WAGES AND PSYCHOLOGICAL, ORGANIZATIONAL AND TECHNOLOGICAL CAPITAL

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Abstract

This paper examines the effect of personality traits and adjustable personal characteristics (jointly referred to as psychological capital), digital technologies and high performance work practices on private sector wages in the Italian economy. Although collective industry bargaining tends to fix wage levels according to job complexity rather than worker competencies, we demonstrate that a 'distinctive' level of flexible personal characteristics (including commitment and 'generic' or soft competencies) leads to a wage premium while rigid personality traits lead to a wage penalty. Flexible personal characteristics are modelled by the organizational design of both the workplace and the job. A second wage premium is associated with competencies expressed in using complex technological capital.

The estimated wage equation controls for a wide array of covariates (firm size, sectors, occupations, working and contractual conditions, education, industrial relations), for selection bias and for heteroskedasticity. The endogeneity of personal characteristics is taken into account and the main results are validated with instrumental variables estimates using alternatively GMM and LIML estimators.

Key words: Wages, Psychological Capital, Organizational Behaviour, 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 new technologies and new work practices associated with the reengineering of workplaces, increases the relative demand for high-competency labour, while reducing 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 (from which the definition '*general purpose technologies'* (GPTs) derives), since they affect virtually every task, job and industry. In terms of organizational innovations, the lean production paradigm is establishing itself as a 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 characteristics 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. Attention has been devoted by researchers to the ability to use computerized technologies; however, the controversy of whether or not workers receive a wage premium for these abilities, due to their shortage in the labour market, remains open.

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

[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 (2013a) for a review of this literature.

which education investments being equal cognitive skills, knowledge and operational competencies 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* ... [test scores that 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 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 learning 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, or their association, if any, with labour market rewards, looking beyond mainstream explanations (i.e., 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 (and not from personal competencies). Dickerson and Green (2004) argue that technical and generic competencies cannot easily be quantified and are only sometimes certified, largely defined in slightly different ways. Empirical works have to date analysed limited information on technical and generic competencies, and cognitive and non-cognitive competencies (see Green et al., 2001; Dickerson and Green, 2004; Leoni, 2012). A rare example of workforce-level generic and non-generic skills data is that analysed by Dickerson and Green (2004) on British employees. Excepting this, robust evidence for other countries is essentially lacking.

Moreover, labour economists have paid less attention to psychological capital, which psychologists denote as those personal traits (assumed quite rigid) and those personal characteristics (assumed quite malleable) that could contribute to an individual's productivity (Goldsmith et al., 1997; Bowles et al., 2001). This is generally treated by economists as an unobservable aspect of individual-specific heterogeneity, and as such, included among

omitted variables or expressed by preference parameters such as time preference, risk aversion, altruism and, more recently, social preferences (Borghans et al., 2008b).

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 premia associated with HPWPs disappear when controlling for human capital.

Most researches have focused on one or a subset of the abovementioned 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 critical examination of previous empirical literature

In this section, we critically summarize the main literature concerning the underlying factors that affect wages: competencies as adjustable/malleable personal characteristics, computer complexity as technological capital-in-use, organizational capital as work practices, psychological capital as personality traits and industrial relations.

2.1 Competencies, computer complexity 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 using computers at the expense of low-skilled workers, increasing the wages of the former and reducing those of the latter (Krueger, 1993). 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 if and when coupled with organizational changes in the workplace. Aghion and Howitt (2002) provide a theoretical model in which the introduction of GPTs 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) show that much of the impact of computer usage on wages disappears once the correlation of computer usage with unobserved individual heterogeneity is considered. This indicates that controls for individual abilities are important, albeit difficult to identify.

Borghans and Weel (2004) find that people using pens at work earn more than the average, which can also be understood as the return to writing skills. 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 only 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 et al. (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, 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 study 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, which are poor proxies for individual cognitive and non-cognitive skills. Although the point is made, the appropriate instruments to analyse this are lacking. Grade variables, simple dummies for computer use and educational level of parents are all inadequate proxies for

individual 'generic' competencies, important wage determinants that are able to influence the continuous learning of competencies. For example, Dickerson and Green (2004) have a wealth of information on the 'generic' skills of British employees (where generic stands for skills used in a broad spectrum of jobs across all industries to varying extents), and distinguish between the different levels of complexity of computing skills, providing evidence of their positive impact on wage premia. 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 analyse 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.

