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Middle managers training in Italy: a firm level analysis

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Abstract

This research presents for the first time panel evidence on the performance and wage effects of middle mangers' training in Italy. It also offers an analysis of the determinants of training by investigating the relationship between training provision and firm characteristics. It is based on a rich and reliable panel dataset covering Italian firms for the years 2006-2011. Several estimation techniques and model specifications are implemented to argue that middle mangers' training significantly increases productivity and to prove the existence of a 'too-much-of a good' thing effect. Similarly a simulation of the wage effects of training shows how the positive magnitude of the coefficients seems to be severely affected by the training measure used. All the analysis implemented suggests the importance of firm's size and geographic location in explaining training provision, firm's performance, and wages. Indeed larger firms and firms located in Northern Italy appear to be more likely to offer training of higher intensity, quality and variety. Furthermore training is found to be more effective for what concerns business results and individual wages. This might suggest that medium-small firms and firms located in Southern areas could be trapped in a circle of scarce, low quality and standardised training provision with obvious implications on its efficiency and returns.

Keywords: Training, Middle managers, Productivity, Wage, Determinants of training, Italian firms

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Glossary

EU27 From 1 January 2007 to 30 June 2013 EU State Members are the following: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom. Source: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:EU_enlargements. 89

JIF The 'Fondi Paritetici Interprofessionali per la Formazione Continua' ('Joint Inter-Professional Funds for Continuing training') were created in the year 2004 in order to foster the development of continuous training in the Italian enterprises. The Inter-professional Funds aims are to promote and support the financing of the agreed training plans, for the continuing training of the employees and managers. The Funds have an associative set-up, since they are promoted by the representing organizations of the Social Partners, th rough specific agreements stipulated, at a national level, by the trade union and the employersŠ associations. Inter-Professional Funds can be set up for each of the economic sectors of the industry, agriculture, tertiary and of the handicraft. The Ministry of Labour authorizes the Funds after verifying the requirements (the representativety of the associations signing the agreement at a national level). The Funds are financed through a compulsory

contribution by the enterprises that decide to participate. Every enterprise can participate to only one Fund for the employers and only one for the employees, they can also participate to different sectors of the one belonging to. The Inter-professional Funds allow the enterprises to use the 0.30% of the compulsory contribution for involuntary unemployment sent to INPS (National Institute for Social Security). The employers can request to INPS to send the contribution to one of the Inter-professional Funds which will finance the training activities for the employers of the participating enterprises. The enterprises can voluntarily take part of the Inter-professional Fund, according to rules and criterias which are established by law. The participation is for one year but it is automatically renewed, unless the enterp rise formally decides not to renew. Source: http://www.trainingineurope.com/mmedia/2007.11.28/1196261086.pdf. 191

MM Middle management (MM) is defined as a position in organizational hierarchies 'between the operating core and the apex' (Mintzberg, 1989:98) whose occupants are 'responsible for a particular business unit at this intermediate level of the corporate hierarchy' (Uyterhoeven, 1972:136) that comprises 'all those below the top level strategic management and above first-level supervision' (Dopson and Stewart, 1990:40). Source: Harding et al. (2014). 1, 2, 3, 10, 37, 40, 41, 79, 80, 81, 82, 83, 84, 85, 88, 87, 89, 92, 93, 95, 98, 99, 100, 102, 118, 119, 121, 122, 123, 124, 125, 126, 127, 128, 129, 131, 133, 135, 136, 137, 138, 147, 149, 151, 153, 154, 160, 169, 170, 171, 172, 176, 178, 179, 180, 184, 186, 187, 188, 189, 191, 192, 193

off-the-job training Vocational training undertaken away from the normal work situation. It is usually only part of a whole training programme, in which it is combined with on-the-job training. Source: CEDEFOP

(2014). 5, 9, 43, 94, 178

on-the-job training Vocational training given in the normal work situation. It may constitute the whole training or be combined with off -the-job training. Source: CEDEFOP (2014). 5, 19, 25, 45, 49, 89, 117, 123, 176, 177

Acronyms

AIDA Analisi Informatizzata delle Aziende Italiane. 87, 91, 151

ATECO ATtività ECOnomiche. 87

BvD Bureau van Dijk. 85, 86

CVTS Continuing Vocational Training Survey. 170

GMM Generalized Method of Moments. 30, 32, 44

HR Human Resource. 11, 13, 15, 17, 18, 19, 20, 19, 20, 26, 28, 33, 35, 36, 38, 46, 47, 119

HRM Human Resource Management. 11, 18, 19, 20, 23, 29, 46, 48

ICT Information and Communication Technology. 33

IMR Inverse Mills Ratio. 156, 158, 159

ISTAT Istituto Nazionale di Statistica. 91

NUTS Nomenclatura delle Unita' Territoriali per le Statistiche in Italia. 128, 148, 157, 158

OECD Organisation for Economic Co-operation and Development. 101

OLS Ordinary Least Squares. 32

RBV Resource-Based View of the firm. 119

ROA Return On Asset. 16, 19

ROE Return On Equity. 16, 19, 129, 132, 133, 136, 137, 172

ROS Return On Sales. 129, 132, 133, 137, 172

SAP Strategy-As-Practice. 81

SIC Standard Industrial Classification. 86, 128, 148, 157, 158

SME Small to Medium Enterprise. 7, 100, 185, 188

SOE State-Owned Enterprise. 25

TFP Total Factor Productivity. 129, 132, 133, 134, 135, 136, 137, 172, 173

TMGT too-much-of-a-good-thing. 2, 119, 121, 122, 133, 137, 172, 179

UK United Kingdom. 5, 7, 27, 30, 50, 121

US United States. 13, 15, 18, 19, 27, 33, 45, 47, 48, 49, 101, 102, 121

VA Value Added. 14, 132

VIF Variance Inflation Factor. 150, 151

Introduction

It is widely documented that human capital investments are essential for firms to maintain high levels of competitiveness, to confront continuing technological change, and to reap their benefits. Training represents one major activity to improve skills and abilities which in turn increase human capital accumulation and then productivity (Becker, 1964). Similarly, there are theories suggesting that higher wages and steeper wage profiles reflect investments in human capital, particularly investments in job training (Becker, 1964; Mincer, 1974). Therefore training is considered to be a crucial ingredient to firm productivity and to employees' wage progression.

Firms' investment in training has been extensively studied in the academic literature and nowadays it still remains a key topic of particular interest to economies, companies and individuals.

Two important issues are raised in most studies of training by economists. First, does training increase performance and by how much? Second, who reaps the gains from training?

The present research is an attempt to shed some light on these two issues, testing for training effects on firm's productivity and wages. Moreover, this study provides an analysis of the correlates of training by investigating the relationship between training provision and firm characteristics.

Many studies have tried to establish these links in an international context. However, very few works have focused on Italy and no such work has been previously done for Middle Managers (MM). This target makes the

present research unique. The importance of MMs is confirmed by a burgeoning literature that argues organizational performance is heavily influenced by what happens in the middle of organizations, rather than at the top. Within this literature MMs are positioned as key strategic actors. Since firm's performance is proved to be affected by management practices, the way a firm is managed becomes a crucial issue. To this end, human capital practices devoted to MMs might be of particular interest for all the actors involved.

Basing on a rich and reliable panel dataset on Italian firms over the period 2006-2011, the present study complements and advances existing research as follows: first, it integrates literature by identifying some relevant factors influencing firm's propensity to train MMs. Second, it provides for the first time evidence about the effects of MM's training on firms' performance in Italy as measured by profitability and productivity. Third, it originally broaden existing literature on the returns to training by proving the existence of a too-much-of-a-good-thing (TMGT) effect. Fourth, the study addresses methodological gaps detected in previous research by showing the importance of measuring training variety, quality and intensity when analysing annual wage growth.

The academic literature has achieved controversial result in these fields of analysis. However, although the magnitude of the returns of training investments to firm's performance indicators and to individual wage growth do not seem to be precisely defined, a positive correlation is generally found. Findings seem to depend on the training measure used, on the modelling specifications and the estimation techniques adopted. In this regard, several estimation approaches have been implemented by the authors in order to deal with the well-known estimation problems that arise when estimating the effect of training on firm's performance and wages. The two biases, named unobserved heterogeneity and endogeneity, are far from being unanimously resolved. Instrumental variables, fixed effects estimations, and

dynamic models are the preferred strategies implemented on panel dataset used to address the estimation problems. Unlike previous literature, the endogeneity issue is addressed in this study by implementing an instrumental variable approach based on an external instrument which seems to mimic the characteristic of the theoretical instrument. This is a key aspect because the use of such a relevant instrument allows the analysis to highlight an exogenous effect of training.

The outline of the thesis is as follows.

Chapter 1 provides and overview of the empirical literature related to the correlates of training and to the organizational and individual effects of training provided by firms.

The following Chapters represent the empirical section of the thesis. Chapter 2 includes the target description, the dataset description, and the analyses of the determinants of MMs' training provision. Chapter 3 and 4 provide an investigation of the effects of training investments on firm's performance indicators and on individual wages respectively.

An overview of the main findings, a discussion about the methodological issues, guidelines for future research and policy implications are proposed at the conclusion of the thesis.

Chapter 1

Literature review

1.1 Empirical literature on training

The review of the empirical literature presented hereafter concerns the following three topics: the correlates of training, the impact of training on firm-level performance indicators and the impact of training on wages.

The empirical evidence about training is wide. The following three Paragraphs review the main academic contributions in this field.

1.1.1 Correlates of training

Results from the literature list a set of worker, job and firm characteristics that increase the probability of being engaged in training activities. General results about the determinants of training with respect to worker, job and firm characteristics are presented in Table 1.1, Table 1.2 and Table 1.3 respectively.

For what concern worker characteristics (see Table 1.1) there is little consensus in the literature about their relationship with training activity. On the majority of the independent variables, the results are mixed across different types of training (such as on- and off-the-job training), across different training measures (training intensity versus training incidence), across

countries and across econometric approaches. There is a consensus in the literature that high educational attainment exhibits a higher probability of participation in training (Albert et al., 2010; Bishop, 1996; Blundell et al., 1996; Dostie and Pelletier, 2007; Frazis et al., 2000; McIntosh, 1999). Apparently, only Beeson Royalty (1996) finds a negative relationship between education level and on-the-job training incidence for men. This fact seems to suggest that training plays a role of substitute of prior education. Furthermore, in a wide literature review about studies on this topic, Bishop (1996) observes that employees who are white, who are expected to have low rates of turnover, and who are married generally undertake more training. In contrast, the relationship with seniority is not well established and some studies of Bishop (1996) review find that training declines with age and tenure on the job. Conversely, Albert et al. (2010) find that the influence of seniority in the firm depends on the training measure considered: 'The probability of training in general declines with length of service in the United Kingdom (UK), Germany and, to some extent, Italy. On the more specific training measures, however, this result no longer holds, except for the United Kingdom, while Spain actually displays a positive relationship between specific training and seniority' (Albert et al., 2010, p. 326). As for gender and for age, results are quite controversial as well. As observed by Bishop (1996), some studies suggest that males are more inclined to receive training. The same result is found by Beeson Royalty (1996) and Blundell et al. (1996). Conversely, Albert et al. (2010) state that there are no differences between men and women, except in France and Italy, where the probability of receiving training is higher for men. McIntosh (1999) analyses the relationship between age and training incidence as well. In his literature review, he cites results of Green (1993) and Blundell et al. (1996): 'Green (1993a) finds that, for males, age is negatively related to the receipt of on-the job training, while for females, age is positively related to the incidence off-the-job training, at

least up to a peak in the mid-30s. Blundell et al. (1995) show that males who are working in large firms are more likely to receive employer-provided training, while for females, those in large firms benefit from more participation in qualification training courses' (McIntosh, 1999, p. 3). McIntosh (1999) finds results partially in agreement with these precedent studies: indeed, he finds that training incidence increases when age decreases.

Training has also been related to job characteristics (see Table 1.2). Holding other worker characteristics constant, full time workers are more likely to engage in training activities (Bishop, 1996; Frazis et al., 2000; McIntosh, 1999) than part-time and temporary workers. Similar results have been found by Albert et al. (2010) for the UK and Spain but in France, Germany, Italy and Portugal nor does working time or type of contract makes any difference. This finding is consistent with Arulampalam et al. (2004). Furthermore, Dostie and Pelletier (2007) find that the incidence of informal training is higher for part-time workers. The likelihood and amount of formal training is higher in high value added jobs where the individual has great responsibility, in jobs where training is relevant, in cognitively complex jobs, in jobs which require the use of expensive machinery, in jobs where the skills learned are not useful at many other firms in the community, and in sales jobs for complicated, changing and customized products (Bishop, 1996). Another important aspect to take into account concerning the relationship between job characteristics and probability of training is the type of contract. Frazis et al. (2000) find that the main driver of training is the presence of contract workers which has been found to be associated with greater expenditures but not with hours intensity. Higher intensity of training is determined by the number of fringe benefits and by workplace practices. On the negative side, formal training is negatively related to higher proportions of part-time workers and the presence of a union (as far as the impact of union is concerned, see later in this Paragraph).

Training is also related to a number of firm characteristics (see Table 1.3). As opposed to the relationship with individual and job characteristics outlined above, on the majority of the firm characteristics results typically hold across specifications and countries. The probability of having a formal training program generally increases with establishment size (Albert et al., 2010; Bishop, 1996; Dostie and Pelletier, 2007). Indeed, workers at very large firms receive substantially more formal training than the employees of smaller firms (Bishop, 1996) owing to such factors as the presence of economies of scale in training, lowered required rates of return on training investments, greater ability to absorb losses associated with turnover among trained employees, or a better capacity to screen potential employees before hiring them. Furthermore, for the same establishment size, establishments that are part of multi-establishment firms tend to train more than single establishment firms (Bishop, 1996). In Smith et al. (2003) study size was not found to be positively related with any training practices, apart from the existence of a training manager. Rather, the firm size is considered to be a proxy for a variety of factors that impact upon the ability of an enterprise to provide training Smith et al. (2003)[1]. Furthermore, a strong correlation of organisational size not only with the volume (Capelli and Rogovsky, 1994; Osterman, 1995), but also with the diversity of training is observed (Bishop, 1996; Jones, 2005). While large establishments invest more in formal training as well as in informal training supplied by colleagues, in small establishments training is often provided by managers and supervisors. This training, particularly for new hired at very small companies, is often informal. In contrast to research that has found size to be the most important explanatory factor for improved training provision (Smith and Hayton, 1999), Jones (2005) finds that size was only a significant determinant of training in low growth Small to Medium Enterprises (SMEs) in 1996-1997. The lack of significance

[1] A discussion about the link between size and training is provided in Chapter 2, Paragraph 2.3.4.

of employment size as a relatively consistent driver of increased training in SMEs following each of the three identified growth development pathways adds weight to Smith and Hayton (1999) contention, that size, in itself, is unlikely to influence training within organisations. The location of establishment (i.e. geographic area, metropolitan area, areas of low unemployment) is found positively related with training by Bishop (1996) and by Dostie and Pelletier (2007). Growth rate and innovation, the industry sector and the introduction of quality systems are also positively related to training and influence the type of training within the individual organisation (Bishop, 1996; Dostie and Pelletier, 2007; Jones, 2005). Smith et al. (2003) found organisational change as the most important explanatory factor for training.

Others important correlates of training probability are the benefits offered, the so-called innovative workplace practices, the presence of labour unions, the occupational structure, and, last but not least, managerial attitudes. Frazis et al. (2000) find that 'establishments that tend to offer more generous benefits and that use more of the so-called innovative workplace practices are more likely to train and employees working in establishments with these characteristics were more likely to receive it' (Frazis et al., 2000, p. 451). Frazis et al. (2000) observe also that other characteristics associated with a reduced likelihood of providing training are higher proportions of part-time workers and the presence of a labour union. Though a number of studies have examined the relationship between labour union status and training, a consensus has not been reached (Frazis et al., 2000). For example, Dostie and Pelletier (2007) observe a positive relationship between the presence of a labour union and the training incidence. Occupational structure is also associated with training, with organisations with more managers and professionals tending to provide more formal and off-the-job training. Industrial relation is not, in itself, a driver of training, but is important in creating an organisational climate conducting to improvements in enterprise training.

Similarly, government training policy also creates a framework within which particular training forms and approaches are more likely to occur. Frazis et al. (2000) find that turnover is also an important correlate with training expenditures (but not with training intensity): for a given establishment, a higher turnover corresponds to a lower incidence of training expenditures, as well as to lower expenditures per employee. Nevertheless, employee turnover does not have a significant negative effect on hours of formal training and it has the predicted negative effect when intensity is measured by training expenditures: 'though the determinants of training show some differences across our measures of incidence and intensity, we find strong support for the notion that those establishments that encourage long-term relationships with their employees also provide more training'. In contrast, Dostie and Pelletier (2007) observe a positive and significant impact of turnover on training probability because of training of new hired.

Finally, managerial attitudes are extremely important to training decisions (Jones, 2005). However, managers' attitudes to training may differ within an organisation. Indeed, while senior managers, having a more strategic point of view, recognise the strategic importance of training, middle and first line supervisors, that strongly influence the form that training takes, often prefer a short and sharp training focusing on the specific problems faced by the enterprise (Jones, 2005).

This Paragraph has provided a quick overview about the main relationships between training provision and workers characteristics as well as jobs and firms characteristics.

Apparently, when the probability of training is analysed there is little consensus about worker characteristics and job characteristics while more consensus is found when the probability of training is related to firm characteristics.

The determinants of MM's training provision with respect to firm's char-

acteristics are empirically analysed in Chapter 2. Findings are interesting and coherent with previous literature.

1.1.2 The impact of training on firm-level performance indicators

Introduction

In the modern context where physical and human capital investments must constantly be justified, it is unquestionably reasonable to evaluate their effects on firms' performance. The reliable and accurate measurement of Human Resource (HR) practices' performance is one of the challenges facing research in this area.

Empirical research focusing on the firm-level impact of Human Resource Management (HRM) practices has become popular in recent years[2]. Two main empirical approaches can be identified. On the one hand, the 'HRM system' approach attempts to analyse the returns of bundles of HR practices. It was initiated (on the empirical front) at the facility level by Arthur (1994); Ichniowski et al. (1997); Macduffie (1995) with a special interest in the so-called High Performance Workplace (Ichniowski and Shaw, 2003). At the firm level, an early study was conducted by Huselid (1995).

On the other hand, by the early 1990s, business performance had been linked to 'single HRM' practices. This set of studies looks at single HR practices pertaining to motivation and ability, demonstrating, for example, a positive association with business performance of incentive compensation (Delaney and Huselid, 1996) and of profit-sharing or result-oriented appraisal (Delery and Doty, 1996).

In line with the main aim of the present research study, this section provides a detailed review of the literature which focuses exclusively on employer

[2]For reviews, see Appelbaum and Batt (1994); Bartel (2000); Berg et al. (1996); Bishop (1996); Huselid (1995); Ichniowski et al. (1997); Wagner (1994).

provided training and its effects on firm performance. Training provision has been empirically analysed both as a 'single' HR practice and as part of a 'system' of HR practices.

First studies concerning human capital investment are those by Becker (1964). Subsequently research has gradually evolved from studies concerning the impact of training on productivity measured at the individual level (Bartel, 1994), at wage level[3] towards studies concerning the impact of training at the firm and the industry level.

The vast majority of the empirical literature on the effects of training relies on data at the individual-employee level and demonstrates that training plays a key role in raising workers' motivation, their job satisfaction, wages and productivity. Less has been done at the organizational level although several works studying the impact of training on firm level performance can be identified. Indeed, in the last few decades the interest on this topic has constantly increased and a growing number of papers have been trying to capture the effect of employer-provided training on productivity by using representative firm-level data from several sectors in the economy. Furthermore, the research horizon has recently changed from cross-section research to longitudinal research. The study of the impact of training on productivity is one developing research field thanks both to the increasing interest of the employer to understand the return on investment of training activities and the availability of data at firm level.

Recent empirical studies concerning training evaluation can be classified in four main categories (Bartel, 2000): meta-analyses (Combs et al., 2006; Jiang et al., 2012), econometric case studies[4], company own evaluation of their training programs, and large sample studies. The first two approaches have the disadvantage that results may not be generalized to other companies

[3] For reviews see Bartel (1995); Budría and Pereira (2004); Duncan and Hoffman (1979); Lillard and Tan (1992).

[4] Bartel (1994); Ichniowski et al. (1997); Krueger and Rouse (1998) are some examples of econometric case studies.

but in contrast they allow to overcome two of the problems of the large-sample econometric studies, namely, heterogeneous production processes and lack of cost data. Indeed, several papers estimating the effects of training on productivity have to deal with worker/firm heterogeneity bias and have little or no mention of the costs of training (i.e., Barret and O'Connell (2001); Bartel (1994, 2000); Black and Lynch (1996); Dearden et al. (2006).

Coherently with the analysis provided in Chapter 3, this review focuses exclusively on large sample studies and presents the most representative contributions based on cross-sectional and longitudinal datasets. It consists of 29 research studies (15 cross-sectional and 14 longitudinal) and covers the time period between 1989 and 2009. A positive correlation between training and firm's performance is generally found, but often results are very difficult to interpret especially when the training measures are based on cross-sectional database and then measured at a single point of time. This implies that many unobservable firm- specific factors correlated with both training and productivity could not be picked up[5].

There are numerous difficulties in measuring the returns to training for firms. In a first instance, it is extremely difficult to obtain reliable data on firm productivity, competitiveness and profitability and even more data on training provision. Furthermore, there are problems in identifying empirical counterparts to the concepts of general and specific training, and in identifying whether and how much of the costs are borne by workers and by employers. Finally, there are difficult questions regarding causality (does company training cause the firm to improve its performance or does a

[5] Black and Lynch (2001) used an establishment training survey at two points of time. In the cross-section, they identified some effects of the type of training on productivity, but they found no significant association when they controlled for plant-specific effects. Ichniowski et al. (1997) investigated the factors that influence productivity in a panel of United States (US) steel finishing mills. After controlling for fixed effects, they found a role for training only in combination with a large variety of complementary HR practices. Ballot et al. (1998); Carriou and Jeger (1997); Delame and Kramarz (1997) used French firm-level panel data to look at the effects of training on value added and found positive and significant effects.

better (poorer) firm performance foster (require) expenditure on training?) (Colombo and Stanca, 2014). Because of these difficulties, studies that have directly assessed the effects of firm training on company performance have started to become available only recently together with the recent increased availability of data. Furthermore, several estimation problems arise when analysing empirically training returns to firms. Thanks to the increased availability of data at firm level, the research horizon has recently changed from cross research to longitudinal allowing econometric model to control for heterogeneity and endogeneity bias.

Productivity, which can be broadly defined as the output per unit input, seems to be the most documented indicator used as dependent variable to estimate training performance[6]. Considering the whole sample of the reviewed studies, 19 studies out of 29 use a parametric approach and provides the estimation of the Cobb-Douglas production function (see Table 1.5, and Table 1.10).

The dependent variable of the model is measured by several indicators (see Table 1.5, and Table 1.10): Value Added (VA)[7] per worker is used in 16 studies, labour productivity is used in 5 studies, and net sales are used in 6 studies. Other performance indicators have been also estimated: 2 studies use financial indicators, 2 studies measure the quality of products and 1 study uses job satisfaction as dependent variable. The perception of firm performance is used as a proxy of firm productivity in 1 study.

For what concern the investment in human capital, the training variable (which, in line with the objective of the present research, represents the most

[6]Some studies have also examined the impact of training on performance indicators which differ from productivity ones. Training has been linked to product quality (Holzer et al., 1993), profitability (Huselid, 1995) and real sales (Ng and Siu, 2004). For further details see Table 1.4, Table 1.5, and Table 1.6

[7]Value-added is a measure of output which is potentially comparable across countries and economic structures. According to the definition by Deardorffs, value added is 'The value of output minus the value of all intermediate inputs, representing therefore the contribution of, and payments to, primary factors of production' (Deardorffs' Glossary of International Economics).

interesting among the regressors) is measured by quantitative indicators such as the number of training hours/days, the rate of access to training, the proportion of employees trained and expenditures (see Table 1.6 and Table 1.11). The type of training is the most common qualitative indicator in the empirical studies analysed.

The empirical literature review is divided into two sections. Cross-sectional studies will be presented first and longitudinal studies will follow.

Five main points will be underlined: (1) the impact of training on firm's performance indicators (the magnitude and the significance of the estimated coefficient will be given); (2) the estimation of training both as a 'single' dimension and as part of a 'system' of HR practices; (3) the importance of the type of training; (4) the presence of the potential biases in the measurement of the training variable and in its relation with the dependent variable; (5) the presence of interaction effects among the regressors.

Table 1.4 to Table 1.13 provide a synthetic overview concerning: dataset features, dependent variables, estimation frameworks, training measurements, main findings, and estimation problems.

Cross-sectional studies

This review uncovers fifteen contributions which are the most representative among the whole set of studies based on cross-sectional datasets for the time period 1989 through 2005[8]. Table 1.4 to Table 1.8 respectively summarize the main details concerning the dataset features, dependent variables and estimation frameworks, training measurements, main findings, and estimation problems.

Some details concerning the statistical techniques, the dependent variables and the measurement of training provision are provided hereafter.

The vast majority of the cross-sectional contributions (see Table 1.4)

[8]For a review of the literature on cross-sectional studies since 1982 to 1997 see Bartel (2000).

relates to US organizations (10 research studies), followed by European countries (2 research studies), developing countries (2 research studies), and Canada (1 research study). All of them are survey-based studies and attempt to evaluate the returns of training investments using employee-level dataset (2 studies out of 15), establishment-level dataset (4 studies out of 15), and firm-level dataset (9 studies out of 15).

The main aim of these studies is to examine the impact of training investments on performance indicators which represent the estimated dependent variable (see Table 1.5).

Performance is most frequently measured by objective firm and individual productivity indicators such as net sales, value added and labour efficiency which are often taken in log. Three studies measure firm performance using accounting and financial indicators such as Return On Asset (ROA) and Return On Equity (ROE) (Delery and Doty, 1996), Tobin-Q and the gross rate of return on capital (Huselid, 1995), and turnover (Bishop, 1989). Only one study uses a subjective indicator as dependent variable which is the perception of firm performance (Delaney and Huselid, 1996). Furthermore, some studies provide also evidence of the impact of training investments on non-productivity performance indicators such as product quality, and scrap rate (see Table 1.5, 'Other indicators') but this goes beyond the interest of the present study.

The mentioned objective productivity indicators are estimated using a Cobb-Douglas production function which represents the most common empirical framework among the fifteen reviewed cross-sectional studies. All the other indicators (accounting, financial and subjective) are estimated using linear and logistic regression analysis.

For what concerns independent variables, Table 1.6 provides an overview of the measurement of training provision and shows that it is quite diversified

among the fifteen studies[9]. Given its importance, it is worthy to provide some details.

Firm's training provision is measured both in absolute value (the number of hours/weeks of training) and in percentage value (calculated with respect to the total number of worked hours). One of the most critical aspects underlined by the vast majority of the authors concerns the lack of information on training costs which is recognized to be a reliable measure of training investments. Indeed, only Ng and Siu (2004) have the chance to use expenditures as a proxy of the firms' propensity to provide training to their workers. Conversely some studies, according to the authors themselves, are based on weaker and questionable indicators of training investments such as training index based on a 7 points-Likert scale and training evaluation.

Despite differences in the choice of the dependent variable and in the measurement of training provision, all the fifteen cross-sectional studies show very interesting and often coherent results (for what concerns the direction of the relatioship between training and performance) which are discussed later in this Paragraph.

The training dimension differs among the studies not only for how it is measured but also for how it is estimated (see Table 1.7). Three different approaches can be identified. The literature includes: (1) studies which examine the influence of 'systems' of HR practices (training is one of them) on organizational outcomes (e.g., Huselid (1995)); (2) studies which focus on the estimation of the 'single' effect of each HR practice, such as training (e.g., Bartel (1994)); and finally (3) studies which provide both the information (e.g., García (2005)).

The presentation of the fifteen cross-sectional studies is organized as follows. General features, estimation problems and main results of those studies which use individual productivity indicators as dependent variable will be

[9]Information on training activity is strictly constrained to data availability.

discussed first. It then follows a discussion about those studies which make use of organizational productivity indicators as dependent variable. The distinction between the 'system' and the 'single' approach in estimating HR practices will be provided.

Among those studies which estimate the impact of training investments at employee level (worker productivity indicators as dependent variable in the equation model) (see Table 1.4 and Table 1.5), two of them provide the estimation of training as part of a set of HR practices and the other two as a single variable (Barron et al., 1989; Bishop, 1989) (see Table 1.7).

Arthur (1994) and Macduffie (1995) provide evidence on the impact of HR systems on productivity and they do not estimate a single coefficient for training. For example, the study realized by Arthur (1994) on 30 small American steel mini-mills has shown that commitment HR systems lead to better performance[10] than control systems. The two HR systems are defined on the basis of eleven practices[11] and training activity is significantly much frequent in commitment systems.

Macduffie (1995) on his side confirms the validity of this relation. His estimation results clearly show that the systems based on complementary innovative practices lead to higher level of performance than traditional systems. He derives specific configurations or 'bundles' of HR practices that enhance workers performance and training represents one of those practices[12]. Such bundle of practices is found to be positively and significantly linked to

[10] Firm performance is measured by labour efficiency which is calculated as the ratio between productivity and the average number of labour hours required to produce one ton of steel at a mill.

[11] Eleven HR practices describe the two HR systems: decentralization, participation, general training, skill, supervisor, social, due process, wages, benefits, bonus, and percentage unionized (Arthur, 1994, p. 676).

[12] He derives specific configurations or 'bundles' of HR practices that enhance workers performance and training represents one of those practices. The author identifies a bundle of innovative practices which he then distinguishes between those that affect the organization of work (called Work Systems) and those that reflect firm-level HR policies affecting employees at all levels (called HRM Policies). Training of new employees and training of experienced employees represent two HRM policies.

productivity. The data come from a survey of, and field visits to, 70 plants in the US auto industry.

Barron et al. (1997) examine the relationships among on-the-job training, starting wages, wage growth, and productivity growth. They estimate that an increase of 10% in the proportion of employees who have received training implies an increase of 3.7% of productivity, suggesting that firms pay most of the cost and reap most of the returns to training. They also suggest the type of training (formal or informal) can have an impact on productivity. The multivariate analysis of Employment Opportunity Pilot Projects (EOPP) data presented in Bishop (1989) generates tentative estimates of both the opportunity costs and the productivity effects of training (general and specific, worker and firm financed combined). The author shows the existence of a positive and significant elasticity between training effort and productivity. Results are confirmed and detailed by different type of training activities and different occupational categories.

As for the research studies which focus on corporate productivity indicators, eleven contributions can be identified. Among them, the study by Huselid (1995) is the only one which provides exclusively the estimation of a bundle of practices without evaluating the specific effect of training investments. He makes use of financial databases (large sample of firms from across the whole of the US economy) to derive financial performance indicators as outcome measures. In line with the universalistic perspective, Huselid concludes that the heavy use of a number of specified HR practices (recruitment, training, information sharing, quality, compensations, and promotions based on merits or seniority) is associated with a level of sales revenue that is on average $27,000 per year per employee. The corresponding increase in shareholder value is estimated at nearly $4,000 per year per employee.

Two research studies in 1996 provide the estimation of training both as part of a 'bundle' of the HR system and as an individual dimension.

On the basis of 216 questionnaires, Delery and Doty (1996) test seven HR practices both individually and in combination[13]. The authors address three different theoretical frameworks in strategic HRM. Results provide relatively strong support for a universal perspective and a weaker support for the contingency perspective. Three individual HR practices have relatively strong universal relationships with accounting measures of performance: profit sharing, results-oriented appraisal, and employment security. Contingency relationship between strategy and three HR practices (participation, result- oriented appraisal, internal career opportunities) explains a significant portion of the variation in the same performance measure. The formal training variable does not have significant effect on the accounting performance indicators (ROA and ROE).

In 590 for-profit and non-profit American firms, Delaney and Huselid (1996) find positive associations between HRM practices, such as training and staffing selectivity, and perceptual firm performance measures. HRM practices, including selectivity in staffing, training, incentive compensation, and also the interaction between training and selectivity staffing are positively related to perceptual measures of organizational performance. Results do not support the assertion that complementarities among HRM practices enhance firm performance.

In the following research studies, training is the only HR practice taken into account and it is then assessed as an individual dimension. Comments follow hereafter.

Using the 1986 Columbia Business School Survey, Bartel (1994) estimates the effect of training programs on net sales (in logarithm) of manufacturing firms. The study by Bartel deserves particular attention because it represents the benchmark for several authors (e.g., Dearden et al. (2006)). She

[13]The seven HR practices concern: (1) career opportunities; (2) training systems; (3) appraisal; (4) compensation strategy; (5) employment security; (6) employee voice; (7) job characteristics.

uses data on personnel policies (one of which is employee training) and economic characteristics of 155 American businesses. Firstly she estimates a simple cross-section production function using 1986 labour productivity as dependent variable and includes the training index variable (measured as the percentage of the actual number of groups in the firm that have formal training) among the independent variables. She does not find any effect of formal training on productivity in the same year and this result is not affected by the inclusion of the variables measuring other HR policies. However this result may be biased because of the existence of unobserved heterogeneity between firms which leads to a correlation between the formal training measure and the error term. In order to avoid this bias, she then estimates a first difference model where the change in labour productivity between 1983 and 1986 is regressed on changes in the incidence of training programs. All unobserved fixed effects that might be correlated with any of the independent variables are then removed. This change in the estimation method increases the measured productivity impact of training. While this approach eliminates heterogeneity in productivity levels, it does not solve heterogeneity in productivity growth. For example, the estimated effect of training on productivity will be biased upward because firms that are introducing technological change are increasing training and are also experiencing high productivity growth. On the other hand, if the heterogeneity occurs because firms that are suffering from falling productivity decide to compensate by instituting new training programs, then the estimated coefficient for training will be biased downward. Bartel (1994) addresses this problem by indirectly using some proxy variables for the introduction of technological change (firm's R&D-to-sales ratio). The training coefficient is only marginally affected; it fell to 0.4 remaining highly significant.

