Strategic reactions of Italian firms to globalization under the EMU[1]

Received
4th May 2014
Revised
10th July 2014
Accepted
27th April 2015

Enrico Tundis - Roberto Gabriele - Enrico Zaninotto

Abstract

***Purpose of the paper**: The paper aims to investigate the strategic choices of Italian firms in response to globalization under the European Monetary Union.*

***Methodology**: Firms are classified into four groups according to their productive efficiency and productivity dynamics. The probability of the firms to fall into each category is estimated using a multinomial logit regression.*

***Findings**: We show that the firms followed different strategies to respond to globalization under the constraints of the European Monetary Union. Human resource strategies were at the core of strategic options: the firms that showed sustained productivity growth used a more qualified, higher salaried workforce, whereas other firms tried to keep up with the pace by lowering labour costs and exploiting the dualism of market labour.*

***Research limits**: The study is based on a sample of continuing firms. It does not consider the real effects of entry and exit on technological progress and we do not analyse the productivity dynamics related to mergers and acquisitions.*

***Practical implications**: The dualism of the labour market allowed the "regressive", short-lived adaptation of a group of firms to access increased global competition. A balanced labour market would promote investment in human capital and push firms towards the use of innovation as a competitive strategy.*

***Originality of the paper**: This investigation is based on an original database with a wealth of information on labour forces, which allows us to study firm strategies. The use of efficiency measures, combined with the ordered logit model, permits a novel look at the dynamics of the strategies of Italian firms.*

Keywords: firm strategy; Italian manufacturing businesses; productivity; globalization

1. Introduction

On the eve of the new millennium, Italian firms were confronted by the introduction of the European Monetary Union (EMU), the challenge of which may be considered equivalent to the shock produced by trade liberalisation. After that event, a long slowdown of productivity plagued the Italian industrial system. Recent studies, however, have emphasised a wide heterogeneity of productivity among firms. The existence of a wide dispersion of total factor productivity was confirmed at both industrial and regional levels by Tundis *et al.* (2012) and Tundis and Zaninotto (2012),

1 We would like to thank the two anonymous referee and the participants to the "XXVI Convegno di Sinergie" Track n.6 for their valuable comments.

who distinguished the technological component from the efficiency component in the slow growth of productivity. They demonstrated that after 2000, the technological component of productivity growth was offset by the average decrease in efficiency, which means that although some firms were able to move the technological frontier, a wide and increasingly dispersed group of firms lagged behind. This observation questions the explanation of the Italian productivity slowdown that claims that Italian firms suffer from common unfavourable conditions: bad regulation (Rossi, 2009), poor institutions (Marrocu and Paci, 2010) and old infrastructures (La Ferrara and Marcellino, 2000), which prevent the entire Italian economy from moving towards dynamic and innovative behaviour. Nevertheless, there are hints that, despite tighter competition and without the protection of competitive devaluations, firms reacted differently to the new competitive set.

Using labour productivity as an indicator of firm restructuring, Bugamelli *et al.* (2010) argued that the increased competitive pressure forced Italian firms to make internal changes, even though the effects of this restructuring were unevenly distributed across firms. Dosi *et al.* (2012) analysed a large sample of firms in all economic sectors, highlighting the apparent weakness of all markets in selecting efficient incumbent firms. Their findings showed that the support of the distribution of labour productivity in firms between 1989 and 2004 was ample and had not decreased over time, giving rise to a kind of "neo-dualism" among firms. Recently, the establishment of a two-tier labour market has been indicated as a possible reason for the increase in the dispersion of labour productivity among Italian manufacturing firms (Boeri and Garibaldi, 2007). However, a thorough analysis of the evolution of productivity dispersion is still lacking in the literature.

The exposure to global competition seemed to be the driver of strategic changes in Italian firms (Varaldo, 2006). Resciniti (2009) discussed the firm-specific paths followed by Italian firms that were initially defeated by international competition. Successful firms stressed process, product innovation and novel relationships with customers. In particular, firms modified their range of activity and changed the degree of extension along the value chain (Resciniti, 2009). However, the small size of Italian firms seemed to be a crucial factor in determining this variety of responses to the challenges of competition (Mattiacci, 2008; Dalli *et al.*, 2010).

In this paper, we use the efficiency scores presented in Tundis *et al.* (2012), which were calculated on the basis of a large sample of firm balance sheets (integrated with social security data), in order to classify various strategic patterns in the adaptation of Italian firms to the global market under the EMU. In addition, we assess the role played by human capital in these different strategic paths. We claim that in order to play in a global market under the fixed exchange regime imposed by the EMU, firms followed different strategies: part of the Italian industry reacted by increasing technological advancement, whereas another part tried to exploit the dualistic structure of the labour market resulting from the successive reforms of labour regulation. The key difference between the

two strategies lies in the investment in human capital, which appears to be a strong characteristic of firms with differing performances in productivity.

The paper is organized as follows. Section 2 presents the theoretical background used to classify firms according to their performance, and Section 3 presents raw data. Section 4 presents the estimation strategy and the model used to assess the role played by strategies of human capital in the strategic choices of Italian firms. The results are presented in Section 5, and Section 6 discusses the most relevant implications for industrial policies and management. Section 7 concludes and recommends some possible extensions of the research.

2. Strategies of firms and patterns of productivity growth

The distribution of firm productivity depends jointly on the patterns of innovation and imitation. Our analysis of the patterns of productivity growth is coherent with neo-Schumpeterian theories of technological progress (see Iwai, 2000; König *et al.*, 2012) and is based on the competence-based theory of the firm (Wernelfelt, 1984; Barney, 1991; Teece and Pisano, 1994; Teece *et al.*, 1997). Through the process of innovation, some firms push forward the technological frontier, while other firms tend to close the gap between them and innovators through imitation. In König *et al.*'s (2012) model, the choice between using a strategy of innovation or of imitation is endogenous depending on the firm's absorptive capabilities and distance from the frontier (the more distant a firm is from the frontier, the easier it is to find better technology). The joint process of innovation and imitation induces productivity dispersion, which is restrained by the easiness of the imitation and exit processes, thus impeding productivity variability's limitless growth.

