Labour Productivity in Italian Manufacturing Industries: a Panel Analysis

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1. Introduction

The purpose of this paper is to analyse the impact of employee training on the production of output in Italian manufacturing industries. To this aim, a production function can be estimated which consider as regressors, besides capital and labour, also expenses in training and education of the workforce. In fact this variable can be considered like an investment, which contribute to the accumulation of human capital stock, and so to firm output. Also, in most cases it is true that the more and the better trained employees are, the higher productivity is obtained. In this sense, then, an assessment of the impact of training on production can be very useful.

The data we used in the analysis is taken from Istat “System of the Enterprises Accounts” annual survey about all Italian enterprises with 20 or more employees for the period 1991-1995. This survey collects data referring to yearly balance sheets and profit and loss accounts of each enterprise, according to the IV EEC Council Directive on the Annual Accounts of certain types of companies of 25 July 1978. The panel was built by considering firms in the manufacturing sectors always active and always responding to the survey questionnaire in every year of the period 1991-1995. Also, the criterion we chose in order to build the panel is only referred to firm permanence in terms of identification code, without considering any society transformation that could alter company configuration. At the end, 10396 firms were selected in this way, with overall employment of about 1.5 million of employees in 1991 and about 1.4 in 1995.

2. Some results

Among the variables in the profit and loss accounts of each firm, we selected first of all expenses in training and education of the workforce, in the following indicated with TRA. The value of this variable in 1991 was used to start a recursive equation to build human capital stock (HCS) as the sum of one year expenses in training and education and the stock of the previous year, taking into account of depreciation, following Boon and van der Eijken (1998), in symbols

\[ HCS_t = TRA_t + (1 - \delta) HCS_{t-1}. \]

In the first year human capital stock is defined as \( TRA_{1991} / (0.05 + \delta) \). HCS was calculated using in (1) two different values for \( \delta \), 0.05 and 0.15.

The model we used is the following specification of the Cobb-Douglas production function:

\[ \log (OUT)_t = a + b \log (HCS)_t + c \log (CAP)_t + d (EMPL)_t + u_t, \]

where \( OUT \) is value added (as measure of output), HCS is human capital stock from (1), CAP is tangible assets from the balance sheets (plant and machinery, land and buildings, tools and equipment) and EMPL is labour input measured by the total number of employees. In order to take into account of possible omitted variables, we also added dummy variables defined at the level of 2-digits NACE Rev.1 classification. The same model was estimated separately for each year, to be able to compare the different impact of HCS on OUT, given also that the same firms are observed.
during the period. Also, two sets of estimates were obtained, one for each choice for $\delta$. Since the variables used in (2) are expressed in logarithms, the estimated coefficients represent elasticities, that is percentage change in output resulting from a 1% rise in the respective input variable.

In 1991, on average, value added per employee was approximately 72 millions of Italian lire; there were about 131 millions of tangible assets per employee and 0.2 millions of expenses in training and education per employee. In 1995 labour productivity, as measured by the ratio of value added over the number of employees, was 98 millions, tangible assets per employee was 180 millions and expenditure in training was 0.23 millions of Italian lire.

The results of the estimation procedure of model (2) show in general a very good fit, as measured by a $R^2$ higher than 0.9 in all cases. Also the individual t-statistics are always significant. In terms of elasticity of output with respect to fixed capital, the evidence shows a value of 0.19 for 1991, which is steadily growing in the following years up to 0.27 in 1995. This is true both with $\delta = 0.05$ and with $\delta = 0.15$. The elasticity of output with respect to labour, as measured by the number of employees, is 0.77 in 1991 and the values are slightly diminishing in the period up to 0.74 in 1995. The estimate of the elasticity of output with respect to human capital stock is, as expected, positive and statistically significant (as measured by the t-statistics) and quite independent of the choice for $\delta$, in fact its value in 1991 is 0.04 in both cases; in the following years the trend is growing for both choices, even if the values are slightly higher for $\delta = 0.15$ (for example, 0.033 vs. 0.029 in 1992, with a growing difference up to 0.033 vs. 0.026 in 1995). The evidence, then, points towards a very significant and positive effect of training and education of employees on value added of manufacturing firms, with an effect that is growing in time.

We also ran a regression of model (2) by year and size of the firms, using three classes of employment (20-99, 100-499, over 499) plus the usual dummies for the divisions of economic activity. The results do not show an interesting difference among the size segments, even if always statistically significant, in terms of elasticities of output with respect to capital and labour. Anyway, there are important differences in the coefficients for HCS, which is, as expected, increasing with the size of the enterprise.

REFERENCES


FRENCH RÉSUMÉ

Le but de ce document essaye d’analyser l’influence apportée par les dépenses de la formation du personnel sur la production d’un panel des entreprises manufacturières italiennes observées dans la période 1991-95. Les résultats achevés se basent sur les estimations effectuées, chaque année, sur la fonction de production ayant comme variables indépendentes les dépenses pour la formation du personnel ainsi que l’input du capital et du travail. Quelques résultats suggèrent que le coefficient qui mesure l’élasticité de l’output vis-à-vis le stock du capital humain, calculé sur la base des dépenses pour la formation du personnel, est significatif et positif, en indiquant par ailleurs un impact de la variable sur la production des entreprises analysées.