Bartel (1994) seeks to address the endogeneity problem too: a model of the determinants of 1983 labour productivity is estimated and the residual

is calculated. Then, for those businesses that did not have any training programs as of 1983, a Logit model is estimated in which the dependent variable is the probability of implementing a training program after 1983 and the independent variable is the value of the residual from the 1983 labour productivity equation. By doing that she discovers faster productivity growth for firms that carry out training programmes. The major finding is that business that were operating below their expected labour productivity levels in 1983 are more likely to implement a formal training program that resulted in significantly larger increases in labour productivity growth in the three following years (they experiences an 6% annual increase in productivity between 1983 and 1986 compared with businesses that did not). Only new training programs, but not formal training, exert a positive effect on firm sales.

Alba-Ramírez (1994) uses data drawn from a yearly survey carried out since 1977 by the Spanish Ministry of Economics and Finance. Of 595 medium- and large-sized Spanish firms, those in which training is provided are found to have a higher level of sales per employee or higher value-added per employee according to the 1988 Collective Bargaining in Large Firms study conducted by the Spanish Ministry of Economics and Finance. The main results indicate that larger firms and those undergoing technological change are more likely to provide their workforce with formal training. By estimating a production function, the author also finds evidence of the positive and significant effects of formal training on labour productivity and wages. He takes into account both the heterogeneity and the endogeneity biases. The first problem is addressed by including several control variables as regressors leading to a diminishing in the magnitude and significance of training coefficient (it diminishes from 0.77 to 0.28 and it is significant at 10% level). Then, when training is treated as an endogenous variable in the specified production function or in the wage equation, such positive effects

are no longer significant. If the training measure (dummy variable) is replaced by the percentage of employees trained, the same study found that only the percentage of senior employees trained has a positive relationship with firm performance (measured by the log value added per employee).

Black and Lynch (1996) estimate a standard Cobb-Douglas production function including training intensity, three specific types of training activities and several controls for other workplace practices. Production functions are estimated for the manufacturing and non-manufacturing sectors in which dimensions of training are included along with capital and labour. The estimations are based on a dataset from the 1994 US-American National Centre on the Educational Quality of the Workforce (EQW). They find no impact of the share of trained employees on sales but this result masks the effects of the different dimensions of training, which do matter. A high percentage of formal training outside working hours has a positive impact on productivity in the manufacturing sector while computer training has a positive impact on productivity in non-manufacturing sectors. However their cross-sectional study is prone to unobserved heterogeneity bias, and furthermore the authors take training as an exogenous variable in their regression as opposed to endogenous. Endogeneity problem is not treated.

In a follow-up paper, Black and Lynch (2001) address the endogeneity problem by restricting the analysis to the manufacturing sector and matching the establishments to the census Bureau's Longitudinal Research Database. They estimate a first-difference production function for the time period 1988-1993 and used coefficients from this equation to estimate an establishment specific residual that is then regressed on variables measuring the establishment's HRM practices obtained from the telephone survey. None of the training variables were significant in the second stage. Once the endogeneity issue is properly addressed, the positive relationship between training and productivity observed in the cross-sectional analysis disappears.

Tan and Batra (1996) assemble a set of firm-level data from Colombia, Indonesia, Malaysia, Mexico, and Taiwan to provide a first look at the incidence, determinants, and productivity outcomes of enterprise training in developing countries. For each country the authors estimate a production function in which the dependent variable is the logarithm of value added and the independent variables are: the logarithms of labour and capital, the rate of capacity utilization, mean education, whether the firm is an exporter, whether it conducts research and developments (R&D), whether it possesses foreign technology licenses, a set of two digits industry dummy variables, and a dummy variable indicating if it provides any formal training and numbers trained by source and by broad occupational groups. Findings from Tan and Batra (1996) indicate that the elasticity between training and value added is equal to 0.028, 0.711, 0.266, 0.282 and 0.444 for firms in Taiwan, Indonesia, Columbia, Malaysia and Mexico respectively. Coefficients are not statistically significant in Colombia and Malaysia. A large and significant impact of training on productivity is found for skilled workers but not unskilled workers, and for in-house formal training as compared with external sources of training.

The endogeneity bias is addressed by using an instrumental variable approach. The estimated parameters of the production function and control variables are moderately affected by the use of this instrumental variable approach, and the principal results remain. The most striking change is on the training variable, which has a positive and statistically significant impact on productivity in all five economies after the instrumental variable correction. While Tan and Batra should be commended for addressing the fact that the firm's decision to train may be determined by its productivity level, it is not clear that their system of equations has been identified properly. Indeed, a number of variables that the authors use in the training equation are eliminated from the productivity equation, arguably could belong in the

productivity equation as well. The result of this misspecification would be an overestimate of the true effect of training on productivity.

Barron et al. (1989) find that training and productivity growth are directly related. A 10% increase in training is associated with a 3% increase in productivity growth measured by the rate of typical worker productivity growth. Of particular interest is the fact that few other coefficients in the productivity growth equation are statistically significant. Formal education, unionization, and gender appear to play no important role in affecting productivity growth. The study is based on a survey sponsored by the National Institute of Education and the National Center for Research in Vocational Education (1982) which provides a unique record of the on-the-job training provided workers in entry level positions.

Similar findings are those by Ng and Siu (2004) who focus their attention on Chinese manufacturing firms. The production function estimation shows that there is a positive relationship between training expenditures, particularly managerial training, and enterprise productivity. Regarding the training provision by enterprise, both State-Owned Enterprises (SOEs) and non-SOEs obtained a positive return from devoting resources to managerial training. A 1% increase in managerial training induced a 0.32% (0.13%) increase in sales for SOEs (non-SOEs). These estimates fell within the range of estimates found by Tan and Batra (1996) in their investigation of enterprises in five developing countries. The authors suggest that enterprises may find it useful to allocate resources continuously to managerial training.

In the same direction, Turcotte and Rennison (2004) try to understand if the content of training could have an impact on the productivity of Canadian firms. Their results show that the content of training programs, especially those with technological content, have a higher impact on productivity with respect to the effect of training intensity (meaning the proportion of trained employees). The results show that an increase of 10 percentage points in the

proportion of employees who received technological training is linked with an increase of 4.5% in productivity.

García (2005) examines the relationship between training policies and business performance. The author opts in favour of a multi-sector analysis. Information is collected through a postal survey sent to HR manager of 420 firms. In a regression framework he estimates the impact of three training index: (1) training service functions; (2) training evaluation, and (3) reactive/proactive training. All of them have positive and significant effects on satisfaction indices (customer satisfaction, employee satisfaction and shareholder satisfaction). Only training service functions and proactive training have positive effects on productivity even though they are not statistically significant. It is probably due to the productivity measurement used and to the fact that productivity can be conditioned by many other aspects which are left aside in the equation but which could even counteract the positive effects of training.

To conclude, it can be argued that the cross-sectional studies report a positive association between training as well as other HR practices and objective and perceptual measures of firm performance, showing a general coherence in explaining that link.

Many authors express some concerns about results that might be biased because of methodological problems. Indeed, the extent to which the reported results can truly be interpreted as productivity impacts depends on the authors' success in correcting for the endogeneity of the training decision; in some cases, positive productivity impacts disappear after the endogeneity correction (e.g. Alba-Ramírez (1994)).

Table 1.8 provides an overview of the approaches adopted to address the heterogeneity and the endogeneity biases as well as the related findings. The limitation of cross-sectional datasets is that they do not allow the two biases to be addressed properly.

Longitudinal studies are discussed in the next Paragraph. Particular emphasis is given to their contribution in explaining training effects on firm productivity and to the solutions adopted to address the estimation problems.

Longitudinal studies

This review uncovers fourteen contributions which are the most representative among the whole set of studies based on longitudinal datasets for the time period 1997 through 2009. Table 1.9 to Table 1.13 respectively summarize the main details concerning the dataset features, dependent variables and estimation frameworks, training measurements, main findings, and estimation problems.

Some details concerning the statistical techniques, the dependent variables and the measurement of training provision are provided hereafter. The vast majority of the longitudinal contributions (see Table 1.9) relate to European countries (Belgium, Sweden, Finland, Germany, the UK, Portugal, and Italy) and only two relate to US firms. All of them are survey-based studies and attempt to explain the observed performance heterogeneity among firms by establishment-level dataset (3 studies out of 14), firm-level dataset (10 studies out of 14), and industry-level dataset (1 study out of 14).

The main aim of the studies is to examine the impact of training investments on performance indicators which represent the dependent variable to be estimated (see Table 1.10). Performance is measured by objective firm and individual productivity indicators which are net sales, value added and productivity-line uptime (often taken in log). Furthermore, some studies provide also evidence of the impact of training investments on non-productivity performance indicators such as product quality, wages and scrap rate.

The Cobb-Douglas production function is the preferred estimation framework among the longitudinal studies and, as opposed to cross-sectional stud-

ies, none of them estimates the impact of training on productivity indicators measured at the individual level.

As for the independent variables, Table 1.11 provides an overview of the measurement of training provision and shows that it is quite diversified across the fourteen studies. Firm's training provision is measured both in absolute value (the number of hours/weeks of training) and in percentage value (calculated with respect to the total number of worked hours). It is also proxied using training expenditure and the share of participants.

Despite the differences in the choice of the dependent variable and in the measurement of training provision, all the fourteen longitudinal studies show very interesting and often coherent results (for what concerns the direction of the relationship between training and performance).

The training dimension differs among the studies not only for the measurement but also for the estimation criteria (see Table 1.12). Two different approaches can be identified. The literature includes: (1) studies that examine the influence of 'systems' of HR practices (training is one of them) on organizational outcomes as well as the single practice by itself (e.g., D'Arcimoles (1997); Ichniowski et al. (1997)); (2) and studies that focus exclusively on the 'single' effect of specific HR practices, such as training (e.g., Almeida and Carneiro (2009)).

The fourteen longitudinal studies will be presented as follows. First a discussion about the general features, estimation problems and main results of those studies which estimate both a 'system' of HR practices as well as training as a single practice will be provided. The studies which focus specifically on the training dimension will be considered next.

In explaining training returns on productivity, the presentation will also emphasize the role of the type of training and of the interaction among the regressors.

Among the longitudinal studies, four authors provide the estimation of

training both as part of a 'system' of HR practices and as its 'individual' effect.

On the basis of a sample of 36 homogeneous steel production lines between 1983 and 1992, Ichniowski et al. (1997) show that the system of innovation practices allows to reach a higher quality of the product and a higher productivity. Furthermore they find evidence of a positive and significant link between the training variable (which is defined by two categories: 'high training' and 'low training') and firm performance indicators (production-line uptime). Similar results are found by D'Arcimoles (1997) in his study based on 42 French firms. The analysis indicates that there are immediate and lagged significant correlations between training expenses and economic performance. The train level is very clearly and permanently associated to an increase in profitability and productivity. The author identifies also a few HRM indicators which may be capable of signalling the present and future economic performance of a firm.

The vast majority of the reviewed longitudinal studies provide the estimation of the training variable singly, and attempt to suggest new strategies to deal with estimation problems such as the potential endogeneity of training and unobserved heterogeneity. In order to correct unobserved time-invariant heterogeneity between firms, Black and Lynch (1996) supplement their data on training and other workplace practices with panel data from the Longitudinal Research Database (LRD)[14]. In the first estimation step, they calculate the average firm-specific, time-invariant residual in a fixed effects Cobb-Douglas production function without the time-invariant workplace practices, training methods and other firm and employee characteristics. In a second step, they regress the average establishment residual on training and the other quasi-fixed factors. In this regression, training intensity has still no impact on productivity, irrespective of whether unobserved time-invariant

[14] Black and Lynch (1996) did not address estimation problems because only cross-sectional data were available.

heterogeneity is corrected for or not. The authors admit that their estimation techniques only correct for endogeneity in the time-variant parameters included in the first step while the second step estimates (including training intensity) are prone to selectivity bias.

Ballot et al. (2001) find that the impact of training hours per employee on firm productivity depends strongly on the underlying estimation technique. In their preferred specification, the system Generalized Method of Moments (GMM) estimation takes account of possible endogeneity of labour, capital, training, and R&D in the productivity estimation. They find that training has a positive and significant impact on value added in France, while in Sweden the effect is insignificant. Their instruments (values of the explanatory variables lagged by one or two years) may be weak because all instrumented variables and the dependent variable may be affected by shocks that take longer than one or two years (Dearden et al., 2000). Their panel includes six years and is too short for designing longer lags. In addition, their specification is very parsimonious and takes only tangible assets and their interactions into account, while further firm and personnel characteristics are absent. Finally, their sample size of 90 firms in France and 270 firms in Sweden is quite small and specific.

Dearden et al. (2006) present a study on the productivity impact of training intensity on the industry level in the UK. They use a long panel dataset of 94 British industries between 1983 and 1996 that entails information on training in every year. They estimate a Cobb-Douglas production function and show that an increase of 10% in the proportion of trained employees leads to an increase in the wages of 3.0% and an increase in the value added per worker of 6.0%. Furthermore, they show that firms which are more incline to make use of knowledge based competences seem to be more incline to provide training for their workers. They address unobserved heterogeneity as well as selectivity of training simultaneously by using a system GMM esti-

mation including levels, first differences and lags of capital, labour as well as training intensity (Blundell et al., 1999). In addition, they calculate the impact and the sign of the biases incurred when training is taken as exogenous in the estimation. The positive and significant effect of training intensity on sector productivity significantly increases when the endogeneity of training is considered. Still, several drawbacks of their approach have to be mentioned. They combine data on different aggregation levels which may lead to aggregation bias. Lagged variables might be weak instruments for current levels of training intensity, capital and labour (Griliches and Mairesse, 1999). The absence of controls for additional personnel management measures might incur omitted variable bias. Finally, their information on training covers only four weeks per year, and service firms have been dropped due to 'measurement problems' in most regressions.

Barret and O'Connell (2001) study the impact of training on productivity of Irish firms since 1993 to 1995. Their study is based on a sample of 215 firms in the manufacturing, service and construction sectors. Following Bartel (1994) approach, they confirmed that general training has a positive and significant effect on the productivity growth, while specific training (meaning training which is specific for that firm and that business) does not show to have significant returns for those firms which provide that kind of training. General training investments are also positively linked with capital investments. These results could suggest that general training captures the omitted variables (firms' size, innovation and organizational changes) which have an impact on productivity.

In Portugal, the research by Almeida and Carneiro (2009) on a sample of 1,500 firms in the manufacturing sector of more than 100 employees between 1995 and 1999 confirms the relation between training and productivity. The authors observe that an increase of 10 hours of training per employee implies an increase of hourly productivity from 0.6% to 1.3%. This study suggests

that training within firms is a good investment for many firms and that it probably implies a higher return with respect to physical capital investment. The authors also document the empirical importance of adequately accounting for the costs of training when computing the return to firm investments in human capital.

It has been pointed out that the estimation of the impact of training on firm performance, in a longitudinal context, is biased by the problems highlighted in the cross-sectional studies review. The first one is the unobserved heterogeneity and the second is the endogeneity problem. In this regard, estimations made by Zwick (2005, 2006) with instrumental variable method on a sample of 2,090 observations from 1998 to 2001 show that, after controlling for different source of bias, an increase of 1% in the proportion of trained employees in 1997 implies an increase of 0.76% points on average on the productivity between 1998 and 2001.

Recently, studies by Colombo and Stanca (2014); Dearden et al. (2006); Zwick (2006) suggest that if firms' heterogeneity is not taken into account, the impact of training on productivity will be overestimated while if the endogeneity problem is not taken into account, the impact of training on productivity will be underestimated. In this regard, Colombo and Stanca (2014) show that failing to account for the potential endogeneity of training leads to underestimate the effect of training on productivity (point estimates are 0.9%, 0.5% and 2.2% for Ordinary Least Squares (OLS), fixed effects and system GMM, respectively). They address the endogeneity problem by using lagged variable of training investment as instrumental variables. Furthermore, focusing on the system GMM (which is the authors' preferred estimate), the coefficient for effective training (average number of days of training per trained employee) is larger (2.2%) than that of training intensity (number of employees undertaking some form of training) (1.9%), although the difference is quite small. This indicates that using a measure

of training intensity that does not account for training duration may lead to underestimate the effects of training on productivity. Also Zwick (2005) concludes that endogeneity and unobserved heterogeneity both have a significant impact on the measurement of the productivity impact. Controlling for endogeneity by adding a selection correction term increases the measured productivity impact of training intensity. Finally, significant omitted variable bias is detected. When a broad variety of firm, employee and personnel management characteristics is not taken into account, the estimated productivity impact is much too high.

Another important aspect to consider in the study of the effect of training on firms' productivity is the moment in time when training investment should be expected to show its effects. Some studies seem to highlight that the impact of training can appear after a while. Results by Black and Lynch (2001) on US data, by Colombo and Stanca (2014) on Italian data, by D'Arcimoles (1997) on French data and by García (2005) on Spanish data, suggest that training effects materialize after one or two years.

These lagged effects have also been confirmed by Zwick (2005). He shows that an increase in the proportion of workers who received formal internal and external training in the first part of the year leads to a positive and significant impact on firm productivity during the same year and the year after. Despite previous studies, he also shows that the impact of internal training decreases in the third year.

All of these studies suggest that the impact of training should be measured on at least one year from the beginning of training to a larger span of time, in order to document the possible returns. This suggests the importance to use a recursive model.

Anyway, in comparison with cross-sectional studies, longitudinal studies do not allow to confirm unanimously the possible interaction among the different factors. In this regards, estimations by Black and Lynch (2001) on

a panel dataset of 638 US firms in the manufacturing sector between 1987 and 1993 do not allow to demonstrate that those firms which implement high-performance work systems of practices, which include the proportion of trained employees, are the most productive. Similar results are obtained by Zwick (2006). Any complementarity between training and other HR practices is observed within establishment. In order to test heterogeneity in the productivity effects of training, interaction terms between training and investments in Information and Communication Technology (ICT) and the personnel management measures included in the production function are added. In accordance with most of the literature (Delaney and Huselid, 1996; Huselid, 1995; Huselid and Becker, 1996), no significant interaction term is identified; however, neither if the interaction terms are added individually or jointly.

In a comparative research on French and Sweden firms, from 1987 to 1993, Ballot et al. (2001) show that training and R&D are complementary and have positive and significant effects on productivity. Results suggest, both for France and Sweden, a possible exchange between training and physical capital investment because the iteration between the two variables held to negative effects on productivity.

On the same branch of studies, the analysis by Ballot et al. (2006) investigates the effects of training, R&D practices, and physical capital investments. It shows that the return of training investment can be shared between the firm and its employees but it remains higher for the firm itself. They find that training returns of investments are higher for French and Swedish firms than for their employees and that employees share with their employer returns of physical capital investments, R&D and training[15]. The study by Maliranta and Asplund (2007) on 916 Finland firms between 1998 and 2001

[15]'More precisely, French workers obtain only 9% of the returns to physical capital, 30% of the returns to training, and 50% of the returns to R&D. The Swedish workers get almost the same proportion of returns to physical capital (7%), but receive about 3% and 25% of the returns to training and R&D, respectively' (Ballot et al., 2006, p. 487).

shows that formal training stimulates firm performance only if it is combined with the adoption of new technologies in a precise moment of time.

Summing up, the literature review shows that most studies at the industry, firm or establishment level find a positive (although sometimes insignificant) impact of training intensity on productivity, but are plagued by estimation or data problems. Table 1.13 provides an overview of the approaches adopted to address the heterogeneity and the endogeneity biases as well as the related findings.

Conclusions

On the basis of the available empirical literature some important conclusions can be drawn.

The vast majority of the empirical literature, either cross-sectional or longitudinal, demonstrates the existence of a positive and significant relation between training activity and firm performance. Nonetheless, results are not always coherent in the estimation of the magnitude of that link (e.g, Ballot et al. (2006); Barret and O'Connell (2001); Colombo and Stanca (2014); Zwick (2006)).

One possible explanation could be that the empirical studies show a large heterogeneity in the use of methods, models and data sources. This diversity seems to lie in differences among countries, labour market institutions and data generation on the one hand, and between the underlying estimation techniques on the other hand Bartel (2000). The major differences among the reviewed empirical studies concern: (1) the measurement of training variable; (2) the 'system' versus 'individual' estimation approach of HR practices; (3) the results obtained; (4) the estimation techniques.

Training variable measurement is strictly constrained by the availability of data. Indeed several research studies have to deal with weak indicators such as training index based on a 7 points-Likert scale (Delery and Doty,

1996) and training evaluation (García, 2005). Furthermore, in all the reviewed studies, training information are draw from surveys: interviewees are asked to provide information about training activities implemented several years before the survey itself leaving room to measurement errors (Bartel, 1994). The preferred and most reliable training measures seem to be the length of training (number of training hours and number of days/weeks), training intensity (% of hours and % of participants) and training expenditure.

It is also worthy to underline that the training variable is estimated following two main approaches. On the one hand, some studies analyse training as part of a 'system' of HR practices and therefore do not provide the evaluation of training singly (Arthur, 1994; Huselid, 1995; Macduffie, 1995). On the other hand some studies provide the estimation of the training elasticity by itself contributing to increase the awareness of its individual impact on firm's performance.

As already mentioned above, the returns of training investments on firm performance indicators do not seem to be precisely defined by the 29 research studies. Even though results show the existence of a positive elasticity (although sometime statistically insignificant) between the provision of training and firm performance, its magnitude is not unanimously defined.

In the end, several estimation approaches are implemented by the authors in order to deal with unobserved heterogeneity and endogeneity. On one side, it could be that firms which provided training to their employees could have had the same performance, even without training investment. In other words, the increase in productivity could be due to the idiosyncratic characteristics of the firm, which have been not taken into account by the model. This potential bias, called unobserved heterogeneity, occurs when some relevant variables like the introduction of new technologies and organizational changes, which are supposed to influence training returns within

firms, are not observed. A second major problem concerns the endogeneity of training, which occurs when one independent variable is correlated with the dependent variable, and which studies such as Barret and O'Connell (2001); Bartel (1994); Bishop (1994) have failed to control for.

These two biases are far from being unanimously resolved: instrumental variables, fixed effects estimations[16], and dynamic models are the preferred strategies used to address the estimation problems. There seems to be no consensus or empirical preferences in the choice of which technique to use in case of estimation biases, leaving room for the treatment of these measurement errors. By the way, it is unanimously recognized that only the use of longitudinal dataset allows the two mentioned estimation problems to be addressed properly.

Comments and main insights

The literature review provides some important insights which can contribute to define the estimation framework of the study provided in Chapter 3[17].

As for the (1) model specification, it is possible to conclude that the Cobb-Douglas production function not only represents the most common specification for the production function, but it is also attractive for several reasons: it generates coefficients and test statistics that are easy to interpret and its assumption of the substitutability of labour and capital (that is, that different mixes of labour and capital, but neither factor exclusively, can achieve the same output quantity) is a good fit to the manufacturing context.

The second aspect concerns the specification of the (2) dependent variable of the model. The present study conforms to the common practice of using value added per worker as a measure of productivity, instead of sales and

[16] In a longitudinal framework, the fixed-effect approach does not seem appropriate when the source of endogeneity varies over time.

[17] On the basis of a six years panel dataset, the present research study attempts to estimate the impact of MMs' training on firm performance.

wages. As a matter of fact, Bartel (2000) recognizes the potential problems inherent in using sales as a measure of productivity. Despite this, because of data limitations, several studies do not have practical alternative to adopting sales (Alba-Ramírez, 1994; Barret and O'Connell, 2001; Bartel, 1994; Black and Lynch, 1996; Ng and Siu, 2004). Conversely, the empirical benefit of using the value-added specification is that it avoids the endogeneity problem in estimating the coefficients on materials (see Griliches and Ringstad (1971) for more details) which instead characterize the standard production model[18].

The third aspect concerns the (3) independent variables. The reviewed empirical studies highlight the importance of using a broad set of control variables in order to deal with both individual and firm heterogeneity. The age of business, ownership type, turnover rate, R&D, dummies for sector as well as the age of workers, education, and sex are only some of the most common regressors. In addition, (4) interaction terms between training and other HR practices are commonly used as regressors but the estimated coefficients in the reviewed research studies are often statistically insignificant. The study offered in Chapter 3 provides the individual estimation of training following the approach of the vast majority of the reviewed studies.

Another important aspect concerns the estimation problems (5). Due to the lack of longitudinal data, many studies have failed to control for unobserved heterogeneity (Black and Lynch, 1996, 2001), and potential endogeneity of training (Barret and O'Connell, 2001; Bartel, 1994; Bishop, 1994). Longitudinal data with repeated training information have become available only recently (Ballot et al., 2001; Black and Lynch, 2001; Dearden et al., 2006; Zwick, 2005). The study in Chapter 3 deals with both the issues of unobserved heterogeneity and endogeneity of training, by using a variety of panel data techniques on an original dataset which contains longitudi-

[18]The standard production model relates gross output to primary inputs (capital and labour), intermediate inputs (energy and materials), and total factor productivity.

nal information on training and measures of corporate productivity covering Italian firms for the years 2004-2011. Coherently with the previous literature, the present research will show that failing to take into account these issues leads to severe biases in the estimates.

However, it is important to underline that there is a wide empirical debate on the endogeneity of training variable and very few studies thoroughly test this endogeneity problem. The estimation of production functions is a difficult exercise because inputs are chosen endogenously by the firm and because many inputs are unobserved. Even though the inclusion of firm time invariant effects may mitigate these problems (e.g., Griliches and Mairesse (1999)), this will not suffice if, for example, transitory productivity shocks determine the decision of providing training (and the choice of other inputs). Recently, several methods have been proposed for the estimation of production functions, such as Ackerberg et al. (2006); Blundell and Bond (2000); Levinsohn and Petrin (2003); Olley and Pakes (1996). Time invariant firm characteristics that are potentially correlated with the decision to invest in training (and with the choice of other inputs) are controlled by estimating the model in first differences. To account for the potential correlation between the stock of training and current productivity shocks, the model includes past measures of training (and past measures of other inputs) to instrument for current training (and the current use of other inputs).

Least but not last, the literature review suggests the importance to study the lagged effects of training. A number of studies focus on longitudinal dataset but very few analyse the effects of training on productivity in the long run. Some of them show that training have positive and increasing delayed effects (D'Arcimoles, 1997; García, 2005; Zwick, 2006).

To conclude, the literature review highlights at least three crucial advantages of the dataset used in the present study. First of all, (1) as opposed to the whole sample of the reviewed studies, training information (i.e., the

number of hours, the number of participants, and the costs) is not collected from a survey. The dataset is generated by the firm itself once the provision of training activity has been planned. The details on training activities must be recorded by the firm and subsequently confirmed by the organization which provides training. Thus, measurement errors do not occur and the reliability and the completeness of data regarding training are ensured. Secondly, (2) information is collected in real time as soon as managers plan the training activity and they are completed with further details once the training activity is over. This is much better than having employee or employer reported information about past training. Thirdly, (3) the dataset is fully representative of the managers in the firm. This important feature allows the whole training activity provided to each manager in the firm to be tracked.

Finally, it is worthy to remind that the vast majority of the empirical literature, both cross-sectional and longitudinal, demonstrates the existence of a positive relation between training activity and firm performance. As a matter of fact, the existing literature does not show coherent results in explaining the magnitude of that link. This consideration gives aid to the ethic of the present research study and to the importance of adding fresh light on this relevant topic.

1.1.3 The impact of training on wages

Introduction

In Paragraph 1.1.2 of the current Chapter, the literature concerning the impact of training on firm-level indicators has been analysed. The present Paragraph switches the attention to individuals and provides a review of the empirical literature concerning the impact of training on wages. This topic will be analysed empirically in Chapter 4 where a simulation of the effects of MMs training on wage level and growth will be provided.

Because wages are often analysed together with labour turnover in the reviewed academic literature, both of them will be mentioned hereafter. However, it should be borne in mind that only the wage issue is closely connected with empirical research provided later in Chapter 4 and, therefore, greater attention will be given to this.

The academic literature shows that both wage and turnover are strictly linked with the career but little evidence is available for MMs.

Research on MMs has a long tradition within the field of strategic management (Mair, 2002). Previous research has shown that MMs assume an active role in both strategy implementation and strategy formulation. More recently researchers have emphasized MMs' role in fostering entrepreneurial initiative in established organizations, since they are seen as vital to translate entrepreneurial initiatives developed at the front into organizational outcomes (Burgelman, 1983). Nevertheless, apparently there is little empirical evidence concerning the determinants of their performance and career's advancement.

During the 1990th the literature on careers grew in an unprecedented fast-changing environment, embracing new information, manufacturing and process technologies in the context of the increasing globalization of product and service markets. As a consequence, the career path appears to be changed in order to adapt the changing economic conditions, characterised by instability, uncertainty and insecurity of traditional career structures (Kelly et al., 2003). Whereas in the last half century the path that was promised to managers was an uninterrupted, upward climb on a corporate ladder, since the late 1990s the promise of lifetime employment in return for hard work and company loyalty was broken and many MMs, even those with good performance records, were laid off in attempts to streamline and cut costs (Reitman and Schneer, 2003). The new career path emerging in this context is characterised by an employability security replacing employment secu-

rity by personal growth, skill development, flexibility, and work/life balance (Peiperl and Arthur, 2000). Thus, careers are now shaped by complex interactions between individual's internal characteristics and the external forces an individual faces. The career is not directed by the organization but by the individual's needs and values as they change over time (Hall and Moss, 1998). The individuals now move from company to company, since changing employers may be the best way to achieve higher salaries and more responsibilities, especially if one has competencies that are transferable and highly valued (Robinson and Miner, 1996). Furthermore, it is interesting to note that the new career paths are making managerial careers more accessible for women, while in the past the 'promised' path, developed for the 1950s managers, never really applied to women (Reitman and Schneer, 2003).

In these new career structures, much more emphasis is placed on individuals managing their own training and development, with a strong emphasis on personal development. In new, 'boundaryless' organizations, all employees receive similar strategic education regardless of their level. In contrast, in traditional hierarchical organizations, senior employees receive strategic education whereas lower level employees only receive skills training (Kelly et al., 2003). In their cross-national analysis (including Ireland, Hong-Kong, Singapore, and China), Kelly et al. (2003) find, for example, a link between career path and training and development practices. High levels of career path within an organization imply that the organization is controlling and managing the individual's career. In organizations where newer models of careers are in use, more autonomy and self-management on the part of the employee are expected (Mallon, 1999a,b). Thus, the higher the level of career path, the more formal the available training, i.e. the higher the number of days spent in training by skilled/technical staff and the higher the level of formal training. In contrast, organizations where newer forms of career are experienced seem to provide more varied training such as training in antic-

ipation of future tasks: workforce is trained in a wide range of skills rather than for on specific job.

Tharenou et al. (1994) analyse the determinants of managerial advancement for men and women respectively and underline that training need to be included in theories on managerial advancement. Indeed, in their empirical study on managers from six different managerial levels of Australian public and private sector, they find a positive impact of training on career advancement. 'Training enhances advancement because it increases individual's knowledge, skills, credibility, and credentials' (Tharenou et al., 1994, p.923). They find also that 'the impact of training is greater for men than for women, who attend fewer internal training courses and conferences or industry meetings [...] . Overall, one path to power appears to be the development of special expertise through training [...] . Work experience increases training because it provides more opportunities for training and the finding adds to the understanding of how job experience influences advancement' (Tharenou et al., 1994, p.923). 'For women, training may be an essential source of expertise in managerial skills, which they may have little opportunity to gain through job assignments and work experience [...] . Furthermore, training also has a positive link to men's advancement [...] . Particularly, men appear to be more advantaged by formal off-the-job training and development than women. Training has a more positive influence on the managerial advancement of men, who attend more internal training courses, especially when between the ages of 35 and 54, and more industry meetings, especially when less than 25; in addition, their education leads to training, unlike women's, and their work experience leads to more training. Training may lead to advancement more for men than for women because men are thought to gain more skills and knowledge from training than women do, and they gain skills and knowledge that are more relevant to managerial work, thus becoming better prepared for advancement than women' (Tharenou et al., 1994, p.924).

The impact of training on wages and turnover has been empirically investigated by several authors. The literature available on this topic is quite developed although it is less extensive than that concerning the impact of training on productivity. It generally takes into account workers in general (no analysis based on a specific worker category seems to be available) who receive formal training by their employer.

Paragraph 1.1.3 provides an overview of the main contributions following this order: 1) literature analysing the impact of training on wages; 2) literature analysing the impact of training on workers' turnover; 3) literature analysing the impact of training on both wages and workers' turnover and their interaction.

The literature suggests that training generally has a positive and significant impact on wages whereas its impact on turnover is more difficult to be identified.

The impact of training on wages

The literature concerned with the estimation of the returns to training on wages is extensive. Since the econometric approach in Chapter 4 is to use a firm-level dataset in a regression framework to estimate the impact of training on workers' wages, the following literature review is restricted to studies of this type. Tables from 1.14 to 1.18 supply a summary of the main results available to our knowledge in the literature on the impact of training on workers' wages.

The study by Dearden et al. (2006) deserves particular attention because several authors applied their methodology for the evaluation of the impact of training on firm productivity and workers' wages (e.g., Conti (2005)). They use a long panel dataset of 94 British industries between 1983 and 1996 that entails information on training in every year. In their regression, they show that an increase of 10% in the proportion of trained employees leads

to an increase in the wages of 3.0%. The unobserved heterogeneity and the potential endogeneity are controlled by a variety of methods including GMM system estimation.

Konings and Vanormelingen (2014) use a firm level data set of more than 170,000 Belgian firms between 1997 and 2006 and find a positive and significant impact of training on wages. Controlling for the possible endogeneity of training and for the sources of heterogeneity, they find that training increase marginal productivity of an employee more than it increases its wage.

Conti (2005) replicates the British study by Dearden et al. (2006) on Italian data but does not find statistically significant effects when the GMM method is used for estimation.