In order to describe productivity heterogeneity within this setting, it is important to take into account both distance from the frontier (i.e., efficiency levels) and productivity dynamics. The frontier is indeed moved by innovative firms, while productivity dispersion behind the frontier is determined by internal (absorptive capabilities) and external (market selectivity) conditions. The mediating role of the distance from the frontier emerged in empirical explanations of the effectiveness of firm strategies (Coad, 2011): the farther the firm is from the technological frontier, the easier it should be to gain unexploited technological opportunities through imitation. Thus, we rank firms with respect to their distance from the frontier and observed productivity growth, which will be measured and described in Section 4. We then group them with respect to the following criteria: (a) the industry average value of efficiency levels (above or below), and (b) firm productivity dynamics (increasing or decreasing). Table 1 shows the resulting classifications.

Tab. 1: The Taxonomy of Italian Firm Strategies

		Productivity change (t, t+Δt)	
		High	Low
Efficiency level (t)	High	Dynamic leader (4)	Static Leader (3)
	Low	Climbers (2)	Laggards (1)

Source: Our elaboration

Four distinct strategic groups of firms can therefore be identified: (1) Laggards are firms with low initial efficiency and negative productivity growth. Although they are far from the frontier, they are not able to seize new opportunities, possibly because they lack absorptive capabilities. It is very likely that these firms compete in costs and are exposed to international competition (Varaldo, 2009). (2) Climbers are firms with low initial efficiency but move rapidly towards the frontier and sometimes induce its shift. In these firms, productivity growth may be particularly rapid because they can act on two factors: efficiency gains related to relatively cheap imitative processes and independent technological advances. (3) Static leaders are firms that are close to the frontier but have negative productivity growth. Therefore, they tend to move away from the frontier over time because they are not able to keep the pace of technological change. (4) Dynamic leaders are firms that are close to the technological frontier at the onset of the period and show positive productivity growth. These firms are likely to improve their productivity, mainly through innovative strategies instead of improvements in efficiency.

3. Data

The study is based on a novel database of Italian single-location manufacturing firms for the 1996-2006 period. The primary source of the data used in this study is the Bureau Van Dijk's AIDA database, which provides detailed information on the finances, geographical location, number of employees and local units in a large sample of limited liability Italian firms. A subsample of single-location manufacturing firms that were continuously active during the 1996-2006 period was selected from the original data collection. The data were supplemented with information about the workforce obtained from the Italian Institute of Social Security (INPS). This additional source provided the yearly average number of employees in all firms in the sample, the decomposition of the workforce into white- and blue-collar workers, and full and part-time contracts for the 11 years covered in this analysis.

The empirical analysis exploits an original dataset containing information on 7,712 Italian manufacturing firms (84,832 observations) over the 1996-2006 period. The database represents a unique collection of data about Italy and allows us to extend the understanding of the dynamics of incumbent firms over a relatively long period. In addition, the choice of single-location firms allows us to work at a level of analysis that is as close as possible to the single establishment level. Focusing on single-location firms also means that changes such as mergers, acquisitions and divestitures only marginally affect the group of firms in the sample. The spurious effect stemming from the intra-group reallocation of equipment and personnel is also neutralised. The industry distribution of our dataset generally reflects the distribution of firms described by the ISTAT "8° Censimento Industria e Servizi" in 2001, as shown at the mid-point in the observation period (Table 2).

Tab. 2: Number of Firms and Employment for Industries. Year, 2001

Industry	Firms				Employees			
	ISTAT		Our Database		ISTAT		Our Database	
	Number	%	Number	%	Number	%	Number	%
Food and beverages	8328	7.2	564	7.3	220922	6.8	25404	6.2
Textiles and clothing	13929	12.0	911	11.8	352291	10.8	51645	12.6
Leather goods	4869	4.2	365	4.7	113573	3.5	19971	4.8
Wood	3281	2.8	204	2.6	56284	1.7	9071	2.2
Paper and printing	9838	8.5	479	6.2	178708	5.5	21419	5.2
Petroleum	352	0.3	22	0.3	24192	0.7	1045	0.2
Chemicals	3797	3.3	309	4.0	197340	6.0	17313	4.2
Rubber and plastic mat.	5993	5.2	492	6.3	175330	5.4	26858	6.5
Non-met. mineral prod.	6399	5.5	433	5.6	175035	5.4	21676	5.3
Fabricated metal prod.	20545	17.7	1445	18.7	503712	15.4	77814	19.0
Machinery and equip.	15879	13.7	1137	14.7	498070	15.3	62991	15.3
Electronics	11291	9.7	574	7.4	344198	10.5	31104	7.6
Transportation equipment	2697	2.3	161	2.1	253778	7.8	10691	2.6
Other manufacturing	8716	7.5	616	7.9	174104	5.3	32288	7.8
TOTAL	115914	100.0	7712	100.0	3267974	100.0	409290	100.0

Source: our elaboration

4. Methodology

A multinomial logit regression model was estimated to isolate significant relationships between a set of explanatory variables and types of firms:

$$P(y = j \mid \mathbf{x}) = \exp(\mathbf{x}\beta_j) \Big/ \left[1 + \sum_{k=2}^{4} \exp(\mathbf{x}\beta_k)\right] \qquad [1]$$

where $P(y= j|\mathbf{x})$ represents the probability of belonging to group j = 2, 3, 4 indicating firm types, $\mathbf{x}$ represents explanatory variables and controls, and β_j are the parameters to be estimated. Obviously, for the reference group (1) we have:

$$P(y=1|\mathbf{x}) = 1 \Big/ \left[1+\sum_{k=2}^{4}\exp(\mathbf{x}\beta_k)\right] \quad [2]$$

In the estimation, we pooled observations of three periods: 1996-2000, 2000-2003 and 2003-2006. We used time dummy variables for each period.