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 measures of the specific activities that the job entails. Nevertheless, a wider and more in-depth investigation would be possible, further enriching information on the use of organizational capital (namely, high-performance work practices: HPWPs), as well as on the psychological capital held by workers, while also 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. 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-

[2] For an overview of WCM attributes see Leoni (2013a).

performance workplaces practices (HPWPs), the cornerstones of which are a flat hierarchy and working autonomy.

A redefinition of the job in terms of role – defined as expected organizational behaviours that workers have to put in act if and when circumstances require it – cannot but also influence the remuneration system, as HPWPs are more productive (Osterman, 2006) and stimulate greater reflexivity, inducing a learning process of key competencies (Leoni, 2012), which implies the shaping of the malleable personal characteristics of workers (McAdams and Pals, 2006). At the same time, a system of incentives strengthens motivation to accept changes (Black et al., 2004). However, consensus is not unanimous. Cappelli and Carter (2000) find evidence that HPWPs are associated with higher wages for manufacturing production workers, although their results weakened when controls for human capital were included, while Handel and Gittleman (2004) find that the practices they considered tended not to have detectable effects on the wages of workers. Moreover, Osterman (2006) finds that a positive association between HPWPs and wages does not change the wage structure, and thus wage inequality within firms remains 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 (e.g. Lucchetti et al., 2004; Green et al., 2002), the authors do not control for the role played by organizational workplace characteristics. Our work aims to bridge this gap.

2.3 Personal characteristics, 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 2000, 2006; Heckman and Rockoff , 2012). Bowles et al. (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 wage determination model) and achievement tests (grades) are good signals and predictors of relational competencies, general knowledge

(especially 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).[3] These results legitimize the use of cognitive and non-cognitive variables in a wage model that aspires to broadening the explained variance while avoiding the problems associated with omitted variables.

However, these type of variables measure individual behaviours or activities that a job entails, which are not worker competencies but merely result therefrom. Competencies seem to reside in intents and not in actions. They are composed of an observable part and a hidden part (Spencer and Spencer, 1993). The former consists in knowledge and skills, while the latter in traits, motives and self-image (*ibidem*). On one side, Borghans et al., (2008b: 974) indicate more precisely what traits are, specifying their personality aspects: they are part of non-cognitive abilities and are defined by the authors as "patterns of thought, feelings and behaviour". On the other side, Costa and McCrae (1994) introduce the term 'characteristic adaptation' to refer to specific patterns of behaviour that are situated between general traits and specific behaviours. Moreover, they include motives, values, self-image and many other aspects of human individuality that denote motivational, social-cognitive and developmental concerns (McAdams and Pals, 2006). Thus, competencies are composed of a more rigid part, the traits, and a more flexible part, namely, the malleable characteristics that can be influenced by the context, for example, by HPWPs.

Traits are efficiently measured by the *Big Five* factors: openness to experience (or intellect), conscientiousness, extraversion, agreeableness and neuroticism. Although this is the most complete measure, Rotter's (1966) scale for the internal-external locus of control and Rosenberg's (1965) scale as a self-esteem indicator are also functional. However, other more malleable personality traits have also proven relevant: for example, commitment, commonly defined as willingness to align own behaviours with the needs, goals and priorities of the organization, acting in a way that promotes organizational goals or meets organizational needs (Spencer and Spencer, 1993: 86), or inferred from elements 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 for and measure genuine discrimination as a negative prejudicial perception of others (in the first three cases) (Becker, 1957), or to account for

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

individual-specific heterogeneity not otherwise controlled for (in the latter case), without explaining in-depth what type of personality traits are involved.

Gender analysis has received a lot of attention in the last few years, reaching a consensus on the fact that women tend to be less effective than men in a competitive environment (e.g. Gneezy et al., 2003; Niederle and Westerlung, 2007), performing worse than men. Women perform relatively better in a non-competitive environment. These results are usually attributed to a combination of distaste for competition and a lower level of confidence in their relative abilities, although Kuhn and Villeval's (2013) recent experimental study obtained a zero casual effect of team environment on women's absolute and relative task performance. If this is the case, lower wages for women cannot but be ascribed to negatively perceived (or not at all appreciated) personality traits (presumed or actual) by chauvinistic leading male managers and employers.

The married/unmarried status is an intriguing issue and empirical literature tends to attribute a wage premium to marriage, 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) 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 professional development and promotion. One could argue that this is not a genuine marriage effect but rather a childbearing effect. Controlling for this can 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 greater motivation to provide work efforts to their greater specialization in the labour market.