Similarly, Turcotte and Rennison (2004) try to understand if training could have an impact on the productivity of Canadian firms and on the wage of their workers. Their results show that in the case of on-the-job computer training, the productivity benefit exceeds the wage gain to workers. In all the other cases, coefficients in the productivity and wage equations are not statistically different and seem to support that worker wages reflect their marginal productivity. A similar result is found by Barron et al. (1989) in their cross-sectional study on worker in entry-level positions in the US. The impact of on-the-job training on wage growth is positive and significant.

On the same branch of studies, the analysis by Ballot et al. (2006) allows to investigate the effects of training, R&D practices and physical capital investments. The analysis is performed on two panels of French and Swedish firms respectively. It shows a positive and significant elasticity of wages with respect to training and that the return of training investment can be shared between the firm and its employees, but it appears that it remains higher for the firm itself.

Veum (1995) focuses on a large sample of young men and women working in different sectors in the US. He finds that the incidence of company training

and of seminars outside work is positively related to the wage level and to wage growth, while no significant impact of training length and training type is observed on the wage level. Furthermore, it appears that the other forms of training do not impact wage levels and wage growth.

Finally, three studies (Bartel, 1995; de Grip and Sieben, 2005; Jones et al., 2012) perform their analysis on samples belonging to a specific firm or to a specific sector.

The work of Bartel (1995) uses a database of one large manufacturing firm. She finds that training has a positive and significant effect on wage growth and this result is obtained eliminating heterogeneity bias in wage levels and in wage growth.

de Grip and Sieben (2005) use data from a survey among pharmacies in the Netherlands in order to analyse the effects of HRM practices on workers' wages and firm productivity. It appears that most specific HR practices do not affect workers' wages. Concerning training, the results obtained are not statistically significant.

Jones et al. (2012) analyse data coming from a large sample of Finnish co-operative banks. The training intensity is positively associated with wages and this result is robust across diverse econometric models.

All the studies, with the only exception of de Grip and Sieben (2005), find that the impact of training on wages is positive and significant. Nevertheless, when the same dataset is used to estimate also the impact of training on firm productivity (i.e. Ballot et al. (2006); Barron et al. (1989); Conti (2005); Dearden et al. (2006); Konings and Vanormelingen (2014); Turcotte and Rennison (2004) results are in general less robust than the same for productivity and, if the impact is statistically significant, the elasticity between training and wages is quite smaller than that between training and productivity Ballot et al. (2006); Conti (2005); Dearden et al. (2006); Konings and Vanormelingen (2014). As explained by Dearden et al. (2006), only partial

explications are available for this result and further research is needed.

The impact of training on labour turnover

Training is probably crucial for survival of companies in the current, extremely competitive economic environment, and the training industry does not stop to grow (Brum, 2007). From the theoretical point of view, an effective training program improves employee commitment and makes workforce more stable (Brum, 2007). Nevertheless, two different schools of thought argue two opposite theories about the impact of training on employee retention (Brum, 2007): training can be seen as a tool for obtaining higher levels of employee retention or, in contrast, it could lead to an increase in turnover. Furthermore, it appears that training is an effective tool to increase employee commitment (and then to reduce turnover rates) if it is part of a 'bundle' of HR practices (Brum, 2007). Thus, employers need more and more analyses helping them in understanding the impact of training investments on their organizations and on commitment of employees receiving training. The literature review shows that only few works analyse the link between training and employees' turnover from the empirical point of view. Tables from 1.19 to 1.23 supply a summary of the main contributions available in the literature on the impact of training on workers' turnover. It is interesting to observe in general theoretical and empirical literature available supports a positive impact of training on workers' retention and motivation. All the empirical studies reviewed, with the only exception of Haines et al. (2006), prove the existence of a positive and significant effect of training on employees' retention.

The work by Shelton (2001) presents the analysis of data collected in a survey on employees of the industrial sector in the US. It underlines that the majority of employees consider training important or very important concerning the decision of staying or not with a company. From the same

study it appears that training is linked with a higher job satisfaction, which is strictly connected with employees' retention.

Furthermore, the results of a survey on managers of the Australian resource sector (Hutchings et al., 2011) shows that, in managers' opinion, employees' training and development is one of the most important strategies to be developed in order to motivate and retain workers.

Focusing on a small, non-branched lodging company in the US, the case study of Choi and Dickinson (2009) shows that a rigorous management training program enhances employees' satisfaction level and reduces turnover rate (the line-level employees' satisfaction is taken by the authors as a direct measure of the effectiveness of the training intervention on their managers).

Manchester (2008) presents a case study of a single employer of the non-profit sector in the US analysing the effect of tuition reimbursement on retention. It appears that tuition reimbursement programs, which are a type of general training, increase employee retention through an interaction between the skills acquired in coursework and prior investments in firm-specific skills. It is important to underline that this retention effect is 'concentrated among workers pursuing degrees related to their job' (Manchester, 2008 p. 19).

Concerning the effect of general training, Srinivas (2008) finds a positive relation analysing a large sample of mid-career employers of a panel of industries in the US. Indeed, for this target of workers, general training is probably intended as a tool to update and reinforce their skills in their current job.

Taking as a target a small panel of Canadian small and medium enterprises, Wagar and Rondeau (2006) find a positive and significant impact of 'bundles' of HRM practices on worker retention. In particular, the presence of formal training programs is significantly associated with a decrease of quit rates. As mentioned before, results by Haines et al. (2006) do not support previous findings discussed above. Analysing a large panel of workplaces in

a representative sample of Canadian industries, Haines et al. (2006) found that employer-provided training increases employees' turnover in the year following the training, since training makes their leaving easier.

The impact of training on wages and labour turnover

Six contributions analysing the interaction among training, wages and labour turnover are discussed in this Paragraph.

Parent (1999) focuses on young workers in Canada receiving formal training by their employers. On the basis on a quantitative analysis of survey data, he finds a positive impact of training with the current employer on the wage, even though, in comparison, skills acquired in previous jobs are more rewarded by employers. It appears also that employers tend to supply fairly specific training programs in order to reduce mobility. These results are confirmed by Parent's following work (Parent, 2003), in which the author finds also the tendency of employers to train more educated people as well as a more evident impact of training on wages for men than for women.

Taking into account similar data concerning young workers in Canada and analysing how training affects wage growth and mobility, Loewenstein and Spletzer (1999) find that much on-the-job training is fairly general and that employers and workers both believe that the skills acquired can be also useful in the current as well as in following jobs: it appears indeed that a worker's training at a previous employer raises his productivity elsewhere. Furthermore, employers seem to reward workers for their skills and to pay them taking into account their previous experience. Hence, the authors conclude that 'a sizable proportion of the skills that workers accumulate through employer-provided training is likely to be general and will not lose its value as they change job' (Loewenstein and Spletzer, 1999, p. 731).

Lynch (1992) analyses data concerning young workers of the private sector in the US receiving formal training by their employers. She also finds

that wages are positively correlated with training. At the same time, gender and race seem to influence the probability of receiving training, and, as a consequence, of receiving higher wages (women and non-whites are less likely to receive training and are generally less paid). Furthermore, Lynch (1992) shows also that the probability of receiving training is influenced by schooling (more educated people are more likely to receive training). Finally, she finds that specific formal training tends to increase the wage with the current employer but, because of its firm-specific nature, it does not affect significantly the wage in a following job.

Gielen (2007) shows the interrelation of profit sharing, training, wages, and mobility. Using data from the UK, it appears that profit sharing can increase training investments: indeed, profit sharing tends, to one side, to reduce the probability separation from the current employer, and, to the other side, to increase returns to training. At the same time, there is evidence that both training and profit sharing positively affect wages. The consequence is an increased productivity due to the greater worker effort and to the skills accumulation. Furthermore, training seems to improve the employability of workers, in particular younger and older workers, both within the firm and in the external labour market.

Using panel data of the French labour market in years 1998-2000, Chéron et al. (2010) find benefits of training as far as mobility and wages are concerned. Indeed, the participation in training programs seems to reduce the probability to switch job or to become unemployed during the two succeeding years. These results are obtained from both matching estimators and bivariate probit models. Furthermore, the participation in a training program shows positive returns in wages as well.

Ok and Tergeist (2003) look at European countries concerning continuous education and training. Observing the relationship between continuous education and training and labour market performance on the basis of existing

studies, they underline that 'a relatively robust correlation at the micro-level between training on the one hand and higher wages and productivity on the other' is established (Ok and Tergeist, 2003, p. 23). They observe also that, in case of job change, workers who received training are more protected against wage losses than non-trained workers. In contrast, while training seems to enhance job mobility of workers within the firm, there is only weak evidence that training has much effect on the mobility of workers between firms.

Table 1.1: Training provision and worker characteristics

	Country	Years	Gender	General features	Seniority	Education
Albert et al. (2010)	France, Germany, U.K., Portugal, Italy and Spain	1995÷2001	No difference except in France and Italy where (+) male		Absence of relationship between workers' length of service and training especially when specific training is considered (save for Spain); an exception is the UK (negative relationship)	(+) high educational attainment
Beeson Royalty (1996)	U.S.	1980÷1986	(+) male		(+) tenure of the current job has a positive and significant impact on company training and off-the-job training if turnover probabilities are excluded (+) tenure of the current job has a positive and significant impact on off-the-job training if turnover probabilities are included	(-) for men (off-the-job training is a substitute of formal education)
Bishop (1996)	U.S.	not available	(+) male	(+) who are expected to have low rates of turnover (+) married (+) white	(-) who are recently hired (it declines with age and tenure on the job)	(+) with many years of education and who scored well on tests assessing verbal, mathematical and technical competence

Continued on next page

Table 1.1 – *continued from previous page*

	Country	Years	Gender	General features	Seniority	Education
Blundell et al. (1996)	U.K.	1981÷1991	(+) male	(+) male in large firms for employer-provided training (+) female in large firms for participation in qualification courses (+) skilled non-manual workers (+) higher social classes have an higher probability of receiving training in their first job and then between 1981 and 1991 (+) previous training and courses		(+) school, post-school and previous EPTC qualifications
Dostie and Pelletier (2007)	Canada	1999÷2002		(-) age for formal training	(-) seniority for formal training	(+) higher level of education implies more not formal education
Frazis et al. (2000)	U.S.	1995				(+) positively related to both training incidence and training intensity
McIntosh (1999)	France, Germany, the Netherlands, Portugal, Sweden and the U.K.	1995	No difference	(+) training incidence increases when age decreases with the exception of Sweden	(-) newly hired workers receive more training	(+) ISCED level of prior education

Table 1.2: Training provision and job characteristics

	Country	Years	Features	Working time	Type of contract
Albert et al. (2010)	France, Germany, UK, Portugal, Italy and Spain	1995÷2001	(+) working in high-skilled non manual jobs	In Spain part-time and temporary workers are less likely to engage in training activities	
Bishop (1996)	U.S.	NA	(+) in high value added jobs where the individual has great responsibility (+) in jobs where vocational training is relevant (+) in cognitively complex jobs (e.g. Professional, technical and managerial jobs) (+) who use expensive machinery on their job (+) in jobs where the skills learned are not useful at many other firms in the community (+) in sales jobs for complicated, changing and customized products	(+) in regular non-temporary jobs	(+) full time jobs
Dostie and Pelletier (2007)	Canada	1999÷2002			(+) informal training of part time workers
Frazis et al. (2000)	U.S.	1995			(-) part time worker
McIntosh (1999)	France, Germany, the Netherlands, Portugal, Sweden and the U.K.	1995			(+) full time workers

Table 1.3: Training provision and firm characteristics

	Country	Year	Size	General features	Turnover
Albert et al. (2010)	France, Germany, U.K., Portugal, Italy and Spain	1995÷2001	(+) large firms and in certain service industries	(-) in Spain part-time and temporary workers are less likely to engage in training activities	
Bishop (1996)	U.S.	Not available	(+) at large unionized manufacturing establishments	(+) in industries which have established industry standardized and certified training (+)located in metropolitan areas (+) multiple establishments (+) in industries with low unemployment rates (+) have long probationary periods for new hires (+) experiencing rapid technological progress and rapid output growth (+) located in areas of low unemployment. (+)located outside the South	
Dostie and Pelletier (2007)	Canada	1999÷2002	(+) for formal and not formal training	(+) formal training when production is falling (+) the presence of a labour union (+) geographic area (+) new technologies and proportion of workers using a computer (-) importance of optimisation of production techniques (-) importance of improving	(+) informal training for new hired
Frazis (2000)	U.S.	1995		(+) establishments that offered more generous benefits and that used more of the so-called innovative workplace practices were more likely to provide formal training (-) the presence of a labour union (+) establishment size is not a significant overall	(-)

Continued on next page

Table 1.3 – *continued from previous page*

	Country	Year	Size	General features	Turnover
Jones (2005)	Australia	1994÷1998	(+) size was only a significant determinant of training in low growth SMEs	(+) growth rate of the enterprise (+) introduction of major change in production technology (+) innovation (+) a documented formal business plan (+) the introduction of a business improvement programme and QA (+) changing business structure and employment size	
Smith (2003)	Australia	1998	Size (i.e. number of employees) is not the most important determinant of the type or volume of training carried out in the organisation. Size was not positively correlated with any training practices for other factors such as the level of resources that the organisation can devote to training and the diversity of skills required in the workforce (size acts as a proxy for other factors such as the level of resources that the organisation can devote to training and the diversity of skills required in the workforce)	(+) learning organization (+) Total Quality Management (-) Lean production (+) Extent of teamwork (+) Integration of training and business strategy (+) Business process re-engineering	
McIntosh (1999)	France, Germany, the Netherlands, Portugal, Sweden and the UK	1995	(-)The general trend in most countries seems to be that small establishments have higher training rates, with the Netherlands and Portugal being the exceptions		

Table 1.4: Dataset description (cross-sectional studies)

	Sample details							Data sources	
	Country	# observations	Employee level	Establishment level	Firm level	Multi-industry	Single-industry	Survey	Case studies
Alba-Ramirez (1994)	Spain	~ 600			√	√		√	
Arthur (1994)	U.S.	~ 30		√			Steel mini-mills	√	
Barron et al. (1997)	U.S.	~ 258			√	√		√	
Barron et al. (1989)	U.S.	~ 1,901	√			√		√	
Bartel (1994)	U.S./Canada	~ 155		√			Manufacturing	√	
Bishop (1989)	U.S.	~ 3,412	√			√		√	
Black and Lynch (1996)	U.S.	~ 1,346		√		√		√	
Delaney and Huselid (1996)	U.S.	~ 590			√	√		√	
Delery and Doty (1996)	U.S.	~ 216			√		Banking	√	
García (2005)	Spain	~ 78			√	√		√	
Huselid (1995)	U.S.	~ 968			√	√		√	
Macduffie (1995)	U.S.	~ 62		√			Automotive	√	√
Ng and Siu (2004)	China	~ 485			√		Manufacturing	√	
Tan and Batra (1995)	Developing countries	from 300 to 56,047			√	√		√	
Turcotte and Rennison (2004)	Canada	~ 4,219			√	√		√	

Table 1.5: List of the dependent variables and estimation framework details (cross-sectional studies)

	DEPENDENT VARIABLES								ESTIMATION FRAMEWORK	
	Firms' performance indicators					Other indicators				
	Net sales	Value added	Labour productivity	Perception of firm performance	Accounting measures	Product quality	Wage (level/ growth)	Scrap rate	Regression	Cobb-Douglas
Alba-Ramirez (1994)	√	√					√		√	√
Arthur (1994)			Labour hours					√	√	
Barron et al. (1997)		√								√
Barron et al. (1989)			Worker productivity growth				√		√	
Bartel (1994)		√								√
Bishop (1989)			Worker productivity growth		√		√		√	
Black and Lynch (1996)	√									√
Delaney and Huselid (1996)				√					√	
Delery and Doty (1996)					√				√	
García (2005)	√								√	
Huselid (1995)	√				√				√	
Macduffie (1995)			Labour hours			√				√
Ng and Siu (2004)	√									√
Tan and Batra (1995)		√								√
Turcotte and Rennison (2004)		√					√		√	√

Table 1.6: List of training measures and content of training (cross-sectional studies)

	TRAINING MEASUREMENT (INDEPENDENT VARIABLE)							CONTENT OF TRAINING			
	Length of training (# of hours)	Training intensity (% of hours)	Number of weeks	Training expenditures	Dummy (% of participants)	Training index (likert 1-7)	Training evaluation	Formal	Informal	General	Detailed by professional occupation
Alba-Ramirez (1994)					√			√			√
Arthur (1994)					√					√	
Barron et al. (1997)	√	√						√			
Barron et al. (1989)	√									√	√
Bartel (1994)					√			√			√
Bishop (1989)	√	√	√					√	√		√
Black and Lynch (1996)					√			√			
Delaney and Huselid (1996)					√			√			
Delery and Doty (1996)						√		√	√		
García (2005)							√	√			
Huselid (1995)	√							√			
Macduffie (1995)	√							√			√
Ng and Siu (2004)				√				√			
Tan and Batra (1995)					√			√			√
Turcotte and Rennison (2004)					√			√	√	√	√

Table 1.7: Main findings (cross-sectional studies)

	HR practices estimation		Impact of training/HR system on firm's performance indicators	
	'System'	'Single'	Sign	Statistically significant
Alba-Ramirez (1994)		√	+	√
Arthur (1994)	√		+	√
Barron et al. (1997)		√	+	√
Barron et al. (1989)		√	+	√
Bartel (1994)		√	+	√
Bishop (1989)		√	+	√
Black and Lynch (1996)		√	+ (training on informatics)	√ (nonmanufacturing)
Delaney and Huselid (1996)	√	√	+	√
Delery and Doty (1996)	√	√	Zero	
García (2005)	√	√	-	√
Huselid (1995)	√		+	√
Macduffie (1995)	√		+	√
Ng and Siu (2004)		√	+ (managerial training)	√
Tan and Batra (1995)		√	+	√
Turcotte and Rennison (2004)		√	+	√

Table 1.8: Estimation problems (cross-sectional studies)

	Heterogeneity bias	Endogeneity bias	Elasticity between training and productivity
Alba-Ramirez (1994)	√ Yes. The estimated coefficient remains positive but significant at 10% level.	√ Yes, two stage least square estimation. Results are no longer significant.	Positive and significant (for the proportion of senior employees who received formal training and for the dummy variable). The training coefficient remains positive but no longer significant after the IV correction.
Arthur (1994)	√ Yes	√ Not addressed	Positive and significant for commitment systems.
Barron et al. (1997)	√ Yes	√ Yes, two stage least square estimation.	Using the 2SLS estimation technique, productivity increase by 3.7%.
Barron et al. (1989)	√ Yes	√ Not addressed	Positive and significant
Bartel (1994)	√ Yes. R&D is introduced as a regressor. Results do not change.	√ Yes. Results do not change.	Positive and significant for new training (not in the same year but between 1983 and 1986).
Bishop (1989)	√ Yes	√ Yes. Results do not change.	Positive and significant.
Black and Lynch (1996)	√ Yes.	√ Not addressed	Positive and significant only for computer training programs in the nonmanufacturing sector and for the percentage of formal training outside working hours in the manufacturing sector.
Delaney and Huselid (1996)	√ Yes.	√ Not addressed	The coefficient of HRM practices are smaller when the variables are entered together than when they are entered individually. Results suggest that HRM practices are positively associated with perceptions of performance.
Delery and Doty (1996)	√ Yes	√ Not addressed	No significant effects.
García (2005)	√ Not addressed	√ Not addressed	Training service function and proactive training have positive but non-significant coefficients.

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Table 1.8 – *continued from previous page*

	Heterogeneity bias	Endogeneity bias	Elasticity between training and productivity
Huselid (1995)	√ Yes.	√ Yes. Two stage least squares estimation (Hausman test).	Returns to the 1st group practices on productivity: elasticity which varies from 0 to 0.073. Returns to the 1st group of practices on Tobin Q: elasticity which varies from 0 to 0.215. Not only were these results consistent with the OLS results, but they were in each case somewhat larger than the OLS results.
Macduffie (1995)	√ Yes	√ Not addressed	Coefficients for Log HRM Policies are positive and significant.
Ng and Siu (2004)	√ Yes	√ Not addressed	Positive and significant (particularly managerial training).
Tan and Batra (1995)	√ Yes.	√ Yes. Instrumental variable approach.	A large and significant impact of training on productivity was found for skilled workers but not unskilled workers, and for in-house formal training as compared with external sources of training. The estimated parameters of the production function and control variables are moderately affected by the use of this instrumental variable approach, but the principal results remain.
Turcotte and Rennison (2004)	√ Yes	√ Not addressed	Positive and significant

Table 1.9: Dataset description (longitudinal studies)

	Dataset description							
	Sample details						Data sources	
	Country	Number of observations	Establishment	Firm	Multi-industry	Single-industry	Survey	Case studies
Almeida and Carneiro (2009)	Portugal	1.5		√		Manufacturing	√	
Ballot et al. (2001)	France/Sweden	290		√	√		√	
Ballot et al. (2006)	France/Sweden	350		√	√		√	
Barrett and O'Connell (2001)	Ireland	215		√	√		√	
Black and Lynch (2001)	U.S.	638		√	√		√	
Colombo and Stanca (2014)	Italy	11,123		√			√	
Conti (2005)	Italy	633		√	√		√	
D'Arcimoles (1997)	France	61 and 42		√	√		√	
Dearden et al. (2006)	U.K.	94			Three-digit industry level		√	
Ichniowski et al. (1997)	U.S.	36	√			Steel production lines	√	√
Konings and Vanormelingen (2014)	Belgium	170		√	√		√	
Maliranta and Asplund (2007)	Finland	916/3,718		√	√		√	
Zwick (2005)	Germany	5,675/6,886	√		√		√	
Zwick (2006)	Germany	209	√		√		√	

Table 1.10: List of the dependent variables and estimation framework details (longitudinal studies)

	DEPENDENT VARIABLES					ESTIMATION FRAMEWORK	
	Firms' performance indicators			Other indicators			
	Net sales	Value added	Production-line uptime	Product quality	Wage (level/growth)	Regression	Cobb-Douglas
Almeida and Carneiro (2009)		√					√
Ballot et al. (2001)		√			√	√	√
Ballot et al. (2006)		√			√	√	√
Barrett and O'Connell (2001)		√					√
Black and Lynch (2001)	√						√
Colombo and Stanca (2014)		√					√
Conti (2005)		√			√	√	√
D'Arcimoles (1997)		√				√	
Dearden et al. (2006)		√			√	√	√
Ichniowski et al. (1997)			√	√		√	
Konings and Vanormelingen (2014)		√			√	√	√
Maliranta and Asplund (2007)		√			√	√	
Zwick (2005)		√					√
Zwick (2006)		√					√

Table 1.11: List of training measures and content of training (longitudinal studies)

	TRAINING MEASUREMENT (INDEPENDENT VARIABLES)						CONTENT OF TRAINING			
	Length of training (n. of hours)	Training intensity (% of hours)	Training intensity (% of participants)	Number of days/weeks	Training expenditures	Training index ('high' and 'low')	Formal	Informal	General/specific	Detailed by professional occupation
Almeida and Carneiro (2009)		√			√		√			
Ballot et al. (2001)	√				√		√		√	√
Ballot et al. (2006)	√				√		√		√	√
Barrett and O'Connell (2001)				√	√		√		√	
Black and Lynch (2001)			√				√			
Colombo and Stanca (2014)	√		√		√		√	√		√
Conti (2005)			√				√			
D'Arcimoles (1997)					√		√			
Dearden et al. (2006)			√				√		√	
Ichniowski et al. (1997)						√	√			
Konings and Vanormelingen (2014)	√		√		√		√			
Maliranta and Asplund (2007)			√	√	√		√			
Zwick (2005)			√				√	√		
Zwick (2006)			√				√			

Table 1.12: Main findings (longitudinal studies)

	HR practices estimation		Impact of training/HR system on firm's performance indicators	
	'System'	'Single'	Sign	Statistically significant
Almeida and Carneiro (2009)		√	+	√
Ballot et al. (2001)		√	+	√
Ballot et al. (2006)		√	+	√
Barrett and O'Connell (2001)		√	+ (general training)	√ (general training)
Black and Lynch (2001)	√	√	Zero	-
Colombo and Stanca (2014)		√	+	√
Conti (2005)		√	+	√
D'Arcimoles (1997)	√	√	+	√
Dearden et al. (2006)		√	+	√
Ichniowski et al. (1997)	√	√	+	√
Konings and Vanormelingen (2014)		√	+	√
Maliranta and Asplund (2007)		√	+ (just the interaction term between training time and innovation)	√
Zwick (2005)		√	+	√
Zwick (2006)	√	√	+	√

Table 1.13: Estimation problems (longitudinal studies)

	Heterogeneity bias	Endogeneity bias	Elasticity between training and productivity
Almeida and Carneiro (2009)	√ Not addressed	√ First difference instrumental variable approach	An increase in training per employee of 10 hours per year, leads to an increase in current productivity of 0.6% (OLS) and of 1.3% (GMM).
Ballot et al. (2001)	√ Not addressed	Blundell and Bond (1998, 1999) show that the lagged levels of a series provide weak instruments for first differences. In order to alleviate this problem, they suggest taking into account additional nonlinear moment conditions which correspond to adding (T-2) equations in levels with variables in differences as instruments (Ahn and Schmidt 1995).	(1) The first result is based on the simultaneous study of training and R&D as inputs and appears to be a new result. It suggests the importance of training as input, especially for France, while controlling for another intangible asset, R&D, often considered as capturing the knowledge capital. (2) Some positive interactions between R&D and training stocks as inputs appear, but they are not very robust. (3) Intangible capital has few positive growth effects. Only training capital of low-skilled workers in Sweden has an impact.

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Table 1.13 – *continued from previous page*

	Heterogeneity bias	Endogeneity bias	Elasticity between training and productivity
Ballot et al. (2006)	√ Not addressed	GMM to control for possible endogeneity in R&D and training investment variables.	Positive and significant elasticity. The interaction variable has a positive (and statistically significant) coefficient in all models, indicating the importance of complementarities between human capital and R&D activities for productivity, and for wages as well.
Barrett and O'Connell (2001)	√ Not addressed	√ Not addressed	
Black and Lynch (2001)	√ Yes.	√ (1) Within estimator and (2) GMM estimator	None of the training variables included are statistically significant.
Colombo and Stanca (2014)	√ Not addressed	√ SYS-GMM and GMM; FE, Re	Positive and significant (OLS, SYS-GMM, RE, and FE estimations).
Conti (2005)	√ Not addressed	GMM technique	Positive and significant elasticity.
D'Arcimoles (1997)	√ Not addressed	√ Not addressed	

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Table 1.13 – *continued from previous page*

	Heterogeneity bias	Endogeneity bias	Elasticity between training and productivity
Dearden et al. (2006)	√ Not addressed	√ SYS-GMM and GMM; FE, Re	Positive and significant (OLS, SYS-GMM, RE, and FE estimations). The estimation results increase when endogeneity and unobserved heterogeneity is taken into account. There are two major drawbacks, however. First they combine data on different aggregation levels which may lead to aggregation bias. Second they do not control for additional personnel management measures and therefore might incur omitted variable bias as well.
Ichniowski et al. (1997)	√ Not addressed	√ Not addressed	
Konings and Vanormelingen (2014)	√ Not addressed	The authors follow the strategy proposed by Ackerberg, Caves and Frazer (2006) for estimating production functions to control for the endogeneity of input factors and training is applied.	The impact of training drop from 0.46 to 0.24.
Maliranta and Asplund (2007)	√ Not addressed	√ Not addressed	√ Not addressed
Zwick (2005)	√ Not addressed	√ Not addressed	√ Not addressed
Zwick (2006)	√ Not addressed	Instrumental variable approach	√ Not addressed

Table 1.14: List of studies on the impact of training on wages

	Dataset description										
	Sample details									Data sources	
	Country	Number of observations	Longitudinal	Cross-sectional	Employee	Establishment	Firm	Multi-industry	Single-industry	Survey	Case studies
Ballot et al. (2006)	France/Sweden	350	√				√	√		√	
Barron et al. (1989)	U.S.	1,901		√	√			√		√	
Bartel (1995)	U.S.	19,000	√		√		√		√ (a large company of the manufacturing sector)	√	
Conti (2005)	Italy	633	√				√	√		√	
Dearden et al. (2006)	U.K.	94	√					Three-digit industry level		√	
de Grip and Sieben (2005)	The Netherlands	549		√	√				√ (pharmacies)	√	
Jones et al. (2012)	Finland	1091	√						√ (two groups of cooperative banks)	√	
Konings and Vanormelingen (2010)	Belgium	170,000	√				√	√		√	
Turcotte and Rennison (2004)	Canada	4,219		√			√	√		√	
Veum (1995)	U.S.	4,614	√		√			√		√	

Table 1.15: Dependent variables and estimation frameworks (impact of training on wages)

	WAGE DEPENDENT VARIABLE		ESTIMATION FRAMEWORK	
	Wage level	Wage growth	Regression	Other
Ballot et al. (2006)	√		√	
Barron et al. (1989)	√ (starting wage)	√	√	
Bartel (1995)		√	√	
Conti (2005)	√		√	
Dearden et al. (2006)	√		√	
de Grip and Sieben (2005)	√		√	
Jones et al. (2012)	√		√	
Konings and Vanormelingen (2010)	√		√	
Turcotte and Rennison (2004)	√		√	
Veum (1995)	√	√	√	

Table 1.16: List of training measures and content of training (impact of training on wages)

	TRAINING MEASUREMENT (INDEPENDENT VARIABLES)							CONTENT OF TRAINING			
	Stock of training (total n. of days receive received up until time period t)	Length of training (n. of hours)	Training intensity (n. of courses received per year)	Training intensity (% of participants)	Dummy (% of participants)	Training expenditures	Proportion of trained workers	Formal	Informal	General/specific	Detailed by professional occupation
Ballot et al. (2006)		√				√		√		√	√
Barron et al. (1989)		√								√	
Bartel (1995)	√							√		√	
Conti (2005)	√			√			√	√			
Dearden et al. (2006)				√			√	√		√	
de Grip and Sieben (2005)		√ (days)	√							√	
Jones et al. (2012)	√					√				√	
Konings and Vanormelingen (2010)		√		√		√		√			
Turcotte and Rennison (2004)					√						
Veum (1995)		√						√			

Table 1.17: Main results (impact of training on wages)

	Impact of training on wage indicator	
	Sign	Statistically significant
Ballot et al. (2006)	+	√
Barron et al. (1989)	+	√
Bartel (1995)	+	√
Conti (2005)	-	√
Dearden et al. (2006)	+	√
de Grip and Sieben (2005)	-	
Jones et al. (2012)	+	√
Konings and Vanormelingen (2010)	+	√
Turcotte and Rennison (2004)	+	√
Veum (1995)	+	√

Table 1.18: Estimation problems and main findings (impact of training on wages)

	Heterogeneity bias	Endogeneity bias	Elasticity between training and wage
Ballot et al. (2006)	√ Not addressed	GMM to control for possible endogeneity in R&D and training investment variables.	Positive and significant elasticity.
			The elasticity between training and productivity is much higher than the elasticity between training and wage.
Barron et al. (1989)	√ Yes	√ Not addressed	Positive and significant elasticity.
Bartel (1995)	FE	√ Not addressed	Positive and significant elasticity.
Conti (2005)	√ Not addressed	GMM technique	Positive and significant elasticity; positive but not significant elasticity applying the GMM technique. The elasticity between training and
Dearden et al. (2006)	√ Not addressed	√ SYS-GMM and GMM; FE, Re	Positive and significant. The elasticity between training and productivity is twice than the elasticity between training and wage.
de Grip and Sieben (2005)	√ Not addressed	√ Not addressed	Results are not significant.
Jones et al. (2012)	FE	√ SYS-GMM	Positive and significant elasticity.
Konings and Vanormelingen (2010)	√ Not addressed	The authors follow the strategy proposed by Ackerberg, Caves and Frazer (2006) for estimating production functions to control for the endogeneity of input factors and training. The same equation is applied to wages.	Positive and significant elasticity.
			The elasticity between training and productivity is much higher than the elasticity between training and wage.
Turcotte and Rennison (2004)	Yes	√ Not addressed	Positive and significant
Veum (1995)	FE	√ Not addressed	The incidence of company training and seminars outside work was positively related both to 1990 wage levels (elasticity: 7.28) and to improvements in wages from 1986 to 1990 (elasticity: 8.97)

Table 1.19: List of studies on the impact of training on labour turnover

			Sample details (empirical studies)									Data sources (empirical studies)	
	Theoretical study	Empirical study	Country	Number of observations	Longitudinal	Cross-sectional	Employee	Establishment	Firm	Multi-industry	Single-industry	Survey	Case studies
Brum (2007)	√												
Choi and Dickinson (2009)		√	U.S.	~700	√		√				√ (lodging)		√
Haines et al. (2006)		√	Canada	4,160		√	√			√		√	
Hutchings et al. (2011) (*)		√	Australia	57		√			√	√		√	
Manchester (2008)		√	U.S.	~2,400	√		√ (single employer)				√ (non-profit)		√
Shelton (2001) (*)		√	U.S.	1,012		√	√			√		√	
Srinivas (2008)		√	U.S.	6,041	√		√			√		√	
Wagar and Rondeau (2006)		√	Canada	323		√	√			√		√	

(*) Works by Hutchings et al. (2011) et Shelton (2001) are not included in the following because they are not based on regression methods.

