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PRODUCTIVITY AND HUMAN CAPITAL THE ITALIAN CASE

CAMILLA ANDRETTA
IRENE BRUNETTI
ANNA ROSSO

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ABSTRACT/RÉSUMÉ

Productivity and Human Capital - The Italian case

This paper investigates whether and how worker composition, ownership and management affect the productivity of firms. To this aim, we use a dataset obtained by integrating the micro-data drawn from Rilevazione su Imprese e Lavoro (RIL), a survey conducted by Inapp in 2010 and 2015 on a representative sample of Italian limited liability and partnership firms, with the AIDA archive containing comprehensive information on the balance sheets of almost all the Italian corporations. We apply different regression models and the findings reveal that a higher share of skilled workers within firms and more experienced managers are associated with higher productivity levels. In addition, firms run by managers with higher education are more likely to introduce innovation. Finally, family ownership and the coincidence of management with ownership are negatively related with firm productivity.

JEL classification: J24, D24.

Keywords: human capital, firm productivity.

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Productivité et capital humain – L'exemple italien

Les auteurs de l'étude cherchent à savoir si, et en quoi, la composition des effectifs, l'actionnariat et la direction des entreprises ont une incidence sur leur productivité. À cette fin, nous utilisons un ensemble de données obtenues en intégrant les microdonnées tirées de l'enquête Rilevazione su Imprese e Lavoro (RIL), menée par l'Inapp en 2010 et 2015 auprès d'un échantillon représentatif de sociétés à responsabilité limitée et sociétés en nom collectif italiennes, à l'aide des archives de la base AIDA contenant des informations complètes sur les bilans de la quasi-totalité des entreprises italiennes. Nous appliquons différents modèles de régression. Il ressort de notre étude que la présence d'une plus importante proportion de travailleurs qualifiés et d'un plus grand nombre de dirigeants expérimentés en poste dans les entreprises est associée à des niveaux plus élevés de productivité. De plus, les entreprises gérées par des dirigeants diplômés de l'enseignement supérieur sont davantage susceptibles d'être innovantes. Enfin, l'actionnariat familial et l'exercice simultané des fonctions d'actionnaire et de dirigeant sont négativement corrélés à la productivité des entreprises.

Classification JEL : J24, D24.

Mots-clés : capital humain, productivité des entreprises.

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Productivity and Human Capital - The Italian case

By Camilla Andretta, Irene Brunetti, Anna Rosso[1]

1. Introduction

1. Differences in productivity across firms are the result of external factors, namely the economic and institutional environment in which firms operate, and internal factors, meaning the firm-specific attributes and resources. Among the latter, a major role in determining firm productivity is played by human capital (Backman, 2014). Owners, managers, and workers are indeed the actors that introduce changes to improve firm performance and the production process is thus affected by their skills, knowledge, and other demographic characteristics. At the same time, the organisation of the individual workers' human capital and the resulting efficiency depend on the structure of the firm (Ballot et al., 2001). Differences across firms in terms of human capital, which result in different individual productivity, and in firms' internal organization therefore contribute to explaining the heterogeneity in firm performance.

2. The purpose of this work is to investigate the relationship between worker composition, ownership, management, and firm-level productivity by analysing the main characteristics of these factors, as well as some complementarities between them. The empirical analysis relies on survey data collected by the National Institute for Public Policy Analysis (Inapp) on a sample of Italian firms operating in the non-agricultural private sector in 2010 and 2015, integrated with company financial accounts from the AIDA archive. First, by analysing information relative to workers' occupation (i.e., blue collars, white collars, directors), gender and nationality, and managers' individual characteristics, we identify the attributes of firms' internal factors that are associated to better firm performance. Second, by looking at the ownership and management structure (i.e., family owned, family owned and managed, foreign owned) we provide evidence about the types of ownership and the relation between owners and managers that result in higher productivity. Throughout the analysis we look separately at firms in the manufacturing, further distinguishing into low and high-tech firms, and in the service sector, split into knowledge intensive and less knowledge intensive, to identify potential differences across macro sectors.

3. Overall, our findings indicate a positive relationship between human capital and firm performance in Italian companies. Higher shares of skilled workers within firms and more experienced managers are associated to higher productivity levels, and firms run by managers with higher education are more likely to introduce innovation. Further, our results show lower productivity in family-owned firms and in firms

[1] Corresponding authors are: Camilla Andretta (camilla.andretta@unimi.it) from the University of Milan, Irene Brunetti (i.brunetti@inapp.org) from the National Institute for Public Policy Analysis (Inapp), Anna Rosso (anna.rosso@unimi.it) from the University of Milan and Centro Studi Luca d'Agliano. The authors would like to thank Peter Gal, Timo Leidecker, Giuseppe Nicoletti (all from OECD Economics Department), Chiara Criscuolo (OECD Directorate for Science, Technology and Innovation) and Giorgio Barba Navaretti (University of Milan and Centro Studi Luca d'Agliano) for their valuable comments.

where management and ownership coincide, while foreign ownership is positively related to firm performance. Some of these results are particularly important for countries like Italy, where there is a prevalence of small firms and family ownership, often overlapped with family management, which tend to create a tight link between managers demographic characteristics and the way human resources are managed (Ricci, 2018).

4. The remainder of the paper is structured as follows: section 2 presents the data and some descriptive statistics, section 3 illustrates the evidence, section 4 concludes.

2. Data and sample characteristics

5. The empirical analysis is based on a representative sample of Italian firms derived from two waves of the Rilevazione Imprese e Lavoro (RIL) conducted by Inapp in 2010 and 2015. The survey covers around 30,000 firms operating in the non-agricultural private sector in each wave and a subsample of the included firms (around 35%) are followed over time, making the RIL dataset partially panel over the period under study. The RIL data collects a rich set of information about the composition of the workforce, including the amount of training investments, the asset of the industrial relations and other workplace characteristics. In particular, the survey provides unique data on the total amount of training expenses and the source of its financing that may be related to other dimensions of personnel policies (such as the amount of hirings and separations, the use of flexible contractual arrangements, the age and education distribution of the workforce, etc.). Moreover, the data contains an extensive set of firm level controls, including the managerial and corporate governance characteristics, productive specialization and other firm strategies (such as innovation and export activities). On the other hand, the RIL survey contains incomplete information on financial and accounting variables, which had to be recovered from another source. For this purpose, we use the national tax number (codice fiscale) to merge RIL data with AIDA archive provided by the Bureau Van Dijk. The AIDA data offers comprehensive information on the balance sheets of almost all the Italian corporations operating in the private sector, except for the agricultural and financial industries. In particular, this dataset contains yearly values of variables such as revenues, value added, net profits, book value of physical capital, total wage bill and raw-material expenditures. The final dataset refers to limited liability companies only, for a total of 31,000 observations.

