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Stefano Prezioso, Stefano Rosignoli

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## Persistences and changes in Italian industry in the years of "stagnation": a regional analysis

Stefano Prezioso

Stefano Prezioso is a senior researcher at SVIMEZ (Institute for economic studies of the "Mezzogiorno", Rome). He is interested in research in industrial economics with econometric application. He has also been the main elaborator of the bi-regional (Centre-North and the "Mezzogiorno") model of the Italian economy developed by SVIMEZ (denominated NMODS).  
s.prezioso@svimez.it

Stefano Rosignoli

Stefano Rosignoli works as statistical researcher at IRPET (The Tuscan Regional Institute for Economic Planning, Florence). His main field is economical statistics and macro-econometrics, particularly works on the construction of regional accounting matrices (Input Output and SAM) and on construction of regional macro-econometric models.  
rosignoli@irpet.it

In the 2000-2006 period, radical changes in economic geography driven by "global" trends obliged entrepreneurs to greatly vary their business strategies and choices. The purpose of this study is to analyse the "micro" factors which have had deeper impact on entrepreneurial behaviour and the diversified repercussion of these at the regional scale. Based on an econometric exercise, the study aims to identify: *i*) the competitive advantages associated with the relatively more successful enterprises in growth performance; *ii*) whether these cases are characterised by aspects of continuity/discontinuity with respect to the "traditional" Italian industrial specialisation model; and *iii*) how such behaviour has distributed across the territorial segments of the country. The paper concludes by reflecting on the uneven distribution in the innovative exploitation of factors capable of spurring higher growth performances in the different territorial contexts.

Structural Change, Industrial Policy

## Introduction

As widely known, the early part of the first decade of the century was marked by a long period of stagnation and/or drop in production which, according to the cyclical dating of the ISAE (Istituto di Studi e Analisi Economica), continued for almost fifty months. It was in these years that the divergence between the pattern of Italian exports and of global demand appeared as most evident. The competitive crisis that hit across the national production system appears largely a result of joining the Economic and Monetary Union. In addition to the loss of an instrument of adjustment, namely the exchange rate, which had been repeatedly used by Italy in previous circumstances, this factor also exposed the Italian production system to the stormy streams investing European economic geography triggered by the most

intensive phase of international integration. According to qualified observers (Banca d'Italia, 2009; Lanza and Quintieri, 2007), the slow process of adjustment that has followed, and which is still in progress, appear to consist in increased variability of entrepreneurial behaviour and performance, as highlighted by a growing dispersion of the growth rates of corporate value added. The analysis of the “micro” factors which have had more relevant impact on entrepreneurial behaviour, and different repercussions of these at a regional scale, are analysed in this contribution. In detail, through an econometric exercise in which the dependent variable is the growth rate of the value added of the individual enterprises present in the sample considered, the analysis proposes to search and test for the following elements:

- a. which were the specific competitive advantages that generated relatively more successful growth performances;
- b. whether these features imply continuity or discontinuity with respect to the “typical Italian” industrial model;
- c. the territorial distribution of the same phenomena.

As will be shown, the evidences derived in relation to points b. and c. would indicate the relevance of a shift in the strategic factors that have given greater impetus to growth, spread unevenly over the territory.

The analysis is based on a dataset, whose units are the enterprises included in the last two three-year sample surveys performed by UniCredit.<sup>1</sup> The variables are derived by budget statement data of these companies and the answers to the questionnaires administered with the survey. We are able to arrive at creation of a substantially original panel covering the whole of the 2001-2006 period, that is, the time-span relevant for the changes of organisational and/or other factors which might in turn have generated the shifts above mentioned. Section 1 provides a rapid overview of the panel and of statistical techniques employed to improve the representativity of the original the sample data Section 2 presents “stylised facts”, as these emerge from our sample, upon industrial structure and behaviour in the period under examination. Section 3 is addressed to the results of an econometric exercise aimed at identifying the drivers of growth. In the conclusion, the main results obtained are put in relation with the targets pursued by industrial policy in the period, for an assessment of coherence and efficacy of the latter with the changes under way.

## 1. Construction of the panel (2001-2006)

As mentioned the panel we used is drawn from enterprises present in both waves of the most recent sample surveys (2001-2003 and 2004-2006) carried out by UniCredit.<sup>2</sup> These cover a total of one thousand and forty-nine enterprises

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<sup>1</sup> Namely, the *VIII and IX Indagine sulle imprese manifatturiere italiane. Rapporto sul sistema produttivo e sulla politica industriale* (8th and 9th Surveys of Italian Manufacturing Enterprises. Report on the production system and industrial policy, hereinafter *Survey*) carried out by UniCredit and relating respectively to the three-year periods 2001-2003 and 2004-2006 (UniCredit, 2001, 2003).

<sup>2</sup> The UniCredit sample considers enterprises with more than nine employees. Although this dimensional cut-off eliminates the most numerically significant segments of the Italian production system, this does not represent a relevant distortion for the investigation being carried out here, since the changes subject of analysis essentially are referred to enterprises of a more strictly industrial dimension.

distributed over the four macro-areas of the country.<sup>3</sup> The main advantage of this panel consists of being able to utilize both information derived from the (reclassified) financial statements and from the questionnaires administered to the enterprises, containing quantitative and qualitative information complementary to the budgetary data. As a whole, this means having available a dataset including almost three hundred variables covering, year by year, the principal characteristics (innovation, human capital, destination markets, efficiency, productivity, degree of vertical integration etc.) for each enterprise included. The time-span covered and the amplitude of information available widely offset limitations deriving from a sample that is not particularly large in quantitative units.

In consideration of this fact, we have adopted a statistical procedure aimed at correcting the discrepancies between the frequency distributions for classification variables in the sample and the corresponding frequency distributions in the population,<sup>4</sup> and on the other hand at enhancing the efficiency of the estimates derived from our panel. The technique used is known as the method of *calibration estimators*. This method allows to enhance the efficiency of the estimates, by calibrating the coefficients of extrapolation to population making the sample estimate for the total of variables at national level to coincide with the values in the population itself.. More specifically, the calibration makes it possible to notably increase the efficiency of the estimates for all figures associated to variables for which the totals in the population are known –the so-called auxiliary variables– and on which the calibration is performed (a survey of the advantages of this method can be found in Deville and Sarndal, 1992). In effect, the estimates of all the figures linked to the auxiliary variables improve their efficiency by a percentage equal to  $1 - \rho^2$ , where  $\rho$  is the coefficient of linear correlation between the estimated and the auxiliary variables. The higher the correlation of the variable being estimated with the auxiliary variables, the greater the reduction of the variability (mean square

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<sup>3</sup> The territorial distribution of the sample is as follows: North West, 38%; North East, 30.8%; Centre, 18.4%; South, 12.8%. On the basis of the ISTAT (National Statistics Institute) data collected in the ASIA database (Archivio Statistico delle Imprese Attive – statistical archive of active enterprises), in 2006 the number of Italian enterprises with more than ten employees is broken down as follows: North West, 35%; North East, 30%; Centre, 19%; South, 16%.

