The strategic reactions of Italian firms to globalization under the EMU

ENRICO TUNDIS[1] ROBERTO GABRIELE ·

ENRICO ZANINOTTO ⋆

Abstract

The paper aims at investigating the different strategic choices of Italian firms in response to globalization. We show that firms followed different strategies to respond to globalization under the constraints of the European monetary union. Human resource strategies appear to be at the core of strategic options: firms that showed sustained productivity growth used more qualified, high salary workforce, while other firms tried to keep the pace by lowering labour costs, by exploiting the market labour dualism. Dualism of labour market gave room to a "regressive", short lived, adaptation of a group of firms to the increased global competition. A more balanced labour market would promote investment in human capital and push firms towards the use of innovation as competitive weapon. The investigation relies on an original database with rich information about labour forces that allows us to study firm strategy. The use of efficiency measures combined with ordered logit model permits a novel look at the dynamics of Italian firm strategies.

Key words: *firm strategy, Italian manufacturing businesses, productivity, globalization.*

[1] Enrico Tundis, Post doc Grant – Department of Economics and Management, University of Trento, e-mail: enrico.tundis@unitn.it, cell: +39 338 3121499. Corresponding author.

· Roberto Gabriele, Assistant professor *Economia e Gestione delle Imprese* – Department of Economics and Management, University of Trento, e-mail: roberto.gabriele@unitn.it.

⋆ Enrico Zaninotto, Full Professor *Economia e Gestione delle Imprese* – Department of Economics and Management, University of Trento, e-mail: enrico.zaninotto@unitn.it.

1. Introduction

On the eve of the new Millennium, Italian firms had to confront with the shock consequent to the introduction of EMU – which may be considered as equivalent to a trade liberalisation shock. Since the same event, dates the long slowdown of productivity that plagues the Italian industrial system. In the following decade, however, a wide heterogeneity of productivity has been observed among firms. The existence of a wide dispersion of total factor productivity has been confirmed both at industry and regional level by Tundis *et al.* (2012) and Tundis and Zaninotto (2012), that distinguish, in the low productivity growth, the technological from the efficiency component. They show that, after 2000 the technological component of productivity growth was more than offset by an average decrease of efficiency, meaning that, at the same time, there were firms able to advance the technological frontier, and a wide and increasingly dispersed group of firms lagging behind. This observation is at odd with a widespread explanation of the Italian productivity slowdown, claiming that Italian firms suffer from common unfavourable conditions: bad regulation (Rossi, 2009), poor institutions (Marrocu and Paci, 2010), old infrastructures (La Ferrara and Marcellino, 2000), that relent the move towards a more dynamic and innovative behaviour.

On the contrary, there are hints that, despite a tighter competition and without the protecting net of competitive devaluations, firms put in action different strategy to react to the new competitive set. Bugamelli *et al.* (2010), using labour productivity as an indicator of firm restructuring, 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), analysing a large sample of firms in all economic sectors, highlighted the apparent weakness of markets in selecting more efficient incumbent firms and found that the support of the sectorial distribution of firms' labour productivity between 1989 and 2004 was ample and did not shrink over time, giving rise to a kind of "neo-dualism" among firms (Dosi *et al.*, 2012). Recently, the establishment of a two-tier labour market has been put forward as a possible reason for the increase in labour productivity dispersion among Italian manufacturing firms (Boeri and Garibaldi, 2007), although thorough analysis of the existence and evolution of productivity dispersion is still lacking.

In this paper we make use of the efficiency scores presented in Tundis *et al.* (2012), calculated from a large sample of balance sheets (integrated with Social security data), to classify various strategic patterns of adaptation of Italian firms to the global market under the European Monetary Union (EMU), and we try to assess the role played by human capital strategies in the different strategic paths. We claim, in line with Boeri and Garibaldi (2007), that in order to play in a global market under the fixed exchange regime imposed by the monetary union, firms followed different strategies: part of the Italian industry reacted by increasing the technological advancement, while another part tried to exploit the dualistic structure of the labour market, consequent to successive reforms of labour regulation. The key difference between the two strategic answers lies in the investment in human capital, that appears to strongly characterize firms with different productivity performance.

The paper is organized as follows. Section 2 presents the theoretical background used to classify firms according to their performance. Section 3 presents row data. Section 4 presents the estimation strategy and the model used to assess the role played by human capital strategies on the strategic choices of Italian firms. Section 5 resumes and discusses the most relevant results and Section 6 concludes and puts forward some possible extensions of the research.

