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Entrepreneurs' education and different variable pay schemes in Italian firms

Mirella Damiani* and Andrea Ricci**

Abstract

In this paper, we investigate the influence of the education of entrepreneurs, which we hypothesise to be a signal of talent, on the adoption of variable pay (VP) schemes in the Italian economy.

We estimate to what extent differences in the diffusion of VP between Italian firms reflect differences in the quality of entrepreneurs. Our estimates, which we obtained by taking both endogeneity and unobserved heterogeneity into account, validate hypotheses about the direct positive effects of entrepreneurs' education on the adoption of VP schemes. Furthermore, we ascertain the role of entrepreneurs' education by examining its influence on the choice between different types of VP bonuses at the individual, group, or establishment levels. Our results suggest that highly educated entrepreneurs are more likely to use individual or collective forms of VP schemes at the establishment level rather than team VP incentives.

JEL Classification: J33; I20

Keywords: Variable pay, Education

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1. Introduction

Much of the recent applied research has shown that substantial productivity differences between firms are explained by differences in their ‘managerial quality’ and their recourse to good management practices (Bloom and Van Reenen, 2007). Practices that are ‘good’ for firm productivity include incentives, and thus, pay and bonuses that reward effort and select employees with higher ability, as shown by the most representative empirical studies of this literature (see Bryson et al. 2012 for a recent survey). Indeed, a vast number of contributions have highlighted the ‘power of incentives’ (Lazear, 2000; Prendergast, 1999) and paid close attention to interactions with other packages of effective workplace strategies. This body of work has given rise to many contributions that explore the ‘value of the complementary role of human resource practices’ on nationally representative samples of enterprises (Black and Lynch, 2001) or insider econometric case studies within firms (Ichniowski and Shaw, 2003).

A whole set of determinants, such as firm specialisation and size, technology, human capital endowments of the workforce, and trade-union influence, have been considered as key factors that underlie a typical firm’s propensity to introduce incentives. However, the decisional process behind the adoption of these ‘good’ practices has not been examined as thoroughly. Indeed, little is known about decisions on these practices, for instance, on collective bonuses and profit sharing, which was recently argued for by Poutsma, Blasi and Kruse (2012) in their introductory contribution to a special issue on this topic¹.

In particular, few available studies consider the quality of entrepreneurs in terms of their education as a proxy for unobserved leader-specific traits and as a driving force behind the adoption of variable pay (VP).² The lack of evidence on this issue is rather surprising because a high level of human capital of entrepreneurs is expected to translate into modern management practices and personnel policies that in turn favour the adoption of performance-related-pay and other forms of wage flexibility at the firm level (Bloom and Van Reenen, 2011). These policies bring to the frontline the role of the entrepreneur, who may exert his influence by affecting a whole set of economic activities that create value, as originally assessed by Baumol (1968). Moreover, Baumol (1990) also paid attention to those entrepreneurial actions that do not increase the firm’s value but lead to the capture of rents. However, following Lazear (2012) we focus exclusively on those aspects of leadership that enhance productivity, such as the implementation of incentives.

In this paper, we investigate the diffusion of variable pay (VP) schemes in Italian manufacturing and service firms by focusing on the influence of the education of entrepreneurs with respect to the adoption of these schemes. One of the features that represents a major trait of the Italian economy is its great fragmentation into small firms, and in this economy, owners of small firms usually adopt

¹ For recent contributions on profit sharing, see the Special Issue on ‘Employee share ownership and profit sharing in different institutional contexts’, which can be found in *The International Journal of Human Resource Management*, 2012, Vol. 23, No. 8.

² Bandiera et al. (2011) use the education of managers as a measure of their talent but consider this factor from a different perspective: they explore the match between firms and managers and conclude that highly talented and less risk-averse managers tend to match with firms that value these characteristics the most.

firm strategies as independent entrepreneurs. In contrast, external managers are less common. We expect that management skills are important leadership features for successful entrepreneurs and that such skills lead to a wider adoption of VP. In our analysis, following the literature on personnel economics, we hypothesise that education is a ‘signal of talent’ (Lazear and Shaw, 2007) and evaluate to what extent differences in the diffusion of VP between Italian firms reflect differences in the quality of entrepreneurs.

We test this hypothesis by performing an empirical analysis based on a large sample of Italian firms for which we have data on entrepreneurs’ levels of education and age; additionally, we have a rich set of information about business activities (innovation, exports, training, and the use of fixed-term contracts) and the workforce’s composition (by gender and education). In particular, we use data from the Employer and Employee Survey (EES) for the year 2010, which were provided from ISFOL (the Italian Institute for the Development of Workers’ Professional Training) on a sample of over 20,000 Italian firms that operate in both manufacturing and the service sector. By using micro-data from a representative sample of Italian firms, we contribute to highlight the PRP experience in Italy, whereas all of the previous research has been restricted to large companies, selected sectors or particular areas in the north of the country (see Amisano and Del Boca, 2004; Origo, 2009).

Thus, our major contribution comes from a broader evaluation of the role of entrepreneurs’ education on the intensity of variable pay. To our knowledge, this issue is considered for the first time in this paper for the whole sample of Italian firms, not only for large firms, but also small enterprises. Second, we ascertain the role of entrepreneurs’ education by looking at its influence on the choice of different incentives and bonuses at the individual, group, and establishment levels.

Finally, our estimates, which were obtained by taking both endogeneity and unobserved heterogeneity into account, validate our hypotheses about the direct positive effects of education on VP variables. Furthermore, our estimates may be useful for addressing policy concerns given that the Italian system of industrial relations is currently under pressure and new measures to promote growth and solve the deep Italian structural crisis are being debated. These measures include the increased diffusion of wage-incentive schemes to tailor wages to firms’ specific needs and promote productivity growth, and according to our estimates, enhance the selection and promotion of high-quality entrepreneurs.

This paper is organised as follows: Section 2 briefly discusses the related literature, Section 3 presents the Italian data that were used and descriptive statistics, Section 4 illustrates the econometric framework and estimation results, and Section 5 concludes.

2. Background

2.1. Literature

The primary goal of this paper is to examine the diffusion of VP schemes and the role of the educational profile of the individual entrepreneur as a potential determinant of these schemes, which are offered at the individual, team, or establishment level. This study is thus related to two

main fields of the literature: the first strand concerns individual and collective incentives and examines both positive and dysfunctional responses to these practices; the second relevant strand focuses on the role of the quality of entrepreneurs in formulating personnel policies that may contribute to the proper selection of incentive schemes.

