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ASSESSING REGIONAL KEY SECTORS IN ITALY : A COMPARATIVE APPROACH

ABSTRACT:

This paper attempts to assess the impact of public policies on closing the regional gap in Italy. In the 1990's the Italian south occupies the same position within the nation that it held in 1951. Since the fifties an array of public policies has been devised and partially implemented to close the gap with no avail. Here we are concerned with public policies that can increase production and employment. Using a regional input-output table for 1992, we try to determine whether a better allocation of funds can increase output and underutilized resources. For this task we adopt standard and not standard techniques, such as Rasmussen's indices, vertical integration indices derived from subsystems and structural path analysis to devise more propulsive sectors and more important links between industries.

1. Introduction

Economic development is a complex process whereby the relative importance and interrelationships among industrial sectors changes over time. Planning economic development thus requires implementing policies that in a given economy will move one structure of production to another. Economists have still not resolved if the process of development should be balanced or unbalanced. The balanced growth proponents suggest that investments should simultaneously stimulate many industries to create the widest possible demand base upon which expansion can take place. Others feel that the development process by its nature is unbalanced but still they emphasize the need for propulsive sectors to move the economy. The identification of such sectors could help policy makers and businessmen in planning future investments. There is no assurance that this will work. For instance in Southern Italy several new large factories in the sixties did not proven to be propulsive because of lack of linkages. On theoretical hand in general, the identification is a way of informing and information by itself is a risk reducer mechanism in the process of economic development. One way of identification of propulsive sectors is the input-output technique.

The best known application of input output techniques to study issues in development policies appears to have been done by Rasmussen (1956). He developed indices to measure the "Power of dispersion" and "Sensivity of dispersion" associated with particular industries. These concepts were analogous with the concepts of backward and forward linkages developed by Hirshman (1958). In input-output terms, the backward linkage for any industry is the contribution that intermediate inputs from other industries make to the value of production of the industry. Expansion of output in industries with high backward linkages will cause a substantial increase in the demand of output in other industries of a given economy. An industry's forward linkage, on the other hand, is determined by the proportion of its output that is sold to other industry for further production rather than sold to final demand. Expansion of output in industries with high forward linkage will facilitate expansion of output in other industries and may induce investment to increase productive capacity in industries. To be sure, backward linkages - with domestic intermediate inputs - is assured because to produce the output one needs the inputs. Not the same is true for forward linkages that requires a willing producer with no assurance.

Yotopulous and Nugent (1973) used several national input-output tables to undertake a general test of the linkage hypothesis. The test was to examine the degree of industries with strong linkages and the rate of economic growth. The test did not support this hypothesis but a modification of it that constrained the degree of industrial concentration of output produced a more favorable result. Other input-output research has focused on identification of "key" sectors in

economic development. Schultz (1976) analyzed 22 input output tables from 14 countries, mainly developing countries, and measured the intensity of inter-industry linkages and the association between those measures and aggregate the economic variables as output, employment and the balance of trade.

Some methodological issues on the concept of linkages, the identification of key sectors (those with high linkage values), and the formulation of development strategy were explored by McGilvray (1977). He notes the difficulty associated with measurement of linkage effects, particularly the choice of industry weights, the weakness of input output technique of explaining the dynamic process of economic development, and the neglect of comparative advantage considerations in output and investment decisions. In particular he criticized Yotopulos and Nugent's hypothesis. He believes that key sectors are supposed to stimulate general economic growth, not necessarily grow faster themselves. This is also our view here. We assume a static view and analyze Italian regional linkages in 1992. In the next section we present our data set and the indirect techniques used to build regional tables. Then we present standard indices of backward and forward linkages for intraregional input coefficient matrices and discuss main findings. Finally we present an alternative approach based on vertically integrated sectors and a decomposition of main effects through structural path analysis.

2. Dataset

The construction of regional tables has requested two main phases. First we collected all available information. This is mainly given by Istat and its data bank "Regio", whose data set concerns value added plus private and public consumption, fixed investment, inventories for 17 sectors. Moreover this data set provides grand total for net taxes and net import from outside each region. National transformation matrices have been used to convert demand data into supply information. Data about import and export from abroad are available from another data set by Istat. Therefore we could construct total flow regional INPUT-OUTPUT matrices at 17 sectors, that is an appreciable disaggregation for our task, updating regional matrices estimated for 1985 (Schachter 1994) via Ras method. The Ras approach has been applied in order to meet regional constraints plus equilibrium conditions related with national data. In other words, this technique satisfy constraints in each sector for each region and for additional information available only at the national level.

Lack of information concerning trade pattern between regions prevents to estimate a complete balance interregional model. For this reason we are forced to adopt a non survey technique to derive at least an intraregional input matrix in order to assess the regional impact of final demand

within each region. It is obvious that standard measures of linkages based on the Leontief inverse of the regional matrix would result in a ranking of sectors quite different from that obtained from the inverse of the technology or domestic matrix. It has been argued that at the regional level a ranking of sectors based on the domestic regional flow matrix (i.e. a matrix which includes imports from the other regions) will better reflect potential linkages than will the regional coefficients matrix (Harrigan & McGilvray 1988). However this approach implicitly assumes equal probability of substitution of local for imported commodities, which is clearly implausible. Since we cannot neither build a proper CGE model that reflects the import substitution effect nor assess the probability of such substitution, we are force to solve the regionalization problem in a standard way with the well known location coefficient method. Even if this technique is rather questionable, it has been shown empirically that, of the various quotient techniques, the simple location quotient is generally as good or better than more complicated versions (Morrison & Smith 1974, Sawyer & Smith 1983). However we are not able to account for feedback effects, since we cannot derive a biregional model for each region and the rest of the country, as supply information is still scarce. This way we can underestimate linkages and key sectors for those regions where the hypothesis of a small region is not tenable.

3. The traditional methodology

It is well known that the concept of linkage can be used in a general way to define an intersectoral link or can be used in a broader sense. Actually Hirshman (1958) followed the second route since he states that investment must be directed to those activities that are deeply interrelated each other such that to stimuli new additional investment and therefore generate unbalanced growth. This idea was previously developed in a different way by Rosenstain Roden (1943) or Chenery & Watanabe (1958), but only Hirschman provides a workable definition of the kind of push which is involved in the concept of linkage. Moreover Hirschman distinguishes between backward and forward linkages, since industries differ in their degree of dependence on other industries, either as purchasers or as sellers of output. The former may be defined as an input provision or derived demand and is given by the fact that “every non primary economic activity will produce attempts to supply through domestic production the input needed in that activity“ (Hirschman 1958, p. 100). The latter is also called output utilization and is generated by the fact that “every activity that doesn’t by its nature cater exclusively to the final demand, will induce attempts to utilize its outputs as inputs in the same new activities” (Hirschman ibid.). However it’s clear that these definitions are of little help to policy makers if we don’t determine key sectors that should sustain an economy or

