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# What deters labor-owned firm creation? Evidence from Italian manufacturing sectors

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ABSTRACT

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We analyze the determinants of labor-owned versus capital-owned firm creation. We match firm-level information on a large sample of new manufacturing firms with available industry-level proxies of the main determinants of ownership structures according to existing economic theories. We estimate a logit model and quantify the empirical contribution of each argument to explain labor-owned versus capital-owned firm entry. Our results show that human capital specificity and workers heterogeneity largely explain labor-owned firm entry, while other dimensions, such as limited worker wealth, have a weaker statistical relevance. These findings are robust to different estimation methods and are unlikely to be affected by endogeneity concerns. Our results contribute to the general understanding of the endogenous dynamics of ownership rights distribution in manufacturing firms and to the elaboration of policy initiatives aimed at supporting cooperative modes of firm organization. *Journal of Comparative Economics* **000** (2016) 1–15. Department of Economic Studies, University "G. d'Annunzio", Viale Pindaro 42, 65127, Pescara, Italy.



## 1. Introduction

The question of what are the main determinants of the ownership of the firm is long-standing. Various types of ownership exist in market economies, but a broad distinction may be traced among the various forms according to whether ownership is shared among workers on a one member - one vote basis (i.e. worker cooperatives or labor-owned firms) or all control rights and rights to residual profits are allocated to capital suppliers (i.e. capitalist or capital-owned firms). An extensive and heterogenous theoretical literature has analyzed the issue of endogenous ownership, pointing to several possibly relevant explanatory factors, including human capital and physical assets specificity, workers monitoring difficulties, decision-making costs, worker risk aversion and liquidity constraints (see Dow and Putterman, 2000 for an extensive survey).

While the empirical literature so far has focused mainly on the relative performance of worker cooperatives (see, e.g., Smith, 1994; Doucouliagos, 1995; Burdín and Dean, 2009 and Burdín et al. (2016)), empirical studies on the determinants of labor-owned ownership structures are scant and the empirical validity of alternative theories of ownership has never been tested systematically. As a result, there is still much we do not understand on the subject of why worker labor-owned firms

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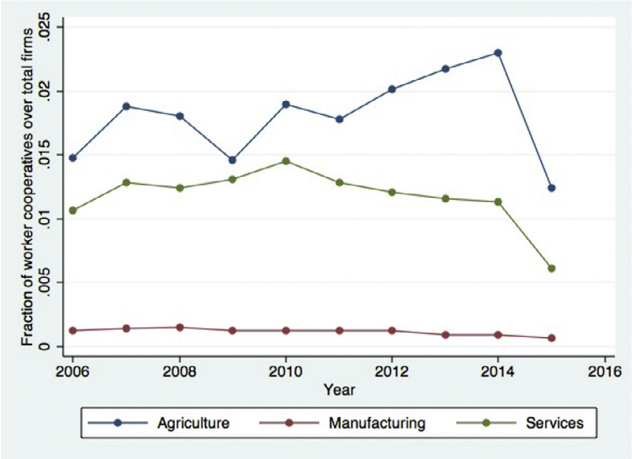


**Fig. 1.** Recent trends in macro-sectoral distribution of worker cooperatives fraction. The macro-sectoral distribution of worker cooperatives (as a fraction of total firms in each macro-sector) is calculated from a sample of 100,000 Italian active firms in the period 2006–2015 (source of the data: AIDA database - BvD, 2016).

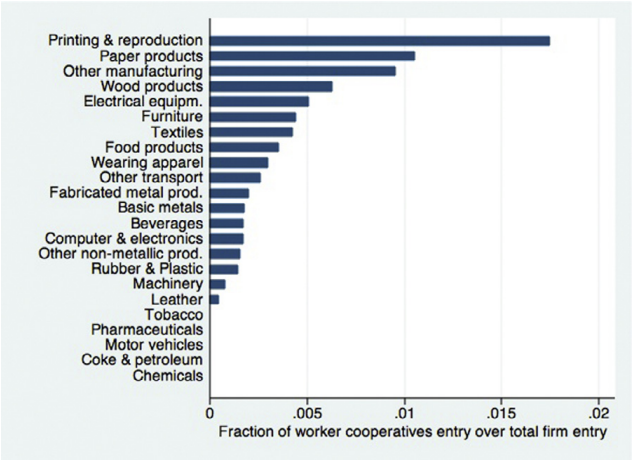


**Fig. 2.** Sectoral distribution of worker cooperatives entry fraction (manufacturing). The 2-digit (NACE classification) sectoral distribution of worker cooperatives entry (as a fraction of total firm entry) is calculated from a sample of 51,655 Italian new firms that entered the market in the period 2003–2007 (source of the data: AIDA database - BvD, 2013).

rarely exist in market economies and why they tend to be so heterogeneously distributed across sectors. We see this basic heterogeneity, in Italy, inFigs. 1 and 2. In Fig. 1 we show the recent trends - over the last 10 years - in the population of worker cooperatives in three macro-sectors (agriculture, manufacturing and services), while in Fig. 2 we focus on within-manufacturing heterogeneity across 2-digit industries over a 5-year window before the recent financial crisis.

This article aims at making a step toward addressing this puzzle empirically.

We first briefly summarize the main theories of firm ownership. Institutional economics literature proposes several plausible arguments that may explain ownership structures heterogeneity, ranging from agency and monitoring problems to hold-up issues, from collective decision-making costs to input access and relative bargaining powers (Alchian and Demsetz, 1972; Grossman and Hart, 1986; Hart and Moore, 1990; Hansmann, 1996; Rajan and Zingales, 1998a). We recall these arguments and explain how they are linked to labor-owned firm creation.

Then, we bring theory to data. We match firm-level information on a sample of 51,655 new manufacturing firms which entered the market in Italy in the period 2003–2007 with available measures of various industry characteristics, which can be considered relevant proxies of the main determinants of ownership according to existing theories. The analysis of the cross-sector heterogeneity of worker cooperatives entry rates allows us to identify the main obstacles to labor-ownership of firms at a sectoral level. We estimate a logit model and quantify the empirical contribution of each theory to explaining labor-owned versus capital-owned firm entry. Our results show that human capital specificity and workers heterogeneity largely explain labor-owned firm entry, while other dimensions, such as limited worker wealth, have a weaker statistical relevance. These findings are robust to different estimation methods and are unlikely to be affected by endogeneity concerns. In particular, we circumvent possible reverse causality by using both time-invariant US-based sectoral indicators to study Italian firms entry and time-variant indicators calculated from a sample of preexisting Italian firms (and, in an unreported robustness check, also from a sub-sample of only capital-owned firms), in order to have industry variables minimally

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influenced by heterogenous firm creation. Furthermore, we show that our estimates are robust to the possible correlation between sectoral heterogeneity and a set of predetermined firm-level characteristics (such as size and capital intensity) which may be additional drivers of the ownership structure and to the presence of possible agglomeration externalities at a geographical level.

The contribution of this study is twofold. On the one hand, this is the first empirical attempt to infer the relative contribution of the main theories of ownership to explaining labor-owned versus capital-owned firm entry. Previous studies have focused on specific aspects of labor-owned firm creation, whereas, with this paper, we measure and compare several possible explanations. Staber (1989, 1993); Russell and Hanneman (1992); Pérotin (2006) and Kalmi (2013) analyzed entry rates of worker firms to investigate whether labor-owned firms creation is countercyclical and showed mixed evidence. Podivinsky and Stewart (2007) used data on UK manufacturing industries and found that labor-owned firms show a reduced ability both to raise funds for investment and to deal with economic risks, thereby confining their activities to the more labor-intensive, low investment and low risk sectors. Arando et al. (2012), more recently, performed a panel data analysis of labor-owned firm entry in the Basque Country in Spain and detected the presence of agglomeration externalities, mainly due to legitimization effects. Our investigation contributes to this literature, by covering additional possible drivers of labor-owned firm entry. On the other hand, from a methodological point of view, we propose some possible solutions to the issue of how to measure human capital and physical assets specificity, workers monitoring difficulties, decision-making costs, and worker risk aversion, which are crucial aspects in the analysis of firm behavior also in other research contexts. In particular, we point to the use of already available measures, easy to gather and to implement at a sectoral-level.