Individual incentives

Much of the literature on wage incentives is grounded in agency theory. Its main model surmises that individual bonuses that are linked to performance may be an efficacious device to motivate individual employees. A large number of studies (which have been appraised by Prendergast (1999)) note that the ‘power of incentives’ depends above all on sorting and motivation. The adoption of variable contracts that link rewards to performance results motivates employed workers to exert more effort, and when there is heterogeneity among the workers, permits firms to attract workers of higher skill who produce more with the same level of effort (Lazear, 2000). Indeed, most of the studies that estimate the separate effects of incentives and selection show that around one-third of the observed increases in performance arise from attracting workers with higher abilities³ (Prendergast, 1999, section 2.1.3).

However, a number of controversial issues have emerged in the literature, and most of these issues are related to the difficulties of objective performance measurement (Holmstrom and Milgrom, 1991; Baker, 1992) and the complexity of correctly rewarding effort in settings where parties (the principal and the agent) cannot write enforceable contracts (Baker, 1992).

Another key issue in this literature is the trade-off between risk and incentives: a provision of pay-per-performance imposes additional risk on workers and leads the entrepreneur to provide substantial risk compensation through higher wages. In this context, VP schemes are less frequent when workers are more risk-averse; or noisy performance measures are more frequent (Gibbons and Murphy, 1990). Performance measures can be improved by making them conditional on an employee’s relative performance rather than absolute standards; in this way, firms can use the performance of a group of workers to filter out the effect of shocks that are common to the whole group, and thus, firms can lower the risk imposed on individual workers (Gibbons and Murphy, 1990).

However, when wages are linked to relative performance, employees may underperform, as employees whose efforts impose negative externalities on their fellows internalise the fear of retaliation; as empirically found by Bandiera et al. (2006).

Other dysfunctional responses to incentives are formalised by the ‘multitask principal-agent model’ that better represents the multi-dimensional tasks of employees in environments characterised by competing worker activities (Holmstrom and Milgrom, 1991). Under these circumstances, a firm may not be able to correctly measure the output of all tasks. Thus, there may

³ Lazear (2000) found in his case study that those pay settings that changed from rewards based on input measures to payments related to output outcomes induced dramatic improvements; moreover, half of these improvements were explained by the attraction of workers of higher ability.

be a misallocation of activities towards those that are more highly compensated and away from those activities that earn less compensation, which would cause undesirable trade-offs across tasks.

More generally, agents can ‘game’ the compensation system (Backer, 1992)⁴, especially when explicit incentive contracts cannot completely specify all relevant aspects of worker behaviour; in these settings, the importance of subjective evaluations (i.e., measures that are not verifiable by a third party) emerge (Baker, Gibbons, and Murphy, 1994). Thus, decisions on pay are under the discretion of superiors in the hierarchy, which might cause favouritism or discretionary behaviour (Prendergast and Topel, 1996). To prevent subjective assessments giving rise to biases, a more holistic view of performance is important, and the quality of leaders comes to the forefront.

Team incentives

Measurement problems are particularly relevant in settings where firm performance is the result of the joint contributions of many individuals and individual performance is difficult to measure (Alchian and Demsetz, 1972). It introduces the importance of team production and group incentives. One main aspect emerges from these incentives: the very fact that incentives are collective may induce employees to free-ride on the efforts of others, which would cut productivity. On the positive side, group incentives may lead to decentralised monitoring due to peer pressure and shame norms (Kandel and Lazear, 1992), which would mitigate opportunistic behaviour. However, the evidence does not always support these positive impacts and some empirical studies show that team-based compensations decrease the performance of those who are more productive (Weiss, 1987; Hansen, 1997) and that team production is more attractive to the less able workers, which causes adverse selection effects (Prendergast, 1999).

Other arguments against team incentives, i.e., incentives that appear to violate the standard agency theory, have come from such authors as Tirole (1986), who show the possibility of collusion among agents. This possibility makes a bureaucratic system superior to collective incentives. An alternative is represented by employee financial participation, as shown below.

Collective incentives and employee financial participation

When the group whose performance is being compensated is the firm or the establishment, group performance pay becomes financial participation (Bryson et al. 2012). Employees in firms with ‘shared capitalism’ (i.e., those firms with profit-sharing and/or employee share ownership) respond more readily to the shirking of their colleagues. Indeed, the provision of group incentives may lead to superior Nash equilibria, which are associated with high levels of productivity due to increased cooperation and lower monitoring costs (Fitzroy and Kraft, 1987). More generally, a plausible way to quell free-riding attitudes is to promote a cooperative culture and employee participation in

⁴ The model of Baker (1992) shows a situation where a firm wants to maximise a non-contractible objective (say, V) but can write a compensation contract on another measure (call it P) that is only imperfectly correlated with V . Thus, the employee who has private information about how his own effort affects both P and V can exert effort that has a large effect on P but not V , which would imply that the compensation contract drives both effort and gaming at the same time.

decision-making; similar to financial participation, cooperation and participation is a policy that contributes to increasing commitment (Blinder, ed., 1990; Jones and Pliskin, 1991; Kruse et al. 2010).

Profit sharing is held to generate beneficial effects in the form of higher effort and work quality, higher commitment and incentives due to firm-specific human capital, better teamwork, greater workforce cooperation in adapting to new technology and organisational changes, lower labour turnover and longer average tenure (Jones and Pliskin, 1991). Indeed, a growing body of research suggests on empirical grounds that the profit sharing-productivity relationship may be positive, as shown by the first report of the experience in EC countries (Uvalic, 1991) as well as other studies on major industrialised economies (Pérotin and Robinson, 2003). The recorded experiences in more than twenty countries offer empirical evidence of the positive or at least neutral effects of these policies on productivity, and the discrepancies may be attributed ‘to differences in participatory practices in firms with profit-sharing plans’ (Pérotin and Robinson, 2003, p. 22).

Recent advances in this field highlight the importance of taking into account ‘actors’ decisions on different levels in shaping the form and the use of financial participation’ (Poutsma, Blasy and Kruse, 2012, p. 1517). To begin to develop these arguments, we consider the role of a crucial actor: the entrepreneur.

Incentives and entrepreneurship

From our short review, it emerges that various distortions in individual and collective incentives that might limit their usage are clearly documented in many studies; these problems are especially relevant when such incentive schemes are badly designed. However, the overall evaluation offered by the survey carried out by Bloom and Van Reenen (2011) is that ‘these distortions are not generally overwhelming’ and favourable arguments for the adoption of incentive pay prevail.