There is little empirical research on how marriage affects personality traits (as a result of close everyday relationships and a pooling of risks as well as economies of scale that enable a better quality of life) in terms of greater conscientiousness, compliance, perseverance, cooperativeness, control impulses, emotional stability, dutifulness, perspective thinking, organizational order, and 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, expecting 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 (rigid) personality traits and (malleable) personal characteristics as sources of individual behaviours

is very similar to that of psychologists (e.g. Goldsmith et al., 1997) when not controlling for a series of aspects such as firm dimension, workplace practices, technologies used or industrial relations, or not considering endogeneity and/or reverse causalities, or even when exclusively assuming linear relationships between traits, characteristics 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 outcomes for public policies promoting human development.

2.4 Industrial relations and wages

Literature widely recognizes that the impact of unions on wage levels and 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, those 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 et al. (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 Sgobbi and Cainarca (2013) also find a positive general effect on wages in the presence of work councils or unions but do not investigate the matter in detail. Dell'Aringa et al. (2005) analyse 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 is higher when unions are able to bargain on a broad set of issues, primarily on effective productivity

incentive mechanisms. 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 with 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 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 ISFOL database.[4] 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 2,372 representing 7.038 million salaried workers.

The questionnaire consists 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

[4] ISFOL is an Italian governmental institute charged with the professional training of workers.

hours and industrial relations; I) the work situation 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 and econometric strategy

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)[5], 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.[6]

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

$$lcw = \alpha_0 + \mathrm{B}'Sector + \Gamma'Occupation + \Omega'Tenure + \xi \qquad [1]$$

Furthermore, employers add a first supplementary structural (or permanent) wage component (such as merit or *ad personam* bonus) that differs from worker to worker. The aim of this paper is to understand the sources of these (mostly) unexplained permanent earnings

[5] According to a survey carried out by Isfol in 2006 on the private sector (agriculture excluded), firms that are not members of any employers association equal 35.9% and are mainly small firms, occupying 15.1% of 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).

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

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 a *part* of individual competencies is attributable to human capital indicators, justifying education amongst the regressors. In addition, two other potential variables must be taken into consideration. First, some firms implement HPWPs that generally determine lower hierarchy and jobs with greater autonomy and responsibilities, which in turn stimulate relational, teamwork and cognitive competencies (reading, writing, calculus). Second, skill-biased technological change may exercise demand pressure, specifically affecting the wages of workers able to manage new digital devices. In some workplaces, these supplementary wage components may be the result of company-level collective bargaining, competitive pressure between labour demand and supply, individual negotiations 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 can 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 due 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 assess the above-mentioned idiosyncratic elements entails the reformulation of [1], as follows:

$$lw = \alpha + \mathrm{B}'FC + \Gamma'OC + \Theta'WC + \Phi WCC + \Lambda'CO + \Psi'IR_i + \varepsilon \qquad [2]$$

where *lw* stands for the log of stable net monthly earnings, *FC* for firm characteristics (including 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 these would be 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 whether dealing with exogenous or endogenous variables, the estimator is OLS weighted or GMM and LIML 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.

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

Occupation

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 other studies (Lucchetti et al. 2004, for example), render these very good proxies.

Worker characteristics

Psychological capital is divisible into two categories:

1. *Personality traits*, non-competency-related, and to some extent quite rigid, are approximated by:
    - *Gender*, as an indirect signal of traits. The dummy is equal to 1 if the employee is female, 0 otherwise.
    - *Marital status*, as an indirect signal of traits. Categorical variable, equal to 1 if the employee is single, 2 if married and 3 if separated, divorced or widowed.
    - *Personality traits in the strict sense.* In psychology literature, the idea of treating personality traits as specific and time-invariant elements of the subjects themselves has been consolidated. Guion (1991: 335), for example, identifies these in «ways of behaving or thinking, generalizing across situations, and enduring for a reasonably long period of time»", contrary to personal characteristics (cfr: *infra*), which can be influenced by situational factors. Traits are seen as internal psychological structures or properties that relate to behavioural regularities, that is to say, adult personality traits are likely to change slowly and only with prolonged exposure to psychologically salient environmental factors. According to Ferrer-i-Carbonell and Frijters (2004), these types of variables (traits) constitute the ideal candidates – in a cross-sectional context – to capture *individual fixed effects*. The conceptualization of these traits led to the taxonomy of the *Big Five* model (McCrae and Costa, 1987). Unfortunately, our dataset does not include the five broad personality dimensions (nor, for example, Hogan's (1991) longer list), but rather a set of items (which we do not claim to be complete) that through factor analysis collapse into a dimension (see Table A3 in the Appendix). The underlying construct reflects a *sui generis* broad trait capturing, on one side, self-esteem of sorts, encompassing beliefs (for example, *I feel pride in…; I'm resolute/determined to…*), and on the other side, traits close to a self-made person's internal locus of control (*I constantly and independently update my profession by means of…*). According to psychology literature, we should expect a positive recognition of such traits, even if some of these traits (e.g., I feel pride in/am resolute…) evince elements of mental and cultural rigidity, which may be an obstacle