The paper is organized as follows. In Section 2, we recall the main theories explaining ownership rights distribution within the firm and providing possible explanation of labor-owned firm entry. In Section 3, we present the data used in the empirical analysis and the econometric strategy. In Section 4, we report the estimation results, whose robustness is checked in Section 5. Section 6 concludes.

## 2. Labor versus capital control: theories of endogenous ownership

It is often thought that the most efficient ownership structure in market economies is one in which capital suppliers wield the ultimate formal control rights. This view, however, is shown descriptively narrow when one looks to the rich diversity in ownership structures that can be observed in many sectors of economic activity. Law and economics scholars have proposed several arguments explaining why capital control of the firm is not necessarily efficient and why labor-owned firms may emerge in free markets. The main explanations offered in the literature can be reconducted to the major theories of the firm, which center around asset specificity, monitoring incentives, wealth constraints, risk aversion and collective choice problems, and which are well known in the institutional economics debate. Here, we briefly recall these arguments, in order to make clearer the variables choice strategy of our empirical study, while we refer to Blair (1999); Dow and Putterman (2000) and Ben-Ner et al. (2000) for more detailed surveys.

A first theory, due to the seminal work of Alchian and Demsetz (1972), posits that the main economic problem in a firm is that of monitoring the activity of multiple individuals undertaking team production. Since monitoring is costly and its benefits have a public good nature, a free rider problem afflicts workers' incentives to monitor. Thus, only those who can retain a significant share of the residual profits will have incentive to undertake monitoring. According to this argument, capitalist firms, where residual earnings, monitoring duties and control rights all fall in the hands of the capital suppliers, should be more likely to emerge when monitoring costs are relatively high.[1]

A different approach, developed by Grossman and Hart (1986) and Hart and Moore (1990) and commonly referred to as GHM theory, argues that ownership is a mechanism to protect firm-specific investments (i.e. investments that have little value outside a firm but a great value inside it) in the presence of contract incompleteness. If a firm can be stylized as composed by workers and capital suppliers, then labor-control of the firm emerges when workers' human capital investments have a relatively greater impact on the value created in the firm with respect to financial capital. On the other hand, when the financial capital is relatively more specific, then the scope for hold-up by workers is limited and firm ownership is allocated to capital suppliers.

The hold-up problem is central also to the theory of access to assets of Rajan and Zingales (1998a). In this case, the firm is conceived as a nexus of specific investments, where ownership over physical assets increases both the owner's bargaining power and therefore his incentive to specialize, on the one hand, and the owner's opportunity cost of specializing, on the other. If the negative effects of ownership by any individual dominate the positive incentive effects, Rajan and Zingales show that the optimal investment decisions cannot be achieved if only one specific investor owns the physical asset. Thus, as the physical inputs specificity increases, the probability of observing third-party (i.e. outside shareholder, typically finance supplier) ownership should also increase.

A different perspective, proposed by Hansmann (1996), focuses on decision-making problems. Hansmann argues that capital-ownership can be explained by the costs of collective decision-making in an environment where firm participants are heterogeneous. If the costs of aggregating the preferences of workers for purposes of exercising control is high, then

[1] That capital-owned firms are better able to cope with internal monitoring costs has been questioned by a number of studies (see, e.g., Bai and Xu, 2001), in particular with reference to the possible disentangling between monitoring costs and agency issues. We will address these concerns in a robustness check of our basic estimation analysis.

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**Table 1**
Possible rationales of labor-owned ownership structures.

| Argument | Main references in the literature |
|---|---|
| Concentration of residual earnings (capital control) reduces free riding where monitoring costs are high; one share - one vote (labor control) ownership should emerge more likely where monitoring problems are milder | Alchian and Demsetz (1972) |
| Ownership rights are assigned to the most specific investor in a production relationship; labor control emerges more likely where the relationship-specificity of human capital investments is higher | Grossman and Hart (1986); Hart and Moore (1990) |
| Third-party (outside shareholder) ownership reduces the single party's bargaining power and the opportunity costs of specialization in a context of high inputs specificity; where physical inputs specificity decreases, inside labor control should emerge more likely | Rajan and Zingales (1998a) |
| Heterogeneity of firm participants increases collective decision-making costs; diffuse labor control of a firm is more likely to emerge where workers heterogeneity is lower | Hansmann (1996) |
| While workers tend to show high risk aversion, capital suppliers are risk-neutral; labor-owned firm entry should be higher in those sectors of activity where economic uncertainty is lower | No specific reference; see generally Pérotin (2006); Podivinsky and Stewart (2007) and Burdín and Dean (2012) |
| Limited worker wealth hampers the labor capabilities to raise external finance; labor-owned ownership should emerge more likely in less finance hungry production environments | No specific reference; see generally Conte and Jones (2015) and Bowles and Gintis (1994) |

decision-making is simplified by ownership of capital suppliers. Where workers heterogeneity is low, labor-owned firms are more likely to emerge.

Finally, it is commonly argued that the prevalence of capital-owned firms may be explained also by limited worker wealth, which may hamper the labor capabilities to raise external finance (the idea that cooperative founders have limited personal wealth and no access to the capital market fits, for example, the model of Conte and Jones, 2015) and by worker risk aversion, due to the fact that workers cannot reduce firm-specific risk exposure by spreading their effort across different activities as their capital supplier counterparts. The two arguments are not necessarily related. On the one side, the limited worker budget constraint is deemed to reduce labor-owned firms entry rates in finance dependent industries, since worker cooperatives tend to have limited access to capital markets, due to relatively higher difficulties in offering credible guarantees of repayment to external investors (see, among others, Bowles and Gintis, 1994). On the other, worker risk aversion should refrain worker cooperatives from operating in markets characterized by relatively higher levels of economic uncertainty and higher profits volatility (Podivinsky and Stewart, 2007). In particular, employee risk aversion may contribute to explain why worker cooperatives are found to pursue mixed objectives, including employment stability of firm members (Pérotin, 2006; Burdín and Dean, 2012).

These arguments are summarized in Table 1.

Notice that, while these theories may be considered as alternative on a theoretical ground, they may be complementary in reality, each of them showing some statistical significance. The aim of our study, therefore, is to test which of them has some empirical validity and to measure their relative empirical contribution.

## 3. Data and model specification

We obtain firm-level information on firm entry from the AIDA database (BvD, 2013), which contains longitudinal balance sheet information on a large sample of Italian firms (Italy's cooperative sector is one of the largest among Western countries). We extract from the AIDA database a representative sample of 51,655 new firms which entered the market in the period 2003–2007. We focus only on new firms entering manufacturing sectors in the 5-year window before the recent financial crisis in order to reduce the impact of possible additional sources of heterogeneity. New firms are identified on the basis of newly activated VAT numbers; thus, firms acquiring another enterprise and preserving their previous VAT number are excluded, while two or more firms merging in a new entity with a new VAT number (which may also imply a change in ownership structure and sector of activity) are included. For each firm, we use information on ownership (worker cooperative versus capital ownership) and sector of activity at a 4-digit level (NACE classification). We then group firms from a 4-digit to a 2-digit level, in order to have non-negligible sectoral level numbers of new firms creation, and match these data with available measures of various industry characteristics, which can be considered relevant proxies of the main determinants of ownership according to the theories discussed in the previous section. Specifically, we consider the following variables:

- *Job_routineness*: Costinot et al. (2011)'s index of routineness of sectors, originally calculated from the 2007 version of the US Occupational Information Network database covering more than 200 occupational characteristics in about 800 tasks, which measures the importance of the worker ability of "making decisions and solving problems" at an industry-level, re-classified in order to match AIDA data (higher values indicate higher routineness and higher worker redeployability). In those sectors where job routineness is higher, on average, human capital specificity is lower, as production processes require more standard and ordinary knowledge; in these contexts, workers can more easily switch over alternative job places within the same sector and tend to develop less specific human capital. Job routineness can be considered, therefore, a proxy of the degree of human capital specificity and accounts for the GHM theory (i.e., where job routineness is

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higher, workers are less exposed to hold-up risks and the cost of capital-ownership is reduced). Nevertheless, this variable may also partly capture some generic human capital of skilled workers, for those occupations requiring high skills that can be used in different firms or industries with low adaptation costs.

