Measuring Skill level integrating Administratrive Dataset and National Collective Agreement Archive

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Abstract

Given the group job classification and collective agreement identification code, we extracted from the national bargaining archive the skill level definition and we created a skill grades classification for the workers. We added this information to Workers History Italian Panel -Whip-, and we created a new variable which allow us to identify whether a worker is skilled or unskilled. The new skill level variable increase the possibility for a better comprehension of labour market issues as well as for new studies in the field of job risk evaluation.

The sections are organized as follow:

1. creation of skill level classification from national collective agreements archive;

2. short explanation of Whip archives;

3. adding informations to Whip archives;

4. checking the consistency and coverage of the skill level variable in Whip;

5. a first interpretation of the resulting skill distribution.

1 The definition of Skill grades for the workers

1.1 Different Measures of Skill Level

The definition of skill level refers to different meanings based on the perspective adopted. If we adopt the "subjective" perspective, the skill level is an individual characteristic of the worker, given by the educational attainment and the experience acquired in the labour market, as well as by unobserved innate different ability.

Education and years of schooling as measure of the human capital were the kernel of the seminal work of Gary Becker(1993), who first developed a complete price theoretic analysis of the individual's investment in education and derived the implications for supply of labor, salary determination, and the path of salaries over the life cycle (Freman,1986). The human capital embodied in a person is defined as an investment at current time and money for future pay. It represents the skills gained by a worker through education. The model has been expanded in these years including on-the-job training and learning by doing as idea of "human capital formation ". There are other sophisticated proxies aimed to measure human capital and skill levels in terms of individual characteristics, but the most relevant problem using these skill grades classification is that those are measures of formal skills that only imperfectly reflect heterogeneity of the individuals, such as innate differences in ability and informal skills (Checchi et al.,2001).

One of the key elements of the human capital model is that education affects earnings. For workers, earnings are proportional to the amount of human capital previously accumulated. From the point of view of the company, human capital is considered as a productive factor, as well as finance and fixed capital. The compensation differential for educated workers is explained by the fact that growing education attainment will increase labour productivity. Starting from these considerations, some studies have used earnings as a proxy for skills, assuming that workers are paid the value of their marginal product.

Davis and Haltiwanger(1991) started from empirical findings concerning the fact that within-skill wage inequality, defined by education, gender and experience, increased continuosly after 1970 (Pierce,1990). They stressed the relevance of heterogenuos experiences in the labour market within the same group of skilled people due to the structural transformation experienced by the economies. Those heterogenous patterns in the labour market may lead workers with the same formal skill level to different earnings. They identify the wage distribution within a firm more adequate then the educational attainment to account for different skills. However, there is an important firm component that may affect wage distribution and indirectly skill grades (Iranzo et al.,2008) as well as sectoral productivity differences which may affect inter-industry wage differentials, such as between services sector and manufacturing sector(Baumol et al.,1966), and between sectors more or less exposed to international competition(Johnson et al. 1999). To overcome these problems, Abowd,Kramarz,Margolis(1999) analyzed simultaneously individual- and firm-level heterogeneity in compensation determination using a linked employer-employee dataset (Leed) of French private sector employment. They proposed a worker fixed effects model obtained as a latent variable from a wage equation, which takes into account both ability and competences of the workers (Iranzo et al.,2008), through the firm fixed effect equation it is also possible to take into account for firm and sectoral idiosyncrasies.

However, some problems remain considering wage distribution as proxies of skill grade levels. As shown by the prominent work of Lazear, firm's compensation policies differ between employers. The bulk of his work is the heterogeneity of