4.1 Independent variables and controls

The hypothesis of the existence of differing strategic behaviours because of the composition of the labour force was studied using a set of explanatory variables that are proxies for the quality of the human capital that is employed by firms. In particular, we assume that, on average, high-quality human capital costs more, and we therefore use the unit cost of labour (*labour_cost*) as a proxy of the quality of human capital available to the firm[2]. To account for different firm choices regarding the quality of the workforce against simple adjustments made due to changes in labour costs, we also consider the ratios of white-collar to blue-collar workers (*skill_ratio*) and of part-time employees to total employees (*partime*). The *skill_ratio* is used as a proxy of the share of skilled workers and the role that upstream and downstream activities have in business strategies (Bugamelli *et al.*, 2010). The share of part-time employment in total employment (*partime*) is a proxy for the use of flexible labour (Arvanitis, 2005), which affects the quality of labour, under the assumption that the contribution of full-time employees is of higher quality than that of part-time employees because of individual motivation, incentive structure, level and rate of learning (Dolado and Stucchi, 2008). We also consider the following control variables:

- firm size (size) is measured through the log of total asset. In this regard, in a study of American firms, Dhawan (2001) showed that small businesses were significantly more productive than larger ones, suggesting a negative relationship between productivity growth and firm size. Recently, however, Harris and Moffat (2011) showed that manufacturing firms in the UK operate under increasing returns to scale and that firm size was positively related to the dynamics of total factor productivity;
- the age (age) of the firm may have a negative or positive effect on productivity growth according to whether the effects of technological obsolescence or learning-by-doing prevail (Cohen and Levinthal, 1990; Argote *et al.*, 2003; Harris and Moffat, 2011);
- the literature shows that stringent financial constraints have a negative effect on firm performance in terms of growth and profitability (Fagiolo and Luzzi, 2006) and productivity (Bottazzi *et al.*, 2008; Bottazzi *et al.*, 2011). The rescaled cash flow (*cash_flow*), expressed as the ratio between cash flow and total sales, is used as a proxy for financial constraints;

[2] Labour cost has already been used as an indicator of the level of human capital in Italian manufacturing firms. See, for instance, Antonelli *et al.* (2013).

- firms have differing abilities to generate new technologies or to exploit other existing technologies, which eventually affects their productivity performance. The variable *intang*, defined as the ratio of the book value of intangible assets to tangible assets, is used as a proxy for the intensity of technical and scientific expertise of the firm (Antonelli and Scellato, 2013; 2015);
- three sets of dummy variables account for time, sector of activity and location in terms of the geographic area, respectively. These variables control the various external conditions in which firms operate.

4.2 Dependent variable

To build the categorical variable used to classify the competitive positioning of firms, we used efficient scores estimated by means of data envelopment analysis (DEA). In particular, we estimated a non-parametric measure of efficiency scores in a base year and a Malmquist productivity index for different sub-periods (the method is explained in detail in Tundis *et al.* (2012). Input and output variables were constructed from balance-sheet data with the exception of data on labour. The raw data were corrected and deflated in order to obtain real values. In this study, we used sectorial deflators constructed from ISTAT data. Output was measured by revenues from sales and services at the end of the year, net of inventory changes or changes to contract work in progress; labour input was measured as the total number of employees at the end of the year. Two intermediate inputs were considered: (a) costs of consumed raw materials and goods for resale (net of changes in inventories); (b) cost of services. The capital stock in a given year was estimated using the perpetual inventory method to determine the nominal value of tangible fixed assets over the analysed period. All monetary measures were expressed in thousands of euros and were deflated by the appropriate industry level index. The deflator for the turnover variable was constructed by processing the time series of national production. The deflator for intermediate inputs was constructed with a weighted deflator of production, with weights calculated as the average of the column coefficients of the input/output matrix of a set of Italian regions for the year 2001.

We detected outliers using a preliminary analysis to check the effect of each observation on the distances from the nearest firm (which depended on that particular observation) by using a method based on the concept of leverage, that is, the effect produced on the efficiencies of all the other firms when the observed firm was removed from the dataset (Sampaio de Souza and Stosic, 2005). Observations with the widest effect on the nearest firms were then discarded from the final calculation.

The efficiency score is calculated for each firm in a given year, as the value of the output oriented distance function. Consider a firm producing a vector of outputs, $\mathbf{y} \in R^{M}_{+}$, from a vector of inputs, $\mathbf{y} \in R^{S}_{+}$. Assume a convex production possibility set with freely disposable inputs and outputs. The output distance function can then be defined by the technology T = {(**x**,**y**): **x** can produce **y**} as:

$$D(\mathbf{x},\mathbf{y}) = \inf_{\theta}\left\{\theta > 0 : \left(\mathbf{x}, \frac{\mathbf{y}}{\theta}\right) \in T\right\} \qquad [3]$$

The distance function defined in [3] is relative to each firm and can be interpreted as the potential increase in output that can be achieved by a firm that uses a given number of inputs. In particular, the scalar $\theta \in (0,1]$ identifies the potential expansion of the output **y**, so that the production possibility $(\mathbf{x},\mathbf{y}/\theta)$ lies on the efficient frontier of T. Therefore, a firm will be efficient (laying on the frontier) if and only if $D(\mathbf{x},\mathbf{y})=1$.

