Turbulence underneath the big calm: Exploring the micro-evidence behind the flat trend of manufacturing productivity in Italy

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Abstract

Italy ranked last in terms of manufacturing productivity growth according to OECD estimates over the last decade (OECD; 2008) with a flat, if not declining, trend. In this work we investigate the underlying firm-level dynamics of enterprises on the grounds of a database developed by the Italian Statistical Office (ISTAT), Micro.3, covering the period 1989-2004 and containing information on more than 100,000 firms. Over the period not only the indicators of central tendency of the distribution of labour productivities have not significantly changed, but also the whole sectoral distributions have remained relatively stable over time, with their support at least not shrinking or even possibly widening over time. This is even more surprising if one takes into consideration the "Euro" shock that occurred during the period of investigation. On the contrary we observe that inter-decile differences in productivity have been increasing. Further, heterogeneous firms' characteristics (i.e. export activity and innovativeness) appear to have contributed to boost such intra-industry differences. Given such wide heterogeneities we resort to quantile regressions to identify the impact of a set of regressors at different levels of the conditional distribution of labor productivity.

1 Introduction

In this paper, exploiting a newly developed database of Italian microdata, we investigate the underlying firm-level dynamics of enterprises hidden behind the flat trend in the aggregate productivity of the Italian manufacturing industry.

A *first* striking feature that emerges from the empirical analysis is the high degree of heterogeneity displayed by firms in the same sector along many dimensions of performance including labor productivity and growth rates (the results corroborate and refine upon those of Bottazzi et al.; 2007). This heterogeneity is an intrinsic property of industries, no matter the chosen level of disaggregation.[1]

[1] As Griliches and Mairesse (1999) put it referring to firms' production function: "we [...] thought that one could reduce heterogeneity by going down from general mixtures as 'total manufacturing' to something more

The parameterization of the distributions also reveals that, given a general fat-tail property, the left tail is much fatter than the right one. This in turn corresponds to a higher heterogeneity in the performance of firms in the left tail, the low productive ones, as opposed to the relative steepness of the right tail which is pointing to a few firms placed near some "efficiency frontier". The trend over time of such shape parameters confirms the persistently large differences in performances. Further, we also show that there is evidence of a widening of the differences between most and least productive firms in each sector.

Second, as far as productivity is concerned our analyses highlight the apparent weakness of markets in selecting more efficient firms. The support of the sectoral distribution of firms' productivities is very wide and do not shrink over time, notwithstanding the "Euro" shock that occurred during the period of investigation. The event, which can be considered equivalent to a trade liberalization shock with perfectly fixed exchange rates, could have been expected to foster a process of market shares reallocation between firms in every industry and, as a result, contribute to shrink the support of the distribution of productivity among surviving. On the contrary the evidence displays, puzzling, a widening, support.

A priori, good candidates for an explanation of the striking differences across firms, even within the same line of business, in their ability to both innovate and profit from innovation ought to include firm-specific features which are sufficiently inertial over time and only limitedly "plastic" to strategic manipulation so that they can be considered, at least in the short term, "state variables" rather than "control variables" for the firm (Winter; 1987; Dosi et al.; 2006).[2]

Among the possible "state" variables idiosyncratically associated with any one firm, we focus upon production efficiency and innovativeness (proxied by patenting activities of the firm) as they both require an ad-hoc organization, which is not easy to be acquired by the firm in the short-term.

In this respect we found that, *third*, exporting and patenting activities are associated with different "types" of firms as revealed also in terms of the productivity distributions. Hence, as far as productivity is concerned, firms exporting[3] and/or patenting enjoy a superior performance than their non-exporting/ non-patenting competitors: there is a very robust evidence which holds in almost all sectors and years of analysis. On the other hand, if we look at the profitability of the firm (as proxied by the ratio of returns on sales) the picture is more blurred. Labor productivity and innovation (patenting) are strongly related to the capability of the firm to generate profits, while this is not the case for the exporting activity as such (see also Grazzi; 2009). Finally, if we consider the relation between these variables and the growth process it becomes apparent that exporting and/ or patenting firms do *not* grow more than other firms.

coherent, such as 'petroleum refining' or 'the manufacture of cement'. But something like Mandelbrot's fractal phenomenon seem to be at work here also: the observed variability-heterogeneity does not really decline as we cut our data finer and finer. There is a sense in which different bakeries are just as much different from each others as the steel industry is form the machinery industry."

[2]In fact, an emerging capability-based theory of the firm (cfr. Teece et al.; 1994 and Teece et al.; 1997), identifies a fundamental source of differentiation across firms in their distinct problem-solving knowledge yielding different abilities of "doing things" - searching, developing new products, manufacturing, etc. (see Dosi et al.; 2000, among the many distinguished others)). Successful corporations, as one argues at more detail in the introduction to the Dosi et al. (2000), derive competitive strength from their above-average performance in a small number of capability clusters where they can sustain a leadership. Symmetrically, laggard firms often find hard the imitation of perceived best-practice production technologies because of the difficulty of identifying the combination of routines and organizational traits which makes company x good at doing z.

[3]Incidentally, notice that there is a large - and growing over time - percentage of Italian firms exporting.

Even industry ‘top performers’, defined as firms with a large share of sales abroad and with at least one patent, do not display higher growth rates than the industry average. Their relative advantage in terms of labor productivity does not get translated into higher growth e.g. by means of market selection or other mechanisms such as the availability of greater cash-flows which can be reinvested.

Then, what about the process of market selection that in a good deal of theoretical models is providing a welfare enhancing allocation of resources to most efficient firms? The evidence in this direction provided by this paper is very scarce if at all there.

Fourth, also our disaggregated longitudinal data confirm a troubling puzzle. In the new millennium, notwithstanding the “euro shock” - which prevents supporting competitiveness via devaluations - there is no evidence of a generalized shock on productivity. On the contrary, in many industrial sectors the distribution of labor productivity at the end of our period of observation does not significantly change as compared to the late ’90s. And some sectors even display a generalized *fall* in labor productivity.

Fifth, our data *do* detect a (very) small number of “outliers” - top performers in terms of labor productivity, innovativeness, export and growth. However, their small number and share of value added as compared to the universe of the considered firms, is unable - at least up to 2004, our last year of observation - to affect the dynamics of the overall mean or even the shape of the relevant distributions over time.

2 Data

The database employed for the analyses, Micro3, has been built thanks to the collaboration between the Italian statistical office, ISTAT, and a group of LEM researchers, and it covers a long time span, 1989-2004.[4]

Micro.3 is based on the census of Italian firms yearly conducted by ISTAT and contains information on firms in all sectors of the economy for the period 1989-2004. In that respect, Micro.3 represents a development of the former Micro.1 (for some results and references of other works on Micro.1, see Dosi; 2007; Dosi and Grazzi; 2006). The census conducted by ISTAT contains standard information as those appearing in firms’ financial statement together with some additional variables that may vary over the years. Further, exploiting the existence of a unique code for the identification of the firm, it was possible to link to Micro.3 other information collected by Istat, most notably for the present work, the data on international trade (COE) and patent data. The census monitors firms bigger than 20 employees. In particular, starting in 1998 the census of the whole population of firms only concerns companies with more than 100 employees. As far as firms in the range of employment 20-99 are concerned, ISTAT directly monitors only a “rotating sample” which varies every five years. In addition, to increase the coverage for firms in the range 20-99, ISTAT also collects data on those firms not included in the “rotating sample”. In this respect, ISTAT resorts, from 1998 onward, to data from the financial statement that limited firms have to disclose, in accordance to Italian law.[5] This further source of data turns out be very important because such legal requirement ensures that we keep track all active limited liability firms after 1998, of course above the 20

[4]The database has been made available for work after careful censorship of individual information. More detailed information concerning the development of the database Micro.3 are in Grazzi et al. (2009).

[5]Limited companies (*società di capitali*) have to hand in a copy of their financial statement to the Register of Firms at the local Chamber of Commerce in accomplishment to article 2435 of the Civil Code. Then the Union of the Chambers of Commerce assembles together the data.

employees threshold.[6]

In synthesis, then, three sources of information on Italian firms have been merged: the census for firms bigger than 100 employees, a “rotating sample” survey for firms in the range of employment 20-100, and, finally, data from financial statement in order to fill in missing observations and to provide the widest possible coverage of the Italian economy. Incidentally, note that in some cases we had two different sources of information that were providing data for the same firm and variable. It was then possible to check for the reliability and consistency of the two sources. The results of these checks were largely positive and are available in Grazzi et al. (2009).

In the end, Micro.3 contains data for 134625 Italian firms, of whom 60084 are active in the Manufacturing sectors. The possibility to resort to a further source of data from 1998 onward also resulted in an increased representativity of Micro.3 on the whole manufacturing sector. In general, to give some coordinates, Micro.3 covers around - depending on the year of observation - 50-60% of the value added generated by all Italian firms in the manufacturing sectors, NACE 15 to 37 (more details in Grazzi et al.; 2009).

Consider that Micro.3 spans over a long period of time, almost two decades, during which many things have changed in the economy, in general, and in industrial structures and their classification, more in particular. Some economic activities, as for instance the recycling industry, NACE 37, did not even exists as an industry of its own according to the industrial classification adopted back in 1989. During the time interval covered by Micro.3 the standards for industry classification have changed many times.

Thanks to the fruitful collaboration with Istat (for further details on the output of the project, see Grazzi et al.; 2009) it was possible to overcome most of the difficulties related to the change in the classification of economic activities, so that the assignment of firms to the different sectors is done, for all years in the sample, according to ATECO 2002 classification that corresponds to the European Nace Rev. 1.1 (ISTAT; 2002) . Quite obviously, having an industry classification that is invariant throughout all the sample period greatly enhances the possibility of making senseful comparison over the years.

The other issue that one is facing in making inter-temporal comparisons is deflating monetary variables. In 1992, for instance, there was a period of severe speculative pressure, also motivated by high inflation rates in Italy, that caused the devaluation of the Lira, the Italian currency, with the consequent exit from the monetary union. Those years, indeed, reported inflation rates which were remarkably higher than those to which we are accustomed nowadays, especially after the Euro introduction. It is then particularly important to appropriately deflate the monetary variables if one wants to be able to make inter-temporal comparisons.

In order to be able to do so, we deflate our data on monetary variables making use of the 2 or 3 digit sectoral production price index provided by ISTAT and taking 2000 as the reference year.[7] The availability of deflators starts in 1991.

[6]In Grazzi et al. (2009) it is shown that in the second subperiod, 1998-2004, the number of observations increase of roughly one third.

[7]ISTAT provides online time series for the Italian economy at: *http://con.istat.it/default.asp*

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
15	54.4	58.9	58.2	56.6	54.9	55.1	56.6	57.6	58.9	58.3	58.0	61.1	60.1	58.9
17	35.4	37.4	39.4	41.9	43.0	40.6	42.2	40.8	40.8	43.2	42.0	41.8	40.2	41.4
18	25.8	26.2	27.7	29.0	32.3	32.1	30.8	32.3	31.7	34.6	35.9	35.8	34.7	36.4
19	30.6	30.1	33.4	35.0	37.4	35.4	31.2	32.6	34.4	37.1	37.2	37.2	36.7	38.3
20	35.1	37.9	38.7	39.2	40.6	39.7	39.2	38.8	38.7	40.9	41.2	41.2	40.4	41.9
21	52.9	51.6	57.9	62.6	63.9	67.8	68.5	72.4	70.0	64.8	61.6	64.4	63.7	67.1
22	61.4	65.4	63.7	63.0	59.9	59.5	63.9	63.2	66.0	70.4	66.8	67.5	68.1	75.0
23	112.2	106.2	128.7	128.2	127.2	124.5	136.1	150.1	126.3	167.3	169.1	124.1	128.3	143.4
24	59.0	64.1	65.2	72.3	84.1	77.0	76.3	79.6	79.7	82.0	77.6	83.5	78.4	82.1
25	46.6	48.9	51.8	53.7	52.2	51.6	50.3	49.4	50.9	49.8	48.1	50.7	49.0	49.0
26	50.9	52.7	51.9	54.8	57.4	53.0	53.8	53.6	57.6	58.3	58.2	61.6	60.2	60.2
27	43.2	42.3	46.7	56.4	67.2	56.5	60.6	58.1	56.5	58.7	53.7	55.1	55.5	60.2
28	40.0	41.0	41.8	43.5	46.3	46.9	45.1	44.0	44.6	45.6	45.7	47.3	45.7	45.8
29	44.5	46.3	48.9	52.1	53.5	52.3	50.9	50.7	51.0	53.0	52.3	52.8	50.7	52.3
30	64.1	88.5	82.3	79.9	74.4	55.7	66.0	44.3	48.0	49.3	75.7	50.0	51.8	66.3
31	43.2	44.1	44.9	46.6	47.5	45.1	47.4	46.1	47.2	48.3	47.6	48.8	48.9	49.7
32	44.7	44.5	44.6	43.9	43.8	43.8	47.1	47.8	48.7	60.9	57.7	52.6	57.7	61.7
33	44.6	44.9	46.8	47.2	49.8	47.6	48.1	49.4	48.4	51.5	52.2	56.5	51.3	55.2
34	37.4	35.2	27.8	36.3	46.6	39.6	52.1	43.8	44.1	45.7	40.7	48.6	42.0	52.1
35	43.5	45.8	49.2	49.6	52.2	43.8	43.3	43.7	46.2	54.2	51.8	54.3	51.4	58.5
36	34.9	35.8	37.0	37.2	39.1	37.7	37.6	38.4	39.5	40.3	39.9	38.9	37.5	37.7

Table 1: Value added per employee in 2 digit manufacturing sectors. Source: Our elaboration on Micro.3 (deflated with con.istat production price index)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
15	49.2	53.85	51.65	55.41	53.89	53.11	52.79	56.18	...	...
17	37.54	40.35	40.63	40.71	40.43	42.82	42.26	41.53	40.22	41.26
18	27.32	30.11	29.02	29.54	28.99	34.11	32.96	33.04	29	32.78
19	31.07	34.41	31.02	33.48	36.32	35.82	35.31	33.77	31.63	35.2
20	34.07	40.66	41.42	40.59	40.58	42.72	42.91	42.08	42.14	42.86
21	53.9	63.01	63	66.5	61.18	58.71	63.45	63.71	59.32	61.59
22	47.24	55.27	55.09	56.51	57.17	60.27	59.75	63.17	60.33	64.53
23	116.32	130.99	124.31	153.85	132.77	157.66	162.54	133.82	126.22	142.1
24	75.25	80.01	77.85	79.05	81.35	81.19	75.61	78.48	77.67	74.22
25	44.57	49.99	47.85	49.56	49.53	49.31	49.37	51.41	49.06	48.62
26	46.46	50.21	50.49	51.29	53.53	54.42	52.39	54.75	54.41	54.35
27	59.77	56.49	59.72	56.97	56.25	59.51	54.03	54.67	54.94	58.09
28	39.79	47.57	46.51	46.98	45.37	46.51	47.4	46.77	46.45	44.93
29	48.52	54.63	51.03	50.45	50.73	53.02	53.37	52.67	51.41	53.8
30	52.39	52.06	59.79	72.48	61.09	50.21	78.22	32.97	45.56	50.75
31	41.76	43.93	46.41	44.88	47.19	46.31	43.97	46.5	45.4	48.17
32	42.29	47.53	49.21	45.03	40.91	64.88	54.34	48.85	58.18	56.48
33	46.88	51.05	49.59	49.67	50.24	56.18	53.12	58.56	52.66	56.9
34	43.07	40.64	51.37	43.95	41.25	44.78	40.81	36.06	41.44	41.24
35	...	40.22	41.39	45.87	44.86	50.2	50.01	52.94	49.3	56.19
36	33.04	38.3	38.38	39.87	37.87	41.91	40.98	39.82	37.44	37.71

Table 2: Value Added per employee. Source: Eurostat data (deflated with con.istat production price index)

3 Micro.3 and Aggregate evidence on labor productivity

It is well known that Italy had a poor performance in terms of productivity growth in the last fifteen years or so. International comparisons (OECD; 2008) shows that Italy ranked last in terms of growth of GDP per hour worked over the period 1995-2006 (see OECD; 2008, p. 17).

In general, the Italian economy registered a zero growth in the years 2001-2005 and an average annual growth below 1% in the previous period, 1995-2000. Only Spain did worse in this subperiod. More in particular, results for the manufacturing sector, are even more dramatic, indeed if we consider the 1995-2005 period, then the average growth rate of value added per employee is negative (OECD; 2008). Again Italy is the only country, with the exception of Spain, that registered a negative growth rate of productivity in the period under investigation.

Let us now investigate how this evidence at the aggregate level relates to what we observe at the level of the sector and of that of the firm with the microdata. Of course, given that OECD statistics are based on data provided by the various National Institutes of Statistics, the aggregate picture that one builds with the micro-data should be coherent with the OECD results. Yet, the picture that one gets at the level of the firm and of the sector is much more informative than the aggregate measure alone.

In the following we are going to uncover the - quite - rich dynamics underlying the relative stagnancy of productivity at the aggregate level. Further we will also seek to identify those hints that are suggesting a way out of the zero-growth trap, and, for instance, if some groups of firms are already on this path.

