

Do female managers affect productivity? Evidence from Italian manufacturing firms

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Abstract

Previous studies have found mixed empirical support for the importance of female participation for firm performance. The present study extends the international evidence, by conducting an investigation on the productivity of Italian manufacturing sector. The aim of the paper is to test whether the presence of females at management level can be considered as an important determinant of firm productivity. The analysis is conducted on a large firm sample extracted from AIDA database for the years 2004 and 2011. Results demonstrate that firm productivity is strongly influenced by both traditional inputs (such as tangible and intangible assets per worker) and participation of women managers. In this context our investigation also confirms the productivity differential due to geographical localization. The results show that, in the presence of female managers, firms located in the North-West regions significantly increase the positive productivity differential of the geographical area, while manufacturing firms located in the South and Islands significantly reduce the differential gap registered by the area. Therefore, we argue that firms can take advantage of female management to increase their productivity. Further investigation also demonstrates that mixed managed firms are more productive than female or male only managed firms.

Keywords: Firm productivity, female participation, gender diversity, Italian manufacturing sector

JEL classification: D24, J16, J24, L6.

Introduction

Among the wide range of factors considered important for firms' performance, the interaction between gender and productivity remains controversial and is yet to be explored. We revisit this issue by concentrating our attention on the productivity of Italian firms in manufacturing sector since little work has been devoted to this field of research.

In particular, this paper investigates whether the presence of females at the management level can be considered as an important determinant of firm productivity. We focus on the case of Italy, which is particularly interesting because Italy is mainly characterized by small and medium size firms, often managed by family members. In most cases these small and medium enterprises are concentrated in the first Pavitt sector (Pavitt, 1984). The productivity of such firms has not experienced substantial growth for a wide range of reasons delineated in the literature, but mainly due to a lack of interest in technological innovation (Castiglione and Infante, 2014; Hall et al., 2013). The average number of employees of these small firms is four, while, in Germany this number is thirteen and in United Kingdom is eleven. The Italian firms with more than fifty labour units are 56.4% of the manufacturing sector, while in France and United Kingdom this number is around 30%. It is worth noting that the firms that have more than 250 labour units represent only 23%, which is the half of that presented in France and United Kingdom and the third part presented in Germany. Given the small size, these firms have a lack of R&D investments due to excessive efforts and costs required (Pagano and Schivardi, 2013; Hall et al., 2009).

Given the prevalence of small and medium size, the characteristics of Italian manufacturing firms are peculiar. The success of this kind of firms often lies in the entrepreneur production function, which depends on the coordination and organisation capacities. The manager of a firm often personally takes the decisions regarding production process and excludes the intervention of external forces, assuming entire responsibility for firm performance. Clearly then, the productivity of small firms directly depends on the personal skills and characteristics of the manager, such as the level of education, previous experience, motivation, innovation capacity, strategic planning and other factors. The analysis of gender differences in the management of firms becomes interesting in such a context since personal capacities are mostly in focus. In addition, the Italian economy presents large differences in terms of business environment across geographic areas, which calls for a diversified analysis of firms' productivity.

Therefore, the objective of this paper is to further explore the impact of female management on firms' performance by concentrating on productivity in Italian manufacturing firms. The Italian manufacturing sector in Italy has been experiencing difficult times in recent decades. In the early nineties manufacturing firms had to adopt new organisational models and new property assets first of all to protect "Made in Italy", the distinctive feature of Italian firms on the world market which is easily imitated. The openness of the world market brought new difficulties for the manufacturing sector through the increase of international competition due to the low production costs of emerging economies. Given the phenomena of globalisation and information technologies, Italian manufacturing firms were more involved in

reorganisation involving, for example, outsourcing. In the process of these organisational changes, a key role was also played by women whose participation in manufacturing sector has increased in the recent years also as a result of active government policies providing incentives for women entrepreneurs.

This research adds to previous studies in several respects. First of all, it offers new evidence on gender differences in firm productivity in the Italian manufacturing sector. Our research question is among the first to focus on this matter. Secondly, in contrast to previous studies on gender differences that are mostly based on very small samples, our analysis covers a large dataset on manufacturing firms. Moreover, female participation is considered for each firm present in the dataset individually, which was not the case in previous studies regarding the Italian economy. In the work closest to our research by Depalo and Lotti (2013), the analysis is concentrated on Italian firms performance by providing a sectorial approach and analysing financial indicators of female firms. The authors, however, do not find any evidence on gender differences in their analysis.

The research is carried out by utilising data extrapolated from AIDA database, carried out by Bureau van Dijk and covers Italian manufacturing firms (sectors 10-33) relative to the year 2004 (19,136 firms) and the year 2011 (58,410 firms). Our main results show that greater female participation as members of boards of directors and managers of manufacturing firm has a positive impact on productivity in all geographic areas taken into consideration (North-West, North-East, Centre, South and Islands). As expected, a higher impact on the productivity is detected in firms situated in the North. Interestingly, mixed managerial teams are found to raise productivity in the South and Islands. We offer possible reasons for our findings and delineate issues of future research. In terms of policy implications, our main results indicate that government policies whose aim is to increase female participation in the manufacturing sector are grounded and represent a necessary condition to achieve greater returns in productivity, especially in the most economically disadvantaged areas of Italy such as the South and Islands.