The Malmquist index represents the productivity changes of each firm between two periods, t and t+Δt. This index can be derived as the ratio of distances from the constant returns of scale (CRS) production frontier, which is composed of the best-practice firms in the observed set of firms in each period. The link between the calculated distances and TFP change is:

$$Malmquist_t = \Delta \hat{TFP}_t = \frac{\hat{D}_t^{CRS}(\mathbf{x}_{t+\Delta t}, \mathbf{y}_{t+\Delta t})}{\hat{D}_t^{CRS}(\mathbf{x}_t, \mathbf{y}_t)} \quad [4]$$

This is the ratio between the distance of the firm in period $t+\Delta t$ from the frontier in period t, and the distance in period t from the frontier in period $t+\Delta t$.

In order to rank firms, we used both the distance (efficiency) measures in the initial year and the Malmquist measures of productivity change in three sub periods: 1996-2000, 2000-2003 and 2003-2006. Table 3 shows the average values of both quantities across industries for the entire period and all sub-periods.

Tab. 3: Efficiency and Malmquist Index Averages per Industry. 1996-2006 Period

Industry	1996-2006		1996-2000		2000-2003		2003-2006	
	Eff.	Malm	Eff.	Malm	Eff.	Malm	Eff.	Malm
Food and beverages	0.845	1.013	0.845	0.970	0.849	1.033	0.859	1.025
Textiles and clothing	0.826	1.051	0.826	0.986	0.828	1.034	0.823	1.040
Leather goods	0.893	1.008	0.892	0.953	0.875	1.021	0.882	1.059
Wood	0.884	1.044	0.884	0.993	0.903	1.043	0.894	1.015
Paper and printing	0.774	1.007	0.774	0.938	0.809	1.065	0.824	1.021
Petroleum	0.930	0.932	0.930	0.834	0.920	1.223	0.947	0.915
Chemicals	0.839	0.984	0.839	0.945	0.844	1.048	0.859	0.998
Rubber and plastic mat.	0.836	1.052	0.836	0.999	0.864	1.051	0.874	1.008
Non-met. mineral prod.	0.827	1.001	0.827	0.965	0.854	1.014	0.865	1.032
Fabricated metal prod.	0.789	1.004	0.789	0.980	0.804	1.047	0.806	0.989
Machinery and equipment	0.806	1.103	0.806	0.974	0.813	1.030	0.818	1.113
Electronics	0.789	1.131	0.790	1.020	0.813	1.042	0.814	1.069
Transportation equipment	0.836	1.101	0.836	0.980	0.857	1.028	0.869	1.112
Other manufacturing	0.850	1.027	0.850	0.979	0.860	1.007	0.854	1.047

Notes: Eff.<1 indicates inefficiency; Malm<1 indicates a decrease in productivity

Source: Our elaboration

Table 4 shows the number of firms falling in each category described in Section 2.

Tab. 4: Number of Firms in Each Category

Category	Period 1	Period 2	Period 3
Laggards	1884	898	1015
Climbers	1917	2800	2647
Static leaders	2407	1562	1542
Dynamic leaders	882	1830	1886

Source: Our elaboration

5. Results

Table 5 shows the average values and standard deviations of the explanatory variables. On average, the values of laggards and climbers were higher than static or dynamic leaders (almost 1,800 thousand against 1,600 thousand euros). Moreover, they used more part-time workers and are older than firms in the other groups are. Leaders - both static and dynamic - pay around 4,000 € more than laggards and climbers do for labour, have a higher cash flow, use more skilled labour, and use more intangibles. In many respects, dynamic leaders resemble static leaders but they have a higher skill ratio.

The correlation matrix (Table 6) shows that the correlations were low for all pairs of explanatory variables.

Tab. 5: Descriptive Statistics

Variable	Laggards		Static leaders		Climbers		Dyn. leaders	
	Avg.	Std. Dev.	Avg.	Std. Dev.	Avg.	Std. Dev.	Avg.	Std. Dev.
labour_cost (Th. €)	20.6	5.3	23.5	7.4	20.1	5.5	24.0	7.4
skill_ratio (ratio)	0.43	1.13	0.65	2.56	0.48	1.43	0.84	3.29
partime (ratio)	0.041	0.060	0.036	0.053	0.043	0.059	0.039	0.056
cash_flow (Th. €)	373	694	620	1164	344	612	617	1271
size (total asset, Th. €)	1791	3013	1563	4063	1832	2692	1602	3595
age (years)	21.6	12.6	21	13.2	21.7	12.3	21.8	12.7
intang (ratio)	0.11	1.19	0.25	1.48	0.13	0.71	0.27	0.99

Source: Our elaboration

Tab. 6: Correlation Matrix

Variable	labour_cost	skill_ratio	partime	cash_flow	age	size	intang
labour_cost	1						
skill_ratio	0.167*	1					
partime	-0.141*	0.034*	1				
cash_flow	0.0.36*	-0.032*	-0.068*	1			
age	0.254*	-0.000	0.046*	0.016*	1		
size	0.192*	0.007	-0.063*	0.195*	0.093*	1	
intang	0.050*	0.213*	0.012	-0.046*	-0.047*	-0.018*	1

Notes: * p-value< 5%

Source: Our elaboration

Table 7 lists the results of the estimated multinomial model with different sets of explanatory variables. In all specifications of the model, we considered the entire set of controls based on financial constraints, the size and age of the firm, as well as the dummies for time, sector and geographical location. The estimated coefficients represent log-odds ratios, i.e., the logarithm of the ratio of the probability of being in group j (j = 2, 3, 4) compared to the probability of being in the baseline group (*j = 1*, i.e., laggards)[3].

