THE IMPACT ON WAGES OF GENERIC COMPETENCIES, PSYCHOLOGICAL CAPITAL, NEW WORK PRACTICES AND DIGITAL TECHNOLOGIES

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Abstract

This paper examines the impact of competencies, psychological capital, new work practices and digital technologies on private sector wages in the Italian economy. It demonstrates – also considering industry collective bargaining that tends to fix wage levels according to job complexity, moreover giving rise to employment relations governed by incomplete contracts – that firms pay extra wage premia to workers who: i) use digital technologies, provided they are versatile in the use of these new tools, ii) activate a bundle of distinctive 'generic' competencies, iii) possess personal traits considered by the firm as productive in carrying out work, and iv) occupy positions to which the organizational design attributes greater autonomy and more responsibilities.
The wage equation used controls for several detailed factors (firm characteristics, occupations, worker characteristics, working and contract conditions, industrial relations) and was estimated with weighted OLS, also controlling for heteroskedasticity. Endogeneity was tested with GMM estimators.

Key words: J24, J31, O33

JEL CODE: wages, competencies, technologies

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1 Introduction

At the micro level, several studies have documented that the performances of successful companies are increasingly influenced not only by investments in some tangible assets, namely, industrial technologies based on microelectronics, but also by intangible assets (mainly organizational capital) (Brynjolfsson and Hitt, 2000, 2003; Brynjolfsson et al., 2002; Black and Lynch, 2004). The most qualifying element of these results is not so much the additive contribution of individual investments in firm performance but their complementarity. In addition, the skill-biased nature of both new technologies and new work practices associated with the reengineering of workplaces, increases the relative demand for high-competency labour, while reducing skills or eliminating the demand for low-competency labour (Bresnahan et al., 2002; Caroli and Van Reenen, 2001).

The extensive diffusion of technological innovations is induced by their versatility, and thus called *general purpose technologies* (GPTs), since they affect virtually every task, job and industry. In terms of organizational innovations, the lean production paradigm is establishing itself as high performance work organization (HPWO) due to better and more virtuous work practices resulting from an organizational reversal, namely, going from functions to processes and from hierarchy to human resource empowerment. [1] Complementarities between GPTs and HPWO originate from the fact that the former enables decentralizing some decisional control, one of the most relevant organizational traits of the latter.

Technological and organizational changes not only increase but also alter the content of competencies required in terms of managing new technologies, confronting the diagnostics of situations and resolving problems, knowing how to work in teams, and being able to communicate and interact with colleagues, redefining not only the occupational structure but also wages.

In a production environment characterized by new technologies, new organizational structures and new requested competencies, the value of education – the key explanatory factor in the Mincer earnings function – is today considerably reduced, according to at least four authoritative sources: i) the results of the international PISA (Programme for International Student Assessment) and IALS surveys (International Adult Literacy Survey) according to which – education investments being equal – cognitive skills, knowledge and

[1] Investments in organizational capital, coherent with the nature of ICT, have given rise to the WCM (World-Class Manufacturing) movement, whose canons provide for, in addition to business process reengineering, abandoning three important traditional management techniques, respectively *standard costing* in favour of *activity-based costing*, *management-by-objectives* in favour of *activity-based management*, and finally, traditional planning and control in favour of *activity-based budgeting*. See Leoni (2012b) for a review of this literature.

operational skills appear to be inconsistent with the test scores of educational institutions; ii) the results of the accredited Heckman studies (2000, p. 4), according to which the preoccupation with cognition and academic 'smarts' as measured by test scores «*are based on fundamental misconceptions about the way socially useful skills embodied in persons are produced* ... [which tend to exclude] ... *social skills, self-discipline and a variety of non-cognitive skills that are known to determine success in life*»; iii) empirical evidence according to which educational wage premia have generally decreased over time (Naticchioni et al., 2008, 2010), due to the obsolescence of knowledge transmitted to students and the educational mismatch (Cainarca and Sgobbi, 2012); and lastly, iv) the teachings of the modern constructivist learning theory, according to which knowledge is not so much the result of the transfer of information and knowledge from teacher to learner but the experiential processes of the latter. The *clue* variable is therefore not formal and organized education in itself but the amount of social, cognitive and emotional experience activated by the learner in the learning process.

A number of theoretical models have been developed to explain how firms should design remuneration schemes in order to induce workers to cooperate in the interests of firms (Prendergast, 1999, 2011). Nevertheless, few attempts have been made to investigate the degree of use of technical and generic (or soft) competencies over and above conventional indicators of educational achievement, nor the association, if any, with labour market rewards and attempting to look beyond mainstream explanations (pay for performance in agency theory, efficiency wages and standard neoclassical theory). In traditional forms of work organization, technical competencies are usually associated with the threshold levels required to cover jobs in a given grade while their remuneration originates from job evaluation (not from personal competencies). Dickerson and Green (2004) argue that technical and generic skills cannot easily be quantified and are only sometimes certified, mostly defined in slightly different ways. Empirical works have to date analyzed limited information on technical and generic competencies, and cognitive and non-cognitive competencies (see Green et al., 2001; Dickerson and Green, 2004; Leoni, 2012a). A rare example of workforce-level generic and non-generic skills data is that analyzed by Dickerson and Green (2004) on English employees. Excepting this, robust evidence for other countries is essentially lacking.

Certain attention has instead been devoted by researchers to a specific component of technical competencies, namely, the ability to use computerized technologies: the controversy of whether or not workers receive a wage premium for these abilities, due to their shortage in the labour market, remains open.

Labour economists have paid less attention to psychological capital, which psychologists denote as those personal traits that do not form part of the productive competencies category but could contribute to an individual's productivity (Goldsmith et al., 1997; Bowles et al.,

2011). This is generally treated by economists as an unobservable aspect of individual-specific heterogeneity, and as such included among omitted variables.

Last but not least, very little attention has been paid to the impact of workplace innovation, more precisely high-performance workplace practices (HPWPs) on workers' pay. These new work practices include job-rotation, employee involvement, self-managed teams and incentives. However, the cornerstone of the lean production model is constituted by the reduction of hierarchical levels, which conversely gives rise to an increase in shop floor discretion and autonomy. Since HPWPs have a significant impact on productivity, it is unlikely that workers involved in these new forms of organization do not receive any benefits. Black et al. (2004) and Osterman (2006) provide positive evidence in this direction, even if Cappelli and Carter (2000) find that wage premiums associated with HPWPs disappear when controlling for human capital.

Most researches have focused on one or a subset of the above-mentioned wage determinants, without combining all these into a unifying equation. The present work attempts to pursue this aim by estimating a wage function on a particularly rich database of Italian employees. It also investigates the role of industrial relations in determining wage levels.

The paper is structured as follow: a brief review of the empirical literature is presented in section 2, while the database and model for the empirical analysis are discussed in section 3. The empirical variables are examined in section 4 and the results in section 5, where we also discuss some econometrical issues. Some final considerations are presented in section 6.

2 A critique of previous empirical literature

In this section, we critically summarize the main literature concerning the underlying factors that affect wages, competencies, computing skills, organizational design, psychological capital and industrial relations.

2.1 Competencies, computing skills and wages

The supply-demand-technology paradigm has become the most widely accepted theoretical framework to explain the patterns observed in schooling premia and wages. According to this theory, the diffusion of new information and communication technologies (ICT) has given rise to skill-biased technological change. The labour market demands more and more high-skilled workers at the expense of low-skilled workers, increasing the wages of the former and lowering those of the latter. After controlling for standard Mincerian worker attributes such as education, Krueger (1993) finds that workers who use computers on the job earn 15 to 20 percent more than non-users. He suggests that the introduction of a PC generates wage rises

for individual workers because it creates demand for this specific skill; the increasing use of computers has therefore been responsible in part for increased wage inequality in the USA. Other authors (Dunne and Schimtz, 1995; Doms et al., 1997; Haskel, 1999) stress the quality of labour on the demand side: technologically advanced establishments pay higher wages and employ a greater proportion of skilled workers. Bresnahan (1999) and Bresnahan et al. (2002) qualify the argument by stressing that wage differentials and the skill composition of the labour force are affected by advances in ICT when coupled with organizational changes in the workplace. Aghion and Howitt (2002) provide a theoretical model in which the introduction of general-purpose technology (such as ICT) by itself does not explain changes in short-run wage differentials but only in conjunction with the different degrees of adaptability of workers to new jobs or tasks. Thus, the uneven diffusion of computers and ICTs among workers alone cannot provide an exhaustive explanation for the large differentials observed in labour compensation.

Other studies have however cast doubt on this hypothesis by reversing the causation: highly paid workers are more competent, and are consequently more likely to be employed in the use of advanced technologies. For example, DiNardo and Pischke (1997) consider that in a cross-section context, the control for worker characteristics implemented by Krueger (1993) is unsatisfactory: in fact, the fixed effect estimations show that much of the impact of computer usage on wages disappears once the correlation of computer usage with unobserved individual heterogeneity is considered. Thus, workers with greater abilities are selected to use computers and would be highly paid anyway since their abilities render them more productive even without the use of computers. The authors also add the use of a set of further tools (pencil/pen, calculator, telephone, working while sitting) into their models. Although ability controls are significant, the coefficients on computer use or other tools hardly change once occupation is controlled for. Indeed, to the extent that some particular skills can be associated with some particular occupations, these tools can therefore simply proxy for the occupational wage structure. Moreover, similar to Krueger's (1993) results for computers, these tools have an effect on wages that is not captured by academic abilities. This, once more, indicates that ability controls, such as grades, may only be poor proxies for the types of skills that are ultimately relevant in the workplace.