Firm productivity and gender differences

Understanding what the determinants of firm productivity are is an important question and theory has outrun theoretical and empirical work here, but it is still an area of active economic research. Extensive empirical and experimental research of this field is dedicated to female participation and its significance for firm performance. The results are often polarised given that positive and negative aspects of female participation can be figured out. For example, among negative effects we find Khalife and Chalouhi (2013) analysis of the financial performance of Lebanese firms who demonstrate that female-owned firms generate lower gross revenues than their counterparts. Positive evidence on the firm performance is provided by Khan and Vieito (2013) who demonstrate that firms with a female CEO are associated with an increase in returns of assets in the United States. The performance of Danish firms (Smith et al., 2005) in the relation to the proportion of women in management demonstrates a variation from none to positive in relation to the characteristics of managers, such as

university degree or selection procedure. Indeed, some studies confirm that no gender difference is found. From this perspective, Du Reitz and Henrekson (2000) evaluate gender differences in terms of profitability of Swedish firms and do not find evidence of female underperformance. Similarly, Lam et al. (2013) have not found any CEO gender–return of assets link for Chinese firms.

As regards Italy, in a recent paper Depalo and Lotti (2013) evaluate whether there are systematic differences between male and female firms in terms of performance. The data comes from Firms Registry of the Chambers of Commerce and the related Cerved database for the balance sheet data. Their analysis regards firms operating in different economic sectors, from agriculture to services and considers different indicators of return of investments and productivity (value added per worker). The estimated results also demonstrate that there are no significant differences in performance between firms run by women or men.

A wide range of literature focuses on the specific characteristics of women that can be of decisive importance in firm management. The evidence is vast and the range of women characteristics that influence firm performance is considerable. Some recent empirical work in this field should be highlighted. Wei (2007) and Schubert et al. (2000) demonstrate that women are more risk averse than men, which can be positive in evaluating financial and investment decisions. Gneezy et al. (2003) and Neiderle and Vestelund (2007) find the evidence of women's reluctance to engage in competitive interactions. Education is another factor that distinguishes females who outperform male students in academia, and, thereafter in labour market (Castagnetti and Rosti, 2009). Ability to cooperate is another positive female feature important for business success (Kuhn and Villeval, 2013). Croson and Gneezy (2009) review the literature on gender differences in economic experiments and add other factors responsible for female-specific outcomes, such as low confidence in investment decisions, high sensitivity to social cues and high context-dependency among others. Negative features are also put in evidence. Scarce managerial experience and insufficient education are detected in Gottschalk and Niefert (2011) analysis. Sex discrimination as a reason of underperformance is discussed in Fisher et al. (1993).

From this brief summary we conclude that the empirical support for the female contribution in firm performance is mixed and needs further investigation. The purpose of the present study is to analyse whether and how the productivity of Italian firms is influenced by the presence of a female manager and by the number of female managers present in a firm and whether this relationship is dependent on the geographic area of the country (North-West, North-East, Centre, South and Islands). The period of study covers two years 2004 and 2011. This gives us the opportunity to analyse the Italian case in very different years, since the year 2004 is one of relative growth of the Italian economy, while 2011 is the year in the middle of the “double-dip” recession that the Italian economy suffered after the 2007-2008 world economic crises.

Empirical model

As known, the firm productivity depends on factors that traditionally include capital, labour, intermediate inputs and other factors. Productivity is also influenced by the way these inputs are managed. The impact of the entrepreneurial factor either on labour productivity or on total factor productivity has been studied in several ways (Infante, 1990; Bresnahan et al., 2002; Castiglione and Infante, 2013; Bloom et al., 2012), following both the neoclassical and Schumpeterian approaches. Our model is focused on managerial gender differentials in firm productivity. To this end, the determinants of firm productivity can be enlarged to include variables regarding participation of women as members of the board of directors of firms. Consequently, production is expressed as a simple model where the production function reflects the relationship between firms' productivity and factors of production, such as tangible and intangible assets, controlling for the manager's gender. The basic model takes the following form:

$$Y_{it} = A_{it} K_{it}^{\beta_1} C_{it}^{\beta_2} L_{it}^{\beta_3}, \quad (1)$$

where Y denotes the output of firm i in year t . A is Hicks-neutral efficiency term, K indicates physical capital, C defines intangible assets and L is labour.

After normalizing the above equation on labour to test for labour productivity, we include gender differences and other observable factors influencing productivity – e.g., dummies for Italian macro-territorial area. Under these assumptions, equation (1) can be written as:

$$y_{it} = \alpha_0 + \beta_1 k_{it} + \beta_2 c_{it} + \beta_3 fem_{it} + \beta_4 women_{it} + \beta_5 area_{it} + \varepsilon_{it}, \quad (2)$$

where y is labour productivity expressed as the volume of sales per worker; k is tangible assets per worker; c indicates intangible assets per worker; fem represents a dummy variable that is equal to one if there is at least one female manager in the firm and zero otherwise; $women$ is a continuous variable that indicates the number of female managers in the firm; while $area$ is a vector of dummy variables that indicate geographic area of North-West, North-East, Centre or South and Islands.