6. Table 1 provides some descriptive statistics relative to employment, output, value added and capital of the firms included in our sample. On average, firms in the manufacturing have more employees and larger output, value added and capital, compared to firms in the service sector.

Table 1. Descriptive statistics of the RIL-AIDA sample

	Manufacturing		Services	
	Mean	Median	Mean	Median
N. employees	22.21	6	8.24	1
Log (output)	14.13	13.99	13.40	13.31
Log (value added)	12.91	12.82	12.03	11.93
Log (capital)	12.32	12.45	11.06	10.96

7. In Table 2, we report labour productivity, defined first as deflated valued added per worker and second as deflated revenues per worker, both in logs and in absolute values. We look at value added per employee to make a comparison with descriptive statistics on the universe of Italian firms reported by Linarello and Petrella (2016): values are similar in the manufacturing, and in the service sector if we consider the median value, whereas the mean value added per worker is considerably higher in the RIL-AIDA sample. This difference is due to the fact that we keep all firms with at least one employee, while in Dosi et al. (2019), who use the RIL-AIDA sample for the same years and keep firms with more than five

employees, the mean value added per worker is in line with the statistics presented by Linarello and Petrella (2016).

Table 2. Labour productivity in the RIL-AIDA sample

	Value added per worker (logs)	Value added per worker (abs values)	Revenue per worker (logs)	Revenue per worker (abs values)
Percentile of productivity				
	Panel A: Manufacturing			
25	10.37	32171	11.43	91924
50	10.70	44500	11.86	140632
75	11.03	61766	12.38	238275
Mean	10.69	56755	11.92	260191
	Panel B: Services			
25	10.17	26273	11.29	78416
50	10.62	40984	11.97	156658
75	11.03	61798	12.64	309088
Mean	10.60	75050	11.99	340657

8. In Table 3, we report two measures of total factor productivity. The latter is computed by applying the beta coefficients for labour and capital estimated on data from Cerved[2] for the same years to the values of labour and capital of the firms in the RIL-AIDA dataset. Beta coefficients are estimated in two different ways: first, we run a simple OLS where we regress the deflated value added on labour and capital, controlling for 3-digit level industry and province fixed effects, where labour is measured as the total number of employees in the firm and capital is measured as total fixed assets. We run this regression separately for each year and 1-digit level industry[3], for a total of 18 regressions (2 years for 9 sectors). Second, we implement an IV estimation strategy where we regress the deflated value added on labour, capital and materials, and we instrument labour with firms' age and market share. Again, this regression is run separately for each year and 1-digit level industry, controlling for 3-digit level industry and province fixed effects.

[2] A proprietary database: it has collected detailed balance-sheet and income statement information on non-financial corporations since 1982 and it is the largest sample of Italian firms for which data on actual investment flows are observed.

[3] We use the 1-digit-sector definition as reported by Inapp in their data, as firms are representative within their 1-digit-sector and sampling weights are also created to make the sample of firms representative at this 1-digit-sector level. Industries are grouped in 9 categories: electricity, gas, water supply and waste management; manufacture of food, tobacco, wood, paper and textiles products; manufacture of chemical products and metals; manufacture of machinery, electronic products, furniture and other manufacturing; construction; wholesale trade, accommodation and food service activities; transportation and storage; information and communication, financial and insurance activities, real estate activities; human health and social work activities and other services.

Table 3. Total factor productivity in the RIL-AIDA sample

	Total factor productivity (OLS)		Total factor productivity (IV)	
Percentile of productivity	Manufacturing	Services	Manufacturing	Services
25	8.98	9.63	9.74	9.34
50	9.47	9.63	10.15	9.80
75	9.83	10.02	10.51	10.34
Mean	9.39	9.54	10.10	9.82

9. Finally, Table 4 provides some descriptive statistics of the relevant variables of the RIL-AIDA sample. First, around 87% of the sample is composed by family firms, while foreign owned firms are only 1%. Second, almost 90% of the firms are managed by the owners. As for managers' characteristics, around 9% of managers are younger than 40, 58% are middle-aged and 31% are older than 60; over a half of the managers completed a high school education, around 29% obtained a university degree, and 16% completed middle school or a lower education. Finally looking at the workforce composition, the average share of women per firm is 28%, the share of foreign workers (i.e., extra EU) is 4% and higher in firms in the manufacturing sector. The average share of blue collars in manufacturing and services is 66% and 40% and the one of white collars is 30% and 55%, respectively. Directors represent around 4% of the workforce.

Table 4. Descriptive statistics

	Whole Sample		Manufacturing		Services	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Share of directors[4]	.044	.141	.034	.104	.048	.150
Share of blue collars	.456	.395	.662	.283	.398	.403
Share of white collars	.500	.389	.304	.268	.554	.400
Share of women	.287	.357	.267	.282	.291	.370
Share of foreign workers	.044	.136	.060	.147	.040	.133
Family firms[5]	.873	.332	.871	.334	.873	.331
Foreign owned firms	.011	.107	.016	.127	.010	.103
Management coinciding with ownership	.892	.311	.903	.295	.889	.314
Management different from ownership chosen within the firm	.070	.256	.055	.229	.073	.261
Management different from ownership chosen outside the firm	.038	.191	.042	.198	.038	.190
Young manager[6]	.096	.294	.093	.289	.096	.294
Middle-aged manager	.587	.492	.575	.494	.589	.491
Old manager	.317	.465	.332	.470	.315	.464
College educated manager	.296	.456	.216	.411	.312	.463
High school educated manager	.535	.598	.538	.498	.535	.498
No/low educated manager	.169	.374	.246	.430	.153	.360

[4] Directors include both top-level and mid-level managers.

