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SOMMARIO

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TECHNOLOGICAL PROGRESS IN ITALIAN REGIONS: SOME COMPARISONS

Abstract

In this paper we study technological progress in a set of representative Italian regions. The analysis is conducted using input-output data. We construct the technological frontiers and calculate new indices of technological progress (see Fredholm and Zambelli, 2009 and Zambelli and Fredholm, 2010). The empirical results are robust and seem to be interesting. We find, for the years 2001 and 2004 that Trentino and Sicily are the regions, among those examined, with the largest number of technologically advanced productive methods, while Veneto and Lombardy are characterized by poor relative technological performance. Given the micro data about observed productivity this result is, at first, surprising, but we provide an interpretation. In the case of the Trentino region the technological progress is actually exploited so that the region is near to full employment and the income generated is relatively high. In the case of Sicily our results show that there is a great potential for growth which is not exploited. Veneto and Lombardy seem to be cases in which the embodied technological progress is not high, this indicates, ceteris paribus, a low potential for future growth or, alternatively, that the development has occurred in the past. Good performance is also indicated by Emilia Romagna.

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1. Introduction

In this article we present the computation of two new measures of technological progress applied to eight Italian regions. The method is that of combining region specific wage-profit curves so as to generate an efficient inter-regional wage-profit frontier.

In this paper we construct indices for region specific technological progress and convergence by combining the region specific wage-profit frontiers. These frontiers are computed with total precision (and, seemingly, for the first time). As explained in Fredholm and Zambelli (2009b) and in Zambelli and Fredholm (2010) this is now possible utilizing the new algorithm they have devised. Here we compute the values of these new indices.

2. Production Prices and the wage-profit frontier
2.1. Standard input-output Framework and Output Prices

Let **A** be a $n \times n$ square non-singular matrix of inter-industry inputs, where the $(i, j)^{th}$ entry represents the ith industry's use of the jth commodity in the production of the ith commodity. Likewise, **L** is a $n \times 1$ vector of labour inputs and **B** is a $n \times n$ positive definite diagonal matrix of outputs, where the ith diagonal entry is the gross output of the ith industry. In short the above can be interpreted as input-output relations of the Leontief type.

These 'real magnitudes' can be given an accounting meaning through the use of imputation prices (also known as production prices). The following situation in which there is an accounting balance in all the sectors (when wage and profit rates are assumed to be uniform):

$$\mathbf{A}\mathbf{p}(1+r) + \mathbf{L}w = \mathbf{B}\mathbf{p} \qquad (2.1)$$

is a standard representation where the costs of production implied

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[1] These prices can be interpreted in many different ways. They can be seen as: Adam Smith's natural prices; Ricardo-Marx's production prices; somewhat analogous to Seton's eigenprices; long term competitive equilibrium prices; Walrasian market clearing prices; shadow prices and so on and so forth. In order not to attach to them any particular interpretation we have chosen to refer to them as imputation prices or auxiliary prices. Moreover there exist a cloud of possible values that the

by left-hand side is equal to the revenues implied by right hand side. The price vector **p** and the uniform profit rate *r* and the uniform wage rate *w* are imputation prices that allow the accounting equilibrium[1].

System (2.1) consists of *n* linear independent equations and *n+2* variables, i.e., the system has initially two degrees of freedom. Choosing a *numéraire* **ç**, such that that **ç′p** = 1, the degrees of freedom reduces to one.

For a given profit rate, it is straightforward to calculate the wage rate and the relative prices that solve system for (2.1). Solve for **p**, **p** = (**B** − **A**(1+*r*))$^{-1}$ **L***w*, premultiply with the *numéraire*, and rearrange to obtain the wage-profit frontier function and the associated prices, viz.

$$w = \left(\mathbf{ç}' \left(\mathbf{B} - \mathbf{A}(1+r) \right)^{-1} \mathbf{L} \right)^{1} \tag{2.2}$$

$$\mathbf{p} = \frac{\left(\mathbf{B} - \mathbf{A}(1+r) \right)^{-1} \mathbf{L}}{\mathbf{ç}' \left(\mathbf{B} - \mathbf{A}(1+r) \right)^{-1} \mathbf{L}} \tag{2.3}$$

A very important property of the above *wage-profit* curve and of the imputation prices is that they are invariant with respect to the level of activities. Hence the *wage-profit curves* of two systems which have very different magnitudes, but have access to the same methods would have exactly the same imputation prices and the same *wage-profit curve*[2]. Furthermore the *wage-profit curve*, due to the established duality between these imputation prices and quantities, can also be interpreted as a measurement of technological progress. Bruno (1969) has demonstrated an important dual relation between the auxiliary prices and the methods of productions (and quantities, i.e., the *production possibility frontier* or the *factor price frontier*). Hence we can attempt a measurement of technological progress by comparing the

individual profit rates could take and that would guarantee a set of values for which the accounting identity would be satisfied: clearly this would imply different imputation prices. The choice of the uniform rate of profit and of the uniform wage rate finds its principal justification from the fact that it allows us to work in a two dimensional space.

[2] For an explanation and elaboration on this important property see Zambelli (2004, p. 105). If **X** is a semi-positive diagonal matrix which represents the intensity of the utilization of the methods used (the activity levels), we have $w = \left(\mathbf{ç}'(\mathbf{B} - \mathbf{A}(1+r))^{-1}\mathbf{L} \right)^{1}$ and that $\mathbf{p} = \frac{(\mathbf{B} - \mathbf{A}(1+r))^{-1}\mathbf{L}}{\mathbf{ç}'(\mathbf{B} - \mathbf{A}(1+r))^{-1}\mathbf{L}}$ respectively generating the same values as in eq. 2.2 and eq. 2.3.

prices associated with the employment of old methods with respect to the prices associated to the employment of new ones. Therefore equation 2.2 can be interpreted both as a *wage-profit curve* and a measure of technological progress: a *wage-profit* curve associated with an economic system when it dominates that of another one can be said to have a higher level of technological progress[3].

2.2 The Velupillai-Fredholm-Zambelli measurement for technological progress

In this paper the study of technological progress is made by using the information embedded in the set of all input-output tables included in a sample. The idea is rather simple. Given a set of production possibilities (also called production methods) there exist an outer bound *wage-profit frontier* which is the result of a combination of the production methods of the individual systems (i.e., it is the outer bound of all possible *wage-profit* curves). This concept of efficient outer frontier is well known in the literature and it has also been used as a pedagogical device, but it is almost always never computed from actual data. One of the reasons is to be attributed to the high combinatorial complexity which would require, when using a brute-force algorithm, several years to be computed.

Fredholm and Zambelli (2009) and Zambelli and Fredholm (2010) present the algorithm that shortens considerably the necessary computational time. Hence it is now possible to compute this outer frontier.

Here we will call it, for clarity and simplicity, the VFZ-*technological frontier*. As originally suggested in Velupillai and Zambelli (1993) this frontier is used as the benchmark to be used to measure technological progress.

Figure 1 shows an example of the *wage-profit* curves associated to 8 economic regions, year 2004, and the outer bound *VFZ-technological frontier*.

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[3] Clearly a higher potential technological progress does imply that actual output per capita would be higher. This does not imply at all that the empirically observed (value of the) output per capita is higher if associated to the higher potential technological progress. This is so because the imputation prices do not contain information about the actual activity levels, the matrix **X**. Therefore, due to a bad combination of activity levels, a region with high technological progress might exhibit actual bad economic performance and vice-versa. In the *ceteris paribus* case in which two economic systems differ in the set of methods, but have the same activity matrix **X**, the system which has the highest dominant *wage-profit* curve exhibits the highest technological progress.

The VFZ - *technological frontier* has remarkable theoretically and empirically useful properties (see Fredholm and Zambelli, 2009).

The *wage profit curves* and *frontiers* are scale independent. This is a result of the *non-substitution* theorem. Hence two different productive systems, let us say the one associated with a small region and the one associated with a large region, can be compared using the same framework.

Comparison between two *wage-profit frontiers* is independent of the cardinality of their productive systems. Two systems which have different cardinality, let us say *n* and *m*, can still be compared as long as they have the same *numéraire*. The only requirement is that the *numéraire* is a transformation based on the subset of commodities which are common to both systems.

The *wage-profits curve* or the *wage-profits frontier* is dual with respect to the *production possibilities curve or frontier*: given set of profit rates the superior *production possibilities curve or frontier* is associated with the superior *wage-profit curve or frontier*.

Figure 1

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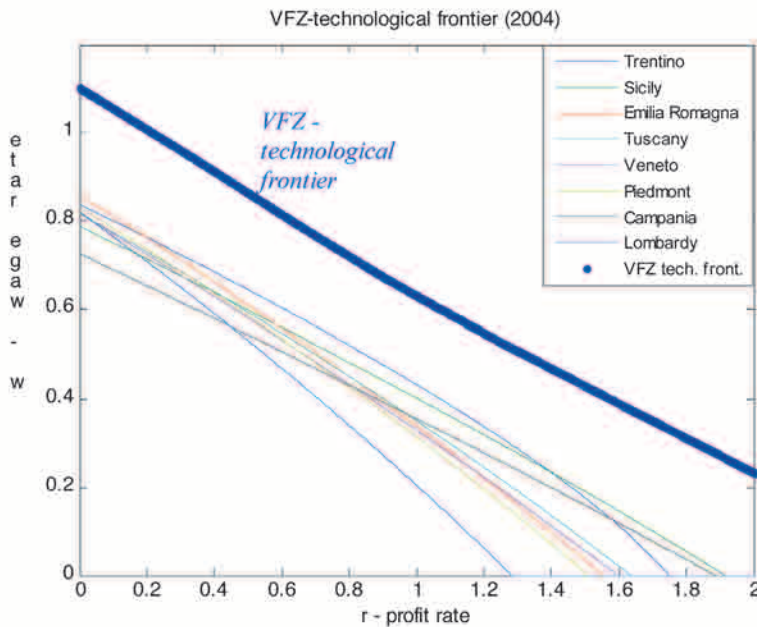
Furthermore, all the possible linear combinations of two sets of methods will result in a set of *wage-profit curves* or *frontiers* which will be dominated by one of the two original wage-profit curves.

The *VFZ-technological frontier* is a piecewise function. The points on the VFZ-*technological frontier* are points in which the change from one set of methods to a new set of methods occur. But it is one and only one method which replaces another method. Moreover while the shape of the VFZ-*technological frontier* depends on the *numéraire* the value of the profit rates at the switch points are independent of it. Independent of the *numéraire* are also the production methods used for the particular piece of the piecewise VFZ-*technological frontier*.

The *VFZ-technological frontier* can be used to measure the technological progress and the relative economic performances of the different economic systems, countries. Zambelli and Fredholm (2010), based on the *VFZ-technological frontier* have constructed two different indices of performance: the VFZ-*index* and the VFZ-*ranking*.

The VFZ-*index* measures the level of development as the ratio between the system specific *wage-profit curve* and the VFZ-*technological frontier*.

The VFZ-*index* is dependent on the choice of the *numéraire*, but has the advantage of assessing the degree of economic backwardness or forwardness in terms of the globally efficient production frontier captured by the VFZ-*technological frontier*. In essence it is an assessment of the actual development of the particular national system with respect to the benchmark represented by the VFZ-technological frontier. Its highest possible value is one.

The VFZ-*ranking* computes the relative performances based on the contribution of the economic systems to the formation of the efficient global VFZ-technological frontier. As Bharadwaj (1969) has shown, the switch points of the *wage-profit frontier* are independent of the *numéraire* and hence the contributions of the economic systems do not change with it. A ranking between the different systems can be made by exploiting this fact. Obviously an economic system that contribute substantially and more than others to the formation of the VFZ-*technological frontier* can be considered as being forward in technological development with respect to those not contributing at all[4].

[4] In order to take account also of methods that are not the most 'efficient' ones, but that are almost

This does not mean that we have to expect that the economic system necessarily performs better than others. Whether this technological forwardness is actually exploited so as to assure, for example, full employment level or high level of per-capita output or income is another matter which is not discussed in this paper.

It has to be stressed that the VFZ-*index* is an 'absolute' measurement of actual potential economic performance, while the VFZ-*ranking* is a 'relative' measure of the access to more advanced, and potentially more productive, industry level production methods.

The computations of these two indices require the computation of the VFZ-technological frontier. Hence, for the reason explained above, they have never been computed before (to the best of our knowledge).

3. Source and preparation of the data and the choice of numéraire

The regions examined in this study are Trentino, Sicily, Piedmont, Tuscany, Campagnia, Emilia-Romagna, Veneto, and Lombardy. From an administrative viewpoint, Trentino is an autonomous province of Italy and it is one of the two provinces which make up Italy's region of Trentino-Alto Adige. The input-output tables for the above regions are made available by the Regional Institute Economic Planning of Tuscany (Irpet), apart from the input-output table for Trentino, which is made available by the Statistical Office of the province of Trento. The data were limited only to two years: 2001 and 2004. All the input-output tables are based on the ESA 95 – NACE Rev.1 classification with 30 industries.

as efficient as the most efficient, Zambelli and Fredholm (2010) have generated a scheme in which methods can be ordered as being first, second, third, ... and last. A method would be ranked second when the method ranked first is removed from the set of methods and it is the one that would contribute to the new, and lower, VFZ-*technological frontier*. It would be ranked third when the methods ranked first and second are removed and would contribute to the new VFZ-*technological frontier* and so on.

Once these rankings have been generated they are aggregated using the Borda Counts weights. That is, the first would weighted with value 1, the second with value 1/2, the third with value 1/3 ... the Nth with value 1/ N^{th} (Obviously this choice is an arbitrary one). These values are used to determine the ranking of the different regions by summing all the values associated to the methods of the region. Clearly if the methods employed in a region are all superior with respect to the others, the highest value would be equal to the number of commodities. Hence it is appropriate to normalize this value with respect to the number of commodities, i.e industries or sectors. In this way the highest possible performance value, as in the case of VFZ-*index* would be 1, but in this case a high performance of

Given that all the data reported in the tables are in current basic prices, industry deflators have been computed and used to deflate the table. The deflated table can be regarded as proxies for the physical flows among industries for the selected regions.

Labour data are taken from the Regional accounts available on the website of the National Institute of Statistics. Labour input is measured as number of workers weighted by an index of hours worked in each sector and year. Labour data are not available at the same level of industry detail of the input-output tables; therefore there is a lack of coincidence between the sector labour input and the sectoral input-output data. Hence, some labour input data were decomposed into smaller aggregate classes so as to fit with the sector subdivision of the tables.

The 30 industries must be aggregated 'down' to 27 in order to ensure comparability.

As a *numéraire*, we have used the bundle of goods formed with the average of the regional per-capita individual industry net national product relative to 2001[5]

Table 1 - Income of per unit of employment. Relative positions with respect to the highest income (Emilia Romagna – 2004)[6]

Region	2001		2004	
	Income per unit of labor %	Position	Income per unit of labor %	Position
Trentino	97.8	3	96.8	2
Sicily	90.0	7	89.1	7
Piedmont	95.7	6	95.1	5
Lombardy	98.8	2	95.9	4
Veneto	97.8	4	96.4	3
Campagnia	83.1	8	82.3	8
Emilia Romagna	99.2	1	**100**	1
Tuscany	96.6	5	94.2	6

[5] For the 27 sectors the bundle used, numéraire, is the following: 1.75; 0.17; 5.51; 6.15; 0.87; 2.27; 1.73; 3.51; 1.46; 1.68; 4.59; 6.49; 4.23; 4.69; 2.21; 0.97; 5.83; 11.68; 3.85; 5.39; 1.97; 2.79; 5.09; 3.01; 4.24; 2.66; 5.20. The sum of the above weights give 100.

[6] The values of income per unit of employment have been computed using the imputation or production prices, that is, with prices that have been generated with the numeraire values of the previous footnote. Strictly speaking the value of income is not actual market generated income, but the average of the income estimated using the imputation prices and for a range of the share of income variable, the profit rate r. For the values reported in the table the profit-rate interval goes from 02 to 0.45.

Figure 2

VFZ-technological frontier (2001)
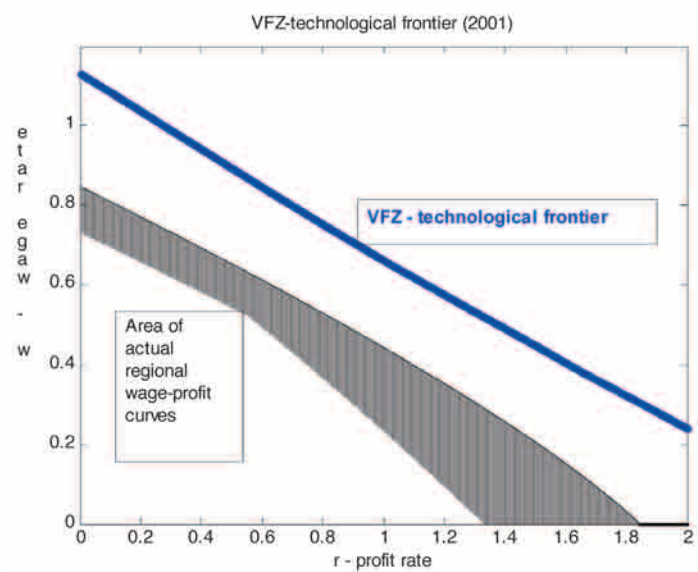
4. Empirical analysis
4.1. *The technological frontiers*

Figures 1, 2 and 3 show the VFZ-*technological frontier* and the area of actual regional *wage-profit curves*. The distance between the VFZ-technological frontier and the actual wage-profit curves is noticeable. This indicates that there is plenty of room for possible technological improvement.

Figure 3
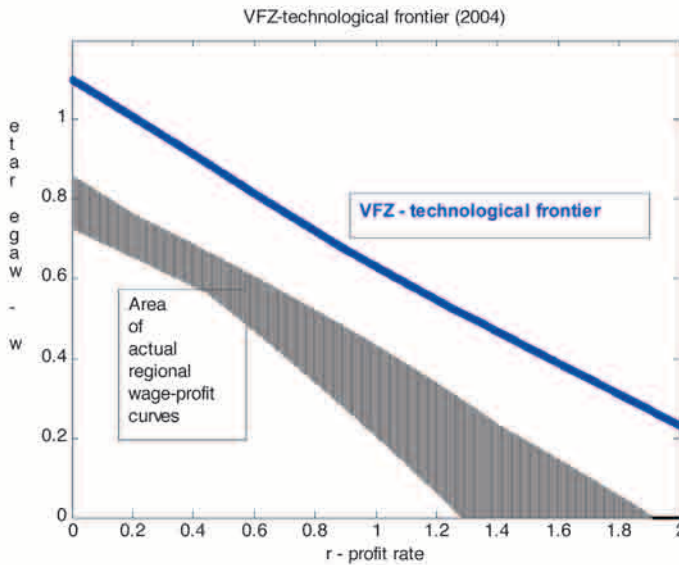
Tables 1-2 report the contributions of the different regions to the 2001 and 2004 VFZ-*technological frontiers*. The first row indicates the value of the rate of profit at switch points, while the other rows indicate the number of the regions that have the dominant technique in each industry. In each column, except the first, the number of the region in industry where the switch of methods occurs is in brackets.