A key idea is to check whether the firms with at least one female manager achieve greater productivity compared with other firms and whether the number of female managers on the board of directors influences statistically the productivity of firms compared with firms run by males only. The expected signs of all the traditional input parameters are positive as well as the expected sign for the fem and $women$ variables.

The model is estimated using both an OLS (for the two years 2004 and 2011) and 2SLS methodology. Taking into account the endogeneity problem, in the latter case we estimate the model for the 2011 year and we use the lagged variables (2004) as instruments.

Data and variables

The analysis is carried out by utilising data extrapolated from AIDA (Analisi Informatizzata Delle Aziende) database, by Bureau van Dijk. The AIDA database provides accounts of Italian firms. It is constructed primarily on the information on the mandatory national registry of firms held by the Italian Chambers of Commerce and contains information on firms registry, sales, managers, employment, capital assets and industrial sector. Our analysis covers Italian manufacturing firms (sectors 10-33) relative to 2004 (19,136 firms) and 2011 (58,410 firms).

A few words should be spent on the variables we use. Productivity is defined as the sales revenue divided by the number of employees. The revenues from sales of goods or services is indicated by the net of returns, discounts, bonuses and sales taxes. The tangible assets per worker are measured by the ratio between tangible fixed assets and the number of employees. Tangible assets correspond to “buildings, installations and machineries” by considering the costs, net of amortisation and loss of value or considering market prices. Intangible assets per worker represent a relevant variable for our analysis given that it includes investments in research and development (R&D) and patents; although, under the Italian balance sheet rules this variable also includes advertising expenditure.

The presence of females on the board of directors and their number were accounted for each firm in 2004 and 2011 of the database. Finally, as for geographic distribution, it should be noted that in the North-West the number of firms in 2004 was 5,573 and in 2011 it was 9,635, while the North-East accounted for 8,441 and 20,755, the Centre for 2,874 and 10,966, and the South and Islands for 2,248 and 8,328, respectively. The model gives us the possibility to investigate the differences in productivity in different geographic areas in relation to gender differences by considering interactive dummies.

Results and Discussion

Descriptive analysis

Table 1 reports the number of firms, the number of men and women managers distributed in each macro-territorial area. It can be seen that the distribution of Italian manufacturing firms is differentiated according to the industrial development pattern that the four-macro areas had in the past century. Manufacturing firms are more concentrated in the so-called “industrial triangle”, defined by the cities of Turin, Milan and Genoa, located in the North-west four Italian regions. The percentage of firms located in this area is around 35% in the two years. In the second Italian industrialized macro North-east area the percentage is 29%. In the four Italian regions located in the Centre the concentration of the firms is 19%, while in the less industrialized area of the country (South and Islands) the concentration is equal to 16% in 2004 and 18% in 2011.

Taking into account that not all of the firms report gender information about managers, the number of firms that have at least a male manager is equal to 35,686 in 2004, and the number of firms that have at least a female manager is 13,525, while in 2011 the numbers are 40,985 and 14,920, respectively. Figure 1 shows the number of

male and female managers in 2004 and 2011. It can be noted that while the picture does not change drastically from one macro territorial area to the other, the number of firms with at least one female manager is always lower. These results are also confirmed in Figure 2, that shows the ratio between men and women managers in 2004 and 2011 where, regardless of the increase of the number of firms over time, the ratio between men and women does not change significantly. However, it is important to highlight that while this ratio is less than three in North-West, North-East and Centre, in the South of the country it increases up to 4.6%.

Table 2 shows the descriptive statistics of the variables used in our analysis for the 2004 and 2011 year samples. It is important to note that the number of observations drastically decreases due to the high number of missing values in both years, and that the mean values for both labour productivity (y) and capital per worker (k) decreased from one year to another, while the values of intangible assets (c) increased.

Econometric analysis

The equation (2) was estimated by using both ordinary least squares (OLS) and Two-Stage Least Square (2SLS) methodologies due to the possible endogeneity of tangible and intangible assets. The results are consistent across the two methods, for this reason we discuss only the 2SLS results and report the OLS results in the Appendix.

Table 3 reports the 2SLS results for the year 2011, taking 2004 variables as instruments¹. Column 1 shows the results of our basic model where tangible assets per worker and intangible assets per worker are taken into account. Column 2 and 3 add the dummy *Fem*, that is equal to 1 if there is at least a female manager in a firm and 0 otherwise, and the continuous dummy *Woman*, that is equal to the number of female managers in a firm and 0 otherwise, respectively. Column 4 shows the results when both dummies are taken into account. Column 5 includes in the estimation all the previous variables together with the territorial macro area dummies. Column 6 presents the estimation results that include, together with the assets variables, the female dummy and the interaction between the macro territorial area and the continuous dummy *Women*. Finally, column 7 offers the estimation results that include the assets variable, the continuous dummy variable (*Women*) and three interactive dummies between the macro territorial areas and *Fem*.

Column 1 shows that the contribution to firm productivity is significantly positive for both types of capital in manufacturing production, although the intensity of tangible assets gives a higher contribution to firm productivity than that of intangible capital. When the dummy variable related to the presence of a female manager is introduced in the production function, its contribution for firm productivity is significantly positive. For given levels of capital intensities the difference in productivity between a firm that has a female at the management level and another firm that does not is 0.07. It means that a firm with female managers is predicted to produce about 7% more, holding other factors unchanged. When the number of women managers is taken into account (column 3), productivity increases only by

¹ First stage results are available upon request from the authors.

