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THE IMPACT OF SOCIAL AND ENVIRONMENTAL FACTORS ON REGIONAL LABOUR PRODUCTIVITY TO MANUFACTURING FIRMS IN ITALY

Romana Gargano[1], Ferdinando Ofria [2]

ABSTRACT

The aim of paper is to examine whether some territorial indicators of equitable and sustainable well-being contribute to influencing the economic performance of manufacturing firms in the Italian regions (measured through labour productivity).

The analysis uses a data relative to years 2013-2016, sourced from the National Institute of Statistics (ISTAT) and relating to all Italian territory. We distinguish the manufacturing firms by following the Pavitt classification: Supplier-dominated, Scale-intensive, Specialised supplier and Science-based.

The original database and a quantile regression approach allow us to highlight that labour productivity is heterogeneous and that the relationship between labour productivity and environmental and firm's characteristics is not constant across quantiles. Our results show that labour productivity is regionally influenced by negative externalities such as predatory criminality and minimum economic condition, in particular it has been demonstrated that these indicators have a greater influence in regions with lower labour productivity.

[1] University of Messina, Department of Economics, via dei Verdi 75, Messina, rgargano@unime.it (corresponding author).
[2] University of Messina, Department of Economics, via dei Verdi 75, Messina, ofriaf@unime.it.

1. Introduction

In recent years, for the Italian economy, many studies have considered the distorting effects of crime on the productivity of manufacturing enterprises (Albanese & Marinelli, 2013; Pinotti, 2015: Ganau & Rodríguez-Pose, 2018). The first implications of organized crime on labour productivity has appeared in economic literature in 1971 with the work of Schelling (1971). Since then, many scientific studies have shown that the presence of organized criminality have both direct and indirect negative effects on the economic activity. In areas where the presence of crime is high, there is a lower perception of legality and safety which makes the work environment more insecure and less dynamic. This circumstance represents a deterrent for investors, both local and foreign, as firms perceive an unfavourable socio-institutional environment and are less likely to establish lasting productive links (Daniele, 2009, Detotto & Otranto, 2010, Daniele & Marani 2011, Brown & Hibbert, 2019). The organized crime influences the market economy in the South of Italy in direct and indirect ways, influencing its development in a negative way. In the first case, it takes the form of a "business" itself; while in the second, it conditions the market with its parasitic and predatory activities, or it co-operates with the legal economy. The "market failures" that follow, obviously generate high social costs, both for the community in general, as well as for single production businesses in particular. Some research asserts that it is the high crime rate in the South which hinders the natural course of business activity. In the South, the activities directly connected to territory size (extortion, the fixing of public and local economy contracts, usury, drug dealing, capital offences, etc.) continue to make up an important percentage of the revenue and are a confirmation of the power of criminal groups. Of these activities, the infiltration of contracting and public works contracts, plays a strategic role, and is, at the same time, the primary source of income, a way to socially legitimize wealth, a method of controlling the territory and the economic fabric, a way to connect and do business with local council management. The deep-rooted existence of mafia-type activity in many parts of the southern Italy is particularly damaging in the way that it conditions local business, and for the overall disadvantages which result, as far as competition is concerned. Above all, it creates a distortion in the market since it modifies the dynamics of public contracts, and also of the work market and capital. Secondly, the presence of a parallel organization which consumes money, and which acts like a parasite, and penetrates the legal economy, helps to drain all the available resources within the territory, changing salary mechanisms. According to Centorrino and Ofria (2008), the mafia-type business (which is seemingly legal but run by the mafia) may secure contracts, win contract bids or auctions, not through competitive offers, but by using the threat of criminal acts and, in the same way, it can hinder non-affiliated businesses from entering the market. In essence, the presence of cartels, which have been instituted by organized crime, constitutes a source of negative pecuniary externality, which reduces the economic activity of many businesses; at the same time, it is a source of inefficiency, since the businesses within the cartel are not forced to increase their productivity because there is no pressure to be competitive (Centorrino and Ofria, 2001). Felli and Tria (2000: 84) write on this point: "the mafia activity within legitimate markets "confuses" other competitors, as it creates barriers which prevent numerous industries from entering both production markets and work markets". In many respects, these markets are much less competitive in those regions affected by organized crime in comparison to other regions. In some extreme cases, where the mafia manages to control both the supply and demand of goods supplied by the State, the markets (both corrupt and normal markets) are suppressed and there is a hierarchic economic organization, in which those businesses outside the cartel, or those potential candidates for entry, are forced to deal with very high transaction costs. This institutional environment is a source of inefficiency and low productivity growth.

In this research we empirically investigate the hypothesis that exists a relationship between regional discrepancies of labour productivity to manufacturing firms and negative externalities (social and environmental factors).

The following questions are answered in this paper: 1) is labour productivity in manufacturing enterprises conditioned by environmental factors such as crime? 2) in the hypothesis that crime has an effect on productivity, which types of firms are more affected by it?

To answer question 2) in an original way, we distinguished the firms using Pavitt's taxonomy (Supplier-dominated, Scale-intensive, Specialised supplier and Science-based).