However, it is conceivable that a crucial aspect is represented by well-designed compensation systems that mitigate many of their own potential distortions and stimulate the adoption of effective practices. Our analysis is intended to explore how high-level skills and the education of the entrepreneur influence the adoption of good practices (which are represented by VP). To that end, a useful starting point is represented by the contribution of Lazear (2004), who proved that entrepreneurs have to perform many tasks and that ‘individuals who become entrepreneurs should have a more balanced investment strategy on average than those who end up specialising as wage and salary workers’ (ibidem, p. 209)⁵. One reasonable indicator of these general skills is captured by the level of education.

⁵ In Lazear’s model, any given amount of availability x takes the form of amounts of ability of types a and b ; i.e., $x=a+b$. A generalist leader with balanced levels of a and b is more likely to choose the correct action when he faces a random problem. A random problem is a problem that can be solved using ability a , which is encountered with a probability of λ , or a problem that can be solved using ability b , which occurs with a probability of $(1-\lambda)$. The probability of successfully making a good decision (that has a value k) is a function (G) of the abilities and the expected value of a decision; this function is as follows:

Indeed, following the seminal works of Mincer (1974) and Becker (1975), education is acknowledged as one of the most relevant components of general human capital. Furthermore, education can be tested as an important source of skills, problem-solving ability, discipline and motivation (Ucbasaran, Westhead and Wright, 2012). Thus, there are a number of channels through which the education of entrepreneurs may potentially lead to better-designed workplace practices and thereby affect the propensity to adopt VP.

First, attending school provides entrepreneurs a broad and balanced set of observable and unobservable skills and capabilities that are valuable both for introducing the best practices in human resource management and for operating efficient, complex economic organisations. For instance, Garicano and Hubbard (2005) find evidence of positive sorting effects in law firms by measuring lawyers' skills based on their education and experience, whereas Cooper et al. (2004) show that general human capital, which is represented by the entrepreneur's education, is an important factor for predicting the success of new ventures. Baptista et al. (2013) performed wage regressions for small Portuguese firms and showed that a higher level of education and experience in the entrepreneur implies a higher wage premium for workers. In addition, they show that workers' wages reflect the value of the match with an entrepreneur's skills. Thus, entrepreneurial skills have an impact not only on job creation but also on the quality of the jobs that are created.

Furthermore, the education of entrepreneurs is valuable mainly in a period of technological and organisational changes. In such a period, these changes call for a diffusion of variable pay, for instance, following the diffusion of ICT – companies (Bresnahan, et al. 2000) or changes in the formal authority structure, e.g., in the 'flattening firm' (Rajan and Wulf, 2006).

Secondly, well-educated entrepreneurs are likely to have a deeper knowledge of those modern management practices that assign increasing importance to the adoption of holistic forms of workplace organisation, including self-managed teams, multi-tasking and the delegation of decision rights. In accordance with theories of super-modular optimisation and complementarities (Milgrom and Roberts, 1995), these bundles of strategies reveal a way to correct those inefficiencies that are related to rewarding workers for completing complex jobs that cannot be regulated by explicit contracts, and therefore, that call for implicit agreements (Baker, Gibbons, and Murphy, 1994). Among these agreements, it is plausible to include wage bonuses at the firm level that are linked to enterprise results, and this setup is captured in our analysis in the form of VP schemes.

A last set of considerations is related to the choice by the entrepreneur of individual versus group incentive schemes. One strand of the literature emphasises how high-quality leadership is expected to encourage cooperation and trust between individuals, as stressed by the literature on behavioural economics. Thus, the propensity of highly educated entrepreneurs to use variable contracts reveals a commitment device that minimises opportunistic behaviour and favours reciprocity at the workplace. As a related argument, notice that a significant share of workers have a preference for

Value = $[\lambda G(a) + (1 - \lambda) G(x-a)]k$. If $G(\cdot)$ is concave, then the first-order condition of the maximisation problem yields a maximum by diversification. At very high levels of ability, the G function is certain to be concave, and as shown by Lazear, diversified abilities are preferable.

fairness that leads them to care about others' wages, as shown by Kahneman et al. (1986), Fehr and Gächter (2000) and their laboratory experiments. In our analysis, broad-based employee-financial participation, i.e., bonuses paid at the firm level, may guarantee an equal split that motivates workers and balances the negative side-effects of opportunism that are caused by free-riding. One important aspect of profit-sharing firms' human-resource-management strategies may be offering equal-opportunity practices that can reduce existing inequalities (Pérotin and Robinson, 2003).

Of course, there are a number of other direct and indirect mechanisms through which the schooling level of entrepreneurs may potentially affect the internal labour market, organisation and particularly wage incentives. However, in this paper we focus on how the education level of entrepreneurs captures a multidimensional set of observable and unobservable skills as well as behavioural traits that are expected to be positively associated with both the overall use of VP and the specific design of VP incentives, which can be offered at the individual, team or establishment level.

Furthermore, along with the education of entrepreneurs, our rich dataset allows us to introduce a number of control variables that have been considered relevant in the related literature. First, we include a corporate-governance variable to take into account the situation when a firm is run by owners or by external managers, as the separation between ownership and control may significantly influence the choice of firms' strategies, as widely debated in the survey paper of Shleifer and Vishny (1997).

In addition, in conformity with related studies, we introduce the sector and firm size (Brown, 1990), firms' geographical locations and export strategies (as in the literature reviewed by Bernard et al. 2007), the presence of unions (Black and Lynch, 2001), and training (Gielen, 2011). Finally, we consider technology and innovation that may significantly influence workplace organisation, as shown in Bresnahan, Brynjolfsson and Hitt (2002). In sum, our rich dataset allows us to examine the influence of entrepreneurs' education, control for a wide spectrum of covariates and undertake a comprehensive evaluation of VP in the recent experience of Italian firms.

2.2. The Italian case

Italy is characterised by a two-tier bargaining regime that was established by the July 1993 National Income Agreement. According to this agreement, the Italian institutional setting is characterised by wage contracts at the sectoral level that link wages to the target inflation rate, whereas decentralised bargaining should distribute wage premiums that are linked to productivity or firm results. This institutional setting should have provided sufficient space for wage compensation schemes that are linked to efficiency gains to promote both the reorganisation of and innovation in productive processes. However, the few empirical works that highlight the degree of diffusion of incentive schemes that are offered at the firm level reveal a limited diffusion of these practices.