[5] Family firms are defined as those where the majority share of the ownership or direct control of the company is held by either a natural person or family, or more individuals/more families.

[6] Age categories are defined as following: young (15-39 years old), middle-aged (40-59 years old), old (over 60).

3. Evidence

10. We estimate the relationship between our different measures of productivity and the characteristics of the firm reported in Table 4 running the following model:

$$Y_{its} = \beta_0 + \beta_1 x_{its} + \beta_2 firmsize_{its} + \theta_{ts} + u_{its} \quad (1)$$

11. Where y_{its} is our measure of productivity in firm *i,* in year *t* and 2-digit sector *s* (total factor productivity or logarithm of labour productivity, computed as explained in the previous section) and the explanatory variable x_{its} measures the workforce composition or the type of ownership or the characteristics of the management of firm *i* (as reported in table 4), in year *t* and in the 2-digit sector. The relationship between these measures and productivity will be estimated in turns in the regressions reported in the tables below. We also control for firm size and include year times 2-digit industry fixed effects, θ_{ts}.

3.1. Workers

12. We first capture firms' human capital by looking at the share of workers in different types of occupation, which gives an insight into the skills that employees possess. Results reported in Table 5 indicate that firms employing higher shares of directors and higher shares of white collars perform relatively better. An increase in the fraction of directors is correlated with a higher level of TFP of around 42% and of labour productivity between 49 and 51%, while an increase in the share of white collars is associated with a higher TFP of around 21% and of labour productivity between 23 and 36%. The positive correlation between the share of directors and productivity appears to be mainly driven by firms in the service sector (Panel C), while higher shares of white collars are associated to better firm performance in both industries.

Table 5. Productivity and workers' occupation

	TFP OLS	TFP IV	LAB PROD (VA)	LAB PROD (REV)
Excluded category: Share of blue collars				
	Panel A: Whole sample			
Share of directors	0.433**	0.425**	0.498***	0.511**
	(0.178)	(0.183)	(0.184)	(0.205)
Share of white collars	0.215**	0.239**	0.238**	0.369***
	(0.083)	(0.096)	(0.099)	(0.091)
Observations	27,072	27,072	27,443	27,795
R-squared	0.211	0.215	**0.172**	0.266
	Panel B: Manufacturing			
Share of directors	0.080	0.172	0.049	0.476***
	(0.156)	(0.122)	(0.174)	(0.155)
Share of white collars	0.286***	0.311***	0.247***	0.630***
	(0.066)	(0.078)	(0.072)	(0.108)
Observations	11,608	11,608	11,742	11,890
R-squared	0.342	0.277	0.145	0.157
	Panel C: Services			
Share of directors	0.470**	0.446**	0.549***	0.495**
	(0.195)	(0.204)	(0.200)	(0.232)
Share of white collars	0.205**	0.230**	0.236**	0.329***
	(0.096)	(0.110)	(0.113)	(0.101)
Observations	15,427	15,427	15,665	15,871
R-squared	0.189	0.206	0.180	0.286

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions control for firm size and include year*sector fixed effects.

13. Another aspect of firms' workforce is its diversity in terms of gender and nationality, therefore we look at how workers' heterogeneity along these two dimensions relates to firm performance. Results shown in Table 6 indicate a negative effect on productivity of an increase in the share of women for the whole sample of firms, yet coefficients are not statistically significant. However, once we separately look at macro sectors, we find that the negative association between firm performance and share of women in the workforce becomes significant for firms in the manufacturing (Panel B).

Table 6. Productivity and gender distribution

	TFP OLS	TFP IV	LAB PROD (VA)	LAB PROD (REV)
	Panel A: Whole sample			
Share of women	-0.140	-0.094	-0.121	-0.044
	(0.087)	(0.099)	(0.110)	(0.112)
Observations	27,072	27,072	27,443	27,795
R-squared	0.205	0.207	0.164	0.253
	Panel B: Manufacturing			
Share of women	-0.199**	-0.217***	-0.286***	-0.181**
	(0.065)	(0.063)	(0.061)	(0.083)
Observations	11,608	11,608	11,742	11,890
R-squared	0.337	0.270	0.147	0.126
	Panel C: Services			
Share of women	-0.125	-0.067	-0.095	-0.018
	(0.102)	(0.115)	(0.128)	(0.130)
Observations	15,427	15,427	15,665	15,871
R-squared	0.182	0.198	0.171	0.276

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions control for firm size and include year*sector fixed effects.

14. As the relationship between productivity and gender distribution may be nonlinear, we introduce categorical variables for the share of women per firm (0-20%, 20-40%, 40-60%, 60-80% and 80-100%) and consider differences within firms in the manufacturing (low and high tech) and in services (knowledge intensive and less knowledge intensive)[7]. Results do not indicate the existence of non-monotonic patterns, and suggest a negative relationship also for firms in the service sector.[8] Conclusions on these correlations are hard to draw. What we are observing is an equilibrium outcome, we do not have observable elements such as the occupation and type of contract of female employees, allowing us to better assess these results. To tackle this issue, we control for the average number of hours worked per week by women using data collected by the Italian National Institute of Statistics[9], and for the share of fixed-term contract employees per firm, which we find to have a positive and significant correlation with the share of women[10]. As low-productive firms use more temporary employment (INAPP, Cirillo and Ricci, 2020), this may partly

[7] High and medium-high tech manufacturing includes the manufacture of pharmaceutical products, computer, electronic and optical products, chemicals, electrical equipment, machinery and equipment n.e.c., motor vehicles, other transport equipment (NACE 20, 21, 26, 27, 28, 29, 30); low-tech manufacturing includes NACE 10-19, 22-25, 31-33. Knowledge intensive services include professional services, information and communication, finance; less knowledge intensive services include retail and wholesale trade, administrative services, transport, accommodation and food, personal and other services.

[8] Results are reported in Table A1 and A2 of Annex 1.

