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Mario Forni and Sergio Paba

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Mario Forni, Università di Modena and CEPR
Sergio Paba, Università di Modena

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Centre for Economic Policy Research
90–98 Goswell Rd, London EC1V 7RR, UK
Tel: (44 20) 7878 2900, Fax: (44 20) 7878 2999
Email: cepr@cepr.org, Website: www.cepr.org

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ABSTRACT

Knowledge Spillovers and the Growth of Local Industries*

The literature on localized knowledge spillovers and growth focuses on the relative importance of intra- *versus* interindustry externalities, but the nature and the characteristics of the dynamic linkages across manufacturing sectors are not investigated. In this Paper we perform a very disaggregated analysis in order to identify, for each 3-digit industry, which composition of industrial activity is more conducive to growth. We find that diversity matters for growth, but each industry needs its own diversity. We provide some evidence of clustering of industries based on dynamic externalities. We find that many spillovers occur within input-output relationships. They often originate in downstream sectors favouring the growth of upstream industries. Lastly, the importance of spillovers does not depend on the technological intensity of the industry.

JEL Classification: L60, O30 and R11
Keywords: growth, spatial agglomeration and spillovers

Mario Forni
Dipartimento di Economia Politica
Università di Modena e Reggio Emilia
Via Berengario 51
41100 Modena
ITALY
Tel: (39 59) 417 852
Fax: (39 59) 417 948
Email: forni@unimo.it

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Sergio Paba
Dipartimento di Economia Politica
Università di Modena e Reggio Emilia
Viale Berengario 51
41100 Modena
ITALY
Tel: (39 59) 417 854
Fax: (39 59) 417 947
Email: paba@unimo.it

For further Discussion Papers by this author see:
www.cepr.org/pubs/new~dps/dplist.asp?authorid=138119

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> *A theory which assumes that most technological change enters the economy 'through a particular door', so to speak, might turn out to be much simpler, and therefore more elegant, than one which assumes that technological changes may be initiated, with equal probability, anywhere in the economy*
>
> (Nathan Rosenberg, 1976, p. 31)

1. Introduction

The importance of knowledge spillovers for the performance of the economic systems has been forcefully emphasized in the literature on growth (Romer 1986, Lucas 1988, Grossman and Helpman 1991). In the usual definition, knowledge spillovers include all the information exchange taking place informally between people working in the same or in unrelated industries. Such flows of information, which are not mediated by the market, may concern the technology of products or processes, specific input requirements, or unsatisfied market needs. As Marshall first noted in the *Principles*, most of these external effects are geographically localized and give rise to local clustering and agglomeration of firms (Krugman 1991, Fujita and Thisse 1996).

Glaeser *et al*. (1992) and Henderson *et al*. (1995) have recently provided indirect empirical evidence of knowledge spillovers for the US standard metropolitan areas (SMAs). According to their approach, based on growth theory, technological externalities increase the productivity and competitiveness of local industries and thus their growth performance. Spillovers are then detected by testing whether the long-run growth of a local industry is affected by the sectoral composition of the surrounding area. The main focus of this literature is to assess whether knowledge spillovers arise primarily from firms in the same industry, i.e. they are MAR externalities (Marshall 1890, Arrow 1962, Romer 1986), or whether they stem from firms outside the industry, i.e. they are Jacobs externalities (Jacobs 1969). If only *intra*-industry or MAR spillovers matter for growth, we should expect economic activities to specialize geographically in order to exploit such externalities. On the other hand, if *inter*-industry or Jacobs-type spillovers are prevalent, we should expect a better economic performance by large, diversified cities.

An index measuring the degree of specialization of the local industry is usually taken as an indicator of the intensity of MAR spillovers, while a concentration index measuring the local `variety' of economic activities is interpreted as reflecting the intensity of Jacobs spillovers. Empirical results based on US census employment data suggest that local spillovers are important, but evidence about their nature is mixed.

Glaeser *et al*. (1992) find that *inter*-industry externalities matter, while *intra*-industry externalities do not. By contrast, Henderson *et al*. (1995) focusing on few manufacturing sectors, some high-tech and some low-tech, find that MAR externalities are important for both groups, whereas Jacobs externalities are important only for high-tech industries.

By using a direct measure of innovative output, Feldman and Audretsch (1999), more recently, provide support for the variety thesis. They show that the diversity of the local industrial structure, measured by the presence of science-based complementary industries, is conducive to greater innovative activity for local industries. Specialization, on the contrary, is associated with lower innovative output.

In this paper we contribute to this diversity-versus-specialization debate by investigating the nature and directions of inter-industry dynamic linkages across manufacturing sectors and by assessing their importance for the growth of each localized industry. In order to do this, we develop a much more disaggregated approach than the ones existing in the literature. Following Glaeser *et al.* (1992) and Henderson *et al*. (1995), we use employment data to provide indirect evidence of knowledge spillovers but, unlike previous works, we study the growth of all manufacturing sectors. More precisely, our dependent variables are the employment growth rates of the three-digit ATECO-NACE Italian industries between 1971 and 1991[1]. Instead of using as explanatory variables the own specialization index plus a variety index as in Glaeser *et al.* (1992), or an index measuring the presence of a cluster of industries a priori defined as complementary according to some technological criteria as in Feldman and Audretsch (1999), we include on the right-hand side the specialization indices for all 2-digit and 3-digit manufacturing sectors. Our spatial units of observation are the 955 Italian local labor systems, which represent relatively self-contained areas with regard to supply and demand of labor (see Istat-Irpet 1986, Sforzi 1990, Forni and Paba 2000).

We use the coefficients of the specialization indexes to construct a sort of input-output table, the "spillover matrix", which shows on the columns the industries which produce externalities and on the rows the industries that benefit from them. This matrix allows us to detect the path of the spillovers and to unveil the complex dynamic interdependencies across sectors, even those that are difficult to detect on an *a priori*

[1] Productivity measures would be better for our purpose, but for Italy these data are not available at the desired geographical and sectoral disaggregation level.

basis[2]. Using this methodology, we can tackle a set of interesting questions which cannot be addressed by the existing literature. Do spillovers stem from firms producing "similar" goods? Do they wander randomly across industrial sectors, as in the original formulation of Jacobs (1969)[3], or are they closely related to input-output relations, as implied in Marshall's own account of external economies[4] or in Rosenberg's idea of customer-supplier relationships? Are they more backward or forward oriented? Are they more important for high-tech industries, as usually claimed in the literature, or do they also play a role in traditional sectors? Are spillovers related to industries producing instrumental goods? If variety matters for growth, as most scholars believe, we would like to know what kind of variety matters for each industrial sector –i.e. which particular composition of industries may favor local industry growth. Our methodology can provide an answer to this problem.

We find that (i) many dynamic linkages occur between firms within the same two-digit and three-digit sector; (ii) spillovers are significantly related to input-output relationships; (iii) spillovers follow both an upstream and a downstream path; (iv) the importance of spillovers does not depend on the technological intensity of the industry; (v) metal products and machinery sectors have dynamic linkages with almost all other sectors of the economy but they are mainly receivers of spillovers; (vi) "own" variety matters and the presence of balanced clusters of sectors is more conducive to industry growth.

[2] To some extent, this matrix resembles the "interindustry technology flows" table developed by Scherer (1984), but in the latter the focus is on R&D outlays, and the flows of technology from the industries of origin to the industries of use are estimated using an input-output table. This procedure does not enable spillovers to be detected, but is basically meant to capture flows of technologies incorporated in products and purchased through market transactions.

[3] According to Jacobs, the process of development of new products and ideas "is full of surprises and is hard to predict –possibly it is unpredictable- before it has happened. But after the fact, after the added goods or services exist, their addition usually looks wonderfully logical and 'natural'" (Jacobs 1969, p.59). In particular, the innovative process has nothing to do with input-output relations: "It is important to notice the kind of logic at work here so we will not be confused by supposing that other and quite different kinds of logic direct this development process. For one thing, the logic at work is *not* the logic of customers of the parent work. The new goods and services being added may be irrelevant to what customers of the older work want" (Jacobs 1969, p.60).

[4] According to Marshall, the specialization in one particular trade is accompanied by the development of machinery producers and, more generally, of "subsidiary industries devoting themselves each to one small branch of the process of production, and working it for a great many of their neighbours" (Marshall 1986, p.225). This may suggest a definition of industry which includes the sectors linked by input-output relations. These kind of forward and backward linkages may represent a privileged channel of information transmission and knowledge spillovers.

In interpreting these results, a note of caution is in order. As in Glaeser *et al.* (1992) and Henderson *et al.* (1995), we provide only an indirect measure of knowledge spillovers. The trouble with this approach is that other Marshallian agglomerating forces, in addition to technological externalities, can play a role in the estimated dynamic performance of local industries. These forces are market-size effects, through backward and forward linkages favored by reduced transportation costs and input sharing, especially specialized labor. However, we have reasons to believe that these static externalities may have affected our results only on a limited scale. First, our spatial units of reference, the local labor systems, represent very small areas. On average, their size is equal to only 315 Km^2 with an average population of 60,000 residents. Given that, transportation costs cannot be the main force behind agglomeration. For the same reason, local final markets are certainly too small for our industries. Second, we focus on manufacturing sectors. Local demand externalities may be important for non-traded service sectors, like restaurants, hairdressers or auto dealers, for which local demand effects are likely to be large. For manufacturing industries, on the contrary, markets are usually national or international, certainly much larger than the local level represented by the local labor systems. Not only does a lot of trade in manufacturing products take place across these areas, but for many industries where spillovers proved to be important Italy is a leading world exporter (see Fortis 1998).

The paper is structured as follows. Section 2 presents the model and the basic econometric specification. Section 3 describes the data set. Sections 4 and 5 present the results and the spillover matrices. Section 6 discusses the role played by input-output relations. Section 7 analyzes Jacobs' type effects. Section 6 concludes.

2. The model and the econometric specification

To begin with, let us concentrate on a single sector, say sector h. Following Glaeser *et al.* (1992), we assume the production function

$$X_{iht} = K_{iht}\, L_{iht}^{(1-a)}, \qquad 0<a<1,$$

where X_{iht} is output of sector h in the economic area i at time t, L_{iht} is labor and K_{iht} is the stock of technical knowledge. We assume a non-negative "iceberg-type" transportation cost, so that net output Y_{iht} is given by $Y_{iht} = T_{iht}\, X_{iht}$, where T_{iht}, the fraction of gross output surviving transportation, depends positively on the size of the local market. As a proxy for the latter, we use total employment in the province to which area i belongs, n_{it}. More precisely,

$$logT_{iht} = \varphi_h + \psi_h n_{it}\,, \qquad \psi_h \geq 0\,, \qquad -\varphi_h \geq \psi_h n_{it} \quad \text{for any } i,t$$

where the latter inequality ensures that $T_{iht} \leq 1$.

Firms take prices and wages as given and maximize profits $T_{iht}\ K_{iht}\ L_{iht}^{(1-a)}$ - $W_{ht}L_{iht}$, where W_{ht} is real wage, so that $(1-a)\ T_{iht}\ K_{iht}L_{iht}^{-a} = W_{ht}$. By taking on both sides the first difference of the logs, we get

$$\psi_h\, \Delta\, n_{it} + \Delta k_{iht} - a\Delta l_{iht} = \Delta w_{ht},$$

where lowercase letters denote logs. We assume that wages are equal for different areas, so that employment growth in each area is a linear function of technology growth, with positive slope, and of the growth of demand, i.e.