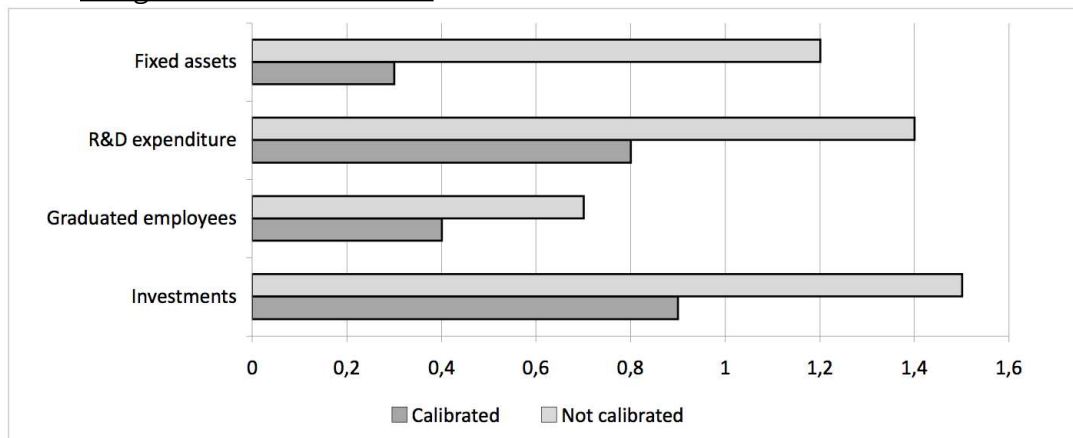
<sup>4</sup> In the extraction of a sample, as is known the dimension variable proves to be the most difficult to monitor *ex ante* in view of the difficulty of obtaining updated information from the administrative sources. The UniCredit sample is no exception to this “rule”: the smaller enterprises (ten-nineteen employees) are over-represented in comparison to the benchmark universe made up of the ASIA archive, while those with over fifty employees are in the opposite situation. More specifically, in the UniCredit sample, the weight of the smaller enterprises is almost nine percentage points lower than the corresponding figure derived from the ASIA archive (a similar, but opposite, situation can be observed for the enterprises with more than fifty employees). As we have controlled in terms of territorial representativeness no relevant differences between the sample data and the reference universe are detected. A similar situation can be observed for the sectoral breakdown. Cited below are the percentages of workers employed in the fourteen ATECO sub-categories of the UniCredit sample, followed in brackets by the corresponding percentage taken from the ASIA archive: food industries, 8% (9%); textile and clothing industries, 12% (11%); tanning industries 5% (4%); timber industry, 4% (2%); paper pulp manufacture, 6% (4%); coke manufacture, 0% (1%); chemical product manufacture, 2% (5%); rubber goods manufacture, 5% (6%); non-metallic mineral manufacture, 5% (7%); metal products manufacture, 23% (17%); mechanical devices manufacture, 11% (17%); electrical machinery manufacture, 8% (8%); manufacture of transport equipment, 3% (3%); other manufacturing industries, 8% (6%).

error) of the estimates. In our case the auxiliary variables, that is, the parameters known for population, are total employees, value added and the cost of labour, available for all dimensional categories and location breakdown.<sup>5</sup>

To better illustrate this latter aspect, Graph 1 shows, as example, the histograms representing the reduction of the coefficient of variation obtained using the calibration estimates with reference to the mean of four “sensitive” variables (fixed assets, R&D expenditure, graduate employees and investments per enterprise). As can be easily noted, in the absence of calibration, the sample estimator of the mean fixed assets obtained from our sample would, for instance, have a coefficient of variation of 1.2%; using the coefficients of extrapolation to the population obtained from the calibration estimation this statistic is about five times lower. The application of this technique appears even more appropriate in the case where, as in the following section, we wish to investigate precisely the changes (if any) occurring in the variability of the principal corporate performance indicators. In fact, through this methodology, the sample error of estimates of the variables correlated with the auxiliaries is considerably reduced.

Finally, it is important to recall that the methodology adopted serves essentially to ensure that our sample, weighted with weights obtained from calibration, generates more efficient and robust estimates as a result of the sole effect of the weighting procedure in itself, without altering the values of the variables observed in the sample.

Graph 1. Reduction of the coefficient of variation of the estimators using calibration estimators



Source: our processing of UniCredit data

## 2. Variability of behaviour

Before presenting the econometric analysis, we first wish to check whether one of the principal assumptions on which this work is based –the increased variability<sup>6</sup> of

<sup>5</sup> The sources from which this information is taken are the aforementioned ASIA database and the SCI (enterprise accounts system) survey, both carried out by ISTAT.

<sup>6</sup> Clearly, this is an element that can be observed only indirectly, precisely through the performance indicators. From this aspect, the availability of data relating to individual enterprises represents a source of primary importance, since this is a prerequisite for a correct analysis of the variability.

entrepreneurial performance following the “dual” shock (Euro plus globalisation) that struck Italian industry– is confirmed by our data, and to which extent.

A useful starting-point is to appraise how, in the period in question, the growth rates of the value added (at current prices) have been distributed. The non-parametric Kolmogorov-Smirnov test makes it possible to assess which statistical distribution adapts best to the standardised variation rates<sup>7</sup> of the value added. Table 1 shows the results of the test.

What clearly emerges is that, in all the territorial divisions, the theoretical function that better adapts to the effective distribution of the growth rates of value added of the enterprises included in our sample, in the 2001-2006 period, is that of Laplace, the peculiarity of which is that it possesses “fat tails”. Only in the South, two functions –Normal and Laplace– can both approximate actual distribution of the growth rates. Nevertheless, in this case too, the p-value indicates a better adaptation for the Laplace distribution. It has recently been demonstrated (Dosi, 2008) that the Laplace function, in addition to more frequently adapting to the actual distribution of the variation rates, also is more suitable in describing situations in which the “growth” phenomena are characterised by the presence of indivisibilities and discontinuities in the occurrence of events (either in positive or in negative). In other words, in the period in question the expansion/regression in the output of a particular enterprise cannot be attributed to events that have involved the whole of population in an homogenous manner (for example, generalised drop/increase in demand), but are rather the results of actions that determined different outcomes repeated over time.<sup>8</sup>

Table 1. Results of the adaptation tests of the theoretical distributions as compared with the normalised growth rate of the value added  $g_i(t)$ :

Distribution	Value test	P-Value	Hypothesis
North-West			
Normal	0,068	0,00	Rejected
Laplace	0,024	0,57	Accepted
LogNormal	0,506	0,00	Rejected
Gamma	0,510	0,00	Rejected
North-East			

<sup>7</sup> For a correct performance of the test, the growth rate of the value added for an individual enterprise has to be cleared of the circumstance of belonging to a more or less dynamic sector. To eliminate the sector effect, the following system was applied at the level of the fourteen “subsections” (ATECO 2002) that make up the manufacturing sector:

$$d_i(t) = \log S_i(t) - \text{sectoral\_average}(\log S(t))$$

$$g_i(t) = d_i(t) - d_i(t - 1)$$

where  $d_i(t)$  is the deviation of the logarithm of the value added of enterprise  $i$  in year  $t$  as compared to the corresponding sector average;  $g_i(t)$  is the growth of the enterprise, in terms of deviation, from year  $t - 1$  to year  $t$ . This latter represents the standardised rate used in the test.