2.8%. When both discrete and continuous dummy female variables are introduced, only the continuous variable remains significant, showing a productivity differential of 2.1%.

The differences in productivity among territorial macro-areas are shown in column 5. The significance of all the parameters stays the same as in column 4. However, firms located in the North-west present a significant positive productivity differential of 5.5%, while firms located in the South and Islands show a significant negative productivity differential of about 23%, with the respect to firms located in the Centre regions. In column 6 we check the previous results by introducing macro-area dummies interacted with female dummies. The results show that in presence of female managers firms located in the North-West significantly *increase* the positive productivity differential of the geographical area, while manufacturing firms located in the South and Islands significantly *reduce* the differential gap registered by the area. The result on the positive role of female managers is also confirmed in the estimations provided in column 7 that control for the interaction between the macro-areas and the continuous female dummies. In this case the positive productivity differential of firms located in the North-West declines from about 6% to 3%, while the firms located in the South and Islands regions significantly reduce their productivity gap from 23% to 6.2%. In all the estimations the productivity of firms located in the North-East is not significantly different from the productivity of firms located in the Centre regions.

Table 4 reports the estimated results of our productivity model when the sample is divided in the four-macro territorial areas. This analysis is necessary if we are to understand if the presence of females at the management level can be considered as an important determinant of firm productivity and can be used by firms to reduce their productivity gap. In particular, Panel A of Table 4 displays the results when the variable *Fem* is added to the basic productivity model, Panel B shows the results when the continuous dummy *Women* is included, while Panel C considers both variables. While in all the estimations the results for the capital per-worker variables hold, the dummy for a female manager is significantly positive only in the North-West area. In other geographic zones the variable turns out not to be significant. In Panel B it can be seen that the continuous variable is positive and significant in the North-West, in the Centre and in the South and Islands areas. However, while in the first two areas the coefficient is similar (0.029 and 0.024), in the Southern regions the magnitude of the coefficient rises to 0.073, meaning that an increase in the number of female managers raises productivity by 7.3%. When both variables are included in the model, the *Fem* dummy turns out not to be significant, while the result holds for the *Women* variable with the exception of the Centre regions. It is worth noting that, while the magnitude of the *Women* parameter remains the same as in Panel B, the coefficient for the South and Islands increases substantially.

To check the robustness of the model, we provide OLS estimations for the two years separately (2004 and 2011). The results are shown in table A1-A3 in the Appendix. Moreover, the model is also estimated for the reduced sample, considering the firms that are present in both years, with OLS for each year separately.² The output is not statistically different from that presented in this section.

² The tables are available upon request.

The results obtained by estimating the 2SLS model confirm our hypothesis, demonstrating that the presence of women in firm management increases productivity of manufacturing firms. However, to test the validity of this result, we examine the subsamples of firms that are managed by man only, by women only, and by both men and women. Table 5 presents our basic productivity model estimated for these three subsamples with the macro territorial area dummies. The results show that the contributions of tangible and intangible assets are significantly positive. However, the magnitude of the parameters changes according to the type of gender management of firms. While for the firms managed only by men the capital elasticity is equal to 0.176, for the firms managed only by women it is higher and equal to 0.221. As regards intangible capital, the magnitude of the elasticities is reversed. For the firms managed both by men and women the magnitude of both coefficients is higher on average. However, it should be noted that the Italian manufacturing firms managed only by women (present in both 2004 and 2011 samples) are only 203, while the corresponding number of firms managed only by men is 5,640. At the same time, the number of firms managed by both men and women is 4149.

The last three columns of Table 5 repeat the previous specification but include as control variables the macro geographic dummies. As can be seen, the same pattern emerges. Firms that are managed by women present a higher elasticity of physical capital and a lower elasticity of intangible capital with respect to firms managed by men. The territorial dummies confirm that firms located in the South and Islands are less productive than firms located in the other areas. In general, therefore, we find that firms run by females in the South and Islands demonstrate a poor performance with respect to firms run by males. It could be argued that this is because women tend to concentrate in the firms of small dimension and operate in sectors that offer low profitability (Depalo and Lotti, 2013). We find that firms managed by both men and women present a lower productivity gap in the South. However, in order to provide proves this thesis, Table A4 in the Appendix reports the OLS estimation results for the two years.

Conclusions

Based on a large database of Italian manufacturing firms extracted from the AIDA dataset referring to 2004 and 2011, we test whether the presence of females at the management level contributes to increase firm productivity, and if this hypothesis also holds among heterogeneous geographical macro-areas of the country.

The peculiarities of Italian economy, based on small and medium enterprises concentrated in traditional sector, suggest particular importance of the role of the entrepreneurs for firm productivity, and therefore, of gender differences. However, there is little empirical evidence on productivity differences between male and female managers in Italian firms. Our results improve upon previous studies in several respects. First, we consider female participation for each firm in a large sample of data including Italian manufacturing firms (19,211 for the year 2004 and 59,188 for the year 2011. Second, gender differences in productivity are considered in different ways. We take into consideration whether the firm has at least one female in the board.