[1] $$\Delta l_{ih} = b_h + (1/a)\Delta k_{ih} + \lambda_h \Delta n_i$$

where we have dropped the index t for notational simplicity. Moreover, we assume that technology growth in each area is a linear function of initial employment (taken in logs), a local competition index, c_{ih}, the intensity of local spillovers, s_{ih}, and an unpredictable local technology shock, ε_{ih}:

[2] $$(1/a)\Delta k_{ih} = s_{ih} + \gamma_h c_{ih} + \delta_h l_{ih} + \varepsilon_{ih}.$$

Both c_{ih} and l_{ih} refer to time t-1. In line with the previous literature, the number of local plants divided by L_{ih} gives the competition index c_{ih}.

Finally, we assume that the intensity of local spillovers depends on the local industrial structure at time t-1. To describe this structure, we depart from existing works. We retain the specialization index of sector h, but, in place of an aggregate index of 'diversity', we include a specialization index for each manufacturing sector. In addition, we use the 'size' of the local area, measured by the log of total employment (including non-manufacturing employment), e_i. More precisely, we assume

$$[3] \qquad s_{ih} = \alpha_{1h}\, d_{1i} + \ldots + \alpha_{mh}\, d_{mi} + \beta_h e_i,$$

where d_{ji}, $j = 1,\ldots,m$, is the fraction of total employment (again including non-manufacturing employment) in sector j at time t-1[5]. The idea behind equation [3] is simply that, if sector j produces spillovers for sector h, the intensity of such spillovers will be greater, the greater is the relative importance of sector j in the local economy. In this case, we would expect a positive sign of the α's. While this assumption seems reasonable, and consistent with the role assigned to the own specialization index in the previous literature, it can be argued that the absolute level of employment in sector j is also important. Among areas having the same specialization in sector j, the smaller ones are likely to produce less externalities. We include the log of total employment e_i on the RHS of [3] in order to allow for this size effect. Obviously we expect a positive β.

Putting together equations [1], [2] and [3] we get:

$$[4] \qquad \Delta l_{ih} = b_h + \alpha_{1h}\, d_{1i} + \ldots + \alpha_{mh}\, d_{mi} + \beta_h e_i + \gamma_h c_{ih} + \delta_h l_{ih} + \lambda_h \Delta n_i + \varepsilon_{ih}.$$

Equation [4] is the basic reference for the empirical work below. In particular, a positive and significant α_{jh} will be interpreted as indicating that sector h benefits from technological externalities originating in sector j.

3. Data set and data treatment

The data set was specifically built for the analysis of local spillovers. The primary sources are the ISTAT Industry Censuses of 1971 and 1991. Original data include over three million data points, i.e. employment and the number of local plants for the mentioned years, 101 three-digit NACE-ATECO industries and 8,086 municipalities. These data have been carefully reclassified by ISTAT in order to harmonize the 1971 and the 1991 sector definitions.

Next, data were spatially aggregated into 955 larger areas, whose boundaries have been identified according to ISTAT-IRPET (1986). These areas are called *local labor*

[5] Dividing by total employment instead of manufacturing employment avoids collinearity problems.

systems and are constructed by using data on the residence and the workplace of workers from the 1981 ISTAT Population Census. The main idea is to cluster municipalities in such a way as to get areas which are both small and "self-contained", in the sense that many of the workers living in the area have their workplace within the area[6]. Using local labor systems as the geographical unit of reference seems particularly appropriate in order to capture Marshallian technological externalities. Spillovers are basically generated by informal exchanges of information on technology and markets, and this flow of information, which requires close proximity between firms, entrepreneurs and workers, is maximized when firms share the same labor market. Notice that these areas are very small, with an average size which is one tenth of that of an average province and approximately equal to 300 km^2. The most important implication of this is that a lot of trade of manufacturing products presumably takes place across these areas. In most cases the local market absorbs a negligible fraction of the supply of local industries. However, market-size effects can occur in areas larger than the local labor systems, such as the provinces. In order to capture these effects, we also aggregated total employment data at provincial level. Some local systems include municipalities belonging to different provinces. In these cases, employment data were equally divided between the provinces.

In the resulting data set, many industries are absent in many areas either at the beginning or at the end of the period. In order to avoid selection on the dependent variable and retain as many data points as possible, we set the log of employment to 0 when employment was equal to 0 either in 1971 or in 1991. Moreover, we eliminated, for each industry, all of the areas with zero employment in both 1971 and 1991. In order to have a sufficient number of degrees of freedom (70) in each equation, we considered only a subset of industries. After all these exclusions, the total number of sectors considered is 88 and the total number of local industries is 44,274.

4. Results I : the 3-digit × 2-digit *spillover matrix*

We estimated [4] for each of these 88 industries by applying OLS equation by equation. Let us begin by looking at the signs of the specialization indexes. Figure 1 shows the significance level of the positive coefficients (matrix A) and the negative coefficients

[6] The methodology includes a first step, in which municipalities which are "central", in the sense that they employ many workers living elsewhere, are identified, and subsequent steps which refine this first choice and cluster other municipalities around the central ones.

(matrix B). On the rows we have the 88 3-digit manufacturing industries whose economic performance is the dependent variable. On the columns we have the 22 2-digit industries representing a potential source of technological spillovers. Black cells indicate a *t*-value smaller than 1%, dark gray smaller than 5% but larger than 1%, light gray smaller than 10% but larger than 5%.

Two observations are in order. First, the negative and significant coefficients are much less than the positive ones. In matrix B, 10% significance occurs in 6% of the total number of cells –a percentage which is very close to the 5% that would be obtained by including as regressors, in place of the specialization indexes, variables independent of everything else in the system. By contrast, in matrix A, black and gray cells are 18.9% (black cells are 8.6%) –a percentage which cannot be explained by purely random factors. These numbers indicate that something is there: local externalities do matter.

The second observation is that in matrix B the black and gray cells seem to be distributed randomly, whereas in matrix A an underlying structure seems to emerge. Such a structure can be better appreciated by looking at Figure 2, where more detailed information is reported. We call this figure the *spillover matrix*, because it shows all the positive and significant dynamic linkages across sectors that occur at the local level in the manufacturing industry. By looking at the distribution of the black and gray cells in the matrix, we are able to draw some interesting conclusions on the nature of inter-industry spillovers.

First, spillovers concentrate on the `diagonal', i.e. the set of cells whose 3-digit industry on the row belongs to the 2-digit sector on the column. The percentage of black and gray cells in the diagonal is 68%, as against the overall 19%. This concentration is statistically significant. More precisely, we can reject at the 1% significance level the null hypothesis that the observed location of gray and black cells is drawn randomly from a uniform probability distribution[7]. To give an idea of the magnitude of the spillover effects, consider that if in area A the percentage of employment of the 2-digit textile industry is 1 point larger than in area B, employment growth, over a decade, is

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7 We used following test. Let $\pi = k/H$ be the observed fraction of non-white cells on the total number of cells and assume as the null hypothesis that all cells have the same probability π of being black or gray. Then fix any set of cells, like the diagonal or a particular row or column, and let h be the total number of cells belonging to this set. Then the number of non-white cells in the set has a hypergeometric probability distribution function, with parameters H, k, and h.

3,5% greater in spinning, 4% in textile finishing, 1,5% in household textiles, 2% in miscellaneous textiles, 1,5% in knitting.

To the extent that the ATECO-NACE grouping reflects technological affinities or input-output relations, this finding can be interpreted as providing a strong support to the Marshallian view. In most cases, the growth performance of these 3-digit industries is positively affected by a high specialization in the corresponding 2-digit industries at the beginning of the period. Interestingly, this is not only the case of a number of low tech sectors, such as textiles, leather and footwear, wood products, metal products, as one would expect on the basis of the findings of Henderson *et al*. (1995). It is also true for more research-intensive sectors, such as machine tools and machinery industries, electronic components and telecommunications equipment, measuring and optical instruments.

Second, some groups of 2-digit sectors tend to reinforce each other in the process of growth at the local level. We refer to these groups as “clusters” of dynamically linked industries (even if they are not identified by means of a clustering procedure). We can recognize these clusters by looking at those sectors which are reciprocally producers and recipients of spillovers –i.e. whose degree of specialization affects the performance of the other sectors in the group and vice versa. Three main clusters can be identified along the diagonal of Figure 2. The first one, in the upper-left corner of the figure, includes textiles, clothing and footwear. The second one, in the lower-right corner, includes metal products and machinery sectors. The last one, in the middle, links wood products with ‘furniture and other manufacturing' (we shall see in the next section that furniture is responsible for such links). Again, some of these linkages occur within input-output relations involving different 2-digit sectors, as in the case of wood products and furniture, but in other cases the industries in the clusters are not involved in vertical transactions.

Third, the metal products and machinery sectors are linked with many 2-digit sectors of the local economies, and their economic performance seems to be closely dependent on the spillovers they receive from them. These industries form a sort of ‘metal-machinery layer’ composed of firms which provide tools, technical equipment, and specialized machinery to local specialized industries. This layer is clearly visible in the lower part of Figure 2. By performing the statistical test described in note 7, the layer emerges as statistically significant at 1% level. Rosenberg (1976) has emphasized the special role played by the machine tool industry as a source of external economies to other sectors of the economy in the industrialization process. This sector represented "a pool or reservoir of skills and technical knowledge which are employed throughout the entire machine-using sectors of the economy" (Rosenberg 1976, p.19). Our finding is consistent with this idea.

Finally, some sectors show a limited number of inter-industry linkages. This is the case of petroleum products, office and computing equipment, motor vehicles, shipbuilding and other transport industries. This result is partly unexpected because some of these industries invest heavily in R&D and have a lot of input-output relations with other industries. There are two possible explanations for this. First, these industries are on average less represented in the Italian industrial structure. As a consequence, the number of observations is lower than the average and it is more difficult to obtain statistically significant coefficients. Second, and probably more importantly, for many of these sectors spillovers may be relatively unimportant at local level, while they may produce external effects and have technological linkages over a wider geographical scale.

Now let us look at Table 1, where the other regression results are reported. The adjusted R^2 is quite good, 0.38 on average, although it differs sharply across sectors, ranging from 0.08 to 0.68 (the standard deviation is equal to 0.126). However, as expected, causes of variation which are not considered here, like the effects of both local administrations (municipalities) and local policies of the central government, or differences in social capital, may have played a major role in explaining the observed variance. Given the large number of regressors, we check for multicollinearity by computing the "condition index" for each of our regressions as suggested by Belsley, Kuh and Welsch (1980). The results, reported in Table 1, are comforting[8].

As usually found in the literature, for many industries the competition index *c* is positively related to economic performance (75% of the sectors exhibit 5% significance). This is a confirmation of Porter's idea (Porter 1990) that the existence of a large number of small firms competing in the same industry and located in the same area can favor the innovative activity and spur growth. This result is also consistent with the Italian literature on industrial districts, which shows that small-firm specialized

[8] As a rule of thumb, a value of the condition index around 5 or 10 indicates weak collinear data, whereas a value of 30 to 100 is associated with moderate to strong dependencies (see Belsley, Kuh and Welsch, 1980, p.105). In our sample, all values except one are below 30 (see Table 1).

industrial systems have been the most dynamic industries of the Italian manufacturing sector in the period under analysis (see Brusco and Paba 1997). Also in line with the literature, the initial condition has always the expected negative sign and is significant for 32 industries.

The coefficient β of total employment is positive for almost all industries and is significant at the 5% level for most of them (76). This lends support to the idea that a size effect should be added to a specialization effect in order to capture the spillover generating process. The higher the absolute number of workers employed in the specialized sector, the higher the probability of knowledge spillovers among firms. The overall significance of the `spillover' proxies, i.e. the specialization indexes plus total employment, is confirmed by the probability values of the F-tests, which are lower than 5% for 66 sectors.

Although market-size effects may be negligible at the level of local labor markets, the economic performance of the surrounding area (the whole province) may have an impact on the growth of local industries. The results support this view. The coefficient of total employment growth in the province is positive for 81 industries and significant at the 5% level for 48 industries.