There are two items of particular interest in the two technological frontiers. First, the large number of dominant techniques found in

Trentino. In 2001, Trentino had 10 dominant techniques out of 27 for profit rate values between 0 and 0.274. This number then gradually decreases for higher values of the rate of profit, but remains noteworthy. Secondly, a considerable number of dominant techniques have been found in Sicily and Campagnia, though these two regions were the worst in terms of aggregate productivity. Alternatively, one could also stress the low number of dominant techniques found in Emilia-Romagna and Veneto, despite the fact that these two regions were the best in terms of aggregate productivity (see Degasperi 2010).

A comparison between the two tables shows that there were only minor changes from 2001 to 2004. Practically, this means that if a region had the dominant technique in an industry in 2001, it had the dominant technique in the same industry in 2004.

We now observe the values of the profit rate at every point of change. What emerges is that the switch points are uniformly distributed along the spectrum of possible profit rates.

A comprehensive examination of the VFZ-technological frontier highlights two important aspects.

The first concerns the number of switch points and their distribution on the frontier. The switch points are less than those found in Fredholm and Zambelli (2009), both in the contemporary and inter-temporal frontiers. As the two authors note, the number of points increase with the number of available techniques and this explain the low number of switch points in this study.

The second aspect is that no region at a single point in time dominates the entire technological frontier. Hence, all regions could potentially gain through greater integration.

Tables 4 and 5 present the VFZ-*ranking numéraire*-free values for 2001 and 2004. The values are parametrized for the number of sectors. Consequently if a region dominates the entire technological frontier the absolute value would be 1.

Trentino is the region with the highest value both in 2001 and 2004 followed by Sicilia and Emilia Romagna.

There are no relevant differences between the two years examined. Campagnia moves up from the sixth to the fourth position of the ranking, while Lombardia and Tuscany loose one position.

Table 2 - Contemporary frontier - 2001 (The switch points are in brackets)

Industry / Rate of Profit	0.098	0.543	0.589	0.628	0.632	0.681	0.879	0.892	1.020	1.221	1.243	1.414	1.535	1.710	2.066	2.076	2.162	2.569
Agriculture and Fishing	4	4	4	4	4	4	4	4	4	4	4	4	4	4	(8)	8	8	8
Extraction of minerals	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Mfr. of Food, Beverages and Tobacco	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Mfr. of Textiles, Wearing Apparel, Leather	1	1	1	1	(2)	2	2	2	2	2	2	2	2	2	2	2	2	2
Mfr. of Wood and Wood Products	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Mfr. of Paper Products, Printing and Publishing	7	7	(2)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Mfr. of Refined Petroleum	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mfr. of Chemicals and Man-Made Fibers Etc.	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Mfr. of Rubber and Plastic Products	8	8	8	(6)	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Mfr. of Other Non Metallic Mineral Products	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	(6)
Mfr. And Processing of Basic Metals	8	8	8	8	8	8	(2)	2	2	2	2	2	2	2	2	2	2	2
Mfr. of Machinery and Equipment n.e.c.	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Mfr. of Electrical and Optical Equipment	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mfr. of Transport Equipment	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mfr. of Furniture, Mfr. n.e.c	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Electricity, Gas and Water Supply	5	(4)	4	4	4	4	4	4	4	4	4	4	(6)	6	6	6	6	6
Construction	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wholesale and Retail Trade	4	4	4	4	4	4	4	4	(3)	4	4	(1)	4	4	4	4	4	4
Hotels and Restaurants	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Transport, Post and Telecommunications	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Financial Intermediation, Insurance	2	1	1	1	1	(1)	1	1	1	1	1	1	1	1	1	1	1	1
Computer, Research and Development, Consultancy	2	2	2	2	2	2	2	2	2	2	2	2	2	(6)	6	6	6	6
Public Administration	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Education	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	(6)	6	6
Health Care Activities Etc.	6	6	6	6	6	6	6	6	6	6	(1)	1	1	1	1	1	1	1
Other Service Activities	1	1	1	1	1	1	1	(2)	2	2	2	2	2	2	2	2	2	2
Renting of Machinery	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	(3)	3

Trentino=1; Sicily=2; Piedmont=3; Lombardy= 4; Veneto=5; Campagnia=6; Emilia Romagna =7; Toscana=8.

Table 4 - VFZ-*ranking:* index of relative economic performance – 2001

Position	Region	Value
1	Trentino	0.4958
2	Sicily	0.3898
3	Emilia – Romagna	0.3499
4	Tuscany	0.3233
5	Lombardy	0.3151
6	Campagnia	0.3127
7	Piedmont	0.2721
8	Veneto	0.2591

Table 5 - VFZ-*ranking*: index of relative economic performance – 2004

Position	Region	Value
1	Trentino	0.4818
2	Sicily	0.4073
3	Emilia – Romagna	0.3561
4	Campagnia	0.3367
5	Tuscany	0.3107
6	Lombardy	0.3034
7	Piedmont	0.2671
8	Veneto	0.2548

Tables 6 and 7 contain the values of VFZ-*index.* It is a measurement of the distance the VFZ-technological frontier and the actual regional wage-profit curves.

5. Conclusive remarks

This paper makes an attempt to measure technological progress from the information embedded in regional input-output tables. We select information from 8 Italian regions, 2001 and 2004.

The measurements of productivity presented here are also standard elaborations based on a particular notion of imputation prices. Using these prices we have computed a measurement of productivity which is based on the notion of net national product. Table 1 reports these

computations which are straight forward calculations and do not measure technological progress, but productivity. For the years 2001 and 2004 we see that Emilia Romagna has had the highest generation of net income per unit of employment and that Sicily and Campagnia are respectively penultimate and last. While the Trentino has moved up from 3rd position to 2nd, and the Veneto from 4th to 3rd, Piedmont from 6th to 5th, Lombardy has dropped from 2nd to 4th, Tuscany from 5th to 6th.

Table 6 - VFZ-*index* - 2001

Position	Region	Value
1	Trentino	0.6332
2	Sicily	0.5776
3	Tuscany	0.5626
4	Emilia Romagna	0.5527
5	Veneto	0.5465
6	Piedmont	0.5351
7	Campagnia	0.5211
8	Lombardy	0.4890

Table 7 - VFZ-*index* - 2004

Position	Region	Value
1	Trentino	0.6153
2	Sicily	0.5842
3	Emilia Romagna	0.5551
4	Tuscany	0.5484
5	Piedmont	0.5333
6	Veneto	0.5281
7	Campagnia	0.5259
8	Lombardy	0.4636

Campagnia has a productivity measure which is almost 20% less and Sicily is around 10% below the productivity level of Emilia Romagna. For these two regions these numbers are a matter of concern especially when one considers the low level of employment of these two regions.

We think that one has to distinguish between the actual labor productivity and the level of technological backwardness and

forwardness Labor productivity can be the result of a complex set of causes that may have little to do with actual technological progress, but can be determined by policy, a particular choice of activity levels, and the particular infrastructure. Clearly, in the case of heterogeneous production the economic efficiency of the individual methods of productions do depend on the structure and on the interdependence with the other sectors.

Here we propose the VFZ-*technological frontier* (see Fredholm and Zambelli. 2009, Zambelli and Fredholm. 2010) as a benchmark against which to measure actual and potential technological forwardness or backwardness of an economic region. Using this concept we have defined (following Zambelli and Fredholm, 2010) two indicators of technological progress, the VFZ-*ranking* and the VFZ-*index*. These measures are independent of the activity levels and are independent of scale.

Using the information of the VFZ-*ranking* we are able to give a measure of relative performance in terms of regional technological progress. This indicator expresses the degree in which a method of production, relative to a specific region, is leading with respect to the other regions. Tables 4 and 5 give these rankings. A 'winner' seems to be the Trentino. The second position of Sicily seems, at first, to be surprising. In terms of the labour productivity of Table 1, Sicily was performing very poorly, but here it is performing well. Our result indicates that Sicily has high potentials for growth and hence the low productivity performance is not to be attributed to technological backwardness, but to other factors. Also the case of Campagnia is a similar one. Campagnia is the lowest in terms of actual productivity, but 4th in terms of the forwardness of some of the sectors. Equally surprising is the performance of the Veneto and Lombardy regions. Our results indicate that these regions have sectoral aggregated production methods that are not advanced. Contrary with respect to Sicily and Campagnia these two regions have high actual productivity. This indicates that, ceteris paribus, these two regions have lower potential for growth with respect to that of other regions. The situation of both the Trentino and Emilia Romagna seem to be particularly favourable. Their good performances and their position in terms of the VFZ-rankings indicate that there potentials have, up to a degree, been exploited and that their sectors can constitute an engine for further development.

While the VFZ-ranking is a measurement of relative performance the VFZ-*index* does measure the distance in terms of the technological progress between the actual regional positions and the potential captured by the VFZ-*technological frontier*. Please note that our measure is independent of the production level, the actual employment levels and the actual market prices, but it depends almost exclusively on the specific regional methods of production that are used to generate a 'global' measure. This is in a way the strength of our approach. This allows us to compare economies with different scales and is independent of contingent short run market factors. When comparing the results of the VFZ-*index* we have some surprising results. From Tables 6 and 7 we see that all the regions are very far from the potential expressed by the VFZ-*technological frontier*. The maximum value would be 1 and all the regions are a little above 50%. This is also clear from Figures 2 and 3. The details of the measure indicate leadership of the Trentino and second position for Sicily and indicate a problematic state of Veneto, Campagnia and Lombardy.

Clearly the results presented here have to be interpreted and compared with the results and data of other studies. We leave this task to those that might be better qualified to do so. What we want to stress is that the tools we have presented (the VFZ-*technological frontier*, the VFZ-*ranking* and the VFZ-i*ndex*) may be used to shed light on the actual forwardness and/or backwardness of a region. In particular our results indicate (see Table 1) that on one hand Emilia Romagna, Lombardy, Trentino and Veneto have an actual structure of production that allows a relative high production per worker, but on the other hand (see Tables 3 to 7) the reading of our indices indicate that the Trentino, Sicily Emilia Romagna and Tuscany have the highest embodied technological progress.

When we intersect the two sets of observations it turns out that it is only Emilia Romagna and the Trentino that have both the characteristics of exhibiting a high level of actual productivity per worker and have at the same time a high level of embodied technological progress.

Whether the results presented here allow us to claim that we observe an Emilia Romagna/Trentino model which is superior with respect to the Veneto/Lombardy model is quite another matter. Further studies on this issue would have to be made.

Surely our data indicates interesting directions for research and require further interpretations.

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MONEY, INFLATION AND THE FINANCIAL CRISIS IN EUROPE

Abstract

The aim of the present paper is to clarify the relationship between the growth of the monetary base and the growth of the supply of money and to formulate a more thorough concept of inflation through an analysis of the monetary policy conducted by the European Central Bank during the economic and financial crisis in the years 2007 - 2008.

To this end it is necessary to investigate the effects of the expansionary policy undertaken before and during the crisis in order to achieve the recovery of the economy, but unable to promote growth of real income and employment, while entailing the rise in asset prices and the formation of financial bubbles.

In the course of this analysis it may be possible to achieve a more appropriate definition of the elements characterizing the phenomenon of inflation so to define a new and more thorough concept of inflation, which focuses not only on the prices of consumer goods and services, but also on the prices of real and financial assets.

The outcome of this analysis allows to point out the shortcomings of the strategies adopted in the recent past in the light of the financial crisis in Europe, the difficulties which hinder the definition of an "exit strategy" from the crisis and the need to build a more efficient operational framework of monetary policy aimed to plan and implement a preventive control of monetary and financial stability, rather than to operate a difficult rescue of a crumbling financial system.

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1. Introduction

The world financial crisis developed since August 2007 may lead to a substantial revision of the goals and possibilities of monetary policy as well as of its structure, strategies and operational framework. In fact, the prolonged and excessively expansionary policy, conducted in the preceding years and conceived in order to fight the state of stagnation and depression wherein has evolved the economy of the western world in the first years of the present century, seems undoubtedly one of the factors placed at the root of the crisis.

In a state of economic depression, the huge amount of liquidity created by the central banks, nominal interest rates at an historically minimum level, zero or even negative real short term rates constitute a powerful inducement to indebtedness and to speculative investments, while productive investments are hindered by the existence of unused productive capacity and low profit prospects[1].

The growing inequality of income distribution which we can observe in many advanced countries, owing to a declining public intervention in the economy and to the operation of an unregulated market mechanism and the growing share of national income accruing to higher income receivers (who have a low propensity to consume) probably contributes to depress private demand for consumption goods and services and to entail the stagnation of the economy in these countries. More than by an increase in disposable incomes, the increase in private consumption, in the last years preceding the crisis, has been supported by an increase in the propensity to consume and by the growth of private indebtedness.

But the growth of private indebtedness, which is physiological in periods of economic expansion and growth (when, on the contrary, public indebtedness should decline) appears somewhat pathological in the last few years, because it happened not in the framework of an expansion in the real economy, but in the framework of low real growth or substantial stagnation and has been mainly promoted by financial innovations and speculative operations.

[1] In the United States the real federal funds rate remained below 1% from mid 2001 to the end of 2005 and even negative in much of this period., while in Europe in the same period the European Central Bank held real short-term interest rates below 1%. In Japan real short-term interest rates fluctuated between 0 and 1% in the last ten years.

Securitization of various kinds of loans has acted as a true multiplier of private indebtedness. The buyers of securities issued by the Special Purpose Vehicles (SPVs) have financed their purchases by the issue of new securities or by borrowing from banks and other financial institutions. The mountain of private debt has been growing at an ever faster rate but the great increase in the outstanding stock of securities has brought out an unavoidable reduction of their quality.

The agencies if rating have not rightly evaluated the risk of many securities not having a true market value.

In the framework of this general economic situation, the aim of the present paper is to review the strategy of monetary policy conducted by the European Central Bank in the years 2007 - 2008 with the primary target to control inflation and the secondary one to promote recovery in a depressed economy. In the course of the analysis it will be necessary to investigate the proper role of money and of monetary aggregates in the framework of an expansionary monetary policy, the relationship between the supply of money and the monetary base and to achieve a more appropriate definition of the elements characterizing the phenomenon of inflation so to define a new and more thorough concept of inflation.

The outcome of this analysis allows to point out the shortcomings of the strategies adopted in the recent past in the light of the financial crisis in Europe and the need to build a more efficient strategy of monetary policy aimed to plan and implement a preventive control of monetary and financial stability, rather than to operate a difficult rescue of a crumbling financial system.

2. Monetary Policy Operations and the Supply of Money

Monetary policy operations, carried out by Central Banks as open market operations, or performed on demand of counterparties using marginal lending and deposit facilities, influence directly the amount of reserves held by the banking systems with their National Central Banks - which are the main component of the monetary base M_O (composed by currency and bank reserves with the Central Banks) - but not the supply of money.

When monetary policy operations occur, the supply of money, as measured by the money aggregates M1, M2 or M3[2] can increase only as a consequence of further operations carried out by credit institutions, which lend a part of the reserves borrowed from the Central Banks to business firms, nonfinancial corporations or households, thereby increasing their current bank accounts or the amount of currency in circulation.

Instead, if credit institutions maintain in their reserve or deposit accounts with the Central Banks the funds obtained through open market or marginal lending operations, only an increase in the monetary base occurs, while the supply of money does not increase.

Because a great part of interbank transactions, as well as bank transactions with Governments which hold their accounts with Central Banks, are settled in monetary base, the amount of this base and its velocity of circulation can greatly influence short term interest rates and the prices of assets traded by banks, even without an appreciable increase in the supply of money, while the supply of money influences the prices of real consumer and investment goods and services bought by business firms or households.

The effects of monetary policy operations on the monetary aggregates, as well as on the amount of other financial assets owned by the private sector of the economy and on the level of total private demand for real consumption and investment goods and services are produced when the banking system extends its loans to business firms and households. The reference monetary aggregates (M1, M2 o M3) can increase only when there is an increase in currency in circulations or in the bank deposits of nonfinancial firms and households with the banking system. This outcome requires, after the settlement of monetary policy operations concluded with the central bank, further operations performed on impulse and with the participation of counterparties which afford loans or deliver currency to non-financial firms and households.

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[2] The European Central Bank defines three concepts of money: a narrow aggregate M1, an intermediate one M2 and a broad one M3, differing with regard to the degree of liquidity of the assets they include. M1 is defined as the sum of currency in circulation (banknotes and coins) and overnight deposits; M2 comprises M1 and deposits with an agreed maturity of up to two years or redeemable at a period of notice of up to three months; M3 comprises M2, repurchase agreements, money market fund shares and debt securities with a maturity of up to two years (including money market paper). See: European Central Bank (2004), pp. 36-38.

So it may happen that even in case of a great amount of lending of monetary base to the banking system the supply of money, during a downturn of the business cycle does not increase sensibly, being very low the demand for credit by nonfinancial firms and households. This demand can rise when it appears a better outlook of the conditions of the economic system and there is the risk that a great part of the monetary base previously accumulated becomes money: in this case a rapid and strong increase in the supply of money can increase the rate of inflation.

Therefore, there is no direct or constant relationship between the amount of the monetary base and the supply of money and the former may undergo great variations while no such variations are observed in the latter. So happened in the euro area in autumn 2008 when, notwithstanding a very high increase in the monetary base trough open market operations and marginal lending the increase in the supply of money was very small.

Table 1 - Evolution of money aggregates M1 and M3 from April to December 2007

Month	Outstanding Amounts (billions euro)		Ratio% M1 / M3	% Growth Rates on the corresponding Month of the preceding Year	
	M1	M3		M1	M3
April	3.740,10	8.036,90	46,5	6,0	10,3
May	3.768,70	8.113,90	46,4	5,9	10,6
June	3.784,40	8.183,00	46,2	6,1	10,9
July	3.809,30	8.296,60	45,9	7,0	11,7
August	3.823,50	8.344,10	45,8	6,7	11,5
September	3.821,20	8.398,00	45,5	6,1	11,3
October	3.836,20	8.530,40	45,0	6,4	12,3
November	3.859,70	8.620,30	44,8	6,3	12,3
December	3.826,50	8.642,20	44,3	4,0	11,5

In analyzing the growth of money supply in the euro area, as is evident from Table 1, we note a sustained growth in the first half of year 2007. In only four months, from April to August, M3, which is the reference aggregate for the monetary policy of the ECB, rises by more than 300 billion euro.

In the second half of the year the rate of growth of M3 becomes even greater and achieves its maximum value of 12,3% in the months of October and November.

Very high is also the rate of growth of aggregate M1, which is the more liquid component of M3. But, as we note from Table 1, the rate of growth of M3 is sensibly higher than the rate of M1, so that the share of M1 in M3 tends to decrease over time.

Quite different is the development of the money supply during year 2008 and in the first and second quarter of 2009; a constant reduction in the rate of growth is portrayed in Table 2.