propel it towards the stage of take off in a developing country. Nonetheless Hirschman tried to refine this concept, stressing some characteristics related to it. In particular we should consider the potential importance of any linkage, which is "the new output of the new industries that might be called for" (Hirschman 1958 ibid.). Furthermore the strength of the effect must be accounted for, that is the probability that these activities will actually come into being. Therefore "the total effect could be measured by the sum of the products of these two elements; in other words, if the establishments n additional industries with net outputs equal to x_i (i=1,2,...,n) and if the probabilities that each one of these industries will actually be set upon a result of the total linkage effect of industry W is p_i (i=1,2,...,n) the total linkage effect of industry W is equal to $\sum_{i=1}^{n} p_i x_i$ " (Hirschman 1958, p.101). It can be shown (Cella 1988) that almost all the attributes of the concept of linkage are related with the dimension of the probability of a link between sectors. For instance the asymmetry is due to the fact that the backward linkage is obtained as derived demand, and therefore is evaluated as "more" probable or realistic that the forward linkage, that may generate an additional production only if it doesn't substitute an equivalent import (Guccione 1986). Actually substitution effects must be considered when we define a proper measure of linkages, even if the theory developed by Hirschman and most of empirical applications are, by its nature, static and without substitution effects.

Let's first review the traditional approach to determine linkages. The simplest measure of the strength of the backward linkage of the sector *j* is the amount by which sector *j* production depends on inputs. Therefore the sum of the elements in the *j*-th column of the direct input coefficient matrix is known as the direct backward linkages. This measure has been introduced by Rasmussen (1956) and used by Hirschman (1958), Chenery & Watanabe (1958).For the *R* region this is given by:

$$B_j^R(d) = \sum_{i=1}^{n} a_{ij}^R = \sum_{i=1}^{n} \frac{X_{ij}^R}{X_j^R} \qquad (3.1)$$

Thus the ratio of intermediate inputs over total production is an index of backward activation. While forward linkages are devised from:

$$F_j^R(d) = \sum_{i=1}^{n} c_{ij}^R = \sum_{i=1}^{n} \frac{X_{ij}^R}{X_i^R} \qquad (3.2)$$

and are measured as the ratio of intermediate deliveries to total deliveries (i.e. the value of output).

However in an open economy and in a multiregional setting we can adopt the technology or intraregional coefficient matrix. It has been argued that "at the regional level it is likely that a ranking of sectors based on the intraregional flow matrix (the matrix which include imports from

other regions) will better reflect potential linkages that will the regional coefficient matrix" (Harrigan & McGilvray 1988, p. 330). We agree that Leontief model by its nature doesn't handle substitution effects and spatial import substitution too, but intraregional coefficients can be used to assess realized (or ex post) short run linkages. Actually we could consider three different coefficient matrices. These are derived form the total, domestic and intraregional flows. We discard the first one since we believe that measures derived from it make sense only if the truly heroic assumption of a fully autarchy of the region is accepted. A ranking derived from the domestic matrix implicitly assumes equal probabilities of substitution of local and national goods, which could be implausible for many reasons. "A better alternative would be to use a hybrid matrix in which coefficients would be weighted to reflect probabilities of import substitution. Unfortunately there is no systematic way to determine what these weights should be within the confines of a standard Leontief model" (Harrigan & McGilvray ibid.). For these reasons we prefer to show only linkages derived from intraregional input coefficients. Since we adopt the location quotient to determine intraregional flows linkages are given by:

$$B_j^R(d) = \sum_{i=1}^{n} a_{ij}^{RR} \tag{3.3}$$

$$a_{ij}^{RR} = \begin{cases} a_{ij}^R \, LQ_i^R & \text{if} \quad LQ_i^R < 1 \\ a_{ij}^R & \text{if} \quad LQ_i^R \geq 1 \end{cases} \tag{3.4}$$

$$F_i^R(d) = \sum_{j=1}^{n} c_{ij}^R = \sum_{j=1}^{n} \frac{X_{ij}^R}{X_i^R} \tag{3.5}$$

$$c_{ij}^{RR} = \begin{cases} c_{ij}^R \, LQ_i^R & \text{if} \quad LQ_i^R < 1 \\ c_{ij}^R & \text{if} \quad LQ_i^R \geq 1 \end{cases} \tag{3.6}$$

with

$$LQ_j^R = \frac{X_{ij}^R \, / \, X_i^R}{X_{ij}^{\overline{N}} \, / \, X_i^{\overline{N}}} \tag{3.7}$$

where $\overline{N}$ is the rest of the country. Actually these measures are almost never used in the literature since they neglect to take into account of induced effects. However they provide a gross measure of regional input content as shown in table 1-3 where we provide normalized linkages for Northern, Central and Southern regions:

$$NB_j^R(d) = \frac{B_j^R(d)}{B_j^N(d)} \tag{3.8}$$

$$NF_j^R(d) = \frac{F_j^R(d)}{F_j^N(d)} \tag{3.9}$$

	Piemonte		Val d'Aosta		Lombardia		Trentino		Veneto	
	forward	backw.	forward	backw.	forward	backw.	Forwar d	backw.	forward	backw.
1) Agricolture	42%	93%	146%	86%	29%	82%	107%	76%	70%	83%
2) Energy	85%	92%	136%	129%	89%	92%	86%	93%	50%	74%
3) Mining	138%	90%	235%	96%	43%	67%	148%	108%	7%	72%
4) Non metallic pr.	85%	92%	83%	79%	46%	75%	26%	80%	79%	86%
5) Chemicals	123%	98%	110%	87%	108%	74%	27%	92%	88%	92%
6) Metal Pr.	81%	75%	54%	116%	45%	49%	87%	119%	100%	61%
7) Vehicles	259%	52%	154%	136%	16%	66%	102%	114%	45%	85%
8) Food Pr.	116%	84%	59%	102%	116%	75%	50%	49%	102%	60%
9) Textile	102%	87%	159%	152%	94%	67%	106%	126%	83%	62%
10) Paper	101%	104%	118%	139%	78%	50%	99%	98%	83%	67%
11) Lumber and Oth.Pr	71%	82%	135%	128%	78%	65%	82%	70%	88%	44%
12) Construction	90%	91%	82%	76%	87%	71%	127%	75%	125%	84%
13) Commerce	76%	89%	133%	89%	61%	81%	133%	89%	84%	90%
14) Trasport, Comm.	62%	92%	40%	75%	32%	83%	142%	95%	65%	91%
15) Banking and Ins.	99%	96%	26%	110%	124%	93%	76%	107%	75%	105%
16) Rent serv.	88%	90%	97%	94%	98%	82%	40%	95%	83%	93%
17) Non mark. serv.	0%	106%	0%	106%	0%	121%	0%	82%	0%	111%