The finding that indicates that people using pens at work earn more than the average can also be understood as the return to writing skills according to Borghans and Weel (2004). The authors find that writing long and short documents, performing advanced mathematical procedures and using computers at a high level of complexity have a positive effect on wages. Moreover, the education and occupation variables partly explain individual heterogeneity.

From another perspective, Osterman (2006) finds that computer use positively affects wages (through skills) but collapses the significance of the education variable so that the

relation between wages and education is a proxy of more contact with technology. A complementary result was obtained by Naticchioni et al. (2008), who show – using a quantile decomposition methodology – that the driving force of change in wage structures is given by a negative coefficient ('between') component in relation to the diminishing dynamics of the coefficients of education over time.

Lucchetti, Staffolani and Sterlacchini (2004) look at some methodological issues. They consider a possible simultaneity between wages and working hours and try to control for unobserved individual heterogeneity with some ability variables, as well as introducing in their estimations the educational level of parents, dummies for 3 grades and level of computing skills. They find that white-collar workers who use computers on the job earn 15 percent more than non-users. This work demonstrates the importance of individual characteristics (unobserved abilities) to explain wage differentials, but is still limited to the use of grades and educational level of parents: poor proxies for individual cognitive and non-cognitive skills. Although the point is made, the appropriate instruments to analyze this are lacking. Grade variables, simple dummies for computer use and educational level of parents are all inadequate proxies for individual 'key' competencies, important wage determinants that are able to influence the continuous learning of competencies (Leoni, 2012a).

Dickerson and Green (2004), in addition to having a wealth of information on the 'generic' skills of English employees (where generic stands for the entire profile of worker competencies, from manual to intellectual, measured at a meta-level), distinguish between the different levels of complexity of computing skills, providing evidence of their positive impact on the wage premium. They estimate a hedonic wage equation where the coefficients are interpreted as the shadow prices of the single characteristic (Lucas, 1977). Moreover, they show that the DiNardo and Pischke criticism does not appear to hold when there is a fuller description of job attributes and individual skills available in the data. Indeed, the coefficients of some skills, such as writing or reading short documents, become small and non-significant once the set of controls is considered. They analyze an employer-employee linked panel dataset and identify the most rewarded competencies. Workers using computers at a high level of complexity, communicating at a high level, who plan activities and have task discretion, receive higher wages. The authors also consider the endogeneity problem and find that high-level communication and the use of computers at a high level of complexity retain their significance and positive relation with wages even after considering control variables such as education, experience or responsibility, and the set of generic skill variables. Moreover, they show that what really matters is the level of complexity of computer use and not its centrality.

Generally, simultaneous information on competencies and on computing skills is not always present or is limited. Only Dickerson and Green (2004) offer some indications of the

levels of sophistication of computer use as well as a rich set of generic skill measures. Nevertheless, a more in-depth investigation would be possible, further enriching information on the use of high-performance work practices, psychological capital held by workers and eventually recognized by the firm, simultaneously taking into account the industrial relations role that unfolds at the workplace level.

2.2 HPWPs and wages

Over the past twenty years, also in western production systems, the new way of organizing firm activities, known as World-Class Manufacturing (WCM) or lean production[2], has taken form. Its prevalence varies from country to country, and Italian companies certainly lag behind their international competitors, although firms have begun, at times timidly, at times only partially, to reengineer the workplace under pressure from international consultancies. This involves a reversal of the organizational logic, with the replacement of 'functions' with 'processes', with the transition from hierarchy to the empowerment of human resources, with individual job design making way for teamwork design. Job descriptions have been superseded by work positions - traditionally designed with limited and simple tasks - which are configured in terms of roles. This is definable as a set of requested and expected competencies, namely, as behaviours that workers have to put in act if and when circumstances require it. The underlying assumption is that the circumstances are no longer easily predictable (with time and motion studies) and thus the worker is required to diagnose them. The set of skills required of workers ranges from the technical to the generic (or soft), and from the cognitive to the non-cognitive, with a composition that varies for clusters of positions.

Under the impetus of the new approach to human resource management, the entire workplace is invested with new working practices; involvement, job rotation, suggestion system, self-management team, cognitive and relational training, all forming part of so-called high-performance workplaces practices (HPWPs), the cornerstones of which are a flat hierarchy and working autonomy.

A redefinition of the position in terms of role cannot but also influence the remuneration system, both in the form of the recognition of exercising greater autonomy and responsibility as the qualifying part of a different organizational design (which is also more productive: see Bauer and Benden, 2002, and Osterman, 2006), as well as a system designed to recognize higher wage levels since HPWPs are 'skill-biased' (see Caroli and Van Reenen, 2001, Bauer and Bender, 2004), namely, requiring higher skills in order to be implemented, and finally as

[2] For an overview of WCM attributes see Leoni (2012b).

a system of incentives aimed at strengthening the motivation to learn new skills and the acceptance of change (Black et al., 2004).

However, consensus is not unanimous. Cappelli and Carter (2000) found evidence that HPWPs are associated with higher wages for manufacturing production workers, although their results were invalidated when controls for human capital were included. Moreover, while Osterman (2006) finds that a positive association between HPWPs and wages does not change the wage structure, and thus wage inequality within firms is unaltered, Black et al. (2004) and Bauer and Bender (2002) find the opposite, namely, the implementation of HPWPs increases within-firm wage inequality through a relative increase in wages at the upper end of an establishment's wage distribution.

Unfortunately, all this evidence is based on datasets containing information collected at firm or establishment level, not at individual worker level. Where individual data have been used (see Sterlacchini et al, 2004; Green et al., 2002), the authors do not control for organizational workplace characteristics. Our work aims to bridge this gap.

2.3 Psychological traits and wages

Psychologists have produced considerable empirical evidence on the link between personality traits, performance and salary (albeit not without flaws and weaknesses in the methodology), unlike economists who have largely ignored this aspect (Heckman et al., 2000, 2006, 2012). Bowles and Gintis (2001) and Edwards (1976), for example, are amongst the few that have pointed out how employers in low-skill labour markets positively evaluate traits such as docility, dependability and persistence, even more that cognitive abilities. However, these are not the only personality traits that organizational psychologists document as important elements of the psychological capital of a worker.

Economists, on the other hand, have focused largely on the role of education as a determinant factor of wages, although it is now well documented that years of study (the key Mincerian variable in the human capital model of wage determination) and achievement tests (grades) are good signals and predictors of both general knowledge (especially, and above all, when we cannot control for study fields) and cognitive abilities, but not of competencies such as, for example, reading and writing long documents or performing calculations (which can always be considered cognitive in nature, namely, to some extent related to abstract reasoning power), or relational competencies, or even team working.[3] These results legitimize the use of

[3] A linguistic-conceptual clarification seems appropriate. The terms skill and ability indicate a 'potential' property that a person possesses, which does not *necessarily* translate into action. The term competence instead indicates an action of good performance. The McClelland school of thought starts

cognitive and noncognitive variables in an explanatory wage model that aspires to broaden the explained variance, while avoiding the problems associated with omitted variables.

Amongst noncognitive variables we must however make a distinction between those that appear to be explicit through an action and therefore more easily observable and measurable (for example, relational skills) and those reflecting personality traits that are explicit in ways that are not easily observable, but which psychologists believe affect behaviour and contribute to personal productivity. These are deeper personality traits or personal characteristics such as a person's perception of self, attitudes towards work and general outlook on life. Although not observed directly, these are usually measured through the self-assessment or evaluation of some expertise using a Likert scale and connote individual stable proprieties not seen as permanently invariant, but that can be changed and learned, even if not quickly and easily, with different mechanisms and to different degrees at different ages. Goldsmith et al. (1997), for example, document how individual wages are directly influenced by self-esteem and indirectly by locus of control. These kinds of variables are usually constructed through factor analysis of specific items: in the first case, one should refer to Rosenberg's (1965) self-esteem scale, which contains ten questions, in the second, to Rotter's (1966) internal-external locus of control scale, which consists of 23 question pairs. However, other personality traits have been proven to be important: for example, commitment, commonly defined as the willingness to align own behaviours with the needs, goals and priorities of the organization, to act in a way that promotes organizational goals or meets organizational needs (Spencer and Spencer, 1993: 86), and inferred from items that express deep feelings and thoughts in coherence with the definition.

At times, economists make use of proxy variables such as gender (male and female), skin colour (black and white), religious beliefs or marital status (unmarried, married, divorced/widowed) to control and measure genuine discrimination as a negative prejudicial perception of others (in the first three cases) (Becker, 1957), or to account for individual-specific heterogeneity not controlled otherwise (in the latter case), without explaining in-depth what kind of personality traits are involved.