<sup>8</sup> The Laplace function, in itself, is only descriptive for the distribution of the value added growth rates and is *not* assumed as subject to normally distributed independent events. This could be due to a multiplicity of causes, including for example, idiosyncratic shocks. In any case, in the econometric model subsequently developed there is a causal link between the higher growth performance and a change in the relative importance of the competitive advantages. Although the estimated relation does not exhaust the possible phenomena occurring in the period, it is considered that the behaviour (the “actions” cited in the text) that gave rise to the shift of competitiveness detected is, partially, the cause of the increasing divergence in the distribution of the product growth rates.

Normal	0,0683	0,00	Rejected
Laplace	0,044	0,07	Accepted
LogNormal	0,496	0,00	Rejected
Gamma	0,526	0,00	Rejected
Centre			
Normal	0,056	0,00	Rejected
Laplace	0,041	0,34	Accepted
LogNormal	0,487	0,00	Rejected
Gamma	0,515	0,00	Rejected
South			
			Rejected
Italy			

(1) See note 7.

Source: our processing of UniCredit data

On the one hand, therefore, growth paths of the enterprises tend to be structurally diverse; on the other hand, in the early part of the decade 2000's, the pressure of competition on both the domestic and foreign markets became progressively stronger. An initial, significant trace of the effects induced by the combined influence of these two factors can be observed in Table 2. In all four macro-areas analysed, the variability (measured by the coefficient of variation) of the logarithm of the value added (v.a.) increased throughout the period despite fairly modest growth rates on the average<sup>9</sup>. Other conditions being equal, this should not certainly be a circumstance that favours an increase in variability. Furthermore, we checked that this increase in variability detected cannot be attributed to a behaviour limited to specific sectors or dimensional category.

Table 2. Coefficient of variation of the logarithm of the value added, by macroarea (2001-2006)

	North-West	Nord-East	Centre	South	Italy
2001	0,054	0,046	0,051	0,041	0,052
2002	0,057	0,050	0,052	0,043	0,054
2003	0,058	0,049	0,050	0,043	0,055
2004	0,058	0,052	0,051	0,042	0,055
2005	0,058	0,053	0,055	0,042	0,056
2006	0,061	0,052	0,054	0,047	0,057

Source: our processing of UniCredit data

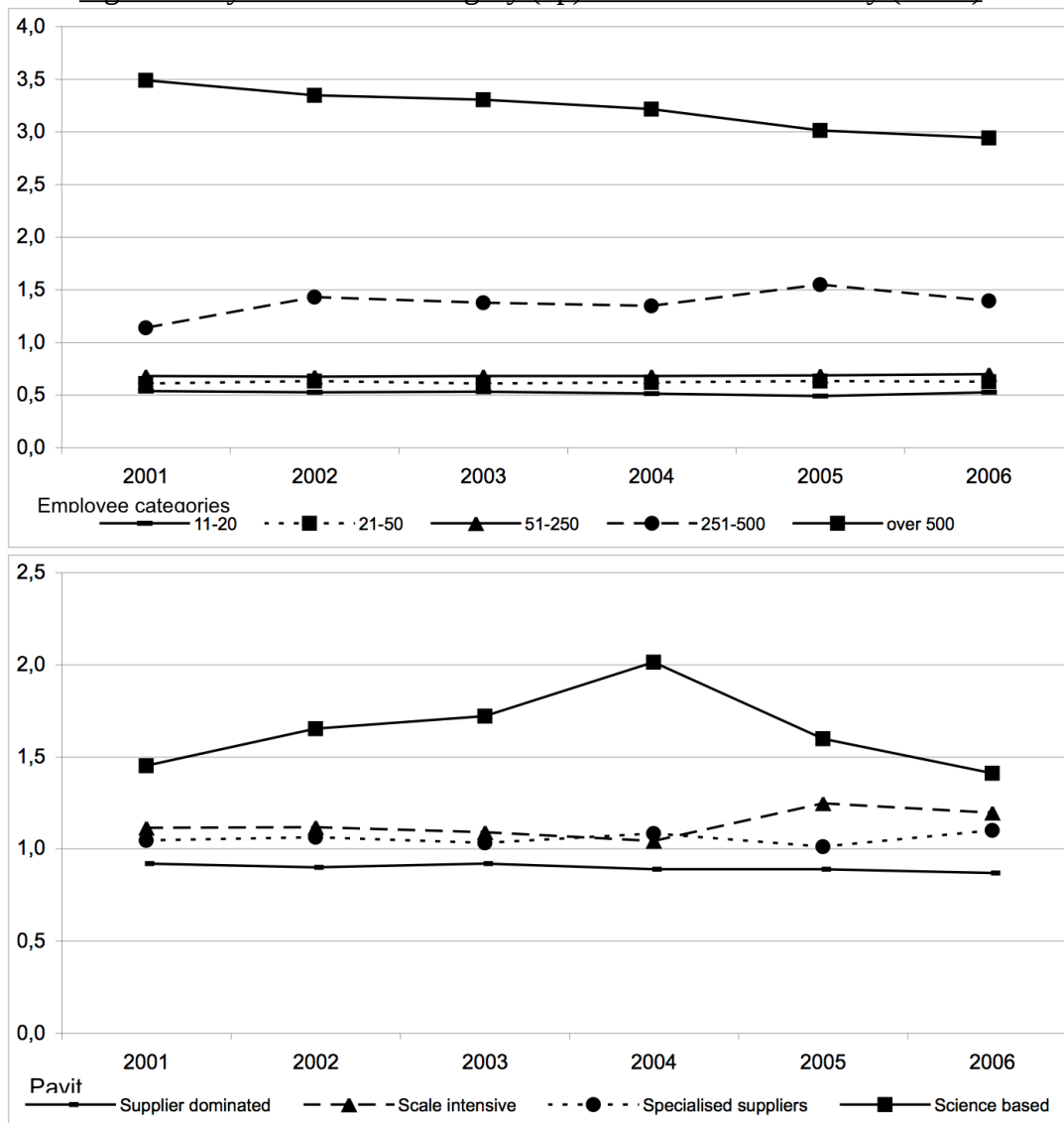
Graph 2 shows the breakdown for changes of the coefficient of variation upon the basis of the two elements mentioned. As for the breakdown by dimensional category, the larger enterprises (with over five hundred employees) reveal a

<sup>9</sup> Between 2001 and 2006 the average annual growth rate of the (nominal) value added was around 1.8% in the two divisions of the North; 1% in the Centre, and slightly below the latter value in the South.

tendency to reduce<sup>10</sup> their contribution to the overall variability; the other groupings do not reveal significant changes, with the exception of a modest increase for enterprises with between twenty-one and fifty employees.

With reference to the Pavitt's Taxonomy by macro-sectors,<sup>11</sup> up to 2004 the high-tech enterprises, probably also given the relatively small number of these, increased their contribution to overall variability; nevertheless, this phenomenon was greatly downsized in the following years.

Graph 2. Trend of the coefficient of variation of the value added logarithm by dimensional category (up) and Pavitt's Taxonomy (down)



Source: our processing of UniCredit data

<sup>10</sup> The line relating to the greater enterprises breaks cleanly away from the others since, in absolute terms and as is obvious, this type of enterprise is largely responsible for the variability of the product result achieved by the enterprises in the sample.

<sup>11</sup> For the illustration, Graph 2 shows the Pavitt type breakdown by macro-sectors. The exercise was repeated using the two-letter ATECO classification without any appreciable differences emerging.