To start with, we want to check that the aggregate statistics that we can build on Micro.3 are indeed coherent with the national statistics released by the OECD or Eurostat. In this respect a methodological note is due. Aggregate statistics for productivity typically report a measure, value added per worker, that is the ratio between the sum of all value added produced by the economy (or by one of its sectors) and the sum of all workers employed. As such every firm has a weight in the summation that is proportional to its size (both in terms of value added and numbers of employees). On the contrary, exploiting the micro-data contained in Micro.3, not only we can (re)produce the same measure summing up value added and number of workers and then taking the ratio, but we can also estimate the average of the productivity of firms in a sector and its variance. Further, in order to evaluate the dynamics of labor productivity over time we can study the dynamics of the whole underlying distribution. In what follows we will use both measures, sectoral average productivity and industry value added per worker. The first measure enable us to make statement about the dynamics of the distribution, whether the latter provides us a benchmark with the aggregate statistics by Eurostat and OECD.

Table 1 reports the value added per employee in 2 digit manufacturing sectors for firms in Micro.3. We can compare these ratios to those released by Eurostat and reported in Table 2. Both measures have been deflated with the sectoral production price index. Let us compare the figures from Micro.3 and Eurostat. The two measures are quite similar, and more important, they display the same broad trend over time. We would not expect them to perfectly overlap as one of them, Eurostat's value added per employee, is computed over the whole population of firms, whether the other is computed on Micro.3 and thus refers only to firms bigger than 20 employees. Probably this difference determines one of the most robust evidence that we can identify looking at the tables: sectoral value added per employee computed on Micro.3 tends to be sligthly bigger than the equivalent measure reported by Eurostat.

This is not much of a surprise if one thinks at the known positive relation between size and labor productivity (for a related work on a previous version of the database, see Bottazzi and Grazzi; forthcoming). Thus, thanks to such a positive relation, firms in Micro.3 tend to enjoy higher ratios of value added per worker than the average firm in the population. Also notice that Eurostat does not report aggregate sectoral data before 1995, whether our micro-data are available since 1989. Then, since the sectoral production price index is only available only starting in 1991[8], we report data only from 1991 onward in order not to compromise inter-temporal comparisons.

Briefly, the comparison of value added per worker for Micro.3 and Eurostat, respectively Table 1 and 2, tells that overall our database produces aggregate statistics comparable to those by Eurostat. Thus it makes sense to keep drawing relation between what we observe at the aggregate, by means of Eurostat or OECD statistics, and what we do observe at the

[8]There was, of course, a deflator comparable to the the production price index even before 1991. What compromise the comparison is the radical change in industry classification that occurred between '90 and '91. The classification that was adopted before, the ATECO 1981 is barely comparable to the ATECO 1991 and NACE-Clio industrial classification (more on this in Grazzi et al. (2009)).

	91	92	93	94	95	96	97	98	99	00	01	02	03	04
15	47.9 (54.3)	51.7 (57.6)	51.1 (56.8)	51.3 (55.6)	50.2 (53.9)	50.8 (53.6)	49.3 (57.1)	52.4 (58.3)	52.7 (59.5)	51.9 (58.2)	52.8 (56.0)	55.0 (60.1)	53.9 (60.6)	53.2 (58.8)
17	33.8 (36.3)	35.5 (38.1)	37.3 (40.0)	39.2 (43.3)	40.1 (43.4)	38.3 (40.7)	38.6 (43.3)	38.3 (41.1)	38.3 (40.8)	40.6 (43.2)	39.5 (42.1)	39.6 (42.4)	38.4 (41.6)	39.2 (42.3)
18	20.5 (30.5)	20.5 (31.1)	21.8 (34.3)	22.6 (37.4)	24.3 (40.1)	25.4 (37.0)	22.7 (35.4)	25.1 (38.0)	24.8 (37.1)	26.9 (41.0)	28.4 (43.2)	28.2 (41.4)	26.7 (39.7)	27.9 (42.0)
19	27.4 (35.3)	27.3 (35.7)	29.5 (38.3)	30.7 (40.2)	31.9 (43.4)	31.5 (38.6)	28.5 (37.0)	29.7 (37.3)	30.7 (39.1)	33.3 (42.5)	32.9 (40.7)	32.7 (41.3)	31.9 (40.0)	33.7 (41.4)
20	32.7 (41.9)	34.7 (45.8)	35.2 (48.8)	35.2 (51.0)	36.2 (53.0)	36.5 (47.0)	34.4 (46.6)	34.6 (45.9)	35.4 (44.9)	36.1 (50.4)	37.5 (47.9)	36.4 (49.3)	36.7 (46.3)	36.6 (49.7)
21	44.6 (51.6)	46.7 (53.1)	49.6 (57.2)	53.3 (64.1)	53.7 (64.2)	58.6 (66.8)	55.5 (67.6)	55.3 (78.1)	54.4 (72.4)	50.1 (65.7)	51.8 (62.6)	53.4 (65.5)	51.8 (64.0)	53.5 (66.2)
22	49.3 (66.8)	50.1 (72.2)	49.5 (68.1)	50.0 (70.5)	49.7 (66.5)	50.6 (63.9)	50.1 (70.1)	51.7 (65.9)	53.2 (71.1)	50.4 (71.0)	51.4 (67.3)	53.1 (69.6)	53.1 (69.6)	52.4 (71.2)
23	89.4 (113)	84.6 (105)	87.6 (114)	83.7 (105)	89.9 (111.4)	108.7 (148)	94.7 (108.5)	107.7 (120)	105.5 (109.6)	90.5 (117)	101.7 (132)	99 (106)	102 (113)	97 (121.7)
24	58.9 (61.0)	63.0 (67.4)	65.3 (67.3)	67.0 (71.5)	71.6 (77.5)	72.2 (75.1)	67.5 (76.1)	74.9 (80.7)	75.3 (81.2)	72.6 (81.5)	73.4 (79.8)	72.7 (82.4)	72.1 (79.2)	73.1 (82.5)
25	44.2 (47.2)	45.5 (50.0)	46.5 (54.7)	48.2 (56.6)	47.2 (55.9)	48.2 (53.9)	45.0 (54.6)	45.2 (53.8)	46.4 (55.1)	45.8 (55.1)	44.6 (51.0)	46.4 (55.5)	45.0 (53.2)	45.3 (51.4)
26	45.4 (53.9)	47.4 (56.1)	45.9 (55.1)	46.1 (58.4)	47.5 (60.9)	47.0 (56.1)	44.8 (55.7)	45.1 (55.7)	47.0 (59.7)	48.4 (62.0)	47.2 (59.5)	49.7 (63.3)	48.8 (63.2)	49.3 (61.3)
27	43.9 (44.7)	46.4 (46.6)	47.4 (49.1)	51.0 (54.4)	56.9 (62.9)	55.4 (55.7)	53.0 (58.3)	52.0 (58.8)	56.0 (63.0)	54.8 (62.5)	53.8 (60.0)	54.5 (61.6)	54.1 (60.4)	52.5 (60.9)
28	38.2 (42.4)	38.5 (44.5)	38.5 (45.3)	40.5 (46.9)	43.3 (51.3)	44.7 (48.2)	41.7 (49.1)	41.4 (48.2)	41.6 (49.9)	42.3 (50.4)	43.2 (49.2)	44.5 (50.9)	43.0 (49.5)	42.5 (50.9)
29	43.1 (46.0)	43.2 (46.6)	44.4 (48.8)	46.3 (51.4)	49.2 (54.0)	50.6 (53.0)	47.3 (52.3)	46.9 (52.6)	47.2 (53.3)	49.3 (55.5)	49.4 (54.2)	49.4 (54.9)	47.1 (52.7)	48.5 (54.5)
30	39.5 (37.7)	41.1 (53.3)	37.2 (45.1)	39.1 (50.9)	46.4 (45.7)	51.2 (35.6)	56.7 (36.8)	50.3 (47.4)	60.3 (56.2)	52.9 (51.2)	64.7 (147.9)	50.7 (43.3)	48.4 (57.2)	50.1 (63.5)
31	36.7 (39.6)	37.9 (42.5)	38.2 (43.7)	39.7 (46.2)	41.8 (49.2)	42.8 (47.9)	43.0 (49.2)	41.9 (47.7)	42.9 (48.3)	44.0 (51.3)	43.6 (49.0)	44.6 (50.5)	44.2 (50.2)	44.7 (53.8)
32	36.9 (39.8)	38.8 (39.4)	40.0 (43.7)	42.4 (44.8)	44.0 (43.5)	45.1 (47.8)	44.0 (47.6)	40.9 (44.5)	42.0 (44.0)	44.2 (49.5)	46.0 (50.6)	45.3 (46.5)	48.3 (49.4)	50.0 (55.5)
33	39.0 (44.2)	39.0 (44.3)	39.6 (47.4)	41.4 (46.8)	45.7 (49.4)	44.5 (47.0)	42.7 (48.3)	43.2 (50.4)	43.6 (52.5)	45.1 (54.8)	47.2 (56.6)	48.6 (59.2)	46.1 (55.1)	49.1 (60.8)
34	38.8 (40.6)	39.5 (41.1)	40.4 (41.9)	42.7 (47.5)	46.1 (50.7)	44.6 (46.9)	46.1 (52.3)	43.8 (46.8)	43.7 (48.1)	44.7 (47.0)	44.2 (46.4)	45.1 (47.8)	43.7 (45.5)	46.3 (50.6)
35	...	...	...	...	...	38.4 (40.4)	37.4 (41.6)	41.8 (44.4)	42.6 (48.3)	44.5 (52.6)	44.7 (47.2)	44.5 (48.4)	43.9 (46.7)	45.2 (51.7)
36	32.7 (38.1)	33.3 (39.8)	33.6 (41.5)	34.3 (42.3)	35.9 (43.5)	36.7 (40.4)	34.0 (41.1)	35.3 (41.3)	35.9 (43.5)	36.3 (44.1)	36.6 (42.8)	36.3 (42.8)	35.3 (40.3)	34.7 (40.5)

Table 3: Average labor productivity in 2 digit manufacturing sectors of Micro.3 for all firms and (in brackets) for firms bigger than 100 employees. Source: Our elaboration on Micro.3 (deflated with con.istat production price index)

	Size Classes			
	1-9	10-49	50-249	250+
Number of firms	435,742	78,397	10,338	1,458
Percentage	82.9	14.9	2.0	0.3
	1-9	10-49	50-249	250+
Employment	1,191,346	1,461,586	994,383	1,111,209
Percentage	25.0	30.7	20.9	23.4

Table 4: Enterprises and employment of manufacturing industries for size classes. Our elaboration on ISTAT (2008).

firm-level in Micro.3.

We can then start to exploit the information about the distribution of firm-level productivity within each industry. In this respect Table 3 displays, for the 2 digit manufacturing sectors of Micro.3, the average labor productivity at constant prices. The levels of average productivity are of course higher in 2004 than at the beginning of the sample period in 1991. But if one takes into account the high heterogeneity characterizing the distribution of labor productivity (cf. Section 4) the differences in the levels of average productivity do not always turn to be significant (more on this in the following). There is another feature of our productivity estimates that closely matches the aggregate data provided by OECD. One can notice indeed that the largest share of growth is registered in the time span 1995-2000, as reported by the OECD data.

A further research question related to the comparison of Micro.3 to the aggregated data concerns the 20 employees threshold of Micro.3. As we have argumented above with respect to Table 1 and 2, given the known positive relation between size of the firm and productivity, one could expect the estimates of sectoral average labor productivity on Micro.3 (Table 3) to be bigger, given the presence of firms with more 20 employees, than the aggregate measure on value added per employee reported by Eurostat for the whole population of firms (Table 2). The comparison reveals that the average sectoral productivity of firms in Micro.3 is not regularly bigger than the aggregate measure of value added per employee by Eurostat. This is so, because in Table 3 we are now computing the sectoral average productivity, assigning the same weight (equal to one) to all firms in an industry, so that bigger, and thus more productive, firms gets the same weight of smaller and less productive enterprises. As a result the average sectoral labor productivity that we get in Table 3 is smaller then the ratio of value added per worker reported, still on Micro.3 data, in Table 1.

As a thought experiment, Table 3 also reports, in brackets, the average sectoral productivity for Micro.3 firms bigger than 100 employees. It is now possible to observe again a substantial difference between the levels of average productivity for this sub-sample of Micro.3 and the estimate for the universe provided by Eurostat.

How does this evidence on productivity relate to other comparable empirical analysis available for Italy? In general, the contribution by Bank of Italy (2008) provides empirical results that largely support the evidence of the many difficulties borne by the Italian economy in general, and the flat trend in productivity more in particular. Bank of Italy (2008) argues that the exogenous shocks that equally affected other industrialized country had a heavier impact on Italy and this was due to the specific structural characteristics of the economy (Bank of Italy; 2008, pp. 6). A slightly different perspective is that taken in Mediobanca - Unioncamere (2008), see also Coltorti (2004). These latter contributions focus indeed only on a sub-set of medium sized firms: those in the employment range 50-499 and turnover range 13-290 millions of euro.[9] In the end one is left with a number of firms that varies between 3543 in 1999 and 3984 in 2005 (Mediobanca - Unioncamere; 2008, pp. IX). Such figures turns out to be far less than half of the total number of firms in the same employment range, that according to the data published by ISTAT were more than 10.000 in 2004-05 (ISTAT; 2008, pp. 61, and Table 4). The selected group of firms on which the contribution by Mediobanca - Unioncamere (2008) is focused displays a positive trend both in terms of economic and financial performance and also in terms of export. These are of course positive signals and support the hypothesis that there are virtuous firms that are hidden behind a flat trend and an apparent stagnation in productivity. This one and similar other conjectures are discussed at length also in other contributions that focus on the recent trend of the Italian economy, see for instance, Baldwin et al. (2007) and Lanza and Quintieri (2007).

4 Characterizing the distributions

Once that the comparability of our database to the aggregate statistics has been ascertained, it is possible to fully exploit the higher information content provided by the microdata. In particular, it is possible to resort to firm level productivities to investigate the properties and evolution of the relative distributions over time. As shown, the aggregate data report no significant growth of productiivty over the last two decades.

In Dosi and Grazzi (2006) it is already shown, on a previous and shorter version of the present database, that labor productivity displays a wide support, both at three and two digit levels of disaggregation.[10] Further, one also notices that such heterogenety is persistent over time.

We are now interested to verify if such typical feature of a wide support survived the shock that followed the introduction of the euro currency. Indeed, such an event, which can be considered equivalent to a trade liberalization with perfectly fixed exchange rates, could be expected to foster the process of market share reallocation between firms in every industry and, as a result, contribute to shrink the support of the distribution of productivity in a given sector. In order to better investigate the distribution of the variable of interest, we will resort to a new 5-parameters family of distributions, the Asymmetric Exponential Power (AEP), introduced by Bottazzi and Secchi (2006b) that allow to properly cope with asymmetries and leptorkurtosis, allowing at the same time for a continuous variation from non-normality to normality.

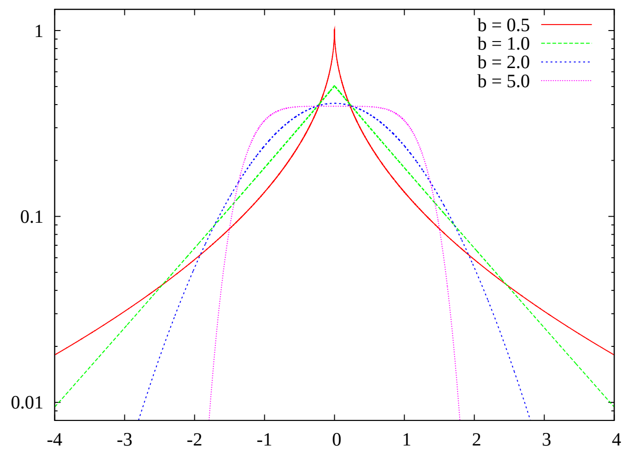

Figure 1: Subbotin distribution or (symmetric) Exponential Power for different values of b. See also Bottazzi and Secchi (2006a).

4.1 The Asymmetric Exponential Power

Subbotin (1923) introduced a family of distribution, generally known as the Exponential Power (EP) distribution, characterized by a scale parameter $a > 0$, a shape parameter $b > 0$ and a location parameter m. The EP density reads

$$f_{\mathrm{EP}}(\mathrm{x};\mathrm{b},\mathrm{a},\mathrm{m}) = \frac{1}{2\mathrm{ab}^{1/\mathrm{b}}\Gamma(1/\mathrm{b}+1)}\,\mathrm{e}^{-\frac{1}{\mathrm{b}}\left|\frac{\mathrm{x}-\mathrm{m}}{\mathrm{a}}\right|^{\mathrm{b}}} \tag{1}$$

where $\Gamma(x)$ is the Gamma function. The Gaussian distribution is recovered when $b = 2$ while when $b < 2$ the distributions are heavy-tailed: the lower is the shape parameter b, the fatter are the density tails, see also Figure 1.