[9] Data are collected by macro area (North-East, North-West, Centre, South) and NACE sections grouped as follows: B-E, F, G, H, I, J, K, L-N, P-Q, R-U. Table A3 of Annex 1 reports some descriptive statistics.

[10] Results are reported in Table A4 of Annex 1.

explain our results on the correlation between the share of women and productivity. Nevertheless, the inclusion of these control variables does not affect the magnitude and significance of previous findings.[11]

15. The other aspect of the demographic composition of workers that we consider is the share of foreign employees (i.e., from extra UE countries) in a firm. As shown in Table A6 of the Annex 1, no significant correlation is found between the share of foreign workers and firm performance, and results do not vary by macro sector.

16. To conclude the analysis on workers, we jointly consider all firm's workforce characteristics in Table 7. The positive relationship between productivity, the share of directors and the share of white collars is confirmed, while the share of women exhibits negative coefficients. Results on the share of foreign workers remain instead insignificant both in the manufacturing and in the service sector.

Table 7. Productivity and workforce composition

	TFP OLS	TFP IV	LAB PROD (VA)	LAB PROD (REV)
	Panel A: Whole sample			
Share of directors	0.430**	0.425**	0.501***	0.509**
	(0.175)	(0.181)	(0.182)	(0.198)
Share of white collars	0.311***	0.319***	0.333***	0.447***
	(0.076)	(0.086)	(0.087)	(0.083)
Share of women	-0.248***	-0.205**	-0.233**	-0.200*
	(0.078)	(0.085)	(0.095)	(0.103)
Share of foreign workers	0.067	0.086	0.126	0.093
	(0.127)	(0.134)	(0.143)	(0.144)
Observations	27,064	27,064	27,433	27,785
R-squared	0.217	0.219	0.177	0.268
	Panel B: Manufacturing			
Share of directors	0.045	0.139	0.001	0.434**
	(0.168)	(0.132)	(0.190)	(0.170)
Share of white collars	0.401***	0.438***	0.393***	0.785***
	(0.064)	(0.078)	(0.072)	(0.121)
Share of women	-0.341***	-0.368***	-0.429***	-0.452***
	(0.068)	(0.068)	(0.064)	(0.101)
Share of foreign workers	-0.004	0.052	-0.036	0.008
	(0.100)	(0.088)	(0.113)	(0.175)
Observations	11,604	11,604	11,736	11,884
R-squared	0.354	0.291	0.166	0.170
	Panel C: Services			
Share of directors	0.472**	0.450**	0.560***	0.499**
	(0.192)	(0.203)	(0.198)	(0.225)
Share of white collars	0.295***	0.299***	0.323***	0.393***
	(0.087)	(0.098)	(0.099)	(0.089)
Share of women	-0.225**	-0.170*	-0.199*	-0.152
	(0.090)	(0.099)	(0.111)	(0.120)
Share of foreign workers	0.083	0.093	0.179	0.130
	(0.172)	(0.183)	(0.192)	(0.187)
Observations	15,423	15,423	15,661	15,867
R-squared	0.195	0.209	0.185	0.288

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions control for firm size and include year*sector fixed effects.

[11] Results are reported in Table A5 of Annex 1.

3.2. Ownership and Management structure

17. In this section we explore the relationship between firm performance and the structure of ownership and management. We begin by analysing different types of ownership in Table 8, which shows first that family-owned firms have between 28 and 37% lower levels of both TFP and labour productivity than other types of firms. Second, firms where ownership and management coincide are found to have lower productivity. Third, we differentiate between family ownership only and both family ownership and management (Panel C) and we find that the lower performance of family firms is confirmed, while the coefficient of firms that are both family owned and managed[12] is not significant. Finally, foreign owned firms are associated to higher levels of productivity, between 48 and 58% higher than other firms, as shown in Panel D.

Table 8. Productivity and ownership structure

	TFP OLS	TFP IV	LAB PROD (VA)	LAB PROD (REV)
	Panel A			
Family ownership	-0.357***	-0.288***	-0.374***	-0.113
	(0.068)	(0.069)	(0.068)	(0.164)
Observations	26,966	26,966	27,334	27,685
R-squared	0.218	0.215	0.178	0.255
	Panel B			
Management and ownership coincide	-0.286***	-0.240***	-0.307***	-0.288***
	(0.058)	(0.062)	(0.062)	(0.071)
Observations	26,997	26,997	27,364	27,715
R-squared	0.210	0.210	0.170	0.259
	Panel C			
Family ownership	-0.285*	-0.172	-0.258*	-0.232**
	(0.145)	(0.150)	(0.149)	(0.117)
Family ownership and family management	-0.159	-0.169	-0.192	-0.139
	(0.109)	(0.113)	(0.121)	(0.095)
Observations	24,435	24,435	24,764	25,083
R-squared	0.227	0.217	0.180	0.278
	Panel D			
Foreign ownership	0.585***	0.512***	0.545***	0.485***
	(0.088)	(0.104)	(0.075)	(0.093)
Observations	27,063	27,063	27,434	27,785
R-squared	0.210	0.212	0.169	0.257

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions control for firm size and include year*sector fixed effects.

18. In Table 9, our focus shifts to the managerial structure, distinguishing between firms where management and ownership coincide, and firms where there is a separation between the two. In the latter case, the manager can be someone selected within the firm, or a professional hired from the outside. In line with Panel B of Table 8, our findings indicate that firms where management differs from ownership are associated with higher productivity levels, compared to firms where management and ownership coincide.

[12] The dummy variable *family ownership and family management* identifies firms where the majority share of the ownership or control of the firm is held by a natural person/a family or more individuals/more families and the direct management of the company (e.g., manager, administrator, CEO) is a natural person who is the owner or the parent or a member of the owner or parent family.

However, the coefficients of the two types of management differing from ownership (i.e., manager is chosen within the firm or outside the firm) are not statistically different between each other.