In addition to the descriptive analysis illustrated so far, in order to check whether the increase in variability of the v.a (expressed in logarithms) is also confirmed by way of inference, we employed two non-parametric tests to assess whether the distribution of frequency of the variable under analysis changed between the first three-year period (2001-2003) and the second<sup>12</sup> (2004-2006). The first of these is again the Kolmogorov-Smirnov test<sup>13</sup> while the second is the Kruskal Wallis test based on ranks. Both yielded a moderately significant result:<sup>14</sup> respectively a p-value of 0.069 and 0.096 (the null hypothesis of equality of distributions is rejected at 10%).

Having checked this, we observe that the area in which the increase in the variability of the product resulted greatest was the South (14.6%), followed by the North West (12%) and the North East (11.3%).

To sum up, in all the macro-areas, albeit with different intensity, the empirical results gathered show:

- a. the persistence of growth patterns connected with different corporate strategies;
- b. the increased variability of the growth rates induced by a further divergence of entrepreneurial behaviour in response to the intense competitive pressure experienced in the period of reference.

The aim of the following section is to attempt to discriminate, among the numerous variables available from the UniCredit dataset, those which had greater influence on growth performance, and whether any significant territorial differences emerge.

### 3. The “engines” of growth

The purpose of this section is to verify the main factors behind differential growth between 2001 and 2006. For this purpose, an econometric exercise has been performed, in which the dependent variable is the growth of the normalised value added of the one thousand and forty-nine enterprises in the UniCredit sample in the period 2001-2006. Since a multiplicity of explicative variables were theoretically available, and it was not possible to insert them each into the regression for obvious reasons of multicollinearity, the “principal components” method was used to reduce the number of the independent variables. More specifically, the principal factors which can, a priori, affect the growth of an enterprise were subdivided into six groups:

- a. incremental innovation;
- b. product innovation;
- c. efficiency;
- d. human capital;
- e. “evolved” forms of internationalisation (FDI- foreign direct investment; joint-venture; etc.);
- f. export quota.

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<sup>12</sup> We cannot make this comparison year by year in view of the small number of the sample enterprises.

<sup>13</sup> The Kolmogorov-Smirnov test was previously used to test for the adaptation of an empirical series to a theoretical one (Laplace). Here instead it is used to verify differences between the distribution of frequency of the variable *log(value added)* between the two periods considered.

<sup>14</sup> In this regard we have to remember that the low power of the non-parametric tests (or in any case that do not make *a priori* hypotheses regarding the population density) combined with a sample size which, despite grouping the data in three-year periods, continues to be relatively small, are elements that have a considerable impact on the non-significance of the hypothesis to be verified.

In the identification of the various blocks, which should synthesize the independent variables of the model to be estimated, we have stressed on the factors that presuppose a “strong” connection, at least a priori. On the other hand, we proceeded to differentiate between incremental vs product innovation; “evolved” forms of internationalisation or only export, since these imply entrepreneurial behaviours and routines which imply different levels of decision complexity and necessary investments. Each of these six sets has in turn been defined starting from a number of elementary variables which, we believe, are representative of different indicators contributing to the same component. More precisely, the principal components method makes it possible to pass from a number of variables to a single composite index that summarises each relevant factor. This method in fact extracts, from a broad but logically correlated set of variables, a single indicator that captures the greatest dimension of variability in the set of the original indicators. In this way, it is possible to summarize complex phenomena through a single variable, with clear advantage for the econometric exercise.

Table 3 shows the individual variables, twenty in all, from which the six factors – principal components<sup>15</sup> subsequently employed in the econometric analysis– are derived.

Table 3. Analysis of the principal components

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<sup>15</sup> The principal component that is obtained using this method is a linear combination of the elementary variables. The coefficients of the linear combination that make it possible to pass from the individual variables to the principal component are given by the elements of the autovector associated with the first autovalue of the matrix of correlation between the original variables.

Group	Category	Description of the individual variable	Coefficient	% variability (1)
1	Incremental innovation	Number of innovations made to existing products	0,70	51
		Marketing costs for new products	0,70	
2	Innovation	Costs for patent rights	0,21	48
		R&D costs	0,56	
		Investments for new products	0,62	
		Costs for design of new products	0,51	
3	Efficiency	Material (fixed) investments	0,24	70
		Investments in software	0,57	
		Investments in telecommunications	0,56	
		Investments in hardware	0,55	
4	Human capital	Number of external directors	0,46	53
		Number of middle managers	0,45	
		Employees with diplomas	0,53	
		Graduate employees	0,53	
		Employees who have done training courses	0,15	
5	Internationalisation	Collaboration agreements with foreign companies	0,49	73
		Acquisition of patents or licences from abroad	0,51	
		Activities in other countries	0,50	
		FDI or collaboration agreements	0,49	
6	Export quota	Share of exported turnover/share of domestic sales turnover	1,00	100

(1) % of variability retained by the principal component.

Source: our processing of UniCredit data

The penultimate column of Table 3 shows the coefficients of the contributions of single variables to the final value of the principal components: these are all positive, attesting that the variables belonging to each group are coherent in contributing to the aggregate indicator. The last column of Table 3 shows the percentage of overall variability retained by the principal component<sup>16</sup> used in the regression. From a theoretical point of view, the individual variables chosen in making up the six groups are fairly standard in literature and do not require particular comment. The advantage, as said, is disposing of this information over a relatively long period and for the same enterprises. The model that we wish to estimate is as follows:

<sup>16</sup> The percentages of total variability explained by the six principal components used in [1], see the last column of Table 3, may appear modest. This is in part the “cost” of the synthesis, namely using a single variable to represent a group of four or five indicators. Moreover, we can observe that the percentage retained is not in any case low: in all the groups the percentage of variance revealed is close to or more than double the ratio 1/number of group indicators (with the exception of the incremental innovation group, which is moreover made up of only two elements).

$$\Delta y_i(t) = \alpha + \beta_0 y_i(2001) + \left[ \sum_{j=1}^6 \beta_j \cdot z_{i,j}(t-1) \right] + \left[ \sum_{j=1}^6 \gamma_j \cdot \Delta z_{i,j}(t) \right] + u_i + \varepsilon_i(t)$$

where  $\Delta y_i(t)$  is the annual variation of the value added of enterprise  $i$ ;  $y_i(2001)$  is the level of the  $\log(\text{value added})$  at 2001 of enterprise  $i$ ;  $z_{i,j}(t-1)$  is the level of the  $\log(\text{explicative})$   $j$  at time  $t-1$  of enterprise  $i$ ;  $\Delta z_{i,j}(t)$  is the annual variation of  $\log(\text{explicative } j)$  at time  $t-1$  of enterprise  $i$ ;  $u_i$  is the first error component for enterprise  $i$ ;  $\varepsilon_i(t)$  is the second error component for enterprise  $i$  at time  $t$ .

The dependent variable is made up of the annual logarithmic differences of the nominal v.a of any enterprise  $i$  present in our sample. The independent variables are the six principal components representing the factors –incremental innovation, product innovation, efficiency, human capital, internationalisation, export quota– also expressed in logarithmic differences, and also in terms of  $\log$ -levels with a lag of one year. The introduction of the level, with a lag, of the principal components, can be justified from the fact that these can influence the dynamics of the dependent, not only through their variation in time, but also through a level effect of their smaller/greater endowment<sup>17</sup>. The fact of considering the same explicative variables in differences and in levels, despite the one-year lag of the, does not generate problems of collinearity, as can be seen from the values shown in Table 4.