	Friuli-Ven. Giu		Liguria		Emilia Rom.		North	
	forward	backw.	forward	backw.	forward	backw.	forward	backw.
1) Agricolture	53%	92%	18%	93%	110%	84%	65%	94%
2) Energy	67%	85%	177%	110%	35%	63%	90%	99%
3) Mining	83%	104%	88%	94%	68%	100%	88%	97%
4) Non metallic pr.	51%	87%	58%	96%	68%	82%	79%	96%
5) Chemicals	82%	102%	136%	107%	42%	94%	96%	93%
6) Metal Pr.	80%	103%	106%	100%	124%	70%	84%	77%
7) Vehicles	199%	91%	151%	89%	93%	117%	107%	83%
8) Food Pr.	108%	75%	77%	113%	85%	43%	105%	83%
9) Textile	128%	129%	120%	155%	119%	101%	99%	86%
10) Paper	103%	112%	121%	141%	104%	111%	90%	85%
11) Lumber and Oth.Pr	81%	51%	79%	136%	100%	104%	84%	81%
12) Construction	120%	85%	36%	94%	128%	85%	99%	94%
13) Commerce	82%	96%	103%	96%	97%	92%	83%	97%
14) Trasport, Comm.	143%	101%	213%	92%	110%	92%	79%	99%
15) Banking and Ins.	97%	110%	90%	106%	105%	108%	102%	115%
16) Rent serv.	147%	97%	81%	96%	94%	96%	92%	98%
17) Non mark. serv.	0%	80%	0%	77%	0%	115%	0%	125%

Table 1 Northern regions normalized direct linkages

	Toscana	Umbria	Marche	Lazio	Center

	forward	backw.	forward	backw.	forward	backw.	forward	backw.	forward	backw.
1) Agricolture	32%	93%	108%	80%	88%	89%	11%	107%	44%	104%
2) Energy	77%	92%	75%	125%	57%	72%	10%	99%	57%	98%
3) Mining	41%	79%	221%	104%	141%	98%	0%	116%	56%	95%
4) Non metallic pr.	197%	94%	152%	88%	41%	77%	59%	104%	135%	102%
5) Chemicals	111%	89%	92%	99%	57%	93%	101%	106%	106%	105%
6) Metal Pr.	109%	97%	102%	132%	86%	90%	90%	156%	107%	138%
7) Vehicles	172%	97%	337%	137%	192%	101%	0%	145%	36%	132%
8) Food Pr.	110%	110%	79%	56%	95%	65%	75%	129%	107%	118%
9) Textile	62%	49%	122%	75%	84%	48%	109%	163%	86%	91%
10) Paper	93%	93%	107%	107%	92%	100%	93%	77%	94%	90%
11) Lumber and Oth.Pr	89%	78%	112%	101%	98%	38%	94%	147%	97%	113%
12) Construction	128%	97%	158%	91%	103%	75%	62%	107%	95%	105%
13) Commerce	87%	92%	83%	96%	117%	89%	96%	102%	102%	101%
14) Trasport, Comm.	53%	96%	73%	86%	64%	96%	220%	104%	130%	104%
15) Banking and Ins.	106%	110%	62%	111%	73%	101%	182%	22%	131%	57%
16) Rent serv.	88%	93%	51%	97%	32%	89%	161%	102%	115%	101%
17) Non mark. serv.	0%	94%	0%	68%	0%	103%	0%	7%	0%	59%

Table 2 Central regions normalized direct linkages

	Abruzzo		Molise		Campania		Puglia		Basilicata	
	forward	backw.	forward	backw.	forward	backw.	forward	backw.	forward	backw.
1) Agricolture	170%	93%	141%	78%	99%	96%	184%	103%	268%	92%
2) Energy	82%	60%	91%	128%	46%	48%	102%	88%	7%	33%
3) Mining	78%	85%	285%	107%	84%	96%	190%	102%	185%	90%
4) Non metallic pr.	53%	75%	86%	88%	72%	86%	46%	74%	56%	70%
5) Chemicals	58%	81%	82%	86%	78%	92%	24%	93%	63%	68%
6) Metal Pr.	128%	95%	49%	132%	75%	107%	97%	115%	73%	101%
7) Vehicles	161%	117%	180%	12%	62%	32%	139%	110%	600%	127%
8) Food Pr.	90%	98%	73%	67%	80%	105%	83%	98%	58%	117%
9) Textile	120%	107%	105%	125%	92%	128%	91%	128%	122%	122%
10) Paper	92%	73%	107%	137%	99%	124%	118%	137%	105%	119%
11) Lumber and Oth. P.	114%	114%	117%	124%	114%	126%	130%	124%	127%	110%
12) Construction	76%	86%	90%	88%	68%	85%	147%	74%	105%	79%
13) Commerce	99%	88%	113%	90%	152%	92%	118%	95%	83%	81%
14) Trasport, Comm.	86%	64%	89%	73%	110%	89%	75%	90%	120%	54%
15) Banking and Ins.	49%	103%	43%	93%	84%	106%	62%	110%	50%	99%
16) Rent serv.	53%	85%	14%	87%	71%	91%	106%	97%	41%	78%
17) Non mark. serv.	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 3 Southern regions normalized direct linkages

	Calabria		Sicilia		Sardegna		South	
	forward	backw.	forward	backw.	forward	backw.	forward	backw.
1) Agricolture	187%	92%	229%	89%	184%	83%	178%	96%

2) Energy	15%	24%	9%	18%	78%	55%	78%	64%
3) Mining	151%	77%	133%	82%	142%	80%	150%	98%
4) Non metallic pr.	16%	61%	39%	60%	146%	83%	61%	78%
5) Chemicals	56%	68%	31%	67%	126%	78%	59%	85%
6) Metal Pr.	59%	95%	83%	113%	101%	120%	90%	114%
7) Vehicles	346%	113%	51%	88%	192%	134%	132%	90%
8) Food Pr.	58%	108%	56%	128%	63%	116%	71%	112%
9) Textile	96%	117%	107%	134%	124%	137%	101%	130%
10) Paper	99%	120%	111%	125%	113%	116%	106%	125%
11) Lumber and Oth. P.	132%	107%	141%	126%	141%	117%	127%	125%
12) Construction	122%	63%	88%	68%	165%	97%	106%	81%
13) Commerce	124%	79%	119%	79%	83%	75%	126%	90%
14) Trasport, Comm.	114%	67%	111%	58%	43%	59%	94%	80%
15) Banking and Ins.	63%	93%	86%	103%	54%	101%	71%	106%
16) Rent serv.	18%	80%	44%	78%	51%	80%	63%	91%
17) Non mark. serv.	0%	0%	0%	0%	0%	0%	0%	0%