The married/unmarried status is an intriguing issue and the empirical literature tends to attribute to marriage a wage premium, but there is still no unanimous consensus on either the reason for this effect or its very existence. In respect of the latter, Loughran and Zissimopolous (2009) even find a negative effect for both women and men. For women, the explanation is in the fact that temporary absences from the workforce, necessary to bear and care for children, cause general and firm-specific skills and rents to depreciate, which leads to lower wages, or lower work experience and tenure, creating missed opportunities for

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out from an individual's performance obtained in a specific work context to establish the intrinsic characteristics that gave rise to that particular performance.

professional development and promotion. One can argue that this is not a genuine marriage effect, but rather a childbearing effect. Controlling for this may entail residual unobserved heterogeneity that researchers try to control for with the residual fixed-effects technique. For men, however, marriage has a positive result on wages (excepting Loughran and Zissimopolous, *ibid*, and Krashinsky, 2004): the explanations range from the greater motivation to provide work efforts to the married man's greater specialization in the labour market.

There is little empirical research on how marriage affects personality traits – both as a result of close everyday relationships and a pooling of risks, as well as economies of scale that allow a better quality of life - in terms of greater conscientiousness, compliance, perseverance, cooperativeness, control impulses, emotional stability, dutifulness, perspective thinking, organizational order, as well as whether, and to what extent, firms appreciate these in the selection process and with a wage premium. We postulate the existence of such a relationship in the present work, waiting for empirical research to transform the assumption into a stylized fact, even if some researchers (see Greenhalgh, 1980, for example) call into question personal characteristics to explain the marriage wage premium found in their studies, suggesting a list of personality traits associated with marriage.

To conclude, the error committed by economists in not paying attention to personality traits is very similar to that of psychologists (such as Goldsmith et al., 1997) when not controlling for a series of aspects such as firm dimension, workplace practices, technologies used or industrial relations, or do not consider endogeneities and/or reverse causalities, or even when they exclusively assume linear relationships between traits and outcomes, forgetting that "too much of a good thing can be bad" (Heckman and Kautz, 2012: 457). A cross-fertilization of the two study fields promises interesting things for public policies fostering human development.

2.4 Industrial relations and wages

Literature widely recognizes that the impact of unions on wage levels as well as the wage structure *also* depend on the industrial relations system (the social, political, legal, institutional and economic environment in which unions operate). Even when controlling for these elements, works studying the effects of industrial relations on wages or wage differentials do not obtain univocal results.

Osterman (2006) studies industrial relations, high performance workplace practices and wages. He finds that unionized establishments pay higher wages to core employees, even if paying lower wages to managers. This finding is consistent with the broad literature on the union wage-compression effect (Freeman and Medoff, 1984).

To the contrary, Black, Lynch and Krivelyova (2004) consider union interaction effects in the presence of profit sharing, non-manager meetings and non-manager self-directed work teams, and find that unionized establishments that adopt HPWPs pay higher wage premia to managers and supervisors, while this is not true for production workers.

Bauer and Bender (2002) and Cainarca and Sgobbi (2011) also find a positive general effect on wages in the presence of work councils or unions, but they do not investigate the matter in detail.

Dell'Aringa et al. (2005) analyze the role of organizational settings, pay policies, bargaining and industrial relations in defining within-firm wage differentials for four different EU countries: Belgium, Ireland, Italy and Spain. They find that decentralized bargaining becomes non-significant once employees and firm characteristics are controlled for. Wage inequality is detected in all cases where second level bargaining (i.e., the decentralized level) is additional to the main level (i.e., the centralized level). An interpretation, in the authors' opinion, could be that employers are able to anticipate the effects of main level bargaining when further negotiations take place within the firm.

Cristini and Leoni (2007) derive an estimable wage equation on the assumption of two-level bargaining and efficiency wages. Theoretical literature on wage determination in the presence of bargaining and efficiency wages finds that the wage premium obtained when these interact is higher than the wage mark-up obtained in the presence of bargaining alone. The authors show that second level rent sharing depends on the additional profit obtainable if more effective production incentive mechanisms are adopted, given union power and the firm's market share.

Finally, Origo (2009) studies the effects of performance related pay (PRP) on productivity and wages while also considering the role of unions. She finds that productivity effects (i.e., incentive effects) are higher in low-unionized firms, while wage effects are higher in high-unionized firms. Overall, these results confirm that PRP effects vary significantly with union density and that wage increases are not automatically associated with substantial productivity gains. Furthermore, wage increases are limited even in highly unionized workplaces, where unions are likely to have more power to bargain for a share of the surplus.

To conclude, there is no consensus on the results obtained thus far. Moreover, none of these studies *simultaneously* considers the role of (technical and generic) competencies, psychological traits, high performance work practices and industrial relations on wages. In view of this, we comprehensively investigate the importance of the use of computerized technologies as a determinant of wages using more complex and complete data on the activities performed. Moreover, given the very rich information on employee competencies

available, we test for individual heterogeneity and determine whether competencies are rewarded or not by firms. That said, we also control for the role of company unions in influencing wage levels at the local level, considering their power in shaping both criteria and premia or incentives, individually or collectively.

3 Database and model for the empirical analysis

3.1 The database

In this study we use the *Istituto per lo Sviluppo della Formazione Professionale dei Lavoratori* database (Institute for the Development of Vocational Training of Workers - ISFOL hereafter). We provide only some generic information here, while for a detailed description we refer the reader to Leoni (2006). The dataset is the result of a CATI survey carried out in Italy in 2004 on a stratified sample of private sector employees (excluding workers in the construction and agricultural sectors). Our aim is to focus on non-managerial workers, since in managerial occupations earnings are very likely the result of personal bargaining tied to output measures through some stock option formula and other reward systems (see Hallock and Murphy, 1999), for which no information is available. The number of observations is 2,335 representing 7.038 million salaried workers.

The questionnaire is composed of 10 sections: A) working position in the firm context; B) general aspects of the interviewee's work; C) the organization's characteristics; D) ability, commitment and work effort; E) task discretion and variety; F) the formation of competencies; G) expressed competencies in working activities; H) remuneration, working hours and industrial relations; I) the work situation 3/4/5 years ago; J) personal interviewee data.

The most innovative part concerns the activities that the job entails, from which we construct measures of the level of competencies based on organizational behaviours actually activated, that is, expressed competencies (supply side), and a detailed list of digital technologies used by workers (white and blue collar).

3.2 The empirical model

It is worth pointing out that under Italian law, Article 2095 of the Civil Code stipulates that a worker employed by a firm must be classified into one of the following four categories: manager, professional (cadre), white-collar worker and blue-collar worker. The same law refers to the National Collective Labour Agreement (CCNL) of each industry - signed by the

social partners (employers' confederations and workers trade unions) - for the analytical determination of job classification levels (according to a hierarchical ranking) as well as the economic-pay evaluation of each grade. The latter reflects job complexity and constitutes 'the minimum', also called basic pay, corresponding to the national (sectoral) minimum wage laid down by law for employers in several industrialized countries. The collective agreements are binding only for signatory members of the (employer) organizations (Italy is unique in Europe in this respect)[4], and also provide for biennial automatic seniority allowances, granted as a fixed sum (differentiated according to job grades) or as a percentage of basic pay, based on the expected increase of competencies acquired by workers through learning-by-doing mechanisms.[5]

On the basis of the above institutional elements, the (log of) stable monthly contractual salary (*lcw*), net of both fiscal and social contributions, and volatile components, for worker i^{th}, at a given time, may be specified as follows:

$$lcw_i = \alpha_0 + \beta_1 Sector_i + \beta_2 Occupation_i + \beta_3 Tenure_i + \xi_i \qquad [1]$$

Furthermore, employers add a first supplementary structural (or permanent) wage component (such as merit or *ad personam* bonus), which differs from worker to worker. The aim of this paper is to understand the sources of these (mostly) unexplained permanent earnings differences. In our understanding, these should mirror the individual and differentiated competencies and the psychological capital of workers, seemingly irrelevant to the great majority of labour economists, even if - ultimately - productive. We retain that only *part* of individual competencies are attributable to human capital indicators, justifying education amongst the regressors. In addition, four other variables must be taken into consideration. First, some firms implement an organizational design labelled as HPWPs, which generally determines a lower hierarchy and jobs with greater autonomy and responsibilities. Second, the adoption of structural flattening alters, increases and deepens the competencies required of workers: the empowerment process includes new competencies such as relational, teamwork and cognitive competencies (reading, writing, calculus). Third, skill-biased technological change may exercise demand pressure, specifically affecting the

[4] According to a survey carried out by Isfol in 2006 on the private sector (agriculture excluded), the firms that are not members of any employers association equal 35.9% and are mainly small firms, occupying 15.1% of the employees of the population of reference. In these cases, employers and employees can determine the level of salary provided it corresponds to the concept of fairness: in fact, in the case of workers claiming ex-post to have received lower wages compared to the complexity of the job, they can appeal to a labour judge, who tends to solve the diatribe on 'fair' wage levels, very often referring to collective contracts and the occupational level of the employee (Cavallaro, 2001).

[5] The bargaining structure was changed in 2009, but here we are referring to the system in force at the time of the survey and giving rise to the database we use in this study.

wages of workers able to manage new digital devices. Finally, an independent source of rising wages, linked to increasing returns to scale of production processes, allows firms to pursue a win-win strategy, partly benefiting employees in order to generate a positive organizational climate.

In some workplaces, these supplementary wage components may be the result of company-level collective bargaining, competitive pressure between labour demand and supply, individual negotiation or unilateral employer decisions. Consequently, in modelling a wage equation, the earnings component captured by the institutional variables (such as sector, occupation and seniority) must be integrated with all these elements.