A number of official studies have examined the application of the bargaining rules regarding decentralised negotiation that were introduced by the 1993 Agreement. The first official national survey on employee financial participation was undertaken in 1997 by the Italian Statistical Institute

(ISTAT). This survey showed that whereas the number of workers involved in financial participation schemes in 1995-96 was approximately 23% of the total population of Italian workers, individual production bonuses were paid to only 12.5% of employees. Because ISTAT has never replicated its 1999 survey, it remains a one-time inquiry.

Other sparse and fragmented information has been made available from other sources over the last decade. Although the Bank of Italy never performed any specific investigations, it integrated some questions on the incidence of decentralised agreements and bonuses linked to enterprise performance into its Invid questionnaire (which was created to explore different economic issues). The responses to these questions provide evidence of the declining importance over time of local bargaining and the marginal importance of VP, as in 2008 VP represented only 4% of the total compensation package (Casadio, 2010).

Two international surveys provide a comparative perspective: the CRANET, which is an e-survey of a sample that was selected randomly from the population of companies with at least 200 employees, and the European Working Conditions Survey (EWCS), which is a household survey that was conducted for 29 European countries (Lowitzsch et al., 2009). Both sources document an increasing percentage of employees and firms involved in VP schemes such as profit-sharing in European countries, but Italy is among the few exceptions to this trend.

However, the evidence described to date has been limited in terms of firm size and the sectors that were examined. This evidence may be enriched by the ISFOL survey, which we discuss below.

3. Data and descriptive statistics

3.1 Data

Our empirical analysis is based on information obtained by the Employer and Employee Survey (RIL) that was conducted by ISFOL in 2010 on a representative sample of 25,000 partnerships and limited firms that operated in the non-agricultural private sector.

The RIL survey collects a rich set of information about personnel organisation, industrial relations and other workplace characteristics. In particular, the RIL survey provides data on the educational levels and other demographic characteristics of entrepreneurs along with information on the intensity of VP. Indeed, from the dataset we know whether VP schemes are based on firm, group or individual performance. In addition, we have information on other firm personnel policies (such as the use of fixed-term contracts), industrial relations (which are captured by the presence of unions), productive specialisation and firms' strategies (i.e., their innovation and export activities) (see the Appendix for detailed definitions of all of the variables from RIL).

Furthermore, the RIL data allow us to perform an up-to-date analysis on a key (but almost unknown) feature of the Italian productive system: the behaviour of partnership firms. Actually, to the best of our knowledge there are no empirical studies based on rich information from representative samples of both limited and partnership firms in Italy that were sampled without any sectoral, geographical or dimensional limitations.

Given the focus of this paper, we exclude firms with fewer than five employees, and we apply a filter to retain only those firms that are characterised by a minimum level of organisational structure. Furthermore, we exclude firms with missing data on the key variables. Thus, the final sample over which the analysis is performed includes approximately 10,000 firms.

3.2 Descriptive statistics

Table 1 presents descriptive statistics for 2010. In our sample, 89% of the firms were run by families and only 1% were large firms (i.e., firms with more than 250 employees). In addition, even by excluding firms with fewer than five employees, we obtain that the majority of firms (nearly 70%) were in the class 5<the number of employees<15. From the data reported in Table 1, we have confirmation of the limited diffusion of VP: only 6% of the surveyed firms had a VP scheme in place in 2010, and after differentiating the different pay schemes, the highest value is the percentage of firms with VP bonuses at the establishment level (4%) and the lowest value corresponds to firms with team bonuses (1%).

The variable that is intended as a proxy for entrepreneurs' human capital is measured by educational degrees. In our sample, 23% of the firms had entrepreneurs with a college degree, 54% had entrepreneurs with an upper-secondary-level education, and 22% had entrepreneurs with a lower-secondary-level education. To capture additional aspects of the entrepreneurs' characteristics, we consider their ages and obtain that the majority of firms (60%) had entrepreneurs between 39 and 60 years old. The sectoral distribution of firms records its highest value for manufacturing firms (30%), followed by Retail and Wholesale Trade firms (22%).

Additional characteristics offer a profile of the majority of Italian enterprises that were not involved in innovation strategies (only 40% and 32% of firms had undertaken product and process innovation, respectively, in the three years before the survey) and were not exposed to international trade (only 24% were exporters). Finally, for the workforce characteristics, Table 1 shows that the share of trained workers was only approximately 20% of the total employees and only 9% of employees had a tertiary level of education. Furthermore, the share of workers with fixed-term contracts represented 14% of the total workforce in 2010.

4. Econometric analysis

4.1 The econometric strategy

Our research question concerns the role of the entrepreneur's education on the adoption of incentive schemes. The first decision is whether to operate a scheme at all; the second choice, on which entrepreneurs have considerable discretion, is the selection among the different forms of VP.

Thus, our econometric analysis is begun by estimating different specifications of the following equation:

$$(1) \quad CP_i = \alpha \cdot employer_educ + \beta \cdot X_i + \delta \cdot Y_i + \varepsilon_i$$

where the dependent variable VP_i is the adoption of a variable pay scheme of any type in firm i , $entrepreneur_educ$ is a dummy variable for the education of the entrepreneur (see Appendix , Table A1), X_i is a vector that describes the composition of the workforce, Y_i is a vector that contains other firms and workplace characteristics and ε_i is an idiosyncratic error term (for details, see the Appendix).

Then, a linear probability model is used to estimate different specifications of equation (1), as suggested by Angrist and Pischke (2008). However, a potential problem with standard OLS estimates is the presence of unobserved heterogeneity and endogeneity issues. In particular, if there are unobservable factors that influence both the entrepreneurs' level of education and the presence of VP schemes at the firm level, our OLS estimates might suffer from an omitted variable bias. For example, highly educated entrepreneurs might be more likely to be concentrated in firms run by professional managers rather than by family members, or they may work in firms characterised by high-quality practices and/or cooperative industrial relations; moreover, these workplace characteristics are most likely associated with the use of VP. In such circumstances, positive OLS estimates of the relation between entrepreneurs' human capital and the likely use of VP may partially reflect unobserved firm heterogeneity rather than skills and behaviour associated with the education level of entrepreneurs. To minimise these biases, we estimate different specifications of equation (1) by including a large set of variables that capture important observable and unobservable characteristics of firms, workers and entrepreneurs. Finally, the reverse-causality problem is taken into account to avoid biased estimates, and we used instruments for entrepreneur education in order to identify its causal impact on VP.