- *Work_heterogeneity*: absolute value of 1 minus the ratio between the percentage of hours worked by employees with at least 16 years of schooling (college) and the average years of schooling, calculated by Ciccone and Papaioannou (2009) at a sectoral level, re-classified in order to match AIDA data; this variable is a measure of workforce heterogeneity and accounts for the Hansmann's theory (notice, however, that this variable refers to a specific dimension of heterogeneity, i.e. education levels, while there may be also other relevant dimensions, such as differences in time horizons and managerial competences, which are not necessarily correlated with schooling).
- *Profits_uncertainty*: standard deviation of an index of profitability (EBITDA, i.e. earnings before interest, taxes, depreciation, and amortization, weighted by firm total sales), calculated at a 2-digit and year-level using firm-level data obtained from the overall AIDA database on manufacturing firms; this variable is a proxy of profits variability within sectors and allows to measure whether risk averse labor-owned firms shy away from turbolent markets.
- *Monitoring_difficulty*: sectoral average degree of ownership shares concentration (the degree of shares concentration refers to the percentage of shares in the hands of the direct or indirect controlling shareholder), calculated at a 2-digit and year-level using firm-level data obtained from the overall AIDA database on manufacturing firms; according to an extensive corporate governance literature (Shleifer and Vishny, 1997), ownership concentration is a mean to align cash flow and control rights of shareholders and to reduce managers/employees discretion in environments where monitoring costs are relevant and it can be considered a response to (and therefore a proxy of) free riding problems as highlighted by Alchian and Demsetz (1972).[2]
- *Input_specificity*: Nunn's (2007) indicator of physical inputs specificity, based on information on whether an input is sold on an organized exchange and whether or not it is reference priced in a trade publication (if an input is sold on an organized exchange then the market for this input is thick, and the scope for hold-up is limited); this variable is calculated at a sectoral level, re-classified in order to match AIDA data, with higher values indicating higher levels of inputs specificity; it therefore accounts for the Rajan and Zingales' (1998a) argument.
- *Finance_need*: Rajan and Zingales' (1998b) measure of industry reliance on external finance, originally calculated at a sectoral level from firm-level data and defined as one minus industry cash flow over industry investment, re-classified in order to match AIDA data; production activities relatively more dependent on external finance should be less attractive for worker cooperatives, when workers are financially constrained.

The variables' description and interpretation are summarized in Table 2.

Notice that we analyze firms entering the market for the first time with their ownership status detected at the moment of entry ($t_0$). Thus, in the empirical investigation, we employ an information set which includes, for each firm, its initial ownership status, year of entry and sectoral variables (linked to the firm depending on its main sector of activity). Each firm is observed once, at $t_0$. Since the data refer to Italian firms only, we do not need to control for heterogeneity in national fiscal regulation or in other possibly relevant country-level factors.

We fit the following logit model on firm-level observations:

$$\Pr(y_{it} = 1) = f(\beta_0 + \boldsymbol{\beta}\mathbf{x}_{it}) \tag{1}$$

where $i$ denotes a generic new firm and $t$ the year in which it entered the market, $y_{it}$ is a dummy variable equal to 1 if the new firm is a worker cooperative and 0 if it is a capitalist firm, $f(z) = e^z/(1+e^z)$ is the cumulative logistic distribution, $\beta_0$ is the model constant, $\mathbf{x}_{it}$ is the vector of explanatory variables and $\boldsymbol{\beta}$ the corresponding vector of parameters. The covariates vector $\mathbf{x}_{it}$ includes our sectoral variables.

Given our variable-coding strategy, for each of the theoretical arguments examined, if the theory is correct then the sign of the corresponding regression parameter is expected to be negative.

It is worth emphasizing that the sectoral indicators used in the empirical analysis are unlikely to suffer from reverse causality, since they refer to technological features of production inputs and processes, and do not tend to be affected by new firm ownership characteristics (*Job_routineness, Work_heterogeneity, Input_specificity* and *Finance_need*, in particular, are obtained from US data and are time-invariant, while *Profits_uncertainty* and *Monitoring_difficulty* are calculated from the overall AIDA database on preexisting manufacturing firms).[3] Moreover, the worker cooperatives entry fraction (as a share of total firm entry) is very small in our data (see Fig. 1 and Fig. 2) and it is therefore unlikely to significantly affect average

[2] This variable captures monitoring problems between managers and employees only to the extent that managers tend to more effectively monitor workers where they are subject to more intense monitoring by concentrated shareholders. This is not obvious, however it is consistent with the empirical evidence reported by a number of studies. Bertrand and Mullainathan (1999); 2003), coherently with a "quiet life" model, argue that managers are reluctant to undertake cognitively difficult activities, and show that a poorly governed management may prefer to avoid the difficult decisions and costly efforts associated with dealing with shirking workers. More generally, Roe (2000); 2003) argues that widely held firms are less effective at coping with labor discretion, because weakly monitored managers will not fight as strongly for shareholders as will strongly monitored managers. From a country-industry perspective, Mueller and Philippon (2011), using survey-based measures of the quality of labor relations, show that, where labor relations are more difficult to manage and the need for monitoring workers increases, ownership concentration must increase correspondingly to ensure a higher monitoring intensity and in fact closely held ownership structures emerge more likely.

[3] The use of US-based indicators requires the assumption that Italian and US firms use close enough organization of work and sufficiently similar production technologies.

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**Table 2**
Empirical proxies of labor-owned firm entry theories.

| Name of the variable | Brief description | Interpretation |
|---|---|---|
| *Job_routineness* | Costinot et al. (2011)'s index of routineness of sectors measuring the importance of the worker ability of "making decisions and solving problems", re-classified at an industry-level [std values] | Higher routineness indicates higher worker redeployability and lower human capital specificity (this variable, however, may also partly capture generic human capital of skilled workers) |
| *Work_heterogeneity* | Absolute value of 1 minus the ratio between the percentage of hours worked by employees with at least 16 years of schooling (college) and the average years of schooling, calculated by Ciccone and Papaioannou (2009) at a sectoral level [std values] | Schooling heterogeneity accounts for a large part of employee heterogeneity in working abilities and skills (differences in time horizons and managerial competences, however, do not necessarily correlate with schooling) |
| *Profits_uncertainty* | Standard deviation of EBITDA values, calculated at a 2-digit and year-level using firm-level data obtained from the overall AIDA database on manufacturing firms [std values] | Profits variability within sectors is a measure of economic uncertainty and market turbulence |
| *Monitoring_difficulty* | Sectoral average degree of ownership shares concentration calculated at a 2-digit and year-level using firm-level data obtained from the overall AIDA database on manufacturing firms [std values] | Concentrated ownership structures emerge as a mean to align profit and control rights of shareholders and to reduce managers/employees discretion in response to high monitoring costs (this variable, however, does not proxy agency costs) |
| *Input_specificity* | Nunn's (2007) indicator of physical inputs specificity at a sectoral-level, based on information on whether an input is sold on an organized exchange and whether or not it is reference priced in a trade publication [std values] | If an input is not sold on an organized exchange then the market for this input is limited, the scope for hold-up is larger and physical inputs specificity higher |
| *Finance_need* | Rajan and Zingales' (1998b) measure of industry reliance on external finance, originally calculated at a sectoral level from firm-level data and defined as one minus industry cash flow over industry investment [std values] | Under binding budget constraints, higher dependence on external finance measures possible financial difficulties for new firms entering the market |

industry-level characteristics. In any event, we also calculate the correlation coefficient between the dependent variable and the residuals of our regression models (Corr($\varepsilon$, $y$)). If endogeneity is absent, Corr($\varepsilon$, $y$) tends to zero.