Our measurement of the quality of human capital (*labour_cost*) and the probability of belonging to either group of leaders - static or dynamic - compared with the baseline category (laggards) were positively related. A higher value of *skill_ratio* was associated with a greater probability of being a leader or a climber with respect to the baseline group, but the coefficient was higher for dynamic leaders. Increasing the number of part-time employees reduced the probability of belonging to any group except that of the laggards. With regard to control variables compared with the baseline group (laggards), the *cash_flow* increased the probability of both belonging to a leader group and the use of intangibles. Finally, the probability of being a leader decreased as the age of the firm increased.

An improved understanding of relevant factors was provided by the estimation of the marginal effect of a variable on the probability of belonging to each group. Table 8 lists the estimated marginal effects for Model 2. Belonging to the two extreme groups - laggards and dynamic leaders - was neatly associated with opposing human resource management strategies. The use of cheaper, less skilled and part-time labour increased the probability of falling into the class of laggards, the use of intangibles, the presence of financial constraints, size and age. The same variables operated conversely to determine the probability of being a dynamic leader, which resulted from an increase in the quality of human capital (*labour_cost*), skill ratio, and a decrease in the number of part-time employees, financial constraints, age and size.

It was more difficult to assess how human resource management was associated with the probability of being a climber or a static leader. Static leaders seemed to result from paying higher wages; they probably used a stock of highly productive workers. However, there were no signs of improvement in the composition of employees. Climbers seemed to exploit lower labour costs. They tended to catch up with the frontier over time despite their propensity to lower the quality of their labour. However, the reduction in their distance from the frontier may be associated with the search for better efficiency or the effect of successful servitisation strategies (Baines *et al.*, 2009) with the expansion of upstream (e.g., product design) and downstream (e.g., marketing and sales) activities.

[3] The multinomial logit model is based on the assumption of Independence of Irrelevant Alternatives (IIA), meaning that the odds ratio between any two choices is not affected by any other alternative choice. The rejection of the IIA assumption leads to biased predictions of probabilities by the model. We tested the IIA assumption of our model specifications with the Small-Hsiao test.

Tab. 7: Multinomial Logit Estimates (log-odds ratios). Reference group: Laggards (1)

Variable	Model 1			Model 2		
	Climbers (2)	Static leaders (3)	Dynamic leaders (4)	Climbers (2)	Static leaders (3)	Dynamic leaders (4)
labour_cost	-0.031*** (0.005)	0.160*** (0.005)	0.162*** (0.005)	-0.034*** (0.005)	0.160*** (0.005)	0.158*** (0.005)
skill_ratio	-	-	-	0.039 (0.024)	0.044* (0.024)	0.062*** (0.024)
partime				-0.823** (0.374)	-1.048** (0.430)	-1.106** (0.445)
intang	0.028 (0.059)	0.262*** (0.056)	0.247*** (0.056)	-0.037 (0.063)	0.277*** (0.058)	0.251*** (0.058)
cash_flow	-4.291*** (0.475)	13.260*** (0.500)	10.078*** (0.526)	-4.245*** (0.478)	13.399*** (0.504)	10.106*** (0.530)
age	-0.114*** (0.037)	-0.346*** (0.038)	-0.403*** (0.042)	-0.103*** (0.037)	-0.339*** (0.039)	-0.389*** (0.042)
size	0.092*** (0.020)	-0.701*** (0.022)	-0.645*** (0.023)	0.090*** (0.021)	-0.703*** (0.023)	-0.639*** (0.023)
Time dummies		Yes			Yes	
Sector dummies		Yes			Yes	
Location dummies		Yes			Yes	
Statistics						
N. Obs.		21,258			21,030	
Log-likelihood		-25054.34			-24775.27	
Pseudo R2		0.076			0.1309	
LR $\chi 2$ (df)		4562.54 (66)			7465.33 (75)	

Source: our elaboration

Tab. 8: Marginal effects

	Model 2			
Variable	Laggards (1)	Climbers (2)	Static leaders (3)	Dynamic leaders (4)
labour_cost	-0.012*** (0.001)	-0.034*** (0.001)	0.025*** (0.001)	0.020*** (0.001)
skill_ratio	-0.007** (0.003)	0.000 (0.003)	0.002 (0.002)	0.005*** (0.002)
partime	0.146*** (0.052)	-0.011 (0.067)	-0.066 (0.064)	-0.068 (0.058)
intang	-0.021** (0.008)	-0.051*** (0.010)	0.042*** (0.006)	0.030*** (0.005)
cash_flow	-0.769*** (0.063)	-2.884*** (0.085)	2.372*** (0.069)	1.281*** (0.065)
age	0.038*** (0.005)	0.035*** (0.007)	-0.034*** (0.006)	-0.039*** (0.005)
size	0.053*** (0.003)	0.129*** (0.004)	-0.107*** (0.003)	-0.076*** (0.003)
Time dummies			Yes	
Sector dummies			Yes	
Location dummies			Yes	

Source: Our elaboration

In summary, the econometric exercise allowed us to characterise the four groups of firms: laggards, climbers, static leaders and dynamic leaders. The laggards employed a cost-cutting strategy based on the use of lower quality labour and gained a cost advantage from the dual labour market. Leader firms were younger, smaller and used skilled labour. Climbers seemed to stress low labour costs and possibly climbed through an increase in efficiency.

Our evidence is consistent with previous studies. Lucidi and Kleinknecht (2009) found that Italian manufacturing firms with a high share of flexible workers and lower labour costs registered significantly lower rates of growth in labour productivity from 2001 to 2003.