Then, we account for the number of females in the management of firms. Finally, we take into consideration the differences of the productivity of firms with or without female management participation and of firms with both male and female participation.

Our main finding is that the contribution to productivity of female managers is significantly positive, raising productivity substantially from 2.8 to 7%, depending on model specification and keeping other factors constant. Interestingly, female participation increases elasticity of tangible rather than intangible assets. These results are sensitive to geographic location, given Italy's historical regional socio-political and economic differences. The positive productivity differential of firms with female participation in management in the North is found to be substantially higher than of firms located in the South and Islands. This result could be explained by factors related to the characteristics of firms located in the South, which are of small size and lower profitability due to lack of investment in R&D and innovation. However, surprisingly, we find that for the firms located in the South and Islands area the productivity gap can be decreased by mixed participation of men and women in firm management. The above results were tested by different econometric techniques, providing a robustness check of the validity of model.

The analysis indicates the importance of female participation in running manufacturing firms and confirms the validity of government policies aimed at increasing female participation at national level. However, despite the original results provided, the study does not offer an exhaustive analysis on gender differences in Italian manufacturing firms. Further research should verify the validity of the preliminary results over the entire period (2004-2011), controlling for industrial sectors, firm size, age of firms and managers, and manager education.

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Table 1: Number of firms and number of managers (men and women) in Italian manufacturing firms

Regions	Manufacturing firms		Men managers		Women managers	
	Number	%	Number	%	Number	%
2004						
North-west	23286	36.85	14126	39.58	5993	44.31
North-East	18049	28.56	11243	31.51	4430	32.75
Centre	11930	18.88	6027	16.89	2182	16.13
South and Islands	9925	15.71	4290	12.02	920	6.80
Italy	63190	100.00	35686	100.00	13525	100.00
2011						
North-west	29068	34.49	15963	38.95	6477	43.41
North-East	23574	27.97	13064	31.88	4945	33.14
Centre	16377	19.43	6923	16.89	2427	16.27
South and Islands	15256	18.10	5035	12.28	1071	7.18
Italy	84275	100.00	40985	100.00	14920	100.00

Table 2: Descriptive statistics

Variables	Obs	Mean	St.dev	Min	Max
2004					
lny	21180	5.333	0.841	-1.593	12.426
lnk	21096	3.197	1.363	-5.626	9.283
lnlmm	19201	0.268	1.920	-9.903	9.643
2011					
lny	71239	5.106	0.922	-6.908	11.684
lnk	70174	2.934	1.679	-8.294	12.108
lnlmm	59188	0.364	2.059	-10.127	9.555

Table 3: Firm productivity and female managers. 2SLS results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ink	0.211*** (0.008)	0.209*** (0.008)	0.208*** (0.008)	0.208*** (0.008)	0.219*** (0.008)	0.210*** (0.008)	0.210*** (0.008)
InImm	0.130*** (0.009)	0.129*** (0.009)	0.128*** (0.009)	0.128*** (0.009)	0.124*** (0.009)	0.127*** (0.009)	0.127*** (0.009)
Fem		0.070*** (0.015)		0.025 (0.022)	0.01 (0.022)		0.039* (0.020)
Women			0.028*** (0.005)	0.021*** (0.008)	0.018*** (0.007)	0.019*** (0.007)	
North-west					0.055*** (0.022)		
North-east					0.031 (0.023)		
South and Islands					-0.230*** (0.031)		
NW_Fem						0.063*** (0.023)	
NE_Fem						0.027 (0.026)	
SI_Fem						-0.187*** (0.052)	
NW_women							0.030*** (0.008)
NE_women							0.008 (0.009)
SI_women							-0.062** (0.028)
Cons.	4.756*** (0.008)	4.735*** (0.029)	4.742*** (0.029)	4.738*** (0.029)	4.695*** (0.033)	4.732*** (0.029)	4.733*** (0.029)
Obs	10,950	10,950	10,950	10,950	10,950	10,950	10,950
Wald chi2	970.79	1010.42	1023.08	1025.61	1127.8	1041.85	1034.4
Prob	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Notes: Robust standard errors in parenthesis

*significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: Firm productivity and female managers in in macro-areas