## 4. Results

### 4.1. Basic estimates

Basic estimation results are presented in Table 3. Table 3 lists the explanatory variables in the first column and the corresponding estimated parameters obtained from different model specifications in the following columns. In particular, we consider four alternative specifications. Firstly, we estimate a basic maximum-likelihood logit model with non-clustered heteroskedasticity robust standard errors. Secondly, we relax the assumption of independence between firm-level observations and employ the clustered version of the Huber-White-sandwich estimator of the variance (Huber, 1967; White, 1980), so allowing for within-group correlation of residuals at a 2-digit sectoral level. Furthermore, we employ a jackknife variance estimation procedure (where the original sample is divided in $N$ sub-samples, each of them excluding the observations of a different 4-digit industry and where $N$ is the number of industries, and where the estimation of each model's parameter is computed $N$ times, once for each sub-group, the final parameter estimates being then calculated as the average of the $N$ parameters obtained in each regression round) and a non-parametric bootstrap estimation with 50 replications (where standard errors are produced after a random drawing of $n$ observations from the $n$-observation dataset and where statistics are obtained by using the resampled dataset in each replication round). The jackknife and bootstrap estimations allow us to check whether our results are driven by outliers both at a 4-digit industry and firm-level, respectively.[4]

Estimated parameters are virtually similar across specifications and differences in standard errors and statistical significance are negligible. We find that *Job_routineness, Work_heterogeneity, Monitoring_difficulty, Profits_uncertainty* are all associated with a negative and statistically significant parameter, corroborating the arguments of Grossman and Hart (1986) and Hart and Moore (1990); Hansmann (1996); Alchian and Demsetz (1972) and worker risk aversion, respectively. *Finance_need* and *Input_specificity* do not seem to be significantly correlated with the probability of a new firm entering the market as a worker cooperative.

[4] In an unreported regression, we have used a different definition of worker-owned firms, including both worker cooperatives and partnership enterprises ("società di persone"). In partnership enterprises (typically limited partnership enterprises) the working contribution of the partners is predominant with respect to capital and ownership rights tend to be distributed among workers in a way that makes this type of firms rather different from standard capital-owned firms. Estimation results remain substantially similar to those obtained when a narrower definition of labor-owned firms (i.e. worker coops only) is used.

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**Table 3**
Estimation results.

| explanatory variables | [1] (Non-clustered std. errors) Coeff. | [2] (Clustered std. errors) Coeff. | [3] (Jackknife std. errors) Coeff. | [4] (Bootstrap std. errors) Coeff. |
|---|---|---|---|---|
| *Job_routineness* | −0.548*** | −0.549*** | −0.548*** | −0.548*** |
| | (0.129) | (0.189) | (0.200) | (0.130) |
| *Work_heterogeneity* | −0.559*** | −0.559*** | −0.559*** | −0.559*** |
| | (0.139) | (0.216) | (0.166) | (0.146) |
| *Profits_uncertainty* | −0.245** | −0.245* | −0.245** | −0.245** |
| | (0.113) | (0.128) | (0.123) | (0.099) |
| *Monitoring_difficulty* | −0.267*** | −0.268** | −0.268** | −0.267** |
| | (0.087) | (0.131) | (0.110) | (0.108) |
| *Input_specificity* | −0.078 | −0.078 | −0.078 | −0.078 |
| | (0.114) | (0.215) | (0.156) | (0.122) |
| *Finance_need* | 0.204 | −0.205 | −0.204 | −0.204 |
| | (0.143) | (0.245) | (0.183) | (0.146) |
| Constant | −6.050*** | −6.050*** | −6.050*** | −6.050*** |
| | (0.101) | (0.197) | (0.162) | (0.092) |
| Estimation method | logit | logit | logit | logit |
| Std. err. type | standard | 2-digit cl. | jackknife | bootstrap |
| Pseudo R2 | 0.0212 | 0.0212 | 0.0212 | 0.0212 |
| Log ps.-likelihood | −975.61 | −975.62 | −975.61 | −975.61 |
| Wald $\chi^2$ | 41.42 | 25.49 | 4.73 [*F*] | 46.50 |
| Prob > Wald $\chi^2$ | 0.000 | 0.000 | 0.000 [> *F*] | 0.000 |
| Pearson $\chi^2$ | 239.52 | 239.52 | 239.52 | 239.52 |
| Prob > Pearson $\chi^2$ | 0.004 | 0.005 | 0.005 | 0.005 |
| Corr($\varepsilon$, $y$) | 0.056† | 0.056† | – | – |
| N. of obs. | 51655 | 51655 | 51655 | 51655 |

Statistical significance: *=10%, **=5%, ***=1%. Standard errors (in parenthesis) are heteroskedasticity robust. †$p$-value > 0.1.

In the presence of endogeneity due to reverse causality, we should observe significant correlation between the dependent variable and the residuals. As reported in Table 3, we find that such correlation coefficient is negligible (Corr($\varepsilon$, $y$) = 0.056 [$p$-value > 0.1]), ruling out that endogeneity significantly affects our estimates.[5]

Finally, as a general diagnostic procedure, we performed the Pearson and the Wald test on all the specifications considered; the test results lead us to reject the null hypothesis of joint non-significance of all the parameters.

### 4.2. Marginal effects

While estimated regression parameters are useful in order to interpret the sign and the statistical significance of the correlation between labor-owned firm entry and the characteristics of the sector of activity, in a logit estimation they cannot be interpreted as marginal effects (i.e. $dy/dx$). Thus, we also calculate marginal effects from predictions of fitted models where heteroskedasticity robust standard errors are clustered at a 2-digit sectoral level. Results are collected in Table 4. In Table 4, we report the marginal effects obtained from a battery of abridged model regressions, where variables are excluded once each, and from the full model version, in order to measure the percentage of the pseudo-R2 of the full model explained by each explanatory variable (last column).[6]

Interestingly enough, *Job_routineness* (GHM theory) is found to explain the 42.3% of the full model pseudo-R2, *Work_heterogeneity* (Hansmann theory) the 27.5%, *Monitoring_difficulty* (Alchian–Demsetz argument) the 12.9% and *Profits_uncertainty* (risk aversion) the 13.7%, while the explanatory power of *Finance_need* and *Input_specificity* is negligible. Notice, however, that, the marginal contributions of both the Hansmann's theory and the risk aversion argument are likely to be under-estimated. On the one side, some possibly relevant dimensions of employee heterogeneity are not captured by *Work_heterogeneity*, which refers only to schooling heterogeneity.[7] On the other, the estimated coefficient of *Prof-*

[5] In unreported regressions, we have also employed *Profits_uncertainty* and *Monitoring_difficulty* calculated from the sub-sample of capital-owned firms (rather than from the full sample of both capital and labor-owned enterprises) and verified that estimated parameters do not change significantly. This confirms that these variables are not affected by heterogeneous firm entry and that reverse causality, if present, does not drive our findings.

[6] It is worth reminding that, while the interpretation of the R2 index is relatively straightforward in OLS estimations, pseudo-R2 values in logistic regressions tend to be considerably lower than those of the standard R2 coefficient and the pseudo-R2 of the full specification should not be directly interpreted as the proportion of the dependent variable's variance explained by the model (McFadden, 1979).

[7] In an additional model regression, we have measured the relevance of the Hansmann's argument also by means of an alternative indicator of workforce heterogeneity based on employee seniority. In particular, we have constructed a new version of the *Work_heterogeneity* variable in four steps, using the full sample of the AIDA firm-level database. First, we have regressed average firm-level wages on a measure of average sectoral human capital intensity, as in the following wage regression equation: $w_{i,t} = \zeta_0 + \varrho HC_s + \epsilon_{i,t}$, where $w_{i,t}$ is the level of firm-level net wages and $HC_s$ is an indicator of the sectoral

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**Table 4**
Marginal effects and relative explanatory powers.