The negative effect of firm size contrasts with a substantial proportion of the literature, which shows a positive relationship between size and productivity. However, firms may have undergone downsizing. The results of the effect of age and firm size on productivity dynamics are in fact consistent with those identified by Hall *et al.* (2009). Analysing a panel of small and medium enterprises (SME) Italian manufacturing firms in the 1995-2003 period, these authors found that larger and older firms were less productive. A negative relationship between size and efficiency was also found by Diaz and Sanchez (2008) in the case of Spanish firms and by Dhawan (2001) in American firms. Finally, this finding is also consistent with recently published results by Hijsen *et al.* (2013), which showed that large Italian firms tend to substitute permanent workers with temporary workers more often than small firms did, which had a perverse effect on productivity.

6. Discussion and implications

The results of this study presented clear evidence that different human resource management strategies made possible by the dual structure of the labour market reflect the levels and dynamics of productivity. However, the mechanisms at work and the casual relationship between variables are still unclear. We propose different interpretative hypotheses and their consequent implications for industrial policies and management.

First, it is worth noting that our observations are not consistent with the simple view of firms as having access to different segments of the dual labour market. This would be the case if, for instance, smaller, less unionized firms could access cheaper and more flexible labour. In this case, firms would adjust their input composition according to the different relative costs of labour to capital. This implies that, in facing different labour costs, the two groups of firms would adjust their position regarding the production function, which however would have no impact on technical efficiency. Moreover, the fact that we observed lower efficiency levels and productivity dynamics among large firms (which are supposed to be unionized) confirms that the latter is not simply a matter of relative price adjustments among firms having access to different segments of the labour market.

The evidence of a relationship between the unit cost of labour and productive efficiency should therefore support the hypothesis that a less rigid labour market leads to differentiation in terms of not only the price of labour but also firms' choices about the quality and the use of labour. This possibility is compatible with different (not mutually exclusive) explanations.

The first is simply a matter of measurement. Quality does not enter directly into the production function because it could be under-specified (along with the position of each firm in relation to it). It is therefore reasonable to expect that-given a certain amount of other production factors-firms resort to higher quantities of low quality labour, which could be incorrectly assessed as "inefficiency".

With this hypothesis of measurement bias, our observations could be compatible with a real movement, which could be explained in the light of the directed technical change theory. This theory rests on the idea of complementarity instead of the more common idea of the substitutability of inputs. According to the directed technical change theory, technical change does not uniformly affect the production function, but it proceeds along directions dictated by given compositions of inputs. If an exogenous technical change requires a given composition of complementary inputs (skilled labour being one of them), it would be easier for firms that already have a similar input composition to innovate. To accede to innovation, firms that are far from that composition should both shift towards the new technological frontier and adjust their input composition in order to gain an input-biased technical change (Antonelli and Scellato, 2015). Firms that are positioned far from the best input composition (regarding technical change) look for cheaper labour, thus moving even further away from the area of the frontier that is actually affected by technical change. This kind of regressive "technical stagnation" affects a part of the Italian industry and is the reverse of the endogenous technical advancement found in the United States (Acemoglu, 1998). In that case, because of the temporary fall of the college premium in the 1980s, an endogenous skill-biased technical change was activated with a subsequent rapid increase of demand for skilled labour and the college premium.

Much must be done to support this hypothesis. Nevertheless, if our first results were to be confirmed, there would be important implications for industrial policies and management. The consequences for industrial policies are obvious: the dualism of labour markets has dangerous consequences for the productivity growth of the Italian manufacturing system; therefore, they should be corrected as soon as possible. In any case, much must be done to re-address the Italian manufacturing system towards a less unbalanced composition of inputs with respect to the direction of technical change. The cost of this adjustment is often neglected in the economic debate about Italian recovery, which stresses demand policies and does not pay much attention to the role of active industrial policies in reactivating the dynamics of productivity (Trento and Zaninotto, 2013).

With regard to management, our findings have shown that a short period of adjustment to labour costs has disadvantages over time because it drags the firm away from the composition of skills that is closest to the direction of technical change. The increased cost of reaching the production frontier

through an input-biased technical change would further increase the use of cheap labour and the divestment of skilled labour. Leapfrogging low-cost labour to maintain a competitive position must face the challenge of competition by emerging countries. The long-term effect of short-term adaptation should be taken into account before addressing human resource management policies. Our results have strong implications in terms of the structural characteristics of firms: the strategies that were implemented to react to the crisis have permanent and irreversible effects. In particular, de-skilling the firm in order to adjust flexibly to the crisis could be a nearly irreversible choice in relation to the presence of complementary inputs and directed technical change. Human resources and industrial relations practices aimed at increasing the flexible use of labour without depriving the firm of resources that are fundamentally important for the long-term survival of the firm are necessary for the reappraisal of productivity dynamics after the crisis.

7. Conclusion

Earlier studies on the Italian economic slowdown pointed to the generalised failure of the entire productive system to meet the challenges posed by the increased globalisation of markets. However, the analysis presented here indicates that the high heterogeneity of firm strategies lies behind the generalized economic stagnation that was experimented by the Italian industrial system after the introduction of the EMU.

The evidence presented here is consistent with the findings of other studies that were carried out using different methods (Bugamelli *et al.*, 2010; Dosi *et al.*, 2012; Tundis *et al.*, 2012; Antonelli *et al.*, 2013) but also pointed to growing dualism among firms. Some firms showed sustained productivity growth, while others clearly failed to keep pace with the group of innovators. We question whether this dynamic is related to different patterns of strategic adaptation.

The evidence reinforces the hypothesis that firms followed different paths in adapting to external shocks, and that differing uses of labour played a decisive role in this process. The labour market reforms that were implemented in Italy in the 1990s dramatically reduced not only labour costs but also the quality of newly hired workers. We hypothesised that firms took advantage of the emergence of the dualistic labour market. For some firms, the availability of flexible labour that was less expensive but less skilled was the easiest solution to compete, whereas more efficient and dynamic firms competed in innovation and invested in skilled labour. Nevertheless, it is difficult to assess the long-term effectiveness of these different modes of adaptation.