Table 1.20: Dependent variables and estimation frameworks (impact of training on labour turnover)

	Dependent variable			Estimation framework	
	Annual turnover rate	Annual retention rate	Probability of leave	Regression	Other
Choi and Dickinson (2009)	√				√
Haines et al. (2006)	√			√ (Tobit)	
Manchester (2008)			√	√ (Probit)	
Srinivas (2008)		√ (two-years retention rate)		√ (Logit)	
Wagar and Rondeau (2006)	√			√	

Table 1.21: List of training measures and content of training (impact of training on labour turnover)

	TRAINING MEASUREMENT (INDEPENDENT VARIABLES)			CONTENT OF TRAINING			
	Dummy	Proportion of trained workers	Training evaluation (5-point Likert scale)	Formal	Informal	General/specific	Detailed by professional occupation
Choi and Dickinson (2009)			√	√			
Haines et al. (2006)		√		√			
Manchester (2008)	√			√		√	
Srinivas (2008)	√			√		√	
Wagar and Rondeau (2006)	√ (training is part of a bundle of HRM practices)			√			

Table 1.22: Main results (impact of training on labour turnover)

	Impact of training on labour turnover indicator	
	Sign	Statistically significant
Choi and Dickinson (2009)	+	√Not applicable
Haines et al. (2006)	-	√
Manchester (2008)	+	√
Srinivas (2008)	+	√
Wagar and Rondeau (2006)	+	√

Table 1.23: Estimation problems and main findings (impact of training on labour turnover)

	Heterogeneity bias	Endogeneity bias	Elasticity between training and turnover
Choi and Dickinson (2009)	√ Not addressed	√ Not addressed	The impact of training on turnover rate is positive: part-time employees' turnover rate dropped from 107% to 70.5%; full-time employees' turnover rate dropped from 34.8% to 18.8%
Haines et al. (2006)	√ Not addressed	√ Not addressed	Negative and significant impact of training on turnover (i.e. positive impact of training on retention).
Manchester (2008)	√ Not addressed	√ Not addressed	Negative and significant impact of training on turnover (i.e. positive impact of training on retention).
Srinivas (2008)	√ Not addressed	Bivariate probit model; Instrumental variables	Negative and significant impact of training on turnover (i.e. positive impact of training on retention).
Wagar and Rondeau (2006)	√ Not addressed	√ Not addressed	Negative and significant impact of training on turnover (i.e. positive impact of training on retention).

Chapter 2

Target, dataset description, and correlates of training

2.1 Middle manager: a key strategic actor within the firm

The uniqueness of the present research lies in the distinctive feature of its target which is MM. This choice is dictated by the renowned and proved importance of this professional within firms. A developing academic literature argues that organizational performance is heavily influenced by what happens in the middle of organizations, besides at the top (Currie and Procter, 2005). Within this literature MMs are considered key and influential strategic actors. According to the definition by Floyd and Wooldridge (1994), MMs are 'the coordinators between daily activities of the units and the strategic activities of the hierarchy'. They are the link between the overall direction provided by top managers with the day-to-day reality of lower-level managers and workforce. Because MMs are both subordinate and superior, they have crucial multiple roles within the organization. Their primary duties typically include monitoring activities in support of top-management objectives, car-

rying out their strategic directives, implementing new strategies mandated by top management, translating goals into actions. They perform a coordinating role where they mediate, negotiate, and interpret connections between the organization, its customers and other external stakeholders. They supervise subordinate employees to ensure smooth functioning of the enterprise; they motivate team's creativity and performance.

As observed by Floyd and Wooldridge (1997), a substantial amount of theory and research includes MMs in models of the strategy development process, placing them as crucial drivers of strategic change. The significance of middle management role on strategy process has lead to a new area of management research (e.g. Balogun, 2007; Rouleau, 2005).

In exploring MMs' contribution to strategy, it can be observed that middle management's role in strategic change has evolved from the view of middle management as implementers of top management intentions (e.g. Hrebiniak, 2008; Nutt, 1987; O'Shannassy, 2003; Schendel and Hofer, 1979) to key strategic actors in a strategy-as-practice process (Balogun, 2003; Balogun and Hailey, 2008). This development reflects similar changes in the view of the strategy development and implementation process itself. In the traditional view, represented here by Hrebiniak (2008), strategy definition and strategy implementation are seen as two separate steps. Another branch of research by Balogun (2003, 2006); Floyd and Wooldridge (1997) considers strategy definition and strategy implementation to interact in an emergent way. From these authors, three different roles can be defined: the 'implementer' (Hrebiniak, 2008), the 'networker' (Floyd and Wooldridge, 2000), and the 'sense-maker' (Balogun, 2003, 2006).

The 'implementer' role sees MMs as responsible of the execution and of the effectiveness of the strategy defined by top management. In this view, MMs just implement. They play a crucial role in this success by training, guiding and motivating subordinate in applying the new strategy in day-to-

day operations.

MMs role is upgraded in the 'networker' view promoted by Floyd and Wooldridge (1994) and Floyd and Wooldridge (1997) suggesting that they provide a significant contribution to the competitive advantage of the company. MMs facilitate change and they are involved significantly in both the definition and the execution of strategy. They are seen to have the potential to alter the firm's strategic course since they have both upward and downward influences on strategy formation. Because they are often asked to interpret, evaluate, and summarize information about internal and external events for top management, they have powerful upward influence of how the situation is perceived and they have the chance to foster for new initiatives. Empirical research has proved middle management's upward influence on strategic decisions, suggesting a positive relationship between middle management involvement in strategy and organizational performance (Floyd and Wooldridge, 1992).

MMs' downwards influence affects the organizational activities, fostering adaptability and implementing strategy, making organizations more flexible and increasing the ability of others to respond to change (Floyd and Wooldridge, 1992, p. 154): 'They also perform a role in managing ideas within the organization that either integrate with or diverge from the strategy'.

Finally, the 'sense-maker' view sees MMs, defined as 'change intermediaries', to have a complex, demanding role to play in connecting the strategic and operational levels of the organization. Balogun and Hailey (2008) is one research in the so called Strategy-As-Practice (SAP) school which embraces the 'sense-maker' view. Focusing on the way MMs experience their role in making strategic changes, the author claims that they are key strategic actors in the process of strategy formation and evolution.

According to Johnson et al. (2008), involving MMs in strategy formu-

lation besides strategy implementation can provide at least two benefits: 'In the first place, MM involvement can lead to better strategic decisions, because MMs have direct, up-to-date experience of the realities of the organisation and its market, unlike many top managers. In the second place, including MMs in the original strategy formulation can improve implementation. MMs who have been involved in the original formulation process will be better at interpreting strategic intentions into action, have a stronger personal commitment to strategic goals, and communicate the strategy more effectively to their teams' (Johnson et al., 2008, p. 563).

Several factors have contributed to increase the importance of middle management in the past years. Johnson et al. (2008) have identified three main forces: 1) decentralization of organizational structures 2) improved business education of MMs and 3) the emergence of the knowledge based organizations. In this regard, Johnson et al. (2008) argue that 'First, many organisations are decentralising their organisational structures to increase accountability and responsiveness in fast moving and competitive environments. As a result, strategic responsibilities are being thrust down the organisational hierarchy. Second, the rise of business education means that MMs are now better trained and more confident in the strategy domain than they used to be. These higher-calibre middle managers are both more able and more eager to participate in strategy. Third, the shift away from a traditional manufacturing economy to one based more on professional services (such as design, consulting or finance) means that often the key sources of competitive advantage are no longer resources such as capital, which can be handed out from the headquarters, but the knowledge of people actually involved in the operations of the business. MMs at operational level can understand and influence these knowledge-based sources of competitive advantage much more effectively than remote top managers. For these three reasons, MMs are increasingly involved in strategy formulation' (Johnson et al., 2008, p.

563).

Despite these considerations, that of middle management is still a developing research area and several authors remind how little is known about middle management practices (Rouleau, 2005), about how middle management activities can be facilitated (Balogun, 2007), and why their role is often misunderstood and unsupported within organizations (Mayer and Smith, 2007).

Given the relevance of the roles carried out by MMs, their position within the firm, their practices and their skills might all have a potential positive impact on firms' performance.

MMs are important actors in the ownership theory too. Several researchers and observers have claimed that firms' performance is also a matter of how property rights are allocated and of who are the owners (Blair, 2005; Schleifer and Vishny, 1997). Even though the issue is not still settled, some authors have provided important results in this field[1]. One study by Barth et al. (2005) compares the performance (measured by productivity) of family-owned versus non-family-owned firms. The results provide significant difference in the estimation coefficients between firms run by owned management versus professional management[2]. Results do not provide support for the hypothesis that concentrated ownership per se affects productivity. It does, however, matter who runs the firm. When choosing between owner-management and professional management, the owner may have to make a trade-off between skills and incentives. Owner-management ensures right

[1] A thorough summary of studies of the effect of ownership structure on firm performance is given by Demsetz and Villalonga (2001).

[2] Results by Barth et al. (2005) show that family owned firms are less productive than non-family owned firms with a difference in productivity of about 10%. The authors attribute the productivity gap to differences in management regimes. They claim that family-owned firms managed by a manager from outside the owner family are equally productive as non-family-owned firms. However, family owned firms managed by a person from the owner family are found to be significantly less productive than non-family-owned firms of about 14%. This gap goes up to 15-16% if family-owned firms managed by a member of the family versus family-owned firms managed by managers from outside the family.

incentives. Nevertheless, it seems that professional managers hired in the market are more efficient in operating the firm.

In this regards, several academic contributions suggest that improving management skills is an effective way for firms to outperform their competitors (Baily et al., 1992). Analyzing a large panel of manufacturing firms in the US between 1963 and 1988 and comparing the relative position in terms of productivity of different plants, Baily et al. (1992) find that relative productivity among plants is persistent (e.g. high productivity plants tend to remain at the top of productivity) and that the persistence of relative productivity is strongly linked with management quality, including technology choice and product choice. Furthermore, the importance of management quality, as far as the persistence of relative productivity is concerned, appears to be more determinant than worker quality.

The importance of enhancing individual skills is connected with the academic literature concerning the importance of individual factors in explaining firm performance. Mollick (2012) examines whether individual differences among MMs or innovators best explain firm performance variation. The results indicate that variation between MMs has a particularly large impact on firm performance, much larger than that of those individuals who are assigned innovative roles. The results also show that MMs are necessary to facilitate firm performance in creative, innovative, and knowledge-intensive industries.

Least but not last, the importance of MMs in explaining firms' performance has been also empirically demonstrated through the analysis of their practices. MMs have been demonstrated to play a relevant role in explaining productivity gaps among firms. Recent cross sectional studies argue that the way a firm is managed has a strong effect on its performance (Bloom and Van Reenen, 2007). Firms across countries which apply accepted management practices perform significantly better than those which do not (Bloom

and Van Reenen, 2007). This issue has been demonstrated firstly by analyzing four countries (Bloom and Van Reenen, 2007) and subsequently by extending the sample to seventeen countries around the world (Bloom and Van Reenen, 2010).

Because the performance of a firm is proved to be affected by management practices, the way a firm is managed becomes a crucial issue. To this end, the above discussion has highlighted the features and the key roles that MMs have within the firm. MMs are the target of the present study: a detailed description of their training activities is supplied in the next Paragraphs.

2.2 Dataset

2.2.1 Data sources, qualities and limitations

As clarified in the , the empirical session of the present work aims at providing evidence about the determinants of MMs' training (see Chapter 2, Paragraph 2.3) as well as evidence about the returns to training at firm level (see Chapter 3) and at individual level (see Chapter 4).

The empirical analysis provided is based on a novel dataset whose details are described hereafter.

The data used in this study cover the time panel 2006-2011 and refer to Italian firms. The final dataset is a match of two sources for the same firms: 1) the Italian section of Bureau van Dijk (BvD), from which all the accounting data of firms for the corresponding years have been collected; 2) Fondirigenti, by which the dataset with all the information about MMs training has been supplied. The two datasets have been merged to create a novel dataset. The reason behind this choice is motivated from the fact that there does not exist a dataset containing both the information on training and measures of corporate performance about Italian firms, which is required for the analysis implemented in Chapters 2, 3, and 4.

The first dataset, collected from the Italian Company Accounts Database[3], comprises the data on financial accounts of a very large sample of firms. A series of firm-level indicators and variables have been drawn from this source such as the Standard Industrial Classification (SIC) sector of activity, sales, value added, physical capital, stock value of fixed capital, number of employees, average number of hours worked per employee, and other variables regarding balance sheets, firm demographics and employment. The selected variables are listed and summarized in Table 2.2.

The second dataset is collected from Fondirigenti[4]. It contains detailed information about middle management training activities provided by Italian firms. It is an individual- level dataset with one observation per individual-year. For each trained manager it includes annual information about the firm by which the manager is employed, about the provider of training[5], the number of days and hours spent in training, the cost of training, the number of training activities undertaken by each manager, training area and methods, as well as manager's gender, age, lost wages during training period, and seniority (number of years worked in the company). It also contains an interesting variable which concerns the amount of money that each year is at disposal of firms to finance manager training. As it will be clarified better in the next Chapters, this information plays a crucial role in the model identification strategy to estimate training effects at firm and individual levels. Furthermore, using this information it has been possible

[3]This is a private dataset which provides accounting information from the balance sheets of Italian companies. It is provided by BvD.

[4]See A for the definition of Fondirigenti and the description of the data generation

[5]The potential source of training examined here can be categorized as follows: universities (e.g., Bocconi, La Sapienza - Università di Roma, Politecnico di Milano, University of Freiburg), corporate universities (e.g., Eni Corporate University, General Electric, L'Oréal France, Microsoft Corporation, Robert Bosch Spa, TÜV SÜD Formazione), business schools (e.g., LUISS Business School, SDA Bocconi, MIP - Politecnico di Milano, Harvard Business School, ISTAO, Imperial College Business School, London Business School, ZfU International Business School, MIB - School of Management), vocational and technical institutes (e.g., Cegos, Federmanager Academy, Galgano & Associati, Skill Lab Srl, Confindustria, Adecco, Ambrosetti, Accenture, McKinsey).

to classify those firms which spend just a portion or over the credit balance ('active' firms) and those which do not use the credit ('inactive' firms). This suggests that the availability of money is not a binding constraint in the sample under consideration.

The result of the matching of the two datasets is a firm-level panel dataset containing firms' economic characteristics and individual training practices, over the time period going from 2006 until 2011. All the original variables have been recalculated and adjusted to the firm-level nature of the final panel dataset by using appropriate statistical measures. The data drawn from the two datasets have then been aggregated into proportions (e.g., gender, age, and seniority) and averages or sums (e.g., value added, wages, capital stock, R&D expenditure, labour turnover, number of employees, training hours, training expenditures, the number of training activities, training methods and areas, as well as lost wages) at firm level, and then merged. The rationale behind this choice relies on the different level of aggregation available in the two original datasets: while the Analisi Informatizzata delle Aziende Italiane (AIDA) database contains data disaggregated at the firm level (5-digit ATtività ECOnomiche (ATECO) 2002), the Fondirigenti dataset provides information at a lower level of aggregation (individual level). The final sample consists of 11,857 firms observed over a maximum period of 6 years, for a total of 71,142 data points used in the empirical estimates. The main characteristics of the matched sample are described in the next Paragraph.

Thanks to the rich and detailed dataset from Fondirigenti, it has been possible to derive additional key information promptly used in the empirical analysis provided in the next Chapters both as explanatory and target variables. Because trained managers are tracked year after year, a measure of labour turnover has been created: it tells if the manager has moved from the original company (and eventually how many times) or not over the six years.

The variable has been named 'labour turnover'[6]. Furthermore, a measure of manager's income, named 'hourly wage' (that is the pay per hour), has been calculated: it comes from the total amount of the wage lost during the training period divided by the number of training hours[7]. Finally, taking advantage of the panel nature of the dataset, the information about hourly wage is available not only in level but also in growth.

The dataset has some unique features that make it useful to provide a thorough description and analysis of MMs training practices in Italy.

As already pointed out, information about managers' training are unusually deep and reliable. That is true for several reasons. First (1), it is quite unusual to have in the same dataset different measures of training activity such as number of hours, number of days, number of participants, number of training activities per manager and training costs as well as methods and areas of training. Second (2), the training variables available are strong indicators. Indeed, according to the most influential studies in the related academic literature the preferred training measures are the length of training (either the number of training hours or days or weeks) and training expenditure[8]. Third (3), as opposed to the whole sample of the reviewed academic studies (see Chapter 1)[9], training information are not collected from a survey. The dataset is generated by the firm itself once the provision of training activity has been planned. Joining Fondirigenti, a company can submit its training plans at any time of year[10]. All the details concerning

[6] However, it is worthy to remind that the information concerning labour turnover is available only for those managers who have undertaken training between 2006 and 2011. Although this information has been tested in a number of models, it has been decided to drop it in the final models presented in Chapters 2, 3 and 4 because of the large number of data missing

[7] See Confindustria (2009) for a comparison regarding the level of MM's salary in Italy

[8] To set an example, several research studies have to deal with weak indicators such as training index based on a 7 points-Likert scale (Delery and Doty, 1996) and training evaluation (García, 2005).

[9] In all the reviewed studies, training information are drawn from surveys: interviewees are asked to provide information about training activities implemented several years before the survey itself leaving room to measurement errors (Bartel, 1994).

[10] Government schemes and the role of infrastructural institutions are avoided here.

the training activities must be recorded by the firm and subsequently confirmed by the organization which provides training. As a consequence, all the information collected is triple- checked: once by the responsible of the training project within the firm, once by the training provider and once by Fondirigenti. Measurement errors are not likely to occur and the reliability and the completeness of data are ensured. It is also true that utilizing a company database avoids the biases that generally result when individual are unable to accurately recall the amount of training they received and/or when definitions of training vary across diverse firms. With a few rare exceptions[11], all the papers revised (see Chapter 1) use data in training that were reported by the individual employee, raising questions about the accuracy of an individual's response regarding duration or costs of training.

Fourth (4), information are collected in real time. As soon the training activity is over, all the data process is generated. This is much better than having employee or employer reported information about past training activities and ensure precise and complete about on-the-job training. Fifth (5), the dataset is fully representative of the managers in the firm. Once the firm decides to join Fondirigenti, the registration involves all the MMs working in the firm. This means that training activities are recorded by Fondirigenti for every manager in the firm. Sixth (6), the panel nature of the dataset allows the whole training activity provided to each MMs to be tracked over the six years.

As mentioned above, the study concerns Italian firms. It might be argued that Italy deserves particular attention for several reasons. First, it is one of the countries with the lowest incidence of on-the-job training in Europe: in 2005 still only about 30% of Italian corporations were investing in training (ISFOL, 2013). Even if this share did increase to 56% in 2010 (http://ec.europa.eu/eurostat/statistics-explained/index.

[11] E.g., Barron et al. (1989); Bartel (1995); Holzer (1990).

php/Continuing_vocational_training_statistics), data are still worrying for the following two reasons: 1) in 2010 the share of training firms was still below the EU27 average (66%) and 2) the improvement between 2005 and 2010 was mainly due to the implementation of training activities required by law such as environmental protection, work health and safety. Furthermore, in 2005 Italy was ranked third from last place, after Greece and Turkey, for what concerns the employees' expectations to be involved in training activities (ISFOL, 2012). Second (2) Italy is an interesting case-study in the field of economic development because of its dualistic nature. There is a high and persistent disparity between the South and the rest of the country. The level of per capita income in Southern regions was 17,324 euro in 2009, a much lower value than that observed in the Centre-North (29,399 euro). This is a substantial gap which is also persistent, given that it has not varied significantly over the last 30 years (Aiello et al., 2014). Third (3), there are only two studies concerned with Italy (Colombo and Stanca, 2014; Conti, 2005)[12] and no evidence is available concerning MM training practices in Italy[13].

In addition to the dataset features highlighted above, the sample size is also remarkable, given that previous studies often count only few hundred observations (see Chapter 1). As shown in the next Paragraph, the dataset is statistically representative of firms in the Italian manufacturing sector regarding dimension, sectors, geographic location, and legal form. It consists of 11,857 companies: about 70% of them are 'inactive' meaning that they have never provided training from 2006 to 2011; the remaining 30% are

[12]Starting from individual-level data on training and from firm-level data on productivity and wage for the years 1996-1999, Conti (2005) analyses empirically an industry panel including all sectors of the Italian economy. Colombo and Stanca (2014) analyse the impact of workers' training on productivity and wages by means of a database representative of the population of Italian firms obtained by merging firm-level information on training and company account data between 2002 and 2005.

[13]For a further discussion about the importance to study the Italian context see Paragraph 3.2.1.

'active' firms, meaning that they have provided training activities at least once in the same time window.

With regard to the 'inactive' firms, the dataset available provides information about firms' characteristics and firms' productivity measures but there is no evidence about the individual characteristics (gender, age, hourly wage, and seniority) of those managers who do not undertake training from 2006 to 2011. Unfortunately this lack of information compromises the robustness of the analysis provided in Chapter 4. When training is regressed on wages (see Chapter 4), the estimation coefficients are significant and in line with expectations and with previous results from the academic literature. However, because the sample is restricted to those managers who undertake training with no evidence about non training recipients, it is not possible to ascribe wage variations entirely to training and to isolate its effect. Nevertheless results are interesting and worthy to be mentioned also because the issues of endogeneity and selection bias have been deeply addressed.

As often happen in empirical studies, the analysis provided herein suffer of data limitations. Although the dataset includes the majority of the variables considered in similar studies (see Chapter 1), it lacks of some information that would be relevant in explaining firms (see Chapter 3) and individuals (see Chapter 4) returns to training.

Technological change, innovation level, expenditures in new technology (which can be a proxy of training provision, e.g. see Alba-Ramírez (1994); Tan and Batra (1996), unionisations, managers' education level and previous career path are some of the main variables which would be interesting to include in the econometric frameworks implemented. A further discussion about data limitations is offered in the following Chapters.

2.2.2 Dataset description

Table 2.2 reports the descriptive statistics about the main firm's productivity and financial indicators used in the econometric frameworks implemented in Chapters 2, 3, and 4. Descriptive statistics are displayed both for the total sample (11,857 firms) and for 'active' and 'inactive' firms (3,504 firms and 8,353 firms respectively). Real values have been obtained by deflating the nominal measures with two digit producer price indices for the different years provided by Istituto Nazionale di Statistica (ISTAT) (the Central Statistics Institute). All the variables listed in Table 2.2 are drawn from AIDA.

The composition of the sample reflects the actual composition of firms in Italy (see Table 2.3). It is primarily composed of small and medium firms (i.e. with less than 250 employees), with about 15% of firms being large (more than 250 employees). The vast majority of firms in the sample is located in the North of Italy (about 78%) and is more than 14 years old in the business (about 72%). Table 2.4 reports the distribution of the activity sector of the firms in the sample. On average, the 60% of the firms belongs to the manufacturing sector. The remaining 40% is highly fragmented though other sectors such as professional, scientific and technical activities (about 7%), wholesale and retail trade (about 7%), business services (about 6%), construction (about 6%), transporting and storage (about 3%) and so on and so forth.

The sample of MMs undertaking training is primarily composed of males (about 88%) aged over 45 years (about 81%). Females represent the 12% of the sample and on average they are aged less than 54 years in the 81% of the cases (see Table 2.5). Manager's level of seniority is equally distributed through the four classes (up to 8 years, 9-15 years, 16-25 years, more than 25 years). About the 26% of mangers have up to 8 years of seniority while about the 55% have from 9 to 25 years of experience. The percentage of females

and males is not evenly distributed across the four categories of seniority. There is a higher share of women in the age group from 35 to 44 years old and a higher percentage of men in the age class over 55 years old.

MMs' hourly wage level is about 30 € on average and it is significantly associated with gender, age and seniority (see Table 2.6). Males' hourly wage level is higher than that of females. It also significantly increases across age categories and seniority categories. The annual wage growth[14] for managers is 11.5% on average[15]. Males' annual wage growth is significantly higher than that of females. It also significantly increases with the age of the manager while significantly decreases with seniority (see Table 2.7).

Tables 2.8, 2.9 and 2.10 summarize information about training activity regarding hours, method, content, and costs.

Table 2.8 displays summary descriptive statistics on the training hours received by MMs in the firm. On average, managers in the sample receive 34 hours of training and no gender gap is observed. The number of training hours received significantly decrease with manager's age and seniority.

Data show that traditional and e-based lessons are chosen in the 83% of cases with an average of 46 hours per year per manager. Practical learning methods are used in the 76% of training activities, with an average of 31 hours per year, per manager. While simulations and experience based methods are preferred in the 48% of cases with an average of 9 hours per year, per manager (see Table 2.9)[16].

In Table 2.10 for each year, the mean number of hours spent in training

[14] As mentioned in the previous Paragraph, the information about wages is available only for those managers who have undertaken training activities in the six year panel data and the annual wage growth is the wage growth measured after the training activity which may have not happened every year.

[15] The high share is probably due to the fact that training is part of the career advancement system

[16] The percentages of training methods and training area are calculated over the total number of training activities which is 55,652. Because each training activity can combine different training methods or content, the sum of the percent response is greater than 100%.

and the mean costs of training are shown. Means refer to the sample of 'active' firms (n=3,504).

On average, 'active' firms provide about 172 hours of training per year, spending over 70,000 euros. Each manager spends on average about 40 hours on training activities per year. The hourly cost of training per activity is about 274 euros and the hourly cost of training per manager is about 84 euros.

The larger the firm the larger is the amount of time and money spent in training (see Table 2.11). The yearly amount of hours and the hourly cost of training per manager both increase with firm's size. Apparently, the larger the firm the higher is the quality of training provided to their managers.

2.3 The determinants of middle manager's training

2.3.1 Introduction

As discussed in Chapter 1, results from the literature list a set of worker, job and firm characteristics that increase the probability of being engaged in training activities (general results are summarized in Table 1.1, Table 1.2 and Table 1.3). The feeling is that a consensus about the correlates of training with respect to individual, job and firm characteristics has not been totally achieved yet. Indeed, on the majority of the independent variables, the results are mixed across different types of training (such as on- and off-the-job training), across different training measures (training intensity versus training incidence), across countries and across econometric approaches.

Nevertheless, some general conclusions can be attempted.

High training industries are characterized by higher fixed capital intensity, more professional workers, more educated workers, and higher R&D (Dearden et al., 2006). High training industries are mainly composed by larger firms, which employ more middle aged female workers with higher

level of education, who work fewer hours, who are more productive and get paid higher wages (Conti, 2005). Moreover, they also experience a higher rate of labour productivity and wage growth, and have higher inflow and a lower outflow rate. In this regard, Dostie and Pelletier (2007) observe a positive and significant impact of turnover on training probability because of training of new hired. Furthermore, the literature suggests that the probability of having a formal training program generally increases with establishment size (Albert et al., 2010; Bishop, 1996; Dostie and Pelletier, 2007). For the same establishment size, establishments that are part of multi-establishment firms tend to train more than single establishment firms Bishop (1996). The location of establishment (i.e. geographic area, metropolitan area, areas of low unemployment) is found positively related with training by Bishop (1996) and by Dostie and Pelletier (2007). Growth rate and innovation rate, the industry sector and the introduction of quality systems are also positively related to training and influence the type of training provided by organisations (Bishop, 1996; Dostie and Pelletier, 2007; Jones, 2005).

The main purpose of this Paragraph is to add new light about the correlates of MM's training by investigating the relationship between MMs' training provision and firm characteristics. Due to data limitations concerning individual characteristics of non-training recipients (as mentioned in Paragraph 2.2.1), the information about training recipients (gender, age, seniority, and wage) are not included into the econometric framework in order to avoid selection bias. Following the approach by Jones (2005), the entire analysis focuses on firm's characteristics only.

2.3.2 Econometric framework

The study adopts a longitudinal research design, enabling the analysis of the determinants of training over time, in training and non-training firms exhibiting different levels of business growth. The longitudinal panel data

employed in this analysis covers a six years-time window and includes 11,857 firms[17].

A series of econometric models has been tested to measure training provision against firms' characteristics. Table 2.1 displays the econometric models implemented hereafter as well as the list of the dependent variables tested.

First, the firm's attitude to train has been analysed as a dependent variable. Firms in the sample are classified as 'active' (n=3,504) and 'inactive' (n=8,353) according to their attitude to train[18]. The dichotomous variable named 'Status' has been generated and assumes value 0 when the firm is 'inactive', 1 when the firm is 'active'.

In addition to the firm's attitude to train, the extent of training has been also regressed on firm's characteristics. In this regard, as opposed to the majority of previous studies, this investigation uses and compares three variables to measure the extent of training provided and not a single item. Training intensity, quality and variety are used as dependent variables and regressed on firm's characteristics. They refer to the number of training hours, the hourly training costs per manager and the number of training activities per manager respectively.

With regard to the econometric framework (Table 2.1), a binary logistic regression and a probit regression model the dichotomous single item measure of training provision ('Status') against the explanatory variables while random effect linear regression models training hours, costs, and number of activities (named 'TrIntensity', 'TrQuality', and 'TrVariety' respectively).

The independent variables used in this analysis have been selected among those variables which are expected to be related to increase training from the literature review (see Chapter 1). The selected explanatory variables, either categorical in nature or metric, are the following: number of employees, age

[17] For further details about the dataset's features see Paragraph 2.2.

[18] Firms are 'active' when they spend just a portion or over their credit balance; 'inactive' when they do not use the credit available.

Table 2.1: Summary of the econometric analysis implemented

Dependent Variables	**Status** (0='inactive'; 1='active')	**Tr Intensity** (# of training hours)	**Tr Quality** (hourly training cost per manager)	**Tr Variety** (# of training activities per manager)
Econometric Models	Binary Logistic Regression (see Table 2.12) Probit Regression (see Table 2.13)	Random-effect and Fixed-effect linear regression model(see Table 2.14)		

of business, growth rate of the enterprise[19], amount of money that each year is at disposal of firms to finance manager training, unemployment rate, geographic location (North-East, North-West, Centre, Islands and South), and business sector (1- digit). Year dummies are also included as controls.

The analysis implemented reveals which of the explanatory variables are associated with increased training provision, and the relative strength of the associations.

2.3.3 Main results

The results about the determinants of firms' training status ('active' and 'inactive' firms) and of the extent of training provision (measured by training hours, costs and number of activities) are strongly coherent across all the econometric specifications and the interpretation is straightforward.

Results indicate that larger firms tend to be more likely to train and to train more intensively. Indeed, organizational size is found to be strongly correlated with training intensity, quality and variety although to a different extent. Training intensity and quality are much strongly dependent from firm's size than the training variety.

As expected, the amount of money that each year is at disposal of firms to finance manager training is found to be a significant determinant of training.

[19] Jones (2005) finds this variable to be relevant in measuring training determinants.

Firms having a higher amount of money available are more likely to provide training to their managers. The larger the credit available the higher the amount of time and money and the number of activities devoted to training. Hence, apparently, training firms are able to take advantage from the money available.

Coherently with previous literature (e.g., Jones, 2005), firms experiencing positive growth level paths are more likely to provide training to MMs and to spend a larger amount of hours and money in training activities.

Geographical area is also significantly associated with training. Firms located in the North of Italy appear to be more incline to train. Firms located in the North-West and North-East spend a higher amount of time in training and provide higher quality training than firms in Central and Southern Italy. The variety of training provided is also found to be higher in the North-East and West compared to the rest of Italy.

The industry sector in which an organisation operates is strongly associated with the provision of training: firms in health services and social services, business services, electricity, gas services, professional, scientific and technical activities, manufacturing, and financial and insurance activities are more likely to provide training to their managers. Conversely, firms in accommodation and food service activities are significantly less likely to provide training activities.

Firms in health services and social services exhibit a much higher coefficient for training intensity, quality and variety. Firms in business services, in professional, scientific and technical activities, in financial and insurance activities and in electricity and gas services follow closely behind.

For what concerns the unemployment rate, the sign is not the one expected. Its relationship with training provision is not consolidated in the academic literature as well. The result corroborate the hypothesis that regional unemployment refers to the differences between regions with respect

of the availability of qualified personnel. The higher is the regional unemployment the easier in terms of money and time qualified employees can be recruited (Niederalt, 2004).

Finally, firm's age of business does not appear to be significantly associated with any measure of training provision.

2.3.4 Discussion

Results about the correlates of training are strongly coherent throughout all the specifications and all the dependent variables tested. Firm's size, geographic location, sectors, growth level paths and credit available to finance training activities are found to be significant drivers of training provision.

Although to a different extent, training intensity, quality and variety are positively dependent from firm's size. Results are not surprising and various reasons might lie behind this link. As a matter of fact, organizational size is a proxy for a variety of factors that might impact upon the ability of an enterprise to provide training. Specifically the larger is the organisation the greater are the economies of scale that can be achieved in training. In addition, it is probably the case that larger enterprises have a greater ability to provide internal, formal training, to support training with training infrastructure, to absorb losses associated with turnover among trained employees, or a better capacity to screen potential employees before hiring them. Moreover, Oi (1983) suggests that firm size may affect the provision of company training because large employers face higher monitoring costs than smaller firms, and these costs may induce large firms to try to economize on monitoring through the provision of training.

Furthermore, large enterprises are also more likely to have more skilled and professional employees, who require more training. As a result, proportionately more training is required in larger organisations. Hence because the present analysis focuses on MMs who are expected to be among the high

skilled workers, this is much likely to be the case.

Findings about the strong link between firm's size and training provision are of much interest if linked to the results concerning the impact of training on firm's productivity. Hypothesis H2 in Chapter 3 shows that training undertaken in large firms is more likely to have positive and significant returns on firm's productivity (see Table 3.6). Findings from the two analyses in Chapter 2 and Chapter 3 lead to the following conclusion. Because larger firms are more likely to provide high quality training (see Table 2.14) (measured by the hourly cost of training per manager) they are also more likely to face higher training returns because of its potentially higher effectiveness.

Despite all the above considerations, it is worthy to remind that results from previous literature concerning firm's size are various. A strong correlation of organisational size not only with the volume (Capelli and Rogovsky, 1994; Osterman, 1995; Smith and Hayton, 1999), but also with the diversity of training is observed in several studies (Bishop, 1996; Jones, 2005). In contrast to research that has found size to be the most important explanatory factor for improved training provision, Jones (2005) found that size is only a significant determinant of training in low growth SMEs in 1996-1997. Frazis et al. (2000) found that larger establishments tend to be more likely to train, but this is largely offset by a tendency to train less intensively. On the contrary, in Smith et al. (2003) study size was not found to be positively related with any training practices, apart from the existence of a training manager. Smith et al. (2003) found organisational change as the most important explanatory factor for training and they unpack the phenomenon of size with respect to organisational change.

As in Jones (2005), firms experiencing positive growth level paths are found to be more likely to provide training to MMs and to train more intensively and effectively.