Table 2 - Evolution of M3 in years 2008 and 2009

	Year 2008				Year 2009		
Month	M3	Growth rates% over corresponding period of the preceding year		M3	Growth rates% over corresponding period of the preceding year		
		Monthly	Quarterly average			Monthly	Quarterly average
January	8.782,5	11,5	11,4	9.399,8		5,9	6,4
February	8.828,5	11,3	10,9	9.442,1		5,8	5,6
March	8.857,1	9,9	10,5	9.396,8		5,0	5,2
April	8.943,3	10,3	10,1	9.476,6		4,9	4,6
May	8.995,3	10,0	10,0	9.410,7		3,8	4,1
June	9.022,1	9,6	9,6	9.424,8		3,6	3,4
July	9.100,5	9,2	9,2	9.428,8		3,0	3,1
August	9.157,4	8,8	8,9	9.436,6		2,6	2,5
September	9.227,5	8,7	8,7	9.415,6		1,8	1,6
October	9.369,8	8,6	8,3	9.399,2		0,3	0,6
November	9.363,8	7,7	7,9	9.339,7		- 0,2	
December	9.385,7	7,5	7,0				

The average quarterly rate of growth of M3, which was 9,2% in July 2008, decreases to 7,0% in the following month of December, to 4,5% in April 2009 and to 3,7% in May 2009.

In this last month, therefore, the growth rate of M3, for the first time after many years, decreases under the level fixed as its reference value from the beginning of the operation of the Eurosystem, namely an annual rate of 4,50%.

In the fourth quarter of 2008, despite the huge amount of monetary base provided by the Eurosystem, the quantity of money as measured by aggregate M3 does not increase, but, on the contrary, undergoes a small reduction in November, while there is a great increase in the amount of funds deposited by credit institutions on reserve and deposit accounts held with the respective National Central Banks. Therefore these funds maintain the nature of monetary base and do not become money.

Enormous and anomalous is the amount of overnight deposits held by credit institutions with the Eurosystem in the first months of 2009, reaching 238,5 billion euro in the reserve maintenance period ending on January 20, 2009, as can be seen in Table 3, especially considering that, in normal times, this amount fluctuates between 300 and 600 million euro only.

Table 3 - Overnight Deposits of Credit Institutions with the Eurosystem

Reserve Maintenance Period ending on	Deposits (Euro Billions)
January 20 2009	238,5
February 10 "	175,4
March 10 "	95,5
April 7 "	57,8
May 12 "	42,7
June 9 "	22,3

From the beginning of October till the end of December 2008 the liquidity supplied to the banking system through Long Term refinancing Operations (LTROs)– and still existing at the end of December – reached the huge amount of 583,4 billions euro while, in the same time, the money aggregate M3 grows only for 158,2 billion and at the end of November is 6 billion lower than at the end of October.

In the first and second quarter of year 2009 the amount of liquidity provided to the banking system of the euro area through longer term refinancing operations (LTROs) and existing on June 30 2009 has been 717,9 billion euro but, despite this enormous increase in the amount of liquidity, the amount of M3 in June 2009, as can be seen in Table 2, was only 39 billion higher than in December 2008, while the amount outstanding in the following month of July was only 62 billion higher than in December 2008.

The ratio between the increase in the monetary aggregate M3 and the increase in the monetary base MO, that is the marginal ratio dM3 / dMO, is an important variable in the analysis of monetary policy; it tends to decrease in the downturn and to increase in the upturn of the business cycle. In the last quarter of 2008 its value was approximately 0,27.

Divergent developments between the monetary base and the supply of money in the course of the financial crisis can be found also in the United States but the difference is lesser than in Europe. While from July 2008 to January 2010 the monetary base grew by about 865 billion dollars, the money supply, as measured by aggregate M2, grew from August 2008 to January 2009 by 528 billion[3]. Probably in the US a

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[3] Source: US Federal Reserve System. In the US M1 consists of (1) currency outside the U.S. Treasury, Federal Reserve Banks, and the vaults of depository institutions; (2) traveler's checks of nonbank issuers; (3) demand deposits at commercial banks (excluding those amounts held by depository institutions, the U.S. government, and foreign banks and official institutions) less cash items in the process of collection and Federal Reserve float; and (4) other checkable deposits (OCDs), consisting of negotiable order of withdrawal (NOW) and automatic transfer service (ATS) accounts at depository institutions, credit union share draft accounts, and demand deposits at thrift institutions. Seasonally adjusted M1 is constructed by summing currency, traveler's checks, demand deposits, and OCDs, each seasonally adjusted separately.
M2 consists of M1 plus (1) savings deposits (including money market deposit accounts); (2) small-denomination time deposits (time deposits in amounts of less than $100,000), less individual retirement account (IRA) and Keogh balances at depository institutions; and (3) balances in retail money market mutual funds, less IRA and Keogh balances at money market mutual funds. Seasonally adjusted M2 is constructed by summing savings deposits, small-denomination time deposits, and retail money funds, each seasonally adjusted separately, and adding this result to seasonally adjusted M1.

greater share of the monetary base passed from the financial network into the real economy, so becoming money.

3. Inflation and Inflation Targeting

A more accurate analysis of the inflationary phenomenon is deemed necessary in order to understand more exactly the various stages of the cyclical evolution of modern economies and to define and to utilize more exactly the various instruments of countercyclical policies.

Building the operational framework for the performance of their fundamental tasks , among which there is the maintenance of price stability, Central Banks adopt a measure of inflation always based on an Index of consumer prices.

 As is well known, the European Central Bank (ECB) has defined the concept of "price stability" as an annual increase of the Harmonised Index of Consumer Prices (HICP) for the countries of the euro area lower but close to 2% over the medium term[4].

Also other Central Banks, such as the Bank of England, the Central Bank of Sweden (Sveriges Riksbank), the Reserve Bank of Australia, the Reserve Bank of New Zealand have set as fundamental target of their monetary policies the stability of prices measured by an index of consumer prices, giving lesser importance to the increase of other kinds of prices that occurs during an inflationary process.

On some of these other prices it would be necessary to draw the attention of policymakers. In particular it must be noted the importance of the following ones:
- Prices of financial assets traded in the Stock Exchange and especially equity prices;
- Prices of land and housing;
- Prices of precious metals and especially of gold and, of lesser importance, prices of silver and platinum.

In a intermediate position between prices of assets and prices of consumer goods and services we find wholesale prices of some raw materials of agricultural or mineral nature and in particular prices of

[4] The HICP for the euro area is a weighted average of the National Harmonised Indexes of the Countries of the area, the weights being defined by the proportion of the value of the consumption of households in each Country on the total consumption of households in the area.

power sources which, differently from prices formerly quoted, tend to influence more directly the prices of consumer goods.

The evolution of prices of the three kinds of goods formerly defined, as well as that of prices of raw and auxiliary materials appear somewhat different from that of prices of consumption goods and services.

In fact the former prices, in the course of the business cycle, show much greater fluctuations than consumer prices and these fluctuations are, at the same time, cause and effect of the formation of speculative supply and demand movements, side by side with ordinary supply and demand functions.

So in the analysis of the movements of prices and production in the market for financial assets the effects of variations in the ordinary supply and demand functions should be distinguished from those of speculative ones.

Only if speculative supply and demand remain low (generally no more than 10% to 15% of total supply and demand) and formulated by a small number of operators can speculation perform its useful function to afford thickness and liquidity to markets and to stabilize prices and production of assets.

But this is not an equilibrium position; expected profits from speculative activity draw more and more operators to speculation so that the prices of assets become determined mainly by speculative operations.

With the present work we intend draw the attention on the effects of an expansionary monetary policy, undertaken in a period of stagnation or recession of the economy in order to promote recovery, but unable to achieve this target owing to a too low inducement to undertake real investments on the part of private entrepreneurs which face a vast amount of unused productive capacity. In fact, at the same time, this policy, owing to the presence of low nominal and real interest rates and a vast amount of liquidity tend to promote many kinds of financial investments, even of a speculative nature, which entail a rise in the prices of assets and goods formerly indicated, without sensible effects on prices of consumption goods and services and hence on the rate of conventional inflation and official inflation targets.

Therefore, it seems that we need a more thorough concept of inflation: a concept which focuses not only consumer prices, but also

other important prices such those of financial assets and real estate; a concept which lays the foundations for a policy aiming to control not only the quantity of money, but also the quantity of monetary base.

While it would not be necessary to set also for the growth of the monetary base a "reference value" similar to that one set for monetary aggregate M3, it would be very useful a continuous monitoring and control of the outstanding monetary base, especially in time of rising prices of financial assets and real estate.

4. Facing the Financial Crisis

The need for a revision of the proper role of money in the framework of a macroeconomic analysis and for   the adoption of an extended theory of inflation appear in full evidence in the light of what happened in the climax of the financial crisis of 2007 - 2008 and of the policy interventions of Central Banks and Governments to face the crisis.

On September 15 2008 the bankruptcy of the great investment bank Lehman Brothers gave rise to a global loss of confidence on the financial markets.

A growing number of financial institutions were facing the risk of default.

In this situation a strong pressure was quickly exerted on Governments and Central Banks to run to the rescue of a collapsing world financial system.

In Europe the crisis was faced by the European Central Bank, first of all, with four fine tuning refinancing open market operations performed between September 15 and 24 for a total amount of 165 billion euro, at a minimum bid rate of 4,25% and a weighted average rate between 4,35% and 4,40%[5].

But it is only in the first half of the following month, in the two meetings of October 8 and 15, that the strategy of the ECB undergoes a radical change.

This change of strategy implies not only a significant variation in the quantitative parameters of monetary policy, such as the official in-

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[4] For a general overview of the monetary policy conducted by the European Central Bank since the first appearance of the crisis see: European Central Bank (2009a), pp. 75-89.

terest rates and the amount of funds lent to the banking system through open market operations, but also a net change in the same structure of the operational framework of the ECB.

In the meeting of October 8 the Governing Council of the ECB reduced by 50 basis points, from 4,25% to 3,75%, the minimum bid rate on the Main Refinancing Operations (MROs) which is the main instrument of monetary policy.

For these operations and also for Longer-Term Refinancing Operations (LTROs) the method of the fixed rate tender has been adopted, the fixed rate corresponding to the minimum bid rate, at which total bid is allotted.

This modification of the operational framework, firstly foreseen until the end of the first reserve maintenance period of year 2009, has been successively extended until the end of this year. Since October 9 it has been reduced from 200 to 100 basis points the width of the "corridor" - resulting from the difference between the rate applied on marginal lending operations and that applied to banks' deposits with the National Central Banks - within which the overnight money market rates can fluctuate.

In the meeting held on October 15 the Governing Council of the ECB decided to extend the list of financial assets eligible as collateral in open market and marginal lending operations and their minimum rating was reduced from A - to BBB -. Yet, for "structured" securities, backed by underlying assets and generally deriving from securitisation operations (Asset Backed Securities or ABS), minimum rating has been maintained to the level A - and for new issued ABS to the level AAA.

The marketable assets added at the end of 2008 to the list of eligible collateral amounted to a volume of about euro 870 billion, namely about 7% of total amount of eligible marketable assets. A significant amount of non-marketable assets, mainly credit claims (bank loans) became eligible when the rating threshold was lowered to BBB, (European Central Bank 2009a, p. 82).

The ECB decided also to enhance longer-term refinancing since October 30 2008 and until the end of the first quarter of 2009 and to allot liquidity in US dollars to the European banking sector through a currency swap agreement arranged with the US Federal Reserve System.

A very important shift of policy was the introduction of fixed rate tender procedures with full allotment of total bid, so giving credit institutions the certainty to get all desired liquidity at a rate known in advance, which underwent a quick decline until May 2009.

This procedure, first applied to Main Refinancing Operations, was applied since 30 October 2008 also to Longer-Term Refinancing Operations, including the special term refinancing operations with a maturity of one maintenance period.

By this modification of the operational framework the policy rates, contrariwise to what before happened in open market operations, almost always settled with a not satisfied demand for funds, achieved equilibrium values, determined by equality between supply and demand for loans, so entailing a further approaching between policy and market interest rates.

This radical reorientation of strategy, which takes place in the fourth quarter of 2008, marks a substantial shift from the tightening to the expansionary stage of the monetary policy of the ECB.

The first effect of this shift in policy is the sensible increase in the liquidity provided to the banking system: while on October 7 2008, last day of the reserve maintenance period September-October 2008, the total supply of liquidity was 463 billion euro, between October 30 and December 31 2008 the supply of liquidity increases on average to 802 billion euro and reaches the maximum value of 860,7 billion at the end of the year (European Central Bank 2009a, p. 83).

But very clear is the beginning of a new policy in the field of interest rates.

A series of successive decisions has quickly reduced the minimum bid rates on Main Refinancing Operations (MROs) as can be seen in Table 5.

Table 4 - Variations of minimum bid rates of Main Refinancing Operations

Dates of decisions	Variations (basis points)
November 6, 2008	- 50
December 4, 2008	- 75
January 15, 2009	- 50
March 5, 2009	- 50
April 2, 2009	- 25
May 7, 2009	- 25

By the decision taken on 15 January 2009 the minimum bid rate on MROs returned to the level of 2%, that is the historical minimum reached in June 2003, while by the decision taken on 7 May 2009 the Governing Council set the new historical minimum at 1%.

The direct impact of decisions taken by the Governing Council of the ECB in the conditions of the open market operations has been very extraordinary and may be seen by comparing the outcomes of the two last MROs at variable rate tender and partial allotment, settled on 1 and 8 October 2008, with the outcomes of the first two MROs at fixed rate tender and full allotment settled on 15 and 22 October 2008.

Table 5 - Main Refinancing Operations (October 2008)

Date of Settlement	Bids (amount in EUR millions)	Allotment (amount in EUR millions)	Fixed Rate (in percentage per annum)	Weighted av. Rate (in percentage per annum)
1 October	228.012	190.000		4,96
8 October	271.271	250.000		4,99
15 October	310.412	310.412	3,75	
22 October	305.421	305.421	3,75	

Not only there is a sensible increase in the amount of funds lent to the banking system, but the interest rates applied to the two last operations are, respectively, 121 and 124 basis points lower than the rates applied on the two preceding operations.

Similar observations can be addressed about Longer-Term Refinancing Operations (LTRO) to the conditions practised in the operations performed from 9 to 30 October 2008.In the first of these, with partial allotment , 50.000 million euro were lent, which were 43,9% of total bids (113.793 million) at a weighted average rate of 5,57%, in the second operations the total amount of bids, 103.108 million has been allotted at a fixed rate of 3,75%, that is 182 basis points lower than the weighted average rate of the preceding operation.

These imposing expansionary measures entailed meaningful effects in market interest rates and on prices.

In the climax of the crisis, during September and October 2008, interest rates on the interbank markets reached very high levels, while there was a net reduction in the volume of trade and an increase of risk for lack of mutual trust in the solvency of counterparties.

This increase of counterparty- risk can be seen also by the increase of the spread between interest rates on unsecured interbank loans (EURIBOR) and rates on secured loans (EUREPO).

Reduction of official rates has soon influenced short term interest rates on the monetary market.

Table 6 - Short Term Rates on Interbank Money Markets
(May 2008 - July 2009)

Month	EONIA	EURIBOR 1 Month	EURIBOR 3 Months
May 2008	4,01	4,39	4,86
June	4,01	4,47	4,94
July	4,19	4,47	4,96
August	4,30	4,49	4,97
September	4,27	4,66	5,02
October	3,82	4,83	5,11
November	3,15	3,84	4,24
December	2,49	2,99	3,29
January 2009	1,81	2,14	2,46
February	1,26	1,63	1,94
March	1,06	1,27	1,64
April	0,84	1,01	1,42
May	0,78	0,88	1,28
June	0,70	0,91	1,23
July	0,36	0,61	0,97

The overnight rate EONIA, which reached the maximum level of 4,27% in September 2009, falls quickly in the following months and is below 1% in April 2009. The EURIBOR 3 months rate which in October 2008 reached the high level 5,11% goes down quickly after November and reaches in May 2009 the level of 1,28%, that is 383 basis points below the level reached in the preceding October.

Also the EURIBOR 1 month rate, which in October 2008 reached the level of 4,83%, falls to 1,01% in April 2009 and goes under 1% in the following May.

Particularly meaningful for its importance as a reference rate for mortgage loans is the EURIBOR 3 months rate. This rate reached the exceptional level of 5,11% on the average of October 2008, with a maximum of 5,39% on October 9, but quickly declined in the following months, reaching 1,28% in May 2009 and going under 1% in the following month of July.

But the crisis entailed also an extraordinary downfall in the rate of inflation, which partly offset the effects of the reduction of nominal interest rates on the level of real rates.

Table 7 - Growth Rates of the Harmonized Index of Consumer Prices (HICP) from July 2008 to August 2009

July	2008	4,0	January	2009	1,1
August	"	3,8	February	"	1,2
September	"	3,6	March	"	0,6
October	"	3,2	April	"	0,6
November	"	2,1	May	"	0,0
December	"	1,6	June	"	- 0,1
			July	"	- 0,7
			August	"	- 0,2

In the month of December 2008, after many years, the rate of inflation falls under the target value of 2% while, after June 2009, negative growth rates are signalling a situation of true deflation.

Table 8 - Retail Interest Rates (%)

Month	Bank Overdrafts	Consumer Credit (Over 5 years)	Lending for House purchase (Over 10 years)	Loans to Nonfinancial Corporations (Over 5 years)
April 2008	10,53	8,46	5,12	5,20
May	10,57	8,44	5,13	5,25
June	10,63	8,44	5,20	5,43
July	10,65	8,58	5,34	5,53
August	10,75	8,69	5,27	5,49
September	10,80	8,70	5,37	5,64
October	10,83	8,69	5,37	5,57
November	10,78	8,69	5,28	5,41
December	10,46	8,39	5,13	5,32
January 2009	10,13	8.63	5,00	5,24
February	10,14	8,49	4,89	4,96
March	9,94	8,31	4,72	4,75
April	9,71	8,27	4,67	4,60
May	9,62	8,17	4,58	4,52
June	9,54	8,03	4,58	4,49
July	9,31	8,04	4,54	4,32

However, the rapid and strong reduction of short-term interbank interest rates did not entail a parallel reduction in long-term rates, neither a reduction in retail rates, which mostly influence the economic situation of households and firms. As we see from Table 8, also retail rates were somewhat reduced, but this reduction is not comparable with that one of interbank rates.

Generally speaking, retail bank rates applied to loans accorded to households and nonfinancial firms follow the variations in wholesale money market rates (in the euro area EURIBOR rates) which measure the marginal cost of funding by banks, but often with a certain slowness[6].

The financial crisis and the outlook of a downturn in the world economy entailed an increase in the default risk of enterprises and a meaningful tightening of terms and conditions for obtaining bank loans. The increase in risk-premiums causing a further slowing down in the process of adjustments of retail rates to the decrease of interbank rates[7].

So it has been observed that "As the economy gradually improves, banks' capital bases are reinforced and their risk-taking behaviour normalises, it will be essential for banks to increase their lending activity" (European Central Bank 2009b, p.105).

Furthermore, it must be observed that, owing to the quick and strong reduction in the rate of inflation - very near to zero in the euro area in the first and second quarter of 2009 - real short term interest rates did not follow a parallel reduction to that of nominal rates, so reducing the expansionary effect of the policy implemented by the ECB, while real medium and long term rates often did not decline at all and sometimes even increased.