A second supplementary wage component is associated with 'extra' bonuses, such as an extra month's pay (a thirteenth month's pay, at Christmas, and in some industries a fourteenth month's pay, usually paid out just before the summer holidays), and incentives based on profit-sharing mechanisms (paid on an irregular basis, depending on the agreement reached by firms and workers). Both these elements could more easily be accounted for in an annual salary, where the information may be more reliable when using registered data rather than worker self-reported data. Nevertheless, this second supplementary wage component is semi-structural, cyclical and fluctuates owing to a second element (profit sharing), which depends not only on individual efforts but also on the sectoral and macroeconomic business cycle. We do not have appropriated information for this second supplementary component of individual wages, and consequently limit our analysis to permanent monthly components.

Thereafter, using compensating earning differentials literature as an analogy, our framework of reference to value the above-mentioned idiosyncratic elements entails the reformulation of [1], as follows:

$$lw_i = \alpha + \beta FC_i + \gamma OC_i + \phi WC_i + \varphi WCC_i + \lambda CO_i + \mu IR_i + \varepsilon_i \qquad [2]$$

where *lw* stands for the log of stable net monthly earnings, *FC* for firms characteristics (inclusive of HPWPs required of employees), *OC* for occupations (proxies for job classification levels), *WC* for individual worker characteristics that labour economists consider (such as education) and do not consider (such as psychological capital, since they are non-skill-related productive traits) as contributing to the production process, *WCC* for working and contractual conditions, *CO* for competencies (decomposable into two subsets: level of generic behavioural competencies and threshold level of technical competencies in the use of digital technologies) and *IR* for industrial relations.

Depending on the circumstances, the estimator is OLS weighted or GMM weighted, where the weightings are the reciprocal selection probability for each individual to control for

sample selection bias. Since the information is cross-sectional, to test for homoscedasticity we apply the Bruesch-Pagan test, and in case of failure, the vce(robust) technique.

4 The variables

This section describes the exact construction of the variables used in the econometric estimates.

4.1 Dependent variables

The dependent variable is the logarithm of the average net monthly nominal wage, including extra hours but excluding additional months (such as 13th and 14th month salaries, which are relatively common in some European countries) and other occasional premia. This continuous variable corresponds to the following question: "*What is (on average in the months from January 2004 to the last received* [at time of interview: late spring]*) your monthly net pay (i.e., the actual amount in your wage packet) including overtime (excluding the 13th and/or 14th month or other occasional rewards)?"*

An alternative dependent variable is constituted by the real wage logarithm, which is the log of the nominal wage minus the log of the cost-of-living index, measured at regional level. For further details on the latter, see below.

4.2 Independent variables

Our model includes six groups of independent variables.

Firm characteristics variables

Size. We consider the logarithm of the number of firm employees.

Industry. These are fourteen dummy variables; we consider extra-agricultural private sectors, excluding the construction industry.

Task discretion and variety. This continuous variable measures the degree to which employees are requested - by the organizational design - to undertake different tasks and make decisions about their own work. It is derived from a factor analysis (with varimax rotation) of four questions: the first concerns the matter of choice/autonomy of respondents, while the second, third and fourth tend to measure how much influence respondents have in: (a) determining the time and effort in carrying out their activities and tasks, (b) deciding which tasks to perform and how often to perform them, and (c) deciding how to perform the

tasks they must accomplish. The responses, codified in a 7-point Likert scale, range from "practically zero ... to ... absolute".

Property. This dummy is equal to 1 when the firm is an entirely foreign firm operating in Italy.

Occupations

Having decided to exclude managers, there are eight dummy variables concerning the different occupational classes based on the English Standard Occupational Classification (SOC). These are not perfectly equivalent to job classifications in national contracts, but the high disaggregated level we use here, compared to others studies (Sterlacchini et al. 2004, for example), render these good proxies.

Worker characteristics

Psychological capital (or non-skill-related traits), approximated by:

- *Gender*. The dummy is equal to 1 if the employee is female, 0 otherwise.
- *Commitment*. This continuous variable indicates employee commitment and is constructed with a factor analysis (with varimax rotation) of items asking respondents to what extent they agreed with the following seven statements: i) I am willing to work harder to help this company succeed; ii) I am not loyal to this company; iii) I feel that my values and those of the firm are similar; iv) this company encourages my best in pursuing my results; v) I am proud to work for this company; vi) I'm ready to cover any position in order to remain in this organization, and vii) I am ready to refuse a job that pays more just to remain with this company. The responses, codified in a 7-point Likert scale, range from "practically zero ... to ... absolute".
- *Civil status*. Categorical variable, equal to 1 if the employee is single, 2 if married and 3 if separated, divorced or widowed.

Human capital approximated by:

- *Education*. We include five dummy variables that show the highest educational qualification achieved by the employee: primary school, secondary school and vocational school, high school, degree and post graduate specializations (i.e., specialization course, Master and PhD).
- *Experience*. We include the years of experience, namely market experience, and the square of this variable.
- *Tenure*. Number of years in current firm.

Dependant relatives:

Number of children dependent on fathers. The social security system grants employees a family allowance for each child dependent on them, conditional on a threshold family income. When both husband and wife work, it is usually claimed by the former and is paid by the

employer in the monthly salary, who is then reimbursed by the INPS (National Institute for Social Security), offsetting the amount against the social security contributions they are liable for. In addition to this supplement, there are also tax deductions, which are generally taken advantage of in equal parts when both spouses work. We assume that respondents have also included family allowance and tax deduction benefits in the average monthly salary. However, as there is also a threshold and scaling family income level, it could be that for the same number of children, the benefits of the social security system are lower or even zero, thus leaving the significance of the estimated coefficient undetermined.

Working and contract conditions

Working hours. This is a continuous variable; it refers to normal weekly working hours and we consider the logarithm.

Temporary contract. This dummy is equal to 1 when the employee has an atypical and temporary contract.

Risky and unpleasant job. This categorical variable indicates the frequency (from never or a negligible time to all or nearly all the time) in relation to a combination of two sets of information: being exposed to the risk of serious injury at work, and to excessive noise, bad weather, heat or cold, as perceived by the employee.

Shift. This dummy indicates whether the employee frequently works shifts, as perceived by the employee.

Training. We use three dummies to indicate a long (> 24 months), medium and short (< 6 months) period of time spent learning to do the job well.

Competencies: level of generic competencies and threshold competencies in using digital technologies

As previously mentioned, the database provides information on 44 items based on self-reported job analysis, focused on actual work behaviours and specific performance, which reflect different dimensions of competencies. We can consider this a supply aspect. We applied factor analysis to respondent data, obtaining 5 factors, whose underlying constructs seem to correspond to the following competencies: reading, writing and calculations ability, autonomy in executing works, managerial autonomy, relational abilities, and being able to work in a team. Details are explained in the appendix, Table A1.

The database also provides information on 21 different types of uses of digital technologies in response to the following question: "*Can you indicate which of the following technological tools you normally use in your daily work*?". Factor analysis made it possible to extract 3 constructs, potentially equivalent to a threshold level of 3 competencies in using computerized technologies: namely, office technologies, warehouse technologies and

production technologies respectively. We consider this a demand aspect. Details are explained in the appendix, Table A2.

The theory, according to which not a single but a bundle of competencies can affect productivity, and consequently wages, suggests creating synthetic indexes, pursuable by weighting factors with relative variances. Before proceeding in this direction, we must point out that the competencies concerning both autonomy in executing tasks and managerial autonomy (which represent supply side dimensions) tend to overlap with the organizational design of HPWPs (demand side dimension) requiring workers to undertake task discretion and a variety of responsibilities. The inclusion of both variables in the same explication wage function would mean hypothesizing that firms pays twice for the same thing, which seems unlikely; we assume that the demand side prevails over the supply side, and therefore exclude from the estimated models the latter variables, both when single and bundles of competencies are considered.

We created two synthetic bundles: the first refers to the three weighted factors relating to generic competencies, while the second refers to the three factors relating to the use of new computerized technologies. With reference to the first indicator (generic competencies), in order to avoid a potential overlap with the 'occupation' variable (which should include the minimal or threshold level of generic competencies together with the technical competencies that a given job needs to be effective but which does not distinguish superior from average performers) we redefine this bundle following Spencer and Spencer's (1993: 15) suggestion: precisely, we rescaled the distribution of the variable attributing a value of zero up to the average value of the factorial variable, maintaining the right part of the distribution, which assumes the meaning of 'distinctive' or superior or differentiating generic competencies.

Industrial relations variables

Unions. This categorical variable measures the influence perceived by respondents on the role of unions to define premia or incentives, individually or collectively, corresponding to the following question: *To your knowledge, are there any bargaining activities in your workplace between the employer (or management) and union representatives? If yes, do you think the union is highly influential (i.e., has a lot of power) in setting collective premiums and extra allowances over minimum pay, and individual and group incentives? The possible response is: yes/no"*

Qualitative information does not allow making a comparison across firms and time. To overcome this problem – at least in part – we interact this variable with the number of employees dimension in order to incorporate a sense of union representative bargaining power in the variable used. The underlying hypothesis is that union influence goes hand in hand with union density, which is in turn correlated with the firm dimension.