human capital and sorting, as well as the relevance of the personnel policies adopted by the firms. There are several compensation methods. Piece rates method is based on the output produced by the workers. In this case the workers get paid the value of their marginal product. Another incentive payment is through content and prizes. The main difference between prizes and other types of incentive compensation is that in a contest earning depend on rank order among a group of workers, whereas piece rates typically are paid on the basis of individual performance(Lazear,Rosen,1979). The tournament theory analyzes incentives polices as if workers are playing in a tournament. The characteristics of the players must be similar, otherwise the probability to win is more related to some previous differences. The winner is the most productive worker. The winner will receive a gift, such as money or a hierarchical advance, and the workers will be sorted by their ability, because the competition will push workers to do their best. The other partecipants will be incentivated to compete and give more to win the competition. The contest is rank-order because the margin of winning does not affect earnings, the differences between winner and losers might be quite small, as well as very big, and the spread of the compensation might be small or big. This would result in paying salaries which resemble "prizes"; wages which for some workers greatly exceed their presumed marginal product(Lazear,Rosen,1979). This means also that similar wage distribution in different firms can refer to different level of production as well as different skill level distributions. "The essence of human capital theory is that the job is unimportant. Wages and wealth are determined by the individual skills. Occupation and industry variables are secondary variables and almost an embarrassment to the theory. The fact that occupation and industry often enter significantly into wage equations is something that human capital rarely explains"(Lazear,1990).

Another source of firm heterogeneity which may affect the wage distribution is workers' bargaining power within firm (Boeri et al., 2002). As shown by Freeman and Medoff (1984) wage dispersion is generally lower among union workers than their nonunion counterparts(Card,1998). Furthermore, unions can affect wages in an economy directly through a wage drift determined by the wages of workers in jobs where wages are set through collective bargaining (for non-members as well as for members)(Farber,2001).

Others possible ways to build a skill grades classification is assuming an "objective" perspective, refering to the job which is the object of the work performed. The occupational classification scheme as collected by the ISCO-International Standard Classification of Occupations is a tool for organizing jobs into a clearly defined set of groups according to the tasks and duties undertaken in the job. We might interpret the information about occupations as indicators of the requirements of the jobs that have been held by the workers. This classification is a coherent solution to the problems listed above. The fact that the construction is based on an objective definition gives the possibility to control for workers innate unobservable abilities, as well as specific firm's compensation policies or sectoral idiosyncratic heterogeneity.

An example is the skill classification scheme proposed by Blossfelds (1987),

based on three-digit occupation classification. All blue-collar workers who are classified by the employer into an occupation which is characterized by simple manual tasks and white-collar workers performing simple services are considered to be unskilled; blue-collar workers who practice an occupation which involves complicated tasks, white-collar workers performing qualified tasks, as well as semi-professionals are considered to be skilled workers. The third group consists of engineers, technicians, professionals and managers (Bender, Bauer,2004).

Iranzo et al. (2008) in order to define skill levels, exploited the Italian Classification of Occupations (CPI1999), aromonized with the International Standard Classification of Occupations (ISCO88) classification. One-digit-level codes of CPI1999 provide an adequate taxonomy of the workforce divided into skill groups, as occupations are ranked according to complexity and range of tasks involved. In particular, they define as high-skill jobs occupations ranked legislators, senior officials and managers, professional, as medium-skill jobs occupations such as technicians and associate professionals, clerks, service workers and shop and market sales workers, and as low-skill jobs occupations skilled agricultural and fishery workers, craft and related trades workers, plant and machine operators and assemblers, elementary occupations (Iranzo et al. ,2008).

In this paper we propose a measure of skill grades which refers to an "objective" skill level classification of the workers, defined as a set of tasks and skill required to perform a job.

1.2 The skill classification in the industry-wide collective agreements as a measure of skill grades

Our classification is built by using the classification system of the industry-wide collective agreements (Ccnl). This classification defines general positions in the work organization which are associated with specific set of tasks. The industry-wide classification system is organized in two dimensions: the category and the qualification level. Given a job, defined as a set of tasks that the worker is required to perform, the worker will be classified in a specific category with a specific level of qualification.

By law, the workers are classified into several categories, which define different professional profiles. The difference between categories is mainly in contractual accessories, insurance and pension treatments, whereas the qualificational level indicates different skills required and different pay levels. The categories were originally defined by the law, the so-called "legal categories", and then extended by the so-called "contractual" categories, defined by the social partners through the bargaining process. In fact, the art.2095 of the Civil Code, while defining and ranking the main categories, also refers to the legislator and the social partners the concrete application and possible extensions of the categories. These categories are: professional ("dirigente","quadro"), white-collar ("impiegato", "piazzisti"), blue-collar ("operaio", "intermedi").