For aims of this research we have used the data published by Italian National Institute of Statistics (ISTAT) and relating to all Italian regions for the years 2012-2016. We consider some variables (already known in the literature) that influence labour productivity such as investments for employees, labour costs, share of exports and turnover share. Investments for employees is a proxy for efficiency investments (Sylos Labini, 2004). The greater mechanization of production processes leads to an increase in labour productivity (Ricardo effect); consequently, the higher labour cost generates both a replacement of labour with capital (Ricardo effect) and an "organization effect", that is greater productivity generated by a reorganization of the production process which follows an increase in the absolute cost of labour. The share of exports is a proxy for competitiveness. Companies that export are stimulated to increase productivity in order to be competitive. This incentive to be competitive drives larger companies to invest in R&D. In this paper, in addition to these covariate, with the aim to verify the possible influence of territorial and environmental factors on labour productivity we have considered the indicator of predatory crime, the indicator of minimum economic conditions and the indicator of innovation, research and creativity. These three indicators belong of the 12 dimensions of well-being equo and sustainable developed by ISTAT, together with representatives of the third sector and civil society, in order to complement the indicators related to production and economic activity with measures of the key dimensions of well-being, together with measures of inequality and sustainability. The relevance of this indicators is confirmed by law 163/2016, with which the "Equitable and sustainable well-being" has become part of the economic planning and the Economic and Financial Document (Def) has to include an analysis of recent trends for selected indicators and an impact assessment of proposed policies. The choice to use these indicators stems from the awareness that to measure well-being requires a plural statistical system, because no single measure can summarize the multidimensional value that characterizes something as complex as (the well-being of) society.

The original database and the quantile regression models allow us to highlight that labour productivity in manufacturing sectors classified by Pavitt taxonomy is very heterogeneous in the Italian regions and that the relationships between labour productivity and environmental factors (safety, economic well-being, innovation) are not uniform across quantiles. Our results show that productivity is regionally influenced by negative externalities that characterize the area. Such an influence results more marked in the traditional sectors (Supplier-dominated) characterized by the existence of small dimension firms that Science based sector, characterized by large firms with high technology.

The paper is structured as follows: section 2 describes the data and introduces the used methodology, section 3 discusses the empirical results and section 4 presents the conclusions.

2. Methodology and data

2.1 Data

Our empirical analysis is based on "Report on the competitiveness of the productive sectors", a report produced by the Italian National Institute of Statistics (ISTAT). The years considered are 2012-2016 relating to all Italian national territory. This report collects a rich set of information about sectorial database with structural economic indicators, key indicators, simple and composite, on the structure and performance of firms, drawn from various official sources (survey and administrative data). In particular, for our purpose, the report provides information on the labour productivity, labour costs per employee, investments per employee, share of exports (impact of the sector on total manufacturing exports of the region), share of turnover (share of the sector compared to the total turnover of the region). Labour productivity is measured as a log of ratio of the value added (output) by number of employees (see e.g. Ahlawat & Renu 2018 and Mundakkad, 2018).

In order to link information concerning Italian manufacturing sectors (divisions of the classification of Ateco 2007 economic activities) and services (sections of the Ateco 2007 classification), to environmental factors, we

added a three composed indicators of Equitable and Sustainable Well-Being (BES) calculated by ISTAT. The environmental factors here considered concern:

- Minimum economic conditions (MCE). It is a composite indicator of the "economic well-being" dimension obtained by summarizing four indicators relating to the condition of serious material deprivation, quality of the home, economic difficulty making ends meet and the very low family work intensity. An increase in the MCE index indicates a reduction in the condition of discomfort.
- Predatory crime (PCI) is an indicator of safety dimension and it is composed of the burglary rate, pick pocketing rate and robbery rate indicators). The calculation of the index is based on the data of the reports of the crime of police statistics (source Ministry of the Interior) corrected with the average de submerged quotas of the victims of crime (by type of crime) taken from the "Citizen safety" survey (ISTAT). The number of home thefts is calculated by multiplying, for each year, the average family size by the number of reports of home thefts. This index is one of the 12 considered in the Def.
- Composite index of innovation of research intensity, knowledge workers, employees in creative enterprises that characterizes the dimension Innovation, research and creativity. In the composition of this indicator, the indices that best capture social and economic progress were preferred. In addition, an indicator of creativity was estimated, using the percentage of employment working in cultural and creative activities as a percentage. Italy ability to attract young people with a high level of education has been included as an indicator of a propensity for future progress.