**Table 4. Matrix of correlation between the explicative variables of the regression [1]: levels and logarithmic differences**

	Y (2001)	1_L	2_L	3_L	4_L	5_L	6_L	1_D	2_D	3_D	4_D	5_D	6_D
Y (2001)	1,00												
1_L	0,17	1,00											
2_L	0,55	0,23	1,00										
3_L	0,50	0,13	0,54	1,00									
4_L	0,75	0,19	0,57	0,53	1,00								
5_L	-0,09	-0,01	0,07	0,14	0,01	1,00							
6_L	-0,14	-0,03	-0,02	-0,03	-0,08	0,10	1,00						
1_D	0,00	-0,03	0,01	0,00	0,02	-0,04	-0,01	1,00					
2_D	-0,05	-0,04	-0,10	-0,06	-0,06	0,05	-0,02	0,14	1,00				
3_D	0,14	0,03	0,14	-0,03	0,15	0,00	-0,02	0,09	0,12	1,00			
4_D	-0,18	-0,01	-0,06	-0,06	-0,27	0,08	0,03	0,08	0,07	-0,07	1,00		
5_D	0,20	0,03	0,12	0,16	0,20	-0,30	-0,09	0,16	0,02	0,06	-0,05	1,00	
6_D	0,08	0,02	0,03	0,02	0,06	-0,03	-0,42	0,01	0,01	0,01	-0,07	0,10	1,00

**Legend: 1 = incremental innovation; 2 = innovation; 3 = efficiency; 4 = human capital; 5 = internationalisation; 6 = export quota. The suffix L indicates the use of the level logarithm while the suffix D indicates the use of the (annual) logarithmic differences.**

**Source: our processing of UniCredit data**

Moreover we considered opportune to include the initial level, again expressed as logarithm, of the dependent variable (in 2001), in order to take into account the

<sup>17</sup> The specification that considers the levels with a year' time lag was chosen after having also tested the possibility of inserting delays with a greater time lag; the specification chosen proved to be the most efficient (inter alia, greater delays would have reduced the sample dimension valid for the estimate of the parameters).

possible inverse relation between growth and initial dimension of the firm. The distributions of the principal components appear to be strongly asymmetrical; consequently we proceeded to carry out a logarithmic transformation through the formula  $\log(1 + indicator)$ .<sup>18</sup> The estimation method adopted is the feasible-GLS, usually applied in models for random effect panel data<sup>19</sup> (with dual error component). A final remark concerns the fact that tests for control of the distribution were applied for regression residuals, both panel constant and idiosyncratic components (Shapiro Francia and Wilks). These tests demonstrate the deviation of the residuals from the normality assumption (all the tests significant at 1%); this leads to a distortion in the estimate of the standard errors of the regression coefficients and a limited reliability of the level of significance. To avoid this problem, we adopt more robust techniques for the estimate of the standard errors, selecting from various alternatives: bootstrap (Efron and Tibshirani, 1986), jackknife (Efron and Stein, 1981; Mooney and Duval, 1993), or sandwich estimators (Huber, 1967; White, 1980). We applied all these methods to the estimated model and obtained robust results: more specifically, the significance of the coefficients classified in the usual three groups (\* = p-value < 0.1; \*\* = p-value < 0.05; \*\*\* = p-value < 0.01) remains the same. The results of the regression are shown in Table 5; in the estimate of the standard errors of the coefficients, we present those when applied the bootstrap method. The VIF (variance inflation factors) values shown in Table 6 confirm the absence of problems of multicollinearity between the explicative variables.<sup>20</sup>

**Table 5. Regression results. Dependent variable  $\Delta \log$  value added**

Determinants	North-West	North-East	Centre	South
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<sup>18</sup> The value “one” placed within the transformation logarithm guarantees that the argument of the logarithm is not negative. For the purpose of the estimate this correction does not cause distortion, since it is a translation on the axes adopted for all the variables, including the dependent.

<sup>19</sup> To discriminate in the choice of the model to be applied –random effects vs. fixed effects– the Hausman test was performed, with results that appear uncertain. In fact, in the case of the North East and the Centre, we accept the hypothesis of random effect with a respective p-value of 0.30 and 0.22. Instead, with reference to the North West and the South, we accept the fixed effect hypothesis (respective p-values of 0.0001 and 0.026). In any case, considering, both, the low power of this test (Rabe-Hesketh and Skrondal, 2008) and the fact that the residuals follow a distribution different from the normal, a circumstance that contributes to invalidate the reliability of the level of significance of the test itself, it was decided to adopt the random effect approach. The latter is in fact that which is generally considered for micro sample data since the fixed effects are considered not very suitable for “parametrically” representing the properties of a randomly selected sample. Moreover, the limited “parsimony” characterising fixed effects estimation is not very suitable for obtaining efficient estimates (Wooldridge, 2002) when this technique is applied to a very broad panel of enterprises over a relatively brief time-span (six years).

<sup>20</sup> As for the usual sectoral and temporal controls, the following observations hold. To focus attention on the aspects that “horizontally” affect the competitiveness of the individual enterprises, both the independent and the explicative variables were normalised in relation to the sector average, in order to avoid (possible) distortions connected with strongly differentiated performances between the different sectors (using the formula illustrated in note 7). The coefficients relating to the sector dummies hence are proven not significant. With reference to controls for year dummies, only the coefficient relating to the year 2002 (in comparison to the dummy pivot of 2001) proved to be significant, and in one single area (the South). We therefore chose not to include the temporal dummies in the results illustrated in Table 5, since the informative content to be gained proved to be modest in comparison to the loss in terms of degrees of freedom.

Log (added value) at 2001	-0,00481		-0,00963	***	-0,01013	*	-0,01601
Incremental innovation_L	-0,00038		-0,00129		0,00342		0,00838
Innovation_L	0,01580	**	0,00782		0,01226		-0,01429
Efficiency_L	-0,01674		0,00371		0,01177		0,01053
Human capital_L	-0,00029		0,00674		-0,00346		-0,00189
Internationalisation_L	0,03644	***	0,00120		-0,00917		-0,00247
Export quota_L	0,00272		-0,00123		-0,00002		0,00702
Incremental innovation_D	0,52460	***	0,51853	***	0,53873	***	0,40124
Innovation_D	0,34147	***	0,21905	*	0,44326	***	0,62452
Efficiency_D	0,03015		0,04258		0,08715		0,08312
Human capital_D	0,03882	*	0,01844		0,05193	**	0,06491
Internationalisation_D	0,37389	***	0,11354		0,27842	***	0,64265
Export quota_D	0,03280		0,06497	**	0,05831	*	0,00446
Constant	0,02391		0,01675		0,02251		0,04254
R-square:							
Within	0,31647						
Between	0,54320						
Overall	0,34325						0,31964
Observations	1995						

Note: \* P-value lower than 0.1%; \*\* P-value lower than 0.05%; \*\*\* P-value lower than 0.01%.

Legend: The suffix L indicates the use of the the level logarithm, the suffix D indicates the use of the logarithmic differences (annual).