Table 9. Productivity and management

	TFP OLS	TFP IV	LAB PROD (VA)	LAB PROD (REV)
Excluded category: management coincides with ownership				
Management differs from ownership and manager is chosen within the firm	0.287***	0.239***	0.310***	0.285***
	(0.071)	(0.078)	(0.078)	(0.094)
Management differs from ownership and manager is chosen outside the firm	0.262***	0.178**	0.300***	0.287***
	(0.071)	(0.070)	(0.071)	(0.073)
Observations	26,997	26,997	27,364	27,715
R-squared	0.210	0.207	0.170	0.259

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions control for firm size and include year*sector fixed effects.

19. Finally, we consider the correlation between different types of management and ownership, estimating the following linear probability model:

$$Y_{its} = \beta_0 + \beta_1 ownership_{its} + \beta_2 firmsize_{its} + \theta_{ts} + u_{its} \quad (2)$$

Where the dependent variable is i) management differing from ownership and selected within the firm ii) management differing from ownership and selected outside the firm, in firm *i*, year *t* and 2-digit sector *s*. $ownership_{its}$ is a dummy variable identifying alternatively i) family ownership, or ii) foreign ownership. We control for firm size and include year times 2-digit industry fixed effects θ_{ts}.

20. Table 10 suggests that in family-owned firms there is a lower probability that the manager is unrelated to ownership. Foreign ownership is instead associated to a higher probability of selecting a manager distinct from ownership, either within or outside the firm. Results remain unchanged when we separately look at the manufacturing and service sector.

Table 10. Management and ownership

	Management differing from ownership and selected within the firm	Management differing from ownership and selected outside the firm
	Panel A	
Family ownership	-0.284***	-0.121***
	(0.034)	(0.017)
Observations	31,084	31,048
R-squared	0.164	0.081
	Panel B	
Foreign ownership	0.542***	0.143***
	(0.039)	(0.032)
Observations	31,146	31,146
R-squared	0.081	0.046

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions control for firm size and include year*sector fixed effects.

3.3. Managers

21. We now examine first the role of managerial experience, captured by the age of the firm's manager (i.e., the highest-ranking executive)[13], in relation to productivity. Second, we consider the relationship between the ownership structure and the level of education of the firm's manager to identify a potential mechanism behind the lower productivity of family firms.

22. As shown in Table 11, there is a positive association between manager's experience and firm performance, as older managers (i.e., older than 60) with respect to middle-aged managers (i.e., 40-59 years old) are found in firms with higher productivity levels. Younger ones (i.e., 15-39 years old) are instead correlated to lower productivity. Firms run by older managers are also less productive if we measure productivity as revenues per worker. While the negative relationship with younger managers is significant for firms both in the manufacturing and in the service sector, the positive correlation between productivity and more experienced managers is driven by services. These findings are robust to the inclusion of manager's education in the regression[14].

Table 11. Productivity and manager's age

	TFP OLS	TFP IV	LAB PROD (VA)	LAB PROD (REV)
Excluded category: Middle-aged manager				
	Panel A: Whole sample			
Young manager	-0.153***	-0.131***	-0.151***	-0.092*
	(0.045)	(0.049)	(0.049)	(0.055)
Old manager	0.079*	0.091**	0.086**	-0.113**
	(0.041)	(0.042)	(0.038)	(0.045)
Observations	27,032	27,032	27,399	27,750
R-squared	0.206	0.209	0.165	0.255
	Panel B: Manufacturing			
Young manager	-0.072*	-0.100**	-0.118**	-0.111*
	(0.040)	(0.040)	(0.046)	(0.062)
Old manager	-0.016	-0.006	0.008	-0.058*
	(0.022)	(0.021)	(0.021)	(0.033)
Observations	11,590	11,590	11,723	11,871
R-squared	0.333	0.267	0.139	0.126
	Panel C: Services			
Young manager	-0.167***	-0.132**	-0.131**	-0.089
	(0.054)	(0.060)	(0.056)	(0.069)
Old manager	0.107**	0.120**	0.109**	-0.125**
	(0.053)	(0.054)	(0.050)	(0.057)
Observations	15,405	15,405	15,640	15,845
R-squared	0.186	0.200	0.172	0.278

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions control for firm size and include year*sector fixed effects.

23. As manager's age may play a different role in more innovative sectors, we make a further distinction and look at firms in the high- and low-tech manufacturing, and in knowledge intensive and less

[13] According to the RIL survey, either the manager or the administrator or the CEO.

[14] Results are reported in Table A7 of Annex 1.

knowledge intensive services. Results reported in Table A8 of Annex 1 indicate that the negative coefficient of young managers is mainly driven by the low-tech manufacturing and the less knowledge intensive services. The positive correlation between productivity and older managers is significant only in the less knowledge intensive services, but the effect is reversed for labour productivity computed from revenues.

24. The other characteristic we explore is the level of education of the firm's manager, and specifically its relationship to family ownership. As managers with higher education are expected to positively affect firm performance (Ricci, 2018), we examine whether the lower productivity found in family firms may be linked to a lower probability of choosing highly educated managers. We thus estimate the following linear probability model:

$$Y_{its} = \beta_0 + \beta_1 familyownership_{its} + \beta_2 firmsize_{its} + \theta_{ts} + u_{its} \quad (3)$$

Where the dependent variable is manager's i) college education ii) high school education iii) low or no education, in firm *i*, year *t* and 2-digit sector *s*. We control for firm size and include year times 2-digit industry fixed effects θ_{ts}.

Table 12. Family ownership and manager's education

	College education	High school education	Low/no education
	Panel A: Whole sample		
Family ownership	-0.148***	0.129***	0.018
	(0.032)	(0.025)	(0.032)
Observations	31,027	31,027	31,027
R-squared	0.143	0.063	0.082
	Panel B: Management coinciding with ownership		
Family ownership	-0.165***	0.149***	0.016
	(0.053)	(0.041)	(0.036)
R-squared	25,343	25,343	25,343
Observations	0.153	0.065	0.090
	Panel C: Management differing from ownership		
Family ownership	0.004	0.030	-0.034
	(0.078)	(0.096)	(0.063)
Observations	5,634	5,634	5,634
R-squared	0.157	0.140	0.142

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions control for firm size and include year*sector fixed effects.