The second dimension is the type and level of qualification, so-called "inquadramento professionale", defined by the set of tasks involved in the execution of a job. In personnel classification as applied by Ccnl, every qualification level

is defined by a specific group job description (declaratoria), which is a detailed description of the type of jobs of uniform professional content and skills which fall into a single job classification level. The Italian Legislator through art.2095 Civil Code and art.86 disp. att. c.c. defines that qualifications are grouped into levels ordered by their relevance in the company.

By law, the employer must hire the worker to the proper category and qualification defined by the content and type of tasks and skills involved in the job. Furthermore, art.2103 Civil Code rules that the job performed by the worker must correspond to the category and qualification defined in the agreement.

Traditionally, the social partners through the bargaining process defined different qualification level for each category, ordered by the complexity of the tasks and the degree of autonomy and responsability.

Contratto dell' Industria Metalmeccanica

cod_contratto	livello	descrizione qualifica	categoria	qualifica
113	1	lavoratori che svolgono attività produttive semplici per abilitarsi alle quali non occorrono conoscenze professionali, ma è sufficiente un periodo minimo di pratica	operai	operai comuni
113	2	lavoratori che svolgono attività per abilitarsi alle quali occorrono un breve periodo di pratica e conoscenze professionali di tipo elementare	operai	operai comuni
113	2	lavoratori che, con specifica collaborazione, svolgono attività amministrative che non richiedono in modo particolare preparazione, esperienza e pratica di ufficio	impiegati	impiegati d'ordine
113	3	lavoratori che, con specifica collaborazione, svolgono attività esecutive di natura tecnica o amministrativa che richiedono in modo particolare preparazione e pratica di ufficio o corrispondente esperienza di lavoro	impiegati	impiegati d'ordine
113	3	lavoratori qualificati che svolgono attività richiedenti una specifica preparazione risultante da diploma di qualifica di istituti professionali o acquisita attraverso una corrispondente esperienza di lavoro;	operai	operai qualificati
113	5	lavoratori che, oltre a possedere tutte le caratteristiche indicate nel 1°alinea della declaratoria della 4a categoria, compiono, con maggiore autonomia esecutiva e con l'apporto di particolare e personale competenza operazioni su apparati o attrezzature complessi, che presuppongono la conoscenza della tecnologia specifica del lavoro e del funzionamento degli apparati stessi	operai	operai specializzati
113	5	lavoratori che, con le caratteristiche di cui al 3° alinea della declaratoria del livello precedente, svolgono coordinamento e controllo di attività tecniche	intermedi	intermedi
113	5	lavoratori che, con specifica collaborazione, svolgono attività amministrative o tecniche caratterizzate da adeguata autonomia operativa nei limiti dei principi, norme e procedure valevoli per il campo di attività in cui operano, e che richiedono un diploma di scuole medie superiori o corrispondente conoscenza ed esperienza	impiegati	impiegati di concetto
113	6	lavoratori sia tecnici che amministrativi che, con specifica collaborazione, svolgono funzioni direttive o che richiedono particolare preparazione e capacità professionale, con discrezionalità di poteri e con facoltà di decisione e autonomia d'iniziativa nei limiti delle sole direttive generali loro impartite	impiegati	impiegati direttivi
113	7q	lavoratori che nell'ambito delle sole direttive strategiche previste per il settore di appartenenza, impostano, sviluppano e realizzano, con ampia autonomia e capacità propositiva e approfondita conoscenza delle connessioni tra il proprio settore e quelli correlati, studi, progetti e piani per il raggiungimento degli obiettivi dell'impresa ..	quadri	quadri

Following, the ranked-order classification scheme by job category:

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Category	Category's definition	Tasks Performed	Qualification
Blue collar	productive activity	simple	operai comuni
	mainly manual tasks	qualified	operai qualificati
		specialized	operai specializzati
		coordination	operai intermedi
White collar	administrative activity	simple	impiegati d'ordine
	mainly non manual tasks	simple	piazzisti
		autonomy	impiegati di concetto
		coordination	impiegati direttivi
Professional	directive functions	strategic	quadri
		managerial	dirigenti

Before the renewal of 1973 the classificational scales were separated by categories. This system was overcome with the introduction of a unique classificational level, the so-called "inquadramento unico". The unified qualificational level rules equal economic treatment between workers hired in the same level, even if in different categories, whereas certain contractual provisions and insurance treatments remain different across categories.