Table 3 Southern regions normalized direct linkages

As we can see in table 1, in Northern regions input content is higher for direct backward linkages, which, however, are on average lower than national ones, but for Banking and Insurance and non marketable services. The latter, that by definition does not sell its output, has a very low backward linkage in Center. In this macroregion most direct backward linkages are higher than the national average as for Metal products and Vehicles. However this performance is only due to Umbria e Lazio, while in North we can observe that mature regions, such as Piemonte, Lombardia, Veneto display low direct backward linkages, while the others present a different pattern. For instance a low industrialized region such as Val d'Aosta has relevant direct backward linkages in most secondary sectors (with the obvious exception for mining), while in Trentino Alto Adige, Friuli-Venezia Giulia and Liguria important backward linkages can be found in Textile. Paper is relevant also in some regions as in Emilia-Romagna, Liguria, Val d'Aosta, but is almost ineffective in relative terms in Lombardia or Veneto. Turning our attention to Southern regions we observe that direct backward linkages are larger that national ones in Banking and transformation sectors but Chemicals and Vehicles. They are very high in Textile and Paper in almost all these regions expect Abruzzo. On the other hand it is interesting to observe that Agriculture doesn't play a prominent role in any regions with reference to backward linkages, while it is relevant in terms of forward linkages. We can note that direct forward linkages are larger in the complement set of sectors. Actually they are very large in Commerce, Agriculture and Mining. On the contrary in North the only sectors with pretty larger direct forward linkages that the national ones are Vehicles and Food products, while in Center we can see that some industries such as Non metallic products, Transport

and Communications, Banking and Insurance have very large direct forward linkages. The overall picture we get is that in North direct backward and forward linkages are less effective than in South and Center. Actually central regions show larger effects in most sectors, with a few exceptions as Textile and Paper, while in South several sectors those have not large forward linkages present on average high direct backward ones and viceversa as Agriculture or Commerce.

Nonetheless we can notice that in some regions the situation is reversed and there are some striking peculiarities. For instance the largest direct backward linkages is Textile in Liguria, while in North this sector doesn't appear to be very important in terms of direct derived demand, or forward linkages for Agriculture in Campania is lower than national one and this result is quite surprising and not in line with the behavior of other Southern regions.

However these results might not be confirmed if we consider the circular process implicit in Leontief model solution. To devise a measure that captures indirect effects too, the Leontief inverse, that incorporates both direct and induced connections, is commonly applied. Its elements are the well known multipliers that show the total impact on the output of sector i which arises through an unitary increase in final demand in sector *j*. Standard statistical summary measures for backward and forward linkages were first defined by Rasmussen from the Leontief inverse:

$$M^{RR} = \left(I - A^{RR}\right)^{-1} \tag{3.10}$$

Backward linkages are the sum of the elements in the columns of the inverse (that is Rasmussen's index of the power dispersion):

$$B_j^R\left(d+i\right) = \sum_{i=1}^{n} m_{ij}^{RR} \tag{3.11}$$

These are Type 1 gross output multipliers as long as underlying parameters of the INPUT-OUTPUT model are defined in value terms, as in our data set. It has been common to normalize linkages for comparative purposes:

$$RB_j^R\left(d+i\right) = \frac{n^{-1}B_j^R\left(d+i\right)}{n^{-2}\sum_{i=1}^{n}\sum_{j=1}^{n} m_{ij}^{RR}} \tag{3.12}$$

where the numerator is the average value of the elements in column *j* while the denominator is the average of all the elements in the inverse, since it is claimed that this measure is independent of the original units of measurements of flows. It is true that this way we can discriminate between sectors that are above average backward linkages, in the sense that they can generate greater than average output response, within each region. However this way we have lost the possibility to compare the

relative strength of backward linkages between regions. Then we prefer to normalize with national backward linkages:

$$NB_j^R(d+i) = \frac{NB_j^R(d+i)}{NB_j^N(d+i)} \tag{3.13}$$

The forward linkages is devised in a similar way, i.e. from the rows of the Leontief inverse. Let' take the sum of elements in row i of the inverse:

$$F_i^R(d+i) = \sum_{j=1}^{n} m_{ij}^{RR} \tag{3.14}$$

This index measures the increase in *i*-th output which would take place if the final demand for each sector's output increases by one unit. We can again follow Rasmussen and normalize forward linkages to compare sectors within each region:

$$RF_i^R(d+i) = \frac{n^{-1}F_i^R(d+i)}{n^{-2}\sum_{i=1}^{n}\sum_{j=1}^{n} m_{ij}^{RR}} \tag{3.15}$$

but we prefer to normalize with national forward linkages since Rasmussen's measure suffers the same limitations than the normalizes backward linkage:

$$NF_j^R(d+i) = \frac{F_j^R(d+i)}{F_j^N(d+i)} \tag{3.16}$$

A more substantial drawback relies on analytical foundations of the concept of forward linkage and its empirical measure. Actually it has been widely criticized the lack of correspondence between the concept due to Hirschman and this index elaborated by Rasmussen. A possible solution to this problem has been advanced by Jones (1976), who used the output model introduced by Augustinovic (1970). This is a supply driven model that utilize output coefficients given by intermediate flows divided by total deliveries (i.e. gross output in a close economy). We don't discuss here the validity of this approach, even if we would like to stress the lack of a theorem corresponding to Samuelson's not substitution theorem within this framework, but we stress that the joint assumption of Leontief and Augustinovic models implies that any change of output must leave unchanged the production structure in terms of output (i.e. production ratios X_i / X_j must be constant, see Cella 1988 for a proof). We believe that this assumption cannot be accepted and stick to the traditional approach.

Piemonte Val d'Aosta Lombardia Trentino Veneto

	forward	backw.	forward	backw.	forward	backw.	forward	backw.	forward	backw.
1) Agricolture	76%	96%	118%	93%	70%	89%	101%	86%	86%	90%
2) Energy	87%	96%	134%	102%	84%	92%	90%	92%	65%	90%
3) Mining	116%	93%	158%	99%	77%	76%	118%	104%	67%	79%
4) Non metallic pr.	94%	94%	94%	89%	78%	82%	72%	87%	90%	89%
5) Chemicals	110%	98%	110%	93%	98%	81%	65%	91%	91%	92%
6) Metal Pr.	91%	86%	78%	111%	70%	71%	92%	111%	95%	76%
7) Vehicles	112%	75%	103%	123%	94%	78%	100%	108%	96%	86%
8) Food Pr.	101%	90%	89%	98%	98%	83%	84%	70%	98%	76%
9) Textile	100%	91%	128%	144%	97%	78%	102%	112%	94%	76%
10) Paper	99%	102%	112%	130%	86%	69%	98%	97%	89%	78%
11) Lumber and Oth.Pr	88%	89%	117%	120%	87%	77%	91%	82%	93%	68%
12) Construction	96%	94%	96%	90%	94%	81%	104%	88%	101%	88%
13) Commerce	81%	94%	132%	96%	63%	89%	122%	94%	80%	93%
14) Trasport, Comm.	78%	94%	69%	90%	61%	88%	122%	98%	76%	93%
15) Banking and Ins.	94%	97%	61%	103%	99%	95%	87%	104%	81%	100%
16) Rent serv.	92%	97%	93%	99%	90%	93%	65%	98%	84%	97%
17) Non mark. serv.	100%	0%	100%	0%	100%	0%	100%	0%	100%	0%