The above findings provide evidence that knowledge spillovers do matter for the growth of local industries. But how important are these factors? In order to evaluate the specific contribution of the `spillover' variables, we computed the increase in the adjusted R^2 due to the inclusion of the 22 specialization indexes plus total employment in the local economy. The average contribution is 12,8% (see the last column of Table 1), which is a large fraction of the explained variance. Again, differences across sectors are quite large, ranging from -0.2% to +56%.

In disagreement with part of the literature, such differences seem to be poorly related to technological intensity. Henderson *et al.* (1995) found that inter-industry spillovers are important for high-tech sectors but not for mature industries. Kim (1995) argued that knowledge spillovers are *by definition* confined to industries where technological knowledge matters –i.e. high tech sectors. Audretsch and Feldman (1996) concluded that knowledge externalities are more important in industries where new economic knowledge plays a greater role. Contrary to these findings, our evidence shows that inter-industry spillovers affect the growth of both research intensive *and* mature industries. In the case of high-tech sectors the average contribution is 13,8% as against 12,3% for low-tech sectors[9]. However, in the case of high-tech sectors, spillovers may well be more important but less geographically localized than in the case of low-tech industries.

There is some evidence that technological externalities are less important for the growth of final sectors (11.2%) than for sectors producing intermediate or instrumental goods (14.5%)[10]. Moreover, within the latter group, the average contribution of spillover variables is particularly high for industries belonging to the metal products and machinery layer as defined above. This is notably the case of general purpose machinery (37%), metal treatment (35%), machinery for specific industries (20%). These figures suggest, somewhat surprisingly, that many spillovers follow an upstream path, running from output to input sectors rather than vice versa. We will discuss this result in more detail in the next section.

5. Results II : the 3-digit x 3-digit spillover matrix

In order to investigate with greater detail the flows of intra and inter-industry spillovers, we have performed the same exercise using as explanatory variables the local specialization index of all the 88 3-digit sectors (so that *m* of equation [4] is equal to 88)[11]. The results are reported in Figure 3. First of all, the number of crossings has obviously increased, due to the finer disaggregation of data, but the general picture is quite similar to the previous one. As before, the statistically significant coefficients crowd particularly the 2-digit diagonal. The percentage of black and gray cells in the diagonal is 34%, while in the rest of the matrix it is only 9%. By using the test described in note 7, we found that this concentration is statistically significant at the 1% level.

With the 3 x 3 matrix, we can also verify the importance of intra-industry spillovers at the level of 3-digit industry. Along the 3-digit diagonal, 82% of our specialization coefficients show a positive sign and 58% are statistically significant at the 10% level (51% at the 5% level). In contrast with Glaeser *et al.* (1992) and Feldman

[9] Research intensive industries are indicated in Table 2. We followed Davies and Lyons (1996) for the identification of high-tech sectors.

[10] We define as final those industries that sell most of their output to final consumers or to non-manufacturing sectors. Conversely, intermediate and instrumental industries sell most of their products to other manufacturing sectors. The resulting classification is reported in Table 2.

[11] As for the 3 x 2 digit specification of the previous section, we computed the condition index in order to check for multicollinearity. We found that only 15 out of the 88 regressions exhibit a value greater than 30 (only two larger than 50).

and Audretsch (1999), this provides a clear confirmation of the importance of MAR externalities for the performance of local industries. Henderson *et al.* (1995) obtained a similar result for eight US manufacturing sectors (five 2-digit and three 3-digit). Here we provide a more general result. Intra-industry spillovers are important not only for low tech sectors (63% of them have a positive and significant coefficient) but also for 48% of high tech sectors.

Looking at the Table, it is still possible to identify a "metal-machinery" layer. Spillovers are particularly important for the growth of metal treatment, metal products, and machinery industries. Again, this concentration is statistically significant at the 1% level according to the test described in note 7.

Finally, it is now evident that the linkages of the 2-digit "other manufacturing industries" are basically due to the furniture sector, which provides spillovers to a large number of industries.

By simply counting the number of linkages associated with each 3-digit sector, the 3 x 3 spillover matrix also provides interesting information on the source and directions of spillovers. Along the rows, industries receive spillovers, and the black and gray cells show the source of these external effects. Industries in the columns are producers of spillovers, and the black and gray cells indicate the receiving sectors. By matching these data, we can evaluate if an industry is a net producer or a net receiver of spillovers. We report these data and information in Table 2.

First, for each industry the total number of spillovers gives a rough idea of the dynamic inter-industry relations which link sectors at local level. Some industries are closely interconnected, while others appear more isolated. Textile, clothing, metal products, machinery, furniture and plastics industries belong to the former group. Each of them has more than 20 linkages at the 5% significance level (more than 30 at the 10% level). Electronic components, reproduction of recorded media and transport (not cars) industries belong to the latter, with less than 4 linkages at the 5% significance level.

More interestingly, we are able to identify net producers and net recipients of spillovers. In this respect, the most important result is that, on average, downstream final industries are net producers of external effects, while upstream intermediate industries are net recipients of spillovers. Industries such as furniture, domestic electrical appliances and food industries are clear examples of the former group. Metal products, metal treatment, plastics, and machinery are some of the main net recipient sectors. For the final sectors as a whole, the difference between the number of spillovers received and the number of spillovers produced is positive and equal to 80 at the 5% level of significance (117 at the 10% level).

To the extent that these linkages capture flows of technological information, the above result provides support for the idea, put forward by Rosenberg (1976), that the innovative process is closely dependent upon a successful collaboration between producers of the final product and specialist makers of components. Rosenberg emphasized this point with reference to machinery producers and their customers, but the argument can easily be applied to other component producers. He stressed the role of "interchange of information and communication of needs to which the machinery producers respond in a highly creative way. They learn to deal with the requirements of their customers at the same time the machinery user learns to rely heavily on the judgement and initiative of the machinery supplier. (..) This is a process which involves an intimate knowledge of customer activities and needs and which presupposes frequent face-to-face confrontations and exchange of information" (Rosenberg, 1976, p.164). Rosenberg was well aware of the fact that this view of the innovative process implies geographical proximity between firms[12]. It is also interesting to note that in this context the industry producing spillovers is in fact transmitting information about its specific input or machinery requirements, but it is not necessarily involved in innovative activity. Innovation in final industries is probably relatively more affected by the presence of universities, research laboratories and institutions, as confirmed by the literature. Our data cannot check for such influences.

The third result concerns the relation between knowledge spillovers and technological intensity of industries. The more disaggregated approach confirms the basic findings of the 3 x 2 spillover matrix. By roughly measuring the spillover intensity with the number of linkages, we can see from Table 2 that the average total number of spillovers is higher for low tech industries (12.41) than for high tech sectors (9.67). This

[12] "Physical proximity between the producer and user of machinery seems to have been indispensable in the past for reasons which we do not really understand but which seem to be rooted basically in the problem of communications. Successful technological change seems to involve a kind of interaction that can best be provided by direct, personal contact. Successful instances of technological change in the past have involved a subtle and complex network of contacts and communication between people, a sharing of interests in similar problems, and a direct confrontation between the user of a machine, who appreciates problems in connection with its use, and the producer of machinery, who is thoroughly versed in problems of machinery production and who is alert to possibilities of reducing machinery (and therefore capital) costs" (Rosenberg 1976, p.168).

is true for both the number of spillovers received (6.07 against 5.1) and the number of spillovers produced (6.34 against 4.57).

6. Knowledge spillovers and input-output relations

We have seen that many inter-industry external effects occur within input-output relations and that, somewhat surprisingly, several links seem upstream-oriented. To confirm this visual impression and give a rough idea of the overall importance of these linkages, we compare the spillover relations with the input-output table of the Italian economy published by Eurostat (1990) and relative to 1985 (see Figure 4). The comparison is constructed as follows.

First, we say that two sectors are linked by an input-output relation if one of them buys from the other at least 5% of the value of total intermediates according to the above table. Using this rule we produce Figure 4a, where I-O linkages as represented as black cells. The input sectors are on the columns. Figure 4b represents the same I-O links without distinguishing for the direction; i.e. it represents the triangular matrix having a black cell in place i,j , $j > i$, whenever either cell i,j or cell j,i is black in matrix 4a.

Unfortunately, the Eurostat table is only available for the 27 two-digit NACE sectors, which are aggregations of our 3-digit sectors. In order to make the comparison possible, we aggregated our 88×88 spillover matrix (see Figure 3) into a 27×27 matrix. The latter is obtained as follows. Each 27×27 cell can be viewed as formed by several small 88×88 cells. We established that a 27×27 cell is black if more than 15% of its 88×88 cells are gray or black in Figure 3. Figure 4c shows the result. As usual, the originating sectors are on the columns. Figure 4d represents the same spillover links without distinguishing for the direction; i.e. it represents the triangular matrix having a black cell in place i,j , $j > i$, whenever either cell i,j or cell j,i is black in matrix 4c.

In our first exercise we disregard both the direction of the I-O relation and the direction of externalities and focus on the triangular matrices 4b and 4d. Spillovers within the area of I-O relations are 28, which represents 42% of the total number of I-O relations; spillovers occurring outside the I-O area are 66, which is only 10% of the non-I-O area. By applying the test described in note 7, we see that the difference is significant at the 5% level. We conclude that I-O linkages are an important source of technological externalities.

As a second exercise, we consider the question of whether spillovers arising within I-O relation are downstream-or upstream-oriented. We define as ‘downstream linkages’ the overlapping black cells of 4a and 4c outside the diagonal, and ‘upstream linkages’ the overlapping black cells of 4a and the transposed of 4c, outside the diagonal. Clearly a link can be both upstream-and downstream-oriented. The result is that we have 11 downstream as against 9 upstream spillover relations, confirming that several spillovers arise from the user sectors.

7. Does variety matter?

Gleaser *et al*. (1992) find that an index measuring the degree of `variety' of the local economy enhances the growth of local industries. To see whether variety matters in our data set, we computed the Herfindhal-Hirschman concentration index $x = \Sigma_h l_h^2 / (\Sigma_h l_h)^2$ and defined the variety index as $v = n(1-x) / (n-1)$, n being the number of sectors, so that the index varies between 0 and 1. The main difference with respect to previous work is that, in computing v, we considered, for each regression, only industries having a t-value larger than 1 in the corresponding regression of Section 5. In other words, for each industry, we considered only the industries which proved to be important as spillover producers (so that in general we get different x's for different industries in the same area). We define this index as `own variety'[13], in order to emphasize that the variety that matters for the growth is specific to each industry. Then we computed, for each sector, an overall specialization index d, defined as the sum of the specialization indexes of the sectors having a t-value larger than 1 in the regression of Section 5. Finally, we regressed each 3-digit sector on d and v, in addition to total employment, the competition index, the employment growth of the corresponding province, and, as initial condition, the number of employees in the industry at the beginning of the period.

Results are reported in Table 3. In this regression, the average corrected R^2 is higher than in the previous ones (41.1%), owing to both the contribution of the variety index and the reduced effect of the correction in this more synthetic specification. The average increase in the R^2 due to the `spillover' variables, including the variety index, is 16.1%. Previous results on variety are confirmed. Own variety has a positive coefficient in almost all equations (82) and is significant at the 5% level in most of them (58). This means that, holding constant the size of the sectors originating spillovers, areas where employment is uniformly distributed across such sectors perform better on average than areas where only a few of them are represented. In other words, different industries complement each other in such a way that their joint effect is larger than the sum of the effects that each one of them would have when taken in isolation. In our context, this `variety effect' reinforces the idea that `balanced' clusters of sectors are more likely to be successful.

