Productivity Dynamics in Italian Manufacturing Firms: Preliminary results

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In this work we explore some basic properties of the dynamics of productivity in Italian manufacturing firms. We consider the distribution of labour and capital productivity in different manufacturing sectors both at two and three-digit level (ISIC). We are interested to assess the degree of heterogeneity within the same sectors and the persistency of these differences in the relative performance.

Recent years have seen a relevant increase in studies on productivity. This is partly due to the rising availability of longitudinal micro-level data (LMD). This trend is also motivated, as explained in Bartelsman and Doms (2000), by the development of a rich theoretical microeconomic foundation and to the displeasure with the concept of the aggregate production function. A considerable feature of longitudinal micro-level data is that they enable to observe the empirical distribution of productivity measures at firm's and sector's level.

The research we present here draws upon the MICRO.1 databank developed by the Italian Statistical Office (ISTAT)[1]. MICRO.1 contains longitudinal data on a panel of several thousands of Italian manufacturing firms with employment of 20 units or more and it covers the years 1989-97. Firms are classified according to their sector of principal activity[2]. The database contains information on the many variables appearing in firms' balance sheet. The richness of the longitudinal dimension of the sample allows to partially overcome shortcomings due to the limited time span of the dataset.

[1]The database has been made available to our team under the mandatory condition of censorship of any individual condition.
[2]The Italian ATECO closely match the ISIC one.

The issue of a significant time dimension is a common one even in more recent literature. Foster et al. (1998), for instance, employ the LMD on the U.S. manufacturing sector over the 1977/1987 period. They investigate the magnitude of input and output reallocation within sectors and the role played by entry and exit in this process. With this respect they make extensive use of a composite index of productivity (total factor productivity). Our study is aimed at providing empirical evidence concerning the distribution of labour and capital productivity in different sectors and at different level of aggregation. With this respect we refer to the work of Bottazzi and Secchi (2003) in considering which properties of the distribution are sector-specific and which survive an aggregation process.

Economic literature is extremely rich in terms of measures of productivity employed, an extensive survey is provided in Hulten (2000). In this work we consider two basic measures as labour and capital productivity. Although elementary, these measures offer the advantage of being accurately approximated given the available data.

Labour productivity (π_l) is defined as value added (VA) over the amount of hours worked per year (L): $\pi_l = AV/L$. Where value added, defined according to standard balance sheet reporting, is the difference between total revenue and cost of input (excluding the cost of labour).

Capital productivity (π_K) is defined as the ratio between value added and fixed assets (K): $\pi_k = AV/K$. Where we consider fixed assets at their original purchasing value and we do not take into account any amortization procedure.

We are aware that these variables provide only a rough approximation, but on the other hand they do not impose any theoretical restrictions on the data. We normalize the considered variables, namely sales (as a proxy of size), VA, L and K in order to wash away the common trend and then we move on to consider the shape of the empirical distribution of the different sectors. We employ both parametric and non-parametric methods. The main preliminary results highlight a substiantial departures from a Gaussian distribution. This is mainly due to presence of fat tails. To investigate the distribution of productivity growth rate in different sectors we fit a large family of distribution, namely the Subbotin, which provides as special families the Gaussian and the Laplace distribution (for a reference Bottazzi and Secchi (2003)). This procedure allows us to consider if the distribution of growth rates of productivity shows the same tent-like shape as the distribution of growth rate of size in Stanley et al. (1996).

Then, exploiting the time dimension of the sample we test for the presence of unit-root and we investigate the autoregressive structure in the distribution of productivity and its growth rate.

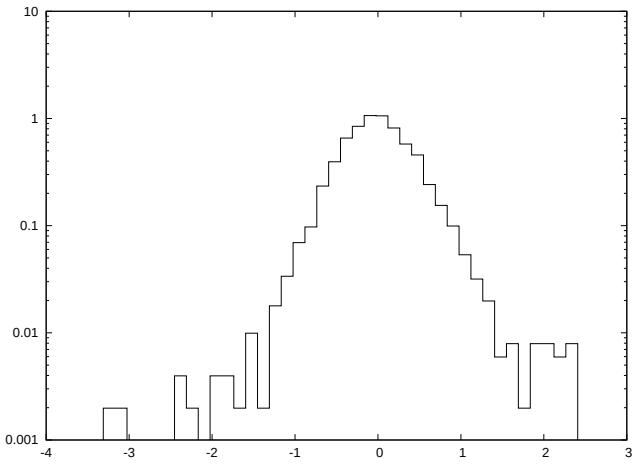

Figure 1: Probability densities of π_l for the food and beverage sector (ATECO 15). The y axis is on a log scale.

Given the stationarity of the distribution over the considered time period, we pool together the yearly observations. A first implication of the observed stationarity is the lack of any reduction in the distributions variances over time, suggesting a persistence in the micro-heterogeneity. This feature is also clearly shown in figure 1 by the width of the distribution supports. It is worth noting that the picture - which is on a log scale - witnesses the co-existence in the same sector of firms whose productivity performance differs of several orders of magnitude. This evidence also supports a central evolutionary hypothesis on the quite inertial reproduction over time of diverse capabilities and related diverse performances (Bottazzi et al. (2002)).

Finally, after examining the structure of the growth process, we move on to investigate possible relations between the dynamics of productivity and firm characteristics. For instance, we test the presence of any effect of a permament above average productivity on size, or if superior performance in terms of productivity directly yields higher growth rates.

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