2. The strategies of firms: Patterns of productivity

Our analysis of the patterns of productivity growth rests on neo-Schumpeterian theories of technological progress (see Iwai, 2000; König *et al.*, 2012). According to this approach, the distribution of productivity depend jointly from the patterns of innovation and imitation. Through the process of innovation, some firms move the technological frontier, while other firms tend to

close the gap with innovators by imitating. In the model of König *et al.* (2012) the choice between a strategy of innovation or imitation is endogenous, depending on the absorptive capabilities and the distance from the frontier (the more distant is a firm from the frontier, the easier is to find a better technology). The joint process of innovation and imitation induces productivity dispersion, which is restrained by the easiness of imitate and the exit process, thus impeding productivity variability to grow limitless.

In order to describe productivity heterogeneity within this setting, it is important to take into account both the distance to the frontier (i.e. efficiency levels), and the 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 distance to the frontier empirically emerged as important in explaining the effectiveness of firm strategies (Coad, 2011). Thus, we rank firms with respect to their distance to the frontier and observed productivity growth, measured as it will be described in Section 4. Then we group them with respect to the industry average value of each variable. 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 elaborations.

Four distinct strategic groups of firms can be consequently identified: (1) laggards are firms with low initial efficiency and below average productivity growth; (2) climbers are ones with low initial efficiency, which move rapidly towards the frontier and sometimes induce its shift. Productivity growth for these firms may be particularly fast, as they can act on two factors: efficiency gains related to imitative processes, and independent technological advances; (3) static leaders are firms close to the frontier but with low productivity growth, which therefore tend, over time, to move away from the frontier; (4) dynamic leaders are firms closer to the technological frontier at the onset of the period which show above-average productivity growth. These firms are likely to improve their productivity, mainly through innovative strategies rather than improvements in efficiency.

3. Data

The study is based on a novel database about Italian single-location manufacturing firms for the period 1996-2006. The primary source of the data used in this study is the Bureau Van Dijk's AIDA database, which provides detailed information on the financials, geographical location, number of employees and local units for a large sample of limited liability Italian firms. A subsample of single-location manufacturing firms which were continuously active during the period 1996-2006 was selected from the original data collection. Data were supplemented with workforce information from the Italian Institute of Social Security (INPS). This additional source yielded the yearly

average number of employees for all firms in the sample and the decomposition of the workforce into white- and blue-collar workers, as well as between full and part-time contracts for the eleven years covered in this analysis.

The empirical analysis exploits an original dataset containing information on 7712 Italian manufacturing firms (84832 observations) over the period 1996-2006. The database represents a unique collection of data for Italy and allows us to extend understanding of the dynamics of incumbent firms over a relatively long period of time. In addition, the choice of single-location firms allows us to work at a level of analysis which 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 – 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 elaborations

4. Methodology

A multinomial logit regression model was estimated to isolate some 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 $P(y = j \mid \mathbf{x})$ 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:

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

4.1 Independent variables and controls

The hypothesis of the existence of differing strategic behaviour as a result of the composition of the labour force was studied by means of a set of explanatory variables which proxy the quality of human capital employed by firms. In particular, we assume that, on average, the higher quality of 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[1]. However, a different unit cost of labour between firms may represent either a different quality of labour employed or, in a segmented labour market, labour of the same quality but at a lower price[2]. However, the effect on efficiency is expected to be different in the two cases. In the former case, between-firm variations of cost of labour due to the (not observed) use of labour of a different quality results in production inefficiency of production units with lower labour skills; in the latter case, a difference in cost of labour will only imply allocative inefficiency if firms do not adjust the composition of production factors (i.e., if they do not employ only less costly labour). 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 not only in terms of the price of labour but also of firms' choices about its quality.

To account for different firm choices as regards the quality of the workforce against simple adjustments 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 which upstream and downstream activities have in business strategies (Bugamelli *et al.*, 2010); the share of part-time employment on total employment (*part-time*), is a proxy of the use of flexible labour (Arvanitis, 2005), which has an impact on the quality of labour under the assumption that the contribution of full-time employees is of higher quality than that of part-time employees, for reasons related to individual motivations, incentive structure, level and rate of learning (Dolado and Stucchi, 2008). We also consider the following control variables:

- Firm size in terms of number of employees (*size*). In this regard, in a study of American firms, Dhawan (2001) shows that small businesses are 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 are operating under increasing returns to scale and that firm size is positively related to the dynamics of total factor productivity.
- The age (*age*) of the firm, which may have a negative or positive effect on productivity growth, either due to the effect of technological obsolescence, or that learning-by-doing prevails (Argote *et al.*, 2003; Cohen and Levinthal, 1990; Harris and Moffat, 2011).
- Cash flow (*cash_flow*). The literature shows that more 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).
- Three sets of dummy variables account for time, sector of activity, and location in terms of geographic area, respectively. These variables control for the various external conditions in which firms operate.