We replicate the same estimation strategy (OLS and instrumental-variable Tobit regressions) carrying out additional estimates of equation (1). However, we differentiate those VP schemes that are based on i) the firm, ii) a group or iii) individual performance.

4.2 The adoption of VP: the main results

The role of the entrepreneur's education

The findings for our VP estimates are reported in Table 2, and they indicate that a higher degree of education among managers significantly influences the probability of adopting VP. In particular, our estimates show that the presence of managers with a tertiary education level is associated with a higher probability of VP with respect to entrepreneurs with a first-level education (the omitted category). A lower but significant coefficient is obtained for entrepreneurs with a secondary-level education. These results are obtained in the baseline specification, where we control for entrepreneurs' ages and firms' geographical locations and sizes (model 1). Furthermore, in other specifications additional covariates for the workforce characteristics (model 2) and firm characteristics (model 3) are inserted. Notice that in all of these specifications, the effect of entrepreneurs' education is statistically significant but relatively small in magnitude. However, the

estimated coefficients reflect endogeneity biases, and we confirmed this fact by means of IV estimates that give higher coefficients; these estimates are presented below.

Control variables

Model 3, in which a wide range of variables are controlled for, is particularly meaningful. A key control variable among the firm characteristics pertains to corporate governance. The research question is whether different governance structures explain different firm practices in terms of incentives and VP. A burgeoning literature has shown that family firms exert direct control to pursue private benefits and that their objective function derives from direct control (Bertrand and Schoar, 2006). Indeed, firms may not adopt the best strategies (in our case, VP) when they are owned and run by families because they may prefer other strategies that divert corporate resources to obtain private benefits (Morck, Wolfenzon, Yeung, 2004). This issue has a particular relevance in our case study because family firms are a special trait of the Italian economy (indeed, they constitute 89% of our sample).

Our results are consistent with the previous literature because we find that family firms are negatively associated with VP (see the estimates in Table 2 and Model 2). Thus, these firms ‘may twist the choice of the manager towards less talented ones and thus provide a rationale for why they might perform worse even when not intrinsically less efficient’ (Bandiera et al. 2011, p. 9).

Concerning other firm characteristics, it is expected that asymmetric information and monitoring costs increase as a firm’s size increases; furthermore, for larger firms the costs of implementing VP can be spread over a large number of employees (Brown 1990; Heywood et al. 1997), which could explain a positive correlation with VP. In line with these predictions, we find that small Italian firms have a low probability of VP, whereas firms with more than 250 employees have nearly a 40% greater probability of VP than do the smallest firms (i.e., firms with fewer than 15 employees).

Exports and a resulting increase in competition may stimulate the use of variable pay to give incentives to workers to enhance their productivity (Brown and Heywood 2002; Drago and Heywood 1995). This hypothesis is confirmed by the higher wage premium offered in other countries by exporting firms (Bernard et al. 2007), and furthermore, it is at least partially verified for the Italian economy because the coefficient associated with exposure to international markets is positive and significant at the 10% level.

Unexpectedly, with respect to innovation, we found that firms that declared themselves to have undertaken product and process innovation in the three years before the survey did not show a higher probability of adopting VP agreements, which reveals an impasse in trends towards the implementation of strategies that are devoted to enhancing organisational flexibility; these trends emerged in Italy from similar studies in the 1980s (Biagioli and Curatolo, 1989). Our results suggest that innovation, technical changes, and increasing uncertainty may make VP less likely, which was also found in related studies (Heywood, Hubler and Jirjahn, 1998).

In addition, our estimations control for worker heterogeneities such as gender, job tenure (the share of fixed-term contracts), and education. Our hypothesis is that the heterogeneity of workers

(who are differentiated by gender, tenure and skills) will influence the relationships we are testing. We find that the main beneficiaries of VP agreements are men, whereas the percentage of women has a negative effect on the probability of adopting VP contracts. Furthermore, the incidence of temporary contracts emerges with a negative and significant coefficient. One likely interpretation of both results is that the presence of short-tenure workers (women and fixed-term workers) are indicators of a climate of industrial relations where Italian firms are oriented to obtain a higher degree of functional flexibility and merely act as cost reducers rather than allow employees' financial participation in the enterprises' results. Conversely, under conditions of employment stability, repeated game solutions and mutual monitoring are more common and motivate greater recourse to VP, which is deducible from our results and was also found for Germany by Heywood, Hubler and Jirjahn (1998).

Finally, the probability of VP is positively associated with training. Indeed, qualified workers are expected to obtain enterprise bonuses and these premiums are most likely more important when firms intend to reduce the turnover costs of training new employees with firm-specific skills. The use of VP contracts may act as a commitment device for workers whose specific skills are enhanced by training investments that are sponsored by firms (Acemoglu, 1997). Moreover, we seem to have confirmation that is supported by other countries' recent experiences (Jones et al. 2012) of this pattern: training provided at the enterprise level encourages workers and firms to bargain over the expected returns of firm-specific skills' accumulation (Hashimoto, 1981).

IV Estimates

Potential problems with standard OLS estimates are endogeneity and reverse causality. Thus, we adopt an instrumental-variable approach that requires finding instruments that can predict the education level of entrepreneurs without directly affecting the probability of VP.

As instruments for education, we consider the province/sectoral share of individuals with a tertiary level of schooling over the total population; the relevant data are drawn from the Census data of 2001. Indeed, the human capital endowments that were found in the local markets in 2001 are persistent over time and significantly associated with the schooling level of entrepreneurs who operated in the same geographical/sectoral area in 2010. In other words, provinces/sectors that were characterised by a large share of graduates in 2001 have a high probability of having highly educated entrepreneurs in firms that still operated in the same province/sector ten years later. Conversely, the province/sectoral share of individuals who had a tertiary level of schooling in 2001 is unlikely to be correlated with our dependent variable, namely, the incidence of VP in the same productive area in the year 2010. This lack of correlation exists because the share of VP contracts is affected by institutional changes of wage settings that are quite variable over time, which has been shown by previous studies on Italy (Damiani and Ricci, 2011; Casadio, 2010).

As an additional instrument, we use an indicator that is represented by the existence of an industrial district in 1999. In this case, the existence of a district is expected to be negatively correlated with the level of schooling of entrepreneurs who operated in the same district ten years

later. We made this hypothesis because Italian districts are generally characterised by family-owned firms that specialise in traditional (low-intensity technological) sectors and related workforce features that are expected to discourage upgrading the education of entrepreneurs over time. In contrast, belonging to an industrial district in 2000 is unlikely to affect the diffusion of VP in 2010.