25. As reported in Panel A of Table 12, managers who run family-owned firms are less likely to hold a university degree, and more likely to have completed a high school education. The correlation is not significant for managers with low or no education. We then differentiate between managers that are members of the owner family and outside managers (Panel B and C) and we find that the negative correlation between family ownership and highly educated managers is significant only for managers who are also the owners[15].

26. Finally, we jointly consider the characteristics of the workforce and those of management and ownership, and find that most of previous results are confirmed (Table 13). First, productivity remains positively and significantly correlated with manager's age. Second, a larger fraction of directors and white collars is found in firms with higher productivity levels, while the share of women in the workforce is negatively associated with firm performance. Third, family-owned firms have lower levels of productivity,

[15] Family firms where ownership and management coincide are 94%.

while the opposite is found for foreign owned firms. Unlike in previous tables, differences in productivity between firms with a separation between ownership and management and other types of firms do not seem to matter when controlling for the characteristics of workers and managers.

Table 13. Productivity and management, ownership and workforce characteristics

	TFP OLS	TFP IV	LAB PROD (VA)	LAB PROD (REV)
Young manager	-0.152***	-0.131***	-0.148***	-0.092*
	(0.038)	(0.041)	(0.044)	(0.053)
Old manager	0.090**	0.099**	0.094***	-0.094**
	(0.040)	(0.040)	(0.035)	(0.038)
Family owned firm	-0.218***	-0.159*	-0.228***	0.070
	(0.079)	(0.083)	(0.084)	(0.212)
Foreign owned firm	0.259**	0.227*	0.172*	0.212*
	(0.104)	(0.122)	(0.095)	(0.121)
Management differs from ownership and is chosen within the firm	0.123	0.113	0.134	0.188
	(0.092)	(0.098)	(0.100)	(0.132)
Management differs from ownership and is chosen outside the firm	0.101	0.057	0.113	0.209*
	(0.078)	(0.076)	(0.075)	(0.122)
Share of directors	0.264*	0.282*	0.327**	0.360**
	(0.150)	(0.160)	(0.155)	(0.176)
Share of white collars	0.245***	0.262***	0.264***	0.400***
	(0.074)	(0.082)	(0.085)	(0.085)
Share of women	-0.215***	-0.172**	-0.195**	-0.180*
	(0.077)	(0.085)	(0.095)	(0.103)
Share of foreign workers	0.086	0.109	0.152	0.109
	(0.119)	(0.126)	(0.133)	(0.143)
Observations	26,827	26,827	27,190	27,538
R-squared	0.240	0.234	0.200	0.284

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions control for firm size and for the manager's level of education, and include year*sector fixed effects.

3.4. Managers, innovation and productivity

27. In this section we analyse the characteristics of the firm's manager in relation to innovation. We estimate the following linear probability model:

$$Y_{its} = \beta_0 + \beta_1 X_{its} + \beta_2 firmsize_{its} + \theta_{ts} + u_{its} \quad (4)$$

Where Y_{its} is i) product innovation[16], or ii) process innovation[17] in firm *i*, year *t* and 2-digit sector *s*, and the vector X_{its} includes manager's characteristics. We control for firm size and include year times 2-digit industry fixed effects θ_{ts}.

[16] Product or service innovation refers to the launch of a product or service into the marketplace, which is technologically new or significantly improved in terms of performance and technical characteristics compared to the firm's existing products and services.

[17] Process innovation refers to the adoption of production process or production management practices which are technologically new or significantly improved. Process innovation includes significant changes in production methods, in the purchase of equipment or software that bring more efficiency to the firm, but also that improve quality standards, production flexibility, or reduce potential damages to the environment or workers.

28. As shown in Table 14, manager's age does not affect the probability to introduce a new product or process within a firm, while there is a positive and significant correlation with manager's education. Firms run by college or high school educated managers are indeed more likely to innovate with respect to firms run by managers with low or no education.

Table 14. Manager's characteristics and innovation

	Product innovation	Process innovation
Young manager	0.026	0.020
	(0.023)	(0.018)
Old manager	-0.020	-0.012
	(0.017)	(0.008)
College educated manager	0.099***	0.049***
	(0.027)	(0.013)
High school educated manager	0.053*	0.032**
	(0.030)	(0.013)
Observations	31,103	31,099
R-squared	0.143	0.150

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions control for firm size and include year*sector fixed effects.

29. To account for differences in the pace of innovation across sectors, we distinguish between high- and low-tech manufacturing, and knowledge intensive and less knowledge intensive services in Table 15. Managerial age does not have a significant effect on the probability to innovate in any of the sectors considered, while the positive correlation with managers holding a college degree is confirmed, except for product innovation in the knowledge intensive services. Compared to managers with low or no education, managers who completed high school are also more likely to introduce a new product or process. The latter result is found across all sectors but in the knowledge intensive services.

Table 15. Manager's characteristics and innovation in high and low tech manufacturing and in knowledge intensive and less knowledge intensive services

	Product innovation	Process innovation
	Panel A1: Low-tech manufacturing	
Young manager	0.041	-0.018
	(0.043)	(0.030)
Old manager	-0.022	-0.014
	(0.021)	(0.020)
College educated manager	0.148***	0.122***
	(0.030)	(0.033)
High school educated manager	0.015	0.042*
	(0.027)	(0.023)
Observations	7,941	7,938
R-squared	0.061	0.059
	Panel A2: High-tech manufacturing	
Young manager	0.017	0.019
	(0.057)	(0.056)
Old manager	0.027	-0.006
	(0.024)	(0.026)
College educated manager	0.186***	0.132***
	(0.046)	(0.043)
High school educated manager	0.133**	0.100*
	(0.055)	(0.052)
Observations	2,733	2,736

R-squared	0.074	0.055
	Panel B1: Less knowledge intensive services	
Young manager	-0.007	0.020
	(0.042)	(0.027)
Old manager	-0.045	-0.008
	(0.040)	(0.020)
College educated manager	0.182***	0.062**
	(0.056)	(0.027)
High school educated manager	0.112**	0.059**
	(0.054)	(0.023)
Observations	9,034	9,029
R-squared	0.065	0.043
	Panel B2: Knowledge intensive services	
Young manager	0.030	0.033
	(0.034)	(0.029)
Old manager	-0.014	-0.007
	(0.023)	(0.011)
College educated manager	0.011	0.033**
	(0.033)	(0.015)
High school educated manager	-0.021	0.006
	(0.035)	(0.023)
Observations	4,944	4,945
R-squared	0.242	0.235

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions control for firm size and include year*sector fixed effects.