	Friuli-Ven. Giu		Liguria		Emilia Rom.		North	
	forward	backw.	forward	backw.	forward	backw.	forward	backw.
1) Agricolture	80%	95%	66%	98%	105%	89%	84%	93%
2) Energy	78%	95%	160%	100%	59%	88%	90%	96%
3) Mining	92%	100%	95%	95%	87%	96%	94%	92%
4) Non metallic pr.	81%	91%	82%	97%	86%	88%	90%	94%
5) Chemicals	89%	98%	117%	104%	71%	92%	96%	92%
6) Metal Pr.	89%	100%	104%	101%	108%	82%	90%	84%
7) Vehicles	107%	94%	104%	96%	99%	104%	100%	87%
8) Food Pr.	99%	85%	87%	108%	96%	68%	99%	86%
9) Textile	111%	119%	108%	139%	107%	99%	99%	89%
10) Paper	101%	107%	113%	133%	101%	106%	93%	87%
11) Lumber and Oth.Pr	92%	73%	92%	122%	99%	100%	92%	86%
12) Construction	106%	90%	87%	97%	104%	90%	98%	93%
13) Commerce	84%	97%	101%	99%	93%	94%	83%	95%
14) Trasport, Comm.	121%	100%	167%	97%	100%	95%	85%	96%
15) Banking and Ins.	97%	102%	95%	103%	100%	102%	96%	99%
16) Rent serv.	125%	98%	90%	100%	94%	98%	92%	97%
17) Non mark. serv.	100%	0%	100%	0%	100%	0%	100%	0%

Table 4 Northern regions normalized total linkages

Toscana	Umbria	Marche	Lazio	Center

	forward	backw.	forward	backw.	forward	backw.	forward	backw.	forward	backw.
1) Agricolture	72%	98%	104%	90%	94%	92%	63%	91%	76%	99%
2) Energy	82%	97%	86%	100%	70%	91%	48%	86%	73%	96%
3) Mining	79%	85%	168%	109%	116%	98%	65%	91%	83%	94%
4) Non metallic pr.	149%	98%	131%	96%	76%	85%	82%	90%	116%	100%
5) Chemicals	104%	94%	99%	101%	77%	92%	96%	91%	102%	99%
6) Metal Pr.	105%	97%	106%	127%	91%	94%	91%	116%	103%	116%
7) Vehicles	104%	97%	115%	132%	106%	98%	93%	112%	96%	113%
8) Food Pr.	98%	106%	96%	74%	100%	79%	85%	99%	99%	107%
9) Textile	88%	71%	110%	85%	95%	69%	103%	125%	95%	92%
10) Paper	96%	94%	105%	108%	94%	98%	95%	79%	97%	91%
11) Lumber and Oth.Pr	96%	86%	108%	104%	97%	66%	95%	110%	99%	102%
12) Construction	104%	98%	112%	99%	97%	86%	92%	94%	100%	101%
13) Commerce	88%	97%	96%	99%	108%	94%	87%	91%	99%	98%
14) Trasport, Comm.	74%	97%	89%	96%	78%	96%	152%	90%	115%	97%
15) Banking and Ins.	99%	102%	80%	105%	82%	101%	133%	76%	115%	86%
16) Rent serv.	92%	98%	71%	101%	60%	97%	127%	94%	109%	98%
17) Non mark. serv.	100%	0%	100%	0%	100%	0%	100%	0%	100%	0%

Table 5 Central regions normalized total linkages

	Abruzzo		Molise		Campania		Puglia		Basilicata	
	forward	backw.	forward	backw.	forward	backw.	forward	backw.	forward	backw.
1) Agricolture	134%	96%	120%	88%	97%	97%	142%	100%	184%	95%
2) Energy	84%	91%	99%	100%	67%	90%	100%	98%	47%	88%
3) Mining	92%	87%	202%	114%	94%	95%	143%	102%	141%	93%
4) Non metallic pr.	80%	84%	95%	96%	88%	91%	79%	86%	82%	83%
5) Chemicals	79%	86%	92%	93%	88%	93%	65%	94%	82%	80%
6) Metal Pr.	113%	96%	77%	128%	89%	103%	100%	112%	88%	101%
7) Vehicles	103%	107%	107%	57%	99%	68%	104%	109%	139%	122%
8) Food Pr.	100%	96%	96%	79%	94%	101%	98%	98%	89%	104%
9) Textile	108%	104%	102%	116%	97%	115%	97%	116%	109%	114%
10) Paper	94%	81%	104%	128%	99%	114%	111%	128%	101%	112%
11) Lumber and Oth. P.	105%	106%	110%	121%	107%	115%	114%	117%	114%	105%
12) Construction	92%	91%	96%	99%	93%	92%	110%	88%	98%	89%
13) Commerce	95%	94%	119%	96%	138%	96%	116%	99%	90%	93%
14) Trasport, Comm.	88%	82%	97%	89%	105%	94%	87%	96%	110%	79%
15) Banking and Ins.	71%	100%	69%	101%	92%	102%	81%	103%	72%	99%
16) Rent serv.	69%	95%	50%	98%	84%	98%	101%	99%	64%	94%
17) Non mark. serv.	100%	0%	100%	0%	100%	0%	100%	0%	100%	0%

Table 6 Southern regions normalized total linkages

	Calabria	Sicilia	Sardegna	South

	forward	backw.	forward	backw.	forward	backw.	forward	backw.
1) Agricolture	136%	95%	155%	94%	133%	91%	135%	97%
2) Energy	50%	86%	48%	85%	85%	88%	85%	93%
3) Mining	119%	84%	113%	86%	120%	86%	123%	98%
4) Non metallic pr.	68%	78%	76%	77%	125%	89%	84%	87%
5) Chemicals	78%	79%	68%	79%	118%	86%	80%	89%
6) Metal Pr.	80%	94%	90%	105%	101%	111%	96%	109%
7) Vehicles	117%	106%	99%	94%	106%	120%	103%	97%
8) Food Pr.	88%	100%	87%	109%	88%	103%	93%	104%
9) Textile	98%	107%	103%	119%	110%	124%	100%	117%
10) Paper	98%	110%	105%	116%	108%	112%	103%	116%
11) Lumber and Oth. P.	114%	102%	119%	115%	120%	110%	113%	116%
12) Construction	100%	81%	95%	84%	110%	98%	100%	91%
13) Commerce	115%	91%	113%	92%	90%	91%	121%	96%
14) Trasport, Comm.	105%	84%	104%	81%	70%	81%	97%	90%
15) Banking and Ins.	79%	98%	93%	100%	74%	100%	85%	102%
16) Rent serv.	53%	94%	67%	94%	70%	95%	78%	98%
17) Non mark. serv.	100%	0%	100%	0%	100%	0%	100%	0%

Table 6 Southern regions normalized total linkages

When we consider indirect effects too the situation for Northern and Southern regions is different. While in North normalized direct and total backward and forward linkages are almost the same, the situation is reversed in South. Total backward linkages are lower than direct ones in South. For instance in Textile sector there is a reduction of about 15%. This is true when we consider also total forward indices as we can see form Vehicles or Commerce, but not for Non metallic products. Moreover there are some striking cases such as Vehicles, that, on the other hand, are no longer spectacular as for direct forward measures.