The manufacturing sectors were considered, grouped according to the Pavitt taxonomy (1984), with regional detail. Pavitt's taxonomy is a classification of product sectors, which, based on the sources and nature of technological opportunities and innovations, the intensity of research and development and the type of knowledge flows, identifies four sectoral groupings:

- Supplier dominated: includes textiles, footwear, food and beverages, paper and printing, timber. These sectors, although not lacking in innovative activities, receive most of their technology from other sectors They are small and medium-sized enterprises active in traditional sectors where innovation is of external origin, the appropriateness of the results is low (in this research we have included the sectors: 10, 11,13,14,15,16).
- Scale intensive: comprehends producers of raw materials and durable consumer goods as base metals and motor vehicles, trailers and semitrailers we have included the sectors (we have considered the sectors 24, 25, 26). This group includes medium / large sized firms competing with each other whose goal is to reduce costs through innovation. The sources of innovation are both internal and external and the degree of appropriability is medium.
- Specialised suppliers: includes machinery and equipment; medical, precision and optical instruments and instrumental mechanics in general. In this paper we have considered the firms of 27 and 28 sector of ATECO code. They are small firms, specialised in producing technologies used by other firms. The degree of appropriability of innovation is high, due to the very nature of the knowledge necessary for the development of these technologies. These are sectors based on engineering knowledge and skills, whose purpose is to improve performance and reduce defects.
- Science based: which includes chemicals, pharmaceuticals and electronics (In this paper, 20, 22, 26 sector of ATECO code). They are high-tech firms that draw on research and development from both internal and university sources. These firms develop the most valuable product and process innovations and enjoy a high degree of appropriability. They are areas which are characterized by an internal research and development and aimed primarily at creating new products and processes, in which the entry is difficult due to the high specialization and learning.

2.2 Methodology

In order to verify whether labour productivity in the Italian manufacturing sector is influenced by some variables linked to the territorial context, as well as the characteristics of the company or sector factors, we have

applied a quantile regression model following the approach used to several scholars (e.g. Velucchi & Viviani (2011), Velucchi et al 2014, Ha et al 2019).

Quantile regression (Koenker & Bassett, 1978; Buchinsky, 1998; Koenker & Hallock, 2001) estimates different conditional quantiles of the dependent variables minimizing the sum of absolute residuals. It can be specified by [1]:

$$y_{it} = \alpha + x'_{it}\beta_\tau + u_{\tau it} \quad [1]$$

for $0 < \tau < 1$, and with:

$$Quant_\tau = (y_{it}|x_{it}) = x'_{it}\beta_\tau \quad [2]$$

where *y* represents the dependent variable, **x** is a vector of all covariates, α is the term constant, β is the vector of parameters to be estimated and u is the vector of residuals. $Quant_\tau = (y_{it}|x_{it})$ specifies the τ-th conditional quantile of *y* given **x,** with i=1, 2, …, 20 region and t=2012, …, 2016 years.

The τ-th regression quantile solves the following minimization problem for ρ:

$$\min(\beta)[(\sum_{i=1}^{n} \rho_\tau(y_{it} - \beta'_\tau \mathrm{x}_{it}))] \quad [3]$$

where $\rho_\tau[\cdot]$ is the check function that where $\rho_\tau(u\tau_{it}) = \tau u_{\tau it}$ if $u_{\tau it} \geq 0$ and otherwise$(\tau - 1)u_{\tau it}$ if $u_{\tau it} < 0$

In particular, in this paper for log of labour productivity we estimated five different quantile regressions with τ = 0.1, 0.25, 0.5, 0.75 and 0.9. In addition, we addressed heteroscedasticity by means of robust standard errors.

Equation 4 specifies the estimated model for our data:

$$\log(LP) = \alpha + \beta_1 \log(W_{it-1}) + \beta_2 \log(IL_{it-1}) + \beta_3(ER_{it}) + \beta_4(FR_{it}) + \beta_5(IRS_{it}) + \beta_6(MCE_{it}) + \beta_7(\mathrm{PCI}_{it}) + \varepsilon_{it} \quad [4]$$

where:

LP represents labour productivity (value added per employee) for each region i at time t, in log

W is the labour cost per employee for each region i at time t-1, in log

IL represents the investments per employee for each region i at time t-1,

ER is a proxy for export ratio (incidence of the sector on the total manufacturing exports of the region) for each region at time t

FR is turnover ratio, the portion of the sector with respect to the turnover of the region i at time t

IRS is the indicator of innovation, research and creativity for region i at time t

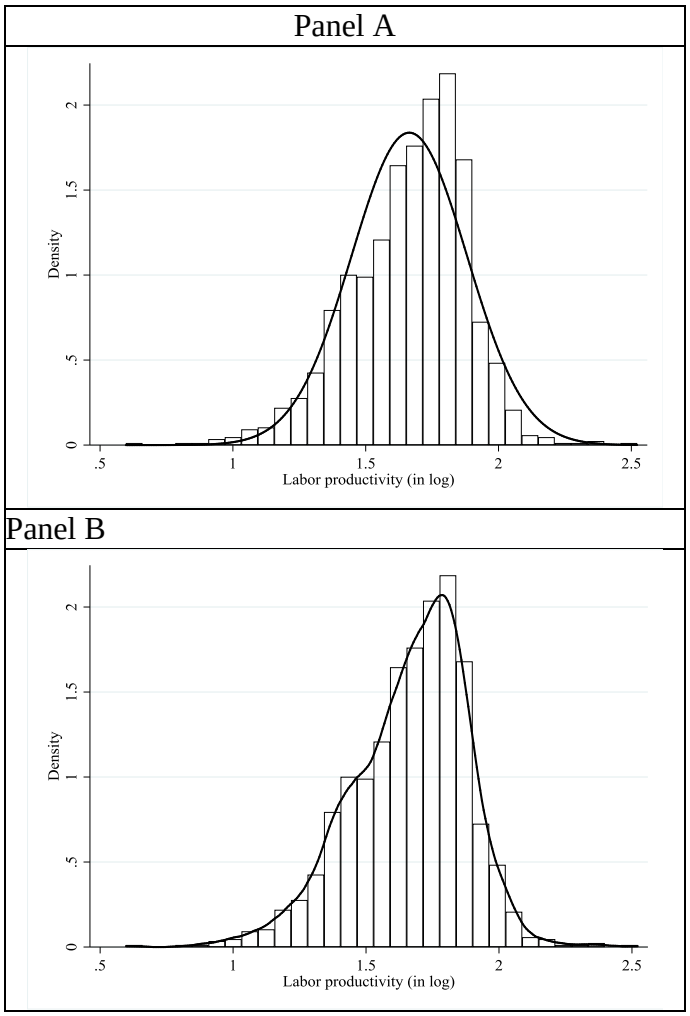
MCE is the indicator of minimum economic conditions for region i at time t;