30. To conclude, we jointly consider the characteristics of the firm's manager and the introduction of product and process innovation in relation to productivity. Results reported in Table 16 indicate a positive effect of product innovation only on firm productivity measured as revenues per worker, while there is a negative correlation with process innovation. The latter however may also refer to the introduction of changes that do not primarily aim at boosting productivity, such as those designed to improve quality standards or to reduce potential damages to the environment or to workers. As for managerial age, previous findings of a positive correlation between more experienced managers and firm performance are confirmed across all measures of productivity.

Table 16. Innovation, manager's characteristics and productivity

	TFP OLS	TFP IV	LAB PROD (VA)	LAB PROD (REV)
Product innovation	0.017	0.016	0.024	0.128***
	(0.045)	(0.043)	(0.040)	(0.032)
Process innovation	-0.063	-0.083*	-0.011	-0.084***
	(0.043)	(0.042)	(0.038)	(0.031)
Young manager	-0.163***	-0.142***	-0.163***	-0.107**
	(0.045)	(0.049)	(0.049)	(0.052)
Old manager	0.089**	0.101**	0.096***	-0.085**
	(0.040)	(0.040)	(0.036)	(0.038)
Observations	26,941	26,941	27,306	27,654
R-squared	0.215	0.218	0.176	0.270

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions control for firm size and for the manager's level of education, and include year*sector fixed effects.

4. Conclusions

31. Our analysis of Italian survey data of firms operating in the non-agricultural private sector suggests a positive relationship between human capital and firm productivity. As for the workforce composition, larger shares of workers in higher-skilled occupations and in managerial roles are associated to better firm performance, while we find negative effects for higher shares of women. This result is in part explained by a correlation between the share of women and the share of fixed-term contract employees, and the fact that low-productivity firms use more temporary employment. Our findings on ownership and management indicate that family firms perform worse compared to non-family firms, and that the separation between ownership and management is positively associated to productivity, even though the latter result is not robust to the inclusion of workers and managers characteristics. Finally, we find a positive relationship between firm performance and managers' experience, which is captured by age, and a higher probability of introducing product or process innovations for more educated managers.

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Annex A. Additional results

Table A.1. Productivity and gender distribution in manufacturing

	TFP OLS	TFP IV	LAB PROD (VA)	LAB PROD (REV)
Excluded category: share of women between 0 and 20%				
	Panel A: High-tech manufacturing			
20-40%	-0.060	-0.066*	-0.072**	-0.011
	(0.037)	(0.034)	(0.035)	(0.036)
40-60%	-0.063	-0.087	-0.116**	0.001
	(0.048)	(0.053)	(0.055)	(0.058)
60-80%	-0.012	-0.060	-0.173**	-0.091
	(0.071)	(0.045)	(0.077)	(0.093)
80-100%	-0.388	-0.471*	-0.618**	-0.524*
	(0.234)	(0.271)	(0.249)	(0.283)
Observations	2,542	2,542	2,580	2,605
R-squared	0.068	0.075	0.085	0.053
	Panel B: Low-tech manufacturing			
20-40%	-0.052	-0.080*	-0.042	-0.012
	(0.038)	(0.041)	(0.044)	(0.036)
40-60%	-0.140**	-0.169***	-0.163**	-0.123
	(0.056)	(0.064)	(0.066)	(0.077)
60-80%	-0.140***	-0.227***	-0.194***	-0.141**
	(0.039)	(0.042)	(0.042)	(0.060)
80-100%	-0.233**	-0.219***	-0.302***	-0.230**
	(0.091)	(0.080)	(0.076)	(0.105)
Observations	7,343	7,343	7,405	7,488
R-squared	0.259	0.177	0.091	0.099

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions control for firm size and include year*sector fixed effects.

Table A.2. Productivity and gender distribution in services

	TFP OLS	TFP IV	LAB PROD (VA)	LAB PROD (REV)
Excluded category: share of women between 0 and 20%				
	Panel A: Knowledge intensive services			
20-40%	-0.227	-0.650***	-0.280*	-0.517***
	(0.150)	(0.178)	(0.161)	(0.140)
40-60%	-0.300	-0.589**	-0.344	-0.429**
	(0.221)	(0.256)	(0.260)	(0.167)
60-80%	-0.227**	-0.538***	-0.273**	-0.531***
	(0.095)	(0.121)	(0.126)	(0.140)
80-100%	-0.488***	-0.523**	-0.552***	-0.449***
	(0.151)	(0.187)	(0.185)	(0.126)
Observations	3,871	3,871	3,964	4,031
R-squared	0.144	0.241	0.197	0.219
	Panel B: Less knowledge intensive services			

20-40%	-0.151**	-0.117**	-0.098**	-0.090**
	(0.057)	(0.052)	(0.049)	(0.040)
40-60%	-0.151***	-0.129**	-0.114**	-0.357*
	(0.050)	(0.057)	(0.055)	(0.185)
60-80%	-0.141	-0.144	-0.089	-0.133
	(0.095)	(0.113)	(0.122)	(0.125)
80-100%	-0.131	-0.118	-0.151	-0.046
	(0.102)	(0.108)	(0.110)	(0.133)
Observations	8,048	8,048	8,160	8,247
R-squared	0.192	0.204	0.180	0.355

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions control for firm size and include year*sector fixed effects.

Table A.3. Hours worked per week by gender

NACE Sections[18]	N. weekly hours worked by women	N. weekly hours worked by men	Observations
B-E	35.65	39.90	12,772
F	31.08	39.15	4,226
G	34.93	42.11	3,484
H	34.50	40.01	1,803
I	33.53	42.53	1,269
J	34.97	40.18	1,583
K	35.08	39.93	777
L-N	31.52	39.78	2,676
P-Q	29.67	33.55	1,858
R-U	29.93	37.26	695

Table A.4. Share of fixed-term contract employees and gender distribution

	Share of fixed-term contract employees
Excluded category: share of women between 0 and 20%	
20-40%	0.044***
	(0.009)
40-60%	0.034***
	(0.010)
60-80%	0.071***
	(0.015)
80-100%	0.043***
	(0.013)
Observations	30,395
R-squared	0.104

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions control for firm size and include year*sector fixed effects.