The allotment of liquidity remained very high during the first and second quarter of 2009. when in the weekly MROs are presented bids always higher than 200 billion euro and sometimes, as in the operations settled on June 10 and 17, higher than 300 billion, wholly allotted at a fixed rate which, since 13 May 2009, is at the minimum historical level of 1%.

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[6] For a general overview of the monetary policy conducted by the European Central Bank since the first appearance of the crisis see: European Central Bank (2009a), pp. 75-89.

[7] Sometimes the increase in the spreads applied to loans accorded to customers has, at least partly, offset the reduction in the EURIBOR rates.

But even more significant is the allotment of liquidity through Longer-Term Refinancing Operations (LTROs) at the same fixed interest rate applied to MROs, with the same criterion of full allotment of total bid applied not only to ordinary monthly LTROs with a maturity of 3 months, but also to similar operations with a 6 months maturity, while on 25 June has been settled an extraordinary LTRO with a maturity of one year, and an allotment of more than 442 billion euro, to which participated 1121 counterparties.

Since the liquidity shortage has been more acute on longer maturities of the money market, the ECB has further enhanced the role of LTROs - already enlarged in the months immediately preceding the burst of the crisis, in comparison to the role of MROs - by lengthening the maturities of the operations and increasing the amount of liquidity allotted through LTROs.

By means of these operations, the monetary policy of the ECB has been able to improve the general economic situation of credit institutions and to partly overcome the difficulties encountered by them on the interbank money market, particularly relevant because the crisis was displayed first of all with an increase in interest rates and a reduction of the volume of exchanges on this market.

Yet, clearly, if for a long time a strategy aiming to satisfy completely total bid at a fixed interest rate is performed by the ECB through open market operations there is a risk that credit institutions may abandon, at least for loans with short maturities, the interbank money market, when on this market interest rates become consistently higher than the fixed rate offered by the ECB. Given the importance of a smooth functioning of the interbank money market for an efficient distribution of liquidity among the various sectors of the European economy, it should be necessary to reintroduce quickly the preceding system of variable rate tenders with partial allotment.

Less effective has been the policy of credit support to the banking system in order to expand the volume of bank loans to nonfinancial corporations and households. Only in part this increase has been realized and often there has been no increase at all. So the expansionary impact of this policy on the economic system as a whole has been reduced. Clearly this policy cannot produce an expansionary effect similar

to the effect of traditional fiscal policy which acts directly on the level of total demand for goods and services.

5. Some teachings that may be drawn from the crisis

The world economic and financial crisis of 2007-2008 should induce a certain revision in the foundations of the traditional theory of inflation.

It may be questioned, of course, if the inflationary phenomenon can be entirely and exactly defined by reference to an index of consumer prices, or, better, if Central Banks should not attempt to overview also the level and growth of other prices, very important for the economy of a country, but different from consumer prices, such as the prices of financial assets, or housing.

The problem of the inclusion of prices of financial assets in a price index apt to measure the rate of inflation was discussed many years ago, but the prevailing orientation of economists was negative.

In his important book *The Art of Central Banking*, first published in 1932, R.G. Hawtrey, answering to the question whether the prices of financial assets should be considered, side by side to the prices of consumer goods and services, in order to calculate the rate of inflation, observes: *securities are not really objects of expenditure at all. The true objects of expenditure are the capital goods over which the securities confer rights. The investment market is an intermediary between the outlay of investors on the one side and the production of capital goods on the other.*

When an investor buys securities he pays their price to the seller. But the money is not by that transaction spent, it is simply passed on to await investment in the hands of the new owner. It may pass repeatedly from hand to hand and still be in the same condition. Bur as soon as it is applied to the purchase of a new capital issue, it really is spent on the creation of fixed capital (Hawtrey, 1932).

The economic features of the stock markets are very different from those of the markets for real consumer or investment goods and services. Quite different are the subjects who participate to the transactions and the objectives of their decisions. They are mainly markets for *stocks* and not for *flows*: only for transactions involving newly issued securities there can be a certain connection with demand and supply of real goods and services. As mainly markets for stocks they are more subject

to speculative operations and price fluctuations owing also to variations in the level of interest rates.

While on markets for consumption goods and services fluctuations in demand are often faced with adjustment in supply owing to depletion of stocks or use of unused productive capacity, which reduce fluctuations in prices, on the markets for real or financial assets the amount of supply can be considered generally fixed, at least in the short run, so that the equilibrium between supply and demand is nearly wholly determined by the rise or downfall of prices.

 Therefore transactions on asset markets generally do not reflect phenomena of economic production or consumption, and often neither indicate a transfer of ownership, because most transactions are reversed before maturity and only the balances between original and final prices are settled.

But if it would be wrong to include prices of financial assets in the index of prices of consumer goods and services, it would be equally wrong to ignore them totally in the definition and implementation of the strategies of monetary policy.

In fact, expansionary monetary policies, undertaken by central banks in period of economic stagnation or depression and justified also by the stability of prices of consumer goods and services may give rise, owing to low interest rates and the increase of liquidity of the banking system, not to an expansion of productive investments in the agricultural, industrial or service sectors of the economy, which prospect too low yields or losses owing to the presence of unused productive capacity, but to the financing of mergers, acquisitions, securitizations and other financial operations which cause strains of prices on the financial markets, on the housing markets or on the markets for precious metals and some raw materials, where more easily develop, by side to ordinary demand and supply, speculative operations undertaken in view to get profits in the form of capital gains.

Furthermore, bigger institutions created by such operations are often affected by diseconomies of scale caused by more difficult and costly internal controls, reduce the degree of competition in the financial markets and raise the level of systemic risk, because many other institutions are exposed to them.

With very low interest rates banks and other financial institutions, looking for higher profits, are often induced to undertake a too high number of risky investments, so enhancing the overall level of risk taking in the economy.

Often, in the framework of an economic system with excess capacity, real investments induced by low interest rates are made in order not to increase production, but rather to activate labour-saving production processes, so reducing the employment of workers and consequently the level of private consumption and therefore exert a depressing and not an expanding effect on the real economy. Also many financial operations, such as mergers and acquisitions, often imply reduction in the number of dependent workers.

Moreover productive investments are often crowded out by an outlook of higher profits obtainable by speculative investments.

The increase of prices of financial assets even in periods of productive depression and low level of general inflation may be often considered partly an effect of an expansionary monetary policy, conducted by means of very low interest rates and strong increase in liquidity.

The low level of interest rates induces financial and nonfinancial institutions to increase indebtedness in order to finance the purchase of assets and produces a lengthening of the financial leverage of the banks and of other financial intermediaries whose debt sums up with the debt of the final users of credit and gives rise to a true "multiplier of the debt"

While speculation exerted in moderate measure and by a reduced number of dealers affords a beneficial effect on the economy, because confers thickness and liquidity to the markets and tends to stabilize price fluctuations, when a growing number of dealers is attracted by the prospect of profits and raise speculative supply and demand, it produces a destabilizing effect and increases the volatility of prices, now influenced more by speculative than by ordinary supply of and demand for assets.

The increase in the prices and in the ratios between prices and incomes of assets tend to reduce ordinary demand and stimulate ordinary supply so exercising an equilibrating function on the markets, but speculative supply and demand may act in opposite direction at least until

a certain level of prices. But if the increase proceeds for a certain time, some doubts can arise about the probability of further increase.

The attempts to realize through the sale of the assets, the conspicuous capital gains matured during the upturn tend to check the process of rising prices and frequently open the way to a downturn.

Often, in consequence of even small increases in official interest rates, decided by Central Banks in case of an outlook of rising inflation, the downfall in asset prices becomes quick and violent and is transmitted among the various sectors of the economy, especially between financial and housing markets and eventually entails the well known phenomenon of the burst of speculative bubbles and sometimes a general financial crisis that may be transmitted to the real economy[8].

The upturn and downturn of business fluctuations are emphasized by the procyclical rise and fall of default risks of firms and corporations, which decrease during the upturn and increase during the downturn.

 In correlation are going to be reduced or increased the prices of derivatives that cover such risks (credit default swaps or cds) so entailing an excessive inducement to risky investments in the expansive stage of the business cycle while such investments are discouraged during a depression, enhancing the fluctuations of total demand[9].

Some important and useful teachings should be drawn from the course of the world economic and financial crisis burst in the years 2007 and 2008, in particular the following ones:

1) A monetary policy whose strategic target is the maintenance of price stability, as measured by an index of consumer prices so to avoid a traditional inflation process or set a determined rate of inflation (Inflation Targeting) is no more satisfactory: it is now ne-

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[8] *Capital gains* may become real income only if timely realized by a few market operators, , but if new operators induced by profit expectations enter the market attempting to realize   the gains by selling their assets, the prices of assets decrease and capital gains also decrease or completely vanish; therefore, in many cases, capital gains may be compared to a mirage. On the connection between financial and housing markets and on the spreading of speculative bubbles see: Robert J. Shiller: Irrational Exuberance, Broadway Books, New York, 2009, p. 41.

[9] The procyclical profile of default risks, considered *ex post*, contributes to the idea of a general undervaluation or *underpricing* of risk, which has been frequently signalled after the burst of the recent economic crisis.

cessary to insure a certain stability also in other important prices, different from prices of consumption goods and services[10]

2) Consequently, during an economic depression or recession, it is necessary to be very cautious in the implementing an expansionary monetary policy, even if this policy seems to have no effect on the level of consumer prices. The rise in prices of financial assets and real estate, especially if substantial and continuous, even in case of stability of prices of consumer goods and services or a strong and continuous divergence between the rate of growth of prices of some kinds of real and financial assets and the rate of inflation - with a large (apparent) increase in the real value of assets - should rouse a serious concern in the Authorities in charge of monetary policy and should be considered a symptom of a probable building of speculative bubbles in the financial or real estate markets. Since the burst of the bubbles may entail serious and not always repairable damages to the economic system, it appears absolutely necessary to forestall the continuous growth and the burst of the bubbles.

3) The instruments of monetary policy, even if employed in massive quantities and through the implementation of non-standard operations, cannot perform a satisfactory management of the economic cycle or a rescue of the economy from the crisis. Furthermore, with nominal short-term interest rates near to zero, as is actually in the US, or near to 1% as in Europe, there is very little room for further rate reductions.

Owing to the decreasing marginal efficiency of the application of every economic policy instrument, a mix of different countercyclical measures, among others also fiscal policy measures, is clearly preferable to the implementation of only one kind of measures.

But in the recent crisis Government fiscal policy has been implemented in a fashion very different from the traditional fiscal measures aimed to promote the level of total demand for goods and services through increases in public spending and investments, because it has been employed mainly to rescue some banks and other financial in-

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[10] That monetary policy must enlarge its field of action and define a new range of reference values is an opinion now generally diffused; see: Bank for International Settlements (2009), pp. 153-54.

stitutions on the edge of collapse. So Government funds were directed to raise the capital stock of banks and financial institution with little effect on the level of total demand for goods and services and on the general economy.

6. Conclusive remarks

There is no direct relationship between the amount of liquidity provided by the Eurosystem to the banking system of the euro area and the amount of the money supply. The growth of the money supply depend on the behaviour of the banking system in the utilization of liquidity provided by the Eurosystem.

The financial crisis has shown that a great amount of liquidity, provided by the Eurosystem in order to foster the expansion of credit, has been used by the banks to settle interbank operations in monetary base or was deposited in their accounts with the Eurosystem. Very little growth of the money supply has been observed since the beginning of the crisis.

The actual concept of inflation, based on the variation of an index of consumer prices is no more satisfactory for conducting a monetary policy aiming to control the economic cycle through a countercyclical action. An expansionary monetary policy conducted in a period of economic depression and low inflation may not achieve the recovery of the real economy, while producing booms and busts in the financial sector. We need a new concept of inflation.

The banking system, receiving great amounts of liquidity from the Eurosystem at a very low rate of interest (presently 1%) even for maturity until one year, buys great amounts of low risk securities (especially government securities) which produce yields greater than 1% and so gets very high profits. More risky loans to non-financial corporations and households are discouraged and do not expand, as is shown in Table 9, but, on the contrary, are slightly reduced in the first half of year 2009.

Table 9 - Loans to non-financial corporations and households

Month	Corporations		Households	
	Outstanding amounts (EUR billions)	% growth rates	Outstanding amounts (EUR billions)	% growth rates
January 2009	4.884,6	9,0	4.898,9	1,2
February	4.880,0	7,8	4.899,2	0,7
March	4.848,3	6,3	4.889,6	0,4
April	4.840,8	5,2	4.888,1	0,0
May	4.827,3	4,4	4.887,2	- 0,2
June	4,789,6	2,8	4.891,2	0,2
July	4.764,5	1,6	4.892,7	0,0
August	4.766,5	0,7	4.900,3	- 0,2
September	4.751,5	- 0,2	4.909,9	- 0,3
October	4.730,4	- 1,2	4.918,9	- 0,1
November	4.721,5	- 1,9	4.935,5	0,5

For the corporations the amount of loans outstanding in November 2009 is about 163 billion smaller than the amount outstanding in January and the annual growth rates are always decreasing and becoming negative in September. For households the amount in August is only 1,4 billion grater than the amount in January while the growth rates are decreasing until April and becoming negative in May and again in August and September. Only in November there is a more sensible growth which bring the outstanding amount to a level higher by 36,6 billion euro than in January.

The strategy of monetary policy adopted by the European Central Bank seems unable to induce the banking system to expand credit to the private sector of the economy and so foster the recovery of the European economy.

Some kind of stabilization policy should be conducted also for other groups of prices most important for the economic system, especially the prices of financial assets and housing, in order to control and prevent excessive expansion of credit and the rising of speculative bubbles.

Quite apart from specific measures that may be taken to reinforce the financial stability of dealers or the regulation of some market transactions (such as limits to the ratio of bond issue to equity capital not only for credit institutions but also for other financial entities, such as Special Purpose Vehicles SPVs which constitute a true *shadow financial system*, the requirement of capital ratios growing more than in proportion with the bigness of the financial institutions, in order to face the growing systemic risk, or the setting of at least temporary rules aimed to forbid or limit short selling, or to transfer some *over the counter transactions* to regulated markets with a centrally established counterpart), the general management of monetary policy should be profoundly changed and should be directed not only to achieve the stability of consumer prices, but also to forestall the growth and burst of speculative bubbles and this implies a more cautious policy in the setting of official interest rates.

Often very low interest rates induce an excessive lengthening of the financial leverage with an unavoidable marginal worsening of credit quality.

This means that even an expansionary policy designed to contrast a state of recession or depression of the economy in the euro area, should not reduce real short term interest rates below a positive value which may be approximately determined in the range of 1,50% - 2%, in order to prevent or limit an excessive level of private indebtedness, financial leverages and speculative operations.

Also reserve requirements ratios of credit institutions could be raised in order to restrain the growth of private indebtedness and curtail excessive financial leverages[11].

A sharp distinction must be made between the growth in the monetary base and the growth in the supply of money. The first variable can grow even without a significant growth in the latter. So the size and the velocity of circulation of the monetary base can influence short- term interest rates and the prices of financial assets owing to the fact that a large part of interbank transactions are settled in monetary base, whi-

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[11] In order to restrain the growth of private indebtedness the manoeuvre of reserve requirements ratios seems preferable to the increase of bank capital ratios as foreseen by the Basel 3 Agreement, for while the former is a flexible instrument which can easily be reversed, the latter is a structural norm of the banking system which cannot easily be modified in the short run.

le the supply of money and the prices of real goods and services may show no meaningful variations.

The virtually unlimited granting of credit at very low nominal short-term interest rates by the Central Banks to the banking systems constitutes a powerful source of speculation and very easy profits for the banks, which can invest enormous sums in the purchase of government and private long term bonds and other low risk securities, so receiving   interest rates higher than those paid to the Central Banks, while very scarce resources are being   addressed by the banks to satisfy the credit needs of households and business firms.

The expansionary monetary policy implemented by Central Banks since the burst of the crisis, with policy nominal interest rates between zero and 1% and real rates even negative, seems more likely to entail the growth of speculative bubbles in the financial markets and in the markets for real estate, for commodities and for precious metals than to build a satisfactory "exit strategy" from the crisis and promote the recovery of real economies.

A real danger may follow from the implementation of this policy: the start of a process of depressionary inflation (stagflation), appearing more likely in the framework of a process of competitive devaluation of the main world currencies. This process can be welcome by governments and business firms because it reduces the real burden of public and private debts.

Therefore, a strategy of monetary policy aimed not to increase speculation and the profits of the banking systems but to achieve benefits for the general economy should be conducted by Central Banks by maintaining real short-term interest rates not   below a small but positive value.

But in order to achieve the recovery of the economy, monetary policy alone hardly can do the job. The *decreasing marginal efficiency shown by monetary policy when the use of monetary instruments is increased set a limit to the implementation of this policy.*

Through automatic stabilisers and discretionary stimulus countercyclical fiscal policy sustains income and employment, lowering the probability that borrowers will default, increasing the value of what is recovered if they do and raising the value of assets on financial institu-

tions' balance sheets. Monetary policy too acts countercyclically. Seeking to head off a cyclical downturn, policymakers lower policy rates and, in so doing, improve the state of financial institutions' balance sheets.

A more balanced approach in the planning and implementation of countercyclical public policies, namely monetary, fiscal and budget policies, may be more helpful to achieve a fast recovery of the world economy and to promote economic growth with price stability. But now stability should mean *stability not only of consumer prices, but also of prices of capital assets*.

Therefore, as has been recently noted, monetary policy must go further in the way to forestall financial and economic crises.

"Stabilising the financial system requires that Central Banks adopt a more activist stance, responding to booms in both credit and assets prices. The financial crisis has shown that it is too costly for central bankers to focus narrowly on inflation over relatively short horizons, with a view towards cleaning up the mess caused by bursting bubbles and collapsing credit after the fact. Monetary policymakers should expand their frameworks to make room for property prices, equity prices and amounts of debt outstanding. When they do make these adjustments they will be in a position to implement policies that lean against the wind, tightening interest rates when they see bubbles and balance sheet overextensions that raise systemic macroeconomic risks.

The expansion of the policy framework is aimed at adjusting the horizon over which policymakers achieve their goals. When asset price and credit booms start to develop they are unlikely to threaten the short – run stability of prices or real growth. In fact they may go hand in hand with a combination of low consumer price inflation and high growth. A boom in asset price or credit can easily be mistaken for an increase in the growth rate of productivity. It is important for policymakers to understand that higher growth and lower inflation today can create instability tomorrow, and policy frameworks must take this into account, When they see a boom in an asset price or in credit, policymakers need to lengthen their policy horizon. Such an approach would help to better achieve the goals of fiscal and monetary policy: after all, macroeconomic stability is built on the foundations of a stable financial system" (Bank for International Settlements 2009, p.136).

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Giordano Bruno[*]

UNCERTAINTY: THE SYSTEMIC THOUGHT OF BRUNO DE FINETTI

Abstract

This paper aims to deepen the contribution made by Bruno de Finetti to contemporary science.

His thought about evaluation of probability related to an event is strictly connected with the last development of new cognitive approach.

The purpose is to show how the problem of coherent assigning of probability to a family of events by an observer is related to the concept of "emergence", as it is considered in modern science.