In the present work we employ an alternative way to tackle the presence of heavy tails and skewness that has been introduced by (Bottazzi and Secchi; 2006b). The authors propose a new 5-parameters family of distributions, the Asymmetric Exponential Power distributions (AEP), characterized by two positive shape parameters b_r and b_l, describing the tail behavior in the upper and lower tail, respectively; two positive scale parameters a_r and a_l, associated with the distribution width above and below the modal value and one location parameter m, representing the mode. The AEP density presents the following functional form

$$f_{\mathrm{AEP}}(x;\mathbf{p}) = \frac{1}{C}\; e^{-\left(\frac{1}{b_l}\left|\frac{x-m}{a_l}\right|^{b_l}\theta(m-x)+\frac{1}{b_r}\left|\frac{x-m}{a_r}\right|^{b_r}\theta(x-m)\right)} \tag{2}$$

where $\mathbf{p} = (b_l, b_r, a_l, a_r, m)$, $\theta(x)$ is the Heaviside theta function and where the normalization constant reads $C = a_l A_0(b_l) + a_r A_0(b_r)$ with

$$A_k(x) = x^{\frac{k+1}{x}-1}\,\Gamma\left(\frac{k+1}{x}\right)\;. \tag{3}$$

[9]Further, it also excludes firms controlled by big or foreign groups.

[10]In this respect the following quotation by Griliches and Mairesse (1999) is quite enlightening: “we (...) thought that one could reduce heterogeneity by going down from general mixtures as “total manufacturing” to something more coherent, such as “petroleum refining” or “the manufacture of cement”. But something like Mandelbrot’s fractal phenomenon seems to be at work here also: the observed variability-heterogeneity does not really decline as we cut our data finer and finer. There is a sense in which different bakeries are just as much different from each others as the steel industry is from the machinery industry.”

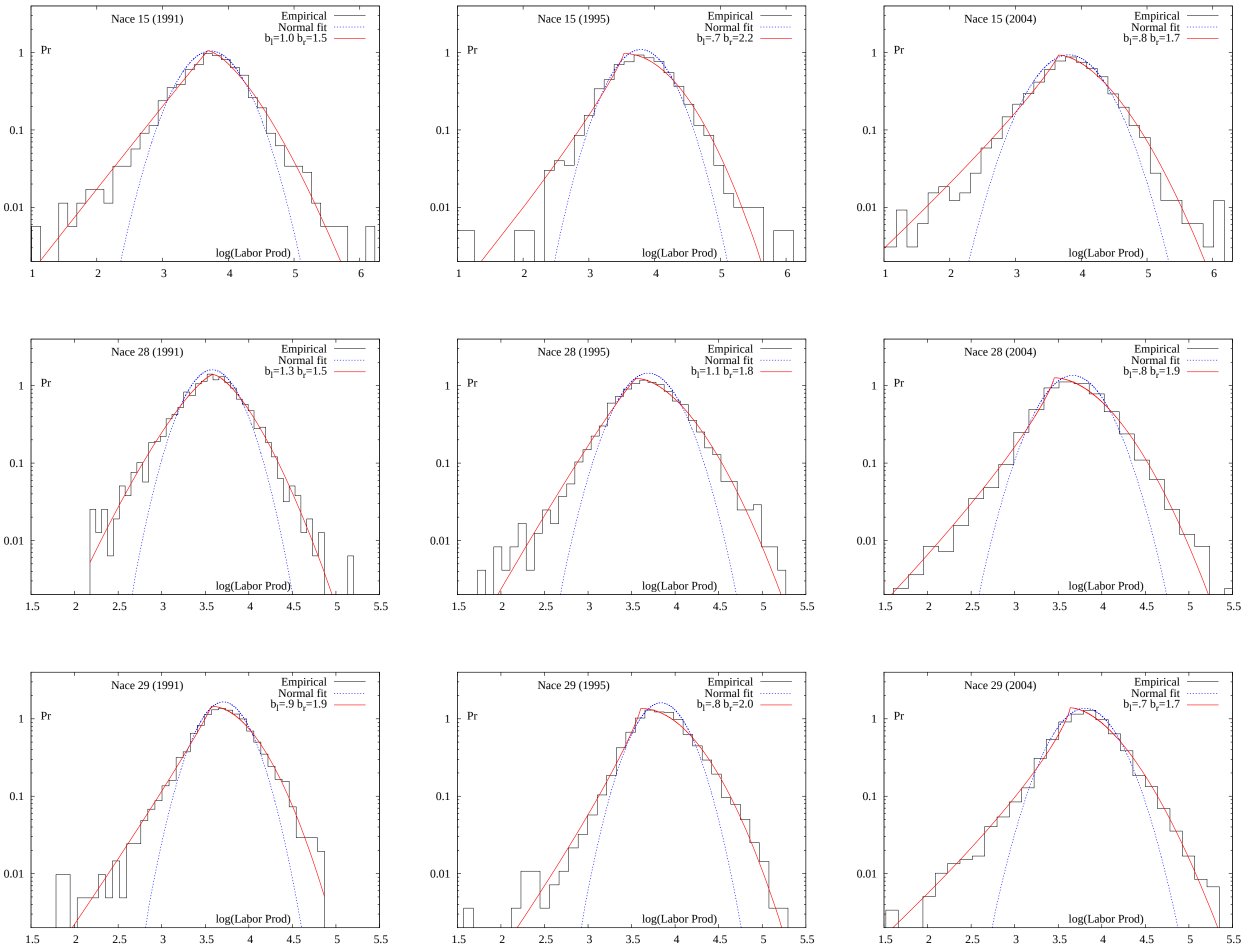

Figure 2: Empirical density of labor productivity for NACE 15, 28 and 29 together with the Normal and AEP fit (deflated with the sectoral production price index).

The AEP reduces to the EP when $a_l = a_r$ and $b_l = b_r$. The density in (2) can be easily integrated to obtain the distribution function, see Bottazzi and Secchi (2006b). In the following we are going to employ the AEP as it enables for a more flexible characterization of the distribution of labor productivity.[11] In particular, we will investigate the dynamics over time and across sectors of the b_l and b_r parameters, thus also accounting for possible asymmetries in the distribution. Given the relative stability of the a_l and a_r we report them in the Appendix A, cf. Table 5.

Figure 2 displays the empirical density of (log) labor productivity for the food and beverage sector, NACE 15, 28 and for the machine tool sector, NACE 29. The plots also display the Normal and AEP fits for a selection of years. Notice that that probability, on the y-axis, is on a log scale to enhance the representation of the tails of the distribution. In both sectors, the departure from normality of the empirical distribution is impressive both with respect to the wideness of the support and also for the asymmetry of the two tails, which is also visually detectable in the plots of Figure 2. It is also noteworthy that there is no shrink in the support of the distributions, suggesting that both at the beginning and at the end of the sample period there exist firms with very different levels of efficiency. On the contrary, one detects a widening

[11]For issues concerning the comparisons of goodness of fit measures with other distribution refer to Bottazzi and Secchi (2006b).

NACE	1991		1995		2000		2004	
	$\mathbf{b_l}$	$\mathbf{b_r}$	$\mathbf{b_l}$	$\mathbf{b_r}$	$\mathbf{b_l}$	$\mathbf{b_r}$	$\mathbf{b_l}$	$\mathbf{b_r}$
15	$1.01_{0.08}$	$1.48_{0.14}$	$0.76_{0.06}$	$2.23_{0.17}$	$0.91_{0.06}$	$1.75_{0.12}$	$0.87_{0.05}$	$1.73_{0.12}$
17	$1.25_{0.11}$	$1.91_{0.18}$	$1.52_{0.13}$	$1.39_{0.14}$	$0.99_{0.06}$	$1.69_{0.12}$	$1.06_{0.07}$	$1.32_{0.11}$
18	$1.04_{0.09}$	$1.30_{0.10}$	$1.08_{0.10}$	$1.29_{0.09}$	$1.09_{0.09}$	$1.46_{0.12}$	$1.09_{0.10}$	$1.63_{0.14}$
19	$0.92_{0.09}$	$1.95_{0.18}$	$0.88_{0.09}$	$1.85_{0.15}$	$0.68_{0.05}$	$2.32_{0.16}$	$0.61_{0.04}$	$2.21_{0.16}$
20	$1.01_{0.13}$	$1.58_{0.21}$	$0.76_{0.08}$	$1.59_{0.18}$	$0.65_{0.05}$	$1.73_{0.16}$	$0.87_{0.08}$	$1.70_{0.18}$
21	$0.57_{0.07}$	$3.14_{0.42}$	$1.19_{0.23}$	$1.90_{0.29}$	$0.78_{0.08}$	$1.68_{0.18}$	$0.50_{0.04}$	$2.32_{0.22}$
22	$0.81_{0.10}$	$1.70_{0.16}$	$0.85_{0.09}$	$1.25_{0.12}$	$0.82_{0.07}$	$1.21_{0.09}$	$0.69_{0.06}$	$1.45_{0.11}$
24	$0.62_{0.06}$	$2.43_{0.24}$	$0.86_{0.10}$	$1.78_{0.18}$	$1.12_{0.10}$	$1.38_{0.14}$	$0.78_{0.06}$	$1.56_{0.12}$
25	$0.79_{0.07}$	$1.87_{0.17}$	$0.68_{0.05}$	$1.98_{0.16}$	$0.93_{0.06}$	$1.67_{0.11}$	$0.79_{0.04}$	$1.63_{0.11}$
26	$1.07_{0.10}$	$1.70_{0.15}$	$0.85_{0.07}$	$2.48_{0.21}$	$0.81_{0.05}$	$1.67_{0.11}$	$0.86_{0.06}$	$1.67_{0.11}$
27	$0.81_{0.09}$	$2.27_{0.26}$	$0.99_{0.14}$	$1.88_{0.23}$	$0.99_{0.10}$	$1.55_{0.16}$	$0.70_{0.06}$	$1.69_{0.15}$
28	$1.34_{0.10}$	$1.52_{0.12}$	$1.10_{0.08}$	$1.78_{0.11}$	$0.93_{0.04}$	$1.64_{0.07}$	$0.81_{0.03}$	$1.87_{0.07}$
29	$0.93_{0.06}$	$1.94_{0.12}$	$0.85_{0.05}$	$2.01_{0.11}$	$0.83_{0.03}$	$1.53_{0.06}$	$0.77_{0.03}$	$1.73_{0.07}$
31	$0.66_{0.05}$	$2.07_{0.20}$	$1.12_{0.12}$	$1.33_{0.15}$	$0.99_{0.08}$	$1.29_{0.11}$	$0.80_{0.06}$	$1.57_{0.12}$
32	$0.90_{0.14}$	$1.17_{0.24}$	$1.92_{0.34}$	$0.80_{0.13}$	$0.71_{0.08}$	$2.04_{0.26}$	$0.72_{0.10}$	$2.42_{0.34}$
33	$1.40_{0.26}$	$1.46_{0.30}$	$1.77_{0.24}$	$0.85_{0.12}$	$0.76_{0.07}$	$2.11_{0.23}$	$0.83_{0.09}$	$1.89_{0.20}$
34	$0.93_{0.12}$	$1.46_{0.24}$	$0.40_{0.04}$	$2.56_{0.33}$	$0.54_{0.04}$	$1.67_{0.16}$	$0.69_{0.07}$	$1.64_{0.17}$
36	$0.87_{0.06}$	$1.40_{0.10}$	$0.74_{0.05}$	$1.97_{0.13}$	$0.51_{0.02}$	$1.94_{0.10}$	$0.73_{0.04}$	$1.58_{0.09}$

Table 5: Summary table of the sectors under analysis. Estimated $\mathbf{b_l}$ and $\mathbf{b_r}$ parameters and standard errors for the distribution of labor productivity. (deflated with the sectoral production price index)

of the support, which is of course coherent with the evidence of Table 6. Thus, there is no evidence that the introduction of the euro has fostered any selection processes as a result of tighter competition.

The properties of the distribution that are apparent in the plots of Figure 2 for sector 15 and 29, also holds for most of sectors in Table 5. Notice indeed, that almost all b parameters in all sectors and years are smaller than two, meaning that they display fat-tails property. Sinc we are considering a ratio (value added over number of employee) there is no issue with thresholds in the variable of interest like there would be with variables as, for instance, total sales - where there might be a truncation in the left tail of the distribution due to the 20 employees threshold. Then, it is now possible to consider the differences in the b_l and b_r as summarizing genuine properties of the distributions. In this respect a feature equally remarkable as the non-normality is the asymmetry of the empirical density. Both b_l and b_r are generally smaller than 2, pointing to the presence of fat tails, however also notice that the left index is often smaller than the rigth one, suggesting that left-tail property is stronger in the left hand of the distribution. That is, the probability decay in the lower-end of the density is much slower than in the higher end. That corresponds to a higher heterogeneity in the left tail, that of low-productive firms, as compared to what happens in the right tail, that of more productive firms. In this respect, the b_l parameter can be informative of different degrees of sectoral tolerance to inefficient firms. Thus, in a sense, there is a relative tighter (technological) constraint to how good a firm can perform, whether on the contrary, there is much less tight constraint on the side of the market selection. Further, the tightness of both these "constraints", as proxied by the b parameters, has not changed a lot over time.

Such differences between the left and right tail parameter is also displayed in Figure 3. The plots report the binned empirical density of, respectively, the b_l and b_r parameter estimated over the 55 three digit sector with the highest number of observations. Quite obviosly, more disaggregated three digit sectors have much less observations than the corresponding two digit

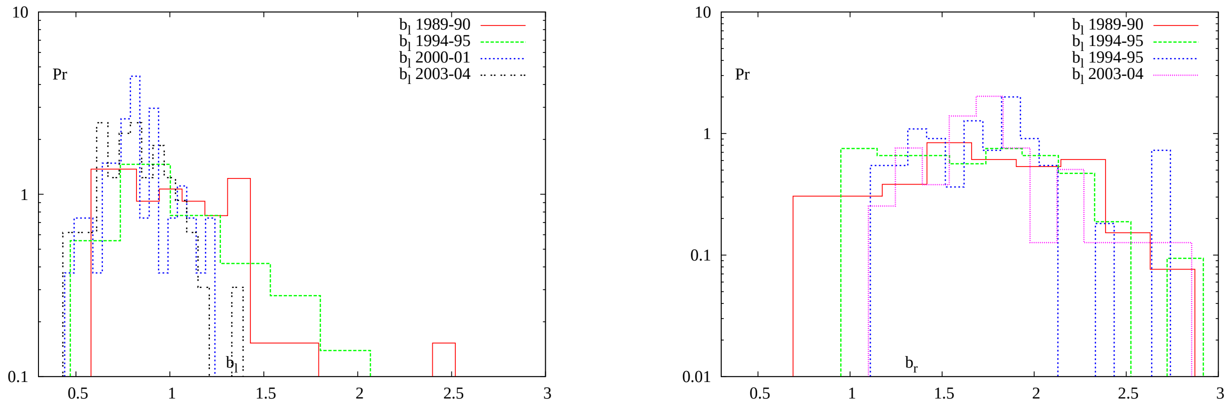

Figure 3: Binned empirical density of the b_l and b_r parameter values estimated over the 55 3-Digit sectors with more observations. The values for different sectors together with standard errors are reported in Table 5.

sectors in which they are nested. Thus in order to recover a higher number of observations we pool together subsequent years as follows, 1989-90, 1994-95, 2000-01, and 2003-04.

As a further check that the support of the distribution do not appear to have narrowed over time, Table 6 reports the ratio of the average labor productivity of the top over the bottom decile for firms in each 2-Digit sectors. First, notice that the 10% most productive firms in a sector are - in most cases - 5 to 6 times more productive than firms in the lowest decile[12]. Consider that looking at the ratio of productivities in the same year is already independent from monetary trends occurring during the period under investigation, thus we can also include in the analysis the years 1989 and 1990 for whom we do not have deflators. The most striking feature of Figure 6 is that the inter-decile differences are not shrinking over time, on the contrary, when it is possible to identify a trend, that is of increasing differences. This is already signaling that the market is exerting a very weak discipline in selecting most efficient firms and in causing the exit of the least efficient. Such evidence is further analyzed and strengthened in Bottazzi, Dosi, Jacoby, Secchi and Tamagni (2009) where the issue of selection is addressed also considering, in a sort of evolutionary accounting exercise, the decomposition of the growth of labor productivity industry wise. There the authors find that it is not possible to ascribe the larger part of growth to the reallocation of market shares to the more productive firms, on the contrary a relevant part of the increase in productivity is due to firm-level effects (the so-called "within" component).

When considering the labor productivity in differences, and thus the growth rates of productivity, these are known to displays a tent-like shape (Bottazzi et al.; 2005), also displaying very similar properties to the growth rates of firm size, that is they are symmetric and with a β coefficient around one. In this work we are interested to investigate the properties of growth rates of productivity as computed also an interval longer than one year. Thus we want to verify if the process of temporal aggregation has any relevant effect on the distribution of growth rates. In particular, one might expect that, considering the growth process on a longer time interval, there would be a tendency to recover a bell shaped distribution. In this respect Figure 4 reports for sectors 15, 28 and 29, the growth rates of labor productivity for two five years long period, 1991-95 and 2000-04, over which the growth rate is defined as

[12]Notice that we do not report the statistics for sector 23 and 30 due to the small number of observations in those industries.