in interpersonal relationships and when facing unexpected events. This bundle of traits tends to identify workers driven by strong self-referential beliefs (typical of the self-made man) disregarding (or discrediting) the Delphic maxim 'nothing in excess' and the Socratic dictum 'know thyself', which may induce excessively extolling what they are and not paying attention to the opinion of others (colleagues, superiors, subordinates, clients, suppliers). These suspicions stem from the fact that the answers given by respondents to these questions have a very high average score, close to 6 in a potential range from 1 to 7. These critical remarks (coherent with Heckman and Kautz's abovementioned maxim: "too much … can be bad") could reverse the relation with respect to wages from positive to negative. Since the factorial variable is continuous, the dimensions captured go from lower to higher levels of self-reported traits.

2. *Personal characteristics*. These refer to the flexible/malleable components of psychological capital, which are competency-related in the sense they can be influenced by workplace and job characteristics:
   - *Commitment*. This is usually defined as the worker's generic involvement or identification with organizational goals, or simply as the worker's willingness to make greater efforts to work hard. This organizational behaviour is assumed to be affected by policies and innovative work practices that foster mutual relationships of consultation and participation within the organization (Gallie et al, 2001). We constructed a continuous variable indicating employee commitment from a factor analysis 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".
   - *Bundle of 'distinctive' generic competencies.* Expressed competencies constitute a reflection of *malleable and adjustable personal characteristics*. As previously mentioned, the database provides information on 44 items based on self-reported job analysis, focused on actual work behaviours and specific performance, and reflect different competency dimensions. We consider this a supply aspect that can be influenced by organizational workplace and job design. We applied a factor analysis to respondent data obtaining 5 factors whose underlying constructs correspond to the following competencies: autonomy in executing work, managerial autonomy,

relational abilities, being able to work in a team, reading, writing and calculation ability. Details are shown in the Appendix, Table A1.

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. We created a bundle that we call *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 requires to be effective but does not distinguish superior from average performers) we redefine this bundle following Spencer and Spencer's (1993: 15) suggestion. Specifically, we rescaled the distribution of the variable attributing value zero up to the average value of the factorial variable (the knot), maintaining the right part of the distribution. It thus assumes the meaning *'distinctive'* or superior or differentiating generic competencies and takes the form of a piecewise linear variable.

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 postgraduate education (i.e., specialization course, Master and PhD).
- *Experience*. We include the years of experience, namely market experience, and its square.
- *Tenure*. Number of years with current firm.

Dependent relatives:

- *Number of children dependent on fathers.* The social security system grants employees a family allowance for each dependent child, 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 INPS (National Institute for Social Security), offsetting the amount against 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 social security benefits are lower or even zero, thus leaving the significance of the estimated coefficient undetermined.

Technological capital-in-use:

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?". The factor analysis enabled extracting 3 constructs, equivalent to a threshold level of 3 competencies in using computerized technologies: office technologies, warehouse technologies and production technologies. We consider this a demand aspect. Details are explained in the Appendix, Table A2. We created a synthetic bundle, which refers to the three factors relating to the use of new computerized technologies. We call this variable *technological capital-in-use* in the sense of Orlikowski (1992) and Aghion and Howitt (2002), according to whom digital tools become relevant not as artefacts (stock of capital) but only to the extent they are considered in conjunction with the competencies of workers to manage these.

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.

Learning. 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.