PCI represents the indicator of predatory crime in each region *i* to the time *t*.

As summarized by Buchinsky (1998) the quantile regression provides robust estimates of the vector of coefficients, not sensitive to outliers in the values of the dependent variable; in the presence of non-normally distributed error terms, the estimators provided by the quantile regression can be more efficient than least squares estimators. Looking at different estimates for different quantiles it is possible to understand the different influence of covariates on the dependent variable, in the various points of the quantile conditioned distribution. Finally, the estimate, based on a linear combination of estimators of the various quantile regressions, is always more efficient than the estimator of the least squares. The quantile regression parameter estimates the change in a specific quantile of the response variable produced by a one-unit change in the covariate, allowing to compare if and how covariates influence some percentiles of the dependent variable.

In this paper, we have chosen to estimate linearized models by quantile regression rather to the classical OLS regression methods for three main reasons. First, the standard least-squares assumption of normally distributed errors does not hold for this database because labour productivity in the Italian regions has not a Gaussian distribution (Figure 1). In addition, the quantile regressions describe all distribution of dependent variable and not focus on the mean (as OLS regression) and their use in the context of this study could be useful as high/low labour productivity regions are of interest for us and are not considered outliers. Finally, using this methodology and avoiding the assumption that the error terms are identically distributed it is possible to consider the regions' heterogeneity and the possibility that estimated slope parameters vary at different quantiles of the conditional distribution.

Figure 1 – Histogram and Normal Density Plot (Panel A) and Kernel Density Plot (Panel B) of Labor Productivity (in log).



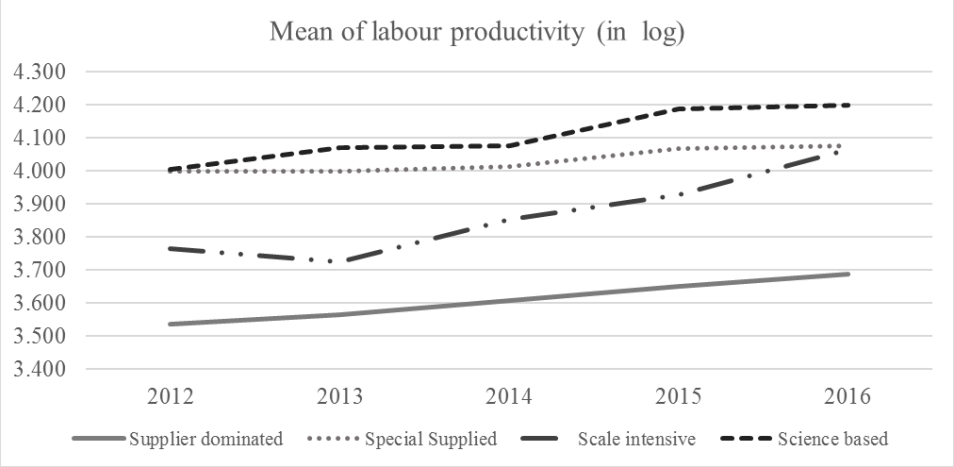
(*Source*: Our elaboration)

3. Results

3.1 Descriptive statistics

Figure 2 shows for Pavitt classification the plot of time series averages labour productivity (log) while table 1 displays the dynamics of the distribution of labour productivity over the period 2012-2016, distinguishing between manufacturing sectors classified by Pavitt taxonomy.

Figure 2 - Time Series of averages labour productivity (log)



(*Source*: Our elaboration)

Table 1 - Mean and quantiles of labour productivity (in log) for year and manufacturing sector