Given the ranked-order job classification specified in each national collective agreement, we are able to group the workers in terms of common professional content, defined as a set of skills needed to get classified in that specific level of occupation. This information can be used as a good proxy of the workers skill levels because of Italian Bargaining Legislation and Article 39 of the Italian Constitution. This law determines the applicability of the industry-wide collective agreements to all workers of the same industry providing automatically elegibility (erga omnes). This means that all the workers in the labour market are automatically covered by Ccnl and by a specific job classification.

The Agreement of 23 July 1993 subscribed by the social partners also formalized the industry-wide level as the unique bargaining level where social partners are allowed to define and rank group job classification. This means that there is an unique skill grades classification by Ccnl. The National Economic and Labour Council (Cnel) provides an on-line public and free accessible database which contains all the industry-wide collective agreements signed by the social partners in the last 20 years.

Summarizing:

1. Each industry-wide collective agreement provides a job classification which refers to the tasks involved in a job;

2. All the workers are classified in their job through this classification;

3. These classifications are collected by the National Economic and Labour Council.

Starting from these exhaustive descriptions of the tasks involved in the bargaining job description, we are able to differentiate the workers and create a skill grades classification. Low skilled workers are all the blue-collar workers who are classified as common workers into an occupation which is characterized by simple manual tasks and white-collar performing simple services and displaced

sellers ("piazzisti"). Medium skilled workers are all the blue-collars who perform an occupation which involves complicated tasks defined as qualified tasks, and white-collars who perform with a sufficient level of autonomy in their job. High skilled workers are blue-collars performing specialized jobs, white collars workers performing directive tasks and professional white-collar, such as doctors and journalists which are classified as white-collar but their job is characterized by a high degree of autonomy and responsability, and professionals.

Category	Category's definition	Tasks Performed	Qualification
Blue collar	productive activity	simple	operai comuni
	mainly manual tasks	qualified	operai qualificati
		specialized	operai specializzati
		coordination	operai intermedi
White collar	administrative activity	simple	impiegati d'ordine
	mainly non manual tasks	simple	piazzisti
		autonomy	impiegati di concetto
Professional	directive functions	coordination	impiegati direttivi
		strategic	quadri
		managerial	dirigenti

# 2   The Construction of Skill Level Classification

The National Collective Agreements Archive is an on-line public archive of industry-wide and company-level collective agreements. As first step, we selected all the manufacturing industry collective agreements for the current year and not expired yet[1]. We were interested in the normative provisions of the bargaining process, where social partners provide a detailed description of job classification levels for blue and white collars as well as for professionals. The normative provisions are subscribed every four years by the social partners, which means that every collective agreement has a four years period of validity by default. We extracted informations concerning the agreement identification code, the description of the qualifications and the relative ranked order levels, the internal sub-sectoral applicability and the period of coverage. The result was a textual archive with all these informations. In the first step we organized and labeled the qualificational level information ("mansione cnel") by categories as in the tradional vocabulary of italian industrial relations and bargaining process. We also searched for other archives already available. We found UnicoLavoro, which is one of the most important private database for professionals. Unicolavoro provides an almost complete skill levels classification. We used UnicoLavoro

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[1]Although the selection of the manufacture industry, the range of the collective agreements we investigated was spread all over the sectors. This because the industry agreement applied to a particular company is not strictly related with the sector where the firm is classified. We may have the case where a firm changed the sectoral classification without changing the collective agreement, as well as, expecially for outsourced companies,cases that apply the agreement of the main contractor.