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

[2] Suppose that employees are divided into two groups: regular and "flexible" employees. Two scenarios are possible. In the first, firms hire employees of the same quality, but at different cost: regular employees cost more than irregular ones. In the second scenario, firms choose only employees in one group but pay them differently, depending on their skills or quality.

4.2 Dependent variable

To build the categorical variable used to classify firms competitive positioning, use is made of efficient scores estimated using Data Envelopment Analysis (DEA). In particular, we estimated a non-parametric measure of the 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 raw materials consumed and goods for resale (net of changes in inventories); (b) cost of services; the capital stock estimate in a given year was estimated using a perpetual inventory method on the nominal value of tangible fixed assets over the period analysed. All monetary measures were expressed in thousands of euros and were deflated by the proper 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 for the year 2001 of a set of Italian regions.

We detected outliers using a preliminary analysis to check the impact of each single observation on the distances of the nearest firm – whose distance depended from that particular observation – 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 is removed from the dataset (Sampaio de Souza and Stosic, 2005). Observations with the wider impact 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, $\mathbf{y} \in \Re_+^M$, from a vector of inputs, $\mathbf{x} \in \Re_+^S$. Assume a convex production possibility set with freely disposable inputs and outputs. The output distance function can then be defined on the technology $T = \{(\mathbf{x},\mathbf{y}) : \mathbf{x} \text{ can produce } \mathbf{y}\}$

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

The distance function defined in [3] is relative to each firm and can be interpreted as the potential increase of output which can be achieved by a firm which uses a given amount 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 *T*. Therefore a firm will be efficient (laying on the frontier) iff $D(\mathbf{x},\mathbf{y}) = 1$.

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

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

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 make use of both the distance (efficiency) measures in the initial year and the Malmquist measures of productivity change for three subperiods: 1996-2000, 2000-2003, and 2003-2006. Table 3 shows the average values of both quantities across industries for the entire period and subperiods.

Tab. 3. Efficiency and Malmquist index averages per industry. Period 1996-2006.

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 of productivtiy

Source: our elaborations

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

Tab. 4: Number of firms falling in each category

Category	Period 1	Period 2	Period 3
Laggards	1439	1572	1693
Climbers	2468	2242	2090
Static leaders	2193	2303	2275
Dynamic leaders	1247	1230	1289

Source: our elaborations

5. Results

Table 5 shows average values and standard deviations of the explanatory variables. Laggards have on average a higher number of employees (54.5), use more part-time workers (0.043) and are older (22.5) than firms in the other groups. Dynamic leaders pay more for labour (23.8), have a higher cash flow (564.3), use more skilled labour (0.88), and are younger compared with the other groups. Lastly, static leaders are similar to dynamic leaders in terms of labour costs, but use fewer part-time workers. However, they have higher cash flows and lower skill ratios.

The correlation matrix (Table 6) shows that the number of employees and cash flow are positively correlated (0.597). Correlations are very low for all the other 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. €)	20.7	5.2	23.8	7.4	20.0	5.6	23.8	7.5
Skill_ratio (ratio)	0.46	1.42	0.66	2.53	0.47	1.28	0.88	3.51
Partime (ratio)	0.043	0.060	0.037	0.053	0.041	0.058	0.039	0.056
Cash_flow (Th. €)	393.0	723.0	649.8	1246.6	327.7	576.6	564.3	1151.8
Size (n. employees)	54.5	52.9	47.5	52.8	53.0	49.6	44.0	46.6
Age (years)	22.5	12.4	21.7	13.2	21.1	12.4	20.9	12.7

Source: our elaborations

Tab. 6: Correlation matrix

Variable	Labour_cost	Skill_ratio	Partime	Cash_flow	Size	Age
Labour_cost	1					
Skill_ratio	0.167*	1				
Partime	-0.141*	0.034*	1			
Cash_flow	0.225*	0.078*	-0.075*	1		
Size	0.147*	-0.009	-0.065*	0.597*	1	
Age	0.256*	0.007	0.038*	0.092*	0.158	1

Notes: * p-value< 5%

Source: our elaborations

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

Our measure of the quality of human capital (*labour_cost*) and the probability of belonging to the group of leaders, either static or dynamic, compared with the baseline category (laggards) are positively related. A higher value of *skill_ratio* is associated with a greater probability of being a leader or a climber with respect to the baseline group, whereas increasing the number of part-time employees reduces the probability of belonging to any of the groups other than the laggards. Looking at the control variables, we see that, compared with the baseline group (laggards) *cash_flow* increases the probability of belonging to a leader group and reduces the likelihood of being a climber (the effect, although statistically significant, is very low) and that probability of being a leader decreases with the age of the firm.