NACE	’89	’90	’91	’92	’93	’94	’95	’96	’97	’98	’99	’00	’01	’02	’03	’04
15	6.9	7.0	6.7	6.3	7.2	6.4	5.9	6.1	7.6	8.0	8.2	7.9	8.1	8.3	7.9	8.2
	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5	0.3	0.3	0.3	0.3	0.3	0.3	0.3
17	5.5	5.8	5.2	6.0	6.4	6.2	6.3	6.2	5.7	6.3	6.2	5.7	5.9	5.6	5.7	6.0
	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3
18	6.6	6.5	7.1	7.6	8.2	7.1	7.4	8.5	7.0	9.1	10.9	11.5	11.1	10.9	10.6	11.8
	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.6	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.7
19	5.3	5.7	5.9	6.7	6.0	6.1	6.0	6.6	6.1	6.0	6.3	6.5	5.9	6.6	6.3	6.3
	0.2	0.2	0.2	0.3	0.2	0.3	0.3	0.6	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.3
20	4.1	3.8	3.9	4.2	4.1	4.1	5.1	4.7	4.5	4.1	4.3	5.1	4.4	4.6	4.6	4.0
	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.4	0.3	0.2	0.2	0.3	0.2	0.2	0.3	0.2
21	3.9	4.3	4.3	3.9	4.5	5.0	5.5	6.6	5.2	6.1	5.3	6.4	5.2	4.7	4.5	5.3
	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.7	0.3	0.4	0.4	0.4	0.3	0.2	0.2	0.3
22	5.2	5.4	4.9	5.5	5.8	5.3	5.6	6.6	6.8	7.4	8.2	6.8	6.5	7.8	8.1	8.0
	0.2	0.2	0.2	0.3	0.3	0.2	0.4	0.8	0.5	0.5	0.6	0.5	0.4	0.6	0.6	0.5
23	10.3	7.7	6.4	5.2	7.8	8.0	7.9	16.4	8.2	7.7	7.7	7.7	12.3	6.0	7.5	7.6
	3.6	2.0	1.0	0.4	1.0	1.6	1.7	7.2	2.3	1.3	1.4	0.8	2.4	0.5	0.9	0.9
24	4.8	4.9	4.6	4.8	5.2	5.9	6.2	6.3	5.8	8.3	7.8	8.6	8.5	7.0	7.7	8.3
	0.3	0.2	0.2	0.2	0.3	0.4	0.6	0.5	0.3	0.7	0.6	0.6	0.8	0.4	0.5	0.6
25	4.0	4.2	4.1	4.3	4.9	5.0	5.1	5.2	4.6	4.6	4.5	4.9	4.2	4.5	4.4	4.9
	0.1	0.2	0.2	0.2	0.3	0.3	0.2	0.3	0.2	0.1	0.2	0.3	0.1	0.2	0.1	0.2
26	5.2	5.3	5.2	5.6	5.6	5.3	5.3	5.6	5.4	5.0	5.4	6.0	5.4	5.8	5.9	6.2
	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.6	0.2	0.2	0.2	0.2
27	4.3	4.3	3.9	5.2	4.5	4.7	5.4	5.6	4.7	4.7	4.9	5.0	5.0	4.9	4.9	6.1
	0.2	0.2	0.2	0.3	0.2	0.2	0.3	0.5	0.3	0.2	0.2	0.3	0.2	0.3	0.2	0.4
28	3.6	3.8	3.6	3.7	3.8	3.9	4.1	4.2	4.1	4.3	4.2	4.5	4.3	4.2	4.2	4.3
	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
29	3.5	3.5	3.4	3.6	3.9	3.6	3.5	4.4	3.9	4.3	4.2	4.3	4.2	4.1	4.2	4.2
	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
30	5.3	4.5	5.0	6.6	5.9	5.0	6.0	8.3	12.1	8.7	12.3	11.2	17.7	8.3	5.6	6.9
	0.8	0.7	0.7	0.7	1.2	0.7	1.4	3.3	5.5	2.0	4.4	2.9	5.8	2.2	0.7	1.1
31	4.2	4.7	4.7	4.3	5.2	4.7	5.0	4.7	4.9	5.7	5.9	6.6	5.7	6.0	5.7	6.0
	0.2	0.2	0.2	0.1	0.3	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.3
32	6.7	7.1	6.6	7.9	6.3	6.1	6.1	6.8	7.1	7.3	6.5	6.6	7.2	7.4	9.0	5.8
	0.7	0.7	0.7	1.0	0.6	0.5	0.7	0.8	0.7	0.6	0.5	0.4	0.6	0.7	1.0	0.4
33	4.4	5.3	4.3	4.6	4.8	4.8	5.1	4.7	5.5	4.9	5.7	5.8	5.3	5.9	5.3	5.1
	0.2	0.4	0.3	0.3	0.3	0.4	0.5	0.4	0.4	0.2	0.3	0.3	0.3	0.4	0.3	0.3
34	3.6	3.5	4.0	4.0	4.9	4.8	4.2	4.1	4.2	5.1	5.4	5.2	5.5	5.2	4.4	5.4
	0.2	0.2	0.2	0.2	0.3	0.4	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.3	0.2	0.4
35	4.4	4.4	5.1	8.8	7.2	5.1	5.2	6.3	4.4	5.4	7.1	6.7	7.1	8.5	7.0	6.8
	0.3	0.3	0.5	1.2	0.6	0.4	0.4	0.6	0.4	0.6	0.7	0.6	0.6	1.5	0.7	0.7
36	3.7	3.8	3.9	3.9	4.4	4.1	4.3	5.5	4.1	4.7	5.1	5.2	4.8	4.9	5.3	5.3
	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.1	0.2	0.2	0.2	0.1	0.2	0.4	0.2

Table 6: Ratio of the average productivity (and relative std err) of the top decile over the bottom one. Source: Our elaboration on Micro.3

the logarithmic difference of the average labor productivity in the last three years and the average productivity in the first two years of the subsample. The motivation of taking average productivities lies in the attempt of constructing a measure of productivity growth that is not depending too much on possible shocks. The plots in Figure 4 reveal that also growth rates as computed on such longer time intervals, display a tent-like Laplacian shape. That has the followting implications. First, that even taking a 'smooth' measure of growth - as the differences of two averages is - do not permit to revert to a Normal, meaning that those heterogeneities in firms performance that one observes in the distribution of annual growth rate are not a by-product of high turbolence in yearly observations of productivity. Second, also in performing regression analysis, we will have to take into consideration this fact of high heterogeneities in the performance for firms, as it might be that the effect of a given regressor on productivity growth rate might differ at different levels of the conditional distribution of the latter.

5 Productivity levels and differences over time

Once that the comparability of our database to the aggregate statistics is ascertained, let us fully exploit the higher information content provided by the microdata. In particular, as far as the levels of productivity are concerned, this allows us to test the hypothesis of an increase in the average labor productivity over time. As said, due to the known heterogeneities in the

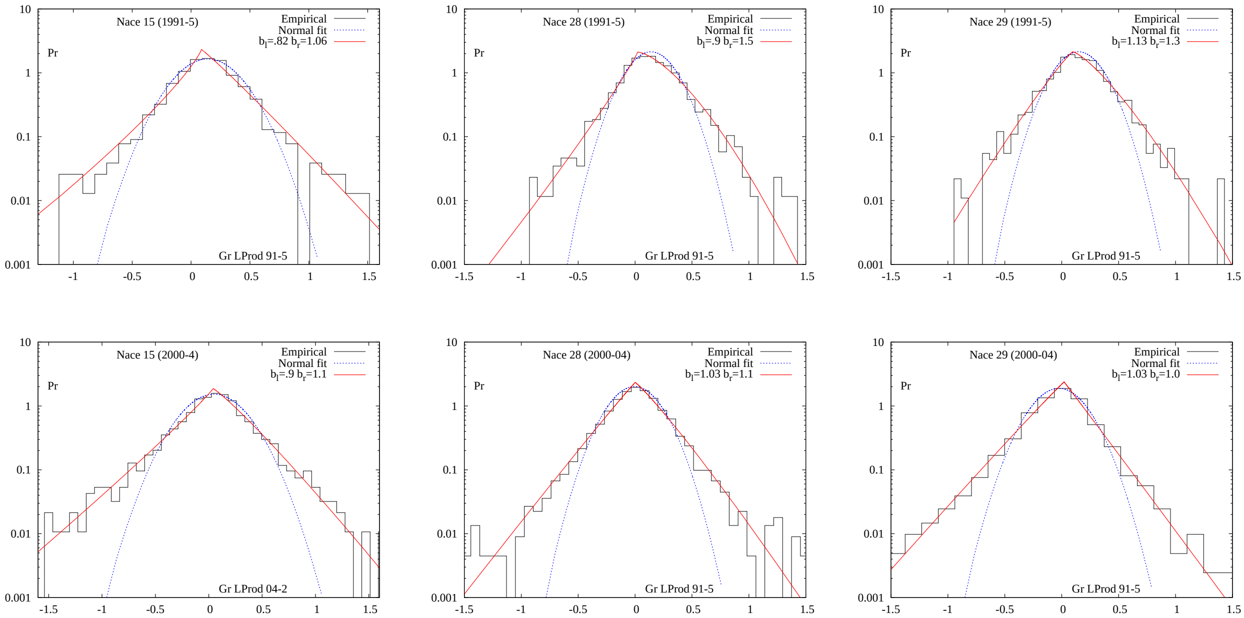

Figure 4: Empirical density of growht rates of labor productivity over five years periods, for NACE 15, 28 and 29 together with the Normal and AEP fit (deflated with the sectoral production price index).

distribution of productivity (see among the others Dosi and Grazzi; 2006) it is not possible to come to such conclusion on the basis of comparisons of averages.

Thus, in order to gain statistical precision in the comparison of the distributions of productivities in two different periods, we will perform formal tests of distributional equality. In particular, given the relevant non-normalities in the distribution (see, for instance, Bottazzi, Grazzi, Secchi and Tamagni; 2009), an appropriate measure of the relative position of the two samples is provided by the concept of stochastic (in)equality as proposed by Fligner and Policello II (1981). Let F_t and F_p be the distributions of the variable of interest for the two periods. Let us denote with $\mathbf{X}_t \sim F_t$ and $\mathbf{X}_p \sim F_p$ the associated random variables, and with X_t and X_p the two respective realizations. The distribution F_t is said to dominate F_p if $\text{Prob}\{X_t > X_p\} > 1/2$. That is, if one randomly selects two firms, one from the t period and one from the p period, the probability that the latter displays a smaller value of X is more than $1/2$, or, in other terms, it has a higher probability of having the smallest value. Now, since

$$\text{Prob}\{X_t > X_p\} = \int dF_t(X)\, F_p(X) \quad , \tag{4}$$

a statistical procedure to assess which of the two distributions dominates can be formulated as a test of

$$H_0 : \int dF_t\, F_p = \frac{1}{2} \quad \text{vs} \quad H_1 : \int dF_t\, F_p \neq \frac{1}{2} \quad . \tag{5}$$

The procedure developed in Fligner and Policello II (1981) provides a valid statistic for H_0. We apply their procedure exploiting the fact that, in case of rejection of the null, the sign of the Fligner-Policello (FP) statistic tells us which of the two distributions is dominating: a positive (negative) sign means that productivity in period t has a higher probability to take on higher values than in the other period.

	91-04	92-04	93-04	94-04	95-04	96-04	97-04	98-04	99-04	00-04	01-04	02-04	03-04
15	**8.749**	**6.123**	**6.694**	**6.268**	**7.028**	**7.324**	**7.270**	1.464	1.003	**2.317**	**1.993**	-0.820	-0.020
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.143	0.316	0.021	0.046	0.412	0.984
17	**10.507**	**7.400**	**4.547**	0.546	1.433	**5.209**	**4.027**	**2.230**	**2.515**	-1.846	-0.069	-0.653	1.107
	0.000	0.000	0.000	0.585	0.152	0.000	0.000	0.026	0.012	0.065	0.945	0.514	0.268
18	**10.392**	**10.760**	**9.157**	**6.904**	**3.720**	**7.781**	**13.635**	**3.082**	**4.018**	1.292	-0.710	-0.499	0.977
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.196	0.478	0.618	0.329
19	**13.179**	**11.424**	**7.948**	**6.098**	**6.676**	**8.595**	**9.202**	**6.288**	**4.418**	0.257	0.847	1.398	**2.623**
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.797	0.397	0.162	0.009
20	**7.757**	**5.846**	**5.129**	**5.306**	**4.705**	**4.593**	**5.750**	**3.730**	**2.255**	1.574	0.257	0.402	**1.985**
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.024	0.115	0.797	0.688	0.047
21	**3.819**	**2.693**	1.282	0.094	0.870	-0.272	0.197	-0.111	-0.797	**3.718**	0.613	-0.283	0.820
	0.000	0.007	0.200	0.925	0.385	0.786	0.844	0.912	0.425	0.000	0.540	0.777	0.412
22	-0.188	-0.098	0.945	0.394	-0.048	-1.042	-0.657	-0.261	-0.273	0.281	-0.756	0.320	1.025
	0.851	0.922	0.345	0.693	0.962	0.297	0.511	0.794	0.785	0.779	0.449	0.749	0.306
23	0.970	0.628	0.431	1.091	0.529	0.467	nan	-1.468	-1.610	0.717	-0.852	-0.912	-1.146
	0.332	0.530	0.667	0.275	0.597	0.640	nan	0.142	0.107	0.474	0.394	0.362	0.252
24	**2.048**	0.171	-0.220	-0.163	**-2.052**	**-3.284**	**-2.215**	-1.091	-1.717	-0.323	0.137	-0.672	-0.456
	0.041	0.864	0.826	0.871	0.040	0.001	0.027	0.275	0.086	0.747	0.891	0.502	0.648
25	**3.132**	1.482	0.775	-1.122	1.301	1.081	**2.193**	0.918	-0.609	0.821	1.588	-1.116	0.522
	0.002	0.138	0.438	0.262	0.193	0.280	0.028	0.359	0.543	0.412	0.112	0.264	0.602
26	**6.447**	**4.431**	**5.469**	**5.140**	**3.661**	**3.726**	**5.244**	**2.810**	1.191	0.906	1.394	-1.366	0.330
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.234	0.365	0.163	0.172	0.741
27	**5.736**	**3.729**	**3.192**	1.146	-1.649	-0.501	0.072	-1.196	**-4.548**	**-3.185**	**-2.708**	**-4.132**	**-3.321**
	0.000	0.000	0.001	0.252	0.099	0.616	0.943	0.232	0.000	0.001	0.007	0.000	0.001
28	**13.865**	**14.321**	**14.518**	**11.315**	**7.888**	**6.549**	**8.666**	**7.611**	**5.322**	3.180	-0.714	**-2.567**	0.727
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.475	0.010	0.467
29	**10.172**	**9.908**	**8.328**	**5.093**	1.176	1.150	**2.792**	**5.040**	**4.422**	-0.930	-1.195	-1.649	**4.046**
	0.000	0.000	0.000	0.000	0.240	0.250	0.005	0.000	0.000	0.352	0.232	0.099	0.000
30	nan	nan	nan	1.005	nan	nan	nan	**2.499**	0.805	1.538	1.702	0.994	1.003
	nan	nan	nan	0.315	nan	nan	nan	0.012	0.421	0.124	0.089	0.320	0.316
31	**9.997**	**9.157**	**9.608**	**8.055**	**5.566**	**5.095**	**4.783**	**3.418**	**2.699**	1.890	1.656	0.553	1.403
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.007	0.059	0.098	0.580	0.161
32	**4.883**	**4.318**	**5.940**	**4.973**	**4.336**	**2.887**	**2.064**	**6.136**	**4.792**	**4.030**	**2.995**	**3.441**	**2.799**
	0.000	0.000	0.000	0.000	0.000	0.004	0.039	0.000	0.000	0.000	0.003	0.001	0.005
33	**2.315**	**3.142**	**3.931**	**2.031**	-0.162	-0.267	0.353	**4.658**	**4.129**	**2.788**	1.933	1.294	**2.239**
	0.021	0.002	0.000	0.042	0.871	0.789	0.724	0.000	0.000	0.005	0.053	0.196	0.025
34	**5.724**	**5.524**	**5.435**	**3.291**	1.296	1.912	0.725	**1.966**	1.841	1.502	1.637	0.554	1.466
	0.000	0.000	0.000	0.001	0.195	0.056	0.469	0.049	0.066	0.133	0.102	0.580	0.143
35	**2.177**	nan	nan	nan	nan	**5.240**	**4.612**	**2.498**	**2.194**	1.341	1.691	**2.175**	**2.079**
	0.030	nan	nan	nan	nan	0.000	0.000	0.012	0.028	0.180	0.091	0.030	0.038
36	**6.957**	**5.827**	**4.506**	**4.611**	**2.159**	**2.804**	**3.803**	-1.427	-1.813	**-2.789**	**-4.100**	**-2.828**	0.839
	0.000	0.000	0.000	0.000	0.031	0.005	0.000	0.154	0.070	0.005	0.000	0.005	0.402

Table 7: Test of stochastic equality, year by year comparison for 2 digit sector. Observed value of the Fligner-Policello statistic and associated p-value. Rejection of the null means that the two distributions are stochastic different. Source: Our elaboration on Micro.3.