4. An alternative measure of linkages and key sectors

The Rasmussen's measures of linkages have been widely criticized. However we must distinguish between issues that are not solvable within the Leontief model and problems related with the application and interpretation of the input/output approach. In the former we must quote substitution effects, which may be very important in the regional framework, or the assumption of excess capacity (Harrigan & McGilvray 1988). We are not going to discuss these issues, even if is pretty obvious that any unspecified CGE model is always better than any specific rudimentary model such as our input-output (Cella 1988). Moreover for comparative purposes a complete interregional Italian CGE model is computational cumbersome and still very unreliable for paucity

of data. On the other hand the concept of linkages have been forcefully criticized even within the input-output approach. Actually the original interpretation given by Rasmussen has been forgotten, since he interpreted the numerator in (3.12) as an estimate of increase in an industry per unit increase in final demand for the products of an industry chosen at random. Therefore the index of the sensitivity of dispersion (3.12) shows the industries which will have to increase its output more or less than other industries for given increase in demand when the index is higher or lower than unity. “Apparently this index expresses the extent to which the system of industries draws upon industry no. i or, in other words, the extent to which industry no. i is affected by an expansion in the system of industry” (Rasmussen 1958). This original interpretation about “dispersion” or “industry chosen at random” has disappeared in later applications and what remains is a deterministic measure that is very questionable. Moreover Skolka (1986) observed that (3.12) is logically unsound since it is a ratio of different quantities. Even if we interpret the input-output model in value terms, the forward linkage seems pretty strange as it acknowledges the importance of a sector when we increase all items of final demand by a unit change. This hypothesis is very curious, since no economy develops in such a way that the deliveries to final demand by all industries increase by the same amount. As noted by Laumas (1976), this procedure can misrepresent the relative strength of linkages in different sectors by ignoring the disparity in size among sectors. This way we may seriously underestimate the forward effects for supply relatively large sectors of the economy. A possible solution is to adopt a weighting scheme through the use of actual or current levels of final output (Hazari & Krishnamurthy 1970) or income elasticities of demand (Yotopoulos & Nugent 1973). However the main issue still remains, since the impacts in different sectors will depend on the scale and composition of final demand. Therefore we prefer to use actual vectors of final demand, which allows to accounts for larger sectors that will score higher in the linkage computation.

Another forceful critique put forward by Skolka (1986) concerns the use of gross output value even for calculating Type 1 multipliers. He suggested to abandon these multipliers since values are biased by double counting of intermediate consumption in favor of value added multipliers. Moreover he argued that the latter are less influenced by the size of the input-output table. Then Skolka reached the conclusion that linkages proposed by Rasmussen should not be used and only value added (and complementary intermediate imports) multipliers are useful tools in economic analysis. Under this view we should amend even the so called second generation of linkage indexes (cf. Harrison & McGilvary 1988), which measure linkages with an hypothetical addition or extraction method (Scultz 1976, Cella 1984).

Here we prefer to follow a different route linked with subsytems or vertically integrated sectors. Sraffa (1960) and Pasinetti (1973) defined a subsystem as gross production needed to supply final demand to a single industry. Then we can deem a diagonal matrix of final demand, say $\hat{\mathbf{y}}$, instead of the usual column vector **y**. The corresponding production matrix of vertically integrated sectors is:

$$\mathbf{X} = (\mathbf{I} - \mathbf{A})^{-1}\ \hat{\mathbf{y}} = \mathbf{M}\ \hat{\mathbf{y}} \tag{4.1}$$

Since each entry in the partitioned Leontief inverse measures impact in industry output due to a unit change in final demand, any column in vertically integrated sector production matrix **X** depicts output activated by a single component of final demand. If, for instance, $\hat{\mathbf{y}}$ is formed by a zero column vector but one deviating element equals to one, than any column in **X** is simply a multi-sector output multiplier, as each m_{ij} specifies how much sector *i* must produce to sustain sector *j* production in order to get one unit of the *j*-th final demand. In other words, if we set $\hat{\mathbf{y}} = \mathbf{I}$, we obtain a decomposition by vertically integrated sector of the standard Type 1 multiplier (Schnabl 1995).

On the other hand, for any final demand vector, eq. (4.1) allows to get a useful decomposition of total production activated by that final demand bundle, since each column of the matrix **X** represents production needed, directly and indirectly, to satisfy final demand for the corresponding industry. It is interesting to notice that columns of **X** comprise subsystems of the economy, while rows show how production efforts by sector *i* are distributed to production of all final demand products, since row sums specify the total level of production needed to produce the whole bill of final demand. In this analysis, we follow an approach due to Momigliano & Siniscalco (1982), who have introduced the so called **S**-operator. This operator is obtained dividing the matrix **X** row by row by the corresponding total production x_i:

$$\mathbf{S} = \hat{\mathbf{x}}^{-1}\ (\mathbf{I} - \mathbf{A})^{-1} \hat{\mathbf{y}} \tag{4.2}$$

The left-hand multiplication of matrix **X** with $\hat{\mathbf{x}}^{-1}$ is simply a norming of the rows such that s_{ij} sum up to unity for each row. Therefore each row shows shares for any sector that belongs to each subsystem, while columns represent a subsystem in terms of sectoral output shares directly and indirectly needed to sustain final demand for the corresponding commodity. Finally we could question sectoral relative importance to explain service output growth, but we are not allowed to figure out the column sum of matrix **S**, since values are not homogenous. To overcome this problem we can premultiply (4) by an appropriate diagonal matrix. This can be given by labor coefficients