Geographical area is also found to be a significant determinant of training

provision. Firms located in the North of Italy are more inclined to provide training activities, to train more intensively and at a higher hourly cost.

Again, results are particularly interesting if read in the light of the findings about the impact of training on firms' productivity. Hypothesis H4 tested in Chapter 3 shows that training is much less effective in firms located in the Center and South areas (see Table 3.6). The impact of training on total factor productivity is positive and statistically significant for firms in the North of Italy (the estimated coefficient is 0.6764*) while it is still positive but not significant for firms in the Center and South of Italy (the estimated coefficient is 1.0257). To conclude, firm's location is a determinant of training intensity, quality, and variety with direct and important consequences regarding its effectiveness and its impact on firm's productivity.

The literature suggests that investments in training and technology are closely related (Blundell et al., 1999). Training plays a significant role when technological change is rapid and the knowledge necessary to implement the new technologies is very specific. For example, several studies (Baldwin and Johnson, 1995, 1997; Baldwin and Peters, 2001), have established that the implementation of new technologies in Canadian manufacturing firms increased the level of required qualifications and stimulated firms to invest in training (Turcotte and Rennison, 2004). Likewise, in the US, Bartel and Sicherman (1998) showed that several technological change indicators positively influenced the number of hours of training through an increase in the participation of workers who had not received any previous training.

Unfortunately, the present study is unable to test the technology dimension directly. Its effect can only be inferred through the firm's activity sector. Results seem to confirm the common view mentioned above. Following the recent classification of manufacturing industries based on technology OECD (2011), some of the sectors exhibiting positive and significant coefficients are classified as medium-high technology sectors by Organisation for Economic

Co-operation and Development (OECD).

As previously mentioned, this study also lacks about relevant information concerning firm's and worker's characteristics which are found to be important correlates of training in previous studies. The proportion of part-time workers, the presence of labour unions, the occupational structure, labour turnover[20], and managerial attitudes are only some of the important information that should be considered while analysing the determinant of training.

This lack of information is partially mitigated by the fact that the present study relies on MMs only. This reminder is particularly important given that the literature suggests that investments in training and education are closely related (Blundell et al., 1999). Bartel and Sicherman (1998) have shown that highly educated workers are more likely to participate in training than those with less education. This fact is confirmed by several other studies in the US and Canada (Jennings, 1996; Leonard et al., 2003; Loewenstein and Spletzer, 1994; Lynch, 1992) and suggests a complementary relationship between human capital acquired through the education system and that acquired through in house training[21].

MMs are more likely to hold high levels of education compared to some other workforce categories. This might partially explain why the results concerning the correlates of training in the present study are found to be very coherent and consistent across econometric specifications and training measures.

[20] In a preliminary version of the model, a measure of the labour turnover has been calculated from the original dataset and included into the estimation framework. The variable named 'Labour Turnover' has been calculated from the original individual-level dataset provided by Fondirigenti. Because each manger and his training activity are tracked over firms and over six years, it has been possible to infer a measure of his loyalty to the firm. Although the information about labour turnover is relevant in explaining training provision, it has been dropped from the simulation due to the large number of data missing.

[21] Bartel and Sicherman (1998) have pointed out that the participation differentials in training between workers with little education and those who are highly educated are mitigated to some extent (although not eliminated) where there is a high rate of technological change.

Table 2.2: Firms' descriptive statistics: productivity and financial indicators

Variable	Obs	Mean	Std. Dev.	Min	Max
TOTAL SAMPLE (11,857)					
Age of Business	69018	27.93923	18.04302	2	156
Number of employees (L)	54405	264.2371	2103.194	1	153369
Capital (K)	61929	3.64E+07	8.28E+08	-20133.8	7.88E+10
Return on sales (ROS) (%)	56782	2.793305	9.877583	-49.5206	29.64096
Return on Equity (ROE) (%)	57273	3.189961	27.41721	-148.681	137.7943
Total factor productivity (TFP)	52023	83836.93	365765.3	0.516841	5.45E+07
Value added per employee (VA)	52846	78.84461	59.01475	-49	499
Annual growth rate of value added (ΔVA)	45180	-0.00425	0.725817	-19.5776	19.63254
Turnover	61900	9.91E+07	1.17E+09	-244536	1.08E+11
1 year turnover growth (ΔTS)	48830	-0.07225	2.215408	-24.3876	25.63278
INACTIVE FIRMS (8,353)					
Age of Business	50118	27.48222	17.48245	2	139
Number of employees (L)	37160	104.7281	238.1252	1	8701
Capital (K)	43571	8809977	6.44E+07	-20133.8	6.26E+09
Return on sales (ROS) (%)	39117	2.476921	10.25756	-49.5206	29.62112
Return on Equity (ROE) (%)	39730	2.757581	28.13596	-148.641	137.7943
Total factor productivity (TFP)	35150	76668.48	295145.9	0.516841	1.95E+07
Value added per employee (VA)	35925	76.6081	59.58192	-49	499
Annual growth rate of value added (ΔVA)	30533	-0.00465	0.718097	-18.2661	18.76225
Turnover	43562	3.19E+07	3.15E+08	-244536	3.75E+10
1 year turnover growth (ΔTS)	33748	-0.10113	2.424313	-22.8048	22.08722
ACTIVE FIRMS (3,504)					
Age of Business	18900	29.15111	19.39986	2	156
Number of employees (L)	17245	607.9514	3696.016	1	153369
Capital (K)	18358	1.02E+08	1.52E+09	0.1	7.88E+10
Return on sales (ROS) (%)	17665	3.4939	8.93964	-48.764	29.64096
Return on Equity (ROE) (%)	17543	4.169183	25.68915	-148.681	117.2548
Total factor productivity (TFP)	16873	98770.3	480307.1	35.59983	5.45E+07
Value added per employee (VA)	16921	83.59293	57.50622	-48	499
Annual growth rate of value added (ΔVA)	14647	-0.00341	0.741675	-19.5776	19.63254
Turnover	18338	2.59E+08	2.08E+09	0.1	1.08E+11
1 year turnover growth (ΔTS)	15082	-0.00762	1.653297	-24.3876	25.63278

Table 2.3: Firms' descriptive statistics: size, geographic location, age of business

		Status		
Size		Inactive	Active	Total
Micro	#	6,450	450	6,900
	% row	93.48	6.52	100
	% column	12.87	2.34	9.95
Small	#	19,224	2,982	22,206
	% row	86.57	13.43	100
	% column	38.36	15.52	32.03
Medium	#	20,904	8,730	29,634
	% row	70.54	29.46	100
	% column	41.71	45.44	42.74
Large	#	3,540	7,050	10,590
	% row	33.43	66.57	100
	% column	7.06	36.7	15.27
Total	#	50,118	19,212	69,330
	% row	72.29	27.71	100
	% column	100	100	100

		Status		
Area		Inactive	Active	Total
North-West area	#	24,462	9,576	34,038
	% row	71.87	28.13	100
	% column	48.81	45.55	47.85
North-East area	#	14,904	6,534	21,438
	% row	69.52	30.48	100
	% column	29.74	31.08	30.13
Center area	#	7,044	3,570	10,614
	% row	66.37	33.63	100
	% column	14.05	16.98	14.92
Islands and South area	#	3,708	1,344	5,052
	% row	73.4	26.6	100
	% column	7.4	6.39	7.1
Total	#	50,118	21,024	71,142
	% row	70.45	29.55	100
	% column	100	100	100

		Status		
Age of Business		Inactive	Active	Total
Young	#	13,059	6,474	19,533
	% row	66.86	33.14	100
	% column	26.06	30.79	27.46
Old	#	37,059	14,550	51,609
	% row	71.81	28.19	100
	% column	73.94	69.21	72.54
Total	#	50,118	21,024	71,142
	% row	70.45	29.55	100
	% column	100	100	100

Table 2.4: Firms' descriptive statistics: activity sector

Ateco01	Freq.	Percent
TOTAL SAMPLE (11,857)		
(Sector 03) Manufacturing	41,754	60.52
(Sector 13) Professional, scientific and technical activities	5,010	7.26
(Sector 07) Wholesale and retail trade	4,674	6.77
(Sector 10) Business services	4,146	6.01
(Sector 06) Construction	3,936	5.70
(Sector 08) Transporting and storage	2,244	3.25
(Sector 14) Administrative and support service activities	1,248	1.81
(Sector 12) Real estate activities	1,218	1.77
(Sector 05) Sanitary Services	1,212	1.76
(Sector 04) Electricity, Gas Services	966	1.40
(Sector 11) Financial and Insurance activities	828	1.20
(Sector 01) Agriculture, Forestry, Fishing	372	0.54
(Sector 02) Mining and quarrying	300	0.43
(Sector 09) Accommodation and food service activities	264	0.38
(Sector 18) Non-classifiable establishments	264	0.38
(Sector 15) Educational services	246	0.36
(Sector 17) Amusement and recreation services	168	0.24
(Sector 16) Health services and social services	144	0.21
INACTIVE FIRMS (8,353)		
(Sector 03) Manufacturing	29,178	58.69
(Sector 13) Professional, scientific and technical activities	3,678	7.40
(Sector 07) Wholesale and retail trade	3,636	7.31
(Sector 10) Business services	2,724	5.48
(Sector 06) Construction	3,222	6.48
(Sector 08) Transporting and storage	1,704	3.43
(Sector 14) Administrative and support service activities	978	1.97
(Sector 12) Real estate activities	1,074	2.16
(Sector 05) Sanitary Services	894	1.80
(Sector 04) Electricity, Gas Services	624	1.26
(Sector 11) Financial and Insurance activities	624	1.26
(Sector 01) Agriculture, Forestry, Fishing	312	0.63
(Sector 02) Mining and quarrying	264	0.53
(Sector 09) Accommodation and food service activities	210	0.42
(Sector 18) Non-classifiable establishments	216	0.43
(Sector 15) Educational services	144	0.29
(Sector 17) Amusement and recreation services	132	0.27
(Sector 16) Health services and social services	102	0.21
ACTIVE FIRMS (3,504)		
(Sector 03) Manufacturing	12,576	65.23
(Sector 13) Professional, scientific and technical activities	1,332	6.91
(Sector 07) Wholesale and retail trade	1,038	5.38
(Sector 10) Business services	1,422	7.38
(Sector 06) Construction	714	3.70
(Sector 08) Transporting and storage	540	2.80
(Sector 14) Administrative and support service activities	270	1.40
(Sector 12) Real estate activities	144	0.75
(Sector 05) Sanitary Services	318	1.65

Continued on next page

Table 2.4 – *continued from previous page*

(Sector 01) Agriculture, Forestry, Fishing	60	0.31
(Sector 02) Mining and quarrying	36	0.19
(Sector 09) Accommodation and food service activities	54	0.28
(Sector 18) Non-classifiable establishments	48	0.25
(Sector 15) Educational services	102	0.53
(Sector 17) Amusement and recreation services	36	0.19
(Sector 16) Health services and social services	42	0.22

Table 2.5: Managers' descriptive statistics: age and seniority

Age	F	M	Total
<34 #	43	244	287
% row	14.98	85.02	100
% column	1.33	1.07	1.1
35-44 #	824	4,161	4,985
% row	16.53	83.47	100
% column	25.54	18.22	19.12
45-54 #	1,760	11,577	13,337
% row	13.2	86.8	100
% column	54.56	50.68	51.16
>55 #	599	6,860	7,459
% row	8.03	91.97	100
% column	18.57	30.03	28.61
Total #	3,226	22,842	26,068
% row	12.38	87.62	100
% column	100	100	100

Seniority	F	M	Total
up to 8 years #	661	5,672	6,333
% row	10.44	89.56	100
% column	21.84	26.19	25.66
9-15 years #	861	5,869	6,730
% row	12.79	87.21	100
% column	28.45	27.1	27.26
16-25 years #	919	5,897	6,816
% row	13.48	86.52	100
% column	30.37	27.23	27.61
more than 25 years #	585	4,220	4,805
% row	12.17	87.83	100
% column	19.33	19.48	19.47
Total #	3,026	21,658	24,684
% row	12.26	87.74	100
% column	100	100	100

Table 2.6: Managers' descriptive statistics: hourly wage level by gender - age - seniority

	Hourly Wage Level		
Gender	Mean	Std. Dev.	Freq.
F	28.9681	15.8949	6954
M	30.4893	17.1248	48698
Total	30.2992	16.9833	55652

	Analysis of Variance				
Source	SS	df	MS	F	Prob > F
Between groups	14080.36	1	14080.36	48.86	0
Within groups	16037496	55650	288.185		
Total	16051576	55651	288.4328		

Bartlett's test for equal variances: chi2(1) = 65.1135 Prob>chi2 = 0.000

	Hourly Wage Level		
Age	Mean	Std. Dev.	Freq.
<34	17.5417	7.0353	361
35-44	23.3882	13.4214	11464
45-54	30.1936	16.0989	27953
>55	35.7663	18.8556	15874
Total	30.2992	16.9833	55652

	Analysis of Variance				
Source	SS	df	MS	F	Prob > F
Between groups	1081074	3	360357.9	1339.51	0
Within groups	14970503	55648	269.0214		
Total	16051576	55651	288.4328		

Bartlett's test for equal variances: chi2(3) = 1.8e+03 Prob>chi2 = 0.000

	Hourly Wage Level		
Seniority	Mean	Std. Dev.	Freq.
up to 8 years	18.6607	9.2979	14275
9-15 years	25.3305	11.1929	15563
16-25 years	36.9933	16.2084	13801
more than 25 years	43.9920	19.2803	8614
Total	29.6651	16.6819	52253

	Analysis of Variance				
Source	SS	df	MS	F	Prob > F
Between groups	4530330	3	1510110	7881.71	0
Within groups	10010735	52249	191.5967		
Total	14541065	52252	278.2872		

Bartlett's test for equal variances: chi2(3) = 7.9e+03 Prob>chi2 = 0.000

Table 2.7: Managers' descriptive statistics: annual wage growth by gender - age - seniority

	Annual Wage Growth		
Gender	Mean	Std. Dev.	Freq.
F	0.100252	0.10377	3851
M	0.116703	0.100996	26839
Total	0.114639	0.101493	30690

	Analysis of Variance				
Source	SS	Df	MS	F	Prob > F
Between groups	0.911458	1	0.911458	88.74	0
Within groups	315.2115	30688	0.010271		
Total	316.123	30689	0.010301		

Bartlett's test for equal variances: chi2(1) = 5.0099 Prob>chi2 = 0.025

	Annual Wage Growth		
Age	Mean	Std. Dev.	Freq.
<34	0.07619	0.109411	199
35-44	0.114658	0.101196	6181
45-54	0.113581	0.101954	15545
>55	0.117376	0.100498	8765
Total	0.114639	0.101493	30690

	Analysis of Variance				
Source	SS	Df	MS	F	Prob > F
Between groups	0.377259	3	0.125753	12.22	0
Within groups	315.7457	30686	0.01029		
Total	316.123	30689	0.010301		

Bartlett's test for equal variances: chi2(3) = 4.7678 Prob>chi2 = 0.190

	Annual Wage Growth		
Seniority	Mean	Std. Dev.	Freq.
up to 8 years	0.12228	0.107273	7781
9-15 years	0.114863	0.102162	8505
16-25 years	0.109649	0.100551	7709
more than 25 years	0.109883	0.096599	4828
Total	0.114637	0.102365	28823

	Analysis of Variance				
Source	SS	Df	MS	F	Prob > F
Between groups	0.75594	3	0.25198	24.1	0
Within groups	301.2591	28819	0.010453		
Total	302.015	28822	0.010479		

Bartlett's test for equal variances: chi2(3) = 71.2926 Prob>chi2 = 0.000

Table 2.8: Managers' descriptive statistics: training hours by gender - age - seniority

	Training Hours		
Gender	Mean	Std. Dev.	Freq.
F	32.98073	60.47922	6954
M	34.06477	61.35664	48698
Total	33.92931	61.2482	55652

	Analysis of Variance				
Source	SS	df	MS	F	Prob > F
Between groups	7150.764	1	7150.764	1.91	0.1674
Within groups	2.09E+08	55650	3751.281		
Total	2.09E+08	55651	3751.342		

Bartlett's test for equal variances: chi2(1) = 2.5063 Prob>chi2 = 0.113

	Training Hours		
Age	Mean	Std. Dev.	Freq.
<34	56.72022	68.33091	361
35-44	38.37195	68.67233	11464
45-54	33.0171	61.7426	27953
>55	31.80893	53.81043	15874
Total	33.92931	61.2482	55652

	Analysis of Variance				
Source	SS	df	MS	F	Prob > F
Between groups	508407.8	3	169469.3	45.28	0
Within groups	2.08E+08	55648	3742.408		
Total	2.09E+08	55651	3751.342		

Bartlett's test for equal variances: chi2(3) = 825.8724 Prob>chi2 = 0.000

	Training Hours		
Seniority	Mean	Std. Dev.	Freq.
up to 8 years	34.55706	62.04652	14275
9-15 years	33.39035	60.22664	15563
16-25 years	32.78125	60.33265	13801
more than 25 years	32.52008	60.67213	8614
Total	33.40474	60.83318	52253

	Analysis of Variance				
Source	SS	df	MS	F	Prob > F
Between groups	31064.59	3	10354.86	2.8	0.0385
Within groups	1.93E+08	52249	3700.293		
Total	1.93E+08	52252	3700.675		

Bartlett's test for equal variances: chi2(3) = 16.3807 Prob>chi2 = 0.001

Table 2.9: Training hours by method and area

Training Method - % of cases	Obs	Freq
TrM1 - Simulations and experience based methods	55652	47.75%
TrM2 - Practical learning methods	55652	76.48%
TrM3 - Traditional and e-based methods	55652	82.79%

Training Method - Hours	Obs	Mean	Std. Dev.	Min	Max
TrM1 - Simulations and experience based methods	21024	9.3974	67.6645	0	4444
TrM2 - Practical learning methods	21024	30.5962	239.6148	0	12205
TrM3 - Traditional and e-based methods	21024	46.2081	526.6650	0	46268

Training Area - % of cases	Obs	Freq
Communication	55652	50.10%
Conceptual	55652	45.32%
Leadership	55652	80.06%
Technical	55652	90.37%

Training Area – Hours	Obs	Mean	Std. Dev.	Min	Max
Communication	21024	19.2147	157.9740	0	12858
Conceptual	21024	8.6518	138.3870	0	15760
Leadership	21024	20.0702	250.5549	0	25672
Technical	21024	38.2650	320.1148	0	22922

Table 2.10: Descriptive statistics: training hours and training cost ($n = 3,504$ per year)

	Total Training Hours		Training Hours per Manager		Total Training Costs		Hourly Training Costs		Hourly Training Costs per Manager	
YEAR	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
2006	206.67387	1208.3158	31.3452	52.7057	57345.4410	209193.5300	226.6350	269.5892	92.3247	42.5297
2007	279.83363	2084.1245	29.8139	45.5084	84751.6960	253519.0400	269.3281	367.8289	84.5917	43.1336
2008	118.5107	339.67436	29.4146	38.7605	70274.0630	205757.7400	303.2826	435.2324	83.3713	42.7546
2009	142.86585	593.06404	33.2313	43.5086	79954.8320	219772.6100	323.8244	476.5843	83.3139	42.8660
2010	132.1123	366.69174	35.5219	40.7982	58933.2050	188639.7900	253.4361	338.0440	83.0326	40.7965
2011	192.35095	344.04216	81.9911	114.0655	63633.2140	178553.5300	220.7610	288.7429	83.2567	36.6994
Total	171.6523	992.45243	39.2704	61.8110	70675.9640	211152.7400	274.6353	389.2775	84.2231	41.6120

Table 2.11: Descriptive statistics: training hours and training cost by firm's size

Total Training Hours

Size	Mean	Std. Dev.	Freq.
Micro	22.5311	78.5355	450
Small	25.7559	79.6871	2982
Medium	36.6857	108.3749	8730
Large	182.4529	1191.9794	7050
Total	88.1481	730.0488	19212

Analysis of Variance

Source	SS	df	MS	F	Prob > F
Between groups	128362837	3	42787612	41.67	0
Within groups	9.96E+09	9704	1026835		
Total	1.01E+10	9707	1039741		

Bartlett's test for equal variances: chi2(3) = 1.8e+04 Prob>chi2 = 0.000

Hourly Training Cost per Manager

Size	Mean	Std. Dev.	Freq.
Micro	32.809777	53.624337	450
Small	33.700108	52.278873	2982
Medium	35.958189	50.356477	8730
Large	43.174223	48.630242	7050
Total	38.181937	50.263564	19212

Analysis of Variance

Source	SS	df	MS	F	Prob > F
Between groups	291762.76	3	97254.25	38.72	0
Within groups	48243405	19208	2511.631		
Total	48535168	19211	2526.426		

Bartlett's test for equal variances: chi2(3) = 28.1617 Prob>chi2 = 0.000

Table 2.12: Probit Regression model

	Status
ln Employees$_{t-1}$	1.1039***
	(0.030)
Age of Business	0.0022
	(0.002)
ln AmTr	0.2363***
	(0.013)
Growth Value Added	0.1328*
	(0.080)
(Area1) North-West	1.0003***
	(0.212)
(Area2) North-East	1.1640***
	(0.230)
(Area3) Center	0.9719***
	(0.186)
(Sector 03) Manufacturing	0.9617**
	(0.491)
(Sector 04) Electricity, Gas Services	1.7032***
	(0.552)
(Sector 09) Accommodation and food service activities	-1.2477*
	(0.702)
(Sector 10) Business services	1.8818***
	(0.501)
(Sector 11) Financial and Insurance activities	0.9509*
	(0.575)
(Sector 13) Professional, scientific and technical activities	1.4398***
	(0.503)
(Sector 16) Health services and social services	4.2071***
	(0.638)
Unemployment Rate	0.0475*
	(0.027)
Constant	-8.0042***
	(0.619)
Sector controls	yes
Year dummies	yes
Estimation period	2006-2011
# of observations	43732
# of groups	10493
Observations per group: min	1
Observations per group: avg	4.168
Observations per group: max	5
Log likelihood	-6274
Wald Chi(2)	2611
Prob>chi2	0

Table 2.13: Binary Logistic Regression

	Status
ln Employees$_{t-1}$	3.0875***
	(0.092)
Age of Business	0.0069
	(0.006)
ln AmTr	0.5943***
	(0.030)
Growth Value Added	0.6226**
	(0.259)
(Area1) North-West	3.1658***
	(0.706)
(Area2) North-East	3.8995***
	(0.772)
(Area3) Center	3.0889***
	(0.608)
(Sector 04) Electricity, Gas Services	4.7915**
	(1.968)
(Sector 09) Accommodation and food service activities	-5.6132**
	(2.543)
(Sector 10) Business services	4.1394**
	(1.734)
(Sector 13) Professional, scientific and technical activities	3.5597**
	(1.718)
(Sector 16) Health services and social services	9.0652***
	(2.118)
Unemployment Rate	0.2937***
	(0.088)
Constant	-23.5038***
	(2.108)
Sector controls	yes
Year dummies	yes
Estimation period	2006-2011
# of observations	43,732
# of groups	10,493
Observations per group: min	1
Observations per group: avg	4.168
Observations per group: max	5
Log likelihood	-5588.61
Wald Chi(2)	1729
Prob>chi2	0

Table 2.14: The determinants of training intensity - quality - variety

VARIABLES	TrIntensity	TrQuality	TrVariety
ln Employees$_{t-1}$	0.4741***	0.4009***	0.1570***
	(0.011)	(0.011)	(0.004)
Age of Business	0.0000	-0.0010	-0.0003
	(0.001)	(0.001)	(0.000)
ln AmTr	0.1213***	0.1175***	0.0471***
	(0.003)	(0.003)	(0.001)
Growth Value Added	0.0753*	0.0962**	0.0202
	(0.041)	(0.041)	(0.016)
(Area1) North-West	0.7088***	0.7943***	0.2558***
	(0.112)	(0.109)	(0.042)
(Area2) North-East	0.7078***	0.7669***	0.2625***
	(0.121)	(0.119)	(0.046)
(Area3) Center	0.6590***	0.6013***	0.2313***
	(0.099)	(0.097)	(0.037)
(Sector 04) Electricity, Gas Services	0.4980**	0.3511	0.1384
	(0.249)	(0.243)	(0.093)
(Sector 10) Business services	0.8034***	0.5515**	0.2444***
	(0.220)	(0.214)	(0.082)
(Sector 11) Financial and Insurance activities	0.5490**	0.5030**	0.1797*
	(0.261)	(0.254)	(0.098)
(Sector 13) Professional, scientific and technical activities	0.6690***	0.4908**	0.2110**
	(0.219)	(0.213)	(0.082)
(Sector 16) Health services and social services	1.3068***	0.9900***	0.5054***
	(0.347)	(0.339)	(0.130)
Unemployment Rate	0.0630***	0.0659***	0.0200***
	(0.014)	(0.013)	(0.005)
Sector controls	yes	yes	yes
Year dummies	yes	yes	yes
Constant	-3.9414***	-3.5072***	-2.7779***
	(0.271)	(0.266)	(0.102)
# of observations	52,712	52,712	52,712
# of groups	10,617	10,617	10,617
Observations per group: min	1	1	1
Observations per group: avg	4.965	4.965	4.965
Observations per group: max	6	6	6
R-sq within	0.0353	0.0353	0.0353
R-sq between	0.300	0.300	0.300
R-sq overall	0.189	0.189	0.189
Wald Chi(2)	5944	5944	5944
Prob>chi2	0	0	0

Chapter 3

Training outcomes: returns to firms

3.1 Introduction

It is widely documented that human capital investments are essential for firms to maintain high levels of competitiveness, to confront continuing technological change, and to reap their benefits. Training[1] represents one major activity to improve skills and abilities which in turn increase human capital accumulation. Indeed, to set an example, some specific skills involved in the operation of a business cannot be learned through the general learning framework provided by the education system. As well, many technological changes and new forms of work organization require workers to upgrade their skills on an ongoing basis, a task best accomplished through on-the-job training.

Becker's influential study on human capital (1964) has shown that the human capital stock of the firm, accumulated through training activities, is one of the main factors enhancing human capital and, in turn, productivity.

[1] Training is defined as 'a planned initiative taken by the organization to impart the job knowledge and skills and also to modify the attitudes and behaviours of employees in ways consistent with the goal of the organization' (Noe, 2002).

In this regard, several empirical studies exist that relate firm productivity to a measure of training (see Paragraph 1.1.2 in Chapter 1). The interest on this topic has constantly increased in the last few decades and a growing number of influential papers have been trying to capture the effect of employer-provided training on productivity by using representative firm-level data from several sectors in the economy.

As discussed in Chapter 1, the magnitude of the returns of training investments to firm performance indicators do not seem to be precisely defined although a positive correlation between training and firm's performance is generally found.

Several estimation approaches have been implemented by the authors in order to deal with the well-known estimation problems that arise when estimating the effect of training on firm's performance (for a thorough discussion see Chapter 1). The two biases, named unobserved heterogeneity and endogeneity, are far from being unanimously resolved. Instrumental variables, fixed effects estimations, and dynamic models are the preferred strategies implemented on panel dataset used to address the estimation problems. In this regard, although previous academic studies are broadly consistent, they do not fully exploit the potential of their panel data by allowing training to be a choice variable.

The contribution of the analysis presented hereafter is to advance the literature in at least three ways. First, the present research investigates for the first time anywhere the effects of MMs' training on firm performance as measured by profitability and productivity. As widely discussed in Chapter 1, MMs training can be seen as an important tool for improving and upgrading managerial practices within the firm in order to sustain corporate strategy and competitive advantage. Second, the study is based on a novel, rich and particularly reliable panel dataset on Italian firms for the period 2006-2011 (for further details about the dataset, see Chapter 2). It is statis-

tically representative of the population of Italian firms regarding size, sectors, geographic location, and legal form. The dataset is also representative of every manager within the firm, meaning that it is possible to track training activity of each manager over six years. Third, the study empirically tests research hypotheses using regression models based on GMM estimation. Unlike previous literature, the endogeneity issue is addressed by implementing an instrumental variable approach based on an external instrument which seems to mimic the characteristic of the theoretical instrument.

In summary, the analysis provided in Chapter 3 finds support for the following: middle management continuing training has an effect on performance, namely return on investment, return on equity, and total factor productivity. However, the first two show a TMGT effect; MMs' training is more effective for the following: larger firms; younger firms; the location where training is activated is important in making MMtraining effective; different methods of training have heterogeneous effects on performance. Managerial implications are derived.

3.2 The Research Hypotheses

3.2.1 Overall Effect of Training

Several currents of thought suggest and demonstrate the role of human resource practices in determining and influencing business results (Becker and Gerhart, 1996; Pfeffer, 1994; Wright and McMahan, 1992). Among them, the Resource-Based View of the firm (RBV) of the firm (Barney, 1991, 1995; Dierickx and Cool, 1989; Penrose, 1975; Rumelt, 1984) highlights the importance of the firm's internal and specific factors in order to generate a competitive advantage. According to the RBV, durable and sustained competitive advantages lie on the development of the bundle of valuable resources and on specific bundles of HR bundles at the firm's disposal which must be nei-

ther perfectly imitable nor substitutable without great effort (Barney, 1991; Conner, 1991; Wernerfelt, 1984)[2]. A number of empirical studies addressed the issue focusing mainly on the effects on performance of firm of training of all the employees. By contrast, the present analysis is entirely focused on MMs. The importance of working on this specific target instead of a broad one is dictated by the two following considerations. As already suggested MMs represent a key professional figure for firms for several reasons. They are typically the decision makers with regard to knowledge diffusion and seizing opportunities afforded by information and communication technologies. They are able to exploit opportunities and neutralize threats. In addition, they could be rare in terms of firm-specific knowledge and constitute an imperfectly imitable, non-substitutable resource for the firm. Indeed, firm-specific knowledge accumulated by managers in a firm is not completely substitutable because the competitive advantage of a firm is determined in a unique historical, social and economic context: other managers would lack the knowledge of these particular circumstances, and they could replace the management team only imperfectly (Mahoney, 1995). Furthermore, organizational capability at a management level is essential to improve international competitiveness (Castanias and Helfat, 1991). Finally, managers are particularly instrumental in creating organizational ethos of learning for all groups of employees (Martin et al., 1998). Indeed, the work of these authors explores the viability of the 'bounded emotionality' in a large and successful private sector corporation. The 'bounded emotionality' is an approach differing from the 'classic' norms of impersonality characterizing large organizations and encouraging the constrained expression of emotions at work to increase community building and well-being in the workplace. Thus, using data from qualitative surveys, Martin et al. (1998) underline that managers

[2] 'Firm resources include all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness' Barney, 1991, p. 101.

at all levels are key figures for the implementation of this approach and are particularly instrumental in creating organizational ethos of learning for all groups of employees.

The fact that MMs have been shown to play a key role in explaining the heterogeneity of business results among firms. More specifically, several studies demonstrate that training devoted to managers has a positive impact on their practices (Mabey, 2004) which in turn have a positive and significant impact on firm performance (Bloom and Van Reenen, 2007, 2010; Bloom et al., 2012). Bloom and Van Reenen (2007) study is based on 732 medium-sized firms in the US, UK, France, and Germany. Considering eighteen individual management practices and taking a score of each practice as independent variable in the productivity function, they find substantial evidence that the measures of management are positively and significantly correlated with superior firm performance in terms of productivity, profitability, Tobin's Q, sales growth, and survival. For example, an increase from the lower to the upper quartile of the management score between firms (0.972 points) is associated with an increase in productivity (measured as net sales) of between 3.2% and 7.5%. In a subsequent study, the same authors extend this kind of analysis to 3,380 manufacturing firms in seventeen countries around the world (Bloom and Van Reenen, 2010). Again, they find that higher management scores are associated with better performance in terms of productivity, profitability, growth rates, survival rates, and market values. Similar results are found also in another work by Bloom et al. (2012), confirming that variations in management practices explain the large differences in productivity among firms and countries. The magnitude of the impact of training on firm's performance is expected to be positive and significant because of its direct effect on manager's practices.

Moreover, recent contributions in the managerial literature recognize non-linearity of effect as a key factor (Wales et al., 2013). In particular,

there could be an inverted U shaped relationship between training and performance. This effect is also known as the TMGT. It is not possible to know ex ante if and when the positive impact hypothesized becomes close to zero or even negative. Conversely, there exists a series of trade-offs in providing training to MMs. Thus, there exists a direct cost of training, then the indirect cost given by the lost production due to the fact that MMis taken away by her/his typical activity has to be taken into account. The point is if and how these costs are offset by the additional returns due to the upgraded managerial competences that translate into new and more productive managerial practices. As a result, when testing whether the impact of training has a performance effect, the following two competing hypotheses are proposed:

Hypothesis H1.a) the impact of MM training on firm performance presents the TMGT effect.

Hypothesis H1.b) the impact of MM training on firm performance does not present the TMGT effect.

3.2.2 Role of firm size

The magnitude of training effects seems to be linked to firms' structural characteristics, even though results are not always significant and coherent (Colombo and Stanca, 2014; Dearden et al., 2006; Turcotte and Rennison, 2004). In particular, firm size directly influences the production process and results in more formalized organizations, since larger firms on average use more capital-intensive production processes and have more specialized positions, with higher qualified personnel and a higher positive correlation between training and productivity (de Kok, 1999).

The belief that firm size is a key measure of firm performance is widely documented in the academic literature: in equilibrium, better-managed firms should be larger (Lucas, 1978). This is partly because the market will allocate these firms a greater share of sales, but also because larger firms have

the resources and incentives to employ better management (Bloom and Van Reenen, 2010). Empirically, there is evidence that MMs perform better practices in large firms. Bloom and Van Reenen (2010) find that the management score (as a measure of the quality of managerial practices) rises steadily with firm size[3]. Furthermore, MMs are often expected to play both operating and strategic roles in small-medium firms (Lubatkin et al., 2006) with possible consequences on manager's qualifications and competence (Floyd and Wooldridge, 1994).