This study has the following limitations. First, because it is based on a sample of continuing firms, it does not take into account the actual effects of entry and exit on technological progress. Population ecology theories suggest that innovation in the form of organizational change occurs at the population level through organizational births and deaths (Hannan and Freeman, 1989). The hypothesis that newly established firms are science-

based and technologically advanced is consistent with the entrepreneurial process of "creative destruction", and many studies of productivity have highlighted the important roles of entry and exit in enhancing productivity (Bartelsman *et al.*, 2013). However, in an intermediate-technology context, such as Italian manufacturing, young innovative firms may not be sufficiently creative and autonomous to shape their innovative processes. Therefore, they need to acquire external knowledge in order to foster their own innovation activity (Pellegrino *et al.*, 2011). In the Italian industrial sector, new entrants do not necessarily cause a shift in the technological frontier, but they are more likely to acquire technologies that are already present in the market, and survivors occasionally produce changes in the frontier. This pattern would be consistent with our findings and with the strand of research that suggests that within-firm changes in existing firms is the principal driver of aggregate productivity dynamics (see, e.g. Bottazzi *et al.*, 2010). It is nevertheless necessary to integrate the findings of the present study with the empirical evidence of the effects of entry and exit in order to increase understanding of the origins of the long stagnation of productivity in Italy.

A second mechanism for the transmission of productivity is the reallocation of human and technological resources stemming from intra-group reallocation and fostered by mergers and acquisitions. The structure of our dataset does not permit us to explore this issue. However, even if internal reallocation could accelerate the process of diffusion, we are convinced that, given the structure of the Italian entrepreneurial system, the phenomenon we highlighted in single-plant firms should predominate. Obviously, a careful testing of this hypothesis is necessary.

Finally, to test the hypotheses we discussed in the previous section, we recommend that future research explore the problem of the endogeneity of technical change.

References

ACEMOGLU D. (1998), "Why do new technologies complement skills? Directed technical change and wage inequality", *The Quarterly Journal of Economics*, vol. 113, n. 4, pp. 1055-1089.

ANTONELLI C., CRESPI F., SCELLATO G. (2013), "Internal and external factors in innovation persistence", *Economics of Innovation and New Technology*, vol. 22, n. 3, pp. 256-280.

ANTONELLI C., SCELLATO G. (2013), "Complexity and technological change: knowledge interactions and firm level total factor productivity", *Journal of Evolutionary Economics*, vol. 23, n. 1, pp. 77-96.

ANTONELLI C., SCELLATO G. (2015), "Firms size and directed technical change", *Small Business Economics*, vol. 44, n. 1, pp. 207-218.

ARGOTE L., MCEVILY B., REAGANS R. (2003), "Managing knowledge in organizations: An integrative framework and review of emerging themes", *Management Science*, vol. 49, n. 4, pp. 571-82.

ARVANITIS S. (2005), "Modes of labor flexibility at firm level: Are there any implications for performance and innovation? Evidence for the Swiss economy", *Industrial and Corporate Change*, vol. 14, n. 6, pp. 993-1016.

BAINES T.S., LIGHTFOOT H.W., BENEDETTINI O., KAY J.M. (2009), "The servitization of manufacturing: a review of literature and reflection on future challenges", *Journal of Manufacturing Technology Management,* vol. 21, n. 5, pp. 547-567.

BARNEY J.B. (1991), "Firm resources and sustained competitive advantage", *Journal of Management*, vol. 17, n. 1, pp. 99-20.

BARTELSMAN E.J., HALTIWANGER J., SCARPETTA S. (2013), "Cross-country differences in productivity: The role of allocation and selection", *American Economic Review*, vol. 103, n. 1, pp. 305-334.

BOERI T., GARIBALDI P. (2007), "Two tier reforms of employment protection: A honeymoon effect?", *The Economic Journal*, vol. 117, n. 521, pp. 357-385.

BOTTAZZI G., DOSI G., JACOBY N., SECCHI A., TAMAGNI F. (2010), "Corporate performances and market selection: some comparative evidence", *Industrial and Corporate Change*, vol. 19, n. 6, pp. 1953-1996.

BOTTAZZI G., GRAZZI M., SECCHI A., TAMAGNI F. (2011), "Financial and economic determinants of firm default", *Journal of Evolutionary Economics*, vol. 21, n. 3, pp. 373-406.

BOTTAZZI G., SECCHI A., TAMAGNI F. (2008), "Productivity, profitability and financial performance", *Industrial and Corporate Change,* vol. 17, n. 4, pp. 711-751.

BUGAMELLI M., SCHIVARDI F., ZIZZA R. (2010), "The euro and firm restructuring", in Alesina A., Giavazzi F. (a cura di), *Europe and the euro*, University of Chicago Press, Chicago.

COAD A. (2011), "Appropriate business strategy for leaders and laggards", *Industrial and Corporate Change,* vol. 20, n. 4, pp. 1049-1079.

COHEN W.M., LEVINTHAL D.A. (1990), "Absorptive-capacity. A new perspective on learning and innovation", *Administrative Science Quarterly*, vol. 35, n. 1, pp. 128-152.

DALLI D., RESCINITI R., TUNISINI A. (2010), "Sviluppo e competitività delle medie imprese italiane dell'era globale", *Mercati e competitività,* n. 3, pp. 19-46.

DHAWAN R. (2001), "Firm size and productivity differential: theory and evidence from a panel of U.S. firms", *Journal of Economic Behavior and Organization*, vol. 44, n. 3, pp. 269-293.