(i.e. l_i / x_i i=1,...,n where l_i is i-th sector labor endowment), that is the inverse of average sectoral labor productivity. Let λ the labor input vector, then :

$$\mathbf{L} = \hat{l}\mathbf{S} = \hat{\lambda}\,\mathbf{M}\,\hat{\mathbf{y}} \tag{4.3}$$

or we can also use value added coefficients:

$$\mathbf{V} = \hat{v}\,\mathbf{M}\,\hat{\mathbf{y}} \tag{4.4}$$

where ν is the value added coefficient vector (i.e. va_i / x_i i=1,...,n where va_i is value added in the i-th sector). The **L** matrix shows, in each row, the contribution by any subsystem to sectoral employment as column sums provide industry employment. If we consider any column, each row points out the contribution by each sector to that subsystem and row sums generate employment by subsystems. In the same way each column in matrix **V** shows value added directly and indirectly needed to sustain a given amount of final demand in that sector. Therefore we can derive several measures in order to provide an assessment of the importance of any industry in the whole economy. For instance we can assess how much value added is generated by its own final demand:

$$SA_i^R(d+i) = \frac{\mathrm{v}_{ii}^R}{\sum_{k=1}^{n} \mathrm{v}_{ki}^R} \tag{4.5}$$

or an index of vertical integration (Heimler 1991), which shows the relative capacity to generate value added in other sectors :

$$IA_i^R(d+i) = \frac{\sum_{k\neq i}^{n} \mathrm{v}_{ki}^R}{\mathrm{v}_{ii}^R} = \sum_{k=1}^{n} \frac{va_k^R}{va_i^R}\beta_{ki}^R, \quad \beta_{ki}^R = \frac{\partial x_k^R}{\partial x_i^R} \tag{4.6}$$

Hence this index of vertical integration can be interpreted as a weighting average of output to output multipliers, whose weights are given by relative value added. The output to output multipliers, which can be obtained by the Leontief inverse matrix too (Miller & Blair 1985), show how much the output of a sector would change if the exogenous output in i-th sector is changed by one unit. Therefore this index shows the capacity to generate value added in other industries due to an increase in gross output without double counting.

Results for the Italian regions are presented in the following tables. As obvious the higher the value added generated by its own final demand the lower the relative value added created in other industries. However it interesting to notice that the less propulsive sector is Energy whose value added is almost 80% of total directly and indirectly activated, while its index of vertical integration is only 0.25. On the other side we find sectors such as Food, Mining and even non

marketable services which have very large index value in most regions. However, in some of them, such as Lombardia or Toscana, index values are pretty low enlightening that different economic structure can generate different results. In order to explain these results we can resort to structural path analysis. The theorem of global influence (Ponsard 1967, Lantner 1972) decomposes an inverse multiplier into the sum of total influences along all the paths connecting vertex *j* to vertex *i*:

$$m_{ij} = \sum_k \mathbf{A}\left[p_k\left(j \to i\right)\right] \frac{\det \mathbf{C}\left[p_k\left(j \to i\right)\right]}{\det \mathbf{C}}$$

where $\mathbf{C} = (\mathbf{I} - \mathbf{A})$ and $\mathbf{A}\left[p_k\left(i \to j\right)\right] = a_{ik_n} \ldots a_{k_2 k_1} a_{k_1 j}$, is the product of coefficients along the path $p_k\left(j \to i\right)$ that measures direct influence, while the ratio $\frac{\det \mathbf{C}\left[p_k\left(j \to i\right)\right]}{\det \mathbf{C}}$ is a path multiplier due to all indirect effects along $p_k\left(j \to i\right)$. The latter is the ratio of the minor of $(\mathbf{I} - \mathbf{A})$ obtained by removing from **C** rows and columns in path $p_k\left(j \to i\right)$. Therefore this theorem provides a tool to evaluate the economic influence of a sector through the variety of interindustry interactions. Moreover since:

$$\beta_{ij}^R = \frac{m_{ij}^{RR}}{m_{jj}^{RR}} = \frac{\sum_k \mathbf{A}\left[p_k\left(j^R \to i^R\right)\right] \det \mathbf{C}\left[p_k\left(j^R \to i^R\right)\right]}{\sum_h \mathbf{A}\left[p_h\left(j^R \to j^R\right)\right] \det \mathbf{C}\left[p_h\left(j^R \to j^R\right)\right]}$$

we can see that any path which connects sector *j* to sector *i* in region *R* is also included in a cycle for the *j*-th sector. Therefore the relative strength between paths and cycles enlighten the magnitude of output to output multipliers.

	Piemonte		Val d'Aosta		Lombardia		Trentino		Veneto	
	self v.a.	vert. Int	self v.a.	vert. Int	self v.a.	vert. Int	self v.a.	vert. Int	self v.a.	vert. Int
1) Agricolture	76%	32%	83%	20%	78%	29%	86%	16%	82%	22%
2) Energy	80%	24%	89%	13%	84%	19%	79%	26%	77%	30%
3) Mining	46%	120%	46%	120%	46%	117%	36%	177%	39%	158%
4) Non metallic pr.	61%	64%	64%	55%	64%	56%	57%	77%	61%	63%
5) Chemicals	55%	83%	55%	81%	64%	55%	43%	134%	53%	88%
6) Metal Pr.	70%	43%	23%	326%	76%	31%	37%	167%	77%	29%
7) Vehicles	79%	26%	3%	3872%	57%	76%	34%	194%	46%	119%
8) Food Pr.	44%	129%	30%	233%	55%	82%	62%	61%	55%	81%
9) Textile	69%	45%	8%	1095%	81%	23%	29%	239%	82%	22%
10) Paper	56%	80%	14%	596%	87%	14%	60%	68%	80%	26%
11) Lumber and Oth.Pr	60%	67%	30%	234%	71%	41%	68%	48%	85%	18%
12) Construction	62%	62%	67%	48%	69%	45%	66%	51%	63%	58%
13) Commerce	78%	28%	84%	20%	79%	27%	81%	23%	78%	28%
14) Trasport, Comm.	74%	35%	74%	35%	73%	37%	77%	29%	74%	35%

15) Banking and Ins.	72%	38%	70%	43%	77%	29%	74%	36%	73%	38%
16) Rent serv.	89%	13%	89%	13%	91%	10%	85%	18%	88%	14%
17) Non mark. serv.	75%	166%	75%	166%	70%	186%	81%	147%	73%	173%

Table 7 Northern regions self activation and vertical integration index

	Friuli-Ven. Giu		Liguria		Emilia Rom.		North	
	self v.a.	vert. Int	self v.a.	vert. Int	self v.a.	vert. Int	self v.a.	vert. Int
1) Agricolture	76%	32%	72%	40%	86%	17%	80%	26%
2) Energy	74%	35%	86%	16%	75%	34%	80%	25%
3) Mining	33%	204%	36%	174%	33%	199%	40%	151%
4) Non metallic pr.	55%	80%	55%	83%	59%	68%	59%	69%
5) Chemicals	45%	123%	48%	109%	43%	132%	55%	83%
6) Metal Pr.	48%	107%	54%	87%	76%	32%	69%	45%
7) Vehicles	54%	87%	56%	77%	33%	204%	57%	76%
8) Food Pr.	45%	121%	13%	643%	70%	44%	50%	100%
9) Textile	39%	154%	9%	972%	60%	68%	70%	43%
10) Paper	50%	100%	25%	296%	51%	97%	70%	42%
11) Lumber and Oth.Pr	79%	26%	10%	891%	48%	108%	64%	56%
12) Construction	62%	62%	59%	69%	62%	62%	61%	63%
13) Commerce	73%	37%	76%	31%	76%	32%	77%	30%
14) Trasport, Comm.	75%	33%	80%	25%	75%	34%	74%	35%
15) Banking and Ins.	70%	43%	72%	38%	73%	37%	74%	36%
16) Rent serv.	89%	12%	87%	15%	87%	15%	88%	13%
17) Non mark. serv.	81%	147%	82%	143%	71%	180%	73%	175%