| Explanatory variables | Abridged model version [1] | Abridged model version [2] | Abridged model version [3] | Abridged model version [4] | Abridged model version [5] | Abridged model version [6] | Full model | % of the pseudo-r2 of the full model explained |
|---|---|---|---|---|---|---|---|---|
| | dy/dx | dy/dx | dy/dx | dy/dx | dy/dx | dy/dx | dy/dx | BY EACH VARIABLE |
| *Job_routineness* | | −0.0008* | −0.0014*** | −0.0013*** | −0.0013*** | −0.0014*** | −0.0013*** | 42.3 |
| | | (0.0004) | (0.0004) | (0.0004) | (0.0004) | (0.0003) | (0.0004) | |
| *Work_heterogeneity* | −0.0007* | | −0.0016*** | −0.0014*** | −0.0014*** | −0.0011*** | −0.0013*** | 27.5 |
| | (0.0004) | | (0.0004) | (0.0004) | (0.0004) | (0.0004) | (0.0004) | |
| *Profits_uncertainty* | −0.0008** | −0.0008** | | −0.0006* | −0.0006** | −0.0006** | −0.0006* | 12.9 |
| | (0.0004) | (0.0003) | | (0.0003) | (0.0003) | (0.0003) | (0.0003) | |
| *Monitoring_difficulty* | −0.0006** | −0.0006** | −0.0006** | | −0.0006** | −0.0005** | −0.0006** | 13.7 |
| | (0.0003) | (0.0003) | (0.0003) | | (0.0003) | (0.0002) | (0.0003) | |
| *Input_specificity* | −0.0002 | −0.0002 | −0.0002 | −0.0002 | | −0.0001 | −0.0002 | 1.8 |
| | (0.0005) | (0.0005) | (0.0004) | (0.0005) | | (0.0004) | (0.0005) | |
| *Finance_need* | 0.0009 | −0.0001 | 0.0004 | 0.0002 | 0.0004 | | 0.0005 | 1.8 |
| | (0.0006) | (0.0006) | (0.0006) | (0.0005) | (0.0005) | | (0.0006) | |
| Constant (coeff.) | −5.972*** | −5.956*** | −6.036*** | −6.043*** | −6.042*** | −6.024*** | −6.050*** | |
| | (0.208) | (0.192) | (0.171) | (0.224) | (0.192) | (0.200) | (0.917) | |
| Estimation method | logit | logit | logit | logit | logit | logit | logit | |
| Pseudo R2 | 0.0110 | 0.0146 | 0.0181 | 0.0179 | 0.0210 | 0.0203 | 0.0212 | |
| Log ps.-likelihood | −985.79 | −982.18 | −978.70 | −978.96 | −975.86 | −976.56 | −975.61 | |
| Wald $\chi^2$ | 10.36 | 12.13 | 29.16 | 9.65 | 23.16 | 23.27 | 25.49 | |
| Prob > Wald $\chi^2$ | 0.065 | 0.033 | 0.000 | 0.085 | 0.000 | 0.000 | 0.000 | |
| Pearson $\chi^2$ | 303.17 | 243.34 | 244.71 | 255.69 | 236.82 | 237.84 | 239.52 | |
| Prob > Pearson $\chi^2$ | 0.000 | 0.003 | 0.003 | 0.001 | 0.008 | 0.007 | 0.004 | |
| Corr($\varepsilon$, $y$) | 0.064† | 0.059† | 0.059† | 0.056† | 0.057† | 0.057† | 0.056† | |
| N. of obs. | 51655 | 51655 | 51655 | 51655 | 51655 | 51655 | 51655 | |

Statistical significance: *=10%, **=5%, ***=1%. Marginal effects are calculated with respect to one-standard deviation changes. †$p$-value > 0.1.
The Huber-White-sandwich estimator is employed. Heteroskedasticity robust standard errors (in parenthesis) are clustered at a sectoral level.

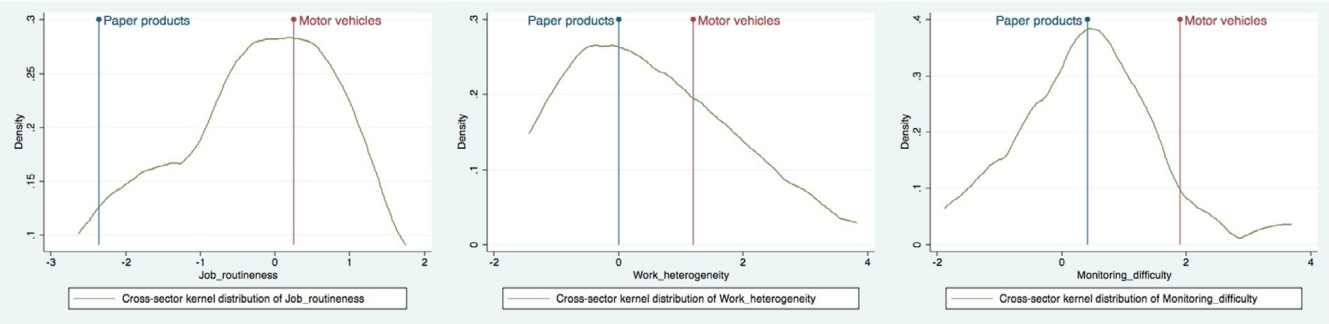


**Fig. 3.** Comparative statistics of paper products and motor vehicles sectors over the main theories of the ownership of the firm. *Job_routineness, Work_heterogeneity* and *Monitoring_difficulty* account for the arguments of Grossman and Hart (1986) and Hart and Moore (1990); Hansmann (1996); Alchian and Demsetz (1972), respectively. Details of the variables' description and interpretation are summarized in Table 2. The paper products industry is an example of a sector shown to be attractive to worker cooperatives, while the motor vehicles industry is an example of a sector shown to be unattractive to worker cooperatives (according to statistics - reported in Fig. 2 - on worker cooperatives entry calculated from a sample of 51,655 Italian new firms that entered the market in the period 2003–2007 (source of the data: AIDA database - BvD, 2013)).

*its_uncertainty* might be reduced by the fact that worker cooperatives may partially emerge also as a mean for new entrepreneurs to mitigate turbulent environments, coherently with previous literature highlighting that labor-owned firms tend to pursue mixed objectives, including employment stability of firm members (Pérotin, 2006; Burdín and Dean, 2012). Again, the correlation coefficients between the dependent variable and the residuals are shown negligible and both the Pearson and the Wald test lead us to reject the null hypothesis of joint non-significance of all the parameters.

To help the interpretation of the results, it is useful to compare two sectors with very different rates of worker cooperatives entry over the period 2003–2007 in Italy, namely the paper products industry (which is an example of a sector shown to be attractive to worker cooperatives) and the motor vehicles industry (which is an example of a sector shown to be unattractive to worker cooperatives). In Fig. 3, in particular, we show comparative descriptive statistics of the two considered industries over the overall cross-sector distribution of the variables *Job_routineness, Work_heterogeneity* and *Monitoring_difficulty*, that account for the arguments of Grossman and Hart (1986) and Hart and Moore (1990); Hansmann (1996), and Alchian and Demsetz (1972), respectively. Coherently with our main estimates, it emerges that the motor vehicles industry, with a very low rate of labor-owned firms creation, shows relatively higher levels of worker redeployability, schooling heterogeneity and monitoring costs, while the paper products sector is characterized by relatively lower values over these three dimensions (similar descriptive evidence can be obtained also by comparing other sectors).

This is consistent with anecdotal experience of several worker cooperatives in the paper products industry. For instance, in the last two decades in the northern regions of Italy, significant numbers of new paper factories entered the market as labor-owned firms. Moreover, in the same sector, some bankrupted capital-owned firms have been taken-over by previous employees and re-entered the market as new entities then showing positive trends in output growth and employment, thanks to lower organization costs and improved specialized long-term human capital (information on specific firm experiences are provided in LegaCoop (2016)).

It is worth emphasizing that, although worker cooperatives entry rates correlate - to different extents - with sectoral characteristics according to the three main theories of the firm ownership (i.e. the GHM's, Hansmann's and Alchian and Demsetz's arguments), routineness on the job place, worker heterogeneity and monitoring issues, on average, tend to be significant in Italian manufacturing sectors (in particular, comparatively to services sectors) and this contributes to explain why worker cooperatives are generally so rare in our manufacturing data.

## 5. Robustness checks

### 5.1. Firm-level omitted variable bias

It may be argued that new entrepreneurs (whether they be capital suppliers or workers) select the new firm's ownership structure which best meets several firm-level characteristics (such as size, capital intensity and geographical location) chosen ex-ante. If these firm-level variables are correlated with any of the considered dimensions of sectoral heterogeneity, then our estimated relationships are spurious and the regression parameters should not be interpreted in a causal sense.

average schooling level calculated by Ciccone and Papaioannou (2009). Second, we used the estimated parameter $\hat{\varrho}$ to compute each firm's predicted average wage $\hat{w}_{i,t}$. Third, we measured the difference ($\eta_{i,t}$) between $\hat{w}_{i,t}$ and $w_{i,t}$ and obtained a firm-level term that - under the assumption that $\epsilon_{i,t}$ are i.i.d. (independent and identically distributed) - captures the firm-level wage variation not explained by average human capital and possibly due to average employee seniority, as suggested by standard wage regression analysis. Fourth, finally, we have calculated the within-sector standard deviation of $\eta_{i,t}$ and used it as an alternative measure of workforce heterogeneity based on estimated employee seniority. The results from estimating model (1) including this alternative version of *Work_heterogeneity* are similar to those reported in Table 4, the coefficient of *Work_heterogeneity* being negative but with a relatively lower statistical significance (slightly above the 10% threshold, suggesting that seniority heterogeneity may be relevant but less significant than educational heterogeneity). These additional estimates are available upon request.