[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. 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			Model 3		
	Climbers (2)	Static leaders (3)	Dynamic leaders (4)	Climbers (2)	Static leaders (3)	Dynamic leaders (4)	Climbers (2)	Static leaders (3)	Dynamic leaders (4)
labour_cost	- 0.021***	0.118***	0.122***	- 0.024***	0.117***	0.118***	0.003	0.127***	0.138***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.007)	(0.007)	(0.007)
skill_ratio	-	-	-	0.032*	0.036*	0.060***	0.034*	0.036*	0.061***
				(0.019)	(0.018)	(0.018)	(0.019)	(0.019)	(0.018)
Partime	-	-	-	- 0.655*	- 0.757**	- 0.705	- 0.718**	- 0.754*	- 0.726*
				(0.353)	(0.385)	(0.436)	(0.353)	(0.385)	(0.437)
p_2 *									
labour_cost	-	-	-	-	-	-	- 0.038***	- 0.017*	- 0.039***
							(0.009)	(0.009)	(0.010)
p_3 *									
labour_cost	-	-	-	-	-	-	- 0.042***	- 0.001	- 0.022**
							(0.009)	(0.009)	(0.010)
Controls									
cash flow	- 0.0003***	0.0008***	0.0008***	- 0.0003***	0.0008***	0.0008***	- 0.0003***	0.0008***	0.0008***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln(age)	- 0.143***	- 0.375***	-0.444***	- 0.130***	- 0.369***	- 0.431***	- 0.146***	- 0.374***	- 0.440***
	(0.036)	(0.037)	(0.041)	(0.036)	(0.037)	(0.042)	(0.036)	(0.037)	(0.042)
ln(size)	0.133***	- 0.968***	-1.033***	0.137***	- 0.961***	- 1.020***	0.135***	- 0.963***	- 1.023***
	(0.032)	(0.035)	(0.039)	(0.033)	(0.036)	(0.040)	(0.033)	(0.036)	(0.040)
Time dummies		Yes			Yes			Yes	
Sector dummies		Yes			Yes			Yes	
Location dumm.		Yes			Yes			Yes	
Constant	0.877***	2.130***	1.686***	0.900***	2.132***	1.703***	0.421**	1.969***	1.310***
	(0.161)	(0.165)	(0.186)	(0.165)	(0,170)	(0.192)	(0.188)	(0.197)	(0.221)
Statistics									
N. Obs.		21258			21030			21030	
Log-likelihood		- 26569.4			- 26294.7			- 26274.2	

To extend our analysis further, we estimated the marginal effect of a variable on the probability of belonging to each group.

Tab. 8: Marginal effects

Variable	Model 3			
	Laggards (1)	Climbers (2)	Static leaders (3)	Dynamic leaders (4)
labour_cost	- 0.0141***	- 0.0181***	0.0195***	0.0128***
	(0.0010)	(0.0011)	(0.0010)	(0.0007)
skill_ratio	- 0.0070**	0.0006	0.0014	0.0050***
	(0.0030)	(0.0024)	(0.0021)	(0.0012)
partime	0.1260**	-0.0432	- 0.0566	- 0.0265
	(0.0542)	(0.0617)	(0.0659)	(0.0515)
p_2 * labour_cost	0.0051***	- 0.0045***	0.0020	- 0.0027***
	(0.0013)	(0.0014)	(0.0013)	(0.0010)
p_3 * labour_cost	0.0043***	- 0.0068***	0.0030**	-0.0005
	(0.0013)	(0.0015)	(0.0014)	(0.0010)
Controls				
cash_flow	- 7.26e-05***	- 0.0002***	0.0002***	8.79e-05***
	(6.38e-06)	(8.02e-06)	(6.18e-06)	(4.06e-06)
ln(age)	0.0520***	0.0264***	- 0.0431***	- 0.0352***
	(0.0055)	(0.0058)	(0.0059)	(0.0046)
ln(size)	0.0961***	0.169***	- 0.164***	- 0.101***
	(0.0049)	(0.0056)	(0.0057)	(0.0043)