Source: our processing of UniCredit data

Tab. 6. Variance Inflation Factors (VIF) (1)

Added value at 2001	2,6
Human capital_L	2,83
Innovation_L	1,82
Efficiency_L	1,73
Export quota_L	1,24
Internationalisation_L	1,20
Incremental innovation_L	1,07
Human capital_D	1,13
Innovation_D	1,06
Efficiency_D	1,09
Export quota_D	1,22
Internationalisation_D	1,21
Incremental innovation_D	1,06

(1) values of under 10 indicate absence of multicollinearity.

Source: our processing of UniCredit data

In the first place, we can observe that the initial product level has a negative effect on growth essentially in the regions of the North East; in the South, and especially in the Centre, this result is more subdued, as we can deduce from a progressively diminishing statistical significance. In the North West, this effect is actually absent. The fact that this effect is more intense in the North East can presumably be attributed, at least in part, to the more marked presence of a distinctly “reticular” industrial structure, in which the phenomena of growth via “external” lines, that is through an vertical disintegration accentuating enterprise demography,<sup>21</sup>

<sup>21</sup> It is considered that the following information offers a partial confirmation of the theory proposed in the paper. On the basis of the data from ISTAT sources on demography of enterprises, between 2002 and 2007 the survival rates of the manufacturing enterprises in the North East proved to be equal or, more frequently, systematically greater than those observed in the other macro-areas

have historically prevailed over those via internal lines (Rullani, 2006). As regards the explicative variables considered as levels, clearly emerges the relative insignificance of these in general in determining the product dynamics in the period. We interpret the lack of significance of the explicatives expressed as levels as a consequence of some structural features characterising Italian enterprises: low level of fixed assets, low vertical integration with acquisition of external input impacting for around 80% on the overall value of the production, the search for elevated operational flexibility (Coltorti, 2004; Mediobanca-Unioncamere, 2009, 2011). The only two cases in which level variables prove to be significant –namely process innovation and “evolved” forms of internationalisation– refer to enterprises located in the North West, and this is an exception that confirms the norm. On the one hand, indeed, the two variables in question are qualified by the presence of discontinuity that are linked to the reaching of “minimum thresholds” for the average sizes. In fact, it is precisely in the North West that the enterprises, which more significantly diverge from the standard “model” above referred, are located. Indeed, in this area there is a relevant group of more integrated enterprises that, also in dimensional terms, present forms of organisation more similar to those prevailing in other industrialised countries (Berta, 2004). Finally, it should also be added that the modest rates of investments noted in all the macro-areas in the period definitely did not foster competitive advantages: between 2001 and 2006 the investment/turnover ratio, for example, in any area was around 5%, and was frequently much below this level.

Moving on to comment on the explicative variables expressed in logarithmic differences, in the first place we can observe a greater number of significant cases, sometimes at a high level (level of significance at 0.01%). This result in the first place confirms what was said earlier a-propos the underlying industrial structure in which competitive advantages of firms do not originate from –are not “built in”– in the relatively high quota of fixed assets, but are rather derived following the short-term indications as emerging from the market. Moving to the results at territorial level, in the North West, in addition to incremental innovation, (product) innovation and internationalisation also prove to be highly significant, also in terms of level, again in the same area. In the North East incremental innovation proved significant and, (with a lower p-value limit at 0.05%), the quota of demand held by exports. Process innovation in the same area was weakly significant (p-value 0.1%), revealing an uneven diffusion of the phenomenon, probably still in progress. Again with reference to the North East, the elements observed confirm the pilasters of the competitive model of the area in question, centred on the of creativity/uniqueness of the product, especially for consumables, giving rise to competitive advantages that are difficult to be replicated, and combined with a strong propensity to export (Becattini, 2009; Fortis and Quadrio Curzio, 2006).

The areas of the Centre and the South partially follow the patterns already observed in the two macro-areas of the North. In the centre, the variables with a p-value of less than 0.01% are: incremental innovation, product innovation and

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(SVI-MEZ, 2010, pp. 84-85). Moreover, the balance between the employees who, in 2007, were employed in enterprises set up un 2002 and the jobs lost in companies that had closed down in the same period (2002-2007) was highest of all precisely in the North East (*ibid.* p. 87).

internationalisation. In the South the first and third out of the three just mentioned. At a lower level of significance, in the Centre human capital also enters, as in the South product innovation.

To sum up, in all the macro areas, incremental innovation proved to be highly significant, in terms of differences; product innovation showed the same level of statistical significance in the North West and in the South, and a lower threshold in the Centre; finally internationalisation show a p-values lower than 0.01% in three areas (North West, Centre and South) out of four. The principal competitive advantages that the more successful enterprises exploited to respond to the intense competitive pressure were, on the one hand, the incremental and/or process innovation, and the recourse to “evolved” forms of internationalisation. We can assume that the latter were in part functional for expansion on out of Europe markets showing high dynamics and, thus alleviating the demand constraints present in the traditional markets (Italian and/or European). In general, on the basis of our estimates, the fact that the foreign market became the principal escape route for the difficulties encountered on the home market is also confirmed by the data referred to the whole stock of the enterprises. With reference to the universe of the manufacturing enterprises, between 2001 and 2007 the v.a of the exporting companies (+18.9%) grew almost two and a half times more than that of the non-exporters (+7.6%).<sup>22</sup>

In relation to this picture, our estimates indicate that the companies that succeeded in making a further “step”, in other words shifting from the mere sale of their products abroad to more evolved systems of internationalisation such as agreements, joint-ventures, FDI, etc., derived a relatively greater benefit as shown by the illustrations in Graph 3. One of the questions that this contribution aimed to answer concerned precisely which, among the various competitive factors considered, had the greatest effect on product growth. Graph 3 shows the coefficients of the explicative variables of the [1] appropriately standardised so that they can be directly compared with each other.<sup>23</sup> It is consequently easy to see how, for example, the impact generated by advanced forms of internationalisation is significantly greater than that attributable to export.

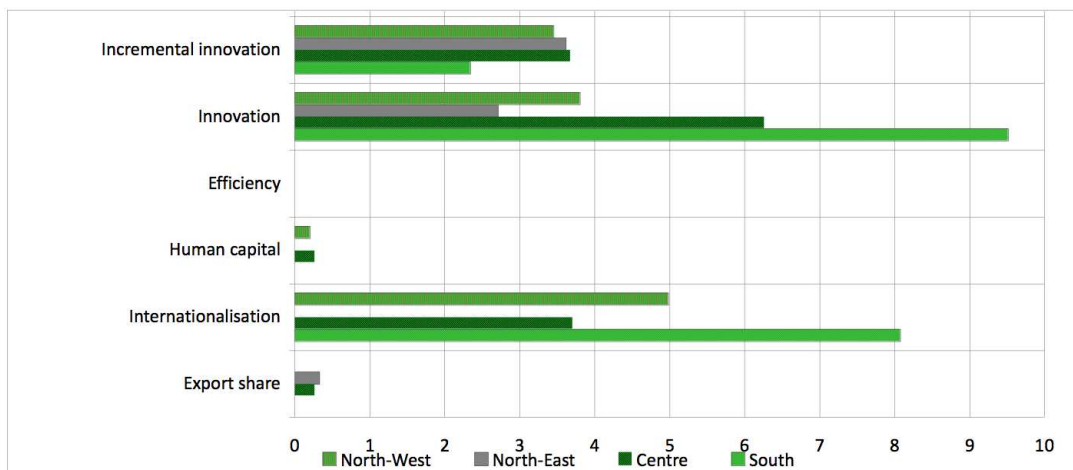
Graph 3. Standardised regression coefficients [1]: logarithmic differences

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<sup>22</sup> Eurostat (2010).