1. Introduction

Based on principles according to which the microscope world is simpler than the macroscopic, and the macroscopic world can be expressed through precise knowledge of infinite details, the mechanistic scientific approach has been put in doubt by many questions like, for example the so-called "Three Body Problem" (Barrow-Green, 1996).

New cognitive approaches have been introduced based on the theoretical role of the observer, on non-linearity, on principles of uncertainty, on constructivism, on the systemic viewpoint and on emergence, to cite only a few.

Here I would like to point out how Bruno de Finetti's thought fits in perfectly with these types of approach; he is in fact a harbinger of

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them. I should like also to emphasize the essential of role of the one who evaluates probability, whom we shall call the observer.

Unlike objectivistic-type orientations, in particular those based on a strictly statistical vision of reality, Bruno de Finetti had in the last century, a fundamental intuition for which the evaluations of probability relating to an event, simply represent the degree of belief that a consistent individual has regarding the occurrence of that event. This degree of belief is determined on the basis of information that the individual possesses concerning that event and in this sense the individual plays the role of observer, as happens in the modern theory of complexity.

De Finetti taught us that the logic of uncertainty explores the realm of the possible, accepting the condition of being unsuitable for making predictions, but providing on the other hand the tools for assessing the probability of events, so as to be able to make forecasts and take decisions.

Traditionally the concept of probability has been considered a consequence of our ignorance, of our limitations. Similarly, the principles of uncertainty were considered by mechanistic thought a limit of our knowledge of infinite details.

Now however, we can consider probability as our instrument for describing nature.

The method de Finetti follows is based on the coherence of assigning probability to single events and families of single events.

Coherence is the essential instrument for evaluating probability and in particular, for updating the evaluation of an event when new (or supposed) information of becomes available.

2. De Finetti and his thought: insights on uncertainty

I propose to show how the problem of a coherent assigning of probability to a family of events by an observer is related to emergence in the way in which it is considered in modern science. I wish to remind readers that emergence (Corning, 2002; Minati and Pessa, 2002; Pessa, 1998, 2002), in this context, can be considered a process of forming new collective entities, (requiring a level of description different from that used for single elements), such as swarms, flocks, traffic, industrial districts, markets; collective effects, such as superconductivity, ferro-

magnetisim, laser effect. These are determined by consistent behavior (as perceived by an observer) of interacting components.

In reference to Anderson's cognitive model (1983), used by the observer, emergence can be seen as a dependent process only by the observer, considering that is, that collective proprieties emerge at a higher level (that is, at a more abstract level) respect to the one he used to deal with the components. The collective properties are noticed by the observer as new, depending on the cognitive model used for establishing consistency. But even more, de Finetti's subjective conception of probability is entirely constructed as a logically open cognitive system. In fact the observer (evaluator), aware of the context, plays an active role, moves within a non-objectivistic milieu, is oriented to the process, learns dynamically from experience inductively, is an integral part of the system and generates its existence, and can finally choose the rules to be used (Minati, 2004).

Starting from this last point I will illustrate what has been said. In assigning a measure of uncertainty to a family of events about which the truth value is not known, the observer can follow two paths, according to the context in which he finds himself (or which he chooses as point of reference).

The first consists of introducing a natural order into the events: in fact, if we suppose, as is legitimate, that one event compared with another, can be either more possible or less possible than it, or equally possible, he can easily construct a relationship of order of not less possible within the family of events examined.

This relationship has the following properties:

An uncertain E_h event in the family is always more possible than the impossible event and less possible than the certain event and is not less possible than itself.

If an E_h event is not less possible than E_k, then E_k cannot be not less possible than E_h unless E_h and E_k are not equally possible.

If an E_h event is not less possible than E_k and E_k than E_j, then E_h is not less possible than E_j.

If an E event is incompatible with E_k and with E_j and E_k is not less possible than Ej then the union of E and E_k becomes not less possible than the union of E with Ej.

In this way the observer introduces a qualitative measure of uncertainty into an event.

Note en passant that in the particular case where we are dealing with a partition of the certain event in cases thought to be equally possible, it follows that the qualitative order introduced is immediately translated into a quantitative measure of their uncertainty as a ratio of the number of favourable cases to the number of possible cases.

If, then a further property relating to conditional events is considered: E_h and E_k events imply E, then E_h/E is not less possible than E_k/E if E_h is not less possible than E_k;

its introduction together with the preceding makes it possible to develop qualitatively the whole theory of probability (de Finetti, 1937).

The second path is that in which the observer expresses his own degree of belief in the occurrence of an event by making a quantitative-type evaluation.

To act in this way a suitable measuring instrument is required. Bruno de Finetti proposed two equivalent measuring criteria: bets and penalties (de Finetti, 1974).

Let's look at betting which seems the most natural as it reflects even historically what happened in the construction of the theory of probability.

Supposing we have to wager a certain sum to win another should a specific event occur. This is what usually happens in all fields of betting.

So, placing a bet on an E event means that we are willing to pay a part of a certain sum S, which can be indicated with pS, to receive S if E occurs, and 0 if it doesn't.

If we introduce the function GE for gain, relating to that particular bet, we obtain the following :

$$G_E = \begin{cases} S-pS, & \text{if } E \text{ occurs} \\ -pS, & \text{if } E \text{ doesn't occur.} \end{cases} \quad \textbf{(1)}$$

Obviously, in betting each one of us aims at maximizing our gains, and this fact could lead us to make a distorted evaluation. How do we

protect ourselves, to prevent the betting instrument from becoming arbitrary and therefore ineffective for the purpose intended?

First of all it is necessary to ensure that who is betting pS to win S (from the other bettor) if E occurs, has, at the same time, to be prepared to pay S to receive pS if E occurs, that is, to exchange the terms of the bet with the other bettor; this will ensure that the evaluation the individual makes reflects his degree of belief without being influenced by the desire to win more, which could otherwise be won by the other. For example, let us suppose that in betting on E I think I can place 70 to win 100 should t E occur; I might consider increasing my hypothetical gain (in this case equal to 30), by declaring my willingness to pay 40. But if I am willing to exchange the betting quotients with the other bettor, then my hypothetical gain could go down considerably (-60)!

But that is not enough. It is necessary to ensure that the possible values of GE gain not be both of the same sign because only in this case would there be no certain win or loss, regardless of whether or not E occurred. Only in this case would an individual be willing to bet. De Finetti aptly called this condition coherence.

As is well known, coherence in betting on an E event leads to establishing that, if S is equal to 1, (but S≠1 is also true) in any case the p amount that an individual is willing to bet to receive 1 if E occurs, is always understood as being between 0 and 1. Furthermore, coherence requires that if E is certain then p must necessarily be equal to 1 and if E is impossible then p must necessarily be equal to 0. Note immediately however, that p=1 does not imply a certain E, nor does p=0 imply an impossible E (for further development see de Finetti, 1974).

Following de Finetti therefore the probability of an E event (or the numeric measure of uncertainty on E) is the p quotient that an individual is willing to pay in a consistent bet to receive 1 if E occurs, and otherwise 0.

The point is that a bet will be coherent only if the observer (individual) that evaluates the uncertainty over E makes it so.

There will exist therefore, regarding E, infinite coherent evaluations, as long as they are between 0 and 1.

How does the observer choose one? He will have to rely on the information he possesses regarding E and express this information in terms

of a number. Of course, the richer the information the fewer doubts he will have in choosing one number from an infinite range of numbers!

Now, in measuring the information an individual, as always, does not possess an objective evaluation criterion; his personal convictions, his mood, and all those characteristics contributing to the formation of a judgement will play a part in reaching a judgement. Therefore he has to formulate a judgement objectively only on the basis of what he has subjectively evaluated!

This is what de Finetti says in L'invenzione della verità (2006):

"Any kind of behaviour …in the sense of holding as plausible the occurrence of this or that event depends therefore only on a feeling, on that very feeling that must be presented as the true point of departure, and that some prefer instead to ignore and shyly conceal behind a barricade of logical, unnecessarily complicated devices which are empty."

Obviously in some cases everything is easier: for example, if an individual assesses as equally possible the occurrence of E and the occurrence of its opposite, E^c, and both are assigned a value of probability of ½ (but are we sure that assuming each of the two real events as equally probable is so easy and natural?). While if E were assessed as being five times as likely to occur as E^c, then E would be assigned a probability of 5/6 and Ec, a probability of 1/6.

In other cases, evaluations are based on the frequency they are observed, but only, as de Finetti says, when event E is part of a family of interchangeable events, that is, when the evaluation of the probability of any n-pla of events in the family under examination depends only on the number of fixed events and not on particular fixed events; in brief, it depends only on how many events and not on which events are being considered (de Finetti, 1974).

Let's take the example of a lottery where the balls are extracted (and then put back in) from a rotating drum or wire cage of an unknown composition, that is, in which the total number of balls is known but not the percentage of red balls. An individual who wanted to evaluate the probability of drawing a red ball at the nth extraction, when (n-1)/3 red balls out of (n-l), had already been drawn, could estimate as equal to (n-1)/3 the probability of the extraction of a red ball at the nth draw because the events of the family considered are exchangeable

(we are interested only in how many red balls are extracted). But if we wanted to know the chances of a certain boxer winning the 101th match of his career, knowing that he had won 85 of the previous 100 matches, would it suffice to assign a probability of 85/100? Obviously not, because, in the worst case, he may have lost the last 15 matches and the degree of belief in his prowess may have dropped.

So far, I have dealt with considerations relating to single events or families of similar events. However, we often run into random phenomena, describable in some cases using random numbers, as for example X number of fatal automobile accidents in a year involving people not wearing seat belts which can be considered (X=n)-type events. Or, we may be interested in more complex phenomena - events like: will the rainfall in a certain Italian city in the next year be greater than the previous year; or will the average humidity level be lower or the smog level higher, or fuel consumption the same?

In the first case, that of random numbers, it is possible to formulate different probabilistic models which allow us to evaluate the probability of any event related to it. But we must remember that these evaluations aren't as objective as they may seem because, given the model, it is enough to apply the formulas to obtain an evaluation; on the other hand it is always the observer who, on the basis of his own information, chooses the model he considers most suitable for describing the phenomenon under examination.

What happens, instead, in the second case?

Again, the systemic aspects of the framework adopted by de Finetti provide an exemplary answer.

Let's remember that the classical approach (commonly used in the applications) concerning a problematic, random phenomenon is formulated like this: first a Ω space of results or possible elementary cases is defined, or partition of certain events is constructed and then a probability is attributed to each one of these cases (or constituents) and since any event concerning that phenomenon can be obtained uniting the constituents, each one of them is assigned a probability in a linear way.

I should like to point out that the question of how to assign probabilities to the constituents remains an unsolved problem.

On the contrary, de Finetti bases his conception of the fact that each

event is single and for each one we can express our degree of belief by giving a qualitative or quantitative evaluation. If then, besides finding ourselves face to face with a single event and having to evaluate the probability of its occurrence, we also need to assign probabilities of the occurrence to further events, how should we behave?

Various cases may present themselves. If we are dealing with a family of E_j events which form a partition of the certain event, then to be coherent, the sum of the probabilities of E_j events must be equal to 1 and the probability of the union of incompatible n events must be equal to the sum of the single probabilities. If, furthermore, n events and their consistent probability attribution are given, then the probability of an event depending linearly on the first ns, is determined. On the other hand, in the cases in which there is a logical type of connection between the E_j events considered and a new E event, then, for consistency's sake, the following procedure should be used: the constituents concerning the given family are constructed (that is, all the possible intersections between events so as in each one, one of them, or the opposite, always appears; for example, $E_1 E_2 \ldots E^c_h E_{h+1} \ldots E_{n-1} E_n$), then two E' and E'' events, which are respectively the maximum event, the union of all the constituents involving E, and the minimum event, union of all the constituents involving E: necessarily the probability of E will have to have a range within the closed interval [P(E'), P(E'')].

Also in this situation therefore, the probability of E is not univocally determined; it can simply reduce the interval [0,1] within which the observer can evaluate it to be coherent.

But the most interesting situation arises when dealing with single events which are examined, beginning with the first and then moving on to the successive ones. On the basis of information he possesses, the observer assigns a consistent probability value, from 0 to 1, to each one of these. In this case however, there may remain logical connections between the events which have not been taken into account and about which information was gained only when all the events had been introduced. What can be done then to check that the overall evaluation is coherent?

Using the events examined, constituents will have to be constructed and since each of these events is the result of the union of some of the

constituents obtained, its probability must be equal to the sum of the probabilities (not yet determined, and therefore "unknown") of these constituents. Therefore a system of n equations in s ($\leq 2^n$) x_i unknowns, with $x_1 + x_2 + \ldots + x_s = 1$ e $x_i \geq 0$ constraints. If there is an s-pla solution of the system, then the evaluation given can be said to be coherent.

It is interesting to observe that the system might not allow for solutions; in this case the evaluation would not be coherent; the system might have only one solution but there could be several solutions, that is, a set of different evaluations, all coherent.

I would like to clarify this last interesting aspect with some examples.

Given three events, A, B and C, an observer has to evaluate their probability in the following way P(A)= 1/2, P(B) = 2/5, P(C) = 1/5

(obviously each one of these has been coherently evaluated)

Note then that ABC = ϕ (where ABC $\equiv$ A∩B∩C).

Then the possible constituents are:

$C_1 = A^cBC$, $C_2 = AB^cC$, $C_3 = ABC^c$, $C_4 = AB^cC^c$, $C_5 = A^cBC^c$, $C_6 = A^cB^cC$,

$C_7 = A^cB^cC^c$ (2)

To establish then whether, under the given conditions, the overall evaluation expressed in the tern P(A) = 1/2, P(B) = 2/5, P(C) = 1/5 is consistent, it is necessary to establish whether the following system allows for at least one solution:

$$\begin{cases} x_2 + x_3 + x_4 = 1/2 \\ x_1 + x_3 + x_5 = 2/5 \\ x_1 + x_2 + x_6 = 1/5 \\ x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 = 1 \\ x_i \geq 0, \, i = 1,\ldots,7 \end{cases} \quad (3)$$

If we say, as is legitimate, that $x_1 = 0$, $x_3 = 0$, $x_6 = 0$, the following solution of the system is obtained with simple calculations.

$$x_1 = 0, x_2 = 1/5, x_3 = 0, x_4 = 3/10, x_5 = 2/5, x_6 = 0, x_7 = 1/10$$

therefore the attributions of probability assigned to events A,B, C are an overall, coherent evaluation!

Note that had we said $x_1 = 0$, $x_3 = 0$, $x_6 = 0$, we would have obtained a different solution to the system:

$$x_1 = 1/5, x_2 = 0, x_3 = 0, x_4 = 1/2, x_5 = 1/5, x_6 = 0, x_7 = 1/10$$

and also in the this case the overall evaluation would be coherent!

Not only, but if initially the observer had evaluated P(A)=αP(B)= β, P(C)= γ with the condition ABC = φ, we would have obtained, respectively, the following system:

$$\begin{cases} x_2 + x_3 + x_4 = \alpha \\ x_1 + x_3 + x_5 = \beta \\ x_1 + x_2 + x_6 = \gamma \\ x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 = 1 \\ x_i \geq 0, i = 1,...,7 \end{cases} \quad (4)$$

$$0 \leq \alpha \leq 1, 0 \leq \beta \leq 1, 0 \leq \gamma \leq 1$$

By choosing the $x_i = 0$, as in the two cases examined before, we would have had the following solutions, respectively:

$$x_1 = 0 , x_2 = \gamma , x_3 = 0, x_4 = \alpha - \gamma , x_5 = \beta , x_6 = 0, x_7 = 1 - (\alpha + \beta)$$

which would give rise to an overall, consistent evaluation as long as $\alpha \geq \gamma$ and $\alpha + \beta \leq 1$

$x_1 = \gamma$, $x_2 = 0$, $x_3 = 0$, $x_4 = \alpha$, $x_5 = \beta - \gamma$, $x_6 = 0$, $x_7 = 1 - (\alpha + \beta)$

which would lead to an overall evaluation which was coherent as long as $\beta \geq \gamma$ and $\alpha + \beta \leq 1$

I will now go on to examine further aspects of the initial given, in particular regarding learning inductively from experience, referring to conditional events.

Let us remember that any two events E and H (as long as H ≠ Φ), can be considered a new E/H expression In which the name attributed is conditional event which means the following:

E/H	=	TRUE,	if H is true and E true
		FALSE,	if H is true and E is false
		UNDETERMINED,	if H is false

Then if we want to place a conditional bet concerning E/H we will have to act, according to de Finetti (1990), in the following way:

PAY p to RECEIVE

1 if H is true and E true
0 if H is true and E is false
p if H is false

From this definition of conditional bet it follows that the uncertainty of event E/H by quotient p that a coherent individual is prepared to pay with the preceding results can be measured and this measure is called conditional probability and is indicated by P(E/H).

Furthermore, de Finetti demonstrates how conditional probability, thus introduced, verifies all the proprieties of a probability and finally, as the only possible interpretation of P(E/H) is that of the probability of E supposedly true H.

In particular, he shows how the simple (and natural) condition of coherence: the random gain not uniformly negative in betting as a whole, leads to the theorem of composed probability:

Considering any two E and H events (H ≠ Φ)

P(E∩H)=P(H) P(E/H) is obtained,

and as its corollary, the theorem of Bayes (with also $E \neq \Phi$):

P(H/E)=K P(H) P(E/H) , with K = 1/P(E), P(E) ≠ 0,

which tells us the probability of H conditionally to E is equal to the product of the probability of H by the probability of E conditionally to H, unless a factor of K proportionality not equal to zero.

Let us pause for a moment to look at the meaning of Bayes' theorem. Actually it tells us much more if we look at it in this way. Both in the case that E is an event which represents the result of an experiment on a given random phenomenon and in the case that H represents a hypothesis relating to that phenomenon, then the theorem states that the probability of hypothesis H conditionally to E is proportionate to the probability of the non conditional H hypothesis multiplied by the probability of E conditioned by H.

To make this clearer, let us use the classic example of the extraction from the urn of unknown composition. Let us say that we know the urn contains N balls but that we don't know the percentage of red balls (meaning that the urn could contain from 0 to N red balls). Let Event E represent a possible result relating to the extraction from the urn of n red balls (not put back, for example): h red balls out of n, and event H as the hypothesis: there are r red balls out of N in the urn. Then Bayes' theorem allows us to evaluate the probability of hypothesis H conditionally to event E (which we can call the final probability) through the probability of H (which we can call initial probability) and the probability of E/H, that is, of E supposed true H (which can easily be calculated and which we can call likelihood) always except for the factor of proportionality K.

In short, Bayes' theorem tells us how to up-date our evaluation of probability in the light of new information (or better supposed, which we learn from the new information):

Final probability = K x initial probability x likelihood.

Note that initial and final in this context refer only to before and after, respectively, E becomes known (is assumed to be known). Natu-

rally, in the same way, the final probability of the opposite hypothesis H_c can be evaluated, resulting in:

$P(H_c/E) = K \, P(H_c) \, P(E/H_c)$,   con $K = 1/P(E)$, $P(E) \neq 0$.

More generally, wanting to evaluate the final probability of m different H_j hypotheses, forming a partition of the certain event, we have the following expressions of the Bayes' theorem:

$P(H_j/E) = K \, P(H_j) \, P(E/H_j)$,   j=1,2,…,m; con $K = 1/P(E)$,
$P(E) = \sum_{J=1,2…m} P(H_j)P(E/H_j)$.