Notes: controls on time, sector and location are considered

Source: our elaborations

Table 8 lists the estimated marginal effects (Model 3). An increase in the quality of human capital (*labour_cost*) increases the probability of belonging to the group of firms close to the frontier (both static and dynamic leaders) and decreases that of being laggards or climbers. The estimated coefficient of *labour_cost*, although remaining negative in all periods, also shows a different evolution over time: there is a downward trend of its negative impact on the probability of belonging to the laggards – as indicated by the positive coefficient of the interaction between the quality of human capital and time, *p * labour_cost*, in the second (0.0051) and third (0.0043) periods – while an increase of (negative) magnitude of the impact on the probability of belonging to the climbers is observed – as shown by the negative coefficients of *p * labour_cost* in the second (-0.0045) and third (-0.0068) periods.

The exercise allows us to characterise the four groups of firms: laggards, climbers, and static and dynamic leaders. Laggards employ a cost-cutting strategy based on the use of labour of lower quality and gain a cost advantage from the dual labour market. Leader firms are younger, smaller, and use more skilled labour. The climbers use a mixture of strategies to reach the frontier.

The sign of *skill_ratio* goes in the expected direction. Variations in this ratio have an effect especially on the extreme groups: an increase in the ratio is positively associated with the increased probability of being dynamic leaders and reduces the probability of belonging to the group of laggards. This result supports the hypothesis that investment in human capital is more valuable for firms close to the productivity frontier. A higher share of part-time contracts increases the probability of belonging to the group of laggards. Firms in this group use flexible labour more than other firms. This 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 had significantly lower rates of labour productivity growth from 2001 to 2003.

Despite their propensity to lower the quality of labour over time, climbers tend to catch up with

the frontier over time. However, reduction of their distance to the frontier may be associated with 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. The fact that climbers have a higher and less dispersed ratio of white- to blue-collar workers with respect to laggards is consistent with this hypothesis.

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 SME Italian manufacturing firms in the period 1995-2003, 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 the United States.

6. Conclusions

Earlier studies on the Italian economic slowdown pointed to a generalised failure of the entire productive system to meet the challenges posed by increased globalisation of markets. However, the analysis presented here indicates that the high heterogeneity of firm strategies lay behind this generalized economic stagnation.

The evidence presented here is consistent with that obtained in other studies carried out with different methods (Bugamelli *et al.*, 2010; Dosi *et al.*, 2012; Tundis *et al.*, 2012; Antonelli *et al.*, 2013), and points 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 the different use of labour played a decisive role in this process. The labour market reforms implemented in Italy in the 1990s definitely and dramatically reduced labour costs, and also the quality of newly hired workers. We hypothesised that firms took advantage of the emergence of a dualistic labour market. The availability of flexible labour, less expensive but also less skilled, was the easiest solution to compete for some firms, whereas more efficient and dynamic ones competed in innovation. Nevertheless, it is difficult to assess the long-term effectiveness of these different modes of adaptation, although the initial evidence we have encourages more careful analysis of this hypothesis.

It is worth to point out some important limitations of the analysis. First, this is based on a sample of continuing firms and is silent about the actual effect of entry and exit on technological progress. Population ecology theories suggest that innovation, in the form of organizational change, occurs at the population level essentially through organizational births and deaths (Hannan and Freeman, 1989). The hypothesis of newly established firms being more science-based and technologically advanced is consistent with the entrepreneurial process of ‘creative destruction’ and many studies of productivity have highlighted the important role 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 enough creative and autonomous to shape their innovative processes. Hence, they need to acquire external knowledge in order to foster their own innovation activity (Pellegrino *et al.*, 2011). In our context, new entrants do not necessarily cause a shift of the technological frontier, but they are more likely to acquire technologies already in the market, and the survivors occasionally produce changes of the frontier. This pattern would be consistent with our findings and with the strand of research which suggests within-firm changes in existing firms as the principal driver of aggregate productivity dynamics (see, e.g. Bottazzi *et al.*, 2010). It is nevertheless necessary to integrate findings discussed in this study with empirical evidence on the impact of entry and exit for better understanding of the origins of the long stagnation of productivity in Italy.

A second issue mechanism of transmission of productivity is given by the reallocation of human and technological resources stemming from the intra group reallocation, and fostered by mergers and acquisitions. The structure of our dataset do not permits to explore this issue. But, even if internal reallocation can accelerate the process of diffusion, we are convinced that, given the structure of the Italian entrepreneurial system, the phenomenon we highlighted for single plant firms should be dominant. Obviously, a careful test of this hypothesis is needed.

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