<sup>23</sup> Only the coefficients in logarithmic differences have been considered, since in levels only two proved to be significant.





Source: our processing of UniCredit data

With reference to the two variables relating to innovation –incremental and process– it should be observed that the former has traditionally been a pivotal element in the very history of Italian industry, characterised by a continual upgrading of production, although this is often difficult to be identified through official statistics (De Nardis, 2010; De Nardis and Traù, 2005). What needs to attract attention is the diverse intensity in the various territorial partitions of impact of product innovation, a factor which, unlike the incremental innovation, proved to be considerably less widespread through the national productive system. In part, this may be the result of changes in how the “knowledge” factor enters into the production processes. In the first place, from around the mid-1990s on, there was an exponential growth in the scientific content of products for a broad range of industries –the so-called science linkage– both, in those in new and more traditional (Bonaccorsi and Granelli, 2005). Moreover, the skills demanded by the research programs have also multiplied, given the increasingly interdisciplinary nature of the research trajectories, and it is not possible for all enterprises to dispose of all the human resources necessary available internally. This latter element, in particular, has not impeded to some relatively small-sized enterprises to exploit the opportunity to specialise in the creation of innovative products, built around specific knowledge developed in-house, and subsequently used as input elsewhere. Robust evidence of this has recently been observed in Italy in both the pharmaceutical (Riccini, 2010) and the chemical sector (Vitaloni, 2010).

Nonetheless, the most interesting aspect is that the impact on the growth of v.a exerted by product innovation is greater everywhere than that of incremental innovation (Graph 3). The greater significance of the product innovation in many macro-areas is a sign that the traditional path followed by Italian industry in innovative strategy –poorly formalised, and not incidentally defined as “innovation without research” or “empathic”– comes up against greater difficulties than in the past in sufficiently improving the performance. The increased pressure of competition led in fact to a major drop in the *average* growth rate of the industrial product. The capacity to overcome this limitation through innovation appears to be more effective when the activities of the firm have a higher content of formal research.

More generally, our estimates indicate that the relative importance of incremental innovation *follows* product innovation, just as exportation comes *after* internationalisation. This is, moreover, a situation that proves to be robust for practically *all* the circumstances where the variables in question were significant.

On the one hand, therefore, that while the “way” of overcoming the competitive shock appears territorially uniform, the capability of response offered by various macro-areas was, as we seek to show, different. To this end, we need to set aside the sample considered so far and strive to see which weight is to be attributed in each individual territory to the two competitive factors identified as the most important. In this operation of “extrapolation to the population”, there is a high degree of approximation, since the official statistics available at territorial level include very little information about the variables of our interest. Despite this, we believe that the data shown in Tables 7 and 8 make it possible to establish certain regularities worth of note.

To get an idea of the number of enterprises involved in forms of internationalisation, Table 7 shows the number of export operators per macro-area. Unfortunately, the information available does not make it possible to distinguish between those who merely trade the manufactured products abroad from those engaged in the more evolved forms of international operation. This implies that the proxy available will overestimate the extent of the phenomenon of which we wish to observe the differences in territorial distribution. The evidence from Table 7 shows that in the period examined the number of enterprises involved in export in the various territories has not substantially changed, or rather it has dropped slightly.<sup>24</sup> Although, as said, we do not know whether within this stock there have been changes in increase or decrease for the specific activities associated with the best performances (joint-ventures, FDI, collaboration agreements, etc.). It appears plausible to assume an evolution in line with the aggregate of reference. In partial support of this assumption, we can bear in mind that in the period examined, the foreign employees of enterprises in which Italian companies hold shares remained substantially stable (Mariotti and Mutinelli, 2008, p. 76). The percentage incidence of the exporting enterprises on the total of active companies is, on average, almost 6% in the North West and the North East, 4% in the Centre and less than 2% in the South. This evidence is certainly not a novelty. In the light of the evidence yielded from our regression, with reference to the entire “Italy enterprise system” it nevertheless represents a element of criticality: the “nucleus” of exporters is limited, and within this, plausibly even smaller is the number of those that adopt “evolved” forms of internationalisation. Moreover, the territorial distribution of the export operators shows clear differentiations, with the two macro-areas of the North in a comparatively better position. These differences appear more accentuated if we bear in mind that, in the South, there were also changes in the composition of the exports in the first part of the last decade. More specifically, in the South the impact of the so-called scale-intensive sectors dramatically increased: from 49.8% in the years 2001-2003 to 60.9% recorded in 2007; this macro branch, it is well to recall, is

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<sup>24</sup> It should be borne in mind that, in addition to the figures shown in Table 7, there is also a quota of export operators that cannot be territorially classified. Adding the incidence of these, the total of export operators remains stable over the entire time-span subject of analysis.

composed prevalently of large enterprises with ownership from outside the area. Conversely, in the same period the group of traditional products, which essentially encompasses the “Made in Italy” undertakings of enterprises of prevalently “local” ownership, lost almost ten percentage points, dropping from 29.3% to 19.6%. Comparable changes at this scale did not take place in any other macro-area of the country.<sup>25</sup> Hence, in the South, in addition to a lower incidence of enterprises involved in foreign business, exports became increasingly the prerogative of a handful of larger companies from outside the area. In the Southern regions, the decisions relating to this important factor of competition area assumed as an “exogenous” level, much more than elsewhere.

**Table 7. Number of export operators by origin macro area**

Macro areas	2001	2002	2003	2004	2005	2006	2009
Nord-West	74 453	74 932	76 855	73 985	73 381	73 425	64 363
Nord-East	55 021	57 453	56 960	55 039	54 436	54 917	48 505
Centre	37 948	38 814	38 451	36 294	36 279	36 270	30 254
South	23 591	24 708	24 707	22 523	22 592	22 922	19 876

**Source: ICE (National Institute for Foreign Trade) (2010)**

**Table 8. Innovative enterprises by type of innovation and territorial area. Industry and services, years 2002-2004**

Macro areas	Enterprises that have innovated only products	Enterprises that have innovated only processes	Enterprises with product and process innovation	Total innovative enterprises	Total enterprises
Nord-West	3 865	10 960	7 515	22 340	65 049
Nord-East	3 197	9 421	5 819	18 437	52 468
Centre	1 771	5 434	3 142	10 347	37 939
South	1 152	4 242	2 800	8 194	37 858

**Source: ISTAT (2006)**

With reference to the diffusion of product innovation, the values shown in Table 8 –which in this case too tend to overestimate the dimension of the phenomenon<sup>26</sup>– indicate a situation marked by even greater criticalities than those which we have just seen for internationalisation. The overall number of the enterprises<sup>27</sup> that between 2002 and 2004 performed some form of innovation, of process or product or both, mirrors in the two Northern areas that of the export operators. In the Centre and in the South the first variable (innovation) shows higher values than the second (export operators). Nevertheless, if we look at product innovation alone, the variable of greater interest, the number of enterprises involved drops significantly: in the two Northern areas these represent around 27% of the total, falling to 16% in the South. This too is, on the whole, a “known” datum; but this is not the main point.