	(1) NW	(2) NE	(3) Centre	(3) SI
Panel A				
Ink	0.185*** (0.011)	0.248*** (0.140)	0.210*** (0.021)	0.328*** (0.028)
InImm	0.124*** (0.013)	0.141*** (0.015)	0.122*** (0.022)	0.060* (0.031)
Fem	0.062*** (0.022)	0.026 (0.012)	0.046 (0.043)	0.088 (0.061)
cons	4.868*** (0.043)	4.626*** (0.053)	4.730*** (0.076)	4.028*** (0.115)
Obs	4896	3417	1584	9449
Wald chi2	379.9	388.18	151.79	162.6
Prob	(0.000)	(0.000)	(0.000)	(0.000)
Panel B				
Ink	0.184*** (0.011)	0.249*** (0.014)	0.207*** (0.021)	0.327*** (0.028)
InImm	0.122*** (0.013)	0.141*** (0.015)	0.121*** (0.022)	0.060* (0.031)
Women	0.029*** (0.007)	0.004 (0.009)	0.024* (0.014)	0.073*** (0.032)
cons	4.871*** (0.042)	4.632*** (0.053)	4.737*** (0.075)	4.027*** (0.115)
Obs	4896	3417	1584	1053
Wald chi2	391.79	387.85	151.79	165.26
Prob	(0.000)	(0.000)	(0.000)	(0.000)
Panel C				
Ink	0.184*** (0.014)	0.248*** (0.017)	0.207*** (0.026)	0.326*** (0.029)
InImm	0.122*** (0.013)	0.141*** (0.016)	0.121*** (0.024)	0.059** (0.030)
Fem	0.003 (0.030)	0.037 (0.038)	-0.007 (0.058)	-0.085 (0.103)
Women	0.029*** (0.010)	-0.005 (0.011)	0.027 (0.019)	0.109*** (0.052)
cons	4.871*** (0.051)	4.625*** (0.064)	4.738*** (0.089)	4.035*** (0.122)
Obs	4896	3417	1584	1053
Wald chi2	308.52	387.85	151.79	165.26
Prob	(0.000)	(0.000)	(0.000)	(0.000)

Note: see Table 3

Table 5: Firm productivity and gender management

	Only men managers	Only women managers	Men & Women Managers	Only men managers	Only women managers	Men & Women Managers
lnk	0.176*** (0.010)	0.221*** (0.044)	0.208*** (0.013)	0.191*** (0.011)	0.245*** (0.045)	0.212*** (0.013)
lnlmm	0.136*** (0.012)	0.098* (0.059)	0.135*** (0.012)	0.132*** (0.012)	0.087 (0.059)	0.132*** (0.012)
North-west				0.025 (0.030)	-0.025 (0.145)	0.062* (0.036)
North-east				0.003 (0.031)	0.268* (0.157)	0.017 (0.038)
South and Islands				-0.216*** (0.040)	-0.260* (0.158)	-0.167*** (0.064)
cons	4.931*** (0.041)	4.625*** (0.156)	4.811*** (0.048)	4.894*** (0.040)	4.565*** (0.180)	4.768*** (0.056)
Obs	5640	203	4149	5640	203	4149
Wald chi2	387.62	31.49	394.93	438.59	40.33	408.15
Prob	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Note: see Table 3

Figure 1: Number of male and female managers in 2004 and 2011

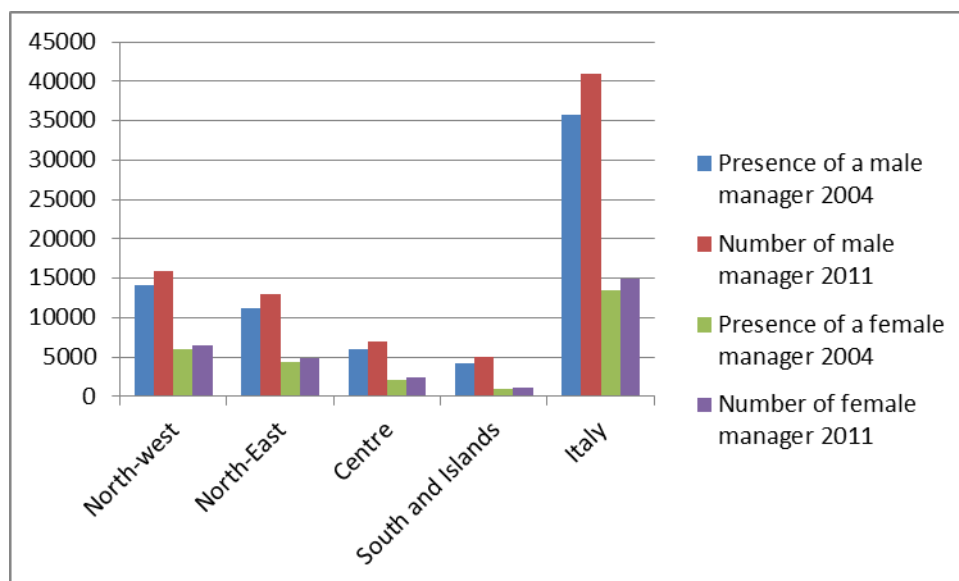
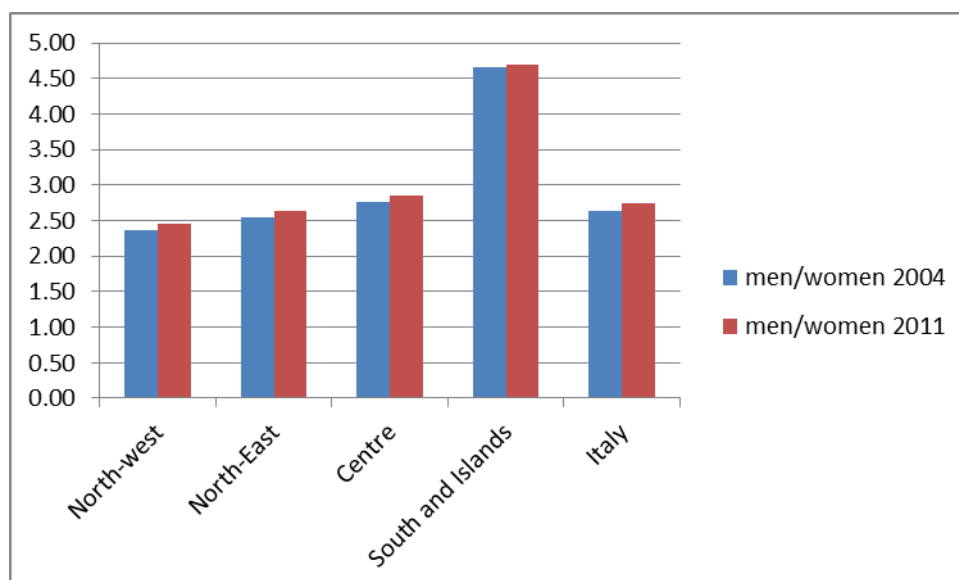