8. Conclusions

This paper is a contribution to the empirics of localized knowledge spillovers. Most of the related literature has tried to assess the relative importance of intra-industry versus inter-industry externalities for the industrial development in cities. In our approach, we depart from this contraposition in order to investigate more closely the inter-sectoral dynamic relations across industries. Admittedly, we provide only indirect evidence of the importance of knowledge spillovers, and our methodology cannot exclude *a priori* some influence of market size effects in the estimated inter-industry linkages. However, the small size of our geographical unit of reference along with the focus on the manufacturing sectors guarantee that the above effects cannot be large.

We found that in most cases specialization *and* variety matter for growth, but each industry needs its own variety. This variety may bring about the formation of specific clusters of industries. We also found that many dynamic external effects occur between industries linked by input-output relations, both within and across 2-digit sectors. The metal products and machinery sectors seem to play a special role in industrial cities by forming a sort of local technological and productive layer which have dynamic linkages with almost all other industries. In many cases spillovers follow an upstream path. They originate in downstream producers of final goods and benefit specialist makers of components and machinery producers. Lastly, technological intensity does not affect the importance of spillovers. In particular, there is strong evidence that low-tech sectors have many intra and inter-sectoral dynamic linkages.

Our findings have also some policy implications for local development. We have seen that dynamic industries tend to cluster together at the local level according to some definite patterns. In these clusters, the growth performance of one industry tends to affect and reinforce the growth performance of other specific industries, linked by

[13] We considered also a variety index including all 3-digit sectors, as in Glaeser *et al.* (1992), but we

technology, market opportunities, and input sharing. Cities specialized in all these dynamically inter-connected sectors may be more successful than cities specialized only in one industry or with the “wrong” mix of industries. In particular, the presence of a metal-machinery layer may be important for the dynamic performance of a number of manufacturing sectors. Policy, through a set of appropriate incentives, may affect the agglomeration of the “right” industries at local level.

Our methodology can be extended in a number of interesting directions, and this is the subject of our future research. To some extent, the performance of local systems may be spatially correlated and it is possible to develop a framework which takes this possibility into account. For most sectors, the presence of small sized firms is positively correlated with growth performance. Small specialized firms often cluster together to form industrial districts, whose specific impact in the dynamic performance of local industries can be assessed. Finally, data on patents can be used to provide some direct measurements of innovative activity.

found that this index is significant only for a few sectors once the own variety index is included.

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FIG.1- SIGNIFICANT COEFFICIENTS FOR THE 22 SPECIALIZATION INDEXES
1% black cells; 5% dark gray cells; 10% light gray cells

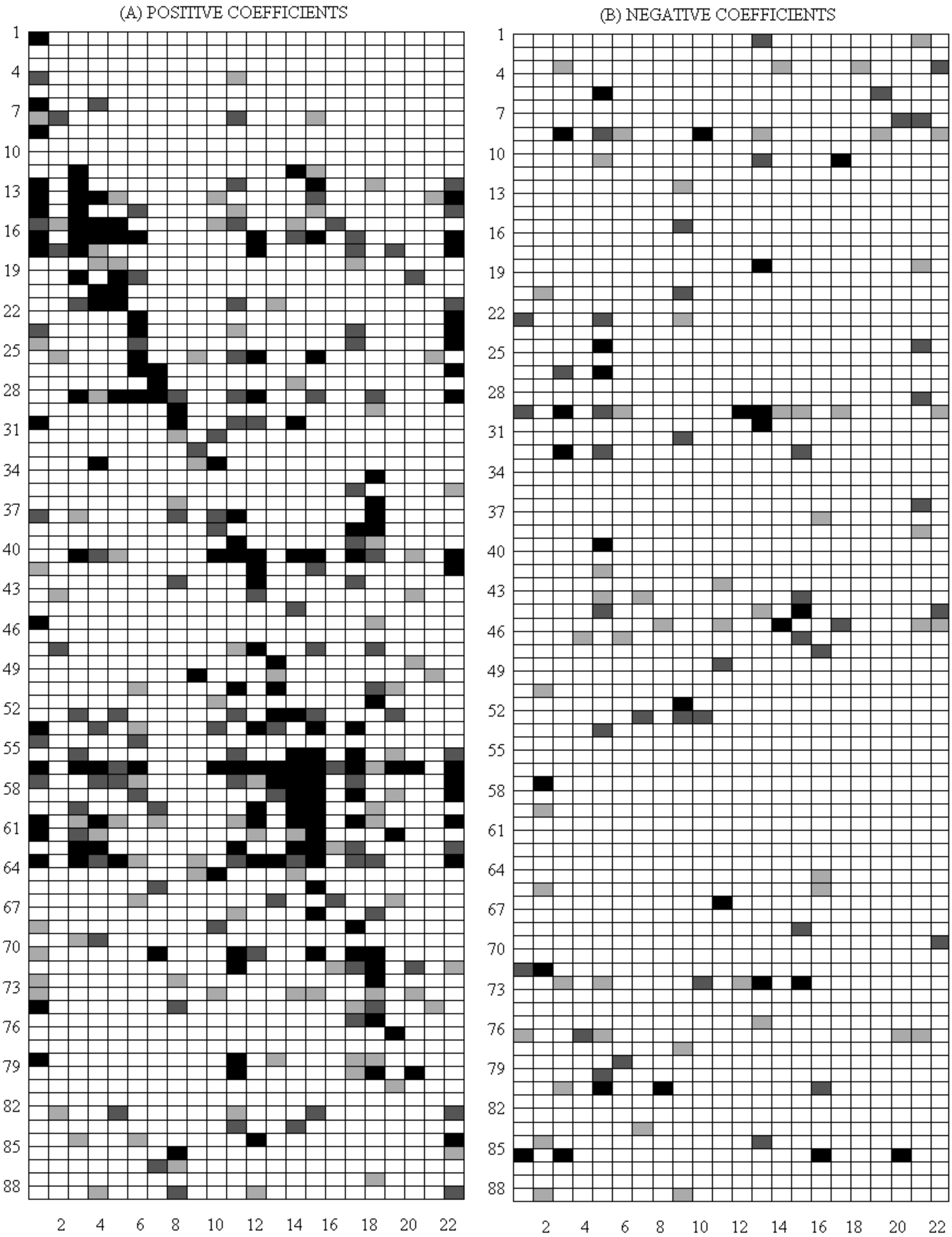


FIG. 2 - LOCAL INTER-INDUSTRY TECHNOLOGICAL SPILLOVERS

t-Student significant at 1% (black cells), 5% (dark gray cells), 10% (light gray cells)