Supplier dominated						
Year	Mean	p10	p25	p50	p75	p90
2012	3.536	2.815	3.150	3.525	3.870	4.250
2013	3.564	2.895	3.205	3.565	3.930	4.210
2014	3.607	2.945	3.235	3.650	3.985	4.275
2015	3.651	3.000	3.285	3.695	4.070	4.305
2016	3.687	3.050	3.310	3.700	4.065	4.330
Specialised supplied						
Year	mean	p10	p25	p50	p75	p90
2012	3.998	3.610	3.830	4.005	4.210	4.325
2013	4.000	3.545	3.845	4.050	4.225	4.290
2014	4.014	3.565	3.915	4.050	4.205	4.300
2015	4.069	3.705	3.910	4.110	4.245	4.345
2016	4.076	3.635	3.925	4.180	4.280	4.385
Scale intensive						
Year	mean	p10	p25	p50	p75	p90
2012	3.766	3.285	3.505	3.800	4.065	4.350
2013	3.726	3.205	3.425	3.740	4.005	4.280
2014	3.852	3.265	3.605	3.860	4.075	4.320
2015	3.927	3.330	4.000	3.970	4.160	4.455
2016	4.066	3.680	3.895	4.110	4.290	4.445
Science based						
Year	mean	p10	p25	p50	p75	p90
2012	4.004	3.550	3.830	4.080	4.260	4.420
2013	4.071	3.845	4.000	4.125	4.290	4.500
2014	4.076	3.735	3.885	4.000	4.135	4.540
2015	4.188	3.860	3.980	4.185	4.335	4.570
2016	4.200	3.780	4.000	4.175	4.385	4.595

(*Source*: Our elaboration)

It is possible observe that during the period considered (2012-2016) the Italian economy has experienced an increase in the average labour productivity of all manufacturing sectors classified by Pavitt taxonomy. In particular, it is highlighted that the average productivity of the sectors classified as "Science based" have the highest average levels of productivity (with a decrease in average labour productivity in 2014) on the contrary the "Supplier dominated" have the lowest levels.

Table 2 provides descriptive statistics of all firm variables used, divided by taxonomic sector Pavitt, while Table 3 gives descriptive statistics of territorial indicators by year.

Table 2 – Descriptive Statistics for Pavitt classification

Supplied dominated				
Variable	*Mean*	*Std. Dev.*	*Min*	*Max*
Log(PL)	3.609	0.535	1.376	5.065
Log(W)	3.400	0.293	2.531	4.161
Log(IL)	1.289	1.053	-2.408	4.187
ER	3.190	4.756	0.000	32.880
EF	1.310	1.783	0.010	9.460
Special supplied				
Variable	*Mean*	*Std. Dev.*	*Min*	*Max*
Log(PL)	4.032	0.295	3.092	4.692
Log(W)	3.726	0.205	3.009	4.165
Log(IL)	1.431	0.662	-2.040	3.084
ER	8.651	7.855	0.050	31.200
EF	1.889	2.192	0.030	9.220
Scale intensive				
Variable	*Mean*	*Std. Dev.*	*Min*	*Max*
Log(PL)	3.867	0.413	2.291	4.957
Log(W)	3.666	0.207	3.022	4.093
Log(IL)	1.828	0.956	-4.605	4.597
ER	7.999	12.710	0.050	87.550
EF	2.366	3.842	0.010	36.170
Science based				
Variable	*Mean*	*Std. Dev.*	*Min*	*Max*
Log(PL)	4.108	0.403	1.946	5.806
Log(W)	3.777	0.206	3.096	4.190
Log(IL)	1.719	1.068	-2.659	4.856
ER	4.542	5.213	0.090	38.330
EF	0.978	0.769	0.030	3.440

(*Source*: Our elaboration)

Table 3 – Descriptive Statistics for Environmental variables considered

2012				
Variable	*Mean*	*Std. Dev.*	*Min*	*Max*
PCI	96.880	8.721	84.400	113.100
IRS	97.125	10.095	79.300	115.400
MCE	96.265	11.754	66.700	109.100
2013				
Variable	*Mean*	*Std. Dev.*	*Min*	*Max*
PCI	94.815	9.336	80.900	109.000
IRS	97.985	9.065	84.800	119.600
MCE	95.240	11.453	65.800	108.900
2014				
Variable	*Mean*	*Std. Dev.*	*Min*	*Max*
PCI	94.660	10.033	76.800	109.700
IRS	98.700	9.912	85.000	124.100
MCE	94.820	10.784	73.100	108.500
2015				
Variable	*Mean*	*Std. Dev.*	*Min*	*Max*
PCI	96.275	8.986	78.600	109.000
IRS	99.670	9.428	88.300	121.100
MCE	95.055	10.451	71.800	106.800
2016				
Variable	*Mean*	*Std. Dev.*	*Min*	*Max*
PCI	100.190	10.478	82.600	115.300
IRS	98.855	9.363	88.700	120.200
MCE	98.255	9.531	76.800	110.000

(*Source*: Our elaboration)

It is noted that since 2015 the average values of the predatory crime index and of the minimum economic conditions have increased indicating a general worsening in security (in relation to this type of crime) and slight improvement of economic well-being respectively. The composite index of innovation, research and creativity marks a setback in 2016 after a period of growth.

In Appendix, figures I-IV show the regional maps of labour productivity mean (in log) and for indicator of predatory crime, indicator of minimum economic conditions and indicator of innovation, research and creativity (mean 2012-2016). These figures allow us to observe the heterogeneity of the Italian regions relative to labour productivity in different manufacturing sector (according to Pavitt classification) and to all the covariates considered in this study.