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 premia 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 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
Ownership : Italian/foreign	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, distinguished by:					
1) Personality traits:					
• gender (M/F)	2372	1.399	0.489	1	2
• personality traits (factor/bundle of 5 items)	2372	9.298	1.558	1.653	11.573
• marital status	2372	1.641	0.589	1	3
2) Malleable personal characteristics:					
• commitment	2372	16.730	4.853	1.602	28.902
• bundle of distinctive generic competencies (5 factors)	2372	0.083	0.141	0	0.804
Human capital, distinguished by:					
1) Education:					

Variable	Obs	Mean	Std. Dev.	Min	Max
• elementary school	2372	0.026	0.161	0	1
• secondary school + vocational school	2372	0.488	0.499	0	1
• 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
2) 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
Technological capital					
Bundle of threshold competencies in using digital technologies (4 factors)	2372	0.063	0.100	0.026	.0419
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
Learning					
• long learning time (> 24 months)	*2372*	*0.156*	*0.363*	*0*	*1*
• medium learning time (>6 and <24 months)	*2373*	*0.379*	*0.485*	*0*	*1*
• short learning time (< 6 months)	*2372*	*0.610*	*0.487*	*0*	*1*
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
Additional instrumental variables					
• *bundles of organizational characteristics at time t (factor of 5 item) >μ*	2980	0.648	0.722	0	1.922
• *bundle of organizational characteristics at time t-5 (factor of 2 item)*	2980	1.157	0.550	1	1.510
• *increase in discretionary power between t and t-5*	2648	0.232	0.422	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 around 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, 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 (Models 3-4). A glance at the four models indicates relatively stable coefficients, in spite of some different specifications.

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 remains in the estimates. 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 12/16 percent (Model 1) to 15/17 percent (Model 4). Firm size gives rise to a further wage premium, very likely linked to productivity deriving from economies of scale.
When controlling for a wider set of factors (including endogeneity: cfr. i*nfra*), the traditional belief that foreign firms pay – *per se* – higher salaries compared to national firms is no longer tenable, unless they are more efficient and better organized, and the wage *premia* is thus captured by these organizational features.

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 to 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 position's occupational class.

Worker characteristics.

Psychological capital. All three variables capturing *personality traits* are statistically robust from Model 1 to Model 4. Having controlled for number of children and for marital status, a wage penalty of around 18 percent associated with being female cannot be interpreted as a childbearing effect, but rather as a signal of a personality trait (actual or alleged) perceived negatively by employers and top managers, who prejudicially consider women less productive (and consequently less deserving of extra-contractual bonuses) with respect to men. 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 discharge the hypothesis of industry and occupational segregation in favour of the discrimination theory put forwarded by Becker (1957), that is to say, women are the bearers of traits that are not appreciated by the chauvinistic perception of leading male managers and employers.

The factorial variable capturing deep personality traits, which at first glance should be positively interpreted, instead has a negative sign: this could mean that being too self-assured is reputed a signal of rigidity, a type of excessive and dogmatic self-esteem, signalling a lower inclination towards negotiation, a lower disposition to organizational and managerial changes.

However, firms positively recognize and associate to marital status a signal of conforming 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 behaviour, very likely reflecting a perception of the efficient use of time (Wayne et al., 2004; Thomas et al., 2005).

Malleable personal characteristics, represented by (self-perceived) commitment and (above average) 'generic' competencies learnt through self-adjustment with respect to stimuli from innovative work practices, show a positive strong evaluation, even when combined in a unique factor (Model 4).