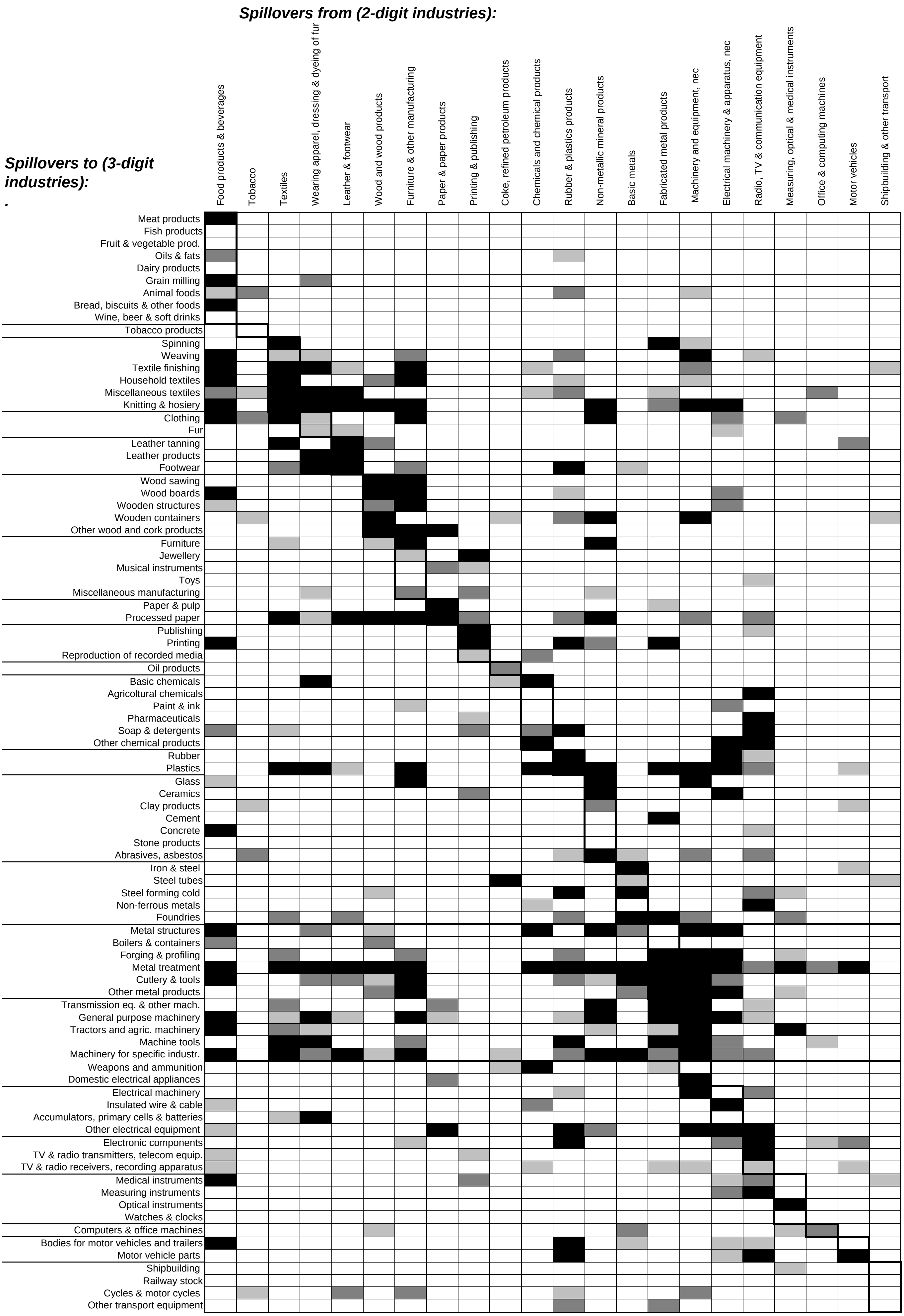
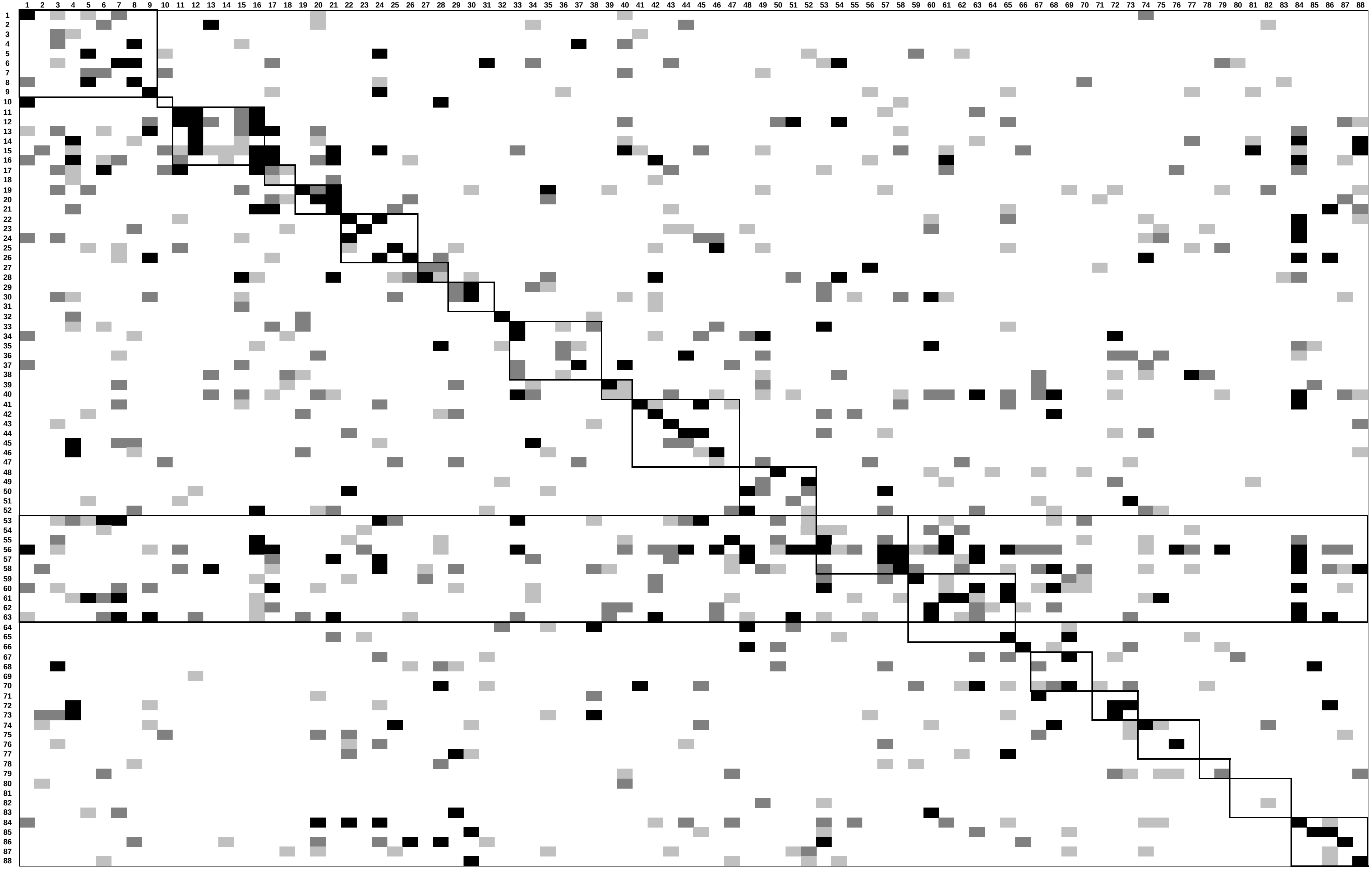
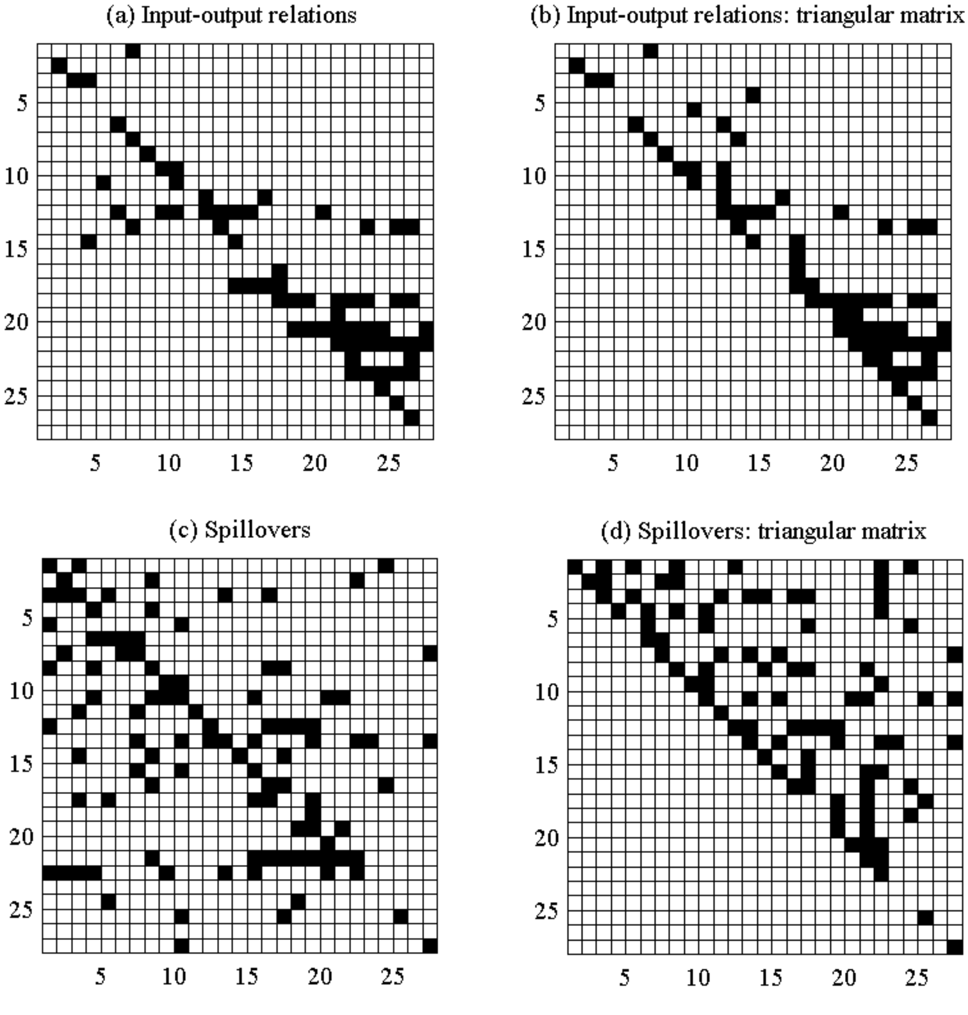


FIG. 3 - LOCAL INTER-INDUSTRY TECHNOLOGICAL SPILLOVERS. t-Student significant at 1% (black cells), 5% (dark gray cells), 1% (light gray cells)



1 Meat products
2 Fish products
3 Fruit & vegetable prod.
4 Oils & fats
5 Dairy products
6 Grain milling
7 Animal foods
8 Bread, biscuits & other foods
9 Wine, beer & soft drinks
10 Tobacco products
11 Spinning
12 Weaving
13 Textile finishing
14 Household textiles
15 Miscellaneous textiles
16 Knitting & hosiery
17 Clothing
18 Fur
19 Leather tanning
20 Leather products
21 Footwear
22 Wood sawing
23 Wood boards
24 Wooden structures
25 Wooden containers
26 Other wood and cork products
27 Paper & pulp
28 Processed paper
29 Publishing
30 Printing
31 Reproduction of recorded media
32 Oil products
33 Basic chemicals
34 Agricoltural chemicals
35 Paint & ink
36 Pharmaceuticals
37 Soap & detergents
38 Other chemical products
39 Rubber
40 Plastics
41 Glass
42 Ceramics
43 Clay products
44 Cement
45 Concrete
46 Stone products
47 Abrasives, asbestos
48 Iron & steel
49 Steel tubes
50 Steel forming cold
51 Non-ferrous metals
52 Foundries
53 Metal structures
54 Boilers & containers
55 Forging & profiling
56 Metal treatment
57 Cutlery & tools
58 Other metal products
59 Transmission eq. & other mach.
60 General purpose machinery
61 Tractors and agric. machinery
62 Machine tools
63 Machinery for specific industr.
64 Weapons and ammunition
65 Domestic electrical appliances
66 Computers & office machines
67 Electrical machinery
68 Insulated wire & cable
69 Accumulators, primary cells & batt.
70 Other electrical equipment
71 Electronic components
72 TV & radio transmitters, tel. equip.
73 TV & radio receivers, recording app.
74 Medical instruments
75 Measuring instruments
76 Optical instruments
77 Watches & clocks
78 Bodies for motor vehicles and trailers
79 Motor vehicle parts
80 Shipbuilding
81 Railway stock
82 Cycles & motor cycles
83 Other transport equipment
84 Furniture
85 Jewellery
86 Musical instruments
87 Toys
88 Miscellaneous manufacturing

Figure 4 - Spillovers and input-output relations



Legenda Figure 4

1	Meat products
2	Diary products
3	Other food products
4	Beverages
5	Tobacco
6	Textile, clothing
7	Leathers, footwear
8	Timber, furniture
9	Pulp, paper, board
10	Paper printing
11	Refined petroleum
12	Chemical products
13	Rubber, plastic
14	Glass
15	Earthware, ceramic
16	Cement, lime, plast
17	Other minerals
18	Irone ore, ECSC production
19	Non-ECSC products
20	Non-ferrous
21	Metal products
22	Agricultural and industrial machines
23	Electrical goods
24	Office machines
25	Motor vehicles
26	Other transport equip.
27	Other manufactures

TABLE 1 - EMPLOYMENT GROWTH IN THE LOCAL INDUSTRIES (1971-1991) - Regression results

Explanatory variables (besides the specialization indexes of the 22 two-digit sectors):