Table 1. Weighted statistical description of the variables used in the estimates

Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent variables					
- *log of permanent net monthly nominal wage*	2372	6.958	0.356	4.700	8.517
- *log of permanent net monthly real wage*	2372	2.308	0.357	-0.36	3.850
Independent variables					
Firm characteristics					
Firm size: log of number of employees	2372	3.781	2.291	0	13.815
Industries:					
- food	2372	0.059	0.235	0	1
- textile	2372	0.062	0.242	0	1
- wood	2372	0.007	0.086	0	1
- paper and printing	2372	0.021	0.143	0	1
- chemical and plastic	2372	0.042	0.201	0	1
- non-metallic minerals	2372	0.019	0.139	0	1
- metal products	2372	0.177	0.382	0	1
- automotive	2372	0.034	0.181	0	1
- other manufacturing industries	2372	0.029	0.169	0	1
- wholesale, retail trade and repair of motor vehicles/cycles	2372	0.188	0.391	0	1
- accommodation and food service activities	2372	0.058	0.233	0	1
- transportation and storage	2372	0.073	0.261	0	1
- information and communication	2372	0.041	0.198	0	1
- financial and communication	2372	0.037	0.188	0	1
- real estate, rentals, research and other activities	2372	0.149	0.357	0	1
HPWPs: tasks discretion and variety	2372	12.424	3.824	3.120	21.842
Property: Italian/foreign property	2372	0.028	0.165	0	1
Occupations:					
- professionals	2372	0.083	0.091	0	1
- associated professional and technicians	2372	0.023	0.150	0	1
- clerical and secretarial occupations	2372	0.352	0.477	0	1
- crafts and related occupations	2372	0.154	0.361	0	1
- personal and protective service	2372	0.006	0.078	0	1
- sales and customer service occupations	2372	0.080	0.272	0	1
- process, plant and machine operatives	2372	0.230	0.421	0	1
- other occupations	2372	0.144	0.351	0	1
Worker characteristics					
Psychological capital					
- gender (M/F)	2372	1.399	0.489	1	2
- commitment	2372	16.730	4.853	1.602	28.902
- civil status	2372	1.641	0.589	1	3
Human capital					
- *Education:*					
- elementary school	2372	0.026	0.161	0	1
- secondary school + vocational school	2372	0.488	0.499	0	1

Variable	Obs	Mean	Std. Dev.	Min	Max
- high school	2372	0.431	0.495	0	1
- degree	2372	0.046	0.209	0	1
- degree + specialization	2372	0.007	0.839	0	1
- Experience:					
- tenure	2372	9.107	8.275	0	44
- market experience	2372	14.878	10.324	0	50
- market experience^2	2372	327.92	383.844	0	2500
- Dependent relatives					
- number of children dependent on father	2372	0.406	0.766	0	7
Working and contract conditions					
log of working hours	2372	3.636	0.340	0	5.123
temporary contract	2372	0.092	0.290	0	1
risky and unpleasant job	2372	5.414	3.860	2	14
shifts	2372	0.199	0.399	0	1
Training					
- long learning time	2372	0.156	0.363	0	1
- medium learning time	2373	0.379	0.485	0	1
- short learning time	2372	0.610	0.487	0	1
Competencies					
- Single generic (or soft) competencies					
- reading, writing and calculations ability	2372	0.868	0.681	-0.314	2.661
- autonomy in executing tasks	2372	1.869	0.549	0	2.905
- managerial autonomy	2372	0.888	0.475	0	2.374
- relational competencies	2372	0.969	0.751	0	3.064
- team working	2372	1.232	0.831	0	3.419
- Single threshold competencies in using digital technologies					
- threshold competencies in office technologies	2372	0.836	0.123	0	0.559
- threshold competencies in warehouse technologies	2372	0.130	0.185	-0.066	0.506
- threshold competencies in production technologies	2372	-0.065	0.174	-0.397	0.377
- Bundles of competencies (weighted sum of factors)					
- 'distinctive' generic (or soft) competencies (3 factors)	2372	0.083	0.141	0	0.804
- threshold competencies in using digital technologies (4 factors)	2372	0.063	0.100	0.026	.0419
Industrial relations					
union influence	2372	0.275	0.571	0	3.484
union influence*log number of employees	2372	1.600	3.732	0	39.336
Cost of living in different regions					
log of cost of living	2372	4.649	0.086	4.443	4.737
Instruments					
dev_tenure	2372	-1.442	8.092	-14.020	35.059
age	2372	36.970	9.970	16	65
age^2	2372	1466.193	773.299	256	4225
organizational characteristics (factor)	2372	0.716	0.607	-0.047	1.922
personality traits (factor)	2372	9.298	1.558	1.653	11.573
ISO certification	2372	0.390	0.487	0	1

Cost of living in different geographical areas

In addition to the six groups of variables, the cost of living log (measured by the level of prices at consumption, assessed at the local level) is either used to deflate nominal wages or as an independent variable. This unique information is provided by a Bank of Italy study (Cannari and Iuzzolino, 2009), which shows nine estimates at purchasing power parity for 20 Italian regions, referring to the year 2006. On average, the cost of living is about 16-17% less in southern regions than in northern regions, a difference that increases to 25% with respect to the most expensive area (Lombardy) and the least expensive areas (Molise and Basilicata). It is well-known that national collective bargaining establishes nominal wage values by sector according to the principle that equal job complexity (ascertained by occupation levels among firms in the same sector) correspond to an equal nominal salary, regardless of the cost of living of workers living in different geographical areas. The nominal salary is protected annually – for the duration of the validity of the national contract – against the national inflation rate, by linking the growth rate of the latter to the former.

We expect that the differential in real wages that workers experience in different local areas has some influence on the wage drift among workers (and firms) living (and operating) in different environments. Among the nine estimates provided by the Bank of Italy study, our choice falls on the 9th definition (*ibidem*: 34), since it lends itself most to our purpose.

Table 1 indicates the descriptive statistics of the variables used for our estimates; the manager occupation level is excluded from our study for the reasons mentioned above.

5 Results of the estimates

Table 2 presents the estimates from the cross-sectional wage equations. The dependent variable is the natural logarithm of permanent net monthly wages, taken alternatively in nominal terms (models 1 and 2) and in real terms (model 3). A glance at the three models indicates relatively stable coefficients.

Firm characteristics. In order to take into account the institutional contractual aspects, model 1 incorporates variables controlling for industries and occupations. The disaggregation level of the industry's collective national labour contracts is higher than we can control for, and thus some degree of distortion in the estimates remains. With reference to the default industry (other manufacturing industry), all workers seemingly earn similar salaries, except those working in information and communication, financial and insurance industries, who receive a wage premium ranging from 11/12 percent (model 1) to 13/15 percent (model 3). Firm size

gives rise to a further wage premium, very likely linked to productivity deriving from economies of scale. Organizations that use HPWPs make more efficient use of labour by reducing hierarchical levels and attributing more autonomy, responsibility and task variety to the shop floor, remunerating this with a wage premium for their contribution to greater productivity. Similar results are obtained by Black et al. (2004) and Bauer and Bender (2002).

Occupational classes. The hierarchical ranking of job classifications reflects the expected signs. The extent of the shift of coefficients from top and bottom (relative to the default class, the lowest in the order: other occupations) is lower with respect of institutional differences that can be observed when looking at the levels of job classification parameters of several national contracts. This casts some doubt on the political line to pay the same salary for equal jobs, since several workers, in the same occupational class, officially earn the same salary but perform tasks, duties and responsibilities that require different and additional competencies, captured – in our estimates – by specific independent variables. Hence, the additional competencies are indirectly recognized, but as a detrimental and not an adjunctive element of salaries linked to the occupational class to which the position belongs.

Worker characteristics.

Psychological capital. All three variables capturing psychological capital are statistically robust and show the expected sign: a wage penalty of about 18 percent is associated with being female, a result – at least partially – of persistent gender discriminatory perceptions of employers and top managers, who prejudicially consider women less productive (and consequently less deserving of extra-contractual bonuses) with respect to men. The assertion is also based on estimates (not shown for reasons of space) in which the gender variable was disaggregated to take into account the conditions of single women, married women and separated/divorced/widowed women. The wage penalty is equal to -0.115, -0.197 and -0.194. All three coefficients have high significance (p-value = 0.000) and the entire regression is highly stable with respect to model 3. If for the second and third conditions the justification can be invoked of absence from work related to permanent responsibility for the home and childcare, and thus to a certain extent lower productivity at work, for the first condition - after discarding the unfounded and provocative theory of biological gender differences and absenteeism related to the 28-day cycle (see Herrmann and Rockoff, 2012) - only one possible interpretation remains. Having controlled for a significant number of factors that could possibly be to the detriment of women (such as hours worked, positions of autonomy and responsibility, commitment, occupations, industries, education, tenure, market experience, risky and unpleasant jobs, learning), we should be able to discharge the hypothesis of industry and occupational segregation in favour of the discrimination theory put forwarded by Becker (1957). More specifically we argue that the coefficient of the unmarried

women represents the genuine gender effect and it thus seems reasonable to call into question – in a negative sense – the male chauvinistic personality traits of leading managers and employers.