Table 2 - Results of estimates of permanent net monthly wages

Dependent variables	Log of permanent net monthly real wage				log of permanent net monthly nominal wage		log of permanent net monthly nominal wage		log of permanent net monthly nominal wage	
	Model 1		Model 2		Model 3		Modl4		Model 5	
	WLS - vce(robust)		WLS - vce(robust)		WLS - vce(robust)		WLS - vce(robust)		GMM Vce(robust)	
Independent variables	Coef.	P>|t|	Coef.	P>|t|	Coef.	P>|t|	Coef.	P>|t|	Coef.	P>|t|
Firm characteristics										
Firm size: log of number of employees	0.019	***	0.022	***	0.022	***	0.022	***	0.030	***
Industries:										
- food	0.038		0.030		0.055	*	0.077	**	0.125	**
- textile	0.027		0.028		0.028		0.036		0.037	
- wood	-0.039		-0.051		-0.062		-0.051		-0.082	
- paper and printing	0.004		0.012		0.030		0.037		0.044	
- chemical and plastic	0.049		0.059		0.073	**	0.076		0.081	*
- non-metallic minerals	-0.030		-0.033		-0.015		-0.010		-0.018	
- metal products	0.031e-3		0.001		0.016		0.020		0.035	
- automotive	0.050		0.048		0.058		0.058		0.069	
- wholesale and retail trade, and repair of motor vehicles/cycles	0.091e-2		-0.023		0.001		0.016		-0.026	
- accommodation and food service activities	-0.062		-0.065		-0.057	*	-0.053		-0.084	
- transportation and storage	0.019		-0.012		0.004		0.004		-0.011	
- information and communication	0.166	***	0.180	***	0.167	***	0.173	***	0.206	***
- financial and insurance activities	0.121	***	0.135	***	0.153	***	0.0153	***	0.144	***
- real estate, rentals, research and other activities	0.014		0.010		0.016		0.022		0.038	
Ownership : Italian/foreign	0.059		0.070		0.077	**	0.074	**	0.035	
Occupations										
- professionals	0.148	***	0.150	***	0.159	***	0.133	***	0.132	***
- associated professional and technicians	0.080	***	0.087	***	0.089	***	0.081	***	0.084	***
- clerical and secretarial occupations	0.040	***	0.043	***	0.044	***	0.039	***	0.035	**
- crafts and related occupations	0.016	**	0.015	*	0.015	***	0.014	***	0.017	*
- personal and protective service	0.028	**	0.032	**	0.030	**	0.027	**	0.033	**
- sales and customer service occupations	0.011	*	0.012	*	0.011	***	0.010	**	0.011	
- process, plant and machine operatives	0.010	**	0.011	**	0.011	***	0.010	***	0.010	*
Worker characteristics										
Psychological capital, distinguished by:										
1) Personality traits:										
• gender (M/F)	-0.182	***	-0.199	***	-0.188	***	-0.189	***	-0.173	***
• personality traits (factor/bundle of 5 item)	-0.021	***	-0.018	***	-0.015	***	-0.013	***	-0.048	*
• marital status	0.034	**	0.076	***	0.081	***	0.080	***	0.058	***
2) Malleable personal characteristics:										
• commitment	0.009	***	0.010	***	0.008	***				
• bundle of distinctive 'generic' competencies (5 factors)	0.242	***	0.245	***	0.263	***				
• bundle of (commitment+bundle of distinctive 'generic' competencies)							0.009	***	0.041	*
Human capital, distinguished by:										
1) Education:										

Dependent variables	Log of permanent net monthly real wage				log of permanent net monthly nominal wage		log of permanent net monthly nominal wage		log of permanent net monthly nominal wage	
	Model 1		Model 2		Model 3		Modl4		Model 5	
	WLS - vce(robust)		WLS - vce(robust)		WLS - vce(robust)		WLS - vce(robust)		GMM Vce(robust)	
Independent variables	Coef.	P>|t|	Coef.	P>|t|	Coef.	P>|t|	Coef.	P>|t|	Coef.	P>|t|
• secondary school + vocational school	0.055		0.014		0.035		0.039		0.046	
• high school	0.076		0.014		0.026		0.037		0.053	
• degree	0.240	***	0.151	**	0.175	***	0.189	***	0.277	**
• degree + specialization	0.307	***	0.200	**	0.213	***	0.264	***	0.367	***
2) Experience:										
• tenure	0.003	**		***						
• market experience	0.007	*		***						
• market experience^2	-0.043e-2			**						
Dependent relatives										
• number of children dependent on father	0.010		0.020		0.014	*	0.013	*	0.006	
Technological capital-in-use										
Bundle of threshold competencies in using digital technologies (4 factors)	0.303	***	0.301	***	0.310	***	0.440	***	0.441	***
Working and contract conditions										
Log of working hours	0.267	***	0.271	***	0.277	***	0.281	***	0.283	***
Temporary contract	-0.091	***	-0.112	***	-0.109	***	-0.115	***	-0.006	
Risky and unpleasant job	0.010	**	0.009	**	0.009	***	0.009	***	0.013	***
Shifts	0.016		-0.004		-0.012		-0.007		0.001	
Learning										
• *Long learning time*	-0.021		-0.011		-0.015		-0.007		0.011	
• *Low learning time*	-0.058	***	-0.071	***	-0.077	***	-0.081	***	-0.054	**
Industrial relations										
- union influence	0.037		0.049		0.056	**	0.070	***	0.074	**
- union influence*log number of employees	-0.009	*	-0.010	*	-0.010	**	-0.012	***	-0.015	***
Cost of living in different regions										
- log of cost of living index					0.404	***	0.422	***	0.561	***
Constant	1.153	***	1.209	***	3.904	***	3.780	***	2.863	***
Number of observations	2372		2372		2372		2372		2090	
Weighted population	7.0387e+6		7.0387e+6		7.0387e+6		7.0387e+6		6.0792e+6	
F-test	26.43		23.40		47.48		46.93			
Prob>F	0.000		0.000		0.000		0.000			
Wald-test									651.85	
Prob>F									0.000	
R^2	0.473		0.448		0.466		0.458		0.279	
Endogeneity test: GMM C statistic Chi^2(1)									2.958	
p-value									(0.085)	
Over-identifying restriction test: Hansen's J Chi^2(1)									1.2329	
p-value									(0.2668)	
Test for weak instruments										
• *Bundle of commitment + bundle of distinct 'generic' competencies*										
• R^2									0.2424	
• *Adjusted* R^2									0.2265	
• *Partial* R^2									0.0064	
• *Robust F(4,2044)*									3.4241	
• *Prob>F*									0.0328	

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.