Dependent variables (log of employment growth 1971-91)	1971 empl. in the local 3-digit industry	t	Competition index	t	1971 empl. in the local economy	t	1971-91 employment growth in the province	t	Adjusted R2	F-test	Condition Index	Number of observations	Contribution of spillovers to R2
Meat products	-0,463	-13,0	-0,351	-2,6	0,415	7,4	1,315	4,4	0,224	0,833	11,8	822	0,054
Fish products	-0,636	-8,3	-1,230	-2,0	0,250	1,7	0,862	0,9	0,276	0,139	14,2	186	-0,016
Fruit & vegetable prod.	-0,642	-15,5	-1,485	-4,8	0,323	3,8	1,437	3,0	0,373	0,876	11,6	523	0,024
Oils & fats	-0,282	-9,3	0,213	1,2	0,235	5,5	0,908	3,5	0,154	0,936	12,6	633	0,052
Dairy products	-0,418	-13,9	-0,749	-4,3	0,331	6,3	1,561	5,4	0,260	0,969	11,7	743	0,056
Grain milling	-0,359	-8,4	-0,551	-3,1	0,203	4,9	0,389	1,7	0,078	0,958	16,2	890	0,040
Animal foods	-0,693	-13,0	-1,268	-3,6	0,233	3,0	0,930	1,8	0,363	0,981	12,9	381	0,043
Bread, biscuits & other foods	-0,741	-37,8	-0,154	-1,5	0,717	26,4	0,562	5,3	0,673	1,000	17,9	955	0,347
Wine, beer & soft drinks	-0,395	-9,3	-0,914	-3,9	0,221	3,4	0,906	2,7	0,119	0,561	13,5	786	0,009
Tobacco products	-0,658	-4,9	-1,422	-1,8	0,438	2,1	0,965	0,8	0,236	0,866	21,4	145	0,083
Spinning	-0,710	-15,6	-1,143	-4,5	0,295	3,5	1,301	2,5	0,393	1,000	13,9	483	0,076
Weaving	-0,711	-18,4	-0,679	-3,6	0,345	4,9	1,487	3,4	0,418	1,000	13,1	578	0,187
Textile finishing	-0,773	-14,7	-1,654	-4,0	0,482	5,2	1,656	2,9	0,507	1,000	15,4	337	0,158
Household textiles	-0,701	-14,5	-0,429	-3,2	0,681	9,6	1,061	3,8	0,263	1,000	14,3	754	0,168
Miscellaneous textiles	-0,754	-23,6	-0,866	-6,8	0,614	11,7	1,194	3,9	0,479	1,000	12,1	777	0,211
Knitting & hosiery	-0,453	-11,6	-0,851	-5,0	0,344	6,2	0,653	2,2	0,161	1,000	16,7	908	0,113
Clothing	-0,374	-4,7	-1,284	-6,7	0,350	4,1	2,843	11,2	0,208	1,000	28,6	955	0,081
Fur	-0,505	-12,1	-0,444	-3,1	0,578	9,5	0,100	0,4	0,301	0,987	14,4	436	0,198
Leather tanning	-0,580	-10,8	-0,543	-1,9	0,161	1,7	1,190	2,0	0,350	1,000	14,9	292	0,077
Leather products	-0,565	-14,9	-0,848	-6,7	0,494	8,0	1,159	3,6	0,302	1,000	12,2	632	0,149
Footwear	-0,522	-13,7	-1,479	-8,7	0,318	5,1	3,142	8,5	0,287	1,000	14,1	754	0,087
Wood sawing	-0,635	-18,1	-0,390	-2,8	0,428	8,7	0,711	2,5	0,320	1,000	11,6	778	0,133
Wood boards	-0,814	-11,4	-1,976	-3,6	0,436	3,2	0,970	1,3	0,377	0,980	13,7	251	0,057
Wooden structures	-0,412	-10,0	-0,378	-3,3	0,288	7,7	1,020	9,5	0,169	1,000	32,9	955	0,096
Wooden containers	-0,647	-15,8	-0,865	-5,1	0,320	5,2	1,234	3,8	0,328	0,992	12,8	622	0,085
Other wood and cork products	-0,782	-24,5	-0,335	-3,4	0,887	18,5	1,305	5,5	0,472	1,000	11,7	849	0,332
Paper & pulp	-0,824	-9,8	-3,735	-3,0	0,533	3,4	0,112	0,1	0,322	0,985	14,2	219	0,070
Processed paper	-0,641	-17,6	-0,536	-1,7	0,563	8,8	1,572	4,7	0,454	1,000	13,4	524	0,146
Publishing	-0,729	-17,9	0,039	0,2	0,951	16,2	-0,004	0,0	0,495	1,000	14,2	468	0,370
Printing	-0,648	-16,3	-0,140	-1,5	0,809	14,6	1,145	7,0	0,336	1,000	16,6	865	0,231
Reproduction of recorded media	-0,662	-9,5	-0,474	-1,5	0,370	5,0	0,980	1,9	0,472	0,718	16,1	169	0,211
Oil products	-0,676	-13,1	-1,011	-2,4	0,474	5,4	0,507	1,1	0,404	0,999	14,2	363	0,082
Basic chemicals	-0,780	-16,4	-0,916	-2,4	0,769	8,1	0,920	1,8	0,397	0,994	13,4	466	0,138
Agricoltural chemicals	-0,746	-7,2	-2,131	-2,8	0,083	0,5	-0,580	-0,5	0,424	0,699	17,4	110	0,027
Paint & ink	-0,613	-13,8	-0,716	-2,7	0,529	7,6	0,957	2,3	0,387	0,860	13,3	365	0,140
Pharmaceuticals	-0,585	-7,8	-2,688	-3,5	0,066	0,4	0,039	0,0	0,339	0,961	15,8	189	0,055
Soap & detergents	-0,545	-11,2	-0,504	-2,3	0,395	4,9	0,707	1,6	0,303	1,000	13,9	388	0,151
Other chemical products	-0,902	-18,5	-0,924	-3,4	0,688	8,3	-0,173	-0,4	0,426	0,967	12,9	459	0,150
Rubber	-0,620	-11,4	-0,902	-4,6	0,404	5,1	0,467	1,3	0,223	1,000	16,7	682	0,075
Plastics	-0,740	-19,8	-0,597	-2,5	0,603	9,4	1,528	5,1	0,454	1,000	13,3	713	0,174
Glass	-0,507	-16,8	-0,364	-2,4	0,483	8,5	1,143	4,3	0,337	0,996	12,2	636	0,132
Ceramics	-0,495	-14,7	-0,049	-0,3	0,391	6,2	1,568	4,3	0,318	0,962	12,0	620	0,085
Clay products	-0,523	-8,2	-0,053	-0,1	0,120	1,3	0,129	0,2	0,187	0,962	14,2	490	0,023
Cement	-0,575	-11,2	-0,721	-1,9	0,359	4,1	1,357	2,6	0,268	0,991	12,8	435	0,052
Concrete	-0,713	-22,7	-0,841	-5,1	0,553	10,2	1,745	7,0	0,469	1,000	11,9	874	0,082
Stone products	-0,403	-13,9	-0,101	-0,8	0,258	6,1	0,664	3,6	0,278	0,962	14,3	898	0,033
Abrasives, asbestos	-0,731	-10,9	-0,784	-2,0	0,309	3,5	0,481	0,9	0,379	0,997	14,2	288	0,117
Iron & steel	-0,880	-7,6	-2,880	-2,4	0,473	2,0	1,234	0,9	0,290	0,931	17,1	166	0,051
Steel tubes	-0,914	-12,3	-2,918	-4,6	0,297	1,8	0,957	0,9	0,478	0,661	14,9	198	0,019
Steel forming cold	-0,826	-16,6	-1,160	-2,7	0,505	5,1	2,701	4,5	0,512	1,000	15,0	325	0,113
Non-ferrous metals	-0,709	-12,8	-1,498	-4,3	0,407	3,8	1,372	2,1	0,416	0,948	13,4	290	0,074
Foundries	-0,748	-14,0	-2,365	-5,2	0,316	3,0	0,991	1,8	0,442	1,000	15,0	341	0,096
Metal structures	-0,736	-28,6	-0,089	-0,9	0,742	16,3	1,577	8,2	0,566	1,000	12,5	934	0,176
Boilers & containers	-0,842	-16,0	-1,539	-3,1	0,793	7,7	1,344	2,4	0,413	0,683	14,3	385	0,095
Forging & profiling	-0,838	-18,2	-0,965	-2,1	0,627	8,9	0,877	1,9	0,490	1,000	13,0	420	0,183
Metal treatment	-0,814	-19,2	-0,665	-5,2	0,821	12,9	1,034	4,1	0,392	1,000	14,5	844	0,348
Cutlery & tools	-0,676	-16,9	-0,760	-3,5	0,689	10,8	1,291	3,3	0,429	1,000	13,1	498	0,226
Other metal products	-0,416	-9,7	0,051	0,3	0,417	10,1	1,013	6,3	0,195	1,000	25,6	953	0,184
Transmission eq. & other mach.	-0,696	-16,8	-1,061	-2,6	0,614	7,8	1,205	2,8	0,416	1,000	13,7	513	0,136
General purpose machinery	-0,837	-20,4	-0,584	-4,9	1,078	17,4	1,118	4,3	0,412	1,000	14,6	819	0,370
Tractors and agric. machinery	-0,450	-13,6	-0,521	-3,8	0,230	4,7	0,496	1,9	0,224	1,000	13,1	750	0,087
Machine tools	-0,665	-15,6	-2,407	-4,1	0,509	5,8	0,478	1,0	0,457	1,000	15,1	369	0,098
Machinery for specific industr.	-0,697	-21,0	-0,939	-2,7	0,787	12,0	1,053	3,2	0,476	1,000	12,8	613	0,203
Weapons and ammunition	-0,739	-5,6	-2,180	-3,7	-0,017	-0,1	-2,128	-1,3	0,418	0,943	17,1	103	0,083
Domestic electrical appliances	-0,818	-13,4	-1,771	-3,7	0,391	3,0	0,730	1,0	0,379	0,983	13,7	340	0,054
Computers & office machines	-0,683	-7,9	-2,338	-1,9	0,250	1,5	0,289	0,3	0,505	0,971	19,6	121	0,107
Electrical machinery	-0,772	-19,4	-0,398	-1,2	0,536	7,0	1,001	2,4	0,498	0,993	12,9	466	0,106
Insulated wire & cable	-0,735	-9,8	-1,768	-2,7	0,239	1,7	1,309	1,7	0,468	0,951	15,6	165	0,047
Accumulators, primary cells & batteries	-0,854	-7,2	-3,318	-3,0	-0,069	-0,3	-0,313	-0,2	0,531	0,831	17,5	99	0,034
Other electrical equipment	-0,913	-18,2	-0,056	-0,3	0,994	13,4	0,751	2,5	0,359	1,000	15,9	843	0,264
Electronic components	-0,975	-13,5	-0,968	-2,0	0,578	5,0	0,911	1,5	0,409	1,000	14,6	328	0,155
TV & radio transmitters, telecom equip.	-0,826	-20,0	-0,159	-0,5	1,179	26,0	0,617	2,3	0,594	1,000	11,6	731	0,557
TV & radio receivers, recording apparatus	-0,984	-15,8	-1,193	-2,8	0,594	4,7	0,843	1,1	0,617	0,924	15,3	226	0,069
Medical instruments	-0,802	-25,3	0,405	3,9	0,992	26,9	0,994	5,2	0,624	0,982	11,8	822	0,525
Measuring instruments	-0,737	-13,8	-0,700	-3,1	0,676	7,3	-0,201	-0,4	0,417	0,903	14,3	381	0,156
Optical instruments	-0,538	-12,2	-0,066	-0,3	0,567	9,3	1,221	3,3	0,305	0,999	12,6	488	0,152
Watches & clocks	-0,917	-8,9	-1,347	-2,3	0,272	1,5	-0,071	-0,1	0,539	0,392	17,1	98	0,025
Bodies for motor vehicles and trailers	-0,833	-15,2	-3,740	-5,1	0,228	2,2	2,027	3,1	0,611	0,997	14,9	219	0,075
Motor vehicle parts	-0,703	-12,0	-1,911	-4,0	0,320	3,0	1,100	1,7	0,376	0,999	13,8	346	0,066
Shipbuilding	-0,349	-7,8	-0,588	-2,6	0,370	4,4	0,819	1,6	0,195	0,958	12,9	322	0,050
Railway stock	-0,824	-7,0	-13,919	-3,0	0,433	1,5	0,441	0,3	0,447	0,008	20,9	102	-0,022
Cycles & motor cycles	-0,493	-8,8	-0,833	-2,2	0,239	2,2	1,141	1,7	0,266	0,887	14,3	258	0,052
Other transport equipment	-1,260	-12,3	-1,706	-5,3	0,234	2,1	1,164	1,5	0,682	0,963	14,4	113	0,094
Furniture	-0,523	-14,7	-0,363	-2,9	0,643	12,0	1,513	6,6	0,238	1,000	16,4	919	0,153
Jewellery	-0,605	-20,7	-0,182	-1,5	0,632	13,1	1,242	4,8	0,461	1,000	11,9	651	0,223
Musical instruments	-0,445	-8,0	-0,103	-0,4	0,195	2,4	1,030	1,8	0,295	0,756	15,0	173	0,054
Toys	-0,673	-15,7	-0,200	-0,7	0,414	5,2	1,055	2,1	0,455	0,459	13,2	338	0,056
Miscellaneous manufacturing	-0,756	-19,7	-0,393	-2,6	0,698	11,4	0,324	1,0	0,433	0,991	12,3	558	0,245