Going back to our example, H_j's would represent the possible hypotheses of the composition of the urn, and once we had made an initial evaluation, we could express a final one using Bayes' theorem.

Generally, in objectivistic formulations of probability (the classical one and frequency one), because evaluations of probability are essentially numerical ratios, the observer (the individual who evaluates) has to be careful in making his calculations, calculations based on situations of symmetry or on repetitions of a given phenomenon (apparently however, because precise and subjective choices have been made previously in any case: in possible cases considered equally probable, and the trials repeated, considered equally probable and independent!). In these conceptions, Bayes' theorem loses its meaning and its intrinsic value and takes on the role of a purely mathematical result.

Bruno de Finetti's subjectivistic conception, on the contrary, expresses better the meaning of how one can (and must) learn from experience very well.

It is the same logical process that leads a doctor to make a diagnosis, for example. To ascertain the presence or not, of a disease he first examines the patient to get an idea of the disease and then he prescribes a series of diagnostic tests the results of which he uses to decide whether or not the patient has the disease.

Notice, by the way, that this procedure seems to belong to the logic of certainty, while on the other hand, more generally speaking, it regar-

ds the sphere of the logic of uncertainty: it is still, and only, a matter of evaluations of probability, even if fortunately, the final probabilities of ascertaining the disease are often near 1 or 0 (not only personal evaluations but also clinical tests can be wrong)! In any case when we consult a doctor, the event - I suffer from a given disease - is always possible, it is neither certain nor impossible!

Often in applications for estimating the value of some parameter relating to a given random phenomenon we use the so-called method of maximum likelihood: roughly speaking, it is a matter of evaluating different values of the probabilities of E (or the density of probability, in the case of a continuous parameter) conditionally to the hypotheses Hj (likelihoods) and to calculate the highest value which is then selected as an estimate.

Going back again to our example of the extraction from an urn of unknown composition we calculate the $P(E/H_j)$ for every j, and then find the largest of all; if this, for example, is $P(E/H_3)$ we say that hypothesis H_3 is an estimate of the true composition of the urn. Exemplifying this further, we say that there are 10 balls in the cage but we do not know how many are red. A sample is taken, that is, balls are extracted (and put back each time) repeatedly for a total of 5 times; of these 3 are red and E is this event. The $P(E/H_j)$, j= 0,1,…,10, are evaluated, resulting in

$$P(E/H_j) = \frac{5!}{3!\,2!}\left(\frac{J}{10}\right)^3\left(\frac{10\text{-}J}{10}\right)^2$$

and apart

$P(E/H_0) = 0$
$P(E/H_1) = 0.0081$
$P(E/H_2) = 0.0512$
$P(E/H_3) = 0.1323$
$P(E/H_4) = 0.2304$
$P(E/H_5) = 0.3125$
$P(E/H_6) = 0.3456$
$P(E/H_7) = 0.3087$
$P(E/H_8) = 0.2048$

$P(E/H_9) = 0.0729$
$P(E/H_{10}) = 0$

Therefore, since the highest value is 0.3456 which is related to hypothesis H6, it can be deduced that the estimate (of maximum likelihood) for the unknown composition of the cage is 6 red balls out of 10.

This method has two counter-indications, both of a logical type!

The first is that of carrying out a hypothesis-related estimate, using inverse conditional probability $P(H/E_j)$ respect to those that would be more correctly compared: $P(H_j/E)$; only by using these, in a logically unequivocal way, is it possible to establish which of the hypotheses of the composition of the urn is the more probable, having observed (having supposedly observed) E, and to take it as the estimate of the composition!

The second counter-indication is that this procedure does not include the probabilities of the $P(H_j)$ hypotheses which can always be evaluated and, not considering them can be absolutely detrimental for the conclusions.

In fact, even in the previous example, if Bayes' theorem were used (as is necessary), in the $P(H_j/E)$ evaluation, $P(H_j)$ would be considered and any distribution of these that is different from equal probability would increase to a maximum the final probability of one of the H_j different from H_6. If for some reason, it were known that it is much more probable that as many red balls as balls of the other colour had been put into the cage respect to the other hypotheses and that is, in our case, if we had, for example,

$P(H_5)= 0.6$, $P(H_4)=P(H_6)=0.15$, and for simplicity's sake $P(H_0)=P(H_1)$ $=P(H_2)=P(H_3)=P(H_7)=P(H_8)= P(H_9)= P(H_{10})=0.0125$, we would get

$P(H_0/E) = 0$
$P(H_1/E) = 0.00035$
$P(H_2/E) = 0.00225$
$P(H_3/E) = 0.00581$
$P(H_4/E) = 0.12185$
$P(H_5/E) = 0.66111$
$P(H_6/E) = 0.18278$

$P(H_7/E) = 0.01357$
$P(H_8/E) = 0.00902$
$P(H_9/E) = 0.00320$
$P(H_{10}/E) = 0$

And therefore the most probable hypothesis, by far would be H5 .

I would like to present an even more significant example, for its paradoxical aspects.

Paolo doesn't go for job interview with "Smile" company. The manager of personnel wants to understand why, and formulates the following hypotheses.

H_1= Paolo has found another job
H_2= Paolo has ended up in jail
H_3= Paolo has won the lottery or any other reason different from the others.

If the manager has to decide on the basis of likelihoods, he would have to choose hypothesis H_2 inasmuch as H_2 implies E and therefore $P(E/H_2)=1$.

While if Bayes' theorem were used the most likely hypothesis might not be H2.

In fact, it would suffice that $P(E/H_1)=0.6$, $P(E/H_3)=0.2$ e $P(H_1)=0.7$, $P(H_2)=0.25$, $P(H_3)=0.05$ to obtain

$P(H_1/E)=0.618$
$P(H_2/E)=0.368$
$P(H_3/E)=0.014$

by which we conclude that the most probable hypothesis is the most reasonable!

Finally, Bayes' theorem is the architrave supporting coherence on which the updating of evaluations of probability rains! Using this theorem uncertainty can be reduced, but never eliminated, reaching certain conclusions. From this point of view it represents an effective form of non-linear thinking.

The updating of evaluations of probability must therefore follow one principle only: that of coherence: this ensures that the observer does not go against the rule in attributing probability: between that which was evaluated before (initial probabilities) and that which is evaluated afterwards (final probabilities). This is what happens when we talk about learning inductively from experience!

In any case, from all the examples presented, we see how a set of events can be transformed into a system of events when the observer makes a coherent evaluation of probability emerge for them. As we have seen, in general there can be more than one of these coherent evaluations; what remains is the responsibility of the observer to choose the one he thinks best represents his state of information respect to the set of events considered!

Therefore the systemic opening of de Finetti's conception explains in this way the wealth of his methodology and exalts the observer's role as carrier and decision-maker of conscious and hence responsible choices.

From the systemic viewpoint, it can be said that in this type of inductive logic, interaction between agents (events in this case) must be consistent, and not linear or deductible from the others. In this circumstance coherence is not something relative to the rules of formal logic like in deduction for deterministic calculus, but relative to emergence.

Coherence, moreover, is not something that can be calculated and established deterministically; it is planned, learned, experimented with, and then formalized in a more general construction of models and in their simulation, as happens in fuzzy logic (Zadeh et al., 1996).

From this point of view the elements of a system are events.

The observer models the emerging system which is a configuration of events considered to be interacting with the probabilities provided by the observer, as well as by physical interactions.

This approach seems necessary, given the crucial, theoretical role of the observer in the emergence processes and in modelling them.

Although it has to do with systems (such as physical, biological and social systems) considered as emerging from interacting components, and assumes in a objectivistic way that the observer is not part of the system, or rather, is part but adopts a logic incompatible with the

system considered (assumes, that is, a linear logic, thinking that he is acting in a deterministic space) the strategies used while not wrong, are nonetheless ineffective.

The approach introduced by de Finetti leads us to consider systems of probability, departing from single events and arriving at systems of events.

3. Conclusive remarks

In conclusion it is important to underline how the language and the logic of uncertainty developed by Bruno de Finetti, play a crucial role in everyday life. Thinking tools which allow us to measure ourselves with complexity and produce disciplines that interact systemically so that concepts, analogies, correspondences and invariants are used consistently.

Instruments that have so far made it possible to enrich our knowledge - which if used, as Bruno de Finetti does, not only in the construction of his theory of probability but also regarding his fusionistic conception of science and not only - will allow us to increase our knowledge which is based on overstepping the discipline barriers which he always taught us to challenge.

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DETERMINANTS OF FIRM COMPETITIVENESS IN THE ITALIAN CITY OF BARI: SOME EMPIRICAL EVIDENCE[1]

Abstract

In the frame defined by the new economic reality, firms are trying to take advantage of the opportunities concerning the development of their urban environment and become competitive. In this connection, a relation between firm competitiveness, city distinctive characteristics and development policies is forged. In the article that follows an attempt is made to identify the determinants of the competitiveness of small-medium firms of the city of Bari, Apulia Region (Italy), through the evaluation of various factors (urban advantages) and development policies, based on an original survey carried out among the city's firms. The aim of the article and the survey is dual. First to identify specific factors and development policies which are able to be related with firm competitiveness in Bari and, second, to determine to what extent the ability of public authorities to plan and implement development policies is linked to the development of the city's firms.

JEL Classification: R5; R38; R50; R58.

Keywords: money aggregates; monetary base; inflation; financial markets; firm competitiveness; urban advantages; development policies; italian city of bari; empirical research and analysis.

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1. Introduction

During the transition from the post-Ford development model in the beginning of the 70s to the European Union of 25 member states, the European cities and firms underwent changes and advances which differentiated their profile, their role and significance. Having competitiveness as a common target, cities and firms take action and develop in the same geographical areas making use of the dynamics of their external environment. Under this frame, a subtle issue comes forward, which is also the objective of this article. This issue concerns the investigation of the relationship between the distinctive characteristics or assets of an urban environment and its development policies and the competitiveness of the firms located in these cities/regions (Parkinson *et. al.*, 2004; Deas, Giordano, 2001).

In this paper, particular attention is given to Southern Italy, focusing on the medium-sized city of Bari (*comune di Bari*), Apulia Region, in the so-called Mezzogiorno of Southern Italy. Taking into consideration that the territorial backbone of Italian economic development is the system of medium-sized enterprises, which is well established in some regions, particularly in the northern and central areas, but weaker in Mezzogiorno of Southern Italy (Salone, 2005), this study attempts to relate the dynamics of the city of Bari, through its distinctive characteristics/urban assets and development policies, with firms' competitiveness located in the city and its greater area. Specifically, the following questions are being discussed: a) which clusters of factors emerge as advantages/disadvantages for Bari and its wider area, b) which development policies are likely to influence the development of the city's firms, c) to what degree development policies are implemented by the local authorities and what is the degree of their effectiveness and d) to what extent the ability of local authorities to plan and implement policies is connected with their effectiveness influencing, this way, the development of the firms in the region. In order to satisfy this aim, the article uses empirical data coming from an original survey conducted among 96 small-medium size firms of the city. The article is structured as follows: in the second section, the relation of firm competitiveness, spatial environment and development policies, is defined generally,

while in the third part particular attention has been given to Southern Italy and Apulia Region. The fourth section presents the city of Bari, and the fifth the profile of studied firms. In the sixth section the empirical results answering the research questions are presented. Finally, the article ends with important conclusions about both the firms which participated in the study and the city of Bari.

2. Firm competitiveness, spatial environment and development policies

The competitiveness of Small and Medium Enterprises (SMEs) has represented a very interesting research field the last 30 years (Slevin, Covin 1995; Man *et al.*, 2002). A wide range of scientific approaches find that the competitiveness of SMEs, among others, depends on the development and planning of networks (Malecki, Tootle, 1996; Cappellin, 2002), the existence of an innovative business environment (Camagni, 1991), the existence of firm clusters (Davies 2001; Porter 1990, 2000), but also the dynamics of spatial environment (urban/ regional characteristics), where firms are located (Dicken, Malmberg, 2001). Several studies examine various factors such as *agglomeration economies and easy access to markets* (national and European markets, access to customers and suppliers, existence of foreign firms and availability of supporting services) [CEC, 1993; Nachum, Keeble, 2003; Redding, Venables, 2004; Iammarino, McCann, 2006)], *regional policies* (strong investments motives, local authorities attitude towards businesses, entrepreneurial climate, and low local taxes) [Fuller et al., 2003; Cossentino, 1996; Bennett, Krebs, 1991; Devereux, Griffith, 2002], *labour factors* (availability, quality and the specialization of the labour force) [Keune, 2001; Sforzi, Lorenzini, 2002 cited in Lazzeretti et. al., 2008], *cost of transportation and the costs of land use and labour* (Harrington, Warf, 1995; Miller, 1977; Zhu, 2000), *urban infrastructure* (efficiency of road/highway network, railway connections, sea connections, air connections and telecommunications) [Vickerman, 1994, 1996].

Regarding the case of Italy, a huge number of studies (Garofoli, 1989, 1994; Becattini, 1989; Savi, 2008:13-31) explaining new firm formation rates at a regional level relate primarily to the local socioeconomic

environment, focusing on the importance of the industrial districts model, especially as far as exports are concerned (Becattini, Coltorti, 2006; Dei Ottati, 2002; Carbonara *et.al.*, 2002; Dei Ottati, Grassini, 2008). Roberto (2004), examining the location determinants of FDI in Southern Italy, recognizes the significance of agglomeration economies, labour costs, productivity trends and public infrastructure. Boltho *et al.*, (1997) focuses on the role of investment and wages in Southern Italy, while Genna (2006), referring to the last trends in *Mezzogiorno* economy, argues that small local firms became successful by focusing on flexibility and adaptive ability in meeting the customers' and clients' expectations. This was accomplished by introducing product and process innovations which, in many cases, enable to keep the qualitative differential with the foreign imitators unchanged. Barca (2001), with particular reference to the New Development Plan for *Mezzogiorno* 2000-2006, mentioned that the competitiveness of the area is related to factors, such as agglomeration economies, social infrastructure, market competition for labour, products and capital, tangible and intangible communication with other areas and accessibility to natural and cultural resources. Barca also points out that firms and agglomerations in the Mezzogiorno are also not exploited to their full potential, since entrepreneurs fail in their propensity to build a strong network of formal and informal relations within the agglomerations. Hubner (2008) and Raimondo (2001) recognize the importance of networking, partnership between public-private sector, institutions quality, provision of good services and effective local governance.

Furthermore, a variety of recent approaches (CEC, 1993; Fest, 2000; Funck, 2000; D'Arcy and Keogh, 1998, 1999; Rogerson, 1999; Donald, 2001), besides the traditional economic factors (local market size, labour costs and land use etc.) that influence firms' competitiveness, give great importance to factors such as availability and quality of cultural and social organizations of cities, recreation and education facilities, the existence of organizations which undertake the promotion and support of investments as well as the existence of co-operations between public local authorities and the private sector.

In addition, the effective planning of development policies on local level are likely to influence the competitiveness of cities as well

as the competitiveness of firms which are located in them (European Communities, 2003). According to Trigilia (2001), a good network of relationships between the interest groups (private and public actors) and public institutions can favour the improvement of infrastructural facilities, as well as the influx of capital and investment of both local and foreign firms. We have to make reference to the policies for the *co-operation with the private sector in specific development projects* (e.g. support of the local industry) or the promotion of *co-operations with University and Research Institutions on specific projects* (e.g. allocation of funds for research). Especially important are the policies concerning *the promotion of the creation of an attractive entrepreneurial environment* focusing on the development of firms and the attraction of new ones (Christiaans, 2002; Stubbs et al., 2002; Ulaga *et al.*, 2002). The *reinforcement of continuous training and life-long education* does highlight, in this way, the direct relationship between education and unemployment, while the *participation in the planning and implementation of specific strategic development plans* or special marketing plans becomes a necessity in order for local authorities to support the total development and competitiveness of the cities they manage [i.e. Metropolitan Plan of Madrid (Jimenez-Moreno, 2001; Compitello, 2003), Glasgow and Bilbao (Gomez, 1998), Strategic Plan of Lisbon (Vasconcelos, Reis, 1997]. Moreover, urban *reforms and reconstructions of urban areas* are actions with positive results for both urban development and competitiveness of firms which act in these cities (Beriatos, Gospodini, 2004; Adair et al., 2000; Seo, 2002). Furthermore, the quest of subsidies and contributory projects of the E.U. and *participation in networks* with other cities, are actions which stimulate the economic profile of cities while, at the same time, contribute to the competitiveness of firms (see: European Commission, 2003; and Florio, 1996; Bianchi, Bellini, 1991 with particular reference to Italy and *Mezzogiorno*). On the other hand, the *monitoring, check and improvement of social and production infrastructures* have a direct impact on the development of firms' actions. The existence of quality production infrastructures is a crucial factor for the achievement of profitable entrepreneurial actions, contributing positively to the competitiveness of firms. If the case is not such, there are negative effects on the quality and quantity of the

produced goods (International Labor Organisation-ILO, 1998). Some of the above policies have been developed also in Italy and Apulia; this will be analyzed in the following sections.

3. Local Authorities, development policies and planning in Italy, Mezzogiorno and Apulia

Focusing on the role of local authorities, several approaches (i.e. Hall, Hubbard 1998; Barlow, 1997) argue that its role and contribution to cities and firms development is crucial. A number of recent studies recognize the significance of *organizing capacity* as an important factor on local development process (Kresl, Singh 1995, 1999, Polidano 2000, van den Berg *et al* 1997, 2003). According to Meyer-Stamer (2002), the public sector supports firm competitiveness. Bennett and Krebs (1991, p.21), approaching the relation between firms and local authorities, mention the creation of "entrepreneurial agents", which will manage and control the available resources and sort out the priorities in firms' actions with one another and with other public and business actors. In this section, we will focus on the role and the profile of Local Authorities in Italy with respect to their contribution to development policies and planning.

Pacione (1976) argues that regions in Italy suffering from a high dependence on ageing industries are usually identified by a traditionally slow rate of economic growth and high levels of unemployment. In our days, the significance of regions and municipalities on local development process is crucial. According to heading V of the Italian Constitution "*Regions, Provinces, Municipalities*", Italian Regions have exclusive competence on issues affecting territorial development (tourism, industry, trade and so on) [Cantoro, 2007]. The movement towards decentralization and towards a progressive reform of local government began around the middle of the 1980s and accelerated progressively at the beginning of the 1990s, during a period of deep crisis in the Italian institutional and political systems (Governa, Salone, 2005; Gelli, 2001). In that period, Italy experiments the remodelling of national policies towards a more effective decisional power at regional and local level (Bagarani, *et. al.*, 2007). Several authors (Piperno, 2000;

Coletti, 2007) argue that municipality governments have always been the core of the Italian decentralization system, through their own structure and operation, being responsible for the planning and the implementation of municipal policies (transportation, innovation policies, zoning, social services, sanitation, etc.). During the last decade, their frame of jurisdiction expanded to cover a broader range of policies such as: the allocation of industrial incentives, public works (except for motorways), education, heritage and environment conservation (Piperno, 2000). The first two legislative provisions (Law 59/97 and Law Decree 112/98) modify the division of administrative powers, while the Constitutional law modifies legislative jurisdiction between Central and local authorities. As a result, local authorities have now legislative power both in matters of their exclusive jurisdiction and in those of the legislation concurrent with the State. Later, the legislation Law 267/2000 aimed at inducing municipalities to join efforts in service delivery, infrastructure investment planning, and other local functions through associative structures, was expected to be particularly beneficial for territories with small and fragmented municipal networks (Magrassi, 2004).