<sup>25</sup> A more in-depth focus on this can be found in SVIMEZ (2007, pp. 55-56).

<sup>26</sup> In fact, for territorial disaggregations, with reference to the aggregate of the enterprises that have introduced innovations, it is not possible to separate the companies operating in industry from those of services.

<sup>27</sup> The information relating to enterprises that have carried out some form of innovation is derived from a sample survey carried out between 2002 and 2004 (Istat, 2006), in which the universe of reference is represented by enterprises with more than ten employees in industry and services, with the exclusion of “other activities” (globally, around one hundred and ninety three thousand units). The number of exporting operators used is instead based on information taken from the entire population of Italian enterprises, without limits in terms of size and/or of sector, and related to the same (slightly over four million, three hundred thousand units).

The fact is that the dual shock that struck Italian industry brought about a change in the relevant factors for the competitive advantages that assure relatively higher product growth: from export to forms of “evolved” internationalisation; and from incremental innovation to product innovation. The increased variability of entrepreneurial responses indicates that there has been an increase, in terms of performance, in the divergence between those who have implemented adequate responses to the new competitive scenario and the rest. The impact of the latter, in the universe of the Italian manufacturing enterprises as a whole, continues to be high; the modest growth rate of Italian industrial output in relation to the principal European competitors is largely dependent on this.<sup>28</sup>

## Conclusion

As we have sought to argue, the competitive shocks that struck Italy in the early part of the decade generated a misalignment between the competitive advantages historically rooted in our productive fabric –incremental innovation, export– and those which instead are capable of ensuring relatively greater growth in the new context: product innovation and “evolved” forms of internationalisation. This does not mean that the traditionally strong points of a “Made in Italy” are no longer valid, but rather that they have a lesser capacity to significantly differentiate product performance.

The factors that, albeit with approximation, identify the two competitive advantages with greater incidence on the product dynamics, prove to be not widespread in absolute terms. Furthermore, their distribution is more concentrated in the two macro-areas of the North. As for the first aspect, this is in part due to the fact that “history matters”, in the sense that it is hard to change an industrial model historically centred on elements other than those identified here as most appropriate to the new competitive context. But that is not all. The higher variability of entrepreneurial behaviour indicates, at least, that successful attempts are under way to change the paradigm. Despite this evidence, this is certainly not an easy operation, given the presence of two unfavourable external conditions: imperfect, frequently oligopolistic, markets and competitors operating in country-systems which, on the whole, display increasing returns. These are the elements that make path-dependence inherent in all processes of growth more cogent (Arthur, 1989; North, 2005). As for the territorial distribution of the aforementioned advantages, we were able to observe how, within an insufficient overall provision, the two macro-areas of the North appear to be better placed. More specifically, the deficit accumulated by the South, a territory already marked by the presence of a limited stock of productive capital, is such as to generate further negative repercussions placing the area in a distinctly peripheral position. Unlike previous episodes in phases of recession induced from international cycle, the crisis that began in the second half of 2008 has struck Southern industry with a greater intensity (SVIMEZ,

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<sup>28</sup> In the cyclical phase (2004-2008) immediately preceding the international crisis that broke out at the end of 2008, the industrial product –at constant prices– increased overall by around 3% in the Centre-North regions and diminished by 2.4% in the South. In the same period, the same aggregate went up by 9.7% in the Euro-zone, by 14% in Germany and by 2.5% in France. In countries such as Poland, in the same time-span, the progress of industrial output amounted to over 40%.

2010). Naturally, in view of the greater degree of openness of industry in the North, this area generally tended to be harder hit by the contractions of global trade. The fact that this did not occur in the recent cyclical episode indicates the relevance in the South of an asymmetrical shock, the roots of which are to be found in the structural weaknesses highlighted.

Industrial policy appears to play a marginal role in relation to these trends. In the first place, we have to bear in mind that the quantitative dimension of this is comparatively inadequate. In 2007, for example, the percentage incidence of State aid to industry and services under whatever entitlement (incentives, tax credits etc.) amounted in Italy to 0.25% of the GDP. This is a figure similar to that recorded in a country with a strong free-trade orientation such as Great Britain, but distinctly lower than the 0.6% of Germany or the 0.88% of Sweden (MET, 2009, p.21). Among developed countries, none has an aid/GDP ratio lower than that of Italy. In the second place, Table 9 shows the percentage impact of the expenditure on measures meant to support the two competitive advantages –research and innovation and internationalisation– that best respond to the new competitive context. It appears evident that the resources destined to the second objective are, with the partial exception of the North East after 2005, decidedly exiguous. The measures scheduled for the research and innovation objective account for a greater share of resources; nevertheless, they show an uneven temporal profile. Over the entire period, the two macro-areas of the North appear to be better positioned. In effect, taken together, the North East and the North West have absorbed over 85% of the grants for the internationalisation objective and around 65% of those for research and innovation. The territorial distribution of the incentives appears to be closely linked with the localisation of the core of the Italian productive system, thus falling short of the goal of territorial rebalancing.

More generally, the evidences we have arrived at indicate that in effect there was an endogenous response to the competitive shock at the start of the decade under consideration. However, the enterprises effectively involved, also considering the “leap” requested by the new competitive scenario, are too few in numerical terms to permit the *average* growth rate of the industrial product to return to levels in line with the past. In this context, the Italian industrial policy does not appear to devote adequate resources, either for the measures aimed at implementing the necessary competitive adjustments, or for achieving the objective of territorial rebalancing. Clearly, it is correct to debate upon the most appropriate means and instruments to ensure an efficient policy. However in a world where, both in developing countries and elsewhere, the effort at industrial policy is much more widespread than what is often believed (Rodrick, 2007), this instrument should be reconsidered as an asset making significant contributions to the overall competitiveness of a country or area.

Table 9. Expenditure for “Research and Development” and “Internationalisation” objectives in relation to the overall public subsidies (% share)

Territorial areas	2001	2002	2003	2004	2005	2006	2007	2008
	Research and Development							
North-West	21,7	19,4	19,4	27,6	25,2	20,1	12,6	7,8
North-East	29,8	28,0	38,7	13,5	37,0	30,7	27,9	32,1
Centre	27,1	23,4	24,8	21,9	28,1	15,6	14,8	9,2
South	2,3	1,6	4,2	8,9	9,1	12,9	18,1	21,0

n.c.	0,0	0,0	0,1	0,0	0,1	0,7	0,1	0,0
Italy	11,2	8,5	13,2	13,6	16,2	16,9	17,7	17,3
Internationalisation								
North-West	7,7	9,1	7,6	13,9	11,6	9,9	10,5	10,4
North-East	4,2	5,1	10,3	8,0	14,1	16,5	20,3	25,7
Centre	4,1	5,4	2,0	7,2	2,0	3,1	6,7	3,6
South	0,0	0,0	0,2	0,1	0,2	0,1	0,2	0,1
n.c.	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Italy	2,3	2,3	3,1	3,9	3,6	3,9	4,7	4,6

Source: MET Report - [www.met.economia.it](http://www.met.economia.it)

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