NACE	1991-2 Vs 1994-1995	1991-2 Vs 2003-2004	1994-5 Vs 2003-2004	99-00 Vs 2003-2004	NACE	1991-2 Vs 1994-1995	1991-2 Vs 2003-2004	1994-5 Vs 2003-2004	99-00 Vs 2003-2004
15	**2.426**	**5.986**	**5.614**	**2.308**	27	**9.172**	**9.188**	1.893	**-3.179**
	0.015	0.000	0.000	0.021		0.000	0.000	0.058	0.001
17	**11.172**	**12.384**	0.692	-0.260	28	**10.956**	**11.847**	**6.782**	**5.768**
	0.000	0.000	0.489	0.795		0.000	0.000	0.000	0.000
18	**8.694**	**14.351**	**7.012**	**3.148**	29	**14.279**	**8.509**	-0.952	-0.271
	0.000	0.000	0.000	0.002		0.000	0.000	0.341	0.787
19	**8.561**	**12.696**	**6.235**	1.390	30	-1.223	0.793	1.477	1.302
	0.000	0.000	0.000	0.165		0.221	0.428	0.140	0.193
20	**2.308**	**5.691**	**3.562**	1.327	31	**5.892**	**8.745**	**5.378**	**2.201**
	0.021	0.000	0.000	0.184		0.000	0.000	0.000	0.028
21	**6.169**	**4.579**	0.062	1.707	32	**2.663**	**2.158**	1.926	**4.034**
	0.000	0.000	0.950	0.088		0.008	0.031	0.054	0.000
22	0.068	-1.791	1.533	-0.376	33	**4.063**	**3.056**	-0.184	**3.218**
	0.946	0.073	0.125	0.707		0.000	0.002	0.854	0.001
23	0.117	1.656	1.310	0.176	34	**5.920**	**4.651**	0.107	1.425
	0.907	0.098	0.190	0.860		0.000	0.000	0.915	0.154
24	**5.334**	**3.994**	0.466	-1.125	35	**2.453**	**2.909**	0.704	0.968
	0.000	0.000	0.641	0.261		0.014	0.004	0.482	0.333
25	**4.021**	0.423	1.932	-0.242	36	**5.732**	**4.746**	0.531	**-3.477**
	0.000	0.672	0.053	0.809		0.000	0.000	0.596	0.001
26	1.345	**4.284**	**3.463**	1.490					
	0.179	0.000	0.001	0.136					

Table 8: Test of stochastic equality. Observed value of the Fligner-Policello statistic and associated p-value. Rejection of the null means that the two distributions are stochastic different. Significant values are in bold. Source: Our elaboration on Micro.3.

This test does not assumes neither normality nor equal variances and it can be interpreted as a test of stochastic (in)equality between the two distributions. We will use the Fligner-Policello statistics to compare the levels of productivity in different years, of course after deflating value added with the relevant 2 (or 3) digit sectoral production price index. The analysis is performed tacking 2004 as our benchmark year. The performance of firms, in terms of labor productivity, in a given year is compared to the distribution of labor productivity in the same sector in 2004. A positive (negative) value of the statistics means that productivity was higher (lower) in 2004 than in the year of analysis. Values of the test statistics that are significant at the 5% level are in bold. Given the non-parametric nature of the test we require a minimum of 50 observations; this is not much of a constraint at the 2 digit level, but it is often when considering 3 digit sectors.

In the following we report results for the Fligner-Policello test both at 2 and 3 digit level, so that we could also assess the extent to which aggregation might determine a bias in the analysis. Table 7 reports results for the 21 2-digit sectors. As said the evidence is not encouraging. In the post-euro subsample, 1999-2004, for most sectors it is not possible to conclude that productivity was higher in 2004 than in other years.

One has to go back to the first subperiod 1991-1995, and compare the distributions of labor productivity to that of 2004, in order to find that in most sectors the distribution has shifted to the right.

In Table 8 we still focus on the comparison of productivity in different years, and we now consider the average productivity in two consecutive years. Although we know that productivity is quite persistent, we want to make sure that we control for possible excessive variability in yearly estimates of productivity so that such volatility in the yearly values does not compromise our temporal comparison. Columns II and VII of Table 8 report the results of the FP test on the distribution of labor productivity in 1991-2 *versus* 1994-1995. The results of the test support the hypothesis that the bigger part of the (yet small) increase in productivity is mostly in the first subperiod. Indeed, the results of the comparison of labor productivity in 1991-92 *vs* 1994-95 suggest that in most sectors there has been a shift in the distributions, whether this is not the case when one is comparing 1999-00 and 2003-04. In order to recover significant differences between the distribution of labor productivity one has to the first two years, 1991-2, with the very last two, 2003-4. It is only when we are considering the complete stretch of the sample period that we get clear evidence of an increase in productivity. Indeed, the positive and significant signs in the other columns of Table 8 are very few. This is very much consistent to the evidence reported by Eurostat and OECD, saying that from 1995 onward, productivity in Italy has had a flat trend. In this respect, notice how the FP test signals that much of productivity increase over the whole sample period, 1991-2004, is due to increase of productivity in the first subperiod, 1991-95, with productivity being much flat thereafter.

Next tables perform the same analysis on the levels of productivity and focuses on 3 digit sectors in order to verify if the aggregated analysis at 2 digit has introduced any bias in the results. This is not the case and results are coherent with the 2 digit level analysis. Comparing the year 2004 and 2000, there are 10 sectors (out of the 61 that fullfil the data requirements) in which productivity is higher in 2004 than in 1999. But there are as 6 for whom the reverse is true; and for all the other sectors the differences in the distribution of productivity in the two years are not significant. Consider now year 2004 versus 1995. Productivity is higher in 2004 for 20 sectors, whether the number of sector displaying a higher productivity in 1995 is only 4. Yet for 2/3 of our sample it is not possible to reject the null that the distribution of productivity has shifted to the right over a quite long time span. Thus, as it was for the analysis at the 2 digit level (cf. Table 7), in order to recover some evidence of significantly different levels of productivity between two years, one has to compare the first and last year in the sample. Indeed, the comparison of productivity in 1991 and 2004 reveals that in the last year of the sample productivity is higher for most of sectors for which observations are available. That is, one has to consider the longest time interval in order to recover evidence of a significant increase in the levels of productivity.

Table 10 reports the same exercise as in Table 8. As in the previous analysis, the purpose is to consider a less volatile measure, like the average over two years, in order to compare productivity in two different periods. As before the reference period is made up by 2003 and 2004. Let us focus on the 2003-4 Vs. 1999-2000 comparison. Out of 72 3-digit sectors[13] that we consider, one notices that in 16 industries the productivity in 2003-2004 was higher than 1999-2000, and the opposite is true for 7 industries. Analyzing a longer time horizon, 2003-4 Vs. 1994-95, one finds again that the number of sectors (20) with a higher productivity in 2003-4 is bigger than for the opposite case (12), yet there are still many sectors that do not display a clear shift in the distribution of labor productivity. As it was the case for the 2-digit exercise, one has to resort to the longest time interval, that is the comparison of 2003-04 and 1991-92 to get a large number of sectors (45) for whom productivity in recent years dominates that at the beginning of the sample. Yet it is impressive to realize that in 2 sectors productivity (at constant prices) in 1991-92 was higher than in 2003-2004, and for the remaining 25 sectors the distribution of labor productivity at the end of the sample period is not dominating that at the beginning of the '90s. If we compare the productivity over the earliest sub-periods, 1994-5 Vs. 1991-2, we observe that, coherently with the evidence at 2 digit, there is a relevant number of sectors for whom productivity is increased. That confirm the picture that the slow down in productivity has become harsher in the latest period of analysis.

In conclusion, the analysis of the dynamics of productivity reveals that, with respect to

[13]Notice that considering two consecutive years it is easier to meet the requirements of 50 observations to implement the test; as a consequence we are able to consider 72 3-digit sectors, versus the 61 for the yearly comparison.

	91-04	92-04	93-04	94-04	95-04	96-04	97-04	98-04	99-04	00-04	01-04	02-04	03-04
151	**5.575**	**4.510**	**4.705**	**5.942**	**6.363**	**4.313**	**3.633**	0.981	**2.622**	**3.471**	1.904	0.002	-0.147
155	**2.490**	0.928	1.188	0.631	0.939	1.949	1.763	1.118	0.367	0.472	1.101	-0.944	-0.408
158	**4.365**	**3.407**	**3.485**	**3.113**	**4.474**	**4.311**	**3.944**	**2.340**	1.549	1.520	**2.416**	0.461	1.215
159	**5.193**	**2.972**	**2.852**	**2.925**	**2.328**	**2.627**	1.281	1.814	-0.085	0.068	0.502	-0.561	-0.567
171	**3.517**	-0.076	-1.653	**-5.066**	**-3.242**	0.159	0.244	-0.334	-0.124	-1.876	-0.307	0.257	0.745
172	**4.649**	**3.828**	1.418	-0.660	-1.651	0.896	0.797	-0.156	0.640	**-1.986**	-1.097	-0.351	1.339
173	**3.062**	**2.047**	1.442	-1.312	1.175	**2.988**	1.755	0.654	1.509	-1.010	-0.157	-1.013	-0.112
175	**4.617**	**4.669**	**2.925**	1.839	1.795	**2.096**	1.546	0.585	1.167	-0.393	-0.190	-1.104	-0.394
177	**8.557**	**6.655**	**6.164**	**5.603**	**4.967**	**5.314**	**3.422**	**4.011**	**3.459**	1.206	0.907	1.507	1.707
182	**10.360**	**10.547**	**8.855**	**6.574**	**3.552**	**7.416**	**13.168**	**2.997**	**4.039**	1.456	-0.537	-0.525	0.954
191	**2.359**	1.546	-0.639	-0.794	-1.542	**2.848**	**4.117**	**2.228**	0.655	**-2.915**	-0.216	-0.029	1.602
193	**11.181**	**9.654**	**7.224**	**5.155**	**6.117**	**6.037**	**7.577**	**5.140**	**3.671**	0.512	0.120	0.757	1.801
202	**3.586**	1.756	0.599	-0.029	-1.316	0.405	0.962	0.764	0.990	0.442	-0.039	0.469	**2.199**
203	**4.677**	**4.124**	**3.667**	**5.051**	**4.311**	**4.970**	**3.851**	**4.686**	**3.358**	**2.619**	1.943	1.090	1.190
205	**2.548**	**2.171**	1.647	**2.068**	1.216	1.028	1.092	0.613	0.318	-0.174	-0.459	0.843	1.269
211	1.830	1.319	0.107	-1.109	**-2.089**	-0.161	-0.039	-1.135	-0.526	0.294	-0.269	-0.277	1.006
212	**3.901**	**2.863**	1.762	0.742	**2.131**	0.284	0.338	0.812	-0.389	**4.591**	1.240	0.050	0.540
221	0.352	0.188	1.371	1.657	1.291	1.757	1.161	1.542	1.214	1.948	1.167	0.835	0.498
222	0.466	0.032	1.280	0.136	0.057	-0.582	0.557	-0.442	-0.679	-0.810	-1.316	-0.042	1.084
241	-0.483	-1.489	-1.854	**-2.710**	**-4.611**	**-3.161**	**-2.800**	-1.896	-1.511	-1.548	-0.286	-0.519	-0.372
243	1.585	1.013	-0.078	-0.072	-0.200	-0.307	0.329	0.899	-0.248	0.870	1.950	0.245	0.193
244	**2.362**	1.017	1.528	**2.411**	1.710	1.064	-0.153	0.949	-0.187	0.438	-0.102	-0.378	0.186
245	-0.151	-0.758	-0.601	-1.319	-0.197	-0.503	-0.590	-0.380	-0.385	-0.260	-0.508	-0.025	-0.507
246	1.551	0.999	0.667	0.096	-0.899	**-2.641**	-1.881	-1.191	**-2.397**	-0.949	-1.323	-0.858	-0.479
251	1.502	0.221	-0.141	-1.803	-0.286	-0.031	-0.206	1.796	1.310	0.169	1.180	-0.002	0.546
252	**2.301**	1.637	0.899	-0.455	1.449	1.021	**2.384**	0.585	-1.272	0.818	1.199	-1.197	0.296
261	**2.335**	**2.418**	**2.306**	0.813	-0.054	-0.315	0.737	-0.146	0.053	-0.494	-0.224	-0.304	1.137
262	**2.794**	**2.059**	0.387	-0.372	-0.377	-0.446	0.036	-1.088	-1.326	-0.172	-0.018	-0.621	-0.055
263	0.782	0.251	-1.542	**-2.186**	**-2.243**	1.040	0.003	-0.578	-0.557	-0.888	0.024	-1.091	-0.442
264	**3.468**	1.653	**3.736**	**5.435**	**7.653**	**8.015**	**5.927**	**10.504**	**7.911**	**6.617**	**4.345**	**3.251**	**2.671**
266	**4.685**	**3.756**	**7.601**	**7.717**	**4.823**	**3.073**	**3.714**	**5.225**	**3.560**	**2.649**	1.456	-1.211	0.247
267	1.035	1.021	-0.068	-0.494	-0.366	0.542	-0.057	-1.952	-1.749	-1.192	-0.343	-0.257	-0.460
273	**3.238**	**2.637**	**3.333**	1.503	-0.052	0.681	1.078	0.766	-1.917	-0.078	-0.097	0.173	0.985
275	**2.236**	0.665	0.942	0.084	-1.831	-1.908	-1.751	**-3.954**	**-5.018**	**-5.041**	**-4.098**	**-5.614**	**-4.653**
281	**7.383**	**9.403**	**10.441**	**9.980**	**6.679**	**4.733**	**5.252**	**7.236**	**5.230**	**5.332**	1.119	-0.904	-0.259
282	0.797	0.377	0.116	0.590	0.334	-0.177	-0.041	-0.300	-0.423	0.347	0.401	-0.813	-0.505
284	**4.466**	**3.961**	**4.193**	**2.380**	0.442	1.389	**2.403**	1.190	1.045	0.294	0.255	-0.527	0.454
285	**9.145**	**8.685**	**9.370**	**7.362**	**6.057**	**5.160**	**7.131**	**6.108**	**5.123**	**3.193**	0.617	0.148	**2.231**
286	**4.630**	**4.481**	**3.569**	1.753	0.119	-0.016	0.056	1.035	-0.271	-0.462	**-2.168**	**-2.062**	-0.638
287	**5.636**	**4.460**	**3.932**	**2.607**	1.164	1.281	**2.989**	1.205	1.245	-0.937	-1.137	-1.855	-0.962
291	**5.548**	**4.651**	**3.837**	**2.419**	0.388	0.265	1.505	**3.934**	**3.842**	1.012	1.876	1.636	**2.266**
292	**4.900**	**4.609**	**5.886**	**4.351**	**2.717**	**2.850**	**3.994**	**5.125**	**3.408**	1.020	0.357	-0.073	**2.062**
293	**5.269**	**3.927**	**3.066**	**2.377**	1.639	1.108	1.856	**2.441**	1.713	1.238	0.778	0.114	1.026
294	**2.441**	**3.735**	**2.981**	1.164	-1.569	-1.626	-1.128	-0.536	0.471	**-3.063**	**-2.554**	-1.367	**2.712**
295	**5.049**	**6.430**	**3.842**	**2.534**	-1.920	-0.435	-0.038	1.473	1.309	**-2.195**	**-2.743**	**-2.565**	1.501
297	1.257	0.672	0.290	-0.201	0.613	1.096	1.349	0.997	0.130	0.033	0.561	-0.895	-0.140
311	**5.185**	**4.930**	**5.391**	**4.127**	**3.225**	**2.120**	1.426	**2.136**	0.743	0.589	1.171	0.538	0.728
312	**4.602**	**3.325**	**3.248**	**2.921**	**2.161**	**2.235**	**2.148**	1.131	1.093	0.795	1.117	-0.140	0.629
313	1.409	1.284	1.898	1.070	-0.877	0.090	0.416	-0.696	-0.276	-0.704	0.106	0.654	0.344
315	**3.108**	**2.865**	**2.893**	**2.186**	**1.979**	1.717	1.536	1.810	1.243	0.389	0.166	-0.912	0.113
316	**6.258**	**5.280**	**5.657**	**4.698**	**4.039**	**3.323**	**3.576**	**2.799**	**2.095**	**2.244**	1.270	0.457	1.054
321	**3.832**	**3.223**	**3.980**	**3.000**	1.748	1.950	0.443	**4.320**	**3.326**	1.770	**2.068**	**2.482**	**2.323**
322	1.398	1.871	**3.589**	**3.469**	**3.606**	**2.219**	**2.020**	**4.004**	**3.051**	**3.318**	**2.124**	1.945	1.581
331	**3.036**	**3.582**	**2.790**	**2.334**	1.862	**1.977**	**2.597**	**2.911**	**2.618**	**2.356**	0.855	1.050	0.848
332	**2.867**	**2.722**	**2.958**	1.738	1.168	1.098	1.123	1.659	**2.020**	0.513	1.331	0.267	0.519
334	0.728	0.481	0.485	-0.382	-1.621	**-2.766**	-1.379	**2.276**	**2.519**	1.645	1.318	0.447	1.500
342	**3.907**	**4.140**	**4.835**	**4.863**	**2.351**	1.932	**3.182**	1.157	0.812	0.194	-0.159	-1.013	1.171
343	**3.645**	**3.243**	**2.814**	0.769	0.020	1.620	-0.390	**1.979**	**1.971**	1.945	**2.237**	1.674	1.070
361	**4.717**	**4.159**	**2.999**	**3.362**	1.457	**2.903**	**4.040**	-1.669	**-2.515**	**-3.307**	**-3.834**	**-2.808**	1.231
362	**2.153**	**2.930**	**2.968**	**2.051**	0.376	-0.369	0.485	-1.043	-0.682	-1.552	-1.581	-0.396	0.920
366	**5.306**	**3.865**	**3.527**	**2.975**	**2.080**	**2.550**	**2.827**	1.560	1.729	1.309	-0.719	-0.192	-0.220

Table 9: Test of stochastic equality, year by year comparison for 3 digit sector. Observed value of the Fligner-Policello statistic and associated p-value. Rejection of the null means that the two distributions are stochastic different. Source: Our elaboration on Micro.3.