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 escalation of between 2 to 3 percent (from Model 1 to Model 4), reaching 4 percent in Model 5, with respect to the annual average rent rate of the default variable captured by the intercept. *Market experience*, *tenure* and *number of dependent children* (and even marital status) show multicollinearity, impeding these from disclosing all their independent effects (Model 1). We retain that – over time – the first two variables discharge their effects in the occupation levels, which we control for, and we thus decided (from Model 2 onwards) to drop these. The child effect is almost statistically significant (at 11 percent) in Model 2, but fully statistically significant (p=0.000, with a coefficient equal to 0.0453) when multicollinearity with marital status is also eliminated by dropping this variable.

Technological capital-in-use.

The wage premium associated with the use of digital technologies is around 30 percent (which becomes 45 percent, when controlling for endogeneity: see Model 5), 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 Lucchetti et al. (2004). With respect to the latter study, we argue that the number of controls used is much lower 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 with both 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 must be coupled with the wider role that workers have in workplaces, namely more responsibility and autonomy, then 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 different directions with respect to the requests from labour demand and the very rapid diffusion of digital technologies, giving rise to structural-

professional mismatches (Leoni, 2013b). Cainarca and Sgobbi (2012) argue that Italy recognizes lower returns to required education and overeducation than other industrialised countries due to – in our interpretation – greater professional competency mismatches.

Working and contract conditions.

The variables referring to *working hours* and *temporary contract* have the expected sign; the former also indirectly controls for overtime and part-time hours, the latter shows a penalty of around 9-11 percent. Contrary to expectations, the dummy indicating whether the employee frequently *works shifts* appears to be non-significant. *Risky and unpleasant jobs* show a premium of around 0.8-1.0 percent, which becomes 1.5 percent after controlling for endogeneity. This result brings to light a concern regarding the efficacy of trade union policies (consolidated in specific legislation: law n. 626/1994 on safety in the workplace) against monetization of risk and health within workplaces. As at this stage it is impossible to disentangle the two components (job riskiness and unpleasantness), we leave this question open for future research.

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 a collective efficiency wage component pursued by managers may also underlie the wage premium agreed between these and workers' representatives (Cristini and Leoni, 2007). When considering the three union role components, overall accounting for the three coefficients in terms of elasticities (size, union and interactive term), a positive value of 1.1-1.2 percent emerges.

Having controlled for employee and firm characteristics, our results which refer to the role of workers' representatives at the 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 of 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 Models 3 and 4 shows an elasticity coefficient of around 0.40-0.42, which becomes 0.56 after controlling for endogeneity (Model 5). This value is rather distant from 1, which would correspond to the neoclassical hypothesis of the perfect rationality of behaviours of economic agents. Disparity 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 opportunities 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.

As a preliminary conclusion, we can assert that the estimates confirm wage premia (i) for malleable personal characteristics (a component of psychological capital), which assume the form of commitment and 'distinctive' generic competencies (in addition to education) and (ii) for technological capital-in-use. In terms of personality traits (the rigid component of psychological capital), a distinction must be made between negative attributes or signals such as gender and excessive self-esteem and positive signals such as marital status and greater conscientiousness, compliance, perseverance, cooperativeness, control impulses, emotional stability, dutifulness, perspective thinking, organizational order.

5.1 Endogeneity of personal (learning) characteristics

The potential endogeneity within a wage function as we have estimated it concerns malleable personal characteristics, which – according to the theoretical arguments reviewed in section two – can be influenced by organizational workplace and job design to the extent that work practices implemented imply psychosocial stimulation, as seems to be the case in HPWPs.