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**Table 5**
Robustness check: omitted variable bias (basic results).

| Explanatory variables | Controlling for physical capital Coeff. | Controlling for intangibles Coeff. | Controlling for no. employees Coeff. | Controlling for cap. intensity Coeff. | Controlling for geo distribution Coeff. |
|---|---|---|---|---|---|
| *Job_routineness* | −0.542*** | −0.541*** | −0.549*** | −0.545*** | −0.540*** |
| | (0.197) | (0.197) | (0.189) | (0.205) | (0.179) |
| *Work_heterogeneity* | −0.522** | −0.527** | −0.560*** | −0.488** | −0.544*** |
| | (0.225) | (0.220) | (0.217) | (0.229) | (0.212) |
| *Profits_uncertainty* | −0.274** | −0.252* | −0.244* | −0.307** | −0.262** |
| | (0.132) | (0.129) | (0.128) | (0.132) | (0.127) |
| *Monitoring_difficulty* | −0.286** | −0.266** | −0.267** | −0.324*** | −0.259** |
| | (0.130) | (0.133) | (0.131) | (0.120) | (0.127) |
| *Input_specificity* | −0.099 | −0.079 | −0.782 | −0.147 | −0.087 |
| | (0.222) | (0.218) | (0.215) | (0.234) | (0.209) |
| *Finance_need* | 0.199 | 0.204 | 0.205 | 0.211 | 0.231 |
| | (0.250) | (0.247) | (0.245) | (0.251) | (0.239) |
| *Physical_capital* | −3.470 | | | | |
| | (4.204) | | | | |
| *Intangibles* | | −65.204 | | | |
| | | (52.773) | | | |
| *Employees* | | | 0.013 | | |
| | | | (0.036) | | |
| *Capital_intensity* | | | | −10.113*** | |
| | | | | (3.461) | |
| *South_Italy* | | | | | benchmark |
| *Centre_Italy* | | | | | 0.165 |
| | | | | | (0.282) |
| *North_Italy* | | | | | −0.363** |
| | | | | | (0.180) |
| Constant | −6.234*** | −7.377*** | −6.050*** | −7.045*** | −5.894*** |
| | (0.326) | (1.144) | (0.197) | (0.502) | (0.262) |
| Estimation method | logit | logit | logit | logit | logit |
| Pseudo R2 | 0.0267 | 0.0270 | 0.0212 | 0.0489 | 0.0242 |
| Log ps.-likelihood | −969.65 | −982.18 | −975.60 | −948.01 | −972.32 |
| Wald $\chi^2$ | 26.16 | 26.15 | 29.16 | 52.47 | 41.65 |
| Prob > Wald $\chi^2$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Pearson $\chi^2$ | 80,163.02 | 40,205.80 | 10,110.99 | 820,476.60 | 606.94 |
| Prob > Pearson $\chi^2$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.057 |
| N. of obs. | 51,646 | 51,648 | 51,655 | 51,646 | 51,655 |

Statistical significance: *=10%, **=5%, ***=1%. The Huber-White-sandwich estimator is employed. Heteroskedasticity robust standard errors (in parenthesis) are clustered at a sectoral level.

Here, we check whether our findings are affected by such firm-level omitted variable problem. We add a vector of firm-level controls to our regression model, following the argument that size, capital intensity and geographical location (as observed at the moment of the firm entry) are actually chosen by the new entrepreneurs in $t_{-1}$, whilst the ownership structure is determined in $t_0$. In particular, we consider the following additional variables at a firm-level: physical capital (*Physical_capital*: total value of tangible assets, including buildings, machinery and all other tangible assets), intangibles assets (*Intangibles*: total value of formation expenses, research expenses, goodwill and development expenses), total number of employees (*Employees*), capital intensity (*Capital_intensity*: physical capital to employees ratio), and the geographical location (*North_Italy, Centre_Italy, South_Italy*: three dummies registering the macro region in Italy - north, center, and south and islands - where the firm located its headquarter) to capture possible agglomeration externalities as suggested by Arando et al. (2012).[8] The resulting full model can be written as:

$$\Pr(y_{it} = 1) = f(\gamma_0 + \boldsymbol{\gamma_1}\mathbf{x}_{it} + \boldsymbol{\gamma_2}\omega_{it}) \tag{2}$$

where, as in model (1), $\mathbf{x}_{it}$ is the vector of our sectoral variables, while $\boldsymbol{\omega}_{it}$ is the vector of possibly relevant firm-level controls.

Basic coefficient estimates obtained from the augmented model regressions are reported in Table 5. On the one hand, size-related indicators (*Physical_capital, Intangibles* and *Employees*) are associated with statistically insignificant parameters, while capital-labor ratios (*Capital_intensity*) and the geographical location (*North_Italy* and *Centre_Italy, South_Italy* being the benchmark) have statistically significant coefficients. In particular, firms that show a relatively higher capital intensity at the moment of entry are less likely to choose a worker-owned ownership structure (coherently with the results of

[8] Agglomeration effects may be captured also by a control variable measuring the sectoral number of pre-existing cooperatives. Such a control, however, is likely to introduce endogeneity in our estimates, due to its correlation with the industry-level variables. Arando et al. (2012), moreover, have shown that agglomeration externalities at a sectoral-level tend to be statistically insignificant. Thus, in our model, we include only a control for geographical spillovers.

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**Table 6**
Robustness check: omitted variable bias (relative explanatory powers).

| Explanatory variables | Controlling for physical capital | Controlling for intangibles | Controlling for no. employees | Controlling for cap. intensity | Controlling for geo distribution |
|---|---|---|---|---|---|
| *Job_routineness* | 40.7 | 41.9 | 42.0 | 38.0 | 41.2 |
| *Work_heterogeneity* | 23.1 | 24.3 | 27.2 | 18.0 | 25.7 |
| *Profits_uncertainty* | 15.5 | 14.1 | 12.7 | 18.4 | 14.3 |
| *Monitoring_difficulty* | 15.5 | 14.1 | 13.6 | 18.8 | 12.6 |
| *Input_specificity* | 1.7 | 1.3 | 0.8 | 3.1 | 1.2 |
| *Finance_need* | 3.4 | 4.3 | 3.7 | 3.5 | 4.9 |

Each line reports the % of the pseudo-r2 of the full model explained by each explanatory variable across different model specifications. The Huber-White-sandwich estimator is employed and heteroskedasticity robust standard errors are clustered at a sectoral level, in all the models considered.

Podivinsky and Stewart, 2007 obtained with UK data), as well as firms locating their headquarters in the northern regions of Italy (this may suggest the presence of agglomeration effects). On the other hand, the estimated coefficients of the industry-level indicators remain stable across model specifications both in sign and statistical significance.

We then study the marginal effects of our sectoral variables, and re-run the augmented model regressions, excluding the sectoral indicators of interest once each in order to measure the relative explanatory power of each sectoral variable in the presence of the firm-level controls above mentioned.

A synthesis of the final results is presented in Table 6 (for reasons of space we do not report the full set of regression batteries, but only the final explanatory powers output). Relative explanatory powers are shown stable across different model versions and only slightly different from those obtained when firm-level controls are excluded. Specifically, Table 6 shows that, once the control variables are included, *Job_routineness* explains from 38.0% to 42.0% of the full model pseudo-R2, *Work_heterogeneity* from 18.0% to 27.2%, *Monitoring_difficulty* from 12.6% to 18.8% and *Profits_uncertainty* from 12.7% to 18.4%. Again, the explanatory power of *Finance_need* and *Input_specificity* is very small.

### 5.2. Interaction effects

In this sub-section, we perform an additional robustness check, by looking at the effects of our industry-level variables interacted with the labor-to-capital structure shown by the new firm at the moment of entry.

In fact, if the theoretical arguments here examined are correct, the effects of the relevant industry-level indicators should be disproportionately larger for labor intensive firms. Specifically, if the choice of the ownership structure is influenced by industry characteristics, shaping average human capital specificity, worker risk aversion, monitoring costs and decision-making problems, then the impact of these factors should be relatively larger for those new firms that, at the moment of entry, will employ a relatively high number of workers with respect to capital. Thus, from an empirical point of view, the presence of such interaction effects (again, following the argument that the labor-to-capital ratio is chosen by new entrepreneurs in $t_{-1}$, whilst the ownership structure is determined in $t_0$) can allow to further test the robustness of the statistical relationships that we have detected.