In Table 3 (specifically, the third column), we obtain that the coefficients associated with our instruments show the expected sign and are significant at the 1% level. The second-stage estimates are reported in column 1 and they offer a validation of our key result: the education of entrepreneurs is a signal of quality that positively influences the use of incentive policies, and furthermore, the magnitude of this impact is even higher than in previous estimates. In addition, notice that for most of our control variables we have confirmation of our OLS results. Some minor changes are related to exposure to international markets (and they are not significant in the IV estimates) and to the schooling of workers; for the latter variable, IV estimates offer clearer evidence of a negative link between the education of employees and the use of VP.

4.3. The adoption of different VP schemes

The dependent variable considered in our previous estimates is any type of VP scheme. In this section, we present the results for OLS and IV models that were obtained when we estimated the probability of using specific VP schemes at the individual, team or establishment level. Overall, the results are quite similar even if some specific features emerge for the team incentives. In particular, for team-type VP schemes, the coefficient associated with the tertiary education of entrepreneurs is lower and it is significant in the OLS estimates but not in the IV estimates. Indeed, according to the IV estimates reported in Table 5, we obtain that the presence of high-quality entrepreneurs increases the probabilities of individual bonuses (by 1.7 percentage points) and of establishment bonuses (by 1.3 points); furthermore, the causal effects are significant at the 1% and 10% levels, respectively. Conversely, for team bonuses no significant causal effects can be identified.

A rationale for this finding is that at least in the Italian economy, team-type VP may represent an intermediate configuration between individual and establishment schemes because team-type VP is less preferable for a number of reasons. First, with respect to individual VP, such schemes are affected by the well-known free-riding problems and are less powerful in terms of incentives' effects. In addition, team incentives are not exempt from other failures because low-ability workers expect that teaming-up with higher-ability colleagues would raise their wages; conversely, the high-ability workers expect a reduction of their pay for the same reason, and thus, an adverse-selection problem is created (Hamilton et al. 2003). Moreover, team bonuses do not present all of the advantages of bonuses offered at the establishment level, such as profit sharing, which reduces the fear of segmentation inside the firm, enhances cooperation among a larger group of peers and leads to superior Nash equilibria (Fitzroy and Kraft, 1987).

In sum, our results seem to suggest that if employees' financial participation is not restricted to subgroups of the workforce, VP schemes may reduce existing inequalities and increase commitment and are desirable policies (Poutsma, 2006).

Other results concerning the determinants of the three different types of VP are obtained for the role of size, which is higher for VP offered at the establishment level. Finally, product innovation only has significant influence (at the 5% level) on VP schemes that are offered at the establishment level; it plays no role in explaining team and individual bonuses.

Conclusions

The present paper contributes to the understanding of factors that can explain how the pay system of Italian firms is designed and to what extent VP is offered at the individual, team, or establishment level. We test the role of the skills of entrepreneurs, which is captured by an indicator of their education level, on the diffusion of VP in Italian firms, which is represented by a large majority of small family firms. We found that this indicator of quality plays a central role. Indeed, our most important result is that the presence of an entrepreneur with a university degree significantly increases the overall probability of the adoption of a VP scheme of any type. In addition, we find that highly educated entrepreneurs are more likely to use collective forms of pay systems at the establishment or individual level rather than the team level. These results were obtained by controlling for a wide set of variables and validated by IV estimates, and furthermore, they are robust with respect to unobserved heterogeneity and endogeneity problems. This robustness suggests a direct causal link between the education of entrepreneurs and the adoption of incentive schemes of different types, especially at the individual or firm level. Furthermore, we have tested the role of firms' control structure, i.e., the influence of governance features on the adoption of VP, which is a key issue in the corporate-governance debate. Our results indicate that firms run by external managers rather than family owners are more oriented to adopt any form of variable payments.

Our concluding remarks concern the policy implications of our work. It is well known that many studies have revealed the crucial influence not only of deepening capital but also of the organisational strategies of Italian firms in explaining productivity performances. Furthermore, these factors highlight the significant slowdown recorded in Italy in the last few decades (Daveri and Jona-Lasinio 2005). Enhanced investments in the 'quality' of entrepreneurs may promote a wider diffusion of a 'wage performance model' that reveals a key driver of productivity growth.

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Table 1: Descriptive statistics (with sampling weights)

	Mean	St dev	Min	Max
Variable Pay (VP)	0,06	0,23	0,00	1,00
Individual level VP	0,02	0,15	0,00	1,00
Team level VP	0,01	0,09	0,00	1,00
Establishment level VP	0,04	0,19	0,00	1,00
Management characteristics				
Tertiary education	0,23	0,42	0,00	1,00
Upper secondary education	0,54	0,50	0,00	1,00
Lower secondary education	0,22	0,42	0,00	1,00
18 <age <40	0,11	0,32	0,00	1,00
39 <age<60	0,60	0,49	0,00	1,00
age>59	0,28	0,45	0,00	1,00
Workforce characteristics				
% tertiary education	0,09	0,17	0,00	1,00
% upper secondary education	0,44	0,30	0,00	1,00
% lower secondary education	0,48	0,34	0,00	1,00
% trained employees	0,20	0,34	0,00	1,00
% fixed term contracts	0,14	0,22	0,00	1,00
% female	0,36	0,29	0,00	1,00
Firm characteristics				
Family firm	0,89	0,31	0,00	1,00
Gest_man	0,04	0,19	0,00	1,00
Foreign market	0,24	0,43	0,00	1,00
ln(Ros)	11,64	1,26	3,58	19,50
Product innov.	0,40	0,49	0,00	1,00
Process innov.	0,32	0,47	0,00	1,00
North -West	0,29	0,46	0,00	1,00
North- East	0,27	0,44	0,00	1,00
Centre	0,22	0,41	0,00	1,00
South	0,22	0,41	0,00	1,00
5< n. employees<15	0,71	0,45	0,00	1,00
14< n. employees<50	0,23	0,42	0,00	1,00
49< n. employees<250	0,05	0,22	0,00	1,00
n. employees>249	0,01	0,09	0,00	1,00
Quarrying, Mining etc	0,00	0,05	0,00	1,00
Manufacturing	0,30	0,46	0,00	1,00
Gas, water and gas distribution	0,01	0,10	0,00	1,00
Construction	0,14	0,35	0,00	1,00
Retail and wholesale	0,22	0,41	0,00	1,00
Trasportation	0,03	0,18	0,00	1,00
Hotels and restaurants	0,11	0,31	0,00	1,00
Insurance, monetary and financial intermediation	0,01	0,11	0,00	1,00
Real estate and rental	0,04	0,20	0,00	1,00
Information, communication and other business services	0,08	0,28	0,00	1,00
Health, education and social services	0,02	0,15	0,00	1,00
Sports, entertainment and others	0,03	0,16	0,00	1,00
N. of Obs.			10106	