Figure 2: Ratio between male and female managers in Italian manufacturing sector by geographic area



Appendix

Tables A1: Firm productivity and female managers. OLS results, year 2004

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ink	0.188*** (0.005)	0.185*** (0.005)	0.185*** (0.005)	0.185*** (0.005)	0.196*** (0.005)	0.186*** (0.005)	0.186*** (0.005)
InImm	0.084*** (0.003)	0.084*** (0.003)	0.084*** (0.003)	0.084*** (0.003)	0.080*** (0.003)	0.083*** (0.003)	0.084*** (0.003)
Fem		0.103*** (0.011)		0.069*** (0.016)	0.043*** (0.016)		0.091*** (0.015)
Women			0.035*** (0.004)	0.016*** (0.006)	0.012** (0.006)	0.023*** (0.005)	
North-west					0.034** (0.017)		
North-east					0.009 (0.017)		
South and Islands					-0.364*** (0.023)		
NW_Fem						0.070*** (0.017)	
NE_Fem						0.051*** (0.019)	
SI_Fem						-0.175*** (0.041)	
NW_women							0.016*** (0.006)
NW_women							0.005 (0.007)
SI_women							-0.0082*** (0.021)
Cons.	4.724*** (0.018)	4.700*** (0.018)	4.709*** (0.018)	4.700*** (0.018)	4.700*** (0.023)	4.701*** (0.018)	4.697*** (0.018)
Obs	19,136	19,136	19,136	19,136	19,136	19,136	19,136
F-test	975.12	684.15	684.93	517.21	357.31	349.47	347.34
Prob	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Adj R-squared	0.145	0.148	0.148	0.148	0.17	0.15	0.149

Note: see Table 3

Tables A2: Firm productivity and female managers. OLS results, year 2011

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ink	0.178*** (0.003)	0.167*** (0.003)	0.170*** (0.002)	0.167*** (0.002)	0.170*** (0.003)	0.169*** (0.003)	0.168*** (0.003)
InImm	0.062*** (0.002)	0.062*** (0.002)	0.061*** (0.002)	0.062*** (0.001)	0.059*** (0.002)	0.062*** (0.001)	0.062*** (0.002)
Fem		0.304*** (0.008)		0.252*** (0.012)	0.217*** (0.012)		0.274*** (0.011)
Women			0.110*** (0.004)	0.027*** (0.005)	0.020*** (0.005)	0.054*** (0.005)	
North-west					0.144*** (0.010)		
North-east					0.111*** (0.010)		
South and Islands					-0.244*** (0.012)		
NW_Fem						0.240*** (0.013)	
NE_Fem						0.183*** (0.014)	
SI_Fem						0.011 (0.029)	
NW_women							0.039*** (0.005)
NE_women							0.009* (0.006)
SI_women							-0.077*** (0.019)
Cons.	4.597*** (0.008)	4.562*** (0.008)	4.576*** (0.008)	4.562*** (0.008)	4.522*** (0.012)	4.567*** (0.008)	4.561*** (0.008)
Obs	58,410	58,410	58,410	58,410	58,410	58,410	58,410
F-test	3304.9	2887.5	2602.57	2183.63	1506.7	1463.92	1478.25
Prob	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Adj R-squared	0.140	0.159	0.154	0.200	0.183	0.159	0.160

Note: see Table 3

Table A3: Firm productivity and female managers in macro-areas. OLS results, years 2004 and 2011