3.2 Estimation results

In table 4 we report the results from quantile regressions for manufacturing sectors classified by Pavitt' taxonomy. Results show that for the sectors classified in Supplier dominated, investments for employees, labour costs, share of exports, minimum economic conditions and predatory crime index contribute to explain the labour productivity. In particular, from the quantile regression estimates, it is observed that the territorial variables (PCI and MCE) are especially relevant for enterprises in regions with low labour productivity while the importance of the export quota increases with the levels of regional labour productivity. This result proving the importance, in term of propensity, of some sectors such as food and textiles for the Italian export.

Table 4 - Quantile Regression Results

Supplier dominated															
	10			**25**			**50**			**75**			**90**		
Log(LP)	**Coef.**	**Std. Err.**	**P>t**	**Coef.**	**Std. Err.**	**P>t**	**Coef.**	**Std. Err.**	**P>t**	**Coef.**	**Std. Err.**	**P>t**	**Coef.**	**Std. Err.**	**P>t**
Log(IL)_t1	0.055	0.025	**0.031**	0.036	0.016	**0.021**	0.041	0.013	**0.002**	0.061	0.013	**0.000**	0.055	0.020	**0.005**
Log(W)_t1	1.661	0.101	**0.000**	1.722	0.068	**0.000**	1.690	0.059	**0.000**	1.497	0.056	**0.000**	1.507	0.082	**0.000**
ER	0.006	0.003	**0.025**	0.008	0.003	**0.022**	0.015	0.004	**0.001**	0.015	0.002	**0.000**	0.015	0.004	**0.001**
FR	0.018	0.010	0.062	0.003	0.009	0.777	-0.018	0.006	**0.003**	-0.030	0.004	**0.000**	-0.039	0.008	**0.000**
PCI	-0.004	0.002	**0.045**	-0.005	0.002	**0.016**	-0.002	0.001	**0.049**	-0.003	0.001	**0.017**	0.003	0.002	0.089
IRS	0.003	0.003	0.286	0.004	0.002	**0.042**	0.003	0.00	**0.047**	0.001	0.001	0.674	0.000	0.002	0.924
MEC	0.007	0.002	**0.000**	0.005	0.001	**0.000**	0.003	0.001	**0.021**	0.001	0.001	0.223	0.000	0.002	0.848
_cons	-1.640	0.410	**0.000**	-1.224	0.361	**0.001**	-1.440	0.206	**0.000**	-1.648	0.217	**0.000**	-1.649	0.381	**0.000**
Specialised supplied															
Log(LP)	**Coef.**	**Std. Err.**	**P>t**	**Coef.**	**Std. Err.**	**P>t**	**Coef.**	**Std. Err.**	**P>t**	**Coef.**	**Std. Err.**	**P>t**	**Coef.**	**Std. Err.**	**P>t**
Log(IL)_t1	0.058	0.057	0.312	0.000	0.026	0.998	0.006	0.013	0.635	0.009	0.029	0.755	0.004	0.031	0.888
Log(W)_t1	1.220	0.132	**0.000**	1.222	0.092	**0.000**	1.109	0.049	**0.000**	0.975	0.077	**0.000**	0.748	**0.171**	**0.000**
ER	0.007	0.005	0.183	0.002	0.002	0.283	0.003	0.002	0.110	0.004	0.003	0.143	0.008	0.008	0.287
FR	0.021	0.017	0.214	0.011	0.005	**0.042**	0.014	0.005	**0.009**	0.022	0.009	**0.015**	-0.019	0.038	0.611
PCI	-0.005	0.003	**0.046**	-0.001	0.001	0.608	-0.001	0.001	0.521	-0.001	0.002	0.698	0.005	0.003	0.077
IRS	-0.003	0.003	0.298	0.001	0.001	0.274	0.001	0.001	0.373	-0.002	0.002	0.418	0.003	0.003	0.381
MEC	0.008	0.004	**0.045**	0.005	0.002	**0.004**	0.003	0.001	**0.010**	-0.005	0.002	**0.025**	0.003	0.003	0.229
_cons	-0.741	0.709	0.297	-1.179	0.404	**0.004**	-0.436	0.282	0.124	0.243	0.416	0.560	0.274	0.536	0.610
Scale intensive															
Log(LP)	**Coef.**	**Std. Err.**	**P>t**	**Coef.**	**Std. Err.**	**P>t**	**Coef.**	**Std. Err.**	**P>t**	**Coef.**	**Std. Err.**	**P>t**	**Coef.**	**Std. Err.**	**P>t**
Log(IL)_t1	0.038	0.082	0.642	0.044	0.028	0.123	0.026	0.014	0.064	**0.026**	**0.012**	**0.035**	0.006	0.056	0.910
Log(W)_t1	**0.806**	**0.380**	**0.035**	**0.969**	**0.157**	**0.000**	**1.192**	**0.126**	**0.000**	**1.427**	**0.113**	**0.000**	**1.449**	**0.249**	**0.000**
ER	-0.004	0.015	0.795	-0.003	0.004	0.447	0.002	0.003	0.360	0.007	0.005	0.178	0.006	0.003	0.057
FR	0.019	0.030	0.518	0.008	0.009	0.395	**-0.006**	**0.010**	**0.586**	-0.009	0.010	0.382	-0.004	0.035	0.917
PCI	0.000	0.010	0.964	**-0.009**	**0.004**	**0.010**	**-0.004**	**0.002**	**0.071**	0.000	0.002	0.842	-0.001	0.007	0.936
IRS	-0.011	0.008	0.182	**0.011**	**0.004**	**0.005**	**0.006**	**0.002**	**0.002**	**0.005**	**0.002**	**0.029**	-0.007	0.007	0.321
MEC	**0.016**	**0.005**	**0.003**	**0.012**	**0.003**	**0.000**	**0.007**	**0.002**	**0.003**	0.001	0.002	0.757	0.002	0.004	0.638
_cons	-0.061	1.949	0.975	0.834	0.760	0.274	-0.275	0.617	0.656	-0.975	0.572	0.090	-0.290	1.523	0.849
Science based															
Log(LP)	**Coef.**	**Std. Err.**	**P>t**	**Coef.**	**Std. Err.**	**P>t**	**Coef.**	**Std. Err.**	**P>t**	**Coef.**	**Std. Err.**	**P>t**	**Coef.**	**Std. Err.**	**P>t**
Log(IL)_t1	0.072	0.084	0.394	0.087	0.020	**0.000**	0.035	0.014	**0.015**	0.035	0.017	**0.036**	0.058	0.031	**0.049**
Log(W)_t1	0.589	0.392	0.134	0.845	0.066	**0.000**	0.999	0.073	**0.000**	1.042	0.098	**0.000**	0.944	0.220	**0.000**
ER	0.012	0.026	0.639	0.005	0.002	**0.044**	0.003	0.001	0.**047**	0.006	0.003	0.**045**	0.034	0.025	0.178
FR	0.080	0.077	0.301	0.046	0.016	**0.004**	0.051	0.017	**0.003**	0.052	0.024	**0.029**	-0.019	0.052	0.720
PCI	-0.013	0.008	0.092	-0.003	0.002	0.168	0.001	0.002	0.618	0.000	0.002	0.954	0.004	0.004	0.224
IRS	-0.001	0.010	0.959	0.000	0.001	0.992	0.000	0.002	0.944	-0.002	0.002	0.414	-0.006	0.003	0.057
MEC	0.004	0.008	0.665	0.002	0.002	0.318	0.001	0.001	0.245	0.002	0.002	0.296	0.006	0.003	0.068
_cons	2.300	1.739	0.187	0.629	0.304	**0.040**	-0.032	0.342	0.926	0.111	0.363	0.760	0.158	0.956	0.869