We add to the regression model a firm-level measure of labor intensity (*Labor_intensity*: employees to total capital ratio), measured at the moment of the new firm creation, and a vector of interaction terms obtained by interacting *Labor_intensity* with each of the available industry-level indicators. Formally, the regression logit model now is:

$$\Pr(y_{it} = 1) = f(\delta_0 + \boldsymbol{\delta_1}\mathbf{x}_{it} + \boldsymbol{\delta_2}\mathbf{x}_{it} \times Labor\_intensity_{it} + \delta_3 Labor\_intensity_{it}) \quad (3)$$

where, again, $\mathbf{x}_{it}$ is the vector of our sectoral variables. We run model (3) repeatedly, excluding the industry-level indicators once each in each round and finally running the full model version, in order to calculate the marginal effects and to measure the percentage of the pseudo-R2 of the full model explained by each sectoral explanatory variable.

Results are reported in Table 7. The marginal effects of the non-interacted industry-level indicators are strongly stable across model specifications and similar to those obtained when interaction terms are excluded (Table 4). More precisely, the analysis of the percentage of the pseudo-R2 of the full model explained by each explanatory variable reveals, again, that human capital specificity (GHM theory) and workers heterogeneity (Hansmann theory) explain a large share of the heterogeneity of labor-owned firm entry across industries, while other dimensions, such as limited worker wealth, have a negligible effect.

Moreover, we find that the interactions between industry-level characteristics and the firm-level labor intensity tend to show statistically significant marginal effects with the same sign as the non-interacted industry-level indicators. Under the assumption that the labor-to-capital ratio is chosen ex-ante by the new entrepreneurs, this corroborates the statistical validity of our estimates. Specifically, the effects of the considered industry-level characteristics (in particular, of those which are shown to be statistically relevant also when taken in isolation) are disproportionately larger for firms that, at the moment of entry, employ a relatively larger number of workers with respect to total capital.

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**Table 7**
Robustness check: marginal effects and relative explanatory powers with interaction terms.

| Explanatory variables | Abridged model version [1] | Abridged model version [2] | Abridged model version [3] | Abridged model version [4] | Abridged model version [5] | Abridged model version [6] | Full model | % of the pseudo-r2 of the full model explained by each variable |
|---|---|---|---|---|---|---|---|---|
| | dy/dx | dy/dx | dy/dx | dy/dx | dy/dx | dy/dx | dy/dx | |
| *Job_routineness* | | −0.0008** | −0.0013*** | −0.0012*** | −0.0012*** | −0.0013*** | −0.0012*** | 46.2 |
| | | (0.0004) | (0.0004) | (0.0004) | (0.0003) | (0.0003) | (0.0004) | |
| *Work_heterogeneity* | −0.0005* | | −0.0014*** | −0.0011** | −0.0014*** | −0.0009** | −0.0011*** | 19.4 |
| | (0.0003) | | (0.0004) | (0.0005) | (0.0004) | (0.0004) | (0.0004) | |
| *Profits_uncertainty* | −0.0008** | −0.0008*** | | −0.0006* | −0.0006** | −0.0006** | −0.0006** | 15.1 |
| | (0.0004) | (0.0003) | | (0.0003) | (0.0003) | (0.0003) | (0.0003) | |
| *Monitoring_difficulty* | −0.0006*** | −0.0006** | −0.0005** | | −0.0006** | −0.0005** | −0.0006** | 14.2 |
| | (0.0003) | (0.0003) | (0.0002) | | (0.0003) | (0.0002) | (0.0003) | |
| *Input_specificity* | −0.0002 | −0.0001 | −0.0001 | −0.0002 | | −0.0001 | −0.0001 | 0.9 |
| | (0.0005) | (0.0005) | (0.0004) | (0.0005) | | (0.0004) | (0.0005) | |
| *Finance_need* | 0.0007 | −0.0001 | 0.0003 | 0.0001 | 0.0002 | | 0.0003 | 3.1 |
| | (0.0006) | (0.0006) | (0.0005) | (0.0005) | (0.0005) | | (0.0006) | |
| *Job_routineness* × *Labor_intensity* | | −0.0045** | −0.0073*** | −0.0072** | −0.0064** | −0.0048** | −0.0013*** | |
| | | (0.0021) | (0.0028) | (0.0028) | (0.0027) | (0.0253) | (0.0004) | |
| *Work_heterogeneity* × *Labor_intensity* | −0.0006 | | −0.0015** | −0.0012* | −0.0011** | −0.0014** | −0.0063** | |
| | (0.0004) | | (0.0006) | (0.0006) | (0.0006) | (0.0007) | (0.0026) | |
| *Profits_uncertainty* × *Labor_intensity* | −0.0008** | −0.0009** | | −0.0005*** | −0.0002** | −0.0004* | −0.0005** | |
| | (0.0004) | (0.0004) | | (0.0002) | (0.0001) | (0.0002) | (0.0002) | |
| *Monitoring_difficulty* × *Labor_intensity* | −0.0024 | −0.0014** | −0.0018 | | −0.0019 | −0.0042** | −0.0018 | |
| | (0.0023) | (0.0007) | (0.0013) | | (0.0014) | (0.0018) | (0.0012) | |
| *Input_specificity* × *Labor_intensity* | 0.0003 | 0.0007 | −0.0001 | 0.0002 | | 0.0001 | 0.0003 | |
| | (0.0002) | (0.0005) | (0.0001) | (0.0002) | | (0.0002) | (0.0003) | |
| *Finance_need* × *Labor_intensity* | 0.0002 | −0.0007** | −0.0003** | −0.0005*** | −0.0003*** | | −0.0005** | |
| | (0.0002) | (0.0003) | (0.0001) | (0.0002) | (0.0001) | | (0.0002) | |
| *Labor_intensity* | 0.0034 | 0.0065*** | 0.0109*** | 0.0089*** | 0.0098*** | 0.0108** | 0.0095*** | |
| | (0.0026) | (0.0025) | (0.0039) | (0.0034) | (0.0036) | (0.0043) | (0.0035) | |
| Constant (coeff.) | −6.045*** | −6.054*** | −6.111*** | −6.122*** | −6.127*** | −6.024*** | −6.115*** | |
| | (0.209) | (0.189) | (0.170) | (0.234) | (0.198) | (0.203) | (0.201) | |
| Estimation method | logit | logit | logit | logit | logit | logit | logit | |
| Pseudo R2 | 0.0232 | 0.0319 | 0.0333 | 0.0336 | 0.0379 | 0.0372 | 0.0382 | |
| Log ps.-likelihood | −926.58 | −918.39 | −917.05 | −916.72 | −912.66 | −913.32 | −912.41 | |
| Wald $\chi^2$ | 767.64 | 605.47 | 246.45 | 250.09 | 465.16 | 716.73 | 588.65 | |
| Prob > Wald $\chi^2$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| Pearson $\chi^2$ | 54262.73 | 54567.01 | 51685.76 | 57457.33 | 54834.57 | 54532.40 | 55620.73 | |
| Prob > Pearson $\chi^2$ | 0.000 | 0.000 | 0.015 | 0.000 | 0.000 | 0.000 | 0.000 | |
| N. of obs. | 51312 | 51312 | 51312 | 51312 | 51312 | 51312 | 51312 | |

Statistical significance: *=10%, **=5%, ***=1%. Marginal effects are calculated with respect to one-standard deviation changes. The Huber-White-sandwich estimator is employed. Heteroskedasticity robust standard errors (in parenthesis) are clustered at a sectoral level.

It is worth noting, finally, that the marginal impact of the non-interacted labor intensity variable is positive and statistically significant, suggesting that labor intensive enterprises are more likely to adopt a labor-owned ownership structure when they enter the market.