Meanwhile, Italy as a member-state of E.U., reinforced - through European projects - the regions of Objective 1 (Southern Italy, *Mezzogiorno*), contributing to their development. In Southern Italy, public administrations were more and more directly involved in the management of Structural Funds and the decision arenas have become more crowded. During the elaboration of the Community Support Frameworks (CSF) 2000-2006, apart from the increasing importance of regional governments, negotiations have included a number of new actors such as representatives of small and medium enterprises (SMEs), financial and business sectors, Chambers of Commerce, as well as non-profit organisations and research institutions (Barbanente, Monno, 2004:37; Bagarani *et.al.*, 2007) creating a 'competitive image' of *Mezzogiorno*, especially in clothing and textile industry of 'made in Italy' products (Aniello, 2002; Baculo, 1997 cited in Burroni et. al., 2008). According to a number of studies the recently-introduced policies for the *Mezzogiorno* have set out in very different ways to foster local development especially in comparison with Northern Italy (D'Antonio

et. al., 1988; Barca, Pellegrini, 2000; Viesti, 2002; Loddo, 2004; Calafati, 2005; Daniele, 2009). According to Viesti (2002), following the reform (1988) of the European Structural Funds, the regional administrations of Southern Italy were called upon to draw up multi-year programmes - that is, coordinated and coherent sets of measures to structurally alter the region's economic circumstances - and they were faced by a task that was entirely new to them. Managing such measures was an entirely new experience and the extraordinary slowness with which policies were implemented was the consequence. On the other hand, the role of local governments within the *Third Italy* (Veneto, Emilia-Romagna, Toscana and Marche regions) notion was crucial, mainly in supporting the development of a modern small industry and in shaping its cooperative nature (Warren, 1994: 98 cited in Waters, 1999; Rossi, 2004). These small industrial firms were often located in relatively small areas where they formed highly dynamic and efficient local production systems which sometimes succeeded to conquer world export markets. This was in contrast with the quite common view that the competitiveness of localities could only be defined in terms of costs of transport and location, rather than in terms of organisational and cultural dimensions (Boschma, 1998). Furthermore, the local representation of interests that provided through decentralized institutions is a major factor in local economic performance (Bagnasco, Sabel, 1995).

Regarding the structure and the implementation of planning policies, a number of Programmes under Community Initiative based on competitive bidding processes and requiring transnational, inter-municipal and/or local co-operation, have forced public administrations to open the policy-making process (Barbanente, Monno, 2004:37). Examples are the Strategic Plan of Taranto - *Città di Taranto* (2000), as a *Port town* (Southern Italy), or the Territorial Plan of Rieti, Lazio Region (Central Italy), or the Sustainable Plan of the Province of Trento (Diamantini, Zanon, 2000). In line with the Strategic Plans, the Mobility Plans Programme is another tool through which local authorities and other actors involved can make the mobilisation process easier, facilitating the access to locations, modalities, beneficiaries, etc. This instrument combines material and immaterial interventions for the logistic governance of trade and

people flows (Ministry of Infrastructure, Italy, 2004[2]). Relevant cases regarding these programmes are for example the "URBAN II Carrara" Programme, which supports the development of specific urban areas through an integrated strategy focused on environmental regeneration, improvement of enterprises and trade and strengthening of social cohesion or the Strategic and Mobility Plans of Benevento and finally the Mobility Plan of Autonomous Province of Trento (Diamantini, Geneletti, 2004).

Regarding finally, the recent changes in Italian urban and territorial policies, Governa and Salone (2005), present in analytical way, the shift from 'traditional' to 'integrated' urban intervention of Italian regions, with particular reference to PIT (Programmi Integrati Territoriali— Territorial Integrated Programmes), operational tools introduced in 1999 by the national legislation in the general framework of new governmental regulations for European structural funds devoted to less favoured regions. According to Pallara (2006), these programmes or projects, previously used by the Regions in the South of Italy and also borrowed by other areas, are characterized by a substantial amount of agreement between public and private subjects in a local environment and present a very wide range of solutions and methods. They range from a territorial dimension (Territorial Integrated Programmes) to a sectorial one (Integrated Sectorial Projects), and to others with a clear agricultural and/or rural connotations (Row Integrated Projects - RIP; Rural Areas Integrated Projects - RAIP). In addition, the Ministerial Decree of 10 July 2003 no. 988 and CIPE Deliberation no. 36/2002 approved *SISTEMA*, an Italian acronym for multi-action integrated territorial development.

Focusing on Apulia, in order to foster local development, it has been established *SISTEMAPUGLIA* of the Apulia Regional Government for the promotion and development of the region itself and its enterprises. The System Apulia initiative, originated by Measure 6.2., action b of the Regional Operation Programme (ROP) 2000-2006 "*Marketing the region and attracting investments*" comprising further sub actions as: regular updating, on behalf of the Regional Government of a public

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[2] www.eukn.org/eukn/themes/Urban_Policy/Transport_and_infrastructure/Roads_and_road_transport/Traffic_management/strategic-plans_1061.html.

information service promoting innovation among enterprises and regional production systems and technical assistance for the creation and coordination at regional level of a "One Stop Shop" for productive activities (Cantoro, 2007). Furthermore, Apulia region, in the frame of European Commission Initiative LEADER+, has activated a strong mechanism of competition among the same territories, establishing some admittance requirements of a quantitative type and using a well-constructed multi-criterion matrix of evaluation of the Local Development Plans (LDPs). In addition, in the frame of ROP, the European Investment Bank (EIB), the European Union's financing institution, is lending EUR 300 million for investment. The investment programme encompasses infrastructural works (water management, forestation, environmental monitoring measures, promotion of renewable energy sources) and private-sector investment incentives designed to rationalise productive activity and to create new businesses. Apulia, with its four million inhabitants, is one of the most densely populated Objective 1 regions in Italy (EIB, 2009).

Finally, the New Operational Programme Puglia 2007-2013 under the Convergence co-funded by the European Regional Development Fund (ERDF) [E.U., 2008], provides the opportunities for regional economic and social development, since its main strategic priorities, among other, concern areas such as, the development of networks, promotion and dissemination of research and innovation for competitiveness, the promotion of the potential of natural and cultural resources to improve the attractiveness and development of the region, the competitiveness of productive systems and employment and finally, the governance, institutional capacity and creation of competitive and efficient markets. In addition, Apulia is in the so called corridor eight of the European community development plan. The corridor 8 of EC will help the territory developing communication ways, infrastructures and providing facilities to investor across this territory. The Paneuropean corridor 8 - Brindisi - Bari - Durazzo - Tirana - Plovdiv - Burgas - Varna is also known as "Traceca Program" (Figure 1)[3].

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[3] www.touringpuglia.com/economy.htm.

Figure 1 - The Corridor 8

Source: www.touringpuglia.com/economy.htm (access day: 1-9-2009)

In conclusion, we will support that the above policies are planned having as an objective the economic development and the competitiveness of regions where they are implemented, influencing positively the development and the actions of firms located in them. What is important, though, is the investigation of the frequency with which such policies and other parameters which influence their effectiveness are implemented. Focusing in Italy we could support that the overall acting of regional and local authorities, through the analysis above, leads to the conclusion that experience and know-how / knowledge in planning and implementing development policies at local level, is strongly related also with the effectiveness degree of these policies (Polidano, 1999; Milio, 2007). This argument will be discussed at the following sections.

4. The city of Bari

Bari in located in the region of Apulia, on the south coast of the Adriatic Sea and is the second most important city in Southern Italy, after Naples (Figure 2). Its population is about 312.000 people, while the region reaches a population of 1.580.000 people.

Figure 2 - The city of Bari and the region of Puglia

Source: www.welt-atlas.de/map_of_apulia_1-20 (access day : 30-8-2009)

Like most cities in the south of Italy, its economy developed during the 70s and 80s since textiles, leather, clothing, footwear and furniture sectors dominated by flexible production systems, were growing faster in some southern regions than in Northeast, as a result of reconstructuring process taking place in Northeast and the subcontracting of less complex stages of production outside the district in search of low labour costs (Spadavecchia, 2005). Bari's traditional production sectors concern the manufacturing of agricultural and sea

products. In addition the production structure of the city is composed of commercial firms, service businesses, soft industrial sectors (textiles, leather etc.) and automobile industries, which makes it a real economic capital within the *Mezzogiorno*, a "Southern Milan" or as the 'California of the South' (Urban Audit, 2000:167; Waters, 1999). Today the city is the most progressive in comparison with to the other areas of the South, more active and commercially competitive[4].

As in overall *Mezzogiorno* area, industrial districts do also play an important role in Apulia Region and Bari province (Figure 3). The industrial district of the Bari-Matera is composed of a furniture industrial cluster that is located in the Murge area (South Italy) with most companies based in the towns of Altamura, Santeramo in Colle (Apulia Region) and Matera (Basilicata Region) (Belgiojoso *et. al*.,2008; Morrison, 2004). The district was created in the 1950s as a result of an agglomeration of isolated craftsmanlike firms, which produced leather sofas in small volumes (Carbonara *et.al.*, 2002). In addition, the *Sofa Cluster* that is mainly based in the north west of Bari all around the Municipality of Altamura. The production of this cluster, already present in the EU and USA markets, is represented by few large industries and a wide number of small and micro sub-suppliers mostly specialized in one single production phase (EU, 2008). Finally, the mechanical district of *Gioa del Colle and Bisceglie* in Bari is composed by few large industries (mainly foreign) as and a wide number of small enterprises with specialized autonomous productions (independents from the large size companies) and export oriented (especially toward EU countries). In addition, it has to be underlined the presence in the province of Bari of high technological enterprises in the "telecommunication sector" (Elettronika, ITEL). This sector has enormous growth potential and is characterized by a strong boost towards innovation. Bari hosts also a cluster of car component producers whose main representatives are: Bosch (about 2000 employed and a turnover of 350M €) produces injection systems and braking plants, Getrag (830 employed and a turnover of 230M €), hand transmission for cars, *Magneti Marelli Powertrain*, robot gears and fuel injectors, *Graziano Trasmissioni*, transmission movers. Those main companies support the production of a large number of local satellite enterprises. As a matter of fact the

production of car components experimented in recent years a strongly positive trend and an increasing exportation (EU, 2008). However, the development model cannot be considered completely district-based, the links between enterprises not being solid enough and coming into play especially in industry supply relationships rather than in technology spillovers. More than 40% of the enterprise fabric of Apulia is situated in the Province of Bari and is characterised by small-sized enterprises and a predominance of individual firms.

Figure 3 - Industrial districts in Apulia Region and Bari
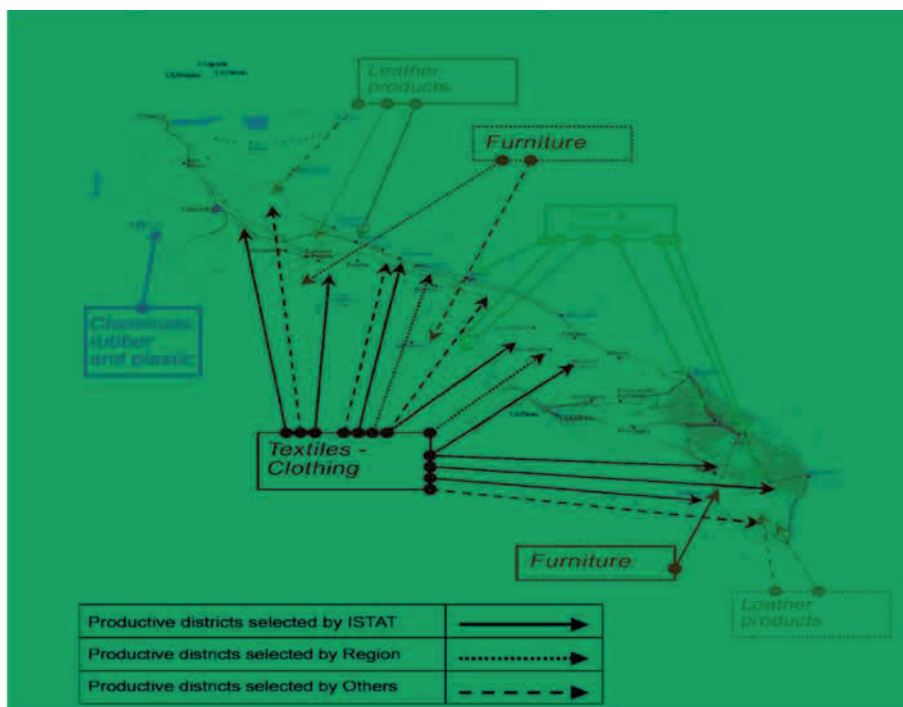
Source: www.diset.palazzochigi.it/html/doc/cartine_sist_prod_en_US/PUG.pdf?date=125180621027
(access day : 1-9-2009)

Regarding, accessibility and transport infrastructure, Bari is connected to the Italian road and rail network, with good connections to the north along the coast, and through Naples to Rome. A significant

role in firms' competitiveness is played by the port of Bari which connects Italy with Greece, while the airport is also well used. Port facilities exist in Taranto (mercantile), as well as in Brindisi and Bari, which have important links with Yugoslavia and Greece. The two domestic airports are: Bari-Palese and Brindisi-Casale (EU, 2008), while airport traffic handled 2.486.154 passengers in 2008. The new Bari International Airport Aeroporto di Bari "Karol Wojtyla" is bound to become an essential benchmark to test the economic development of Apulia. However, the existing communications infrastructures are not considered sufficient to sustain the economic development of the city. The main highway is the last stretch of the Adriatic autostrada, which passes by S. Severo, Foggia, Bari and Taranto; railway connections are based principally on the Milan-Bologna-Bari-Lecce line. As a result, the municipality has drawn up plans to improve the existing infrastructure, and to improve connections with the other cities. Finally, over the past 15 years, the town has developed new research-based growth with the creation of the science park Technopolis in 1984 (Waters, 1999) which is a link between the university community, and the information engineering and advanced technology firms (Europa – Urban Audit, 2005). Finally, Bari is also a historical, monumental city, whose medieval walled centre has been recently regenerated with funds from the URBAN programme of the European Commission (van Winden, Woets, 2003).

At the end, in the case of Bari, the municipality plays an important role in a range of public policies, including urban planning, public transport, waste disposal and treatment, education, culture and social services. Particular development initiatives have been taken place in order to enforce the local development process. For instance, the *URBAN* I initiative was used for the historical centre of the city: Bari Vecchia. Thanks to this program, one of the most dangerous areas of the city (considered as 'no-go' area even for the police) has been transformed in a very attractive and vibrant one. *URBAN II Mola di Bari Programme* that is based on an integrated approach combining physical and socio-economic interventions. Its strategy is based on actions aimed to renew buildings and open areas, environmental infrastructure (e.g. water purification), natural and cultural heritage. Moreover, the *URBAN II*

Mola di Bari Programme supports small and medium enterprises (SMEs) and the development of the harbour. Furthermore, many interventions concern the enhancement of the tourism sector and local crafts in order to implement new services and stimulate tourism and cultural activities. These actions promote the enhancement of social economy, social services and training to facilitate access to the labour market for disadvantaged groups (EUKN, 2009).

5. Profile of research and firms

Research has been done with the collection of primary data from 96 local medium-sized firms mainly (average 88 employees), from all production sectors (industry/manufacture, commerce, services and tourism) [Table 1]. Regarding their age, most of them have been established the period 1990-1999 and some are traditional with more than 30 years in the market.

Table 1 - Production activity

Production activity	n	%
Industrial/ Manufacture	42	43,7
Commerce	17	17,7
Services	23	23,9
Tourism	14	14,5
Total	**96**	**100,0**

Source: Author's elaboration

More specifically, the characteristics of the research are the following: a) research took place from May, 2004 to November, 2005 through the use of questionnaires and personal interviews. The method of programming and not random interviewing was preferred in order: to collect a bigger number of questionnaires, to sustain the chance of clarifying ambiguous questions, to avoid 'quick' and 'non-skeptical' answers, b) the questionnaire includes open-closed questions in five groups of questions, for the answers Likert scale was used (1-10)

[Likert 1932; Stathakopoulos 2005:134], c) each interview lasted 25 to 45 minutes, d) 90% of the firms had over 20 employees, e) research took place within 50 km of the city centre, f) interviews were made with high level managers and also business-owners, g) each interview was certified with the signature of the responder who filled in the questionnaire and the business stamp and h) the selection of the firms was based on data provided by Chamber of Commerce of Bari.

6. Some statistical evidence
6.1. Evaluation of characteristics as advantages and disadvantages

Table 2 presents the evaluations of the firms of Bari (mean and standard deviation) for the clusters of factors examined and which synthesize the city's environment within which the firms act. The target is to bring out those factors which constitute the main advantages and disadvantages of the city and are likely to influence firms' competitiveness. The important fact is that the evaluations come from local firms whose views carry a certain weight as they are able to know well which city characteristics are linked, and to what degree, with their competitiveness, either positively or negatively.

Table 2 - Bari local characteristics as advantages and disadvantages (mean and standard deviation)

Factors (advantages/ disadvantages)	$\overline{x}$	sd
Group 1: **Agglomeration and access to markets**		
Access to other national markets	6.0	1.7
Access to customers / suppliers	5.5	1.6
Existence of foreign enterprises	4.7	1.4
Access to West and North European markets	5.0	1.7
Access to South and East European markets	5.7	1.8
Availability of supporting services	5.7	1.8
Average of mean and standard deviation of Group 1	*5.4*	*1.7*

Group 2: **Regional Characteristics-Policies**		
Availability of strong investment incentives	5.3	1.9
Local Authority attitude towards business	5.3	1.8
Low local taxes	4.7	1.6
Average of mean and standard deviation of Group 2	*5.1*	*1.7*
Group 3: **Labour factors**		
Availability of workforce	6.6	1.9
Quality and specialization of workforce	6.1	1.8
Good management labour relationships	6.3	1.6
Labour ethic	6.4	1.6
Average of mean and standard deviation of Group 3	*6.3*	*1.7*
Group 4: **Cost factors**		
Cost of land use	4.9	1.5
Labour cost	5.1	1.7
Average of mean and standard deviation of Group 4	*5.0*	*1.6*
Group 5: **Urban Infrastructure**		
Efficient Highway-road connections	6.4	1.6
Efficient Rail connections	6.0	1.5
Efficient Sea connections	6.5	1.5

|		
Efficient Air connections	5.4	1.6
Efficient Telecommunications	**7.1**	1.5
Average of mean and standard deviation of Group 5	*6.3*	*1.5*
Group 6: **Quality of life-Environment**		
Urban aesthetic	5.9	1.8
Attractiveness of natural environment	6.4	1.7
Average of mean and standard deviation of Group 6	*6.1*	*1.7*
Group 7: **Research/ Development/ Education**		
Quality and availability of Universities and Technological Institutes	6.3	1.5
Quality of continuing education and training	6.2	1.6
Quality of Research Centers	5.9	1.4
Average of mean and standard deviation of Group 6	*6.1*	*1.5*
Average of mean and standard deviation of all groups	*5.7*	*1.6*

Source: Author's elaboration

From Table 2, the following conclusions may be drawn. The initial picture is that the firms of Bari attribute the same significance to many different factors. This fact means that the firms of Bari estimate that the city has a variety of advantages but also some disadvantages, which, to a certain extent, contribute to the competitiveness of both the city and the firms[5]. More specifically, there is a fairly intense focus of the total of estimations on average mean (5.5). Close to that level come the mean

[5] On this point we have to clarify that a low value attributed to a factor means that the factor is important for firms, but in this case it is considered a disadvantage deriving from a location in Bari.

values of the factors of agglomeration economies, regional policies and cost factors. On a second level, and on scale 6.0, are found the values of the rest of the factors. The standard deviations deriving are fairly high (1.5 - 1.7), a fact which shows that there are differences of estimation among the firms concerning the importance of some factors. We could say that these fluctuations concern whether and to what extent the factor being examined constitute significant advantages are just advantages for the city. Under the same rationale, we can refer to the factors that are faced as disadvantages or significant disadvantages for the city. However, the fact that there is high concentration of estimations around the average value does not permit the characterization of the concept "powerful" as an advantage or disadvantage but only as a characterization, something which becomes clear in Figure 4, that presents the 'top five' advantages and disadvantages of Bari in means values (the five highest and lowest).