	91-2 Vs 94-95	91-2 Vs 03-04	94-5 Vs 03-04	99-00 Vs 03-04		91-2 Vs 94-95	91-2 Vs 03-04	94-5 Vs 03-04	99-00 Vs 03-04		91-2 Vs 94-95	91-2 Vs 03-04	94-5 Vs 03-04	99-00 Vs 03-04
151	-0.590	**4.166**	**5.735**	**4.402**	246	**3.441**	**2.067**	-0.292	**-2.060**	296	0.097	**3.069**	1.198	1.441
155	**1.996**	1.075	0.873	0.741	247	**3.717**	0.960	**-2.059**	0.075	297	1.836	1.007	-0.408	0.235
158	0.723	1.518	**2.308**	1.265	251	**3.860**	1.148	-1.547	0.639	311	**2.426**	**6.600**	**4.878**	1.009
159	1.863	**5.555**	**3.750**	0.411	252	**2.849**	-0.412	-1.401	-0.530	312	**2.180**	**5.371**	**3.445**	1.095
171	**9.188**	**2.048**	**-6.753**	**-1.991**	261	**3.401**	1.713	-0.928	-1.321	313	**2.396**	0.652	-0.842	-0.702
172	**9.042**	**4.400**	**-3.630**	-1.916	262	**4.025**	**2.945**	-0.916	-1.112	314	1.406	0.552	-0.116	-0.270
173	**4.221**	**3.033**	0.213	0.541	263	**5.265**	1.007	**-2.236**	-0.493	315	1.520	**3.683**	**2.340**	1.635
175	**4.771**	**5.940**	1.935	0.818	264	**-5.793**	1.520	**6.881**	**8.011**	316	**4.588**	**3.146**	1.709	**2.277**
177	**2.788**	**8.900**	**5.886**	**2.014**	266	**-3.812**	**2.970**	**4.906**	**3.498**	321	**3.025**	1.910	0.582	1.785
182	**9.154**	**14.398**	**6.854**	**3.459**	267	1.668	0.138	-1.493	-1.673	322	-0.829	-0.039	1.641	**3.403**
191	**4.509**	-0.174	**-3.258**	**-2.824**	273	**3.860**	**3.528**	-0.042	-1.739	323	**3.434**	**4.879**	-0.048	1.493
193	**7.123**	**13.009**	**6.864**	1.627	275	**4.662**	**5.687**	**2.877**	**-3.577**	331	**1.997**	**3.145**	**2.218**	**2.493**
202	**4.646**	**2.611**	**-2.138**	-0.331	281	0.164	**7.250**	**6.693**	**7.208**	332	**3.088**	**2.902**	0.828	1.241
203	-0.338	**3.245**	**3.646**	**3.334**	282	0.323	0.656	1.515	0.436	333	1.441	-0.331	-0.522	0.945
205	0.441	1.140	0.348	-0.778	283	1.512	**3.365**	**3.391**	**2.612**	334	**3.312**	1.240	**-2.736**	1.859
211	**6.793**	**1.967**	**-3.141**	-0.914	284	**7.177**	**6.458**	**2.214**	0.993	341	1.679	1.447	0.000	-0.387
212	**4.608**	**4.348**	1.576	**2.636**	285	**5.062**	**7.796**	**2.145**	**4.363**	342	0.350	**3.378**	**2.159**	-0.126
221	-1.474	-0.005	1.926	1.872	286	**6.008**	**6.018**	1.310	-0.052	343	**6.098**	**3.301**	-1.127	**2.149**
222	0.569	-1.211	-1.700	-1.518	287	**6.780**	**6.002**	**1.968**	0.865	351	0.606	**3.644**	1.672	0.786
241	**5.275**	1.627	**-2.108**	**-2.029**	291	**7.604**	**6.816**	1.556	1.877	352	0.245	1.080	-0.193	1.727
242	1.199	1.507	0.779	0.848	292	**3.107**	0.297	-1.027	1.605	353	1.722	-1.346	**-2.483**	-1.640
243	**2.177**	**2.716**	1.180	0.492	293	**5.590**	**5.207**	0.272	1.416	361	**3.926**	**2.342**	-0.212	**-4.290**
244	-0.886	1.463	**2.022**	0.178	294	**6.696**	1.660	**-3.255**	**-3.798**	362	**2.252**	**2.776**	0.508	**-2.268**
245	1.464	0.544	0.511	0.364	295	**9.795**	**5.059**	**-2.460**	-1.654	366	**4.414**	**4.314**	1.646	**2.503**

Table 10: Test of stochastic equality. Observed value of the Fligner-Policello statistic and associated p-value. Rejection of the null means that the two distributions are stochastic different. Significant values are in bold. Source: Our elaboration on Micro.3.

the period 1991-2004, there has been a considerable stagnation, once we consider constant price values, of value added per worker. Even more worrying, it is not possible to statistically discard the hypothesis that in some sectors labor productivity was higher back in1991 than in 2004.

Let us now focus on the growth rates of productivity. Again we are referring to the measure of value added per employee, that is obtained summing up, sector-wise, value added and number of employees of every firms. This, of course, is slightly different from the sectoral firm's average productivity that one can compute with firm level data.[14] However, considering value added per employee allows us to cast a direct comparison with international statistics. OECD aggregate figures (OECD; 2008) report a growth rate of around 1% for the period 1995-2000 and a negative rate, around -1.5% during the period 2000-2005. Let us see what is the evidence on Micro.3, with the known 20 employees threshold. To provide a first reference point at the level of the whole manufacturing sector, we notice that, once again, firms in our sample performed better, reporting an average rate of growth of 1.76% in the interval 1995-2000 and a mere - but at least positive - .275% over the years 2001-04. Thus we might conclude, that bigger firms, as those in Micro.3, performed better in terms of average growth than the universe of firms.

In Table 11 we report the annual growth rates of value added per employee in 2 digit manufacturing sectors. The sectoral data on Eurostat are available only starting in 1995. The first two couple of columns report the comparison for the growth of value added per employee in Micro.3 and Eurostat, respectively for the intervals 1995-2000 and 2001-04. We choose this two intervals to match the data as reported by OECD (OECD; 2008). We notice that in almost all sectors the Eurostat data report a higher growth rates as compared to that of Micro.3. Consider this evidence together with that on the levels of value added per worker on Micro.3 and Eurostat, respectively, Table 1 and 2. As far as the levels of productivity

[14]It is of course a matter of assigning or not weight to the average.

	95-00		01-04		91-95	99-04
	Mic.3	Eu.St	Mic.3	Eu.St	Mic.3	Mic.3
15	1.1	1.6	1.3	nan	0.1	0.6
17	-0.1	2.8	-0.7	-0.8	5.4	0.2
18	0.9	5.0	0.7	-0.2	6.6	3.1
19	-0.4	3.1	0.8	-0.1	5.8	2.2
20	0.2	5.1	0.2	-0.0	4.0	1.6
21	0.1	1.8	2.8	-1.0	5.1	-0.8
22	3.5	5.5	4.5	2.7	-0.5	3.1
23	6.7	7.1	-4.9	-4.2	8.6	2.4
24	-0.6	1.6	1.5	-0.6	10.9	0.2
25	-0.9	2.1	0.6	-0.5	2.9	-0.7
26	0.3	3.4	1.3	1.2	3.1	1.2
27	-2.3	-0.1	3.6	2.5	14.2	1.0
28	-0.6	3.4	0.4	-1.7	4.2	0.8
29	-0.1	1.9	0.1	0.3	5.3	0.8
30	-7.5	-0.8	-0.5	-11.7	3.8	9.2
31	0.3	2.2	2.9	3.2	2.7	1.7
32	7.3	10.7	1.8	1.3	0.1	5.1
33	0.3	4.0	3.0	2.4	3.7	3.6
34	-0.2	0.8	2.1	0.4	5.8	-0.3
35	nan	nan	4.2	4.1	-18.3	5.1
36	0.6	5.4	-1.7	-2.7	3.5	-0.6

Table 11: Growth rates of value added per employee, in annual change. Eurostat and Micro.3 comparison.

were concerned we noticed that value added per worker is almost always higher in Micro.3, at beginning, throughout, as well as at end of the sample period, yet the differences with level of productivity of the Eurostat data is shrinking over time. This becomes more apparent when comparing the first and the last year of observation. In this case it sometimes happens that the Eurostat sample reports a higher productivity than Micro.3. Consider for instance the sector of machineries (NACE 29). In the Micro.3 sample the value added per worker in 1995 is 52.9 thousands of euro and the corresponding data reported by Eurostat is 48.5 thousands of euro. Looking at the same productivity indicator in 2004 one notices that in Micro.3 it has decreased to 52.1, whether the data for the 'universe' of firms considered by Eurostat is 53.8. In this case, not only the difference has shrank, but the Eurostat sample reports even a higher level of productivity then Micro.3.

We then compare the pre and post-euro performance of firms in Micro.3 as reported in the last two columns of Table 11. We observe that, on average, the years preceding the introduction of the euro reported higher growth rate than the period 1999-2004.

In conclusion the evidence on the levels and differences of value added per worker is twofold. On one side, firms in Micro.3, and thus bigger ones, are more productive than firms in Eurostat's universe. On the other side, we also notice that, thanks to a different dynamics in the process of growth, at end of the period of observation the gap has shrank. Such evidence is coherent with the results in Bottazzi and Grazzi (forthcoming), where the authors show that, on the one side, bigger firms benefit of a positive size-productivity relation, but on the other side, they do not appear to fully exploit such scale advantage because the higher productivity that comes as a "size effect" is more than compensated by the higher cost of labor borne by bigger firms.

So far we have looked for the existence of a trend in the central tendency of productivity and the evidence was scarce, both with aggregate and micro data. Thus, if one wants to detect if there has been any dynamics, one will need to focus on the distributions, and on the tails of the distributions in particular (see also Dosi; 2007). We already know that firms, or groups of them, in the tails have not had such an impact so as to determine a shift in the whole distribution. Yet it would appear that, given the disconforting plateau of productivity, the disclosure of some dynamics can only get revealed in the analysis of the distributions (and their tails), and that lending support to the existing differences among firms is the only clue to interpret the direction of future changes.

6 Productivity growth regression

So far, the analysis of the dynamics of productivity has revealed that, with respect to the period 1991-2004, there has been a considerable stagnation in productivity measured as value added per worker. Even more worrying, it is not possible to statistically discard the hypothesis that in some sectors labor productivity was higher in the past than in 2004.

Though the growth in productivity has been rather limited, our interest lies in identifying those factor which have contributed most to the productivity growth over the sample period. Further, in order to account for possible effects caused by the euro introduction, we keep distinguishing the pre and post euro subperiods, 1991-95 and 2000-04, respectively.

We consider the following model

$$\Delta_{t,t+1}\Pi_i = \alpha + \beta_1\,\Pi_{i,t} + \beta_2\,\mathrm{Size}_{i,t} + \beta_3\,\mathrm{exp}_{i,t} + \beta_4\,\mathrm{pat}_{i,t} + \gamma\,\mathrm{controls}_{i,t} + \varepsilon_i \qquad (6)$$

where the time indexes $t, t+1$ refer to the period over which we compute the growth of labor productivity. Since productivity is quite stable over time (see Table 7), in order to observe a shift in its distribution it is necessary to consider a span of some years (see Section 5). To account for this, and for the fact that some variables, i.e. research activity and patents, takes a relevant span of time before producing their effects, we consider the growth of productivity over a period of five years. Then the growh of productivity is measured as the logaritmic differences between the average productivity in the first two years of any subperiod, 1991 and 1992 for the pre and 2001 and 2004 for the post euro, and that over the last three years of the subperiods, 1993 to 95 and 2002-05. The reason of taking averages is to avoid that an observed high rate of growth of productivity is only due to particular occurances in one year, and it does not correspond to a stable increase in the level of efficiencies. Accordingly, we will refer to the time index t to denote the average of a variable over the first two years of the subsamble, and $t+1$ as the average over the last three years. Then we consider as indipendent variables the original level of productivity at time t, $\Pi_{i,t}$, the size, as number of employees at time t, an export dummy[15] that takes value one if the firm was exporting in both first two years, a patent dummy that value one if the firm had any registered patents in the first two years, and finally we also control for the location of the firm. Monetary variables have been deflated with the 2 digit industrial production price index. Results of regression are reported in Table 12.

Let us focus on the left panel that reports results for the pre-euro period. The coefficient that accounts for the initial level of productivity is negative and almost always significant suggesting that firms that starts with a higher level of productivity are less likely to have an increase in productiivity in the following period. That makes sense at the theoretical level and is also coeherent with empirical findings. At a more theoretical level it appears reasonable that

[15] In Grazzi (2009) it is shown that the export status is very stable over time. if a firm is exporting in a given year then there 90% chances that it will be exporting the following year, too.

	1991-95					2000-2004				
	const	lprod t	size	exp	pat	const	lprod t	size	exp	pat
15	0.837	-0.202	-0.000	0.026	0.024	0.697	-0.191	0.007	0.017	-0.021
	0.078	0.019	0.008	0.017	0.097	0.070	0.016	0.009	0.018	0.061
17	0.577	-0.159	0.009	0.075	0.178	0.866	-0.254	0.001	0.026	-0.001
	0.071	0.017	0.009	0.015	0.073	0.071	0.017	0.009	0.016	0.047
18	0.384	-0.137	0.023	0.059	0.000	0.325	-0.125	-0.002	0.074	-0.099
	0.069	0.022	0.011	0.020	0.000	0.078	0.022	0.013	0.026	0.151
19	0.278	-0.100	0.027	0.031	0.097	0.522	-0.188	0.017	0.015	-0.049
	0.088	0.024	0.015	0.025	0.119	0.078	0.019	0.013	0.026	0.059
20	0.178	-0.104	0.057	0.010	0.016	0.738	-0.227	0.025	-0.021	0.066
	0.132	0.034	0.019	0.023	0.108	0.098	0.027	0.015	0.020	0.062
21	0.510	-0.103	0.008	-0.019	0.250	0.802	-0.220	0.028	0.019	0.065
	0.160	0.040	0.017	0.031	0.125	0.099	0.025	0.014	0.025	0.058
22	0.411	-0.174	0.051	0.018	-0.135	0.122	-0.096	0.056	-0.012	-0.162
	0.098	0.025	0.012	0.020	0.135	0.085	0.022	0.012	0.020	0.088
23	-0.544	0.113	0.027	-0.006	0.372	1.219	-0.255	0.009	0.028	0.000
	0.311	0.076	0.026	0.066	0.178	0.279	0.063	0.034	0.074	0.000
24	1.099	-0.318	0.029	0.086	0.019	1.149	-0.271	0.002	0.010	0.003
	0.131	0.029	0.011	0.032	0.042	0.099	0.021	0.011	0.042	0.032
25	0.371	-0.151	0.052	0.000	0.103	0.713	-0.211	0.017	0.002	0.013
	0.101	0.026	0.011	0.023	0.043	0.065	0.017	0.008	0.018	0.022
26	0.686	-0.246	0.043	0.106	0.042	0.512	-0.165	0.047	-0.121	-0.089
	0.076	0.019	0.009	0.017	0.077	0.074	0.019	0.010	0.016	0.037
27	0.590	-0.207	0.054	-0.008	-0.089	0.469	-0.136	0.015	0.003	0.065
	0.141	0.033	0.012	0.027	0.095	0.092	0.023	0.010	0.023	0.044
28	0.734	-0.207	0.000	0.063	0.013	0.669	-0.206	0.024	0.006	0.019
	0.073	0.019	0.009	0.012	0.036	0.041	0.010	0.006	0.008	0.016
29	0.684	-0.205	0.022	0.051	0.057	0.912	-0.254	0.009	0.019	0.012
	0.069	0.018	0.006	0.015	0.019	0.049	0.012	0.005	0.014	0.011
30	1.326	-0.488	0.079	0.364	-0.298	1.537	-0.449	0.034	0.129	0.109
	0.349	0.103	0.030	0.112	0.225	0.406	0.085	0.070	0.103	0.137
31	0.694	-0.229	0.034	0.020	0.040	0.561	-0.151	-0.002	0.013	0.007
	0.125	0.035	0.011	0.025	0.059	0.081	0.020	0.009	0.022	0.028
32	1.082	-0.293	-0.007	0.113	0.058	1.212	-0.289	-0.048	0.060	0.024
	0.212	0.054	0.018	0.061	0.112	0.212	0.051	0.026	0.058	0.081
33	0.439	-0.145	0.018	0.106	0.035	0.912	-0.274	0.018	0.090	0.007
	0.163	0.043	0.015	0.041	0.059	0.129	0.032	0.014	0.036	0.032
34	0.870	-0.227	-0.003	0.039	0.015	1.247	-0.362	0.012	0.047	0.023
	0.203	0.052	0.013	0.039	0.078	0.144	0.037	0.013	0.039	0.046
35	0.657	-0.156	0.047	0.249	-0.028	0.889	-0.195	-0.022	-0.000	0.098
	0.914	0.191	0.063	0.182	0.106	0.197	0.047	0.023	0.049	0.081
36	0.431	-0.164	0.032	0.048	0.078	0.767	-0.260	0.014	0.043	0.072
	0.075	0.020	0.010	0.016	0.041	0.067	0.017	0.010	0.022	0.029