### 5.3. Disentangling monitoring and agency costs

In our basic estimates, we analyzed the Alchian and Demsetz (1972) theory by focusing on monitoring issues, as captured by the average degree of ownership concentration at a sectoral level, and following the argument that more concentrated ownership structures tend to emerge in response to more severe monitoring problems encountered by shareholders in their relationship with managers and, in turn, with employees. In particular, the Alchian and Demsetz's hypothesis predicts that labor-owned firms face a disadvantage compared to capital-owned firms, because the former tend to suffer from higher free riding problems due to the absence of centralized supervisors holding both monitoring duties and residual earning rights.

On the other side, the opposite may also arise in a principal-agent framework, with worker cooperatives showing an advantage with respect to capitalist firms. In labor-owned firms, in fact, all members are equal (i.e., they are both owners and workers) and agency costs tend to be significantly reduced. Thus, worker cooperatives may be better able to cope with asymmetric information problems and to circumvent the organizational obstacles that capitalist firms, with a hierarchical structure, typically encounter due to the agency nature of the relationships between their members (Bai and Xu, 2001; Bowles and Gintis, 2008).

From both points of view, monitoring of effort is a crucial issue. However, in the pure team production theory of Alchian and Demsetz worker cooperatives should tend to refrain from entering market environments characterized by high monitoring costs in the shareholder/manager-employee relationship, while, according to a more general principal-agent framework, capital-owned firms should face more severe conflicts of interest between members in markets with high asymmetric information.

In this sub-section, we try to tackle this issue by including an additional variable in our model, aimed at separating out possible agency costs effects from monitoring difficulty effects. Specifically, we construct a proxy indicator of agency problems at a sectoral level, based on average firms' age. A large literature has clarified that a firm's age is associated in predictable ways to the extent of agency costs (see, generally, Frank and Goyal, 2008; Hall, 2009; Hall and Lerner, 2010 and Belloc et al., 2016). Previous studies on new firms' governance have established that sectors populated by younger firms tend to show, on average, higher asymmetric information problems because members of young firms may not use reputation as an effective signal to address agency issues. Employees in young firms may lack a track record through which they can

**Table 8**
Robustness check: disentangling monitoring and agency costs.

| Explanatory variables | Coeff. | dy/dx | % of the pseudo-r2 of the full model explained by each variable |
|---|---|---|---|
| *Job_routineness* | −0.552*** | −0.0013*** | 42.2 |
| | (0.198) | (0.0004) | |
| *Work_heterogeneity* | −0.551** | −0.0013*** | 25.2 |
| | (0.216) | (0.0004) | |
| *Profits_uncertainty* | −0.244* | −0.0005* | 12.7 |
| | (0.129) | (0.0003) | |
| *Monitoring_difficulty* | −0.269** | −0.0006** | 13.8 |
| | (0.128) | (0.0003) | |
| *Input_specificity* | −0.082 | −0.0002 | 1.2 |
| | (0.215) | (0.0005) | |
| *Finance_need* | 0.205 | 0.0004 | 4.1 |
| | (0.245) | (0.0006) | |
| *Agency_problems* | 0.051 | 0.0001 | 0.8 |
| | (0.114) | (0.0002) | |
| Constant | −6.048*** | – | – |
| | (0.198) | – | – |
| Estimation method | logit | – | – |
| Pseudo R2 | 0.0214 | – | – |
| Log ps.-likelihood | −975.25 | – | – |
| Wald $\chi^2$ | 25.87 | – | – |
| Prob > Wald $\chi^2$ | 0.000 | – | – |
| Pearson $\chi^2$ | 3417.78 | – | – |
| Prob > Pearson $\chi^2$ | 0.000 | – | – |
| N. of obs. | 51,575 | – | – |

Statistical significance: *=10%, **=5%, ***=1%. The Huber-White-sandwich estimator is employed. Heteroskedasticity robust standard errors (in parenthesis) are clustered at a sectoral level.

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signal trustworthiness and compliance attitudes to managers and shareholders. Moreover, young firms tend to have higher growth rates, which increase their opacity in the internal management and work organization. Sectors dominated by mature firms, instead, have larger stocks of common knowledge, which they have accumulated through past experience of long-term employees and more standardized procedures.

To proxy agency costs, we therefore construct a new indicator (*Agency_problems*) as the inverse of the average firms' age at a 4-digit sectoral level obtained from the full AIDA sample and use it as an additional explanatory variable in our basic model (1). Results are reported in Table 8.

On the one side, we obtain estimated coefficients, marginal effects and relative explanatory powers largely similar to those showed in our basic estimation analysis, including the effect of *Monitoring_difficulty* (again, associated with a negative and statistically significant effect, explaining the 13.8% of the full model pseudo-R2). On the other, the *Agency_problems* indicator results to be associated with a positive coefficient, as expected, but with both low statistical significance and low explanatory power. Thus, while we can conclude that the possible disentangling between pure monitoring effects and agency problems effects does not affect our main results, the question of how agency issues can be measured and to which extent they may affect worker-owned firm creation remains open and is left for future research.

## 6. Conclusions

Our analysis is the first empirical exercise attempting to infer the relative contribution of the main theories of ownership to explaining labor-owned versus capital-owned firm entry. In particular, we focused on the cross-sector heterogeneity of worker cooperatives entry rates in manufacturing industries in order to identify the main obstacles to labor-ownership of firms at a sectoral level. We find that human capital specificity, workforce heterogeneity, monitoring difficulty and profits uncertainty explain the most of cross-sector heterogeneity in labor-owned firms distribution, while physical inputs specificity and average industry-level financial needs play a mild role.

These results have relevant implications for both the institutional economics research and the policy debate. On the one side, our estimates suggest that the there is no on-size-fits-all argument explaining labor-owned firm entry and that different causal mechanisms play a role. Taken together, these findings show that the distribution of labor-owned firms across sectors is endogenous to several features of technology and production processes, and they point to the importance of modeling this source of endogeneity when worker cooperatives performance is analyzed comparatively to that of their capital-owned counterparts. On the other side, the identification of which factors tend to stimulate labor-owned firm entry may help the elaboration of more effective initiatives for the implementation of co-determination mechanisms and fiscal policies aimed at supporting cooperative modes of firm organization.

It is interesting to notice that, over the 5-year pre-crisis window analyzed in this paper, sectors showing a relatively higher density of new worker cooperatives have experienced relatively lower and more stable growth rates. OECD (2016) data report, for the Italian manufacturing sectors, an average annual growth rate of the gross output equal to 3.07% [std.dev. = 4.85] over the 2003–2007 period. Nevertheless, while, for example, the tobacco sector (where labor-owned firms are virtually absent) has shown a decline in output equal to −12.07% [std.dev. = 20.20], over the same period the printing and reproduction sector (which is the manufacturing industry with the highest share of worker cooperatives) has reported a 1.64% [std.dev. = 0.87] average annual growth rate. Also other sectors relatively attractive for labor-owned firms, such as the paper products and the wood products industries, show both a positive (and relatively low) average growth rate and a low variability of output (2.79% [std.dev. = 3.52] and 2.07% [std.dev. = 3.68], respectively). At the same time, other sectors less attractive for worker-owned firms have shown very high and unstable growth rates; this is the case, for instance, of the coke and petroleum industry, with a 15.14% [std.dev. = 13.00] growth. This descriptive evidence may be masking many other effects, however it might also suggest a link between the presence of worker cooperatives and economic stability at an industry level. The analysis of a possible causal relationship between labor-ownership of the firm and resistance to economic shocks goes beyond the scope of this paper; nonetheless, we believe that the issue of how democratic firms interact with the larger economic environment and how they respond to economic instability deserves further attention both by economic scholars and policy makers.

Although our findings are suggestive, there is much that remains to be done.

First, the empirical analysis conducted in this paper is based on labor-owned firm entry in Italy. The general validity of our findings should be corroborated with the use of international data over larger samples of countries. This is important, in particular, both for the academic debate on the empirical significance of the theories of the firm ownership and for policy-making.

Second, future research should consider elaborating *ad hoc* proxies for the theoretical arguments considered in the literature, in order to further test the robustness of the empirical relationships analyzed in this study. Moreover, original instruments should be elaborated for analyzing the extent to which average technological features of sectors tend to be affected by the way workers sort among occupations and types of firm (see the intuitions of Burdín, 2016). While in this paper endogeneity concerns are circumvented by partly using time-invariant sectoral variables and US based indicators, the study of the two-way relationship between heterogeneous firm entry and technology dynamics should be considered an interesting area for future research both at a firm-level and in the comparative analysis of economic systems.

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