(*Source*: Our elaboration)

Focusing on Specialized supplied sectors results we can observe that investments for employees, share of turnover and MEC are statistically significant on labour productivity. Table 4 show that FR does not significantly effect on businesses located in regions with higher productivity and lower productivity (10 and 90 quantile). Note that the role of labour cost and MEC on labour productivity are much more important for low productive regions than for highly productive regions.

Observing the results of scale intensive classification, we notice that labour cost, indicator of minimum economic conditions and indicator of innovation, research and creativity have a significant role on fostering regional labour productivity of these manufacturing sector. In particular, the labour cost is more important for high productive regions than for lower productivity while the IRS and MCE is more relevant for the Italian regions with lower productivity.

Finally, the science-based results show that investments in workers, labour costs, exports and turnover share contribute significantly to explaining labour productivity in the Italian regions. The territorial variables considered do not seem to be relevant for the explanation of the regional labour productivity.

4. Conclusions

In this research we start from the idea that the different socio-environmental conditions (presence of crime, social malaise), among the Italian regions, have diverse effects on the productivity of manufacturing firms.

In particular, in this paper we use a quantile regression approach to test how a set of firms' characteristics and environmental factors of well-being influence the Italian regions labour productivity growth in the 2012-2016 years.

The analysis is conducted distinguishing the firms on the basis of Pavitt's taxonomy (Supplier-dominated, Scale-intensive, Specialised supplier and Science-based) and using an original dataset produced by Istat that includes, at regional levels, indicators of structure, performance, cost and foreign trade and for the first time in the literature, the indicators of "equitable and sustainable well-being" (such as predatory criminality, minimum economic conditions and innovation and research) effect on economic performance of Italian regions (defined in terms of labour productivity). We have chosen to use these indicators such as social and environmental factors because we believe that the economic and social well-being of a society cannot be measured by considering a single measure. Also, with the law 163/2016, Italy is the first country that, by linking the indicators of fair and sustainable prosperity to economic and budgetary programming, gives them a role in the implementation and monitoring of public policies.

Our results allow us to highlight that labour productivity is heterogeneous and that the relationship between labour productivity and environmental and firm's characteristics is not constant across quantiles.

Our results allow us to highlight that labour productivity is heterogeneous and that the relationship between labour productivity of Italian regions and their environmental and firm's characteristics is not constant across quantiles. In particular, the clustering of manufacturing sectors into Pavitt taxonomy has allowed us to observe how the covariates tied to the territory differently influence the productivity of the job in the regions.