Firms pay wage premia for workers with cognitive traits that induce self-perceived commitment. However, firms also indirectly recognize personality traits, attributing to marital status a signal of conformity to social expectations (Pfeffer and Ross, 1982), but also (non-observed) positive attitudes such as stability, responsibility and perseverance, in other words consciousness (Greenhalgh, 1980). Consciousness is explained by the Big Five model as leading to less conflictual behaviours, very likely reflecting a perception of the efficient use of time (Wayne et al. , 2004; Thomas et al., 2005).

Education. The shift coefficients, in relation to the default variable (the lowest in the order: elementary school), rise as the education level increases and are equivalent to an average mark-up of 1.5 percent with respect to the annual average rent rate of the default variable captured by the intercept. Market experience impacts on wages at a rate of 0.6-0.7 percent per year, while tenure is unexpectedly weak or not at all significant. To our understanding, since the underlying source of this wage increase is an automatic contractual clause linked to a hypothesized learning-by-doing mechanism, its irrelevance can be viewed as the result of the previously seen expedient of occupation grades, namely, recognition of doing other things (captured by other specific variables) than the simple and direct deepening of competencies, which would ensure an adjunctive element to the salary linked to the occupation class to which the position belongs. For example, with ongoing tenure, one can learn how to use digital technologies: since the result of this informal learning process is captured by an appropriate variable, the de-escalation of the pure tenure effect is consequential.

Dependent relatives. Number of children dependent on fathers has the expected positive and statistically significant sign.

Working and contract conditions. All variables have the expected sign: working hours, which control for overtime; temporary contract, with a penalty of around 9-10 percent; and risky and unpleasant jobs, with a premium of around 0.8-0.9 percent. Contrary to expectations, the dummy indicating whether the employee frequently works shifts appears to be non-significant. The extent to which the risk component in the 'risky and unpleasant job' variables prevails, brings to light a concern regarding the efficacy of trade union policy (consolidated in a specific legislation: law n. 626/1994 on safety in the workplace) against monetization of risk and health within workplaces. At this stage, it is impossible to disentangle the two components (riskiness and unpleasantness of the job), and we therefore leave this question open for future research.

Competencies. As stated previously, two factorial variables have been left out of the estimates (autonomy in executing work and managerial autonomy) because they overlap with the organizational variable 'task discretion and variety'. The estimates show the significance of only two of the three single behavioural competencies (reading, writing and calculation ability; and relational competencies), while the three referring to the use of digital technologies appear to be non-significant (model 1). When bundles are considered, and the first necessarily takes positive values above the average mean of its distribution in order to capture the 'distinctive' dimension of these competencies (since the threshold level should have already been captured by occupations), both bundles appear to be statistically significance with the expected sign (models 2 and 3). The wage premium associated to the use of digital technologies is about 27 percent, a little higher compared to the 15-20 percent estimated by Krueger (1993) for US workers, and much higher compared to the 5 percent for Italian workers (and to the 15 percent for higher-level white collar workers) estimated by Sterlacchini et al. (2004). With respect to the latter study, we argue that the number of controls used are much fewer than ours, especially with regard to the occupational dimension, generic competencies and psychological capital. Moreover, having controlled for generic competencies, the coefficient we estimated should refer to the centrality of using computerized technologies *per se*, contrary to Dickerson and Green's (2004) interpretation, according to which (*ibidem*: 392) the nature of the tasks for which they are used matter. Our interpretation is supported by two further tests (not reported here): we interacted the use of the digital technologies variable both with distinctive generic competencies and task discretion and variety, without obtaining any significant results. If considering Bresnahan (1999) and Bresnahan et al.'s (2002) findings, according to which the wage premium of using digital technologies has to be coupled with the wider role that workers have in workplaces, namely more responsibilities and autonomy, according to our estimates, a maximum of approximately one percent would have to be added.

Since the use of digital technologies refers specifically to the threshold level of competence, we are much more inclined to interpret the wage premium as reflecting demand pressure over and above the supply of this specific competence, despite that during the last fifteen years the labour market has registered a growing level of education; unfortunately, the content of this educational process has taken other directions with respect to the requests from labour demand and the very rapid diffusion of digital technologies, giving rise to structural-professional mismatches (Leoni, 2011). Cainarca and Sgobbi (2012) argue that Italy shows lower returns to required education and overeducation than other industrialised countries due to - in our interpretation - greater professional competency mismatches.

Industrial relations. The traditional role of trade unions has been confirmed in terms of extracting higher wages thanks to bargaining power through local collective negotiations. It is not possible to discard the idea that underlying the wage premium agreed between managers and workers' representatives there may also be a collective efficiency wage component pursued by managers (Cristini and Leoni, 2007). Considering the three union role components, accounting overall for the three coefficients in terms of elasticities (size, union and interactive term), a positive value of 1.1 percent emerges.

Having controlled for employee and firm characteristics, our results – which refer to the workers' representative role at decentralized level – contrast with those obtained by Dell'Aringa et. al. (2005), while they conform with Cristini and Leoni's (2007) and Origo's (2009) estimates.

Cost-of-living for different workers living in different regions. Relaxing the hypothesis underlying models 1 and 2 of relating nominal wages to an average national cost-of-living, in favour of regional differences, even with the residual limitation of considering a national rather than a local basket of consumptions at purchasing parity power, the estimate of model 3 shows an elasticity coefficient of 0.295, distant from value 1, which would correspond to the neoclassical hypothesis of the perfect rationality of behaviours of economic agents. Disparities in cost-of-living transforms an equal nominal salary for equal jobs (whatever its allocation: in the Lombardy or Basilicata region) into an unequal salary for the same jobs. Should this be a temporary situation, it would be compatible with the rationale of mainstream labour market theory, provided we observe migrations of workers from lower *real* wage areas (northern regions) to higher real wage areas (southern regions). Since the migration flow is in the opposite direction, due to different employment possibilities between the two areas, one would be tempted to conclude that the negative externalities of moving from one area to another constitute the main factor hindering the functioning of the labour markets. This interpretation could be valid if prepared to disregard other important factors that influence individual choices such as social norms, values linked to relational networking, sense of belonging to a community, and so forth. This comes close to Solow's (1990) view, according to which the labour market is a non-market, in the sense that it is not a market as others (goods or financial assets), but rather a social institution, whose functioning depends on how much is considered mutually acceptable by the parties involved in the exchange.

Table 2 - Results of the basic estimates of permanent net monthly wages

Dependent variables	Log of permanent net monthly real wage				log of permanent net monthly nominal wage	
	model 1		model 2		model 3	
	WLS - vce(robust)		WLS - vce(robust)		WLS - vce(robust)	
Independent variables	Coef.	P>|t|	Coef.	P>|t|	Coef.	P>|t|
Firm characteristics						
Firm size: log of number of employees	0.022	***	0.020	***	0.020	***
Industries:						
- foods	0.037		0.025		0.055	
- textile	0.041		0.035		0.033	
- wood	-0.020		-0.029		-0.046	
- paper and printing	0.013		0.002		0.030	
- chemical and plastic	0.054		0.044		0.059	
- non-metallic minerals	-0.021		-0.022		-0.001	
- metal products	0.008		0.003		0.020	
- automotive	0.049		0.046		0.056	
- wholesale and retail trade, and repair of motor vehicles/cycles	0.001		-0.005		-0.002	
- accommodation and food service activities	-0.065		-0.060		-0.055	
- transportation and storage	0.010		-0.010		0.008	
- information and communication	0.115	**	0.141	**	0.128	**
- financial and insurance activities	0.116	***	0.127	***	0.146	***
- real estate, rentals, research and other activities	0.012		0.008		0.011	
HPWPs: task discretion and variety	0.009	**	0.009	***	0.010	***
Property: Italian/foreign property	0.063		0.056		0.056	
Occupations						
- professionals	0.098	**	0.136	***	0.146	***
- associated professional and technicians	0.055	***	0.075	***	0.076	***
- clerical and secretarial occupations	0.024	**	0.039	***	0.039	***
- crafts and related occupations	0.015	*	0.016	**	0.016	**
- personal and protective service	0.010		0.026	**	0.024	*
- sales and customer service occupations	0.003		0.010		0.010	*
- process, plant and machine operatives	0.012	**	0.011	**	0.011	**
Worker characteristics						
Psychological capital						
- gender	-0.156	***	-0.159	***	-0.152	***
- commitment	0.005	**	0.005	**	0.004	**
- civil status	0.024	*	0.029	**	0.030	**
Human capital						
- *Education*						
- secondary school+vocational school	0.063		0.068		0.096	**
- high school	0.075		0.086	*	0.109	**
- degree	0.226	***	0.248	***	0.285	***
- degree+specialization	0.274	***	0.279	***	0.309	***
- *Experience*						