Table 7 Northern regions self activation and vertical integration index

	Toscana		Umbria		Marche		Lazio		Center	
	self v.a.	vert. Int	self v.a.	vert. Int	self v.a.	vert. Int	self v.a.	vert. Int	self v.a.	vert. Int
1) Agricolture	74%	35%	85%	17%	83%	21%	69%	44%	73%	38%
2) Energy	78%	28%	76%	32%	79%	27%	75%	33%	75%	34%
3) Mining	40%	152%	43%	131%	42%	139%	28%	262%	36%	179%
4) Non metallic pr.	71%	41%	68%	48%	61%	65%	53%	90%	61%	63%
5) Chemicals	55%	82%	50%	101%	48%	106%	46%	119%	46%	116%
6) Metal Pr.	53%	88%	31%	219%	59%	70%	20%	390%	31%	226%
7) Vehicles	50%	99%	32%	211%	47%	114%	21%	368%	27%	265%
8) Food Pr.	23%	329%	63%	59%	49%	102%	20%	406%	25%	297%
9) Textile	85%	17%	82%	22%	90%	11%	11%	839%	62%	61%
10) Paper	63%	59%	56%	80%	56%	77%	75%	34%	66%	52%
11) Lumber and Oth.Pr	64%	56%	55%	83%	88%	14%	20%	413%	44%	127%
12) Construction	60%	67%	62%	61%	66%	51%	56%	79%	56%	79%
13) Commerce	78%	28%	78%	29%	82%	22%	72%	39%	74%	35%
14) Trasport, Comm.	72%	39%	73%	36%	75%	34%	77%	29%	74%	35%
15) Banking and Ins.	73%	37%	73%	37%	76%	31%	95%	5%	87%	14%
16) Rent serv.	88%	14%	85%	17%	86%	16%	89%	12%	87%	14%

17) Non mark. serv.	79%	154%	85%	137%	77%	161%	99%	101%	88%	128%

Table 8 Central regions self activation and vertical integration index

	Abruzzo		Molise		Campania		Puglia		Basilicata	
	self v.a.	vert. Int	self v.a.	vert. Int	self v.a.	vert. Int	self v.a.	vert. Int	self v.a.	vert. Int
1) Agricolture	86%	16%	87%	14%	77%	30%	85%	17%	92%	9%
2) Energy	90%	11%	83%	21%	83%	21%	83%	20%	87%	15%
3) Mining	40%	147%	48%	107%	36%	178%	42%	138%	47%	112%
4) Non metallic pr.	63%	59%	61%	64%	59%	69%	62%	61%	65%	53%
5) Chemicals	52%	92%	52%	91%	48%	108%	43%	132%	58%	73%
6) Metal Pr.	65%	54%	20%	398%	45%	123%	41%	141%	47%	114%
7) Vehicles	40%	150%	100%	0%	85%	17%	41%	146%	50%	101%
8) Food Pr.	38%	163%	54%	84%	26%	290%	32%	217%	28%	260%
9) Textile	57%	74%	32%	209%	32%	215%	34%	195%	34%	192%
10) Paper	78%	29%	1%	6750%	33%	207%	23%	341%	22%	358%
11) Lumber and Oth. P.	42%	139%	36%	180%	31%	225%	38%	166%	46%	117%
12) Construction	64%	57%	63%	59%	62%	61%	68%	47%	68%	47%
13) Commerce	80%	25%	83%	20%	82%	22%	78%	28%	80%	25%
14) Trasport, Comm.	81%	23%	78%	28%	78%	29%	75%	33%	85%	18%
15) Banking and Ins.	74%	35%	78%	28%	72%	38%	70%	42%	76%	31%
16) Rent serv.	88%	14%	86%	17%	87%	15%	88%	13%	88%	13%
17) Non mark. serv.	82%	144%	85%	137%	82%	145%	82%	143%	83%	141%

Table 9 Southern regions self activation and vertical integration index

	Calabria		Sicilia		Sardegna		South	
	self v.a.	vert. Int	self v.a.	vert. Int	self v.a.	vert. Int	self v.a.	vert. Int
1) Agricolture	87%	16%	88%	14%	88%	14%	84%	19%
2) Energy	89%	13%	91%	9%	92%	9%	88%	13%
3) Mining	48%	108%	44%	126%	49%	104%	41%	143%
4) Non metallic pr.	64%	55%	67%	49%	73%	37%	62%	60%
5) Chemicals	56%	77%	53%	87%	64%	57%	50%	98%
6) Metal Pr.	39%	157%	31%	220%	30%	230%	41%	146%
7) Vehicles	40%	150%	53%	90%	20%	401%	56%	80%
8) Food Pr.	24%	310%	14%	604%	21%	368%	24%	312%
9) Textile	34%	198%	18%	456%	10%	903%	31%	227%
10) Paper	22%	358%	18%	461%	32%	217%	31%	224%
11) Lumber and Oth. P.	45%	120%	27%	265%	39%	160%	34%	197%
12) Construction	73%	36%	71%	41%	65%	54%	66%	52%
13) Commerce	85%	18%	83%	20%	84%	19%	81%	24%
14) Trasport, Comm.	84%	19%	84%	20%	81%	23%	79%	27%
15) Banking and Ins.	79%	27%	77%	30%	76%	32%	74%	35%
16) Rent serv.	87%	15%	88%	13%	89%	12%	87%	14%

17) Non mark. serv.	85%	135%	85%	134%	88%	127%	83%	141%

Table 9 Southern regions - vertical integration index

5. Conclusions

Our original hypothesis is that continuos transfer of funds creates a culture of dependency that diminishes the efficiency of an economic system. When one expects the “dole”, then competitive forces are an how to control public resources and prefers to maximize a dole rather than efficiency. This can produce an increase in income but not in production or employment and we believe that this situation can explain the gap of most of Italian southern regions. However public spending provided directly to more effective sectors can provide an answer to policy makers willing to reduce the existing gap with more developed Italian regions. A standard exercise for public policy planner is to figure out indices of backward and forward linkages. Using a regional data set for Italy we have calculated the well known Rasmussen’s indices for backward and forward linkages. However we recognize the shortcomings of this input output technique and we attempt to provide a better estimate of key sectors. For this task we have derived an alternative measure derive from vertically integrated sectors, which does not suffer most of the flaws of standard indices. Moreover this approach can be interpreted in the contest of output to output multiplier and can be decomposed via structural path analysis.

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