Table 12: Growth of productivity regression. OLS estimates. Standard errors in brackets. Coefficients significant at the 5% are in bold. Our elaboration on Micro.3

a firm that is already efficient cannot increase much its level of productivity.[16] This is also coehrent with the negative autocorellation coefficient in productivity growth found in Dosi and Grazzi (2006). As far as the initial size of the firm is concerned, that does not appear much relevant, for it turns to be not significant in most sectors. While positive and significant is coefficient accounting for the export status. Firms that have exported in both initial years, have registered a higher growth of productivity in the next period. In the following (see Section 7) we will investigate more in depth the issue of export status, also considering the effect of the number of destination countries and the number of products exported. Finally the dummy accounting for registered patents of the firm is almost always not significant, suggesting that the relation between holding patents and the increase in productivity is weak. Only in few sectors, one of these is the machine tool industry, NACE 29, holding patents is related to higher productivity growth in the following period.

The only difference between the pre and post euro introduction that emerges from Table 12 concerns the effect of the export activity. It would appear that in the more recent years exporting is less associated to a higher productivity growth. This fact might have two complementary explanations. First, consider that the percentage of firms exporting has steadily

[16]Or to put in a 'frontier' framework, a firm that is already on a - however defined - efficiency frontier is hardly going to get more efficient, by for instance reducing slack. Of course if a technological shock occurs than the firm will move to a new "production function", but that is not due to increased efficiency in the use of inputs.

	1991-1995						2000-2004					
	const	lprod t	size	inv	exp	pat	const	lprod t	size	inv	exp	pat
15	0.783	-0.198	0.001	0.295	0.027	0.023	0.693	-0.195	0.011	0.109	0.011	-0.040
	0.078	0.019	0.008	0.056	0.016	0.095	0.098	0.022	0.011	0.042	0.026	0.070
17	0.516	-0.142	0.001	0.385	0.080	0.172	0.921	-0.267	-0.002	0.088	0.031	-0.016
	0.067	0.016	0.008	0.032	0.014	0.068	0.118	0.028	0.013	0.051	0.028	0.059
18	0.373	-0.137	0.021	0.590	0.058	0.000	0.402	-0.170	-0.002	0.181	0.141	-0.095
	0.069	0.022	0.011	0.258	0.020	0.000	0.160	0.044	0.025	0.274	0.055	0.183
19	0.299	-0.107	0.026	0.301	0.030	0.102	0.640	-0.257	0.042	0.172	0.018	-0.026
	0.089	0.024	0.015	0.226	0.025	0.119	0.134	0.033	0.018	0.055	0.051	0.068
20	0.355	-0.145	0.034	0.450	0.023	0.050	0.947	-0.284	0.013	0.123	0.009	0.095
	0.122	0.032	0.018	0.057	0.021	0.098	0.143	0.040	0.021	0.090	0.033	0.083
21	0.589	-0.128	-0.001	0.317	-0.005	0.281	0.683	-0.205	0.020	0.128	0.024	0.078
	0.155	0.039	0.016	0.066	0.030	0.120	0.141	0.035	0.018	0.065	0.042	0.065
22	0.369	-0.168	0.050	0.414	0.013	-0.124	0.053	-0.069	0.054	0.011	-0.033	-0.216
	0.097	0.025	0.012	0.114	0.020	0.133	0.145	0.036	0.019	0.070	0.039	0.152
23	-0.482	0.098	0.024	0.090	0.004	0.311	1.608	-0.305	-0.011	-0.271	0.055	0.000
	0.345	0.085	0.028	0.202	0.071	0.227	0.340	0.080	0.041	0.300	0.091	0.000
24	0.642	-0.209	0.028	0.209	0.071	0.011	1.001	-0.215	-0.012	0.036	-0.005	0.013
	0.130	0.029	0.010	0.023	0.029	0.038	0.136	0.029	0.014	0.019	0.053	0.036
25	0.367	-0.153	0.050	0.158	0.001	0.100	0.541	-0.166	0.015	-0.084	0.032	0.002
	0.100	0.025	0.011	0.071	0.023	0.043	0.106	0.028	0.011	0.042	0.036	0.029
26	0.715	-0.258	0.037	0.348	0.111	0.030	0.653	-0.220	0.058	0.276	-0.115	-0.074
	0.075	0.019	0.009	0.063	0.017	0.076	0.100	0.024	0.012	0.052	0.024	0.042
27	0.573	-0.200	0.052	0.031	-0.009	-0.085	0.410	-0.129	0.016	0.023	0.016	0.079
	0.143	0.034	0.013	0.037	0.027	0.095	0.121	0.030	0.012	0.048	0.034	0.053
28	0.753	-0.216	-0.003	0.298	0.060	0.008	0.726	-0.225	0.025	0.003	0.001	0.001
	0.072	0.019	0.009	0.058	0.012	0.035	0.080	0.021	0.009	0.028	0.017	0.023
29	0.681	-0.206	0.020	0.371	0.051	0.059	0.960	-0.264	0.009	0.023	-0.010	0.006
	0.069	0.018	0.006	0.079	0.015	0.019	0.083	0.020	0.007	0.062	0.030	0.015
30	1.409	-0.518	0.088	-0.312	0.386	-0.302	1.744	-0.492	0.027	-0.626	0.041	0.190
	0.420	0.129	0.038	0.669	0.131	0.245	0.453	0.103	0.078	0.465	0.120	0.121
31	0.760	-0.248	0.024	0.540	0.018	0.035	0.602	-0.158	-0.009	0.146	0.044	0.037
	0.122	0.034	0.011	0.108	0.024	0.057	0.119	0.029	0.013	0.105	0.034	0.035
32	1.026	-0.281	-0.008	0.328	0.104	0.050	0.847	-0.163	-0.071	0.031	0.009	0.019
	0.216	0.055	0.018	0.262	0.061	0.112	0.254	0.066	0.029	0.047	0.084	0.080
33	0.445	-0.143	0.015	0.257	0.102	0.036	1.099	-0.318	0.014	0.090	0.086	0.008
	0.163	0.043	0.015	0.229	0.041	0.059	0.197	0.051	0.019	0.124	0.059	0.043
34	0.947	-0.238	-0.022	0.571	0.027	0.034	0.987	-0.291	0.002	0.181	0.097	0.015
	0.196	0.050	0.013	0.133	0.037	0.075	0.180	0.047	0.016	0.138	0.058	0.047
35	0.089	-0.153	0.048	1.109	0.226	-0.054	1.060	-0.268	-0.015	0.387	0.043	0.095
	2.062	0.228	0.075	3.416	0.230	0.149	0.247	0.062	0.024	0.355	0.064	0.083
36	0.482	-0.182	0.028	0.452	0.051	0.078	0.634	-0.212	0.005	0.107	0.030	0.040
	0.074	0.020	0.010	0.082	0.016	0.040	0.110	0.029	0.013	0.075	0.043	0.036

Table 13: Growth of productivity regression (II) with observed investments. OLS estimates. Standard errors in brackets. Coefficients significant at the 5% are in bold. Our elaboration on Micro.3

grown from the beginning of our sample period to the end. In 1989 there were - of course with some sectoral variation - 60% of firms above the 20 employees threshold, that were exporting. The same percentage in 2004 was around 80%, with some sectors, as for instance the machine tool, having 90% of firms that export (Grazzi; 2009). Given that nowadays almost all firms are involved in some form of international trade, it might be that the dummy variable export itself is not much related to an increase in productivity, and that a more fine grained investigation of the trade activities of firms is necessary to identify its relevance. Further, it is also well known that the devalation of the Lira in 1992 has had beneficial effects on those firms that were exorting.

As we have described in the data section, the database we employ is an integrated source of data. That also means that in assembling the database, some variables are available for all the observations, and that was the case for the variables in Table 12, whether other variables are available only for a subset. One of such variable are the investments in capital goods made by the firm during one year.[17]

In Table 13 we report results for a regression model equal to equation 6 where we add investments among the independent variables. As for the other variables, we consider the

[17]In particular, the variable 'investment' is always available in the first subperiod, 1991-1995, whether in the second subperiod, 2000-2004 it is only available for firms surveyed by Istat, the National Office of Statistics. That amounts to all firms above 100 employees and a representative sample of firms in the employment range 20-100.

average of investments in the first two years of every subperiod, further, we divide such average by the average value added over the same period. That provides a measure of investment rate that can be compared across firms of different dimesions. First, notice how all other coeficcients in Table 13 are stable with respect to the previous regression without investment (see Table 12). Further, and more relevant, notice that investment is positively and significantly associated to productivity growth in the period 1991-1995. Firms that have invested in the first two years, are more likely to register a productivity growth in the following three years. In the second subperiod the evidence is more scant, and there are many sectors for which investment does not appear to be associated with a growth in productivity.

Next, we will investigate which are the effects of the regressors at the different levels of the conditional distribution of the dependent variable, productivity growth. Given the significant and pervasive heterogeneities that have emerged in the analysis of the distribution of labor productivity and its growth rate (Section 4), there are reasons to believe that such effects migth be rather different at different deciles.

6.1 Quantile Regressions Analysis

In the previous section we have investigated the effects of a set of regressors on the growth rate of productivity. This effects have been estimated via Ordinary Least Squares (OLS). OLS models consider the effects exerted by a set of covariates on the conditional mean of the dependent variable. However, the covariates often influence the whole distribution of the dependent variable, not only the mean value (Koenker and Basset; 1978).[18] For instance we might observe that a change in the covariates may have opposite effect on the high and the low deciles of the dependent variables. Given the relevant heterogeneities that we observe both in the dependent and independent variables, one might suspect that effects of the covariates on the conditional mean or at a given decile of the conditional distribution of the dependent variable are rather different. In particular, it might be that the productivity enhancement effects of some covariate are different at the low and high decile. In this respect, it would be of particular interest if one were to identify a regular pattern in the coefficients of the quantile regression, so that, for instance referring to the regression model in equation 6, the positive effects of the export status is more relevant for firms that are in the top decile of productivity growth. Plots in Figure 5 reports a selection of such trends, of course it would not be possible to report here all coefficients. In the figure we report on top, for the first subperiod, the effects associated to investement at different deciles of the conditional distribution of productivity growth. At bottom we report, for the latest period, the effects associated to the export status of the firm.

All plots in Figure 5 display a trend that is not detectable with OLS estimates, which are represented by the flat line. Thus, for the sectors considered in the first subperiod, it appears that what one might call "return from investments" are higher from firms that have registered a higher productivity growth, meaning that investing in the first two years, 1991-92, has proven more benificial for firms in the top decile of the conditional distribution of productivity growth. In the latter period, 2000-04, plots at bottom of Figure 5, one notices that considering the effects associated to export at different deciles yields, for some levels of the conditional distribution, coefficients that are significantly different from zero. One would not be able to observe that if he were to focus on OLS estimates only. Further, we also observe that, for the sectors reported in the plots, exporting activity has been associated with a higher

[18] For a comprehensive introduction to quantile regression techniques refer to Koenker (2005).

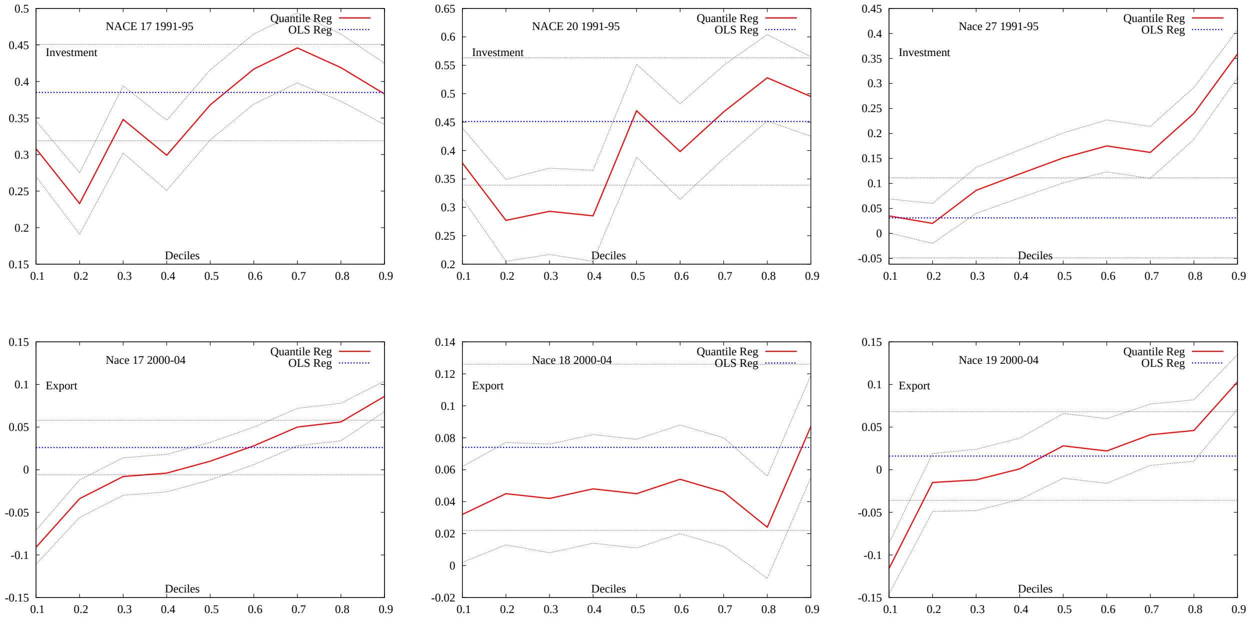

Figure 5: Quantile regression estimates. **Top** The effect of investment on productivity growth in the first subperiod, 1991-95. The error band is of two standard. **Bottoam** The effect of export on productivity growth in the second subperiod, 2000-2004.

productivity growth especially for firms in the higher deciles of the conditional distribution.

Jointly taken these two pieces of evidence suggest that, even during this two decades of low productivity growth, the effects associated to variables that may spur a productivity boost are unevenly distributed among firms. In particular, it is those firms that report a higher growth that benefit more of export activity or investment, just to mention what occurs in the plots reported in Figure 5.

Such uneven distribution would - which is also reminding of the so-called “Matthew effect” in science (Merton; 1968) - then questions about the chances of firms to exit the low productivity trap, or to put it differently, how hard is for firms to climb up the productivity distribution, and conversely, how sticky are the productivity rankings over time. The next section will address this question

7 Dynamics of firms in the distribution of productivity

It is known that firm level productivity is relatively stable over time with autoregressive coefficients close to one (Dosi and Grazzi; 2006). However, it has proven hard to provide sound estimates for the transition probabilities over time, especially because of the requirement of balanced panel. Previous works have shown that year to year transition probabilities display a very high degree of persistence (Bartelsman and Dhrymes; 1998), and this is also true for longer time intervals (Baily et al.; 1992) - see also Bartelsman and Doms 2000 for a review.

What is most interesting - beyond verifying that such persistency holds also on this database - is to identify which are the characteristics of three groups of firms: those firms that lie persistently at the bottom of the productivity distribution, the “productivity laggards”, those that - and how many are they ? - the succeded in increasing their productivity, the “productivity climbers”, and those that have been persistently in the top of the productivity distribution, the “productivity leaders”.

Table ?? in the appendix reports the frequencies and probabilities of the transition matrix.