The results show that the crime and the economic wellbeing: 1) does not effect on productivity firms' in the Science based sector, characterized by large firms with high technology; 2) have a negative influence on low productivity levels in the "Scala intensive" sectors, large enterprises that produce durable goods. For this sector is very important the innovation research and creativity; 3) have a significant negative effect in the "Supplier dominated" sectors, characterized by small firms that produce traditional goods (textiles, clothing, leather, leather, footwear, wood etc.) and 4) only the indicator of minimum economic condition has a low negative effect for "Specialized suppliers" sectors with small and medium-sized enterprises. In conclusion, as can be seen from the results obtained, companies operating in a strictly local market are more influenced by environmental conditions such as crime and security and economic well-being. Generally operating in a strictly local market, they have little propensity to adhere to cooperation strategies with other companies ("group"). This makes them more easily "attackable" and also, as relatively isolated, less collaboration agreements with foreign companies,

acquisition of patents and licenses from abroad, technical production agreements with other Italian companies. Even the financial advantages, for the companies belonging to the group, can be independent of the environmental conditions of the geographical area where they are allocated. At the same time, the state's anti-crime policy is important. The confiscation of assets from the mafia and the efficient use by the Ministry of the Interior of the Italian State of direct European funds (Internal Security Fund) and indirect, European regional development fund, (ERDF), see PON legality) represent important tools to reduce the externalities of crime.

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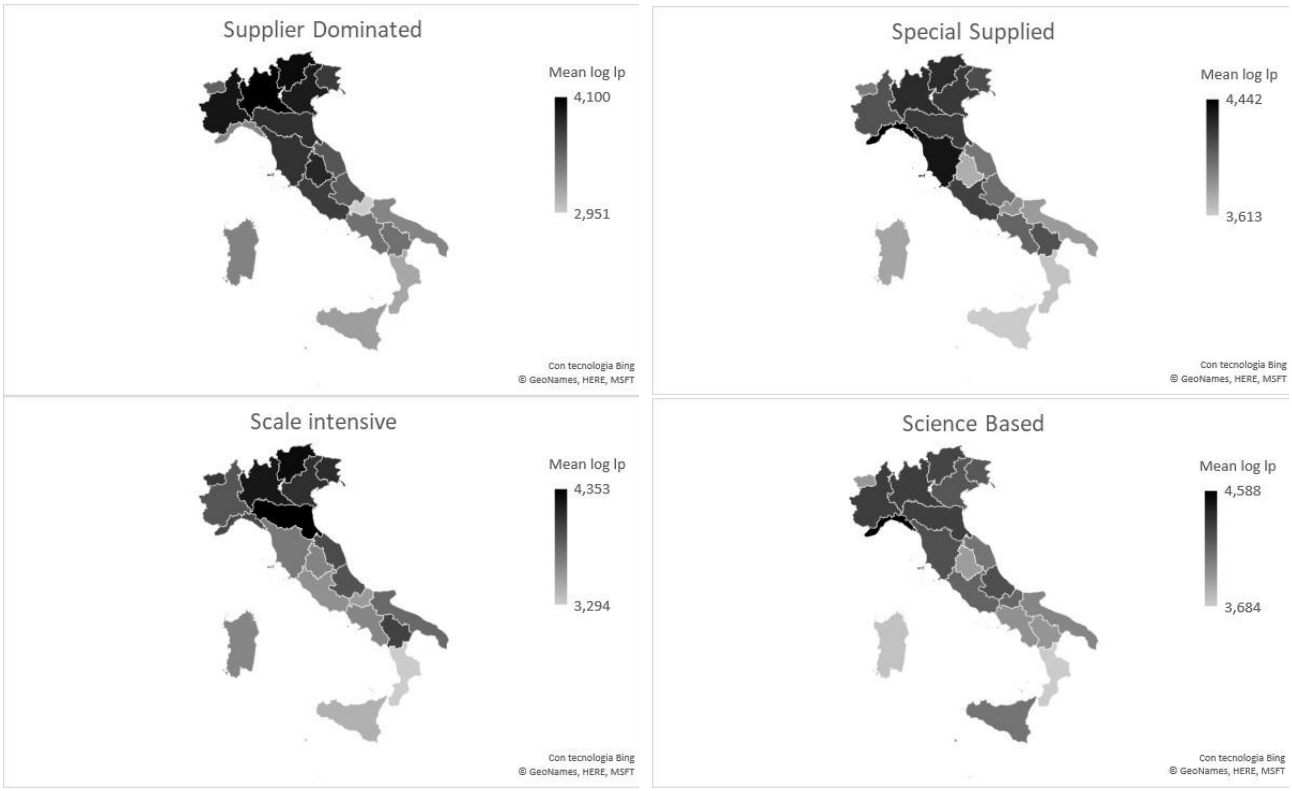
Appendix

Figure I - Maps of log labour productivity Median in Italian region – Pavitt classification



(*Source*: Our elaboration)

Figure II – Map of Predatory Crime Index – Mean 2012-2016

(*Source*: Our elaboration)

Figure III Map of index of minimum economic conditions – Mean 2012-2016

(*Source*: Our elaboration)

Figure IV Map of indicator of innovation, research and creativity – Mean 2012-2016

(*Source*: Our elaboration)