Figure 4 - The 'top' five advantages and disadvantages of Bari (mean and standard deviation)
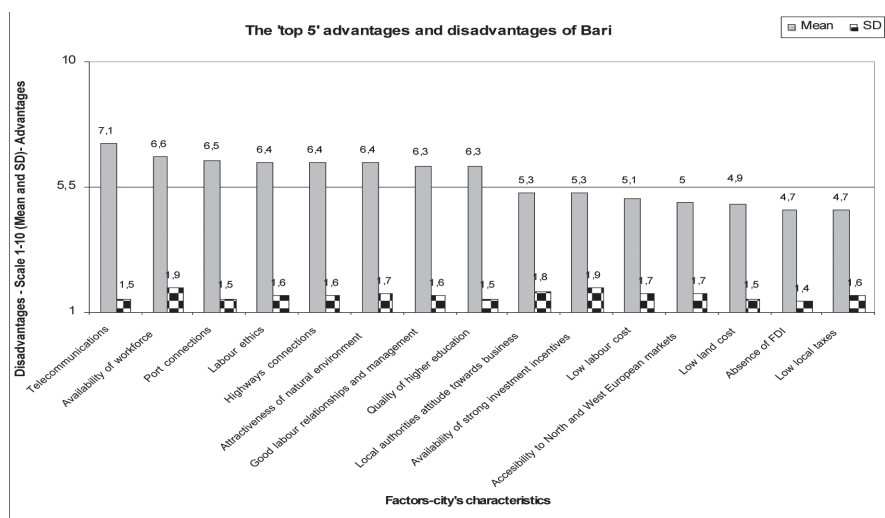
Source: Author's elaboration

6.2. Development policies and firm competitiveness

Table 3 presents the degree of influence on firm's competitiveness due to the implementation of a number of specific development policies by the city's local authorities.

According to the firms' estimations, the policy which exerts the greatest influence on their competitiveness is "*Monitoring, check and improvement of social and production infrastructures*" (P10). Of course this policy has been evaluated positively only from 20 firms and this fact does not lead to a conclusion regarding the direct contribution on this policy on Bari firms' competitiveness in general, something that is also supported by the quite high standard deviation (1.8), which means that there are different approaches on the part of firms concerning the significance of the specific policy. Next are the policies "*Seeking of financing and support programs in the E.U.*" (P8), and "*Reinforcement and support of the Education Process and Continuous Training*" (P4). The policy with the lowest standard deviation (1.3) is P4. The firms estimate that training actions influence greatly the achievement of high degree of competitiveness among them. Finally, P8 seems to be especially important for the firms in Bari, since Bari belongs to the Objective 1 regions of the E.U.

The firms of Bari seem to focus mainly on the 3 of the 10 policies, in which they participate with high percentage (>50% of the sample)[6]. These policies are P4, P8 and P3. All three policies are characterized by a focus on the entrepreneurial factor and the need for continuous learning and training, leading to the conclusion that Bari's firms have identified the axis which contribute, or are going to contribute in future, to their development. We could suppose that some firms or all these firms could take part in specific projects/programmes related to such policies. At the same time, it becomes clear by the majority of firms (<50% of the sample), that most of the policies examined are not linked with and do not influence their competitiveness. This picture can be explained by the medium value of implementation and effectiveness of the development policies of the local authorities given by the firms, according to the analysis in Tables 5 and 6 that follow. Thus,

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[6] The response rate is high.

we come to the conclusion that the medium value of implementation and effectiveness of development policies, is not deemed capable of influencing the competitiveness of firms positively, which is something suggested by the majority of firms, anyway.

Table 3 - Degree of influence of development policies on firm's competitiveness

Policies	n	$\overline{X}$	sd	% (96)
Promotion of partnerships with private sector in specific development projects (P1)	43	5.5	1.4	*44,7*
Promotion of partnerships WITH Universities and Research Centres (P2)	27	5.6	1.5	*28,1*
Promotion and support the creation of an attractive entrepreneurial environment (P3)	52	6.0	1.7	*54,1*
Enforcement the continuing learning and training process (P4)	71	6.2	1.3	*73,9*
Participation on the planning and the implementation of a city development plan (P5)	30	6.0	2.0	*31,2*
Development of City Marketing Plan with specific aims and budget (P6)	39	5.6	1.6	*40,6*
Control of land use and promotion of regeneration and reconstruction of city image (P7)	34	5.6	1.5	*35,4*
Seeking of financing and support programs in the E.U (P8)	69	6.3	1.5	71,8
Participation in networks with other cities (P9)	21	5.0	2.0	*21,8*
Monitoring, check and improvement of social and production infrastructures (P10)	20	6.6	1.8	20,8
Average of mean and standard deviations		**5.8**	**1.6**	

n= the number of the respondents to each question

Source: Author's elaboration

6.3. Degree of implementation and effectiveness of development policies

Tables 4 and 5 contain the estimations of firms regarding the degree on implementation of the above policies by the local authorities and the degree of effectiveness of their implementation for the competitiveness of the city. The number of respondents (n) on these tables is different and bigger that on Table 3. The reason is that in Tables 4 and 5 firms evaluate the implementation and the effectiveness of development policies into Bari environment, regardless of which of these policies relate to their competitiveness.

According to the results of Table 4, the value of implementation for most of the policies is over the average (5.5), without, though, any one of the policies to be distinct. We can support that policies P6 and P8, are the policies with the highest significance as they present higher mean values, in comparison with the rest, and fairly low standard deviations. In reference with P8, the firms, at a high percentage (81.2%), support that the local authorities, up to a certain extent, do implement financing seeking and participation in European development projects in order to reinforce Bari's competitiveness. On the other hand, the implementation of P6 (Development of a Marketing Plan), a policy which gains ground, is the decision making process and the development of actions taken by European cities, especially during the last twenty years. As a result, we can support that it is an interesting challenge for local authorities and for that reason they adopt and implement it.

Table 4 - Degree of development policies implementation

Policies	n	$\overline{X}$	sd	% (96)
Promotion of partnerships with private sector in specific development projects (P1)	55	5.4	1.6	*57,3*
Promotion of partnerships WITH Universities and Research Centres (P2)	42	5.4	1.5	*43,7*
Promotion and support the creation of an attractive entrepreneurial environment (P3)	59	5.5	1.2	*61,4*

Enforcement the continuing learning and training process (P4)	78	5.8	1.3	*81,2*
Participation on the planning and the implementation of a city development plan (P5)	45	5.7	1.6	*46,8*
Development of City Marketing Plan with specific aims and budget (P6)	56	6.0	1.5	*58,3*
Control of land use and promotion of regeneration and reconstruction of city image (P7)	56	5.8	1.7	*58,3*
Seeking for European Funds and programmes (P8)	78	6.2	1.4	*81,2*
Participation in networks with other cities (P9)	30	5.3	1.8	*31,2*
Control of the quality of production and social infrastructure (P10)	34	5.5	1.1	*35,4*
Average of mean and standard deviations		**5.6**	**1.4**	

n= the number of the respondents to each question

Source: Author's elaboration

As for the value of effectiveness, there is no radical change. The value of effectiveness of policies lies on the same level as that of implementation value. A small exception concerns P8, for which the firms of Bari give the local authorities the highest value of effectiveness. This recognition is significant since it expresses the view of almost all the firms of every production sector to a degree of 81,2% again.

Table 5 - Degree of effectiveness of development policies implementation

Policies	n	$\overline{X}$	sd	% (96)
Promotion of partnerships with private sector in specific development projects (P1)	55	5.2	1.4	*57,3*
Promotion of partnerships WITH Universities and Research Centres (P2)	42	5.3	1.4	*43,7*
Promotion and support the creation of an attractive entrepreneurial environment (P3)	59	5.4	1.4	*61,4*

Enforcement the continuing learning and training process (P4)	78	5.7	1.2	*81,2*
Participation on the planning and the implementation of a city development plan (P5)	45	5.8	1.4	*46,8*
Development of City Marketing Plan with specific aims and budget (P6)	56	5.9	1.3	*58,3*
Control of land use and promotion of regeneration and reconstruction of city image (P7)	56	5.6	1.5	*58,3*
Seeking for European Funds and programmes (P8)	78	6.3	1.2	*81,2*
Participation in networks with other cities (P9)	30	5.6	1.4	*31,2*
Control of the quality of production and social infrastructure (P10)	34	5.6	1.3	*35,4*
Average of mean and standard deviations		5.6	1.3	

n= the number of the respondents to each question

Source: Author's elaboration

6.4. Local authorities' capacity and development policies

Initially, the firms of Bari were asked to estimate the value of successful exercise of development policies by the local authorities. This ability was estimated 'under the average' (Mean: 4,8 - Standard deviation: 1,0) on a scale 1 – 10.

The firms, irrespective of production sector, show a common and firm evaluation attitude towards the local authorities. This 'under the average' estimation is not negative, of course, but we could support that, in total, it involves an intense dissatisfaction with the ability of local authorities to plan and implement policies which will contribute to the competitiveness of both the city and the firms. This view is further supported by the results which are presented in Table 6. The firms of Bari estimate the degree of responsibility of a number of factors concerning the ability of local authorities to implement development policies. Since the value of implementation of development policies was set to 'under the average', the firms are asked to estimate which factors contributed to its formation.

The firms, as a whole, estimate that, for all levels examined, the degree of responsibility of local authorities for the successful implementation of development policies is high (mean values > the average 5.5). As a factor with the highest degree of responsibility for mediocre implementation of development policies the firms regard the ability of local authorities to plan and implement development policies. That means that *the ability to plan and implement development policies* is major importance for the city's firms[7].

Factors concerning the management and development of co-operations, as well as the management of regional resources (natural and human), receive high mean values. This picture brings out the intense need of the firms for more effective actions, on the part of local authorities, towards these goals. This is a very important finding since it concerns a common stance by all the firms, which is supported by the low standard deviations.

Table 6 - Degree responsibility of Bari's Local Authorities on development policies implementation

Responsibility to..	$\overline{x}$	sd
…..plan and perform development policies	7.8	0.9
…. develop and manage partnerships	7.7	0.9
….manage local resources	7.5	1.0
….develop, control and manage legal issues	6.9	1.1
….improve the operation of the existing organisations	6.3	0.8
….manage and control local public investments	6.2	0.8

Source: Author's elaboration

[7] At this point something important must be mentioned. This factor expresses two different aspects, in fact, planning/ conformance and implementation. It is likely that although there is a proper planning process the implementation of actions is unsuccessful. For this reason, planning and implementation should be aspects faced by a different action cluster, with high level of know-how and experience (Roberts, 1995). As a result its significance is great, as the local authorities are evaluated by the firms on two levels.

The impression created by the analysis of the firms' estimations is that the firms wish to participate in the development of their regions through co-operations with the local authorities. No matter how well-intentioned this impression is, it involves certain difficulties concerning its implementation, since in the city's environment there is a group of interests as firms and local authorities aim at achieving their own goals. We could support that in the frame of local economic development process in which the firms have a crucial role, the planning and the implementation of development policies, derive as a major need for the firms of Bari. These policies should include the active contribution of firms or even better they should be oriented on firms' perspectives and needs.

7. Conclusive remarks

The aim of this article is to show, through empirical research, which specific characteristics in an urban environment and which development policies implemented by local authorities, are able to contribute to or influence (positively or negatively) the development and competitiveness of firms in a region. For this reason as a case study was used the city of Bari (Apulia Region) and the firms located in its region. According to the results of the statistic analysis, the following interesting conclusions are drawn.

First, the firms of Bari express a conservative and quite common stance towards all the examined factors. They do not bring out any significant advantages for the city but no disadvantages either. Their estimations lie a little over or a little under the average (5.5) on a scale 1 – 10. In spite of this, there are significant high values standard deviations, a fact that means that although there is a general view on which factors are advantages or disadvantages, there is difference in opinion among the firms concerning how 'strong' these factors are. In general terms, two are the factor clusters which, up to point, stand out as advantages for Bari. The first cluster of factors (characteristics) is that of urban infrastructure with significant advantage telecommunications. The second cluster is that of labour factors. The firms of the city recognize that Bari is a city with effective urban infrastructure and available, specialized labour force, factors which contribute to its development

and prosperity. On the other hand, the regional factors-policies seem to be the main disadvantage for the city, with special focus on the lack of strong investment incentives. The firms express an intense dissatisfaction towards the factor related to the degree of ability of local authorities to formulate an attractive entrepreneurial profile for the region.

Second, with regards to which policies are able to relate with the development of the city's firms, it is sensational that most of the firms (>50% of the sample) support that only some specific policies, such as the creation of an entrepreneurial climate, the process of education and training and financing programs by the E.U., are able to influence their competitiveness. Comparing this picture with the number of firms which answer and evaluate the rest of the policies and the mean-values that derive, we will support that the firms of Bari are oriented to specific axis concerning their development.

Third, it is considered significant the picture derived through the comparison between the degree of implementation of development policies and the degree of effectiveness of these policies. The first important fact is that the firms participate actively and express their opinion that the degree of implementation is close to the average, mean-value 5.5. In most of the evaluations of the policies the firms participate with high percentages (>50% of the sample), which is a fact that means that they wish to give notice of their stance concerning the value and the dynamics of the implementation of these policies. Combining this picture with the picture of effectiveness value, we come to the conclusion that development policies effectiveness depends, to a great extent, on the frequency of implementation, but also the ability to implement such policies. For the four out of the ten policies evaluated (P5, P8, P9, P10), the effectiveness value is marginally higher than the respective value of implementation; a fact which means that, towards that aspect, the local authorities have done better.

Fourth, the firms support that the role of local authorities is crucial for the reinforcement of the local economy and the development of the firms themselves, as highlighted in Table 6. The degree of local authorities' responsibility for the aspect of planning is important for the effectiveness of policies. Especially on matters concerning planning and

development of co-operations and management of human and natural resources, the degree of ability of local authorities is linked with the effectiveness of whatever is implemented and the effectiveness of such policies influences the development of both the region and the firms.

We will support that the article brings out the importance of the aspects of local environment for the development of firms, confirming the intense interest of literature in that. At the same time, however, it also points out the need for an active role that the local authorities must play aiming at the strengthening of the local economy and prosperity. The firms of Bari are seeking co-operations with the city's authorities, recognizing that the ability of local authorities, on issues of planning, management and control in an urban environment, influences their own competitiveness. On this point we have to make clear that the role and the contribution of Local Authorities in Apulia Region and Municipality of Bari, according the analysis above, is important and quite active. An apparent disappointment runs through the enterprises' estimates due to the limited effectiveness of the development policies to the local and the wider economy. None the less, the local actors have evolved an intense activity mirrored in policies, such as territorial pacts, integrated projects, feasibility studies and urban II, aiming to give "life" and economic power to the local business environment of the greater area of Bari. The new Operational Program 2007-2013 for Apulia (Bollettino Ufficiale della Regione Puglia, 2008) and the Strategic Development Plan 2007-2013 for Apulia (Documento Strategico della Regione Puglia 2007-2013, 2006) define the basic support axes, such as the enhancement of the productive sectors, the boosting of productivity and competitiveness and the focus on culture and the attractiveness on urban areas, for the area's image. Regarding transportations and urban infrastructure, the SIMCODE IGT – INTERREG IIIB (EU, 2009) is a representative project for the development of actions targeting on the emergence of the city of Bari as a Gateway city. Moreover, during the programming periods 2000-2006 and 2007-2013, an attempt for the promotion of the greater area of Bari and Apulia as "Puglia: the new border line of new technologies is taking place". Thus, a desirable potential image for the invigoration of the wider area's economic, operational and technological dynamism is weaved.

Hence, it can be supported that the liveliness on behalf of the local and regional actors, concerning the taking over of initiatives regarding program planning, does not "reach" the area's enterprises. As a result, the distance between the private and the public sector is considered to be significant. This extremely important ascertainment is derived from the facts of the analysis and is supported from the SWOT analysis (EU, 2009: 16), where the propensity for cooperation among the private operators and the public authorities is considered to be insufficient.

Besides all these factors, however, Bari as a metropolitan area must exploit the opportunities that arise in its internal environment and enhance the dynamism of its image. The most important opportunity is the existence of a significant number of enterprises in its greater area. These enterprises, through the development of cooperation and their participation in programs and actions of development, can contribute essentially to the overall economic, social, technological and cultural / touristic development of the area (EU, 2009: 18). This fact must constitute the main priority for both the enterprises and the local authorities.

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In the latest centuries, generally speaking, history records the alternation of some important seasons which lend themselves to represent economic models, which are the bases of modern economic thought.

First of all, there is the age of *colonial economy* centered on the role of imperial states, together with the birth of monopolistic companies, in the management of trades with dominion areas.

Then, the age of *international economy* was lived, culminating in the second post war trade relation system. It was mainly founded on the functions of the national states and their authorities to support both national espansionary fiscal policy and exchange clearings, in their trade ratios with the rest of the world.

At last, in the latest years, *interglobal economy* took vehemently the lead through the modern electronic infrastructures of telematic and telecommunications.

As the former models, the *interglobal economy* too does not automatically assure either stable equilibrium or the overcoming of traditional crises.

It gives benefits and disadvantages too.

From the normative and positive points of view, one of the disadvantages which most drew the attention of researchers is the weakening and disappearance of national and subnational economic and monetary policy instruments.

Instead one of the benefits which most attracted interest might be located on the nature itself of the technological revolution in progress, foreboding new opportunities in the integration process of local economic systems, which might qualify themselves as network growth links (or growth poles?).

The Review has the aim to represent and to inquire the normative and positive profiles of the foundamentals which might characterize the thin and difficult frontier between globalization and economic localism.

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