542002
Legal, engineering, accounting, and related services	0,840388	0,979256	1,007973	0,942539
Advertising	1,397485	0,977587	0,953230	1,109434
Finance	0,579337	0,713564	0,738714	0,677205
Average	0,615074	0,702178	0,721640	0,679631

(b) Goods-producing activities giving the induced effects(column sum of the elements of S_1 ; activities having a column sum higher than the average in 1998)

	1987	1992	1998	1987-1998 Average
Crude petroleum and natural gas	0,264715	0,355431	0,683108	0,434418
New, maintenance and repair construction	0,311493	0,639797	0,631183	0,527491
Petroleum refining and related products	0,337856	0,459940	0,579628	0,459141
Livestock and livestock products	0,373093	0,398787	0,448759	0,406879
Computer and office equipment	0,254113	0,335007	0,442242	0,343788
Metal containers	0,348459	0,408015	0,424692	0,393722
Agricultural fertilizers and chemicals	0,437121	0,402302	0,422788	0,420737
Motor vehicles (passenger cars and trucks)	0,341706	0,419801	0,418388	0,393298
Industrial and other chemicals	0,307610	0,375811	0,376171	0,353197
Plastics and synthetic materials	0,323270	0,386658	0,373203	0,361044
Apparel	0,225617	0,320836	0,371519	0,305991
Food and kindred products	0,313364	0,349861	0,371237	0,344821
Primary iron and steel manufacturing	0,351180	0,372929	0,369099	0,364403
Primary nonferrous metals manufacturing	0,371497	0,399841	0,362165	0,377834
Cleaning and toilet preparations	0,231001	0,324768	0,357127	0,304298
Metallic ores mining	0,307289	0,330624	0,353307	0,330407
Truck and bus bodies, trailers, and motor vehicles parts	0,301102	0,346069	0,351350	0,332840
Footwear, leather, and leather products	0,249618	0,301344	0,347611	0,299524
Miscellaneous textile goods and floor coverings	0,300633	0,331306	0,333817	0,321919
Household appliances	0,277628	0,322403	0,333775	0,311268
Coal mining	0,207375	0,240884	0,327680	0,258646
Electronic components and accessories	0,221755	0,267655	0,320981	0,270131
Other agricultural products	0,293137	0,288210	0,320794	0,300714
Audio, video, and communication equipment	0,219633	0,245634	0,320051	0,261773

Tab. 8 The power of induction of the service-producing activities on the input of goods

(a) Goods-producing activities receiving the induced effects

(row sum of the elements of G_1 ; activities having a row sum higher than the average in 1998)

	1987	1992	1998	1987-1998 Average
New, maintenance and repair construction	0,844548	0,787406	0,832506	0,821487
Crude petroleum and natural gas	0,419489	0,573920	0,547728	0,513712
Food and kindred products	0,359585	0,298553	0,275240	0,311126
Truck and bus bodies, trailers, and motor vehicles parts	0,195386	0,255695	0,256677	0,235919
Other printing and publishing	0,365229	0,307767	0,246400	0,306465
Petroleum refining and related products	0,476207	0,431034	0,216004	0,374415
Rubber and miscellaneous plastics products	0,215047	0,139109	0,137998	0,164051
Computer and office equipment	0,045465	0,118967	0,125751	0,096728
Electronic components and accessories	0,157587	0,133262	0,114356	0,135068
Aircraft and parts	0,055452	0,034595	0,084738	0,058261
Coal mining	0,135162	0,119886	0,082436	0,112495
Paper and allied products, except containers	0,104972	0,079055	0,077959	0,087329
Other fabricated metal products	0,135228	0,062009	0,069864	0,089034
Industrial and other chemicals	0,100753	0,071593	0,064083	0,078810
Average	0,075491	0,067924	0,063524	0,068980

(b) Services-producing activities giving the induced effects

(column sum of the elements of G_1 ; activities having a column sum higher than the average in 1998)

	1987	1992	1998	1987-1998 Average
Gas production and distribution (utilities)	0,386569	0,621307	0,624601	0,544159
Eating and drinking places	0,300381	0,304671	0,286288	0,297113
Water and sanitary services	0,391259	0,328568	0,275661	0,331829
Automotive repair and services	0,268570	0,252013	0,253249	0,257944
Electric services (utilities)	0,242004	0,231246	0,194368	0,222539
Railroads and related services; passenger ground transportation	0,237035	0,200740	0,186031	0,207935
Air transportation	0,221977	0,185381	0,175419	0,194259
Educational and social services, and membership organizations	0,233881	0,167938	0,159380	0,187066
Computer and data processing services	0,160774	0,150545	0,146091	0,152470

Tab. 9 The power of induction of the goods-producing activities on the output of services**(a) Services-producing activities receiving the induced effects**(row sum of the elements of S_2 ; activities having a row sum higher than the average in 1998)

	1987	1992	1998	1987-1998 Average
Wholesale trade	2,977483	3,509018	3,559257	3,348586
Other business and professional services, except medical	1,096370	1,495003	1,957243	1,516205
Real estate and royalties	1,091690	1,294246	1,524056	1,303331
Motor freight transportation and warehousing	0,938403	1,173883	1,280996	1,131094
Legal, engineering, accounting, and related services	0,718098	0,898480	0,944142	0,853573
Advertising	1,057348	0,904172	0,900651	0,954057
Finance	0,663332	0,715342	0,822663	0,733779
Electric services (utilities)	0,980487	0,929466	0,725296	0,878416
Average	0,501359	0,555630	0,584960	0,547316

(b) Goods-producing activities giving the induced effects(column sum of the elements of S_2 ; activities having a column sum higher than the average in 1998)