	(1) NW	(2) NE	(3) Centre	(3) SI	(1) NW	(2) NE	(3) Centre	(3) SI
	2004				2011			
	Panel A							
Ink	0.166*** (0.005)	0.219*** (0.009)	0.189*** (0.013)	0.261*** (0.015)	0.149*** (0.004)	0.170*** (0.005)	0.165*** (0.006)	0.209*** (0.006)
InImm	0.078*** (0.005)	0.085*** (0.005)	0.077*** (0.008)	0.075*** (0.010)	0.056*** (0.003)	0.063*** (0.003)	0.057*** (0.004)	0.057*** (0.005)
Fem	0.049*** (0.016)	0.046*** (0.018)	0.106*** (0.030)	0.199*** (0.045)	0.245*** (0.012)	0.207*** (0.012)	0.332*** (0.019)	0.358*** (0.029)
cons	4.838 (0.028)	4.642*** (0.032)	4.713*** (0.045)	4.077*** (0.054)	4.737*** (0.014)	4.645*** (0.015)	4.521*** (0.019)	4.148*** (0.020)
Obs	8,441	5,573	2874	2248	20,755	17,240	10,966	9,449
F-test	212.00	286.71	112.77	157.72	865.42	804.45	482.97	610.98
Prob	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Adj R-squared	0.124	0.188	0.146	0.216	0.134	0.157	0.146	0.205
	Panel B							
Ink	0.166*** (0.008)	0.219*** (0.009)	0.189*** (0.013)	0.261*** (0.015)	0.151*** (0.004)	0.172*** (0.005)	0.168*** (0.006)	0.210*** (0.006)
InImm	0.077*** (0.005)	0.085*** (0.005)	0.076*** (0.008)	0.075*** (0.010)	0.055*** (0.003)	0.063*** (0.003)	0.056*** (0.004)	0.056*** (0.005)
Women	0.021 (0.006)	0.012** (0.006)	0.038*** (0.012)	0.103*** (0.022)	0.091*** (0.005)	0.067*** (0.005)	0.124*** (0.011)	0.194*** (0.018)
cons	4.840*** (0.028)	4.647*** (0.031)	4.723*** (0.045)	4.085*** (0.055)	4.750*** (0.014)	4.657*** (0.015)	4.537*** (0.019)	4.153*** (0.020)
Obs	8,441	5,573	2,874	2,248	20,755	17,240	10,966	9449
F-test	215.01	286.21	112.68	159.59	806.19	769.29	423.33	599.68
Prob	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Adj R-squared	0.125	0.187	0.145	0.216	0.132	0.153	0.141	0.203
	Panel C							
Ink	0.165*** (0.008)	0.219*** (0.085)	0.188*** (0.013)	0.261*** (0.015)	0.148*** (0.004)	0.170*** (0.005)	0.165*** (0.006)	0.209*** (0.006)
InImm	0.077*** (0.005)	0.085*** (0.005)	0.076*** (0.008)	0.075*** (0.010)	0.056*** (0.003)	0.063*** (0.003)	0.057*** (0.004)	0.057*** (0.005)
Fem	0.01 (0.023)	0.043 (0.028)	0.07 (0.045)	0.111 (0.073)	0.176*** (0.017)	0.204*** (0.021)	0.279*** (0.029)	0.287*** (0.056)
Women	0.018*** (0.008)	0.002 (0.002)	0.018 (0.017)	0.056* (0.034)	0.037*** (0.007)	0.002 (0.009)	0.030*** (0.012)	0.05 (0.033)
cons	4.839*** (0.028)	4.642*** (0.032)	4.715*** (0.045)	4.079*** (0.055)	4.737*** (0.014)	4.645*** (0.015)	4.522*** (0.019)	4.149*** (0.020)
Obs	8,441	5,573	2,874	2,248	20,755	17,240	10,966	9,449
F-test	161.27	215.02	85.06	120.13	657.45	603.62	366.57	460.11
Prob	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Adj R-squared	0.125	0.188	0.146	0.217	0.135	0.157	0.146	0.205

Note: see Table 3

Table A4: Firm productivity and gender management. OLS results, 2004 and 2011

	Only men managers	Only women managers	Men & Women Managers	Only men managers	Only women managers	Men & Women Managers
2004						
Ink	0.169*** (0.008)	0.163*** (0.029)	0.174*** (0.010)	0.148*** (0.008)	0.179*** (0.028)	0.178*** (0.010)
InImm	0.078*** (0.005)	0.073*** (0.022)	0.082*** (0.005)	0.075*** (0.004)	0.069*** (0.022)	0.080*** (0.005)
North-west				0.006 (0.025)	-0.062 (0.099)	-0.008 (0.029)
North-east				-0.039 (0.025)	0.093 (0.107)	-0.033 (0.030)
South and Islands				-0.314*** (0.032)	-0.299*** (0.115)	-0.235*** (0.052)
cons	4.846*** (0.027)	4.742*** (0.097)	4.847*** (0.033)	4.849*** (0.033)	4.743*** 0.119	4.861*** (0.041)
Obs	8706	358	5972	8706	358	5972
Wald chi2	370.65	25.58	266.75	180.88	14.54	111.4
Prob	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
2011						
Ink	0.118*** (0.004)	0.126** (0.013)	0.134*** (0.006)	0.123*** (0.004)	0.131*** (0.014)	0.136*** (0.006)
InImm	0.053*** (0.004)	0.057*** (0.009)	0.062*** (0.003)	0.052*** (0.002)	0.056*** (0.009)	0.062*** (0.004)
North-west				0.036*** (0.015)	0.053 (0.050)	0.072*** (0.021)
North-east				0.007 (0.015)	0.085 (0.053)	0.009 (0.022)
South and Islands				-0.174*** (0.018)	-0.124*** (0.059)	-0.166*** (0.040)
cons	5.030*** (0.014)	4.923*** (0.044)	4.993*** (0.022)	5.024*** (0.018)	4.896*** (0.054)	4.960*** (0.027)
Obs	23167	1523	11281	23167	1523	11281
Wald chi2	703.94	65.34	405.37	324.04	29.16	182.95
Prob	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Note: see Table 3