TABLE 2 - NUMBER OF LOCAL TECHNOLOGICAL SPILLOVERS IN THE ITALIAN MANUFACTURING INDUSTRY

(*)	(**)	3-digit industries	(1) Spill. produced Significance: 1%	5%	10%	(2) Spill. received Significance: 1%	5%	10%	Difference (1)-(2) Significance: 1%	5%	10%	Total (1)+(2) Significance: 1%	5%	10%
F		Meat products	3	10	12	1	3	7	2	7	5	4	13	19
F		Fish products	0	3	5	1	3	6	-1	0	-1	1	6	11
F		Fruit & vegetable prod.	1	10	17	0	1	3	1	9	14	1	11	20
F		Oils & fats	6	9	16	2	4	5	4	5	11	8	13	21
F		Dairy products	3	5	11	2	3	6	1	2	5	5	8	17
		Grain milling	2	7	12	3	8	11	-1	-1	1	5	15	23
F		Animal foods	4	11	14	0	4	5	4	7	9	4	15	19
F		Bread, biscuits & other foods	3	7	11	2	4	6	1	3	5	5	11	17
F		Wine, beer & soft drinks	4	7	10	2	2	8	2	5	2	6	9	18
F		Tobacco products	0	5	6	2	2	3	-2	3	3	2	7	9
		Spinning	3	7	10	3	5	6	0	2	4	6	12	16
		Weaving	5	6	8	4	12	13	1	-6	-5	9	18	21
		Textile finishing	2	5	6	4	8	11	-2	-3	-5	6	13	17
F		Household textiles	0	0	3	4	5	11	-4	-5	-8	4	5	14
		Miscellaneous textiles	1	8	14	8	14	23	-7	-6	-9	9	22	37
F		Knitting & hosiery	10	10	16	7	11	16	3	-1	0	17	21	32
F		Clothing	6	12	17	3	10	13	3	2	4	9	22	30
F		Fur	0	1	7	0	1	4	0	0	3	0	2	11
		Leather tanning	1	6	7	3	8	16	-2	-2	-9	4	14	23
F		Leather products	2	9	16	2	6	8	0	3	8	4	15	24
F		Footwear	8	11	12	4	7	9	4	4	3	12	18	21
		Wood sawing	4	7	11	3	4	8	1	3	3	7	11	19
		Wood boards	1	2	4	2	4	10	-1	-2	-6	3	6	14
F		Wooden structures	9	13	16	2	7	9	7	6	7	11	20	25
		Wooden containers	2	6	8	2	4	12	0	2	-4	4	10	20
		Other wood and cork products	2	4	7	6	7	9	-4	-3	-2	8	11	16
		Paper & pulp	1	3	4	0	3	4	1	0	0	1	6	8
F		Processed paper	4	8	12	4	9	14	0	-1	-2	8	17	26
F		Publishing	2	8	11	1	4	5	1	4	6	3	12	16
		Printing	4	4	8	2	8	15	2	-4	-7	6	12	23
F		Reproduction of recorded media	1	1	5	0	1	2	1	0	3	1	2	7
	R	Oil products	1	2	4	1	3	4	0	-1	0	2	5	8
	R	Basic chemicals	5	9	9	2	6	10	3	3	-1	7	15	19
F	R	Agricoltural chemicals	1	5	9	3	6	9	-2	-1	0	4	11	18
	AR	Paint & ink	1	3	9	2	4	8	-1	-1	1	3	7	17
F	AR	Pharmaceuticals	0	2	5	1	7	9	-1	-5	-4	1	9	14
F	AR	Soap & detergents	2	3	4	2	7	7	0	-4	-3	4	10	11
	R	Other chemical products	2	5	8	1	7	12	1	-2	-4	3	12	20
	R	Rubber	1	3	6	1	6	9	0	-3	-3	2	9	15
		Plastics	2	8	15	4	14	25	-2	-6	-10	6	22	40
		Glass	2	2	4	3	7	10	-1	-5	-6	5	9	14
F		Ceramics	4	7	14	2	6	8	2	1	6	6	13	22
F		Clay products	1	7	11	1	2	4	0	5	7	2	9	15
F		Cement	3	7	9	2	5	7	1	2	2	5	12	16
F		Concrete	3	8	10	2	6	7	1	2	3	5	14	17
F		Stone products	3	7	9	2	3	7	1	4	2	5	10	16
		Abrasives, asbestos	1	5	10	0	7	9	1	-2	1	1	12	19
		Iron & steel	6	7	9	1	1	5	5	6	4	7	8	14
		Steel tubes	1	8	14	1	3	6	0	5	8	2	11	20
		Steel forming cold	1	6	8	3	5	7	-2	1	1	4	11	15
		Non-ferrous metals	3	6	8	1	2	5	2	4	3	4	8	13
		Foundries	2	4	9	2	8	13	0	-4	-4	4	12	22
		Metal structures	5	12	18	5	10	17	0	2	1	10	22	35
		Boilers & containers	0	4	8	0	2	8	0	2	0	0	6	16
		Forging & profiling	0	3	5	4	8	13	-4	-5	-8	4	11	18
		Metal treatment	0	2	6	18	31	38	-18	-29	-32	18	33	44
F		Cutlery & tools	3	9	13	7	10	12	-4	-1	1	10	19	25
		Other metal products	3	6	10	6	18	27	-3	-12	-17	9	24	37
	R	Transmission eq. & other mach.	1	4	6	1	6	10	0	-2	-4	2	10	16
	R	General purpose machinery	5	9	12	6	10	19	-1	-1	-7	11	19	31
F	AR	Tractors and agric. machinery	4	7	13	6	7	15	-2	0	-2	10	14	28
	R	Machine tools	1	4	9	2	8	11	-1	-4	-2	3	12	20
	R	Machinery for specific industr.	5	11	13	8	16	23	-3	-5	-10	13	27	36
F	R	Weapons and ammunition	0	0	2	2	4	6	-2	-4	-4	2	4	8
F	AR	Domestic electrical appliances	5	10	18	2	3	6	3	7	12	7	13	24
F	R	Computers & office machines	1	4	5	2	4	6	-1	0	-1	3	8	11
	R	Electrical machinery	1	8	12	1	5	7	0	3	5	2	13	19
	R	Insulated wire & cable	5	8	11	2	6	8	3	2	3	7	14	19
	R	Accumulators, primary cells & batteries	3	4	9	0	0	1	3	4	8	3	4	10
	R	Other electrical equipment	0	3	7	4	8	14	-4	-5	-7	4	11	21
	R	Electronic components	0	0	3	1	2	3	-1	-2	0	1	2	6
	R	TV & radio transmitters, telecom equip.	3	6	11	4	4	6	-1	2	5	7	10	17
F	AR	TV & radio receivers, recording apparatus	2	6	10	3	5	8	-1	1	2	5	11	18
F	R	Medical instruments	2	6	15	3	5	11	-1	1	4	5	11	26
	R	Measuring instruments	1	3	8	0	4	6	1	-1	2	1	7	14
F	AR	Optical instruments	2	3	4	1	3	6	1	0	-2	3	6	10
F	AR	Watches & clocks	1	3	8	2	3	5	-1	0	3	3	6	13
	AR	Bodies for motor vehicles and trailers	0	1	3	0	1	4	0	0	-1	0	2	7
	R	Motor vehicle parts	1	4	7	0	5	9	1	-1	-2	1	9	16
F		Shipbuilding	0	1	2	0	1	2	0	0	0	0	2	4
F	R	Railway stock	1	1	4	0	0	0	1	1	4	1	1	4
F	R	Cycles & motor cycles	0	2	4	0	1	3	0	1	1	0	3	7
		Other transport equipment	0	0	2	2	3	4	-2	-3	-2	2	3	6
F		Furniture	15	20	22	4	10	15	11	10	7	19	30	37
F		Jewellery	2	3	4	3	4	7	-1	-1	-3	5	7	11
F		Musical instruments	5	7	10	4	8	10	1	-1	0	9	15	20
F		Toys	1	5	10	0	1	10	1	4	0	1	6	20
F		Miscellaneous manufacturing	4	7	12	2	2	7	2	5	5	6	9	19

(*) F: final sectors

(**) R: research intensive industries; AR: advertising and research intensive industries. See Davies and Lyons (1996)

TABLE 3 - REGRESSION RESULTS WITH THE ESTIMATED 'OWN VARIETY'