In the following we report for a few sectors the characteristics of the aforementioned three groups of firms

```
# settore  15
# Vars              Steady Laggard   Productivity climber    Prod Leaders
#                     avg     std.dev   avg       std.dev      avg     std.dev
log_employment    3.9099    0.7554    4.1719    1.1144    4.2407    1.0287
export_dummy      0.6960    0.4366    0.8889    0.3234    0.8785    0.3128
exp_num_gruppi    2.4693    3.3672    2.6667    3.5728    6.8107    7.9581
imp_num_gruppi    2.8911    4.4597    3.7222    6.3367    8.2009   10.6394
exp_num_paesi     6.8713    9.6380    9.9167   13.3375   17.1565   18.4012
imp_num_paesi     3.0802    3.7857    4.0278    5.4785    6.9229    6.2684
patent_dummy      0.0079    0.0887    0.0556    0.2357    0.0421    0.2012
GrossOpMarg       6.0425    5.4370    6.4991    4.1570   13.6963    8.7383
obsANDtrprob    505.0000   84.9453   18.0000    6.0555  214.0000   71.9933
# settore  17
# Vars              Steady Laggard   Productivity climber    Prod Leaders
#                     avg     std.dev   avg       std.dev      avg     std.dev
log_employment    3.9000    0.6888    4.1133    0.7371    4.1568    0.8264
export_dummy      0.7566    0.4083    0.9423    0.2157    0.8734    0.3129
exp_num_gruppi    4.1742    4.7981    6.6731    4.7306    7.5633    7.8858
imp_num_gruppi    4.4925    5.5686    8.4808    6.1441    9.9760    8.6567
exp_num_paesi     9.8820   11.5097   19.0769   16.2928   20.8450   17.2199
imp_num_paesi     4.3324    4.6309    8.0385    5.7305    8.9760    6.4180
patent_dummy      0.0075    0.0863    0.0385    0.1961    0.0524    0.2233
GrossOpMarg       7.6976    6.4921    7.2265    7.6480   15.7557    8.6196
obsANDtrprob    534.0000   80.7256   26.0000    7.8609  229.0000   69.2366
# settore  24
# Vars              Steady Laggard   Productivity climber    Prod Leaders
#                     avg     std.dev   avg       std.dev      avg     std.dev
log_employment    3.9356    0.7772    4.4339    0.9325    4.7477    1.1702
export_dummy      0.9236    0.2507    0.9706    0.1213    0.9489    0.1945
exp_num_gruppi    5.9522    6.0341    8.9412   14.0322    8.7044    8.1160
imp_num_gruppi    8.2532    7.1492   15.1765   11.4700   16.3650   13.0417
exp_num_paesi    15.5478   14.9896   20.1765   20.3354   27.5985   20.6251
imp_num_paesi     6.6258    4.5808   11.5882    9.3211   11.2993    6.3655
patent_dummy      0.0605    0.2388    0.1176    0.3321    0.2409    0.4292
GrossOpMarg       8.0693    6.1603    5.8147    6.8130   17.9652    9.2072
obsANDtrprob    314.0000   81.8774   17.0000    8.8657  137.0000   71.4472
# settore  27
# Vars              Steady Laggard   Productivity climber    Prod Leaders
#                     avg     std.dev   avg       std.dev      avg     std.dev
log_employment    3.9631    0.7857    4.0595    0.7021    4.6008    0.9943
export_dummy      0.7511    0.4107    1.0000    0.0000    0.9425    0.2087
exp_num_gruppi    3.7806    6.2992    2.9286    2.6209    5.1593    5.1734
imp_num_gruppi    3.6034    7.3952    3.3571    3.7049    9.8496    9.6681
```

```
exp_num_paesi      8.6709   12.3988      9.0714   10.5808     14.9823   14.1151
imp_num_paesi      3.0063    4.2280      6.8571    8.5864     10.2876    8.2537
patent_dummy       0.0295    0.1697      0.0000    0.0000      0.0442    0.2066
GrossOpMarg        8.4423    6.1771      6.1259    3.9939     12.7169    7.0097
obsANDtrprob     237.0000   81.1644      7.0000    4.7945    113.0000   77.3973
# settore  28
# Vars                Steady Laggard   Productivity climber    Prod Leaders
#                       avg     std.dev    avg      std.dev      avg     std.dev
log_employment     3.6418    0.5027      4.0976    0.8767      4.0399    0.7473
export_dummy       0.5660    0.4741      0.7000    0.4206      0.8740    0.3141
exp_num_gruppi     2.5520    4.0839      3.9625    5.0082      6.7723    7.3005
imp_num_gruppi     1.7862    4.0228      5.1500    7.2485      6.8314    8.1811
exp_num_paesi      5.3590    9.6533      5.9625    8.6783     14.4448   15.4573
imp_num_paesi      1.4527    2.2463      3.2625    3.4455      5.1473    4.8173
patent_dummy       0.0170    0.1295      0.0750    0.2667      0.0911    0.2880
GrossOpMarg        8.8749    5.2785      8.2598    6.5834     17.7758    9.0175
obsANDtrprob    1174.0000   82.3282     40.0000    5.6101    516.0000   72.3703
# settore  29
# Vars                Steady Laggard   Productivity climber    Prod Leaders
#                       avg     std.dev    avg      std.dev      avg     std.dev
log_employment     3.8127    0.7111      4.3880    1.0306      4.3197    0.8802
export_dummy       0.8569    0.3360      0.9314    0.2453      0.9763    0.1398
exp_num_gruppi     5.7816    6.2218     11.4608   11.0462     11.2027    9.7545
imp_num_gruppi     3.9655    5.3550      9.5098   10.8878     10.1564    9.7337
exp_num_paesi     16.3619   15.9739     24.8823   17.8915     30.6142   21.4163
imp_num_paesi      3.7561    4.1326      7.7843    7.7726      8.8642    7.4293
patent_dummy       0.0763    0.2656      0.2745    0.4507      0.2695    0.4442
GrossOpMarg        7.8323    5.4168      6.4885    5.3602     16.9027    8.1643
obsANDtrprob    1101.0000   78.6710     51.0000    7.2883    486.0000   69.4534
# settore  36
# Vars                Steady Laggard   Productivity climber    Prod Leaders
#                       avg     std.dev    avg      std.dev      avg     std.dev
log_employment     3.6534    0.4801      3.8945    0.6955      4.1915    0.7317
export_dummy       0.8693    0.3224      0.9722    0.1179      0.9727    0.1561
exp_num_gruppi     4.2881    4.2090      7.1667    5.7112     10.7705    9.1272
imp_num_gruppi     2.4782    3.5900      4.4444    5.6253      8.2886    7.9103
exp_num_paesi     12.6020   11.8943     16.0000   12.1776     28.6386   19.0378
imp_num_paesi      2.4693    2.8791      3.7222    3.2685      6.9000    5.6264
patent_dummy       0.0099    0.0991      0.0000    0.0000      0.1455    0.3534
GrossOpMarg        6.9734    4.6711      6.1423    3.1078     13.4751    6.7371
obsANDtrprob     505.0000   81.6492     18.0000    5.8205    220.0000   71.1398
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A AEP 'a' parameters

In Section 4 we introduced the AEP to account for possible asimmetries in the considered distributions. In the following tables we report the values for the $\mathbf{a_l}$ and $\mathbf{a_r}$ coefficients.

NACE	1989		1994		2000		2004	
	$\mathbf{a_l}$	$\mathbf{a_r}$	$\mathbf{a_l}$	$\mathbf{a_r}$	$\mathbf{a_l}$	$\mathbf{a_r}$	$\mathbf{a_l}$	$\mathbf{a_r}$
15	$0.41_{0.02}$	$0.44_{0.03}$	$0.49_{0.03}$	$0.40_{0.03}$	$0.41_{0.02}$	$0.58_{0.03}$	$0.42_{0.02}$	$0.57_{0.03}$
17	$0.56_{0.03}$	$0.31_{0.02}$	$0.48_{0.03}$	$0.43_{0.03}$	$0.36_{0.02}$	$0.47_{0.02}$	$0.45_{0.02}$	$0.35_{0.02}$
18	$0.31_{0.02}$	$0.53_{0.03}$	$0.31_{0.02}$	$0.49_{0.02}$	$0.47_{0.03}$	$0.66_{0.04}$	$0.45_{0.03}$	$0.73_{0.04}$
19	$0.35_{0.04}$	$0.48_{0.04}$	$0.29_{0.02}$	$0.70_{0.03}$	$0.30_{0.02}$	$0.71_{0.03}$	$0.27_{0.02}$	$0.72_{0.02}$
20	$0.29_{0.03}$	$0.33_{0.03}$	$0.33_{0.04}$	$0.32_{0.03}$	$0.29_{0.02}$	$0.40_{0.02}$	$0.26_{0.02}$	$0.40_{0.03}$
21	$0.23_{0.02}$	$0.44_{0.04}$	$0.36_{0.05}$	$0.41_{0.06}$	$0.32_{0.02}$	$0.54_{0.03}$	$0.26_{0.03}$	$0.68_{0.03}$
22	$0.22_{0.02}$	$0.59_{0.03}$	$0.22_{0.02}$	$0.55_{0.03}$	$0.30_{0.02}$	$0.43_{0.02}$	$0.28_{0.02}$	$0.61_{0.03}$
23	$0.48_{0.10}$	$0.56_{0.14}$	$1.41_{0.15}$	$0.27_{0.27}$	$0.25_{0.06}$	$0.99_{0.12}$	$0.29_{0.13}$	$2.15_{0.06}$
24	$0.24_{0.02}$	$0.58_{0.03}$	$0.38_{0.03}$	$0.41_{0.03}$	$0.46_{0.03}$	$0.49_{0.03}$	$0.36_{0.02}$	$0.54_{0.03}$
25	$0.30_{0.02}$	$0.40_{0.04}$	$0.28_{0.01}$	$0.43_{0.02}$	$0.29_{0.01}$	$0.45_{0.02}$	$0.29_{0.01}$	$0.43_{0.02}$
26	$0.30_{0.02}$	$0.51_{0.03}$	$0.31_{0.02}$	$0.59_{0.03}$	$0.29_{0.01}$	$0.53_{0.02}$	$0.31_{0.01}$	$0.55_{0.02}$
27	$0.21_{0.02}$	$0.55_{0.04}$	$0.28_{0.02}$	$0.51_{0.04}$	$0.32_{0.02}$	$0.43_{0.03}$	$0.29_{0.02}$	$0.55_{0.03}$
28	$0.27_{0.02}$	$0.35_{0.02}$	$0.25_{0.01}$	$0.44_{0.02}$	$0.29_{0.01}$	$0.41_{0.01}$	$0.24_{0.01}$	$0.47_{0.01}$
29	$0.22_{0.01}$	$0.38_{0.01}$	$0.24_{0.01}$	$0.38_{0.01}$	$0.27_{0.01}$	$0.38_{0.01}$	$0.25_{0.01}$	$0.42_{0.01}$
30	$0.26_{0.12}$	$0.73_{0.14}$	$0.59_{0.09}$	$0.24_{0.08}$	$0.44_{0.14}$	$0.64_{0.07}$	$0.43_{0.07}$	$0.60_{0.08}$
31	$0.29_{0.03}$	$0.37_{0.03}$	$0.33_{0.02}$	$0.41_{0.03}$	$0.38_{0.02}$	$0.43_{0.02}$	$0.33_{0.02}$	$0.43_{0.02}$
32	$0.36_{0.04}$	$0.52_{0.06}$	$0.42_{0.05}$	$0.36_{0.05}$	$0.31_{0.03}$	$0.67_{0.04}$	$0.37_{0.04}$	$0.49_{0.06}$
33	$0.56_{0.08}$	$0.29_{0.05}$	$0.28_{0.03}$	$0.51_{0.05}$	$0.31_{0.02}$	$0.57_{0.04}$	$0.28_{0.02}$	$0.50_{0.03}$
34	$0.21_{0.02}$	$0.45_{0.03}$	$0.29_{0.03}$	$0.51_{0.03}$	$0.27_{0.03}$	$0.49_{0.02}$	$0.29_{0.02}$	$0.46_{0.03}$
35	$0.33_{0.04}$	$0.49_{0.06}$	$0.28_{0.03}$	$0.50_{0.06}$	$0.30_{0.05}$	$0.76_{0.04}$	$0.29_{0.03}$	$0.74_{0.05}$
36	$0.32_{0.02}$	$0.29_{0.02}$	$0.21_{0.01}$	$0.52_{0.02}$	$0.26_{0.02}$	$0.58_{0.01}$	$0.30_{0.01}$	$0.38_{0.02}$

Table 14: Summary table of the sectors under analysis. Estimated $\mathbf{a_l}$ and $\mathbf{a_r}$ parameters and standard errors for the distribution of labor productivity.

B Transition Probabilities matrix

Transition probability matrix over the period 2000-2004. Productivity in t is defined as the average of productivity in 2000 and 2001, and in $t+1$ as the average over the years 2002 to 2004. The first row of each cell reports the observed frequencies, and the second the probabilities

	1	2	3	4	
1	219.00	67.00	10.00	3.00	15.00
	73.12	22.37	3.34	1.00	15.00
2	64.00	160.00	61.00	15.00	15.00
	21.37	53.42	20.37	5.01	15.00
3	10.00	63.00	161.00	66.00	15.00
	3.34	21.04	53.76	22.04	15.00
4	6.00	10.00	68.00	215.00	15.00
	2.00	3.34	22.70	71.79	15.00

1	228.00	75.00	20.00	8.00	17.00
	68.83	22.64	6.04	2.42	17.00
2	77.00	155.00	79.00	20.00	17.00
	23.25	46.79	23.85	6.04	17.00
3	22.00	75.00	159.00	75.00	17.00
	6.64	22.64	48.00	22.64	17.00
4	4.00	26.00	73.00	229.00	17.00
	1.21	7.85	22.04	69.13	17.00

1	135.00	37.00	4.00	2.00	18.00
	75.52	20.70	2.24	1.12	18.00
2	36.00	102.00	35.00	5.00	18.00
	20.14	57.06	19.58	2.80	18.00
3	4.00	36.00	104.00	34.00	18.00
	2.24	20.14	58.18	19.02	18.00
4	3.00	3.00	35.00	140.00	18.00
	1.68	1.68	19.58	78.32	18.00
1	137.00	49.00	3.00	1.00	19.00
	72.01	25.76	1.58	0.53	19.00
2	47.00	97.00	41.00	5.00	19.00
	24.70	50.99	21.55	2.63	19.00
3	5.00	36.00	99.00	50.00	19.00
	2.63	18.92	52.04	26.28	19.00
4	1.00	8.00	47.00	135.00	19.00
	0.53	4.20	24.70	70.96	19.00
1	135.00	46.00	10.00	2.00	24.00
	69.77	23.77	5.17	1.03	24.00
2	49.00	91.00	41.00	13.00	24.00
	25.32	47.03	21.19	6.72	24.00
3	8.00	44.00	102.00	40.00	24.00
	4.13	22.74	52.71	20.67	24.00
4	1.00	13.00	41.00	138.00	24.00
	0.52	6.72	21.19	71.32	24.00
1	200.00	51.00	12.00	5.00	26.00
	74.56	19.01	4.47	1.86	26.00
2	58.00	145.00	55.00	10.00	26.00
	21.62	54.05	20.50	3.73	26.00
3	8.00	58.00	147.00	55.00	26.00
	2.98	21.62	54.80	20.50	26.00
4	2.00	14.00	54.00	199.00	26.00
	0.75	5.22	20.13	74.18	26.00
1	98.00	38.00	10.00	0.00	27.00
	67.01	25.98	6.84	0.00	27.00
2	39.00	61.00	38.00	8.00	27.00
	26.67	41.71	25.98	5.47	27.00
3	9.00	41.00	70.00	26.00	27.00
	6.15	28.03	47.86	17.78	27.00
4	0.00	6.00	28.00	113.00	27.00
	0.00	4.10	19.15	77.26	27.00
1	506.00	160.00	37.00	10.00	28.00

	70.92	22.42	5.19	1.40	28.00
2	160.00	349.00	175.00	30.00	28.00
	22.42	48.91	24.53	4.20	28.00
3	36.00	175.00	345.00	158.00	28.00
	5.05	24.53	48.35	22.14	28.00
4	11.00	30.00	157.00	515.00	28.00
	1.54	4.20	22.00	72.18	28.00
1	447.00	183.00	58.00	13.00	29.00
	63.70	26.08	8.27	1.85	29.00
2	169.00	305.00	189.00	38.00	29.00
	24.08	43.46	26.93	5.42	29.00
3	59.00	159.00	318.00	165.00	29.00
	8.41	22.66	45.32	23.51	29.00
4	26.00	54.00	135.00	489.00	29.00
	3.71	7.70	19.24	69.68	29.00
1	211.00	76.00	17.00	6.00	36.00
	67.95	24.48	5.48	1.93	36.00
2	76.00	144.00	79.00	12.00	36.00
	24.48	46.38	25.44	3.86	36.00
3	16.00	73.00	152.00	70.00	36.00
	5.15	23.51	48.95	22.54	36.00
4	7.00	18.00	63.00	222.00	36.00
	2.25	5.80	20.29	71.50	36.00