Dependent variables	Log of permanent net monthly real wage				log of permanent net monthly nominal wage	
	model 1		model 2		model 3	
	WLS - vce(robust)		WLS - vce(robust)		WLS - vce(robust)	
Independent variables	Coef.	P>|t|	Coef.	P>|t|	Coef.	P>|t|
.... continued						
- tenure	0.002	*	0.002	*	0.001	
- market experience	0.006	*	0.005		0.007	**
- square market experience (10^{-2})	-0.000		-0.000		-0.000	
- Dependent relatives						
- number of children dependent on father	0.041	***	0.039	***	0.025	**
Working and contract conditions						
log of working hours	0.252	***	0.253	***	0.260	***
temporary contract	-0.099	***	-0.100	***	-0.094	**
risky and unpleasant job	0.008	**	0.008	**	0.007	*
shifts	0.029		0.028		0.022	
high learning time	-0.030		-0.034		-0.039	*
low learning time	-0.049	***	-0.047	**	-0.053	***
Competencies						
Singles competencies (factors)						
- reading, writing and calculations ability	0.056	**				
- relational competencies	0.026	*				
- team working	-0.018					
- threshold competencies in office technologies	0.361					
- threshold competencies in warehouse technologies	-0.161					
- threshold competencies in production technologies	-0.136					
Bundles of competencies (weighted sum of factors)						
- 'distinctive' generic competencies (3 factors)			0.160	**	0.176	**
- threshold competencies in using digital technologies (3 factors)			0.249	**	0.273	**
Industrial relations						
- union influence	0.060	*	0.060	*	0.066	**
- union influence*log number of employees	-0.013	**	-0.013	**	-0.013	**
Cost of living in different regions						
- log of cost of living index					0.295	***
Constant	0.949	***	0.942	***	4.143	**
Number of observations	2372		2372		2372	
Weighted population (10^6)	7.0387		7.0387		7.0387	
F-test	23.65		24.84		25.86	
Prob > F	0.000		0.000		0.000	
R^2	0.482		0.477		0.502	

Notes:
- default variables: wholesale and retail trade + car repair shops, elementary and service occupations, primary school + vocational school, medium learning time.
- statistically significant: * at the .10 level; ** at the .05 level; *** at the .01 level.

As a preliminary conclusion, we can assert that the estimates confirm wage premia (i) for distinctive generic competencies (in addition to education), (ii) for psychological capital, (iii) for organizational job design consistent which HPWPs, which implies a flat hierarchy associated with discretionary tasks and multi-responsibilities, and (iv) for excess pressure of demand of workers able to use digital technologies.

Endogeneity

Based on theoretical debate, potential endogeneity within a wage function concerns the education, work experience, tenure and competencies variables. Since our dataset does not contain any information indicated by literature as good instruments for education, such as parents' education and family background (see Checchi, 2006), we are forced to treat education as an exogenous variable. Literature suggests that work experience (and squared experience) and age (and squared age) constitute eligible instruments (Dustmann and Meghir 2005; Cingano 2003; Sulis 2009). For tenure, Altonji and Shakotko (1987) and Sulis (2009) find that the deviation of individual tenure from the sample's average industry tenure is an efficient instrument, since it is not correlated, by construction, with the individual fixed effects component.

As far as behavioural competencies are concerned, Leoni (2012) found that the formation of 'key' competencies – which are a specific subset of generic competencies, ascribable to an epistemological concept of meta-competencies, intended by Ryken and Salganik (2003) as a superior order logic class with regard to other competencies – are influenced by organizational characteristics (taken with a 5 year time lag) typical of the high-performance work organization paradigm. We use here the same variable as an instrument, together with two others, namely a variable regarding non-strictly-productive personality traits (on the assumption that these have been captured by psychometric tests used in selection procedures), and a variable concerning information on whether or not firms are certificated according to ISO procedures.

Model 4 in Table 3 shows that in the GMM estimates using instrumental variables – within the over-identified models (4 endogenous variables, 6 instruments) – the endogeneity hypothesis should be rejected: GMM Hayashi C statistic, also known as the difference-in-Sargant statistics (see Stata 11, manual on line: p.762), rejects the null hypothesis and we should hence accept the idea that all four variables are exogenous.

Table 3: Results of the estimates of permanent net monthly nominal wage: endogeneity tests

Dependent variables	log of permanent net monthly nominal wage					
	model 4		model 5		model 6	
	GMM - vce(robust)		WLS - vce(robust)		GMM - vce(robust)	
Independent variables	Coef.	P>|t|	Coef.	P>|t|	Coef.	P>|t|
Firm characteristics						
Firm size: log number of employees	0.024	***	0.025	***	0.020	***
Industries:						
- foods	0.107		0.136	*	0.053	
- textile	0.046		0.066		0.031	
- wood	-0.020		-0.003		-0.046	
- paper and printing	0.031		0.026		0.028	
- chemical and plastic	0.063		0.077	*	0.054	
- non-metallic minerals	0.011		0.023		-0.002	
- metal products	0.024		0.045		0.018	
- automotive	0.039		0.050		0.050	
- wholesale and retail trade, and repair of motor vehicles/cycles	0.029		0.043		-0.003	
- accommodation and food service activities	-0.049		-0.045		-0.058	
- transportation and storage	0.008		0.004		0.003	
- information and communication	0.145	***	0.152	***	0.128	**
- financial and insurance activities	0.139	***	0.148	***	0.143	***
- real estate, rentals, research and other activities	-0.025		0.022		0.007	
HPWPs: task discretion and variety	0.012	*	0.019	**	0.009	***
Property: Italian/foreign property	0.050		0.038		0.052	
Occupations						
- professionals	0.106		0.052		0.145	***
- associated professional and technicians	0.066	**	0.040		0.074	***
- clerical and secretarial occupations	0.035	**	0.017		0.038	***
- crafts and related occupations	0.020	***	0.013	*	0.016	**
- personal and protective service	0.020		0.013		0.024	*
- sales and customer service occupations	0.009		0.040		0.010	*
- process. plant and machine operatives	0.014	***	0.010	**	0.010	**
Worker characteristics						
Psychological capital						
- gender	-0.162	***	-0.156	***	-0.152	***
- commitment	0.006	**	0.006	***	0.004	**
- civil status	0.016		0.012		0.179	
Human capital						
- *Education*						
- secondary school+vocational school	0.092	*	0.126	**	0.092	*
- high school	0.126	**	0.167	**	0.110	**

Dependent variables	log of permanent net monthly nominal wage					
	model 4		model 5		model 6	
	GMM - vce(robust)		WLS - vce(robust)		GMM - vce(robust)	
Independent variables	Coef.	P>|t|	Coef.	P>|t|	Coef.	P>|t|
....continued						
- degree	0.413	***	0.355	***	0.294	***
- degree+specialization	0.413	***	0.512	***	0.321	***
- Experience						
- tenure (10^{-2})	0.098		0.020		0.007	
- market experience	0.013	***	0.014	**	0.014	***
- square market experience (10^{-2})	-0.016		-0.019	*	-0.017	
- Dependant relatives						
- number of children dependent on father	0.022	**	0.021	**	0.020	*
Working and contract conditions						
log working hours	0.307	***	0.265	***	0.259	***
temporary contract	-0.072	**	-0.097	***	-0.083	**
risky and unpleasant job	0.004		0.007	*	0.006	*
shifts	0.045		0.042	*	0.024	
high learning time	-0.029		-0.019		-0.041	*
low learning time	-0.061	***	-0.055	**	-0.049	***
Competencies						
Bundles of competencies (weighted sum of factors)						
- 'distinctive' generic competencies (3 factors)	-0.333		-0.764		0.179	***
- threshold competencies in using digital technologies (3 factors)	0.478	*	0.683	**	0.269	***
Industrial relations						
- union influence	0.098	**	0.112	***	0.059	*
- union influence*log number of employees	-0.018	***	-0.020	***	-0.012	***
Cost of living in different regions						
- log of cost of living index	0.285	***	0.285	***	0.269	***
- predicted value of tenure			0.005			
- predicted value of market experience			-0.013	**		
- predicted value of market experience^2 (10^{-1})			0.002	**		
- predicted value of distinctive generic competencies			0.952			
Constant	3.957	***	4.005	***	4.251	**
Number of observations	2372		2372		2372	
Weighted population (10^6)	7.0387		7.0387		7.0387	
Wald chi^2	1268.34				1183.86	
Prob > chi^2	0.000				0.000	
F-test			25.27			
Prob>F			0.000			
R^2	0.463		0.505		0.499	
Diagnostic tests for endogeneity						
Endogenous variables: tenure, market experience, market experience^2, bundles of distinctive generic competencies						

Dependent variables	log of permanent net monthly nominal wage					
	model 4		model 5		model 6	
	GMM - vce(robust)		WLS - vce(robust)		GMM - vce(robust)	
Independent variables	Coef.	P>|t|	Coef.	P>|t|	Coef.	P>|t|
....continued						
- *instruments*: dev_tenure, age, age^2, pf_ORG, pf_TR_T, ISO certification ,						
- *Endogeneity test*: robust DHW: GMM C statistics chi2 (4)	5.798	0.214				
Predicted values of endogenous variables			F-test	Prob>F		
- hat1- tenure (Ho=0)			0.320	0.659		
- hat2 - market experience (Ho=0)			5.020	0.025		
- hat3 - market experience^2 (10^{-2}) (Ho=0)			3.880	0.049		
- hat4 - bundle of distinctive 'generic' competencies (Ho=0)			2.220	0.136		
- hypothesis Ho: hat1=hat2=hat3=hat4=0			2.030	0.087		
Endogenous variables: market experience, market experience^2						
- *instruments*: age, age^2						
- *Endogeneity test*: robust DHW: GMM C statistics chi2 (2)					4.607	0.099
Test for weak instruments: Shea's test						
market experience						
- Shea's adj. partial R^2					0.407	
- robust F (2, 2325)						220.814
market experience^2						
- Shea's adj. partial R^2					0.426	
- robust F (2, 2325)						154.454

Notes:
- default variables: wholesale and retail trade + car repair shops, elementary and service occupations, primary school + vocational school, medium learning time;
- statistically significant: * at the .10 level; ** at the .05 level; *** at the .01 level;

The applied test refers to all four variables considered together, we suspect however that only some of these could be exogenous, while others could be endogenous. In order to pursue this idea, we manually constructed the DWH test to check the hypothesis of endogeneity on each variable. We estimated the OLS regression, adding the predicted value of each endogenous variable. Model 5 in Table 3 shows the results, where the second and third predicted values, referring to market experience and squared market experience, are statistically significant. Moreover, the test of all coefficients of predicted variables being equal amongst each other, and equal to zero, is rejected at a p-value of 10 percent.