In addition to the above considerations, larger firms can more effectively benefit from managers' training because of the different 'internal environment' they provide. For instance, in smaller firms managers can take advantages from an easier direct contact with the owners, facilitating higher levels of concern and caring for employees (Kuratko and Hodgetts, 1998). But on the contrary, disadvantages could include owner's unwillingness to delegate authority to lower levels. MMs who do not receive adequate authority can be easily frustrated; they probably see their career opportunities as limited (Kuratko and Hodgetts, 1998). In medium-small firms, the MMs know that they have few hopes of achieving top management positions (Barth et al., 2005). Limited career prospects may function as a disincentive to these MMs with reduced efforts as a result (Barth et al., 2005). It can be supposed that they can hardly apply what they learn from training, compromising outcomes on their operations and firm's productivity. Last but not least, large companies scan rely on their own internal training providers (e.g., corporate university)[4].This could imply a number of benefits. A continuative dialogue, a higher mutual commitment, a deeper knowledge of the business and its workforce may contribute to higher probability to meet business needs by

[3] A high score represents a best practice in the sense that a firm that has adopted the practice will, on average, increase their productivity (Bloom and Van Reenen, 2010).

[4] Among the Italian firms present in the sample Eni, DeAgostini, Ferrero, Fiat, General Electric Company, Microsoft, Porsche, Robert Bosch, and TUV, among others, do have an internal training institution.

providing more tailored training programs. Furthermore, small firms have a much lower training propensity compared to large firms, and, at best provide often informal on-the-job training (Cosh et al., 2003). Hence, the following hypothesis is stated:

Hypothesis 2 (H2): Larger firms benefit more from MMs training.

3.2.3 The age of the firm

The role of the age of the firm and its relationship with productivity has been weakly analysed both theoretical and empirically in works concerning training. Young businesses may be relatively informal organizations and will have low sales per employee while they are developing new products. As the business and product lines mature and go to market, sales per employee grow and the business growth requires the implementation of formal personnel policies such as training (Black and Lynch, 2001; Colombo and Stanca, 2014; Delery and Doty, 1996). However, the relationship between firm age and growth as well as between firm age and training propensity does not seem always linear (Arvanitis, 2010; Bartel, 1994; Goedhuys, 2007).

The third hypothesis finds its roots in the theoretical framework outlined by Stalk and Evans-Clark (1992). They discuss a new logic of growth for firms named 'capabilities-predator'. According to them, competing on capabilities[5] provides a way for companies to gain the benefits of both focus and diversification. Put another way, a company that focuses on its strategic capabilities can compete in a diversity of regions, products, and businesses and do it far more coherently than can the typical conglomerate. Such a company is a 'capabilities predator'–able to come out of nowhere and move rapidly from non-participant to major player and even to industry leader.'(Stalk

[5] 'A capability is a set of business processes strategically understood. Every company has business processes that deliver value to the customer. But few think of them as the primary object of strategy. Capabilities-based competitors identify their key business processes, manage them centrally, and invest in them heavily, looking for a long-term payback.'(Stalk and Evans-Clark, 1992, p. 60).

and Evans-Clark, 1992, p. 64). They state that the human resource system plays a significant role in enhancing organizational capabilities and they underline how important is for companies 'to provide the necessary training so that employees could understand how their new roles would help achieve new business goals' (Stalk and Evans-Clark, 1992, p. 63). Furthermore, the authors claim that becoming a competitive-based competitor is mainly a prerogative of mature firms. For what concern the present research, all the above considerations about the capability-based theory would clearly suggest that older firms can potentially benefit more from MMs' training. Conclusions are straightforward: training helps firms to become a capabilities-based competitor, and mature firms are more likely to face this challenge.

Relying on their background, older firms have a strong knowledge of their own business and a higher awareness of their training needs. They are more familiar with the most effective training methods and training areas they should implement to fill the lack of competences in their workforce and business. Because training is probably a consolidated practice in older firms, it meets with great workforce approval. Training can be more focused and more effective because older firms can rely on long-term relationships with training providers. Consequently, the following hypothesis is tested:

Hypothesis 3 (H3): Older firms benefit more from MMs' training.

3.2.4 External Environment

This hypothesis is based on the belief that the impact of managers' training relies on the context in which the firm is placed. Indeed, if the location variable is considered, institutional factors that may affect productivity of firms such as the regulatory environment, provision of business infrastructure and corruption that may differ across states or regions have to be included (Goedhuys, 2007). To set an example, Colombo and Stanca (2014) found that 'across Italian regions, the effect of training is large and significant in

North and Central regions, while small and not significant for firms located in the South'.

The present analysis is expected to confirm these results. It is not claimed to isolate and quantify one environmental factor which, above all, could influence and explain the observed heterogeneity in firm's performance and training efficiency between different areas. That is quite a difficult and delicate task which goes beyond the interest and the scope of the present study. The contextual conditions provide a bundle of factors that coupled with private training inside firms can lead to amplified effects on performance of training itself.

Many factors can contribute to explain why external environment matters especially in a country like Italy where North, Center and South represent extremely different areas from an economic perspective. North Italy gross national product is 42% higher than South, it is more urbanized, industrialized and richer (www.istat.it). It can benefit from more infrastructures, efficient services and it is more easily affected by others European countries (Banca d'Italia, 2009). Firms are more efficient and productive (Aiello et al., 2014). People living in North regions have a higher education endowment and have to face with a much less entrenched black market labour (www.istat.it). Least but not last, firms and their workforce in North regions can have an easier access to renowned university and business schools.

Consequently, the following hypothesis is tested:

Hypothesis 4 (H4): The geographical location of firm (e.g. infrastructure and economic environment of the area in which the business firm is 'active') is a key factor in activating the positive effects of training of MMs on firm performances.

3.2.5 Type of Training Method

Taking advantage of the detailed dataset available, it is possible to argue that some training methodologies, above all the applied ones, are more suitable and effective for managers than others. Previous literature does not provide much insight[6]. However, Zwick (2005) does consider the impact of the training method on productivity. He distinguishes training methods as follows: formal external courses, formal internal courses, training on the job, seminars and talks, job rotation, self-induced learning, and quality circles. Furthermore, at a theoretical level, the use of applied methodologies is encouraged by Read and Kleiner (1996), although no single training method can be considered superior to all others. The characteristics of what has to be presented, the number of participants and their background, the equipment and the time available should be taken into account in order to select the most appropriate training method, and, in addition, the effectiveness of a training program hangs only partially on the training method. The benefits of training, such as an increase in productivity, should exceed the cost of training in order to consider training as effective. Employees should transfer in their daily work what they have learned, then measuring post-training behaviour indicates if training is applied and, thus, if training is beneficial to the company. As a consequence a method encouraging active participation by the trainee and providing adequate feedback (e.g., one-on-one instruction, role plays, games/simulation, and case studies) is generally to be preferred, since it increases the likelihood that what is taught will be retained and later applied. Nevertheless, methods that are inherently passive can be made active with an effort on the part of the trainer.

The present study can rely on precise information about the method of each hour of training MMs were engaged. In particular, three categories can

[6] Callahan et al. (2003) use random factors meta-analysis to explore the effects of three instructional methods (lecture, modelling, and active participation) and four instructional factors (materials, feedback, pacing, and group size) on observed training performance.

be defined: simulations and experience based methods; traditional and e-based methods and group learning methods (see Table 3.1 for details about the taxonomy).

Hence, the final hypothesis can be formalized as follow:

Hypothesis 5: MMs' training activities performed using Simulations and experience based methods have a higher impact on performances than those based on Traditional and e-based methods and Group learning methods.

3.3 Methodology

3.3.1 Regression model

The test of the hypothesis is tackled through the estimation of a series of regression models in which the performance of firm is regressed against a set of control variables and the training variables. The models vary according to the different performance indicator used and the different set of covariates introduced as controls.

In general, a set of regression is estimated having the following form:

$$\begin{aligned} perf_{i,t} =& \alpha_i + \beta \cdot Training_{i,t-1} + \delta_1 X^1_{i,t-1} + \delta_2 X^2_{i,t-1} + \\ &+ \gamma' Z_{i,t-1} + \tau_t + \epsilon_{i,t} \end{aligned} \tag{3.1}$$

Here the subscript i refers to firm and t to year. $perf_{i,t}$ represents the performance of firm i in year t. $training_{i,t-1}$ is the logarithm of intensity of training activity (in turn: the number of hours or the expenditure per year); $X^1_{i,t-1}$ is a vector of time variant independent variables given by the number of employees and a proxy for the capital assets of firm, $X^2_{i,t-1}$ is the age of business; $Z_{i,t-1}$ is a vector of additional independent covariates, namely, the sector of activity (SIC 1-digit level) and the geographical area of activity at Nomenclatura delle Unita' Territoriali per le Statistiche in Italia (NUTS) 1

level. The term τ_t is a time dummy to control for business cycle effect. In addition, to test assumption H1.a *vs* H1.b the quadratic term $training^2_{i,t-1}$ has been also introduced.

The independent variables are all lagged one period with respect to dependent variables to avoid simultaneity bias. All estimations are done using GMM-IV technique that allows coping with the problem of endogeneity of training variable. Moreover, in order to get rid of heteroskedasticity robust standard errors are estimated.

The performance indicators used are: Return On Sales (ROS), the ROE, and the log of Total Factor Productivity (TFP).

The estimation of TFP is according to the Levinsohn and Petrin (2003) method which has the advantage of tackling a key issue in the estimation of production function: the correlation between unobservable productivity shocks and input levels. Indeed, firms respond to positive productivity shocks by expanding output, which requires additional inputs. Conversely, negative shocks lead firms to contract output, decreasing their input usage. Levisohn and Petrin suggest to use the intermediate input as a proxy of investments so to solve the problem of simultaneity of shocks and input level[7].

3.3.2 The Choice of the instruments

As mentioned in the Introduction of the present Chapter, a key aspect of the present work is the availability of an instrument that seems to mimic the characteristic of the theoretical instrument. In the context of the present study the endogeneity issue arises from the fact that the main aim is to single out the impact of training activity of MMs on the firm performance. Nonetheless, it is not possible to exclude *ex ante* that the past performance has an effect on the level of training activity of firm. Under this condition 'standard' regression coefficient are biased (Wooldridge, 2002). A first way to

[7] See Levinsohn and Petrin (2003) and Olley and Pakes (1996) for a discussion about the issues arising in estimating a production function and the related econometric solutions.

solve the problem is suggested by the GMM-Sys technique that makes use of longitudinal structure of the data to address the problem using lagged values of variables as 'internal' instruments. Hence, the lagged values of the variables are introduced into the regression models. Note that an ideal solution would be to individuate a variable that is related with the training activity but not with the performance of firm. Consequently, an external instrument is used, given by the yearly amount of money that Fondirigenti put together to be used by each firm for training activity, the so called 'contoformazione' (yearly amount of money available for training, $AmTr$). This sum of money is generated by the administrative legislation related to the membership to Fondirigenti. In particular, Fondirigenti saves a percentage of the annual fee due from the firms - 0.30% from the overall amount of wages paid each year by a firm- in a reserved fund that is accessible from firms themselves only to 'buy' training for MMs. After three years the fund 'expires' meaning that firm cannot use it anymore and Fondirigenti reallocates the money for other purposes.

This variable appears to be significantly correlated with the number of hours yearly spent in training (0.467; 0.000) and with the amount of money spent in training each year (0.312; 0.000). At the same time the correlations with the performance indicators used are not significant and close to zero.

Hence, the number of hours and the amount of money spent in training are instrumented by the budget available each year for training for each firm that *ex ante* is correlated with hours of training but not with the performances of firm. A *Hansen J* statistics testing over identifying restrictions was calculated for every model and the results show that equations are correctly specified.

3.4 Results

3.4.1 Descriptive Analysis

The sample is primarily composed of small and medium firms (i.e. with less than 250 employees), with about 36.7% of training firms being large (more than 250 employees). But, in fact, the composition of the sample reflects the actual composition of firms in Italian manufacturing sector. The vast majority of firms in the sample is located in the North of Italy (about 78%) and is more than 14 years old in the business (about 65%). Table 3.3 reports the descriptive statistics.

As already mentioned, the dataset also contains information about training methods. Data show that traditional and e-based lessons are chosen as a method by the 42% of managers, with an average of 127 hours per year. Practical learning methods are chosen by the 29% of managers, while simulations and experience based methods are preferred in the 28% of cases. The sum of the seven training methods provides a direct measure of the total amount of training received by managers. On average a manager spends about 172 hours in training per year.

Training expenditure is the second measure of training intensity used in the equation model. On average, firms in the sample spend over 70,000 euros on MMs training per year. The larger the firm, the greater is the amount of time and money spent in training. The same conclusions can be drawn if the relationship between firm size and the hourly cost of training is considered. The largest is the firm the higher is the quality of training (proxied by the hourly cost of training) is provided to their managers.

3.4.2 Econometric Results

All the results are obtained using the IV-GMM technique to control for the endogeneity of the training variable: more productive firms can do more

training because they have more resources to devote to this activity or because they better understand the value they can get from training of MMs. If this is the situation a regression analysis without further corrections could signal a correlation between training and productivity that could be wrongly interpreted as the causal effect of training on productivity. Hence, the endogeneity of the training variable can bias the estimations and needs to be addressed. As prescribed by the IV-GMM technique, the models include variables that are correlated with training but not with the productivity. In particular, internal instruments are used, which are provided by lagged values of independent variables and one external instrument given by the amount of money that yearly Fondirigenti saves for financing the training activity of MMs. Moreover, the generalized method of the moments as estimation algorithm is used.

The tables present the p-values for the following two tests: the *Hansen J* statistic (where it is possible to calculate it) and the endogeneity test of endogenous regressors. Both of them suggest the validity of the IV-GMM approach since instruments are proved to be valid and training can be treated as exogenous. Furthermore, a set of dummy variables for geographic area and sector are included as control variables in all the models estimated.

Table 3.4 shows the results of estimating the effects of training on firm performance. The analysis delivers mixed results and the variables generally take their expected signs. Nine dependent variables are tested. Both productivity indicators and financial indicators are used as dependent variables. Columns 1, 2, 3, and 7 present the estimations of the impact of training on the firm's productivity, which is defined by VA, labour productivity, annual growth rate of VA, and TFP respectively. Columns 4, 5 and 6 report the estimations of the impact of training on financial performance, which is defined by annual turnover growth, ROS, and ROE. Among the independent variables, training is measured by the total number of hours of training

provided by the firm.

Results recorded in Table 3.4 show strong support for a positive effect of training on both levels of productivity and financial indicators. In more details, the estimates imply that raising the training variable by 1% point is associated with an increase in value added of about 0.29% (Column 1) while the effect is halved (0.15%) when looking at labour productivity (Column 2). In contrast, the magnitude of the impact of training is much higher (0.60%) in TFP (Column 7). These results seem to be in line with those found in the literature, which range from a value of 0.028% (Tan and Batra, 1996) to a value of 0.761% (Zwick, 2006). For what concerns the two Italian studies, Colombo and Stanca (2014) and Conti (2005) suggest that the return to training is equal to 0.074% and to 0.4% respectively. They both show that failing to account for the potential endogeneity of training leads to underestimate the effect of training on productivity. It is important to remind that the target is peculiar with respect to worker: MMs are the link between the overall direction provided by the top managers with the day-to-day reality of lower-level managers. They need competences in order to interact efficiently upward and downward in the hierarchy: they represent the connection between the organization institutional (strategic) and technical (operational) levels, they mediate between the organization, its customers and its suppliers, and, as administrators, MMs direct the organization's overall technical task.

Turning now to the financial indicators, results show that an increase of training hours by 1% point is associated with an increase of about 0.67% in ROS (Column 5) and about 1.5% in ROS (Column 6). Table 3.5 displays the effect of training expenditures on firm performance. The estimates of the impact of training on ROS, ROE, and TFP are significant, but their magnitude is lower in comparison to the previous analysis (where training is measured in hours). Raising the training expenditure by 1% point is asso-

ciated with an increase of about 0.38%, 0.86% and 0.14% in ROS (Column 1), ROE (Column 2), and TFP (Column 3) respectively. Columns 4, 5, and 6 respectively present the results for models in which the squared term of cost of training for ROS, ROE and TFP (log of) has been introduced. Both profitability indicators show a TMGT effect: there exists an optimal training expenditure which maximize the benefit arising from training activity and minimize its costs for the firm.

H1.a prevails with respect to H1.b for profitability indicators. At the same time, H1.b cannot be rejected for models where TFP is considered as the objective variable. The conclusions hold using the number of hours or the expenditure as a measure of intensity of training activity.

Table 3.6 shows the results concerning H2, H3, H4, and H5 discussed above. It first presents the link between training and firm's size (i.e. firms with less and more than 50 employees), the age of business, the geographic location (i.e. firms located in the North, and in the Centre-South of Italy), and the method of training (i.e. group learning methods, traditional and e-based methods, and simulations and experience based methods). The analyses shown in Table 4.3 are implemented by using the IV-GMM technique. Training is measured in terms of costs for H2, H3, and H4.

A positive effect of training on TFP is observed for medium and large firms (i.e. with more than 50 employees), while results for small firms are positive but not significant. In medium and large firms, an increase of 1% point in training expenditure leads to an increase in TFP of about 0.28%. Results are consistent with those from previous literature. The link between training and firms' characteristics (e.g., structure, dimension, etc.) is proved to be positive even not significant in Colombo and Stanca (2014) and Dearden et al. (2006). Significant results are those by Turcotte and Rennison (2004) and Zwick (2005). Turcotte and Rennison (2004) find that an increase of 1% point in the number of workers trained in class corresponds to

an increase of 0.478% in productivity for firms with more than 20 employees (results are not significant for firms with less than 20 employees)[8]. Zwick (2005) finds that the magnitude of the impact of training on productivity growth increases with firm's size (elasticity is equal to 1.130, 2.190, 2.546, and 3.185 for firms of 20-199, 200-499, 500-1,000, and more than 1,000 employees respectively).

To conclude, there is strong and coherent evidence that supports the hypothesis H2: larger firms benefit more from MMs training. These findings should be read keeping in mind that often larger firms can afford to employ better management and that better management practices are more likely to be implemented in larger firms than in smaller ones. In larger firms, MMs are likely to be more empowered and they probably apply easily what they learn from training. Results from testing H2 could help to explain why formal training programs are more common at large companies than at small companies.

H3 is also confirmed empirically. Results suggest that there is a vintage effect: younger firms benefit from MMs' training more than older companies. The coefficient for older firms is still positive but not significant. Among the literature analysed (see Chapter 1), only Bartel (1994) includes the age of business variable into the model. She finds out that the business age variable does not have the expected positive coefficient in the training implementation equation and the result is not statistically significant.

The area in which the business firm is active is a key factor in activating the positive effects of training of MMs on firm performances (H4). An increase of 1% in training expenditure leads to an increase of about 0.68% in TFP for firms located in the North of Italy. The impact is not statistically significant for firms located in the Centre-South of Italy. This result is plau-

[8] Turcotte and Rennison (2004) find also that an increase of 1% point in the share of workers trained in class with computer training entails an increase of 0.485% in productivity form firms with less than 20 employees, while the estimation is not significant for firms with more than 20 employees.

sible in the light of the previous findings. Colombo and Stanca (2014) find that across regions, the effect of training is large and significant in North and Central regions (0.08 and 0.12 respectively), while small and not significant for firms located in the South. A rationale could be that in different regions there exist different conditions that enhance the effectiveness of training (e.g. social capital, infrastructure and economic environment). Several academic research in the last decade show how the regional endowment of infrastructure, the efficiency of local administration and the investments in R&D exert a positive effect on firms' performance (Aiello et al., 2014). Geographical gaps between North and South in the endowment of these factors help to understand how training can better perform when implemented in a wealthier context.

The empirical test of the last hypothesis (H5) shows how some MMs training methods are more suitable and effective for firm than others. This conclusion represents a key contribution of the study since it deals with characteristics of training which, seem have not been analysed so far in previous literature. Results show that the three groups of methods have different impacts on TFP. In particular, the increase by 1% point training hours for off-the job formal training leads to a 1.31% increase in TFP when simulation and experience methods (TrM1) are used; a 0.91% increase in TFP if group learning methods are used (TrM2); a 0.26% increase in TFP if 'instructor-lesson' and e-based methods are employed (TrM3).

3.5 Conclusions

This Chapter has examined for the first time the performance effects of training devoted to MMs in Italy. The existence of a positive and significant link between training investments devoted to MMs and firm's performance (proxied by productivity and financial indicators) is demonstrated. The present analysis highlights an exogenous and significant effect of training

on firm performance measured both by productivity (TFP) and financial indicators (ROE). Returns to training investments seem to be much higher for those firms which are large (more than 50 employees), located in the North area of Italy, with less than 14 years of business and which focus on applied methods.

In more details, on the basis of a unique dataset, a set of hypotheses are empirically tested and support is found for the four of the five following ones. (H1) Middle management continuing training has an effect on two performance indicators, but the effect is non-linear. Raising the training variable by 1% point is associated with an increase of about 0.29% in value added and of about 0.60% in TFP. Results are in line with those found in the literature, which range from a value of 0.028% (Tan and Batra, 1996) to a value of 0.76% (Zwick, 2006). Moreover, H1.a has to be preferred to the alternative H1.b for models in which ROS and ROE are used. The TMGT effect is in place: profitability is affected by training but the effect is non-linear and after a given threshold the effect training effort starts to be negative.

It is also stated that MM training is more effective for larger firms (H2) because a positive effect of training on TFP is observed for medium and large firms (i.e. with more than 50 employees), while results for small firms are positive but not significant. In medium and large firms, an increase of 1% point in training expenditure leads to an increase in TFP of about 0.28%. The analysis of the age of business suggests the existence of a vintage effect but the sign of the relationship is not the one expected: younger firms benefit from MMs' training: an increase of 1% in the training expenditure leads to an increase of about 0.31% in TFP of younger firms.

The geographic location in which an organization operates is confirmed to be significant in explaining training returns on firm's performance (H4): an increase of 1% in training expenditure leads to an increase of about 0.68%

in TFP for firms located in the North of Italy. The impact is not statistically significant for firms located in the Centre-South of Italy. Last but not least the method of training matters in explaining firm's performance. Increasing by 1% point training hours on simulations and experience based methods (TrM1), practical learning methods (TrM2) and traditional and e-based methods (TrM3) leads to an increase of about 1.31%, 0.26%, and 0.91% in TFP respectively. These results suggest that 'applied' methods (TrM1 and TrM2) are by far more effective than 'traditional' ones (TrM3).

On the basis of the above results it can be concluded that training investments devoted to MMs are effective. This finding is consistent with previous literature. Investments in human capital devoted to MMs are a key strategy which allows an improvement in management and firm's productivity in the long run. This is true because of the effects it has on manager's practices that in turn have an impact on firm's performance. In other words, human capital investments (e.g. training investment) have an important role in driving good and accepted managers' practices, which help to explain productivity gaps among firms. Influential previous studies suggest and prove the existence of the second link (namely manager's practices vs. firm's performance) while very few studies address the first one so far (human capital investments vs. manager's practices), leaving room for further researches on this topic. In order to do this, more complete data on manager's practices in organizations need to be collected and an effort by businesses and governments is likely to be necessary in order to generate these data.

Table 3.1: The taxonomy of training methods

Method category	Type of training
TrM1: Simulations and experience based methods	Business games, in-basket, role play, action learning, outdoor, training-groups, coaching, learning communities
TrM2: Practical learning methods	Object lesson and seminar
TrM3: Traditional and e-based methods	Frontal lesson and e-learning (blended, community on line, knowledge forum)

Table 3.2: Variables description

Dependent Variables		
Name:	*Description:*	*Notes and formulas:*
LP	Labour productivity	As measured by the VA divided by the total number of employees
ROS	Return On Sales	Ebitda/Total sales
ROE	Return On Equity	Ebitda/Total assets
TFP	Total factor productivity	TFP is estimated using the method of Levisohn and Petrin (2003)
Turnover	Turnover	
VA	Value added	Gross revenues minus expenses on materials
ΔVA	Annual growth rate of value added	$Log(VA_t)$-$Log(VA_{t-1})$
ΔTS	1 year turnover growth	$Log(Turnover_t)$-$Log(Turnover_{t-1})$
Independent Variables		
Name:	Description:	Notes and formulas:
TrH	Yearly number of hours devoted to middle managers training	
TrE	Yearly expenditure devoted to middle managers training	
TrM	Training method	TrM are grouped in three categories: Simulations and experience based method (TrM1); Practical learning methods (TrM2); Traditional and e-based lessons (TrM3)
L	Number of employees	Average number of employees in a year
K	Capital	K is measured by a permanent inventory method based on fixed assets
Age	Age of the firm in years	
Sector	1-digit SIC codes in manufacturing	
Region	Geographic locations macro-regions level	Italian Regions are grouped into four categories: North-East, North-West, Centre and South
AmTr	Yearly amount of money available for training activity	

Table 3.3: Summary statistics

	Mean	Min	Max	N	Standard deviation
Dependent Variables					
Return on sales (ROS) (%)	2.86	-49.95	30.00	56782	10.09
Return on Equity (ROE) (%)	3.27	-150.00	140.75	57273	28.01
Total factor productivity (TFP)	83.84	0.52	54,467,040	52023	365,765
Turnover	9.91E+07	0.0	1.0E+11	61900	1.17E+09
Value added per employee (VA)	78.86	-5.00E+01	499.00	52846	59.02
Annual growth rate of value added (ΔVA)	-0.0043	-19.58	19.63	45180	0.73
1 year turnover growth (ΔTS)	-0.0722	-24.39	25.63	48830	2.22
Independent Variables					
Training hours	171.65	1.00	59696.00	10558	992.45
Training expenditure	70676.0	29.14	2020957.77	9988	211152.73
Number of employees (L)	264.24	1.00	153369.00	54405	2103.19
Capital (K)	37179738	0.0	8.0E+10	61929	8.45E+08
Yearly amount of money available for training activity (AmTr)	1190.33	0.00	598047.03	71142	7624.91
Age of business (Age)	27.94	2.00	156.00	69018	18.04
Training methods: (hours spent):					
Simulations and experience based methods (TrM1)	77.66	1.00	4444	2544	180.41
Practical learning methods (TrM2)	102.97	1.00	12205	6247	431.04
Traditional and e-based lessons (TrM3)	127.07	1.00	46268.00	7645	867.51
Region: (hours spent)					
North-West area	195.13	1.00	59696.00	4881	1336.85
North-East area	96.46	1.00	6456.00	3135	225.85
Center area	250.29	1.00	15763.00	1889	879.54
Islands and South area	129.69	1.00	1396.00	653	188.57

Table 3.4: The effect of training on different indicators of firm performances

Independent variables	*Value added*	*Labour productivity*	*growth_1 year(VA)*	*Turnover growth_1 year*	*ROS*	*ROE*	*TFP*
TH_{t-1}	0.2930***	0.1518***	0.0245***	0.2299***	0.6676***	1.5081***	0.6035***
	(0.009)	(0.007)	(0.007)	(0.021)	(0.083)	(0.241)	(0.048)
K_{t-1}	0.0778***	0.0414***	0.0015	0.0273***	0.1027***	-0.3163***	
	(0.005)	(0.003)	(0.004)	(0.010)	(0.029)	(0.060)	
L_{t-1}	0.5823***	-0.1764***	-0.0509***	-0.2204***	-0.2905***	-0.4254**	-0.0995***
	(0.009)	(0.006)	(0.008)	(0.020)	(0.069)	(0.179)	(0.027)
Age of business	-0.1187***	-0.0350***	-0.0748***	-0.2830***	0.4659***	1.5514	-0.0426
	(0.010)	(0.007)	(0.007)	(0.021)	(0.086)	(0.238)	(0.032)
Constant	12.4024***	11.4976***	0.3372***	0.8749***	-2.3219**	4.2341**	7.7090***
	(0.114)	(0.083)	(0.081)	(0.254)	(0.904)	(2.133)	(0.952)
Sector controls	Y	Y	Y	Y	Y	Y	Y
Geographical area controls	Y	Y	Y	Y	Y	Y	Y
Observations	13,757	13,242	13,629	14,028	13,535	13,411	1,707
F	426.5	32.39	14.56	5.266	12.20	11.12	24.61
F p-value	0	0	0	0	0	0	0
Kleibergen-Paaprk LM statistic[3]	964.6	875.2	944.9	995.6	929.	942.2	193.1
P-value	0	0	0	0	0	0	0
Hansen J statistic[4]	.	.	.	.	.	.	10.97
P-value	.	.	.	.	.	.	0.000927
Endogeneity test for regressors[5]	316.8	272.2	8.032	22.98	44.16	23.8	158.4
P-value	0	0	0.0046	1.64e-06	0	1.07e-06	0

*Notes: [1]:one period lagged variable; [2]: three period lagged variable. Robust standard errors in parentheses.*** p<0.01, ** p<0.05, * p<0.1.*
[3]: K-P rk test whether the equation is identified when homoschedasticity is dropped. The null is that the equation is underidentified.[4]: Hansen J: the null is that the instruments are valid instruments. [5]: Endogeneity test: the null is that the specified endogenous regressors can actually be treated as exogenous

Table 3.5: The effect of cost of training on performances

		Models					
		(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variables	ROS	ROE	Log(TFP)	ROS	ROE	Log(TFP)
H1	$Log(T_{Expenditure(t-1)})$	0.3830***	0.8647***	0.1447***	2.9685***	6.3976***	-0.8820***
		(0.048)	(0.138)	(0.006)	(0.414)	(1.148)	(0.059)
	$Log(T_{Expenditure(t-1)})^2$				-0.3519***	-0.7549***	0.1173***
					(0.050)	(0.138)	(0.007)
	$Log(K_{t-1})$	0.1047***	-0.3137***		0.0866***	-0.3762***	
		(0.029)	(0.060)		(0.029)	(0.061)	
	$Log(L_{t-1})$	-0.2965***	-0.4353**	-0.0778***	0.1169**	0.4103***	-0.0740***
		(0.070)	(0.180)	(0.010)	(0.054)	(0.125)	(0.012)
	Log(Age of business)	0.4735***	1.6639***	-0.0268**	0.5049***	2.6979	-0.0863***
		(0.086)	(0.238)	(0.011)	(0.091)	(0.250)	(0.015)
	Constant	-3.0383***	26.367	11.4174**	3.1782**	16.467**	8.8981***
		(0.873)	(2.039)	(0.143)	(1.431)	(3.738)	(0.191)
	Sector controls	Y	Y	Y	Y	Y	Y
	Geographical area controls	Y	Y	Y	Y	Y	Y
	Observations	41,328	41,602	18,386	41,328	41,602	24,068
	F	12.23	11.14	11.39	8.198	8.855	25.24
	F P-val	0	0	0	0	0	0
	Kleibergen-Paaprk LM statistic[3]	1003	1019	152.5	133.8	150.1	439.3
	P-value	0	0	0	0	0	0
	Hansen J statistic[4]	.	.	64.2	.	.	125.1
	P-value	.	.	0	.	.	0
	Endogeneity test for regressors[5]	42.6	22.21	232.4	41.38	21.69	414.7
	P-value	6.73e-11	2.44e-06	0	1.25e-10	3.21e-06	0

Notes:
[3]: K-P rk test whether the equation is identified when homoschedasticity is dropped. The null is that the equation is underidentified.
[4]: Hansen J: the null is that the instruments are valid instruments.
*[5]: Endogeneity test: the null is that the specified endogenous regressors can actually be treated as exogenous.Robust standard errors in parentheses.*** p<0.01, ** p<0.05, * p<0.1.*

Table 3.6: The impact of training on TFP

Hypothesis tested:	Subsample:	Estimated coefficients
		(cost of training):
H2:	Small firms (less than 50 employees)	0.2914
		-0.177
	Medium and large firms (more than 49 employees)	0.2837***
		-0.064
H3:	Young firms (less than 15 years old)	0.3136***
		-0.068
	Older firms (more than 14 years old)	0.5590
		-0.271
H4:	Firms in North of Italy	0.6764*
		-0.377
	Firms in Center-South of Italy	1.0257
		-0.236
		(hours of training):
H5:	Training (total number of hours)	0.6035***
		-0.048
	TrM1 - Hours spent in simulation and experience based training	1.3109***
		-0.227
	TrM2 - Hours spent in practical learning methods	0.2650***
		-0.030
	TrM3 - Hours spent in traditional and e-based training methods	0.9101***
		-0.056

Notes: standard errors in italics.

The Table reports the estimated coefficients for training variables of separate regressions. In the case of training methods, the estimated coefficients of different training categories for the whole sample are reported.

Chapter 4

Training outcomes: a simulation of the returns to individuals

4.1 Introduction

Several theories have been advanced to explain why wages increase over an individual's work life. A commonly accepted interpretation of this relationship is that higher wages and steeper wage profiles[1] reflect investments in human capital, particularly investments in job training (Becker, 1964; Mincer, 1974).

As shown in Paragraph 1.1.3 of Chapter 1, there is quite a varied empirical literature on the effect of training on wages. Some of the main results are briefly recalled here. Several studies found considerable returns on workers' participation in training (e.g. Jones et al., 2012; Lynch, 1994)[2]. Some stud-

[1] Moreover, apart from their wages, workers may receive some kind of non-financial remuneration, and part of the returns to their human capital may be 'backloaded' towards the end of their careers to ensure their loyalty to the firm (Lazear, 1979).

[2] The estimates of the wage premium associated with training has been found to vary between 5% and 15% in the US (Altonji and Spletzer, 1991; Barron et al., 1989; Lynch, 1992; Veum, 1999, 1995) and in Canada it has been showed to be of about 11% (Betcher-

ies suggest that the productivity gains associated with training are twice as high as the wage gains (Dearden et al. (2006); Konings and Vanormelingen (2014)). Conversely, some other studies found that training has no real effect on workers' wages (Conti, 2005; Goux and Maurin, 2000). Apparently, a consensus about the existence and the magnitude of the effects of training on wages has not been empirically achieved yet.