to control and integrate our classification. We end up with a classification for each job category in every collective agreements not yet expired.
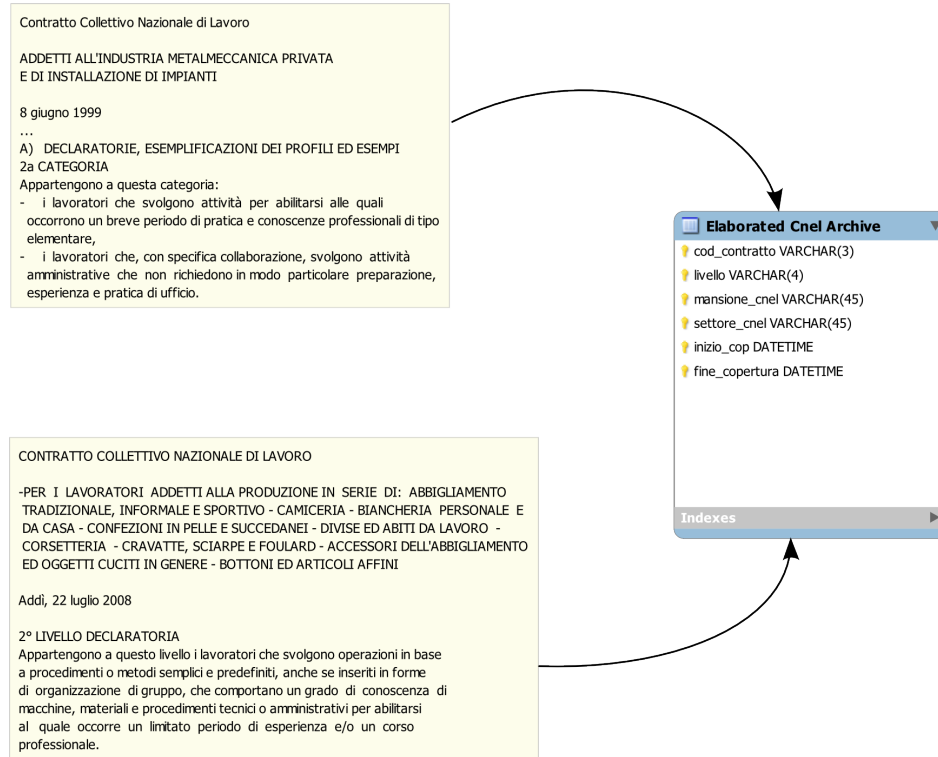
In the first extraction of the qualification identified in the collective agreements, we also found other categories, such as doctor and journalist. These other high skill workers are assigned to the white collar category, but they are not ranked in the traditional qualificational classification. We decided to expand the category of directive white collar ("impiegati direttivi"), including in it professionals white collar, given the particular level of responsability and autonomy in the tasks performed. So, the new category become directive and professional white collar ("impiegati direttivi e professional").

| Table 1. Normalized Cnel Archive: Expanding directive white collar category		
Categoria	**Mansione_cnel**	**Professione**
impiegati	impiegati direttivi	impiegati direttivi professional
impiegati	medico	impiegati direttivi professional
impiegati	fisico biologo chimico	impiegati direttivi professional

Some collective agreeements provides also an internal classification by industry, because they cover different industries. So, we separated each internal sectoral classification.

Table 2. Normalized Cnel Archive: Splitting records by industry			
cod_contratto	livello	professione	settore_cnel
35	3e	operaio comuni	chimico farmaceutico
35	3e	operaio qualificati	fibre chimiche
35	3e	operaio comuni	ceramica e abrasivi

The main problem with the internal sub-sectoral job classification is when mapping this information into other archives, particularly, with the panel of workers history -Whip-. The problem concern the fact that the sectoral attribution as defined in the industry-wide agremeents does not correspond to the National Bureau of Statistics Classification Code, which is used in labour market archives, such as Whip. This fact may lead to a miscoding of the workers skill level. In fact, in a particular agreement the same level may refers to different skill grades, due to the fact of different sub-classification, as shown in the example above. To overcome this problem, we created a conversion table between the 5-digit csc code[2] with the sectors as defined in the agreements. The conversion tabel was constructed in three steps. In the first step, we extracted the list of industry-wide collective agreements with internal sectoral classification. Second, we selected from the Worker History Italian Panel among years all the workers who were applied one of the agreements in our list. Then, we extracted from these workers the information about the 5-digit industry were they resulted hired. We end up with the complete list of industries at 5-digit Inps classification code (csc) associated to our agreements with sub-classification. The next step was to construct the conversion table, associating the 5-digit csc codes to the proper sector, as defined in the collective agreement. To do that, we checked the "industry field of application" of every collective agreement, and with the support of a labour union representative, we attributed to some of the industry codes the sectoral reference in the agreement. We assigned the reference list to every sub-classification.