DIAZ M.A., SANCHEZ R. (2008), "Firm size and productivity in Spain: a stochastic frontier analysis", *Small Business Economics*, vol. 30, n. 3, pp. 315-323.

DOLADO J.J., STUCCHI R. (2008), "Do temporary contracts affect TFP? Evidence from Spanish manufacturing firms", *IZA Discussion Paper*, n. 3832.

DOSI G., GRAZZI M., TOMASI C., ZELI A. (2012), "Turbolence underneath the big calm? Exploring the micro-evidence behind the flat trend of manufacturing productivity in Italy", *Small Business Economics*, vol. 39, n. 4, pp. 1043-1067.

FAGIOLO G., LUZZI A. (2006), "Do liquidity constraints matter in explaining firm size and growth? Evidence from the Italian manufacturing industry", *Industrial and Corporate Change*, vol. 15, n. 1, pp. 1-39.

HALL B.H., LOTTI F., MAIRESSE J. (2009), "Innovation and productivity in SMEs. Empirical evidence for Italy", *Small Business Economics*, vol. 33, n. 1, pp. 13-33.

HANNAN M.T., FREEMAN J. (1989), *Organizational Ecology*, Harvard University Press, Cambridge, MA.

HARRIS R., MOFFAT J. (2011), "Plant-level determinants of total factor productivity in Great Britain, 1997-2006", *SERC Discussion Papers*, n. 64.

HIJSEN A., MONDAUTO L., SCARPETTA S. (2013), "The perverse effect of job-security provision on job security in Italy: results from a regression discontinuity design", *Institute for the Study of Labor,* IZA DP n. 7594.

IWAI K. (2000), "A contribution to the evolutionary theory of innovation, imitation and growth", *Journal of Economic Behavior and Organization*, vol. 43, n. 2, pp. 167-198.

KÖNIG M., LORENZ J., ZILIBOTTI F. (2012), "Innovation vs imitation and the evolution of productivity distributions", *CEPR Discussion Papers*, n. 8843.

LA FERRARA E., MARCELLINO M. (2000), "TFP, costs, and public infrastructure: an equivocal relationship", *Working Paper*, n. 176, Igier.

LUCIDI F., KLEINKNECHT A. (2009), "Little innovation, many jobs: An econometric analysis of the Italian labour productivity crisis", *Cambridge Journal of Economics*, vol. 34, n. 3, pp. 525-546.

MATTIACCI A. (2008), *Nicchia e competitività. Strategie di focalizzazione per la competizione globale*, Carocci Editore, Roma.

MARROCU E., PACI R. (2010), "The effects of public capital on the productivity of the Italian regions", *Applied Economics*, vol. 42, n. 8, pp. 989-1002.

PELLEGRINO G., PIVA M., VIVARELLI M. (2011), "Young firms and innovation: a microeconometric analysis", *Structural Change and Economic Dynamics*, vol. 23, n. 4, pp. 329-340.

RESCINITI R. (2009), "La competitività", in Varaldo R., Dalli D., Resciniti R., Tunisini A. (a cura di), *Un Tesoro Emergente: Le Medie Imprese Italiane dell'Era Globale*, Franco Angeli, Milano.

ROSSI S. (2009), *Controtempo. L'italia nella crisi mondiale*, Laterza, Bari.

SAMPAIO DE SOUSA M.C., STOSIC B. (2005), "Technical efficiency of the Brazilian municipalities: correcting nonparametric frontier measurement for outliers", *Journal of Productivity Analysis*, vol. 24, n. 2, pp. 157-181.

TEECE D., PISANO G. (1994), "The dynamic capabilities of firms: an introduction", *Industrial and Corporate Change*, vol. 3, n. 3, pp. 537-556.

TEECE D., PISANO G., SHUEN A. (1997), "Dynamic capabilities and strategic management", *Strategic Management Journal,* vol. 18, n. 7, pp. 509-533.

TRENTO S., ZANINOTTO E. (2013), "Una politica industriale utile e sostenibile", *Il Mulino*, vol. 62, n. 2, pp. 228-236.

TUNDIS E., ZANINOTTO E. (2012), "La caduta della produttività industriale in Italia e nelle regioni del Nord Est: una rilettura", *L'Industria*, vol. 33, n. 1, pp. 165-191.

TUNDIS E., ZANINOTTO E., GABRIELE R., TRENTO S. (2012), "Crescita della produttività, progresso tecnico e impiego del lavoro nelle imprese manifatturiere italiane: 1996-2006", *Economia e Politica Industriale*, vol. 39, n. 4, pp. 25-61.

VARALDO R. (2006), "Il nuovo modello competitivo e aziendale dei distretti industriali", *Economia e Politica Industriale*, n. 1, pp. 25-42.

VARALDO R. (2009), "Introduzione", in Varaldo R., Dalli D., Resciniti R., Tunisini A. (a cura di), *Un Tesoro Emergente: Le Medie Imprese Italiane dell'Era Globale*, Franco Angeli, Milano.

WERNERFELT B. (1984), "A resource-based view of the firm", *Strategic Management Journal*, vol. 5, n. 2, pp. 171-180.

Academic or professional position and contacts

Enrico Tundis
Research fellow
Free University of Bolzano - Italy
e-mail: enrico.tundis@unibz.it

Roberto Gabriele
Assistant Professor of Management
University of Trento - Italy
e-mail: roberto.gabriele@unitn.it

Enrico Zaninotto
Full Professor of Management
University of Trento - Italy
e-mail: enrico.zaninotto@unitn.it

sinergie
italian journal of management

ISSN 0393-5108
DOI 10.7433/s98.2015.12
pp. 195-212

CUEIM