Dependent variables (log of employment growth 1971-91)	Constant	Empl. share own variety sectors	t	Own variety index	t	1971 empl. in the local economy	t	Competition index	t	1971 empl. in the local 3-digit industry	t	1971-91 empl. growth ı the provinc	t	Adjusted R2	Number of observations	Contribution of spillovers to R2
Meat products	-14,316	6,571	6,4	11,327	3,1	0,373	8,1	-0,371	-2,9	-0,505	-14,8	1,386	5,2	0,258	822	0,089
Fish products	-1,806	4,986	1,6	0,906	0,1	0,176	1,8	-0,702	-1,3	-0,595	-8,7	1,100	1,5	0,324	186	0,032
Fruit & vegetable prod.	8,833	7,089	2,1	-8,704	-0,7	0,251	4,2	-1,614	-5,3	-0,650	-16,3	1,815	4,2	0,390	523	0,040
Oils & fats	-17,037	6,681	5,3	13,270	1,9	0,216	7,4	0,265	1,6	-0,272	-10,2	1,046	4,3	0,194	633	0,091
Dairy products	-19,556	6,474	4,9	16,533	2,9	0,293	7,2	-0,766	-4,6	-0,448	-15,0	1,702	6,4	0,272	743	0,067
Grain milling	-5,475	3,776	5,1	3,483	1,3	0,175	5,4	-0,477	-2,8	-0,349	-8,6	0,407	1,9	0,106	890	0,068
Animal foods	-21,517	9,668	6,4	18,738	3,1	0,233	3,9	-1,210	-3,7	-0,724	-15,2	1,235	2,9	0,411	381	0,092
Bread, biscuits & other foods	-15,914	4,476	7,4	12,176	3,8	0,664	31,8	-0,084	-0,9	-0,725	-40,4	0,614	6,2	0,674	955	0,349
Wine, beer & soft drinks	-11,403	5,694	4,3	9,331	2,1	0,179	3,6	-0,863	-3,8	-0,400	-10,1	1,077	3,6	0,143	786	0,033
Tobacco products	-22,493	7,786	1,6	17,974	0,9	0,410	2,9	-1,557	-2,2	-0,651	-6,1	1,652	1,6	0,196	145	0,043
Spinning	-14,577	9,200	8,3	11,813	3,6	0,248	3,7	-1,089	-4,5	-0,695	-16,9	1,015	2,2	0,427	483	0,111
Weaving	-11,879	8,465	9,3	8,109	2,6	0,352	6,3	-0,555	-3,1	-0,662	-18,8	0,710	1,8	0,414	578	0,182
Textile finishing	-19,902	10,966	9,2	14,933	3,9	0,488	6,5	-1,626	-4,2	-0,742	-16,9	1,032	2,2	0,531	337	0,183
Household textiles	-11,709	4,567	7,1	5,898	2,2	0,732	12,3	-0,489	-3,9	-0,742	-16,2	0,793	3,1	0,293	754	0,198
Miscellaneous textiles	-12,684	5,972	10,9	7,203	4,6	0,658	16,0	-0,882	-7,6	-0,777	-26,0	1,116	4,1	0,513	777	0,245
Knitting & hosiery	-13,265	6,837	11,8	9,409	5,8	0,436	9,5	-0,852	-5,3	-0,535	-14,2	0,656	2,5	0,221	908	0,172
Clothing	-11,988	5,906	9,2	8,444	4,1	0,488	9,4	-1,205	-7,1	-0,496	-9,1	2,596	11,0	0,245	955	0,118
Fur	-6,586	2,654	3,0	2,589	0,9	0,536	10,0	-0,394	-2,8	-0,492	-12,6	0,267	1,1	0,297	436	0,194
Leather tanning	-15,759	11,208	7,3	12,829	3,4	0,199	2,8	-0,495	-1,9	-0,593	-12,5	1,315	2,7	0,413	292	0,140
Leather products	-10,327	5,280	7,1	6,156	3,1	0,553	11,0	-0,852	-7,1	-0,589	-16,1	0,889	3,1	0,331	632	0,178
Footwear	-9,118	7,655	9,3	5,667	2,6	0,321	7,0	-1,393	-8,8	-0,511	-15,8	3,431	10,3	0,339	754	0,139
Wood sawing	-13,305	7,639	7,1	10,129	2,8	0,378	10,4	-0,384	-2,8	-0,648	-19,5	0,624	2,5	0,347	778	0,160
Wood boards	-16,095	12,209	6,7	12,377	2,3	0,297	3,5	-1,740	-3,6	-0,776	-13,3	1,112	1,8	0,478	251	0,159
Wooden structures	-7,292	3,009	8,3	6,121	4,9	0,225	7,9	-0,229	-2,3	-0,359	-10,3	0,979	9,8	0,207	955	0,135
Wooden containers	-11,485	5,995	7,5	8,957	3,1	0,284	6,2	-0,773	-4,9	-0,660	-18,1	1,552	5,3	0,379	622	0,136
Other wood and cork products	-10,243	5,618	7,4	4,301	1,6	0,780	21,1	-0,237	-2,5	-0,744	-25,4	1,221	5,5	0,466	849	0,325
Paper & pulp	-40,498	18,243	4,6	35,002	2,6	0,352	3,2	-3,879	-3,2	-0,789	-10,5	0,862	1,0	0,349	219	0,096
Processed paper	-11,992	5,893	9,3	7,839	4,8	0,544	10,3	-0,634	-2,1	-0,634	-19,5	1,287	4,3	0,477	524	0,169
Publishing	16,569	2,104	0,7	-19,778	-0,9	0,848	15,4	0,219	1,4	-0,641	-17,2	0,361	1,3	0,450	468	0,325
Printing	-10,357	3,519	8,1	5,495	3,3	0,717	16,1	-0,112	-1,3	-0,566	-19,1	1,093	7,3	0,352	865	0,247
Reproduction of recorded media	-10,769	5,139	2,7	6,412	1,3	0,425	7,3	-0,522	-1,8	-0,617	-10,5	1,264	3,0	0,485	169	0,224
Oil products	-10,668	11,217	3,0	7,651	0,5	0,360	5,3	-1,198	-2,9	-0,609	-13,3	1,267	3,1	0,386	363	0,063
Basic chemicals	-19,392	10,272	6,6	12,833	2,6	0,727	10,0	-0,959	-2,6	-0,764	-18,1	0,458	1,0	0,446	466	0,187
Agricoltural chemicals	-24,706	17,623	4,5	22,325	0,9	0,061	0,5	-3,040	-5,4	-0,659	-8,1	-0,814	-1,0	0,578	110	0,180
Paint & ink	-17,818	8,988	4,9	13,286	2,1	0,504	8,8	-0,803	-3,3	-0,626	-15,5	0,738	2,1	0,432	365	0,186
Pharmaceuticals	-35,032	16,332	4,1	32,282	2,5	0,216	1,7	-2,635	-3,6	-0,606	-8,8	-0,042	-0,1	0,353	189	0,068
Soap & detergents	-42,423	13,833	7,9	37,010	4,0	0,411	6,3	-0,388	-1,9	-0,550	-12,4	0,727	2,0	0,367	388	0,214
Other chemical products	-20,014	10,735	5,7	14,561	2,4	0,693	10,7	-0,766	-3,0	-0,903	-19,7	0,001	0,0	0,463	459	0,186
Rubber	-10,061	8,780	6,6	7,274	1,8	0,363	5,8	-0,910	-5,0	-0,637	-13,3	0,614	1,9	0,256	682	0,108
Plastics	-14,530	6,430	11,3	9,968	6,2	0,695	13,5	-0,619	-2,7	-0,769	-24,1	1,129	4,2	0,488	713	0,208
Glass	-14,188	6,571	7,8	10,167	3,7	0,481	10,4	-0,386	-2,7	-0,531	-18,5	1,081	4,6	0,387	636	0,182
Ceramics	-3,016	5,714	4,9	0,103	0,0	0,378	7,6	0,023	0,1	-0,511	-17,1	1,760	5,4	0,354	620	0,121
Clay products	-29,575	17,196	6,8	24,636	3,1	0,245	3,6	0,152	0,3	-0,615	-10,4	0,912	2,0	0,255	490	0,090
Cement	-14,265	12,240	4,7	10,311	0,9	0,313	4,7	-0,709	-2,0	-0,641	-12,7	1,713	3,7	0,303	435	0,087
Concrete	-29,151	8,516	6,8	24,745	3,3	0,512	11,5	-0,838	-5,2	-0,724	-24,6	1,866	8,0	0,483	874	0,096
Stone products	-8,276	5,179	5,8	6,618	2,6	0,238	6,7	-0,102	-0,9	-0,427	-15,0	0,648	3,8	0,302	898	0,057
Abrasives, asbestos	-27,246	11,447	7,1	23,558	4,8	0,350	5,2	-0,832	-2,3	-0,745	-12,5	0,562	1,3	0,428	288	0,167
Iron & steel	-39,572	22,355	3,2	35,841	1,3	0,064	0,4	-1,661	-1,5	-0,562	-6,4	1,565	1,3	0,295	166	0,056
Steel tubes	-37,477	23,943	4,5	32,541	0,8	0,430	3,9	-2,673	-4,9	-1,018	-15,2	-0,232	-0,3	0,564	198	0,105
Steel forming cold	-18,682	10,445	6,2	15,209	2,3	0,344	4,4	-1,188	-3,0	-0,761	-17,1	2,751	5,3	0,540	325	0,141
Non-ferrous metals	-23,887	12,458	6,0	19,627	3,6	0,404	4,9	-1,505	-4,8	-0,726	-15,1	1,219	2,2	0,466	290	0,123
Foundries	-13,250	8,620	6,4	10,192	2,5	0,380	4,3	-2,180	-5,0	-0,723	-14,5	0,698	1,5	0,452	341	0,106
Metal structures	-9,470	3,203	8,1	5,414	3,6	0,741	18,5	-0,120	-1,2	-0,744	-30,9	1,390	8,0	0,578	934	0,188
Boilers & containers	-64,001	16,835	6,3	56,051	3,4	0,651	8,3	-1,530	-3,4	-0,892	-18,1	1,488	3,2	0,472	385	0,154
Forging & profiling	-15,183	7,604	8,5	11,130	3,5	0,564	10,0	-1,047	-2,5	-0,820	-20,3	0,292	0,7	0,525	420	0,217
Metal treatment	-17,018	7,638	20,0	11,610	9,8	0,730	13,4	-0,651	-5,3	-0,779	-20,4	0,757	3,3	0,436	844	0,393
Cutlery & tools	-13,843	6,558	9,7	9,218	4,4	0,581	11,4	-0,769	-3,7	-0,647	-18,8	0,864	2,5	0,460	498	0,256
Other metal products	-7,624	3,090	10,1	4,759	5,1	0,422	12,7	-0,065	-0,4	-0,437	-11,5	0,956	6,5	0,234	953	0,224
Transmission eq. & other mach.	-14,815	8,974	6,9	10,188	2,5	0,625	9,6	-0,923	-2,4	-0,700	-19,1	0,464	1,2	0,439	513	0,159
General purpose machinery	-16,358	6,233	11,1	8,399	3,7	1,078	19,5	-0,583	-5,0	-0,829	-21,0	0,756	3,2	0,434	819	0,392
Tractors and agric. machinery	-13,328	5,984	9,4	10,446	4,5	0,311	8,0	-0,613	-4,7	-0,491	-15,7	0,324	1,4	0,266	750	0,130
Machine tools	-8,534	6,831	6,8	5,645	1,6	0,411	5,9	-1,838	-3,3	-0,618	-17,0	-0,295	-0,7	0,502	369	0,143
Machinery for specific industr.	-11,661	5,309	9,1	6,281	4,1	0,783	14,3	-0,893	-2,8	-0,707	-23,9	0,796	2,7	0,504	613	0,231
Weapons and ammunition	-29,555	26,445	4,1	27,387	1,3	-0,011	-0,1	-1,889	-4,1	-0,752	-7,8	-1,079	-1,0	0,531	103	0,196
Domestic electrical appliances	-31,273	17,030	6,4	25,847	3,6	0,538	5,4	-1,414	-3,2	-0,834	-15,3	-0,201	-0,3	0,430	340	0,105
Computers & office machines	-8,533	11,384	3,5	6,153	0,9	0,390	3,3	-1,825	-1,6	-0,756	-11,2	0,553	0,7	0,516	121	0,118
Electrical machinery	-14,945	7,032	6,3	10,958	2,8	0,544	8,5	-0,424	-1,4	-0,745	-21,2	0,694	1,9	0,524	466	0,131
Insulated wire & cable	-5,853	11,408	2,9	6,411	0,4	0,064	0,6	-2,848	-4,6	-0,603	-10,1	0,669	1,0	0,469	165	0,048
nulators, primary cells & batteries	-87,596	24,323	2,6	66,277	1,2	-0,003	0,0	-2,931	-3,1	-0,808	-8,2	1,092	1,0	0,545	99	0,048
Other electrical equipment	-25,984	8,963	10,2	18,334	5,0	0,969	14,7	-0,154	-1,0	-0,923	-19,6	0,790	2,8	0,393	843	0,298
Electronic components	-26,048	16,128	6,9	19,949	3,1	0,678	7,1	-0,918	-2,0	-0,959	-14,7	0,175	0,3	0,439	328	0,185
radio transmitters, telecom equip.	-19,444	8,324	6,7	10,240	2,8	1,157	31,9	-0,147	-0,5	-0,771	-20,9	0,734	3,0	0,599	731	0,561
io receivers, recording apparatus	-24,635	10,795	4,4	19,279	3,0	0,481	4,9	-1,026	-2,6	-0,916	-18,0	0,854	1,3	0,629	226	0,081
Medical instruments	-16,586	5,145	7,7	9,585	3,7	0,973	32,5	0,431	4,3	-0,803	-27,4	1,233	7,1	0,647	822	0,548
Measuring instruments	-27,344	9,493	5,1	21,157	2,7	0,658	8,8	-0,733	-3,4	-0,767	-17,1	-0,024	-0,1	0,450	381	0,188
Optical instruments	-11,338	5,641	3,8	7,247	1,6	0,445	9,1	0,039	0,2	-0,484	-12,8	1,282	3,8	0,297	488	0,144
Watches & clocks	-1,553	8,150	1,7	-0,017	0,0	0,237	2,4	-0,896	-2,0	-0,873	-10,7	0,616	0,7	0,589	98	0,075
Coachwork	-40,546	12,713	4,0	37,271	1,8	0,276	3,1	-3,927	-6,0	-0,805	-16,7	1,709	2,8	0,602	219	0,067
Motor vehicle parts	-19,868	11,778	4,8	17,502	1,6	0,298	3,4	-1,915	-4,2	-0,664	-13,3	0,563	1,0	0,391	346	0,080
Shipbuilding	-48,568	8,420	1,9	44,086	0,9	0,114	1,8	-0,566	-2,5	-0,259	-6,6	0,586	1,3	0,168	322	0,023
Cycles & motor cycles	-28,680	11,473	5,8	24,706	3,2	0,308	3,6	-0,879	-2,5	-0,565	-11,0	0,354	0,6	0,3471	258	0,133
Other transport equipment	-91,655	23,786	4,6	78,609	3,2	0,265	3,3	-1,499	-5,2	-1,226	-14,5	1,285	2,1	0,692	113	0,105
Furniture	-10,192	4,044	7,4	6,082	3,3	0,564	13,2	-0,338	-2,8	-0,493	-16,4	1,526	7,3	0,25623	919	0,171
Jewellery	0,684	5,208	3,4	-4,682	-1,0	0,583	13,9	-0,092	-0,8	-0,609	-21,3	1,664	7,0	0,45913	651	0,221
Musical instruments	-12,398	11,731	4,3	9,466	1,0	0,191	3,4	0,032	0,1	-0,423	-9,1	1,334	3,1	0,41447	173	0,174
Toys	-1,027	7,323	2,6	-1,660	-0,1	0,386	6,2	-0,317	-1,1	-0,713	-17,0	1,046	2,5	0,4817	338	0,083
Miscellaneous manufacturing	-23,215	7,789	8,1	17,634	4,6	0,680	13,9	-0,378	-2,6	-0,799	-22,1	0,153	0,5	0,47864	558	0,291