Table 2: Linear probability regressions of adoption of VP schemes

	model 1		model 2		model 3	
	coef	robust st er	coef	robust st er	coef	robust st er
Management characteristics						
tertiary educ. (0/1)	0,094 ***	0,008	0,082 ***	0,009	0,065 ***	0,009
secondary educ. (0/1)	0,028 ***	0,006	0,028 ***	0,007	0,022 ***	0,007
39 <age<60	0,022 ***	0,008	0,012	0,009	0,009	0,009
age>59	0,027 ***	0,009	0,020 **	0,010	0,021 **	0,010
Workforce characteristics						
% tertiary educ.			0,012	0,019	-0,031	0,020
% secondary educ.			-	0,010	-0,046 ***	0,010
% trained			0,054 ***	0,008	0,051 ***	0,009
% fixed term contracts			-	0,013	-0,068 ***	0,014
% females			0,067 ***	0,012	-0,059 ***	0,012
Firm characteristics						
Family firms					-0,094 ***	0,011
Managers					0,061 ***	0,017
Foreign market					0,015 *	0,008
ln(Ros)					0,002	0,003
Product innov.					0,003	0,007
Process innov.					0,006	0,008
North West	0,057 ***	0,007	0,051 ***	0,007	0,037 ***	0,007
North East	0,084 ***	0,007	0,077 ***	0,008	0,064 ***	0,008
Centre	0,051 ***	0,007	0,052 ***	0,008	0,039 ***	0,008
14< n. employees<50	0,059 ***	0,005	0,060 ***	0,006	0,046 ***	0,006
49< n. employees<250	0,225 ***	0,010	0,237 ***	0,012	0,200 ***	0,012
n. employees>249	0,407 ***	0,018	0,431 ***	0,022	0,371 ***	0,024
Sector dummies		(Yes)		(Yes)		(Yes)
Constant	0,040 **	0,023	0,071 ***	0,026	0,142 ***	0,044
F()		86,400		58,370		48,180
Prob. > F		0,000		0,000		0,000
R-squared		0,183		0,203		0,215
N. of obs.		13206		10530		10106

Source: RIL-ISFOL data. Note: omitted variable: entrepreneur with primary education and age <40 % workers with elementary education ,South; n. of employees<15; statistical significance *** at 1%, ** at 5%, * at 10%

Table 3: Instrumental variable estimates of adoption of Variable Pay

	Second stage		First stage	
	Coef.	robust st. er.	Coef.	robust st. er.
Management characteristics				
tertiary educ. (0/1)	0,265 ***	0,091		
secondary educ. (0/1)	0,135 ***	0,052	-0,570 ***	0,007
39 <age<60	0,024 **	0,011	-0,071 ***	0,010
age>59	0,056 ***	0,019	-0,177 ***	0,011
Workforce characteristics				
% tertiary educ.	-0,109 ***	0,040	0,368 ***	0,018
% secondary educ.	-0,088 ***	0,022	0,203 ***	0,012
% trained	0,049 ***	0,009	0,010	0,008
% fixed term contracts	-0,052 ***	0,016	-0,086 ***	0,019
% females	-0,058 ***	0,013	0,003	0,014
Firm characteristics				
Family firm	-0,078 ***	0,013	-0,076 ***	0,008
Gest_man	0,042 **	0,019	0,092 ***	0,010
Foreign market	0,008	0,008	0,036 ***	0,008
ln(Ros)	0,000	0,003	0,012 ***	0,003
Product innov.	0,004	0,008	-0,005	0,007
Process innov.	0,002	0,008	0,021 ***	0,008
North West	0,036 ***	0,008	0,005	0,010
North East	0,074 ***	0,009	-0,045 ***	0,010
Centre	0,051 ***	0,009	-0,064 ***	0,011
14< n. employees<50	0,035 ***	0,008	0,056 ***	0,007
49< n. employees<250	0,174 ***	0,017	0,132 ***	0,010
n. employees>249	0,331 ***	0,030	0,180 ***	0,013
Sector dummies	(yes)		(yes)	
Share of graduates 2001			1,601 ***	0,276
Industrial district 1999			-0,055 ***	0,008
Constant	0,062	0,059	0,386 ***	0,043
F(.)	46,750		1119,5	
Prob.> F	0,000		0,000	
Centred R2	0,183		0,610	
Un-centred R2	0,283		0,740	
N. of Obs.	10019		10019	

Source: RIL-ISFOL data. Omitted variables: entrepreneurs with elementary education and age <40 %, workers with primary education, South; firms with number of employees<15. Statistical significance *** at 1%, ** at 5%, * at 10%

Table 4 Linear probability regressions of different Variable Pay schemes

	Individual		Team		Establishment	
	Coef.	robust st. er.	Coef.	robust st. er.	Coef.	robust st. er.
Management characteristics						
tertiary educ. (0/1)	0,024 ***	0,006	0,015 ***	0,004	0,065 ***	0,008
secondary educ. (0/1)	0,007	0,004	0,004	0,003	0,020 ***	0,005
39 <age<60	0,005	0,006	0,000	0,004	0,010	0,008
age>59	0,008	0,007	0,001	0,005	0,022 ***	0,009
Workforce characteristics						
% tertiary educ.	0,001	0,015	-0,002	0,012	-0,003	0,018
% secondary educ.	-0,005	0,007	-0,007	0,005	-0,021 **	0,009
% trained	0,030 ***	0,006	0,018 ***	0,005	0,048 ***	0,007
% fixed term contracts	-0,035 ***	0,008	-0,019 ***	0,006	-0,060 ***	0,011
% females	-0,026 ***	0,008	-0,009	0,006	-0,045 ***	0,011
Firm characteristics						
Family firm	-0,037 ***	0,008	-0,019 ***	0,006	-0,078 ***	0,010
Gest_man	0,051 ***	0,014	0,028 **	0,012	0,069 ***	0,017
Foreign market	0,006	0,006	0,001	0,004	0,013 *	0,007
ln(Ros)	-0,003	0,002	-0,002	0,002	0,003	0,002
Product innov.	-0,007	0,005	0,006	0,004	0,015 **	0,006
Process innov.	0,018 ***	0,006	0,003	0,004	0,006	0,007
North West	0,027 ***	0,005	0,002	0,004	0,029 ***	0,006
North East	0,028 ***	0,005	0,005	0,004	0,043 ***	0,007
Centre	0,021 ***	0,005	0,000	0,004	0,030 ***	0,007
14< n. employees<50	0,017 ***	0,004	0,008 ***	0,003	0,033 ***	0,005
49< n. employees<250	0,077 ***	0,009	0,050 ***	0,007	0,187 ***	0,011
n. employees>249	0,234 ***	0,021	0,163 ***	0,018	0,471 ***	0,023
Sector dummies						
constant	0,064 **	0,030	0,048 **	0,023	0,046	0,038
F(.)	16,240		8,590		56,550	
Prob. > F	0,000		0,000		0,000	
R-squared	0,129		0,097		0,292	
N- of Obs.	10106		10106		10106	