[18] B-E: industry (except construction); F: construction; G: Wholesale and retail trade, repair of motor vehicles and motorcycles; H: transportation and storage; I: accommodation and food service activities; J: information and communication; K: financial and insurance activities; L-N: real estate activities, professional, scientific and technical activities, administrative and support service activities; P-Q: education, human health and social work activities; R-U: other collective and personal services.

Table A.5. Productivity and gender distribution

	TFP OLS	TFP IV	LAB PROD (VA)	LAB PROD (REV)
	Panel A: Whole sample			
Share of women	-0.145*	-0.099	-0.127	-0.050
	(0.085)	(0.096)	(0.108)	(0.112)
Share of fixed-term contract employees	-0.464***	-0.479***	-0.447***	-0.337***
	(0.076)	(0.079)	(0.077)	(0.103)
N. hours worked by women per week	-0.032	-0.033	-0.044*	-0.039
	(0.021)	(0.020)	(0.024)	(0.024)
Observations	27,072	27,072	27,443	27,795
R-squared	0.217	0.219	0.175	0.258
	Panel B: Manufacturing			
Share of women	-0.194***	-0.208***	-0.276***	-0.179**
	(0.067)	(0.065)	(0.062)	(0.084)
Share of fixed-term contract employees	-0.321***	-0.393***	-0.423***	-0.248*
	(0.106)	(0.110)	(0.101)	(0.142)
N. hours worked by women per week	0.054*	0.042	0.040	0.061
	(0.030)	(0.031)	(0.035)	(0.048)
Observations	11,608	11,608	11,742	11,890
R-squared	0.343	0.278	0.158	0.130
	Panel C: Services			
Share of women	-0.134	-0.077	-0.106	-0.028
	(0.099)	(0.112)	(0.126)	(0.130)
Share of fixed-term contract employees	-0.485***	-0.493***	-0.454***	-0.349***
	(0.086)	(0.089)	(0.086)	(0.116)
N. hours worked by women per week	-0.039*	-0.038*	-0.046*	-0.045*
	(0.022)	(0.021)	(0.025)	(0.026)
Observations	15,427	15,427	15,665	15,871
R-squared	0.197	0.211	0.183	0.282

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions control for firm size and include year*sector fixed effects.

Table A.6. Productivity and share of foreign workers

	TFP OLS	TFP IV	LAB PROD (VA)	LAB PROD (REV)
	Panel A: Whole sample			
Share of foreign workers	0.000	0.006	0.043	-0.036
	(0.114)	(0.120)	(0.123)	(0.128)
Observations	27,064	27,064	27,433	27,785
R-squared	0.202	0.206	0.162	0.253
	Panel B: Manufacturing			
Share of foreign workers	-0.044	0.004	-0.069	-0.106
	(0.099)	(0.086)	(0.111)	(0.160)
Observations	11,604	11,604	11,736	11,884
R-squared	0.333	0.265	0.136	0.124
	Panel C: Services			
Share of foreign workers	0.005	-0.002	0.075	-0.011
	(0.154)	(0.163)	(0.165)	(0.166)
Observations	15,423	15,423	15,661	15,867
R-squared	0.180	0.197	0.170	0.276

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions control for firm size and include year*sector fixed effects.

Table A.7. Manager's age

	TFP OLS	TFP IV	LAB PROD (VA)	LAB PROD (REV)
Young manager	-0.162***	-0.140**	-0.162***	-0.106**
	(0.044)	(0.048)	(0.048)	(0.053)
Old manager	0.090**	0.102**	0.096**	-0.086**
	(0.040)	(0.040)	(0.036)	(0.038)
Observations	26,981	26,981	27,348	27,698
R-squared	0.214	0.217	0.175	0.268

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions control for firm size and for the manager's education, and include year*sector fixed effects.

Table A.8. Managers' age in high and low tech manufacturing and in knowledge intensive and less knowledge intensive services

	TFP OLS	TFP IV	LAB PROD (VA)	LAB PROD (REV)
Excluded category: Middle-aged manager				
	Panel A1: Low-tech manufacturing			
Young manager	-0.103*	-0.148**	-0.121**	-0.021
	(0.062)	(0.059)	(0.055)	(0.076)
Old manager	0.001	0.003	0.019	-0.066
	(0.027)	(0.026)	(0.026)	(0.044)
Observations	7,335	7,335	7,397	7,480
R-squared	0.252	0.169	0.077	0.094
	Panel A2: High-tech manufacturing			
Young manager	-0.120	-0.116	-0.219	-0.385**
	(0.111)	(0.122)	(0.165)	(0.181)
Old manager	-0.066	-0.046	-0.031	-0.064
	(0.045)	(0.043)	(0.042)	(0.041)
Observations	2,540	2,540	2,578	2,603
R-squared	0.057	0.056	0.056	0.052
	Panel B1: Less knowledge intensive services			
Young manager	-0.217***	-0.191***	-0.192***	-0.168*
	(0.060)	(0.058)	(0.061)	(0.088)
Old manager	0.110**	0.117**	0.116**	-0.155**
	(0.053)	(0.050)	(0.047)	(0.071)
Observations	8,033	8,033	8,143	8,229
R-squared	0.201	0.213	0.189	0.348
	Panel B2: Knowledge intensive services			
Young manager	0.063	0.164	0.059	-0.016
	(0.126)	(0.137)	(0.139)	(0.132)
Old manager	0.092	0.116	0.120	-0.081
	(0.150)	(0.155)	(0.153)	(0.108)
Observations	3,864	3,864	3,956	4,023
R-squared	0.118	0.207	0.167	0.190

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions control for firm size and include year*sector fixed effects.

BETTER POLICIES FOR BETTER LIVES