The present Chapter offers a study of the effects of MM's training on wages. Unfortunately, unlike the analysis of the effects of training on firms' performance (Chapter 3), the sample available is not as complete. Indeed, it concerns the solely firms which have provided training at least once between 2006 and 2011 (named 'active' firms). Thus, the subsample consists of 3,504 firms. The cut in sample size is due to data constraint about wages and other individual characteristics which are only available for training recipients[3]. Although the information available regarding training recipients are extremely reliable, the dataset does not provide information about wage levels, gender, age, and seniority of non-recipients.

In the light of this limitation, as shown in the title of the Chapter, it has been preferred to refer to the analysis provided herein using the term 'simulation', hoping that this helps to bear in mind hereafter that estimation results requires some care in interpretation. Further comments about this issue are provided in the following Paragraphs.

Despite this limitation, the simulation offers interesting results. It also offers some insights regarding how training should be measured when linked to wages. In this regard, findings allow one to doubt about the accuracy of the estimations provided by several existing work on the effect of training on wages. Indeed, it appears that there is a chance that the magnitude of the

man et al., 1997). Several other studies suggest that training plays an important role in explaining wage growth (Ballot et al., 2006; Barron et al., 1989; Brown, 1983; Duncan and Hoffman, 1979; Mincer, 1984).

[3] It is worthy to mention that, probably for this reason, the data do not show downward-sloping wage profiles.

training effect on wages has been often overestimated.

Paragraph 4.4 and following offer an extension of the wage equation estimation. A two-step estimation framework is implemented in order to correct for both endogeneity bias and selection bias. Results are coherent with the previous model but more accurate.

4.2 Methodology

4.2.1 The wage equation

In order to ease comparability and to follow the standard approach used in the related literature[4], the wage equation parallels the productivity Equation 3.1 (see Paragraph 3.3). The only difference here is that two additional variables have been added. First, unlike the productivity regression, a set of individual characteristics is included into the wage equation in order to control for MMexperience. In this regard, individuals have been classified into two categories according to their level of experience using a k-mean cluster analysis[5]. Age, seniority and wage level have been used as entry variables to classify MMs. Two clusters have been identified[6]. The first one represents the 58% of the sample and is composed on average by those managers with

[4] See (Conti, 2005) and (Dearden et al., 2006).

[5] Raw variables for individual experience (age, seniority and average wage level) have also been tested individually. The variables generally take their expected signs through the model specifications. Although it is clear that there is some loss of precision using cluster results rather than raw variables, it has been opted for the previous one following the principle of parsimony recommended in regression frameworks. The choice has been dictated by the coherence of the results and by the intent to ease the interpretation of coefficients.

[6] The k-mean cluster analysis has been run on the individual-level dataset. The choice of the k-means algorithm rather than the hierarchical clustering algorithm has been mainly dictated by the large dataset available and by the continuous nature of the input variables. The cluster membership for each individual, have been created and appended to the individual level dataset. Results have been aggregated into proportion and added to the firm-level panel dataset. Finally, the variable named 'Proportion of low experienced workers' has been generated and included into the regression framework as a measure of MMs experience. It contains the proportion of low experienced MMs at firm level. Although results are not displayed, a number of tests have been implemented. Solutions with three and four clusters have been tested and compared.

11 years of seniority, aged 48 years and with a wage level of about 22€ (see Table 4.2). The second cluster represents the 42% of the sample is composed on average of MMs with 22 years of seniority, aged 53 years and with a wage level of about 40€. The two clusters have been named 'Low experienced workers' and 'High experienced workers' respectively.

Second, a measure of the unemployment rate has been included following the approach by Veum (1995) and Jones et al. (2012). In all regressions, all monetary variables have been deflated. The independent variables are all lagged one period with respect to dependent variables to avoid simultaneity bias and to allow comparison with respect to the productivity regressions (see Equation 3.1).

The wage equation takes the following form:

$$\begin{aligned} WageLevel_{i,t} =& \beta_i + \beta_1 \cdot Training_{i,t-1} + \beta_2 X^1_{i,t-1} + \beta_3 X^2_{i,t-1} + \\ &+ \beta_4 Z_{i,t-1} + \beta_5 M_{i,t} + \lambda Unempl_{i,t-1} + \tau_t + \epsilon_{i,t} \end{aligned} \tag{4.1}$$

Here the subscript i refers to firm and t to year. $WageLevel_{i,t}$ represents the average wage level of firm i in year t. $Training_{i,t-1}$ is the logarithm of the extent of training activity (in turn: the number of hours, the hourly training cost per manager, the number of training activities per manager); $X^1_{i,t-1}$ is a vector of time variant independent variables given by the number of employees and a proxy for the capital assets of firm; $X^2_{i,t-1}$ is the age of business; $Z_{i,t-1}$ is a vector of additional independent covariates, namely, the sector of activity (SIC 1-digit level) and the geographical area of activity at NUTS 1 level. The term $M_{i,t}$ is a vector of individual characteristics which measure managers' experience (proportion of high experienced workers vs/low experienced workers) and the proportion of female employees. Remaining controls are the local unemployment rate ($Unempl_{i,t-1}$) and year dummies to control for business cycle effects (τ_t).

Taking advantage from the panel nature of the dataset, the simulation

also provides evidence on the effects of training on the annual wage growth[7]. Therefore, all the models presented hereafter are tested using two measures of wage at firm level: the average wage level and the annual wage growth.

The comparison between the estimated coefficients of the wage level and of the wage growth provides interesting findings as shown in the following Paragraphs.

Table 4.1 provides a list of the variables used in the estimation framework. All variables are entered in logarithmic form and lagged one year.

Table 4.2 provides the results of the k-mean cluster analysis implemented in order to classify MMs according to their level of experience.

The basic results for the firm-level regression of Equation 4.1 are presented in Table 4.4. The first five columns of Table 4.4 use the $ln(average\ wage\ level)$ as the dependent variable. The last five columns repeat the specifications but instead use annual wage growth as the dependent variable.

4.2.2 Training measures

There are very few studies in the literature which provide evidence of the effects of training on wages exploring different measures of the training activity provided by firms. Most of them are based on a single measure which is often the amount of hours. None of them analyse the contribution of different measures of training in explaining wages although they provide different information regarding the extent of the training provided.

The impact of training on wages might not only depend on the intensity of training (measured by total amount of training hours). It might also depend on the quality of the training provided. In this regard, the hourly training cost per manager can be reasonably used as a measure of quality. The two variables are not necessarily correlated. Indeed, training activities can be very time consuming but low in quality (due to the content or to

[7] Few existing studies analyse the effects of training on both wage level and growth (see Barron et al., 1989; Veum, 1995).

the training provider). On the contrary, training programs can often be concise but high in quality. Furthermore, the frequency of training activities yearly undertaken by each worker is also important to explain wage profiles. Indeed, it can be reasonably interpreted as the variety of training activities provided.

The detailed dataset available has allowed the simulation provided herein to test the effects of training intensity, quality and variety singularly and jointly. Therefore, the following three meaningful measures of training are analysed in the simulation: number of training hours, hourly training costs per manager and number of training activities per manager. These variables have been named 'TrIntensity', 'TrQuality', and 'TrVariety' respectively.

From a methodological perspective, it can be argued that those variables should not coexist in the same regression because they could cause multicollinearity. If that is the case, given that multicollinearity increases the standard errors of the coefficients, the coefficient for some independent variable may be found not to be significantly different from zero whereas without multicollinearity and with lower standard errors, these same coefficients might have been found to be significant. In other words, multicollinearity would make some variables statistically insignificant while they should be otherwise significant.

Here, the multicollinearity issue has been addressed by calculating the Variance Inflation Factor (VIF)[8], which represents the standard approach to check for multicollinearity. All the three measure of training pass the

[8]Formally, VIFs measure how much the variance of the estimated coefficients is increased over the case of no correlation among the X variables. If no two X variables are correlated, then all the VIFs will be 1. As a rule of thumb If VIF for one of the variables is around or greater than 5, there is collinearity associated with that variable. The easy solution is: If there are two or more variables that will have a VIF around or greater than 5, one of these variables must be removed from the regression model. The VIF has a lower bound of 1 but no upper bound. Authorities differ on how high the VIF has to be to constitute a problem. Personally, I tend to get concerned when a VIF is greater than 2.50, which corresponds to an R^2 of .60 with the other variables. As a rule of thumb, a variable whose VIF values are greater than 10 may merit further investigation.

VIF analysis. For completeness, all the collinearity diagnostics suggested by Stata have been tested (results are displayed in Table 4.3).

The VIFs and the other multicollinearity diagnostics are not worrisome. All of them indicate that the three measures of training are not redundant[9]. Thus, they can be safely included jointly into the regression framework to test if they potentially explain a different amount of the wage variance.

4.2.3 Testing for robustness

In order to test the robustness of the results, the simulation of the effect of training on wages has experimented with a number of additional variables[10] and specifications on the firm level panel dataset. Results are robust across diverse econometric models. The focus on firm level data has avoided possible aggregation biases and hence captured the effects of training more precisely. Second, the analysis at the firm level allows us to control for the endogeneity of training.

Since participation in training is potentially endogenous results are pre-

[9] Results are not surprising. Intuitively, training activities can be very time consuming but low in quality or content. On the contrary, training programs can often be concise but of high-quality.

[10] Following the approach by Dearden et al. (2006) and Conti (2005), the R&D variable drawn from AIDA has been tested as a proxy of innovation in a first specification of the wage equation. The coefficient has turned out to be positive and significant almost through all the models in Table 4.3. Despite its significance, the magnitude of the training coefficients did not turned out to be affected by the presence of the R&D variable. Furthermore, following the approach by Ballot et al. (2006), interactions terms with training and capital have also been tested but they turned out to be not always coherent through the model specifications. However, given the high presence of missing values (about 50%) for micro and small firms and in order to enhance simplicity, it has been dropped from the final model. This omission made no difference to the training coefficients, which preserve the same magnitude and significance. Furthermore, in the preliminary version of the model, a measure of the labour turnover has been calculated from the original dataset and included into the estimation framework. The variable named 'Labour Turnover' has been calculated from the original individual-level dataset provided by Fondirigenti. Because each manger and his training activity are tracked over firms and over six years, it has been possible to infer a measure of his loyalty to the firm. However, it is worthy to remind that, similarly to several other variables used in the wage equation, the information concerning labour turnover is available only for those managers who have undertaken training between 2006 and 2011. Although the information about labour turnover is relevant in explaining wage level and wage growth (Dearden et al., 2006), it has been dropped from the simulation due to the large number of data missing.

sented using a GMM-IV technique, replicating the econometric approach implemented in Chapter 3 (see Paragraph 3.3.1). Alike the estimation of the effects of training on firms' performance, the external instrument used is given by the yearly amount of money that Fondirigenti put together to be used by each firm for training activity. In short, the instrumental variable used is the yearly amount of money available for training (named $AmTr$)[11]. This variable appears to be significantly correlated with the number of hours yearly spent in training (0.467; 0.000) and with the amount of money spent in training each year (0.312; 0.000). At the same time the correlations with the wages indicators used are not significant and close to zero. Hence, the number of hours and the amount of money spent in training are instrumented by the budget available each year for training for each firm that ex ante is correlated with hours of training but not with the wage levels or wage growth. A *Hansen J* statistics testing over identifying restrictions is calculated for every model and the results show that equations are correctly specified. Moreover, in order to get rid of heteroskedasticity robust standard errors are estimated.

4.3 General results

4.3.1 The effect of training on wage level

As mentioned above, unlike the majority of previous studies which deal with a single measure of training activity (which is often the total amount of training hours), the simulation provided herein tests and compares three measures of training activity, named: the hourly cost of training, the amount of training hours and the number of training activities provided yearly by

[11] This sum of money is generated by the administrative legislation related to the membership to Fondirigenti. In particular, Fondirigenti saves a percentage of the annual fee due from the firms - 0.30% from the overall amount of wages paid each year by a firm - in a reserved fund that is accessible from firms themselves only to 'buy' training for MMs. After three years the fund 'expires' meaning that firm cannot use it anymore and Fondirigenti reallocates the money for other purposes.

each firm. All of them turn out to be relevant in explaining the extent of training activity and pass all the multicollinearity diagnostics (see Paragraph 4.2.2).

The three measures of training activity have been entered singularly and jointly into the regressions so as to provide a more accurate estimation by controlling for changes in their marginal effects.

The first five columns of Table 4.4 display the effects of training on the average wage level. Hourly training costs, training hours, and training activities are added to the regression equations one at time and with different combinations in columns (1), (2), (3), and (4). In column (5) the three measures are entered all at once. The estimated coefficients of the training measures are highlighted in bold type when the statistically significant at the $>.10$ level.

Results show that the effect of the three measures of training on the annual average wage level is coherent through the five specifications (see Columns (1), (2), (3), (4), and (5)).

The effect of training quality, intensity and variety is positive and significant. When the three measures are entered jointly (see Column (5)), it seems that they have a different role in explaining wage levels. The effects of variety and quality are by far larger than the effect of intensity. Findings indicate that dropping the information about the variety and quality of training from the regression would have given an overestimated coefficient for the quantity of training (see Column (1) and (5)).

In the light of the statistical considerations made with regard of training measures (see Paragraph 4.2.2), the simulation allows to question that the three measures of training are not offsetting but complementary in explaining wages. Thus, if results are the same as those in Table 4.4 even in the presence of a robust sample, the preferred specification would be the one in Column (5), where the three measures of training are entered jointly.

All the other variables are conventionally signed although not always significant. As expected, MMs' average wage level results to be positively associated with increases in individual experience and firm's capital assets. Men who participate in company training experience high wage levels than women one year after the training activity is over. Finally, findings indicate that unemployment rate is negative correlated with wage level. The result is coherent throughout all the five specifications although not always statistically significant.

Controls for sector, geographical area and year dummies are always included in the five model specifications.

4.3.2 The effect of training on wage growth

To examine the effect of training on changes in wages rather than wage levels, the annual wage growth has been taken as the dependent variable in Equation 4.1.

Results slightly change when studying wage growth.

Keeping in mind the considerations made in Paragraph 4.2.2, Column (10) in Table 4.4can be identified as the most accurate estimation of the effects of training on wage changes. Training intensity, quality and variety explain a significant but different portion of the wage growth variance. They all have positive and statistically significant impacts on wage changes when taken jointly, showing that the accumulation of human capital, although the firm finances it, has favourable effects for MMs. As for the simulation of the effects of training on wage level, it is argued here that each measure of training explain a different portion of the wage growth variance. Apparently, variety and quality play a major role in explaining wage changes. Intensity explains a much lower amount of the wage growth variance although it is statistically significant at 99% confidence.

Again, men who participate in company training experience higher wage

changes than woman. However, due to the limitations of the sample, it is not possible to infer that they experience wage change higher than non-training recipients.

The estimates for nearly all of the others individual characteristics and firm characteristics are largely as expected.

4.4 Summary of the main results

A simulation of the returns of training to wages has been attempted.

As has been said repeatedly above, since the information regarding age, wages, seniority and gender are available only for training recipients; the simulation of the effect of training on wage level and growth does not authorize to generalize any conclusion.

However, the exercise has been useful for at least two reasons. First, the sign of the training coefficients are in line with those in the literature although they refer to the bias subsample. The human capital model suggests that trained workers should receive higher wages and have steeper wage profiles than workers who do not undertake training. Unfortunately, given the lack of data, it is not possible to draw any conclusion to support or reject this standard vision. Anyway, wage levels appear to be driven by the quality and variety of training activities provided by the firm. In more detail, for those mangers who undertook training in the time window between 2006 and 2011, wage changes appears to be positive correlated with the number of training activities provided by the firms (the estimated coefficient is equal to 6.2618)[12]. The higher is the number of training activities and the quality the higher is the wage growth. Time spent in training of whatever kind apparently affects wage growth in a less extent.

[12]Because the estimated regression is a linear-log function, the interpretation of the magnitude of the coefficients is as follow: a 1% increase in X (independent variable) leads to a change of 1% β_1 in Y (dependent variable).

The second interesting result concerns training measures. The simulation has offered some insights regarding how training should be measured when linked to wages. In this regard, findings allow one to doubt about the accuracy of the estimations provided by several previous academic studies. Indeed, it appears that there is a chance that the magnitude of the training effect on wages has been often overestimated (see Table 4.4 Columns (1), (5) for wage level and Columns (6), (10) for wage growth). It is probably the case that some of the differences in previous findings may stem from the different measures of training used. Further considerations follow in the next Paragraphs.

4.5 Controlling for endogeneity and selection bias

Following the interesting results obtained in the previous Paragraphs where the endogeneity bias has been addressed, it has been considered worthwhile develop the analysis with the correction for selection bias.

Sample selection bias and endogeneity bias refer to two distinct concepts, both entailing distinct solutions. In general, sample selection bias refers to problems where the dependent variable is observed only for a restricted, non-random sample. Endogeneity refers to the fact that an independent variable included in the model is potentially a choice variable, correlated with unobservables relegated to the error term.

In the case analysed here, an individual's wage is observed only if the individual has been trained. Here training status may be endogenous if the decision to join or not join a training program is correlated with unobservables that affect wages. For instance, if more able workers are more likely to join a training program and therefore receive higher wages ceteris paribus, then failure to control for this correlation will yield an estimated training effect on wages that is biased up. The problem with training and wages can be treated either as a sample selection problem or as an endogeneity problem.

To correct for endogeneity bias and selectivity bias jointly, the 'appropriate' model should be developed in two steps. To fit this model, one would start by estimating a probit model explaining the decision of undertaking training or not. One would then generate the Inverse Mills Ratio (IMR) and include the IMR and the training variables in a second-stage wage regression, where one would instrument for training if it was thought to be endogenous. Because the two biases coexist in the sample, the estimation framework requires implementing the two steps described above.

4.5.1 Empirical framework

To correct for endogeneity and selection bias, two steps are required (Heckman, 1976). The two estimated models take the following form:

First step:

$$\begin{aligned} Pr(Status_{i,t}=1) =& \alpha_i + \alpha_1 X^1_{i,t} + \alpha_2 X^2_{i,t} + \alpha_3 Z_{i,t} + \\ &+ \alpha_4 M_{i,t} + \alpha_5 AmTr_{i,t} + \lambda Unempl_{i,t} + \tau_t + \epsilon_{i,t}, \end{aligned} \tag{4.2}$$

Second step:

$$\begin{aligned} WageGrowth_{i,t} =& \beta_i + \beta_1 \cdot training_{i,t-1} + \beta_2 X^1_{i,t-1} + \beta_3 X^3_{i,t-1} + \\ &+ \beta_4 Z_{i,t-1} + \beta_5 M_{i,t} + \lambda Unempl_{i,t-1} + \\ &+ IMR_{i,t} + \tau_t + \epsilon_{i,t}, \end{aligned} \tag{4.3a}$$

$$WageGrowth_{i,t} = \begin{cases} \geq 0, & \text{if } Status_{i,t}=1, \\ \text{-}, & \text{if } Status_{i,t}=0. \end{cases} \tag{4.3b}$$

In both equations, the subscript i refers to firm and t to year.

The first step equation is estimated through a probit model for panel

data[13]. In Equation 4.2, $Status_{i,t}$ is a dummy variable which takes value 1 when the firm is 'active', meaning that it provides training, and 0 otherwise. $X^1_{i,t}$ is a vector of time variant independent variables given by the number of employees (taken in log) and the annual growth rate. $X^2_{i,t}$ is the age of business (taken in log); $Z_{i,t}$ is a vector of additional independent covariates, namely, the sector of activity (SIC 1-digit level) and the geographical area of activity at NUTS 1 level. $M_{i,t}$ is a vector of individual characteristics which measure managers' experience (proportion of high experienced workers vs/low experienced workers) and the proportion of female employees. $AmTr_{i,t}$ is the is the yearly amount of money available for training. Remaining controls are the local unemployment rate ($Unempl_{i,t}$) and year dummies to control for business cycle effects (τ_t).

The wage equation in the second step replicates Equation 4.1 in Paragraph 4.2.1 with the addition of the term $IMR_{i,t}$. In Equation 4.3, $Wage\ Growth_{i,t}$ represents the average annual wage growth of firm i in year t. $training_{i,t-1}$ is the logarithm of the extent of training activity (in turn: the number of hours, the hourly training cost per year, the number of training activities); $X^1_{i,t-1}$ is a vector of time variant independent variables given by the number of employees, a proxy for the capital assets of firm; $X^2_{i,t-1}$ is the age of business; $Z_{i,t-1}$ is a vector of additional independent covariates, namely, the sector of activity (SIC 1-digit level) and the geographical area of activity at NUTS 1 level. The term $M_{i,t-1}$ is a vector of individual characteristics which measure managers' experience (proportion of high experienced workers vs/low experienced workers) and the proportion of female employees. The term $IMR_{i,t}$ represents the IMR which has been calculated from the probit

[13] Xtprobit is a convenience command for obtaining the population-averaged model. It fits random-effects and population-averaged probit models. There is no command for a conditional fixed-effects model, as there does not exist a sufficient statistic allowing the fixed effects to be conditioned out of the likelihood. Unconditional fixed-effects probit models may be fit with the probit command with indicator variables for the panels. However, unconditional fixed-effects estimates are biased (http://www.stata.com/manuals13/xtxtprobit.pdf#xtxtprobit).

regression (Equation 4.3) and added to the instrumental variable regression model [Equation [5]) as an independent variable to correct for selection bias. Remaining controls are the local unemployment rate ($Unempl_{i,t-1}$) and year dummies to control for business cycle effects (τ_t). The wage equation has been estimated using the instrumental variable regression model in order to correct for endogeneity bias[14].

4.5.2 Main findings

The first step estimation replicates the model implemented in Chapter 2 where the determinants of training were estimated. The random-effects probit regression indicates that the Status of the firm is mainly driven by the geographic location (firms located in the North-West and North-Est are more likely to train), the firm's size and growth, and by the yearly amount of money available for training[15].

The most interesting findings of the econometric framework implemented are those in step two, where the effects of training on changes in wages have been estimated while correcting for both endogeneity and selection bias. As expected, the IMR coefficient is statistically significant through the five specifications suggesting that the sample is affected by selection bias.

The magnitude of the coefficients from the estimation of Equation 4.3 is expected to be different from that of Equation 4.1 due to the presence of the IMR term. Indeed, the comparison of Columns from (6) to (10) in Table 4.4 with Columns from (11) to (15) in Table 4.6 respectively shows that all the variables keep the expected sign but their magnitude slightly differs.

Keeping in mind the considerations made in Paragraph 2.2.2, Column (15) in Table 4.6 can be identified as the most accurate estimation of the effects of training on wage changes. Training intensity, quality and variety

[14] The Stata command used to estimate Equation 4.3 is ivreg29.

[15] For a thorough discussion about the results of the Probit estimation (Table 4.5) see Chapter 2.

explain a significant but different portion of the wage growth variance.

They all have positive and statistically significant impacts on wage changes when taken jointly, showing that the accumulation of human capital, although the firm finances it, has favourable effects for MMs. When the selection bias is taken into account, it appears that the variety, quality and intensity of training explain a significant but decreasing amount of the wage growth variance.

Again, the estimates for nearly all of the others individual characteristics and firm characteristics are largely as expected. Men who participate in company training experience higher wage changes than women and less-experienced workers show less steep wage profiles. However, due to the limitations of the sample, it is not possible to infer that they experience higher wage change than non-training recipients.

4.6 Discussion

The present Chapter has offered a simulation of the effects of MM's training on wages. Due to the sample restrictions the study had to face the problem of selection bias besides the endogeneity bias which is common in this kind of analysis. The endogeneity has been addressed with the implementation of instrumental variable regression. Results are displayed in Table 4.4 and described in Paragraph 4.2, 4.3 and 4.4. Although the endogeneity bias has been successfully treated, any conclusion can be inferred because the econometric framework is still affected by selection bias.

In Paragraph 4.5 the endogeneity bias and the selection bias have been studied further. A two-step estimation framework has been developed. In the first step, a probit model has been implemented in order to explain the decision of providing training or not. The inverse Mills ratio have been generated and included into the instrumental variable regression as independent variable. The two-step procedure has allowed for the correction of both the

two biases.

The selection bias problem has been shown to have a substantial impact on the magnitude of the coefficients. Indeed, results indicate that the coefficients in Table 4.4 are biased due to selection. Controlling for sample selection bias has dropped the magnitude of the training coefficients downward (see Table 4.6 compared with Table 4.4).

The correction of endogeneity and selection bias makes some conclusions possible.

The annual wage growth appears to be explained significantly by all the three measures of training: variety, quality and intensity. In more detail, for those mangers who undertook training in the time window between 2006 and 2011, wage changes appears to be positive correlated with the number of training activities provided by the firms (the estimated coefficient is equal to 4.3294)[16], with the hourly training costs (2.2302) and with the number of training hours (0.4996). The higher is the variety and the quality of training provided the higher is the wage growth. Time spent in training of whatever kind apparently affects wage growth in a less extent.

One last interesting result concerns training measures. The two simulations provided in this Chapter offer some coherent insights regarding how training should be measured when linked to wages. If the three measures of training are not included jointly into the regression, it seems that the coefficient for a single measure would be bias upward. Let's consider training intensity for example. Apparently it has an impact of about 0.8 on wage growth (see Column (11) in Table 4.6) but in fact it is quite lower. When variety and quality of training are entered into the regression, the magnitude of the coefficient for training intensity decreases to about 0.5 (see Column (15) in Table 4.6).

[16]Because the estimated regression is a linear-log function, the interpretation of the magnitude of the coefficients is as follow: a 1% increase in X (independent variable) leads to a change of 1% β_1 in Y (dependent variable).

These findings allow one to doubt about the accuracy of the estimations provided by several previous academic studies. Indeed, it appears that there is a chance that the magnitude of the training effect on wages has been often overestimated[17]. It is probably the case that some of the differences in previous findings may stem from the different measures of training used.

It would be of much interest to develop the simulations provided in this Chapter by upgrading the sample with the information about individual characteristics for non-training recipients which are not available here.

[17] Indeed, this is what happened in the two simulations implemented here (see Table 4.4 and Table 4.6).

Table 4.1: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Annual Wage Growth	6308.0000	0.5461	1.9197	0.0002	94.3566
Hourly Wage Level	10561.0000	27.7987	14.2495	2.0575	119.0000
Training Hours (# Total)	10558.0000	171.6523	992.4524	1.0000	59696.0000
Training Hours (# per Manager)	10550.0000	39.2704	61.8110	1.0000	1136.0000
Training Activity (# Total)	10560.0000	5.1336	23.6046	1.0000	1051.0000
Training Activity (# per Manager)	10553.0000	1.0372	0.1628	1.0000	3.0000
Hourly Training Costs (Total)	9988.0000	274.6353	389.2775	3.4609	6503.1360
Hourly Training Costs (avg per Manager)	9991.0000	87.5084	46.1731	3.9315	502.3303
Age of Business	69018.0000	27.9392	18.0430	2.0000	156.0000
Labour Turnover (In+Out)	21024.0000	0.0683	0.7052	0.0000	43.0000
Labour Turnover Ratio*	17245.0000	0.0115	0.7721	0.0000	100.0000
Unemployment Rate	71142.0000	5.4959	2.4087	2.7382	15.5234
Tangible Assets	61929.0000	36400000.0000	828000000.0000	-20133.8100	78800000000.0000
Employees (#)	54405.0000	264.2371	2103.1940	1.0000	153369.0000
Proportion of Males	10149.0000	0.6777	0.3179	0.0047	1.0000
Proportion of Low Experienced Workers	9552.0000	0.6630	0.3219	0.0064	1.0000

*See http://en.wikipedia.org/wiki/Turnover_(employment)#Calculation.

Table 4.2: K-Mean cluster analysis

Final Cluster Centers

	Cluster	
	1	2
Seniority	12	23
Age	49	54
HourlyWageLevel	20.65	48.90

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
Seniority	1532313.664	1	57.318	52251	26733.659	.000
Age	249955.893	1	42.396	52251	5895.724	.000
HourlyWageLevel	9064850.496	1	104.806	52251	86491.771	.000

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

Number of Cases in each Cluster

Cluster	1	35572.000
	2	16681.000
Valid		52253.000
Missing		3399.000

Table 4.3: Collinearity Diagnostics

Collinearity Diagnostics

Variable	VIF	SQRT VIF	Tolerance	R-Squared
Training Hours (# Total)	1.01	1.00	0.9921	0.0079
Training Activity (# per Manager)	1.00	1.00	0.9966	0.0034
Hourly Training Costs (avg per Manager)	1.00	1.00	0.9953	0.0047

Mean VIF 1.01

	Eigenval	Cond Index
1	2.8283	1.0000
2	0.9641	1.7128
3	0.1957	3.8017
4	0.0118	15.4501

Condition Number 15.4501
Eigenvalues & Cond Index computed from scaled raw sscp (w/ intercept)
Det(correlation matrix) 0.9920

Table 4.4: Training, wage level, wage growth

	Wage level					Annual wage growth				
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$TrIntensity_{t-1}$	**0.1731*** **		**0.0856*** **		**0.0738*** **	**1.0701*** **		**0.8272*** **		**0.7523*** **
	(0.021)		(0.032)		(0.027)	(0.162)		(0.240)		(0.198)
$TrQuality_{t-1}$		**0.1699*** **	**0.9892***	**0.1681*** **	**0.9206***		**4.4492***	**4.2339***	**4.0943***	**3.9089***
		(0.024)	(0.507)	(0.024)	(0.442)		(1.855)	(2.288)	(1.597)	(1.995)
$TrVariety_{t-1}$				0.1215*	**1.1187***				**9.2061*** **	**6.2618***
				(0.071)	(0.559)				(3.316)	(2.685)
Proportion of males	0.4613***	0.5144***	1.1915***	0.5111***	1.1160***	0.4550***	3.9347**	3.9334**	3.4498***	3.5286**
	(0.021)	(0.027)	(0.379)	(0.027)	(0.321)	(0.128)	(1.538)	(1.910)	(1.271)	(1.617)
Proportion of low-experienced workers	-0.4637***	-0.5401***	-1.3418***	-0.5378***	-1.2639***	0.0737	-4.1468**	-3.8621*	-3.6845**	-3.4570*
	(0.020)	(0.025)	(0.441)	(0.025)	(0.378)	(0.122)	(1.746)	(2.087)	(1.467)	(1.778)
Unemployment Rate	-0.0706	-0.1662***	-0.3828	-0.1648***	-0.3457	-0.4228*	-1.4811	-1.3822	-1.4202	-1.2677
	(0.044)	(0.056)	(0.244)	(0.056)	(0.214)	(0.218)	(1.129)	(0.993)	(1.026)	(0.882)
ln $Capital_{t-1}$	0.0003	0.0058	0.0128	0.0056	0.0110	0.0088	0.0091	0.0509	0.0090	0.0433
	(0.004)	(0.005)	(0.013)	(0.005)	(0.012)	(0.020)	(0.071)	(0.056)	(0.065)	(0.050)
ln $Employees_{t-1}$	-0.0243**	-0.0078	-0.0068	-0.0068	0.0019	-0.1054**	-0.0539	-0.0726	-0.0314	-0.0251
	(0.012)	(0.013)	(0.034)	(0.012)	(0.028)	(0.053)	(0.221)	(0.175)	(0.196)	(0.141)
Age of Business	0.0004	0.0011***	0.0009	0.0011***	0.0008	-0.0040**	-0.0002	-0.0032	-0.0013	-0.0037
	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.002)	(0.006)	(0.004)	(0.005)	(0.004)
Sector controls	yes	Yes	yes	yes	yes	yes	yes	yes	yes	Yes
Geographical area controls	yes	Yes	yes	yes	yes	yes	yes	yes	yes	Yes
Year dummies	yes	Yes	yes	yes	yes	yes	yes	yes	yes	Yes
Constant	2.6148***	2.7783***	-1.4038	2.7812***	-1.0875	-1.6613***	-11.3398**	-18.8933*	-10.1818**	-17.3258**
	(0.141)	(0.210)	(2.162)	(0.208)	(1.883)	(0.508)	(5.150)	(9.675)	(4.444)	(8.387)
Observations	4,823	6,595	4,823	6,589	4,819	4,340	4,560	4,340	4,554	4,336
Estimation period	2006-2011	2006-2011	2006-2011	2006-2011	2006-2011	2006-2011	2006-2011	2006-2011	2006-2011	2006-2011
F	4.725	4.725	4.725	4.725	4.725	1.708	1.708	1.708	1.708	1.708
Fp	0	0	0	0	0	0.00711	0.00711	0.00711	0.00711	0.00711
Endogeneity test for regressors	47.38	47.38	47.38	47.38	47.38	40.62	40.62	40.62	40.62	40.62
P-value	0	0	0	0	0	1.85e-10	1.85e-10	1.85e-10	1.85e-10	1.85e-10
Kleibergen-Paaprk LM statistic	4.601	4.601	4.601	4.601	4.601	4.360	4.360	4.360	4.360	4.360
Hansen J statistic	.	.	.	.	.	.	.	.	.	.