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[2]CSC, Codice statistico contributivo, refers to Inps sectoral classification compatible with Ateco '81 classification code as applied by the National Bureau of Statistic ISTAT.
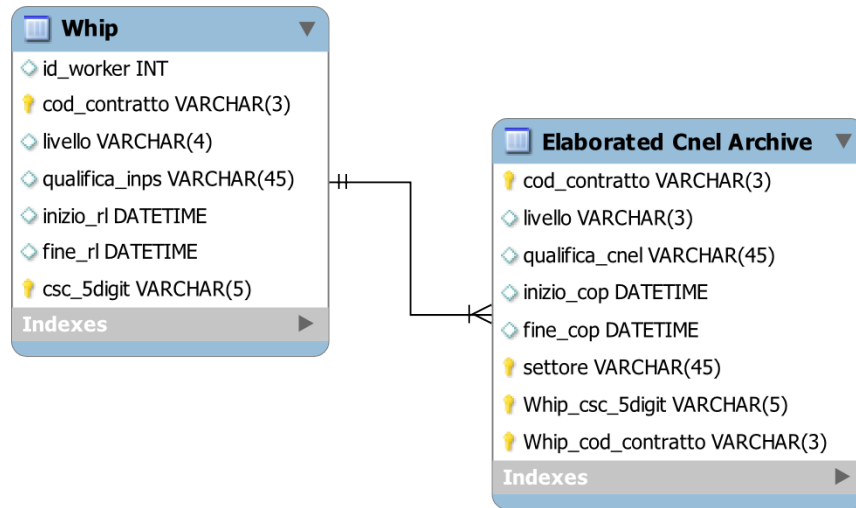
The next table shows the average percentage of coverage for the cases with internal subclassification, where we applied our conversion table.
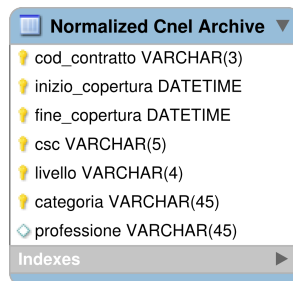
Table 3. Mean of Covered Workers 1995 2004 (%)	
Cod_contratto	Percentage of coverage
014	68,75
035	69,09

Once we finished this first classification, we controlled for change in job classification since 1990. A change in the grouped job classification can only be due to an industry-wide renewal by the social partners. We created a new variable which contains the start and end period of validity of a particular skill level definition and classification. This variable allow us to extend the coverage of our skill variable to all the year that we controlled for.

Table 4. Normalized Cnel Archive: Adding Coverage Period			
cod_contratto	livello	professione	inizio_copertura
47	7	impiegati direttivi	29nov1990
47	6	impiegati di concetto	29nov1990
47	5	operai specializzati	29nov1990
47	3	impiegati d'ordine	29nov1990
47	b1	impiegati direttivi	1jan2001
47	ca	impiegati di concetto	1jan2001
47	cc1	impiegati d'ordine	1jan2001
47	da2	impiegati d'ordine	1jan2001
37	1a	operai comuni	27jul1990
37	2b	impiegati d'ordine	27jul1990
37	3c	operai qualificati	27jul1990
37	5f	impiegati direttivi	27jul1990
37	h	quadri	27jul1990

Summarizing, the Normalized Cnel Archive provides a proper skill level classification for each occupational category (composed by "livello" and "professione") and internal sub-sector ("csc"), for an extended span of time ("inizio_copertura" ,"fine_copertura") for each collective agreement ("cod_contratto").

Normalized Cnel Archive ▼
- cod_contratto VARCHAR(3)
- inizio_copertura DATETIME
- fine_copertura DATETIME
- csc VARCHAR(5)
- livello VARCHAR(4)
- categoria VARCHAR(45)
- professione VARCHAR(45)

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Starting from our variable "professione", we create a skill grades classification which put together blue and white collars and professional. The skill level variable is classified as follow:

Profession	Skill level
operai comuni	low
operai qualificati	medium
operai specializzati	high
operai intermedi	high
impiegati d'ordine	low
piazzisti	low
impiegati di concetto	medium
impiegati direttivi professional	high
quadri	high
dirigenti	high

Once we created skill grades classification, the next step was to map this information to the workers careers in the labour market. We added the skill information to the Workers History Italian Panel.