To test for this assumption, we instrumented our target variable starting with four variables: (1) organizational characteristics at time t, a factorial variable based on 5 work practises exercised in the previous twelve months, namely: (i) having participated in improvement groups; (ii) having formally submitted improvement suggestions; (iii) being interviewed for performance evaluation purposes; (iv) receiving constant information flows; (v) being involved and consulted by supervisors and managers; (2) a subset of these work practices (factor based on 2 work practices, precisely the second and the third) put into action at time t-5; (3) having benefiting from an increase in discretionary power during the last five years (which is usually the outcome of a delayering process); and (4) seniority, based on the

idea that the inferred reflectiveness and confidence in the aforementioned work practices slowly produce their effects on personal characteristics, provided a worker remains in the same firm, since learning, which implies a change of something (personal characteristics, in our case), becomes embodied knowledge to the extent that it is achieved through reflection-in-action as well as reflection-on-action (Schön, 1983) in a shared mental place so that emerging relationships can take place.

In the presence of heteroskedasticity, the GMM estimator is appropriate with respect to 2SLS. The estimated results (not reported here) reject the null hypothesis that the 4 instruments are all valid (Hansen's J-test: $chi^2(3) = 16.4713$, with a p-value = 0.0000). The redundant test, equivalent to a likelihood-ratio test, implemented on each single instrument leads to excluding seniority and the factorial variable relating to organizational characteristics at time t.

Model 5 in Table 2 shows that – within the over-identified model (1 endogenous variable, 2 instruments) – the endogeneity hypothesis must be accepted: the GMM Hayashi C statistic rejects the null hypothesis of exogeneity at the 0.10 level; at the same time, the Hansen's J test cannot reject the null hypothesis and we must therefore conclude that the over-identifying restrictions are valid. Finally, with reference to the R^2 and adjusted-R^2, our instruments contribute greatly to the fit, although the partial R^2 is rather low, which suggests some caution; in addition, F=3.72 (Prob>F 0.033) is not above the critical value of 10 indicated as a rule of thumb by Staiger and Stock (1997), even if their theory presumes homoscedasticity errors, which is clearly not appropriate in our case. It is worth remembering that the GMM estimator is based on asymptotic theory, which provides a poor guide to actual finite-sample distribution. These doubts have suggested using an alternative and more suitable estimator such as LIML, which gave rise to very similar results (available on request) with the diagnostic tests no longer inferred from asymptotic theory. We therefore feel comfortable in rejecting the null hypothesis of weak instruments.

Thus, not considering that personal (learning) characteristics can be influenced by HPWPs would lead to a strongly downward biased coefficient, aside from ignoring the virtuous role played by HPWPs. 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, which shape malleable personal characteristics (*inducing* a learning process). This leads to a wage premium for contributing greater productivity, adjusting some own characteristics, namely, learning. Similar results were obtained by Black et al. (2004) and Bauer and Bender (2002).

6 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 – in our opinion – to overcoming the gap between economic theories, psychological theories and sociological theories around the question of wages, and to 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 the design of either workplaces or national policies in terms of training the workforce, nor 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*?". Finally, 4 items were used to compact personality traits.

We applied factor analysis to three sets of respondent data, which enabled extracting 5 factors in the first case, three factors in the second case and 1 factor in the last 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 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. The construct underlying the factor identifying personality traits appears to bring out the profile of a very, perhaps excessively, self-confident person with extreme self-esteem.

Table A1, Table A2 and Table A3 show the factor loading and rotation coefficients (> ± 0.30).

Table A1 – Factor analysis of 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 CALCULATION 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 to 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 – Factor analysis of 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 their 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			

Table A3 – Factor analysis of personality traits

Items	**Questions**	**Responses**	**Loading coefficients**
D.8_2	With reference to your work, to what extent do you agree with the following statement: "I feel pride in doing my job better" [replies allowed: 1-7 [1 = strongly disagree, 7 = totally agree]	1-7	0.8165
D.8_3	With reference to your work, to what extent do you agree with the following statement: "I am resolute/determined to do my job well" [replies allowed: 1-7 [1 = strongly disagree, 7 = totally agree]	1-7	0.8368
B.9.1_3	Does your current job require constant updating? If yes, do you self-update: "Through books and magazines" [replies allowed: 1 = yes, 2 = no]	Yes (1)	0.1966
I.26_	Starting from your position of 3/4/5 years ago (as appropriate), did you undertake any of the following types of training/education?: _3: "I taught myself from books, from magazines, from manuals, from video-cassettes, from computers, etc." [Replies allowed: 1 = yes, 2 = no] _4: "I undertook one or more correspondence courses" [replies allowed: 1 = yes, 2 = no] _5: "I have taken evening or weekend courses" [replies allowed: 1 = yes, 2 = no]	Yes (1) Yes (1) Yes (1)	0.2182 0.0293 0.0548