[a] $TrQuality_{t-1}$ is measured by ln (Hourly Training Costs (avg per Manager) $_{t-1}$)
[b] $TrIntensity_{t-1}$ is measured by ln ($TrainingHours_{t-1}$)
[c] $TrVariety_{t-1}$ is measured by ln ($ManagerTrainingActivities_{t-1}$)

Table 4.5: Probit model

	Status
ln $Employees_{t-1}$	1.1039***
	(0.030)
Age of Business	0.0022
	(0.002)
ln AmTr	0.2363***
	(0.013)
Growth Value Added	0.1328*
	(0.080)
(Area1) North-West	1.0003***
	(0.212)
(Area2) North-East	1.1640***
	(0.230)
(Area3) Center	0.9719***
	(0.186)
(Sector 03) Manufacturing	0.9617**
	(0.491)
(Sector 04) Electricity, Gas Services	1.7032***
	(0.552)
(Sector 09) Accommodation and food service activities	-1.2477*
	(0.702)
(Sector 10) Business services	1.8818***
	(0.501)
(Sector 11) Financial and Insurance activities	0.9509*
	(0.575)
(Sector 13) Professional, scientific and technical activities	1.4398***
	(0.503)
(Sector 16) Health services and social services	4.2071***
	(0.638)
Unemployment Rate	0.0475*
	(0.027)
Constant	-8.0042***
	(0.619)
Sector controls	yes
Year dummies	yes
Estimation period	2006-2011
# of observations	43732
# of groups	10493
Observations per group: min	1
Observations per group: avg	4.168
Observations per group: max	5
Log likelihood	-6274
Wald Chi(2)	2611
Prob>chi2	0

Table 4.6: Training and wage growth (with the correction for endogeneity bias and selection bias)

	Annual wage growth				
VARIABLES	(11)	(12)	(13)	(14)	(15)
$TrIntensity_{t-1}$	**0.8175*** **		**0.5361*** **		**0.4996*** **
	(0.130)		(0.124)		(0.109)
$TrQuality_{t-1}$		**2.3435*** **	**2.3645** **	**2.2454*** **	**2.2302** **
		(0.817)	(1.170)	(0.760)	(1.074)
$TrVariety_{t-1}$				**5.7455*** **	**4.3294*** **
				(1.685)	(1.528)
Proportion of males	0.4634***	2.2612***	2.3990**	2.0602***	2.1958**
	(0.120)	(0.691)	(0.976)	(0.616)	(0.869)
Proportion of low-experienced workers	0.0456	-2.2107***	-2.1669**	-2.0331***	-1.9687**
	(0.118)	(0.778)	(1.063)	(0.704)	(0.951)
Unemployment Rate	-0.6019**	-1.3542**	-1.2994**	-1.3481**	-1.2550**
	(0.238)	(0.649)	(0.630)	(0.623)	(0.585)
ln $Capital_{t-1}$	-0.0055	-0.0214	0.0107	-0.0183	0.0092
	(0.018)	(0.040)	(0.034)	(0.039)	(0.032)
ln $Employees_{t-1}$	-0.3935***	-0.6554***	-0.5414***	-0.6176***	-0.5012***
	(0.127)	(0.232)	(0.202)	(0.216)	(0.182)
Age of Business	-0.0051***	-0.0030	-0.0048	-0.0037	-0.0052*
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Sector controls	yes	yes	yes	yes	yes
Geographical area controls	yes	yes	yes	yes	yes
Year dummies	Yes	yes	yes	yes	yes
Inverse Mills Ratio	-0.2220***	-0.4460***	-0.3485***	-0.4250***	-0.3368***
	(0.077)	(0.101)	(0.090)	(0.094)	(0.086)
Constant	1.5385	0.0036	-7.1805	-0.0012	-6.7289
	(0.976)	(2.205)	(4.813)	(2.117)	(4.498)
Observations	4,299	4,518	4,299	4,512	4,295
Estimation period	2006-2011	2006-2011	2006-2011	2006-2011	2006-2011
F	3.414	3.414	3.414	3.414	3.414
Fp	1.02e-10	1.02e-10	1.02e-10	1.02e-10	1.02e-10
Endogeneity test for regressors	32.23	32.23	32.23	32.23	32.23
P-value	1.37e-08	1.37e-08	1.37e-08	1.37e-08	1.37e-08
Kleibergen-Paaprk LM statistic	5.376	5.376	5.376	5.376	5.376
Hansen J statistic	0	0	0	0	0

[a] $TrQuality_{t-1}$ is measured by ln (Hourly Training Costs (avg per Manager) $_{t-1}$)
[b] $TrIntensity_{t-1}$ is measured by ln ($TrainingHours_{t-1}$)
[c] $TrVariety_{t-1}$ is measured by ln ($ManagerTrainingActivities_{t-1}$)

Conclusions

Overview of the main findings

This work has contributed to the literature on the role of training in explaining its returns to firm's performance and individual wage progression. It has also provided evidence concerning the determinants of training provision taking a close look at the firms' characteristics.

Now that the whole picture of the results is available, it is possible to sketch out the findings and to provide an overall interpretation.

The rationale for the present research is to provide a thorough overview of the trend and returns of training undertaken by MMs in firms. To this end, several modelling specifications and a variety of panel data techniques have been implemented to provide evidence about firms' training trends and drivers, and to show how and to what extent training significantly boosts firm's performance and individual wages.

The rich dataset, upon which the current study is based, has made possible to analyse training trends and returns by using a wide range of salient information and to perform a number of robustness checks to show that results are not driven by one particular econometric specification.

The dataset has been created by merging two data sources and includes detailed information about firm's demographics, firm's balance sheets, and training provision (see Table 2.3). Firms are the unit of analysis. The final sample size is remarkable; it consists of 11,857 firms observed over

six years from 2006 to 2011. Information regarding training is extremely deep and reliable compared to previous studies. Taking advantage of this, the following three training measures are tested and compared: number of training hours, hourly training costs per manager and number of training activities per manager. The three variables, to a reasonable extent, provide a measure of training intensity, quality and variety respectively.

MM is the target on which the whole study focuses. The acknowledged importance of MMs does not seem to reflect the amount of employers investments in training offered to them. Indeed, findings from cross-tabulation analysis indicate that the provision of training to MMs is, on average, restricted to nearly the 30% of the Italian firms. This finding is extremely interesting because it confirms the unsatisfactory performance of Italy on this ground. The share is in line with what has emerged from the Continuing Vocational Training Survey (CVTS) 2005 which refers to workers in general. About 70% of Italian corporations did not invest in training in 2005. The improvement observed between 2005 and 2010 (http://ec.europa.eu/eurostat/statistics-explained/index.php/Continuing_vocational_training_statistics) was mainly due to the implementation of training activities required by law such as environmental protection, work health and safety. Although the two shares do not refer to the same target, they still are comparable because there is no discrepancy concerning the definition of training and they both refer to the same time window. Then, it can be argued that the incidence of MMs' training provision reflects the overall state of the art of Italian firms for what concerns the provision of training to the workforce.

The scenario is particularly worrying for medium, small and micro enterprises because the 70% share of 'inactive' firms is made up of firms of these sizes mainly. In other words, only the 30%, 15% and 7% of medium, small, and micro firms respectively have provided formal training over the six years

from 2006 to 2011. The trend for large firms is much more optimistic: the share of 'inactive' firms drop down to 30% (see Table 2.4).

On average, MMs in the sample receive a considerable higher amount of training hours compared to the national average (39 hours versus 23 hours) and no gender gap is observed. The number of training hours received significantly decreases with manager's age and seniority. Another way of gauging the size of employers' investment in training is to measure the amount of money spent on training-related activities. On average, 'active' firms spend over 70,000 € in training activities per year, providing about 172 hours of training per year. The hourly cost of training per activity is about 274 € and the hourly cost of training per manager is about 84 €. The quality of training provided (measured by the hourly cost of training per manager) significantly increases with firm's size.

Results from cross-tabulation analysis have been investigated further in a multivariate framework. There appear to be some relevant factors influencing firm's propensity to train.

Firm's size, geographic location, sectors, growth level paths and the credit available to finance training activities are found to be significant drivers of MM's training provision in Italy.

Although to a different extent, training intensity, quality and variety are positively dependent from firm's size. It could be that the larger is the organisation the greater are the economies of scale that can be achieved in training. In addition, it is probably the case that larger enterprises have a greater ability to provide internal, formal training, to support training with training infrastructure, to absorb losses associated with turnover among trained employees, or a better capacity to screen potential employees before hiring them. Furthermore, large enterprises are also more likely to have more skilled and professional employees, who require more training. As a result, proportionately more training is required in larger organisations. Coherently

with that, firm's size is found to be significantly linked to training returns on firm's productivity as well (see Table 3.6). It is probably the case that, because larger firms are more likely to provide high quality training (see Table 3.14) they are also more likely to face higher training returns.

Firms in the North of Italy are found to be more likely to train than firms located in other areas. Again, results are particularly interesting if read in the light of the findings about the impact of training on firms' productivity where training is found to be much less effective in firms located in the Center and South areas (see Table 3.6). Then, it appears that firm's location is a determinant of training intensity, quality, and variety with direct and important consequences regarding its effectiveness and its impact on firm's productivity.

As expected, firms experiencing positive growth level paths and having a higher credit are found to be more likely to provide training to MMs and to train more intensively and effectively.

Consistently with the majority of previous studies, training investments devoted to MMs have been shown to be effective on firm's level performance indicators. A clear impact of training on firm's performance is detected from the econometric analysis performed. An exogenous and significant effect of training on firm performance measured both by productivity (TFP) and financial indicators (ROE) is found.

Again, size and geographic location appear to be salient variables in this context as well as age of business and training methods: returns to training investments seem to be much higher for those firms which are large (estimated coefficient of about 0.28%), located in the Northern Italy (estimated coefficient of about 0.68%), with less than 14 years of business (estimated coefficient of about 0.31%) and which focus on applied methods.

Middle management training has an effect on two performance indicators, but the effect is non-linear. Raising the training variable by 1% point is

associated with an increase of about 0.29% in value added and of about 0.60% in TFP. Moreover, when ROS and ROE are used as target variables, the TMGT effect is in place: profitability is affected by training but the effect is non-linear and after a given threshold the effect training effort starts to be negative.

Last but not least different methods of training have heterogeneous effects on performance (see H5 in Table 3.6). Increasing by 1% point training hours on simulations and experience based methods, practical learning methods and traditional and e-based methods leads to an increase of about 1.31%, 0.26%, and 0.91% in TFP respectively. These results suggest that 'applied' methods are by far more effective than 'traditional' ones.

Several modelling specifications and a variety of panel data techniques have been implemented to demonstrate that training significantly boosts productivity. Such effect is also uncovered for wages.

The empirical analysis of wages is affected by data restriction. The analysis is based on a subsample made of 3,504 firms. The cut in sample size is due to data constraint about wages and other individual characteristics which are available for training recipients but not available for non-training recipients. This limitation does not authorize to generalize the findings about the effects of training on wage progression but at least it offers interesting hints to reflect on and interesting insights for future investigations.

The annual wage growth appears to be explained significantly by the three measures of training: variety, quality and intensity. In more detail, for those mangers who undertook training in the time window between 2006 and 2011, wage changes appear to be positive correlated with the number of training activities provided by the firms (the estimated coefficient is about 4.33), with the hourly training costs (2.23) and with the number of training hours (0.5). The higher is the variety and the quality of training provided the higher is the wage growth. Time spent in training of whatever kind

apparently affects wage growth in a less extent.

As happened when estimating the determinants of training and the training effect on productivity, geographic location and size appear to be salient information in explaining wage progression too.

Furthermore, the positive effect of experience is consistent with all theories that explain upward-sloping wage profiles, including the human capital model, since experience may reflect the extent of informal training. A result of interest is that concerning gender. The proportion of female is positively related to wage growth and similar results are found for males.

Findings concerning training measures allow for puzzling over how training should be measured when linked to wages. Indeed, when the three measures of training are not included jointly into the regression, it seems that the coefficient for a single measure would be biased upward. Let's consider training intensity for example. Apparently it has an impact of about 0.8 on wage growth but in fact it is quite lower. When variety and quality of training are entered into the regression, the magnitude of the coefficient for training intensity decreases to about 0.5.

These findings allow one to doubt about the accuracy of the estimations provided by several previous academic studies. Indeed, it appears that there is a chance that the magnitude of the training effect on wages has been often overestimated. It is probably the case that some of the differences in previous findings may stem from the different measures of training used.

Methodological issues and research developments

It is important to raise a cautionary note about the interpretation of the results from the empirical analysis provided in the present study and more generally of the results from empirical analysis in the field of training.

The dataset accuracy and its internal validity are two necessary but not sufficient prerequisites to ensure the validity of the findings and the integrity

of the whole study. Empirical studies should never disregard them.

Moreover, the understanding from the large amount of empirical studies reviewed is that three major issues are likely to occur when training effects are analysed at firm level.

Specifically, identifying training drivers and assessing the impact of training on firm's performance and wages require addressing three potential sources of bias named omitted-variable, unobserved heterogeneity and endogeneity.

The omitted-variable bias is likely to affect all the three empirical analyses implemented in this work. Indeed, there are certain important control variables that have not been included in the present study and unfortunately this is likely to be the case for all the empirical studies regardless the field of analysis. First of all, as repeatedly mentioned throughout the thesis, the sample is severely limited by a lack of information about non-training recipients such as wages, gender, age, and seniority which however are available for training recipients. Moreover, this study includes neither information about previous career path nor the level of the relevant manager's skills.

This lack of information firstly affects the estimation of the effect of training on wage progression indeed results cannot be generalized. Anyway, although the sample is truncated, the selectivity bias is properly addressed econometrically.

The estimation of the determinants of training and of the effects of training on firms' performance would have also benefited from the presence of complete information regarding individual's characteristics. Coherently with the findings from the bivariate analysis, I would expect to find age and seniority influencing the provision of training. Indeed, previous literature suggests that the likelihood of getting training may depend on the initial human capital of workers. Training is most prominent amongst the young and highly educated workers, suggesting a complementary relationship between human

capital acquired through the education system and that acquired through in house training. Furthermore, if ability and training are complementary in production, however, higher ability workers able to command higher wages will be matched to positions offering more training.

For what concerns productivity growth, the lack of information concerning the mentioned individual characteristics does not appear to be such relevant. Indeed several previous studies which are able to consider such information show that formal education, unionization, and gender appear to play no important role in affecting productivity growth. This consideration, coupled with the finding that training is one of the few variables having a significant direct impact on wage growth, is in line with the conventional human capital explanation of wage growth. Indeed, as predicted by the human capital model, on-the-job training appears to be an important determinant of both productivity and wage growth (Barron et al., 1989).

The lack of information concerning individual characteristics is probably less problematic in the present study given that it relies on a specific workforce category only, MMs.

The proportion of part-time workers, the presence of labour unions, the occupational structure, the technological change, the innovation level, expenditures in new technology (which can be a proxy of training provision), the labour turnover, the ownership structure, and managerial attitudes would be some other important pieces of information that should be considered while analysing the determinant of training and its impact on firm performance and wages. Indeed, the literature suggests for example that investments in training and technology are closely related (Blundell et al., 1999). Training plays a significant role when the technological change is rapid and the knowledge needed to implement new technologies is very specific. Unfortunately, the present study is unable to test the technology dimension directly. Its effect can only be inferred through the firm's activity sector. Moreover, R&D

is demonstrated to be positive correlated with technology and wages. Knowledge and skills generated by R&D as well as by training activities are largely embodied in workers, and they are transferable to other firms. In this regard, an interesting development of the present research should be to analyse the effects of spillovers and of R&D and training interaction effects. Similarly, empirical findings in the context of training might be also sensitive to the inclusion of information regarding innovation. Changes in the composition of the workforce as a result of innovation and/or external shocks could be associated with the wage increases. For example, the firm, after a successful innovation, can increase its productivity, and may replace (older) workers with (younger) workers who are well- educated in new technologies, and demand higher wages. Similarly, the firm may shed less productive/low-wage labour as a response to a negative external (demand) shock. In both cases, the productivity and wages in the firm will increase, although the workers do not share benefits of any type of investment with the firm. In such cases, the estimates for the returns to the workers are likely to be overestimated.

Managerial attitudes are also extremely important to training decisions (Finegold, 1991; Matlay, 1996). This kind of information can probably be gathered only through a specific survey because managers' attitude to training is quite likely to differ within an organisation. While senior managers may recognise the strategic importance of training, middle and first line supervisors strongly influence the form that training takes, and often prefer training to be short, sharp and focused on the specific problems faced by the enterprise.

There remain two last considerations about the omitted-variable bias. First, the estimated coefficient of training is probably often overestimated because it incorporates the effect of informal human resource development (e.g., informal training) which is not measured here. Indeed, apart from workers' participation in training, wage progression also incorporates the ef-

fects of workers' acquisition of many work-related skills by means of informal on-the-job training or 'experience' (cf. Mincer (1974)). Second, the present study is unable to measure the extent of other human resource practices besides training. Focusing on participation in training only has probably led to an overestimation of the training coefficient because it might incorporate the effect of other practices. However, the majority of previous studies analysing bundle of practices find that training is one of the most relevant in explaining productivity.

The second source of bias that affects the present analysis is called unobserved heterogeneity, which is a form of omitted variables bias. It refers to omitted variables that are fixed for an individual (at least over a long period of time). Methods for obtaining valid statistical inferences in the presence of unobserved heterogeneity include the instrumental variables method; multilevel models, including fixed effects and random effects models; and the Heckman correction for selection bias. All these econometric procedures have been tested in the analysis implemented here.

Similar econometric procedures have been implemented to deal with the third source of bias which is endogeneity. Controlling for endogeneity is another fundamental challenge in the empirical studies concerning training.

For what concerns the study of the impact of training on firm's performance, what happens is that more productive firms can do more training because they have more resources to devote to this activity or because they better understand the value they can get from training of MMs. If this is the situation a regression analysis without further corrections could signal a correlation between training and productivity that could be wrongly interpreted as the causal effect of training on productivity. Hence, the endogeneity of the training variable can bias the estimations and needs to be addressed.

In estimating the actual magnitude of the returns to training, we have to take into account the fact that participation in training is not randomly

assigned across the population but is endogenous. For what concerns wages, the problem arises because individuals are non-randomly selected into training programs based on unmeasured characteristics. For instance, if firms provide training to workers of higher ability or if individuals who receive off-the-job training are exceptionally motivated, the estimates of the effect of the training measures on wages may be biased upward. This selectivity issue is probably mitigated here because the study refers to MMs. Individuals within this workforce category are more likely to be homogeneous in terms of ability and education level.

In this regard, a key aspect of the present work is the availability of an instrument that seems to mimic the characteristic of the theoretical instrument and which allows the analysis to identify an exogenous and significant effect of training on firm performance and wage growth.

There would be a number of other key aspects and strengths of the present work worthy to be mentioned. However, they are not illustrated here as they have all been already discussed through the thesis.

To conclude, the present study complements and advances existing research as follows: first, it integrates literature by identifying some relevant factors influencing an employer's decision to train MMs. Second, it provides for the first time evidence about the effects of MM's training on firms' performance in Italy. Third, it originally broadens existing literature on the returns to training by proving the existence of a TMGT effect. Fourth, findings show that management training can only be expected to impact on firm performance in the long term. Thus, the present study suggests that the productivity payoff may take some time to materialise thus research needs to be longitudinal. Last but not least, the study addresses methodological gaps detected in previous research by showing the importance of measuring training variety, quality and intensity when analysing annual wage growth. Findings show that the magnitude and the significance of the training vari-

able may vary by the type of training measure.

Even though there remain econometric problems that could make one disputes the exact quantitative magnitude of training effects, the key qualitative conclusion that MMs' training boosts firm's performance and individual wage growth should be valid. However, one thing that is clear from the present research is that there seems to be great variations among firms in terms of the intensity, quality, and variety of training provided. This has wide implications in today's global economy where it is important to appreciate that an understanding of culture is vital to successful management.

In order to improve and develop the present study the following actions should be taken.

First, as stated throughout the discussion concerning the methodological issues, it would be important to test the results about the effects of MMs training on firm's performance using a more complete set of information. Of course, it is quite unlikely to have a remarkable dataset containing all the information needed, thus unobserved heterogeneity is likely to remain a problem unless business and governments do not make an effort in order to generate more complete data on manager's practices in organizations.

Second, it would be interesting to test the results about the effects of MMs training on wage progression in the presence of a complete sample regarding individual characteristics. Indeed, the magnitude and the significance of the relationship between training and wage levels are found to be strictly conditioned by how training is measured and different estimation results are quite likely to occur if training quality, intensity and frequency are not included jointly into the econometric framework. Unfortunately, this finding is valid for the sample of trained managers only and it cannot be generalized to the population until the dataset will be integrated with further information about non-training recipients.

Furthermore, following the approach by Ballot et al. (2006) and other

scholars, having a complete sample would allow the study to show how benefits of investment in physical capital, training and R&D are shared between the firm and the workers. With this regard, a further investigation about the role of gender, seniority, age, and experience would have wide interesting insights for policy makers.

Finally, the analysis could be extended by adding macro variables to the equations. For example, it would be interesting to test if results hold in the pre/post crisis period by splitting the sample into two smaller panel datasets (one from 2006 to 2008 and one from 2009 to 2011).

Ideally, having comparable data in other countries, a cross country analysis should be implemented in order to know if results are robust enough to be observed under different institutional environments.

A caveat is in order before concluding this discussion about the improvements suggested. The data set used in this study covers only firms which provide subsidised training. Further research is needed to check if results are still valid when training is sponsored by firms themselves. It is quite reasonable to expect so.

Future research

Some potential insights for future research are suggested below.

Firms' returns to investment in training appear to be quite substantial, and raise new puzzles. Since there is an emerging consensus that training is necessary for competitiveness, why are not firms doing more of it? Part of the answer could be related to the complex nature of the investment decision. Workplace training, unlike other forms of human capital investments such as education and government training, involves two parties (the individual and the firms) which greatly differ in their preferences, access to capital markets, level of risk aversion, time horizons and information about the labour market.

Firms may not provide more training, especially more general training,

even though they might wish to do so, for a variety of other reasons. Resources devoted to training activities are often expensed as costs (rather than amortised over time like an investment) and have uncertain effects on future productivity (Bassi et al., 2002). A related problem is that training investments may require some time to translate into productivity gains, as workers and organisations gradually respond to the new skills of the workforce.

Another reason, as suggested by Ballot et al. (2006), may be the lack of trainable workers in the labour market. All the studies show that firms select for training workers who have some initial education. If these hypotheses are validated, they suggest that public policy should be redirected from general levies on firms towards programmes of intensive training for workers with low initial education. Further research that distinguishes the types of workers by initial education and computes the returns to training with this added distinction is needed.

Moreover, a firm may be understandably reluctant to invest in training if employee turnover is high. In addition, training may itself contribute to employee turnover.

The lack of information on the returns to training and the fear of poaching of trained workers by other firms is another entrenched barrier to the provision of training. Many organizations are probably unaware of the effectiveness of training programs. This lack of knowledge concerning the results of managerial training is primarily due to the lack of evaluative research on these programs. Since companies expect their investments to pay off, a cost-benefit analysis showing the return of investments in training would be an interesting tool for performance evaluation. Similarly, government policy makers require information on the return of subsidised investments in training to guide and promote future resource allocations.

In this regard, an important avenue of future research would include probing the returns to training by combining enterprise data with industry-

level data to investigate the externalities story in greater detail. Indeed, because of the externality, firms under-invest in training activities, and because workers are financially constrained, there is an overall under-provision of training in the economy.

Looking at the training barriers from the employees' perspective, their resistance to undertake training might occur for a number of reasons. Lack of time, job pressures, personal effort it requires, financial constraints, not identifying the need, lack of organisational support, commitments in personal or family lives, are likely to be among the key barriers to engaging in more training activities.

All the considerations above suggest the importance of a comprehensive analysis of training outcomes. Indeed, statistics indicate that investment in training is continuing to grow as more and more companies realize its importance.

Potentially, training is likely to produce improvements in a number of ways.

A virtuous management approach to train can lead to a cultural change by reducing reliance on external recruitment and increasing reliance on internal staff development. It may develop the recognition of the need for a long term approach towards human resource development. Furthermore, firms may emerge from training better organized in relation to business and manpower planning. Management teams may be established, job description and appraisal introduced. The overall organization of the firm may be improved following training.

Following training, firms could also potentially experience a range of improvements in various aspects of external relations including better customer care and external image. By providing training the employee commitment to the company could be enhanced. Indeed training may increase reciprocity, may help the employee to identify with the organization, to feel more val-

ued by the organization and serves to limit alternative employment options. The result of this would be an organization that is better able to retain its workforce.

Providing employees with up to date training gives them the tools they need to become more productive and ensures that they will be able to complete their tasks in the most efficient manner possible while providing consistency and quality for the organization. Providing employees with training allows them to develop their individual skills making them better able to contribute to the overall success of the organization.

Some others potential outcomes of training might be: develop self-awareness, opportunity to network with colleagues and professionals; legitimation of intuitive practices (becoming aware that practices and techniques being used intuitively are supported by research; learning of tools, skills, techniques that are transferable to the workplace). Participants reported being reinforced in attitudes, knowledge or skills that they had already learned previously. It also enables interactions with participants' peers (as reported by Billet (1994) and Enos et al. (2003)). Focusing on MMs, training activities may also have a positive impact on the development and reinforcement of skills, the establishment and maintenance of networks, and the opportunity for MMs to meet, discuss and solve mutual challenges (Terrion, 2006). In addition to that, management education and training are recognised as essential elements of the careers' development.

All the potential training outcomes are more likely to occur if the training delivered meets the training needs. Then, another important issue for further research is the question of needed competencies. What are the MMs' key competences in their different roles? How to facilitate the changes in the role demands by e.g. training? Are firms well aware of the need to train?

It seems critical that these MMs have the knowledge, capabilities and skills to play their role. The underdevelopment of management, especially

MMs, needs to be addressed because all staff in management positions should be motivated and supported to access the body of information, theory and skills needed to work with and through others to accomplish organisational goals (Cardno, 2005, p. 301).

Training is one of the possible solutions to solve these deficits as long as it is designed and delivered properly. Indeed, some management training might not work either because of external circumstances, inappropriate attitudes of the part of management or limitations in the training provided. The quality of training and the specificity of training relative to an industry's unique competitive situation and needs are important. Training should not be disconnected from managers' job indeed if learning is not integrated with people's work, they might not utilize it.

Training may be most effective when it is designed for the targeted industry and size firm. The practice of sending mangers to 'canned' or 'pre-packaged' training programmes that are not industry specific may produce less powerful results.

This issue is particularly relevant for small and medium firms which might not have cushion that the larger firms have to absorb 'mistakes' in resource allocations or to write off bad training decisions and lost opportunities. Smaller firms often have higher training costs per employee than larger firms because they cannot spread fixed costs of training over a large group of employees. In addition, the loss in production from having one worker in off-site training is probably much higher for a small firm than for a larger firm. Here again there is a rich vein of research to be mined. Indeed, there appear that not only do SMEs themselves pay less attention to training but the issue of training and development on SMEs has also been relatively neglected by academics.

Finally, research into the factors which facilitate, inhibit and stabilise training provision, among firms of different size, in different sectors, age,

and even localities are needed. They would be of direct interest of policy makers.

Understanding and identifying training optimum is a recommended issue for future research as well.

Policy implications

To conclude, policy implications are derived.

This research provides useful insights and tools for all the actors involved in the training decision process.

Focusing on the Italian context, the overall feeling, although to a different extent regarding firm's size, geographic location, and industry sector, is that firms should be more committed to training activities and should give MMs time to focus on their development. What probably happens is that training, although maybe promised, is in reality often not available because managers do not have the time to do it. Many managers probably feel that they are stuck in a situation which is continually demanding more in terms of hours and skills, without the support of proper training and development. In this regard, firms should also be aware that training is likely to have a faster rate of depreciation than schooling, so it requires a higher year-on-year return in order to give incentives for investment (Moretti, 2004).

Social support for training might be a major factor in ensuring successful integration of training into Italian firms. Moreover, all the actors involved in the training decision process can make more efficient human capital decisions and can contribute to a successful implementation of their strategies and by the following actions.

First, developments in the analysis of training are recommended in order to assess if and how employee training expenditures are associated with the creation of future value. Some interesting extensions in this area have been suggested above. To this end, all the actors involved should make an effort

to allow data to become available. There is need for large-scale surveys, to establish statistical associations. There is also need for intensive interviews with management and consultants to enlighten for example hidden qualitative and subtle linkages between training and firm performance.

Given their strategic role and the paucity of studies addressing MMs, further research on training outcomes and on how mangers training is designed and delivered is mandatory. Indeed management behaviour and attitude is one of the most notable determinants of successful training programs. Firms and their managers should be more willing to make efficient levels of training investments (armed with additional evidence that such investments result in positive returns for the firm).

Managers know that people make the critical difference between success and failure. The effectiveness with which organisations manage, develop, motivate, involve and engage the willing contribution of the people who work in them is a key determinant of how well those organisations perform. Yet there is surprisingly little research demonstrating the causal links between people management and business performance. Many studies describe particular management practices and styles which are claimed to lead to more motivated, or satisfied, or productive employees. However, there are few that apply rigorous, comparative analysis over time to the individual elements of management activity and measure the contribution they make to performance.

Future research should focus on the analysis of the factors and forces that make training more efficient, again giving special attention to MMs. The way training is planned, designed, tailored and delivered as well as the quality of its provision are all factors which guarantee efficiency. Least but not last, information on the effects of such investments must be better communicated to managers and investors. There is need to invest time and effort in the communication process. In this regard, support from upper manage-

ment, MMs, and colleagues can significantly impact the level of investment an employee will make. Cues from these people and from company policies can send a message to employees regarding the importance of training. The more positive the cues, the more likely training will enhance an employee's identification with the company. As a result, employee commitment is enhanced due to the perceived support that one receives from colleagues and managers.

The analysis of Italian context is particularly interesting for at least three reasons: first, firms in Italy lag behind their foreign competitors in terms of the scale of training and this negative picture is even more worrisome when looking at MMs only. In Italy, the general belief among management that training is important is not converted into expenditure on specific programmes.

Second, the research has shown that the local context helps in explaining the Italian economic divide. Bearing in mind the weak availability of territorial resources in the South of Italy, it is hard to be optimist for the future about the role of training especially for firms in Southern Italy.

Third, small and medium sized firms are apparently more reluctant for what concern training provision and in Italy they represent the vast majority of firms.

All the considerations made so far and all the training barriers mentioned above are exacerbated in SMEs. Indeed, it appears that management training projects are less successful in the smallest firms which do not have the managerial capacity to benefit from them. Findings show that large firms seem to be able to plan for the future while small firms are more likely to miss the boat. Here again there is a rich vein of research to be mined. The statistical information on training in SMEs is limited, and the research base consists mainly of a series of small scale and fragmented studies. The findings suggest that the reasons SMEs provide training depend closely on the

particular business needs of relevance to the enterprise, and as such, may be of interest to policy-makers. To date, there has been a paucity of research examining the demand side of SME training.

The research extensions suggested are more difficult to investigate because small firms do less formal training, but they often do a lot of informal training, which is not easily measured by surveys. There still remains a need for more context sensitive studies of MMs' contribution to firm and individual performance.

I do hope this study has contributed to induce more research on the returns to training as well as on the other relevant training aspects and issues highlighted above. Firms and policy makers should be well informed that in spite of poaching training is valuable.

Future research should help to understand why training should be the life blood of organizations and why it should no longer be an option but a must for most firms.

Appendix A

Fondirigenti and 'Conto Formazione'.

Fondirigenti is an Italian Joint Inter-Professional Fund (JIF), founded in 2004 and promoted by Confindustria and Federmanager. Its main objective is to fund and support MMs' training of member firms. Italian firms are required by law to devolve a share of their workers' salary to any Inter-professional Fund. However each firm has the power to choose which Fund to adhere to. In that respect Fondirigenti can be considered a sort of levy grant system. Once a firm has registered to Fondirigenti it has to devolve to it 0.30% of the overall amount of yearly salaries paid to its MMs. Fondirigenti puts 70% of this annual fee income in a reserve fund which is accessible by each firm to 'buy' training for MMs. As a result, joined firms accumulate every year an amount of credit in the so called 'Conto Formazione'. The credit available can be spent any time of the year and the amount available can be verified online in real time. Firms don't have particular constraints with respect to the training features as long as it is devoted to MMs: subject to approval by Fondirigenti, each firm can decide about type of training, method, content, cost and length as well as training provider[1]. Companies

[1]The potential source of training examined here has been categorized as follows: universities (e.g., Bocconi, La Sapienza - Università di Roma, Politecnico di Milano, University of Freiburg), corporate universities (e.g., Eni Corporate University, General Electric, L'Oréal France, Microsoft Corporation, Robert Bosch Spa, TÜV SÜD Formazione), business schools (e.g., LUISS Business School, SDA Bocconi, MIP - Politecnico di Milano, Harvard Business School, ISTAO, Imperial College Business School, London Business School, ZfU International Business School, MIB - School of Management), vocational and

can furthermore submit their training plans at any time of year. After three years the credit 'expires' meaning that the firm cannot use it anymore and Fondirigenti reallocates the funds for other purposes. The credit is at disposal of each firm until 31st December of the second calendar year since money was paid.

Type of data collected.

The datasets collected from Fondirigenti are of two kinds. One is at the firm-level and one is at the individual-level. In the first dataset there is one observation per firm per year. It contains yearly information concerning the total amount of money spent in training, the number of hours, the number of participants, the credit available in the 'Conto Formazione'. As mentioned above, this last information is concerned with the amount of money that each year is at disposal of firms to finance manager training. The individual-level dataset has one observation per manager, per firm, per year. Per each training activity it contains yearly information regarding training and the characteristics of the participant. With respect to the training activity the dataset includes: number of hours, number of days, costs, training provider, method and topic. For what concerns individual characteristics the dataset includes: gender, age, seniority (number of years worked in the company) and lost wage during training period. Individual characteristics are only available for training recipients. The firm-level dataset can be derived from the individual-level dataset by aggregating the variables of interest into proportions or averages or sums according to their nature. The datasets collected from Fondirigenti are extremely reliable for the following main reasons. First (1), information is collected in real time. As soon the training activity is over, all the data process is generated. This is much more informative than having employee or employer reported information about past training activities and ensure precise and complete about training. Second (2), the dataset is

technical institutes (e.g., Cegos, Federmanager Academy, Galgano & Associati, Skill Lab Srl, Confindustria, Adecco, Ambrosetti, Accenture, McKinsey).

fully representative of the managers in the firm. Once the firm decides to join Fondirigenti, the registration involves all the MMs working in the firm. This means that training activities are recorded by Fondirigenti for every manager in the firm. Third (3), the dataset is generated by the firm itself once the provision of training activity has been planned. All the details concerning the training activities must be recorded by the firm and subsequently confirmed by the organization which provides training. As a consequence, all the information collected is triple- checked: once by the responsible of the training project within the firm, once by the training provider and once by Fondirigenti.

In the available dataset, 70% of firms are inactive meaning that they have never provided training to their MMs in the six years observed. As discussed in the Conclusion, a number of potential barriers to training could explain the high share of inactive firms.

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