3   Adding Skill Grades Information to Workers History Italian Panel

3.1   Imputing Rules for Workers Micro-data

Before adding the skill informations of the normalized cnel archive, we adjusted our worker archives. The main problem for the attribution of a skill level for the workers concerned the apprenticeship contract. The workers who are employed with an apprenticeship contract are recorded by the National Social Insurance Institute with a particular code, which does not specify whether they are blue-collar or white-collar. As already mentioned above, without this information it is impossible to attribute a univoque skill level identification, and to apply our skill grades classification. For this reason, we needed an imputation rule to map those cases.

Following Italian Legislation, the apprenticeship contract is a fixed-term mixed contract with work and occupational training. It has a duration between 2 and 6 years, depending on the level of the skill the workers will reach at the end of the contract. During this period the worker is classified not more than two levels under the level that he/she will reach at the end of the apprenticeship. He/she is also applied a reduction on his/her salaries, which will decrease over time. When the contract expires, the employer has the possibility not to hire the worker. In case of hiring, the worker will be classified in the new level. In order to impute the category of the apprentices, we followed the history of these workers over time, particularly, when they switch from apprenticeship to other contracts. When they change their occupational category but do not change company identification code where they are hired, the category of the contract must correspond to the category of their apprenticeship. The job spells classified as apprenticeship in the whole period are 109012, through our procedure we

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identified 43165 employment spells (39,6%). We also imputed the category for those workers that change job, but find a new one in less than six months. We can assume that their human capital is not obsolete and that they will be hired in the same category that they were originally trained for.

3.2 Merging Skill Grades Variable to Workers Micro-Data

In the previous section we created our Normalized Cnel Archive, which contains a skill level identification for each job qualification as specified in the industry-wide collective agreements. This archive defines a unique skill level, given the collective agreement applied to the worker, the level and the qualification, the period when the worker is hired and the industry where the worker is employed. Mapping the skill level variable to Whip means that for all the workers in Whip, knowing the collective agreement that is applied to them, the occupational category, the complete employment spells history with relative periods and the information about the industry code[3] assigned to the company where they are employed, we are able to assigne a unique skill attribution. Of course, Whip provides all these informations.

The merging key is composed by five variables: contract code, category, level of qualification, employment spell period, industry classification code. The resulting query attributes the skill level "professione" for each workers of Whip archive.

4 Checking for Skill Level Variable coverage

Once we mapped our skill level variable into Whip archive, the next step is to control how it fits with our original data. To do that, we first control year by year the percentage of coverage in Whip, which means the percentage of workers that we are able to assign a skill level.

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[3]Whip provides two different classification: 5-digit Ateco '81 and 3-digit Ateco '91

Tab.5 Coverage, Overall Economy and Manufacture					
Year	**Coverage**	**Overall**		**Manufacture**	
		Abs Value*	Percent	Abs Value*	Percent
	Covered	74206	65,93	40647	84,63
1995	Not covered	33062	29,37	3981	8,29
	Not recognized	5288	4,7	3398	7,08
	Covered	75248	66,09	41179	84,72
1996	Not covered	33600	29,51	4220	8,68
	Not recognized	5009	4,4	3207	6,6
	Covered	75536	66,1	41115	84,93
1997	Not covered	33789	29,56	4174	8,62
	Not recognized	4964	4,34	3125	6,45
	Covered	77916	67,13	41651	85,68
1998	Not covered	33144	28,56	3853	7,93
	Not recognized	5005	4,31	3104	6,39
	Covered	82163	66,57	42363	84,9
1999	Not covered	35593	28,84	4121	8,26
	Not recognized	5671	4,59	3415	6,84
	Covered	87962	66,19	43868	84,61
2000	Not covered	38627	29,07	4339	8,37
	Not recognized	6294	4,74	3640	7,02
	Covered	89799	65,1	43475	83,49
2001	Not covered	40787	29,56	4441	8,53
	Not recognized	7373	5,34	4155	7,98
	Covered	90527	64,05	42811	82,91
2002	Not covered	42507	30,08	4377	8,48
	Not recognized	8289	5,87	4448	8,61
	Covered	90668	62,79	41495	81,95
2003	Not covered	44371	30,73	4493	8,87
	Not recognized	9361	6,48	4648	9,18
	Covered	89361	61,35	39828	80,51
2004	Not covered	45600	31,31	4465	9,03
	Not recognized	10686	7,34	5173	10,46
*Whip is a worked based sample 1:90					

The non-selected agreement column refers to those agreements that, at this first step, we do not take into account.