Source: RIL-ISFOL data. Omitted variable: entrepreneurs with primary education and age <40 %, workers with elementary education; South; firms with n. of employees<15.

Statistical significance *** at 1%, ** at 5%, * at 10%.

Table 5: Second stage regressions of probability of Variable Pay schemes

	Individual		Team		Establishment	
	Coef.	robust st er.	Coef.	robust st. er.	Coe.f	robust st. er.
Management characteristics						
tertiary educ. (0/1)	0,166 ***	0,064	0,027		0,046	0,129 * 0,077
secondary educ. (0/1)	0,088 **	0,037	0,011		0,026	0,056 0,044
39 <age<60	0,015 **	0,008	0,002		0,006	0,015 * 0,009
age>59	0,034 ***	0,013	0,004		0,009	0,034 ** 0,016
Workforce characteristics						
% tertiary educ.	-0,056 *	0,029	-0,007		0,021	-0,027 0,035
% secondary educ.	-0,036 **	0,015	-0,009		0,011	-0,034 * 0,019
% trained	0,029 ***	0,006	0,019 ***		0,005	0,047 *** 0,008
% fixed term contracts	-0,024 **	0,011	-0,018 **		0,007	-0,055 *** 0,013
% female	-0,026 ***	0,009	-0,009		0,006	-0,045 *** 0,011
Firm characteristics						
family firm	-0,026 ***	0,009	-0,018 **		0,007	-0,073 *** 0,012
gest_man	0,038 **	0,015	0,026 **		0,012	0,063 *** 0,018
foreign market	0,001	0,006	0,000		0,004	0,010 0,007
ln(Ros)	-0,005 **	0,002	-0,002		0,002	0,002 0,003
Product innov.	-0,006	0,005	0,006		0,004	0,016 ** 0,006
Process innov.	0,016 ***	0,006	0,004		0,004	0,005 0,007
North West	0,023 ***	0,005	0,002		0,004	0,028 *** 0,006
North East	0,033 ***	0,006	0,005		0,005	0,046 *** 0,007
Centre	0,026 ***	0,006	0,001		0,005	0,034 *** 0,008
14< n. employees<50	0,009 *	0,005	0,007 **		0,004	0,029 *** 0,006
49< n. employees<250	0,059 ***	0,012	0,048 ***		0,009	0,180 *** 0,015
n. employees>249	0,210 ***	0,025	0,162 ***		0,020	0,460 *** 0,027
Sector dummies	(Yes)			(Yes)		(Yes)
Constant	0,007	0,041	0,044		0,031	0,024 0,052
F(.)	16,050			8,520		56,300
Prob > F	0,000			0,000		0,000
Centered R2	0,095			0,097		0,290
Un-centered R2	0,143			0,122		0,360
N. of Obs.	10019			10019		10019

Source: RIL-ISFOL data. Note: omitted variable entrepreneur with primary education and age <40 %, workers with elementary ,South; n. of employees<15; statistical significance *** at 1%, ** at 5%, * at 10%-

APPENDIX

Table A1: Variable definitions

Education of entrepreneurs and Workforce	
Tertiary education	A dummy variable that equals 1 if the entrepreneurs have a tertiary education (post-secondary education) and 0 otherwise
Secondary education	A dummy variable that equals 1 if the entrepreneurs have a secondary education and 0 otherwise
Primary education	A dummy variable that equals 1 if the entrepreneurs have a primary or basic education and 0 otherwise
AGE	Classes of the age of entrepreneurs
18<age<40	Between 18-40
39<age<60	Between 39-60
age>59	Over 59
Other Workforce characteristics	
% Fixed-term contracts	The percentage of fixed-term workers
% Training	The percentage of total employees trained
% Females	The percentage of women relative to the total number of employees
Wage practices	
VP	A dummy variable that equals 1 if the firm adopts VP payments of any type and 0 otherwise.
VP- Individual level	A dummy variable that equals 1 if the firm adopts VP payments at the individual level and 0 otherwise.
VP-team level	A dummy variable that equals 1 if the firm adopts VP payments at the team level and 0 otherwise.
VP-establishment level	A dummy variable that equals 1 if the firm adopts VP payments at the establishment or enterprise level and 0 otherwise.
Firm characteristics	
Firm Size	The total number of employees divided in four classes by size
Family firm	A dummy variable that equals 1 if the firm is run by family owners and 0 otherwise.
Gest_man.	A dummy variable that equals 1 if the firm is run by professional managers and 0 otherwise.
Foreign market	A dummy variable that equals 1 if the firm is an exporter and 0 otherwise.
Ln (Ros)	The percentage return on sales, operating profits/total sales (ln transformation)
Product innov.	A dummy variable that equals 1 if the firm undertook product innovation in the three years before the survey and 0 otherwise
Process innov.	A dummy variable that equals 1 if the firm undertook process innovation in the three years before the survey and 0 otherwise
North-West	A dummy variable that equals 1 if the firm is localised in Italy's North-Western regions and 0 otherwise.
North-East	A dummy variable that equals 1 if the firm is localised in Italy's North-Eastern regions and 0 otherwise.
Centre	A dummy variable that equals 1 if the firm is localised in Italy's Central regions, and 0 otherwise
South	A dummy variable that equals 1 if the firm is localised in Italy's Southern regions and 0 otherwise.
Instruments	

Share of graduates 2001	The province/sectoral share of individuals with a tertiary level of schooling relative to the total population, drawn from the Census data in 2001.
Industrial district 1999	An indicator of the existence of an industrial district in 1999 in the location of firms

Source: RIL Survey, ISFOL