Again, suspecting that the above result is due to the influence of the second and third variables, we proceeded to re-estimate the GMM model, considering only two endogenous regressors. Model 6 in Table 3 shows that the hypothesis of exogeneity must be rejected. Since the estimated model is 'exactly identified', we further investigated the hypothesis of weak instruments (partial R^2, F test and Shea's partial R^2): the parameters lead to a rejection of the null hypothesis and the instruments must therefore be considered strong. In particular,

the F-test is always above the critical value of 10, suggested as a rule of thumb by Staiger and Stocks (1997).

As concerns the overall results of the estimated coefficients, they appear relatively stable with respect of those previously mentioned in model 3 of Table 2, apart from that related to market experience, which is somewhat reduced.

Discussion and some final considerations

The coefficients we estimated can scarcely be interpreted – to our understanding - as shadow prices of particular attributes (Lucas, 1977), unless one assumes that markets equilibrate sufficiently rapidly so that one can abstract from disequilibria. Schultz (1975: 829) cautioned us not to err by not distinguishing between the analytical property of a theory (Walrasian theory, in Lucas' case) and the fact that human beings are not always in equilibrium and the further fact that they do not regain equilibrium instantaneously. It follows that wages – at any given moment – can be more appropriately interpreted along a Schumpeterian tradition (Bowles et al., 2001) as capturing some 'disequilibrium rents': for example, some attitudes differing in kind, not referable to mere rational economic behaviours, or even a portion of the economic return of schooling that Schultz (1975: 843) himself attributes to the individual ability to deal with disequilibria, to the extent that ability – such as, for example, different degrees of risk aversion, the degree of self-directedness, or self-confidence – is enhanced through education.

The general framework used in the wage function estimation in this work contributes - to our understanding - to overcoming the gap between economic theories, psychological theories and sociological theories that has developed around the question of wages, and reconsider the determinants of wage gains in a broad and unifying perspective. The results of our study show that the components, which in labour economist terminology are defined as strictly non-economic, non-observable and are therefore treated as omitted variables - such as generic competencies, psychological capital and organizational designs that redefine and further develop the competencies required of workers - play an unexpectedly important role. Should our results be confirmed by more detailed analyses that are information-rich in organizational and psychological capital, then these should not be neglected in either the design of national policies in terms of training the workforce or in the strategies of actors in charge of contractual wage negotiations, be they on a national industry level or decentralized at the workplace level.

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Appendix A Factor analysis

As mentioned in the text, we considered 44 items based on self-reported job analysis, focused on actual work behaviours and specific performances reflecting the different dimensions of generic competencies. Moreover, a further 21 variables describe different uses of digital technologies that respond to the following question: "*Can you indicate which of the following technological tools you normally use in your daily work*?" We applied factor analysis to two sets of respondent data, which made it possible to extract 5 factors in the first case and three factors in the second case. The 'eigenvalues-greater-than-1' criterion was used to determine the number of factors to be extracted, and varimax rotation was applied to improve the interpretability of the loading coefficients. The total variance explained in the first case is 0.687, while in the second case it is 0.678; the Kayser-Meyer-Ohlin measure of sampling adequacy is 0.948 and 0.795 respectively.

The constructs underlying the factors allowed identifying the following generic competencies: reading, writing and calculation ability, autonomy in executing tasks, managerial autonomy, relational abilities, and being able to work in a team. The threshold competencies in using digital technologies include the use of office technologies, warehouse technologies and production technologies respectively. Table A1 and Table A2 show the factor loading and rotation coefficients ($> \pm 0.30$).

Appendix A: Factor analysis

Table A1 - Results in relation to actual work behaviours and specific performances, reflecting the different dimensions of generic (or soft) competencies

Item		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
		READING, WRITING AND CALCULATIONS ABILITY	AUTONOMY IN EXECUTING WORKS	MANAGERIAL AUTONOMY	RELATIONAL COMPETENCIES	TEAMWORKING
1	Paying close attention to detail		0.565			
2	Dealing and interacting with people	0.304		0.440	0.458	
3	In-depth analysis of complex problems	0.448				
4	Writing long documents in an orthographically and grammatically correct form (for example, long reports, manuals, articles or books)	0.523				
5	Working hard, even without a supervisor		0.425	0.323		
6	Solving problems or defects (which may relate to their work, someone else's or equipment)		0.481	0.382		
7	Organizing their time		0.415			
8	Joining team endeavours					0.685
9	Ensuring that things are correct (referring to their work or someone else's)		0.696			
10	Detecting errors (with reference to their work or someone else's)		0.520			
11	Helping other members of the team					0.767
12	Knowing or understanding how the organization functions	0.371				
13	Knowing how to use/operate tools, equipment, machinery related to their work		0.497			
14	Having good mental and physical strength or good concentration (to work for long periods or for physical activities)		0.579			
15	Working without suggestions or advice		0.375	0.324		
16	Having specialist knowledge (or understanding)	0.303	0.413			
17	Checking things until there are no errors (in their work or someone else's)		0.684			
18	Persuading or influencing others			0.411	0.494	
19	Dealing with and managing problems with little guidance and assistance		0.308	0.417		
20	Writing notes or filling out forms correctly in terms of spelling and grammar (e.g., short reports, letters or memos)	0.678				
21	Being reliable in executing a task		0.713			
22	Completing the task in the time agreed		0.507			
23	Taking initiative			0.476		
24	Making effective presentations or speeches or speaking in public			0.325	0.327	
25	Using a personal computer or other computerized tools	0.724				
26	Forward thinking	0.347		0.402		
27	Planning their activities	0.334	0.346	0.373		
28	Engaging in counselling or advisor activities or care for others	0.332		0.346	0.433	
29	Planning the activities of other people			0.435		0.448
30	Selling a product or service				0.761	
31	Learning about particular products or services related to their work		0.376		0.421	
32	Moving things forward even if they become more complicated and difficult		0.404	0.389		
33	Thinking of solutions to problems	0.356	0.402	0.441		
34	Reading and understanding short documents such as reports, letters or memos	0.786				
35	Reading and understanding long documents such as reports, manuals, articles or books	0.678				
36	Listening carefully to colleagues					0.440
37	Performing calculations with decimals, percentages or fractions (using a calculator or a computer if necessary)	0.630				
38	Accuracy and ability to use hands and fingers (for example, to assemble, repair and/or construct objects, etc.)	-0.443				
39	Have the physical strength to push, pull or carry objects or work instruments	-0.501				
40	Reading written information in the form of modules, notices and recommendations	0.604				
41	Performing calculations using mathematical procedures or advanced statistics (using a calculator or a computer if necessary)	0.561				
42	Making strategic decisions for the future of their organization			0.465		
43	Instructing, training or teaching people individually or in groups			0.375		0.507
44	Acting as a consultant and taking care of customers				0.679	

Table A2 - Results in relation to threshold competencies in using digital technologies

Item		Factor 1	Factor 2	Factor 3
		OFFICE TECHNOLOGIES	WAREHOUSE TECNOLOGIES	PRODUCTION TECHNOLOGIES
1	Numerical control machines			0.525
2	Computerized numerical control machines			0.573
3	PLC machines (Programmable Logic Control)			0.541
4	Machines included in flexible automation systems			0.578
5	Machines included in machining cells (two, three robotic machine tools)			0.522
6	Robotic systems			0.352
7	Flexible manufacturing systems (CIM: Computer-Integrated Manufacturing)			0.381
8	Automated warehouse		0.731	
9	Laser machines		0.700	
10	Personal computer to manage and write simple documents (letters, invoices, orders, diary management of appointments, etc.)	0.501	0.597	
11	Personal computer to handle complex documents using a word processor or performing calculations using spreadsheets	0.574	0.514	
12	Personal computers to communicate and interact with other people through the use of electronic mail	0.778		
13	Personal computer to access, within the corporate network, data and information for their activities (for example, purchases, sales, customer services, banking services, etc.).	0.751		
14	Personal computer to access via the web (outside the corporate network) data and information for heir activities (for example, purchases, sales, customer services, banking services, etc.)	0.377		
15	Personal computers to process information, or for designing, including CAD, or eventually to use statistical analysis programs	0.441		
16	Personal computer for programming	0.490		
17	Personal computers that are part of ERP management systems (examples: SAP, Baan, Oracle, Peoplesoft, JD Edwards, etc.)			
18	Personal computer systems that are part of CRM management systems (Customer Relationship Management)			
19	Personal computer systems that are part of MRP management systems (Material Requirements Planning)			
20	Personal computer systems that are part of EDI management systems (Electronic Data Interchange)		-0.333	
21	Personal computers that are part of management information systems			