	1987	1992	1998	1987-1998 average
New, maintenance and repair construction	0,316270	0,608090	0,619325	0,514562
Crude petroleum and natural gas	0,307892	0,340424	0,593017	0,413778
Agricultural fertilizers and chemicals	0,395165	0,366266	0,371730	0,377720
Primary iron and steel manufacturing	0,330518	0,334602	0,352596	0,339239
Computer and office equipment	0,208951	0,257188	0,341362	0,269167
Cleaning and toilet preparations	0,189746	0,294354	0,340904	0,275002
Industrial and other chemicals	0,282000	0,318444	0,319830	0,306758
Coal mining	0,196071	0,228042	0,314496	0,246203
Drugs	0,239187	0,314108	0,308580	0,287292
Stone and clay products	0,309698	0,349164	0,303452	0,320771
Other agricultural products	0,286507	0,263639	0,302110	0,284085
Metallic ores mining	0,311391	0,260194	0,299421	0,290335
Motor vehicles (passenger cars and trucks)	0,211601	0,299323	0,297550	0,269491
Plastics and synthetic materials	0,255959	0,290095	0,291330	0,279128
Primary nonferrous metals manufacturing	0,279094	0,300309	0,286607	0,288670
Glass and glass products	0,280570	0,256551	0,286433	0,274518
Livestock and livestock products	0,214117	0,251348	0,282806	0,249424
Apparel	0,133487	0,215561	0,281065	0,210037
Electronic components and accessories	0,189807	0,222651	0,274256	0,228905
Petroleum refining and related products	0,221147	0,307468	0,272964	0,267193
Nonmetallic minerals mining	0,265562	0,261115	0,270546	0,265741
Paper and allied products, except containers	0,250005	0,270082	0,266281	0,262122
Miscellaneous manufacturing	0,274611	0,292342	0,263953	0,276969
Newspapers and periodicals	0,243400	0,251578	0,261924	0,252301

Tab. 10 The power of induction of the service-producing activities on the output of goods

(a) Goods-producing activities receiving the induced effects

(row sum of the elements of G_2 ; activities having a row sum higher than the average in 1998)

	1987	1992	1998	1987-1998 Average
Crude petroleum and natural gas	0,509668	0,791175	0,699408	0,666750
New, maintenance and repair construction	0,653957	0,618607	0,677529	0,650031
Food and kindred products	0,352596	0,317903	0,302869	0,324456
Truck and bus bodies, trailers, and motor vehicles part	0,173518	0,226050	0,229416	0,209661
Petroleum refining and related products	0,434816	0,417804	0,228840	0,360487
Other printing and publishing	0,283512	0,242144	0,186453	0,237370
Rubber and miscellaneous plastics products	0,247709	0,184191	0,185933	0,205944
Electronic components and accessories	0,148528	0,162578	0,162025	0,157710
Industrial and other chemicals	0,241030	0,181277	0,158565	0,193624
Primary iron and steel manufacturing	0,120626	0,119944	0,127382	0,122651
Paper and allied products, except containers	0,195255	0,148729	0,126614	0,156866
Lumber and wood products	0,108014	0,107224	0,120049	0,111763
Other fabricated metal products	0,163815	0,096834	0,105944	0,122198
Primary nonferrous metals manufacturing	0,105176	0,096691	0,097836	0,099901
Computer and office equipment	0,040632	0,097697	0,094275	0,077535
Aircraft and parts	0,054653	0,038281	0,083742	0,058892
Average	0,088543	0,082808	0,078269	0,083207

(b) Services-producing activities giving the induced effects

(column sum of the elements of G_2 ; activities having a column sum higher than the average in 1998)

	1987	1992	1998	1987-1998 average
Gas production and distribution (utilities)	0,303716	0,690144	0,778764	0,590875
Eating and drinking places	0,538094	0,521453	0,492998	0,517515
Automotive repair and services	0,379128	0,387850	0,397003	0,387994
Water and sanitary services	0,522265	0,446017	0,383388	0,450557
Railroads and related services; passenger ground trans	0,331775	0,292681	0,263571	0,296009
Electric services (utilities)	0,309365	0,292818	0,246605	0,282929
Air transportation	0,306847	0,265726	0,243829	0,272134
Computer and data processing services	0,183288	0,197520	0,198230	0,193013
Educational and social services, and membership orga	0,305641	0,209103	0,196112	0,236952

Tab. 11 External multipliers - 1998**(a) Services-producing activities**(row sum of the elements of S_e ; activities having a row sum higher than the average in 1998)

Real estate and royalties	1,347829
Wholesale trade	1,256699
Other business and professional services, except medical	1,167248
Legal, engineering, accounting, and related services	1,103508
Motor freight transportation and warehousing	1,100827
Gas production and distribution (utilities)	1,082713
Finance	1,070575
Electric services (utilities)	1,061009
Advertising	1,058704
Average	1,058521

(b) Goods-producing activities(row sum of the elements of G_e ; activities having a row sum higher than the average in 1998)

Crude petroleum and natural gas	1,344643
Maintenance and repair construction	1,329820
Other printing and publishing	1,140131
Petroleum refining and related products	1,122576
Electronic components and accessories	1,107822
Rubber and miscellaneous plastics products	1,102532
Truck and bus bodies, trailers, and motor vehicles parts	1,101159
Paper and allied products, except containers	1,090594
Lumber and wood products	1,072373
Industrial and other chemicals	1,071895
Food and kindred products	1,070339
Primary iron and steel manufacturing	1,060347
Coal mining	1,057121
Other fabricated metal products	1,051257
Primary nonferrous metals manufacturing	1,047668
Computer and office equipment	1,047502
Paperboard containers and boxes	1,040750
Average	1,038169

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