In fact, we focused on the most important contracts in the labour market, which cover the greatest number of workers; in the next future, we will extend our map.

The table shows that, on average we are able to identify the skill level for 80% of the workers in the manufacture industry and 65% in the overall economy.

As mentioned above, our key merge has 5 components: the contract code, the period of validity of the contract (start and end), the category and the qualificational level. The cases that we didn't recognized refer mainly to unidentified classificational levels. These classificational levels are different from the levels that we extracted from the agreement archives. This fact could be due to a misscoding process, when storing the classificational level of the workers, or by different way adopted by the officers to store it. About 60140 employment spells not recognized (38,41%) refer to those workers hired as apprentice that we are not able to distinguish (see previous paragraph).

Table 6 shows the percentage of coverage by area in the manufacturing industry. In the North of Italy, we have the highest percentage of coverage, about 85% of the workers in North-West and 83% in Nort-East; whereas the lowest level is reached in the South (77%) and Islands (74%).

Tab.6 Coverage by area, Manufacture			
Area	Covered	Not covered	Not recognized
North-East	83,53	7,05	9,42
North-West	85,67	8,11	6,22
Center	75,6	15,08	9,32
South	77,3	14,2	8,5
Islands	74,02	17,65	8,33

In Table 7 we control for the percentages of coverage in the manufacturing sub-sector. We use a 2-digit industry disaggregation. The table shows that there are differences in the levels of coverage across industries. There are two sectors that seems to be problematic. The residual manufacture industry ("*Industria delle manifatture diverse*") has the lowest level of coverage, with only 36% of the workers skill level recognized. In this sector are employed about 4% of the workers in the manufacture industry. The other sector which exibit a problem of coverage is the Print and Paper Industry ("*Industria della carta, della stampa e dell'editoria*"), which has a coverage rate of 59 percent. In this sector are employed about 5% of the total workers in the manufacturing industry.

Tab.7 Coverage by 2-digit sector, Manufacture

Industry	Covered	Not covered	Not recognized
Industria della carta, stampa,editoria	59,24	29,15	11,61
Industria della costruzione di altri mezzi di trasporto	88,4	4,28	7,32
Industria della costruzione di prodotti in metallo	90,16	4,01	5,83
Industria della costruzione di strumenti, di apparecchi di precisione	76,99	15,74	7,27
Industria costruzione,installazione di macchine,materiale meccanico	92,76	2,71	4,53
Industria di costruzione, montaggio di autoveicoli,parti ed accessori	97,42	0,99	1,59
Industria della costruzione, installazione di impianti,riparazione	89,98	4,45	5,57
Costruzione, riparazione macchine per ufficio,elaborazione dati	86,16	10,36	3,48
Industria della gomma,manufatti di materie plastiche	65,65	6,73	27,62
Industrie alimentari di base	73,43	11,15	15,42
Industrie del legno e del mobile del legno	78,61	4,2	17,19
Industrie di calzature,articoli d'abbigliamento,biancheria per la casa	82,2	7,28	10,52
Industrie delle pelli e del cuoio	60,61	9,9	29,49
Industrie dello zucchero, delle bevande,del tabacco	85,2	7,75	7,05
Industrie manifatturiere diverse	35,2	57,64	7,16
Industrie tessili	90,05	4,83	5,12

Ateco81 Industry Classification 2 digit

### 4.0.1   A first interpretation of Skill distribution

When observing the skill distribution, one should bear in mind that skill grades attribution results from skill groups classification as defined in the collective agreements. This means that we are not taking into account *ad hoc* benefits or premium (individual or collective) that the employer could use as a matter of recognition of not accountable ability. The skill distribution emerging from our analysis is a formal measure of the legal tasks that a worker is supposed to do during his/her jobs.

The graph.1 shows the distribution of skill level in the manufacture industry in the period 1995-2004; the percentages are calculated by category and for all the workers in the manufacture industry.

Graph.1 Skill Distribution in Manufacture 1995–2004
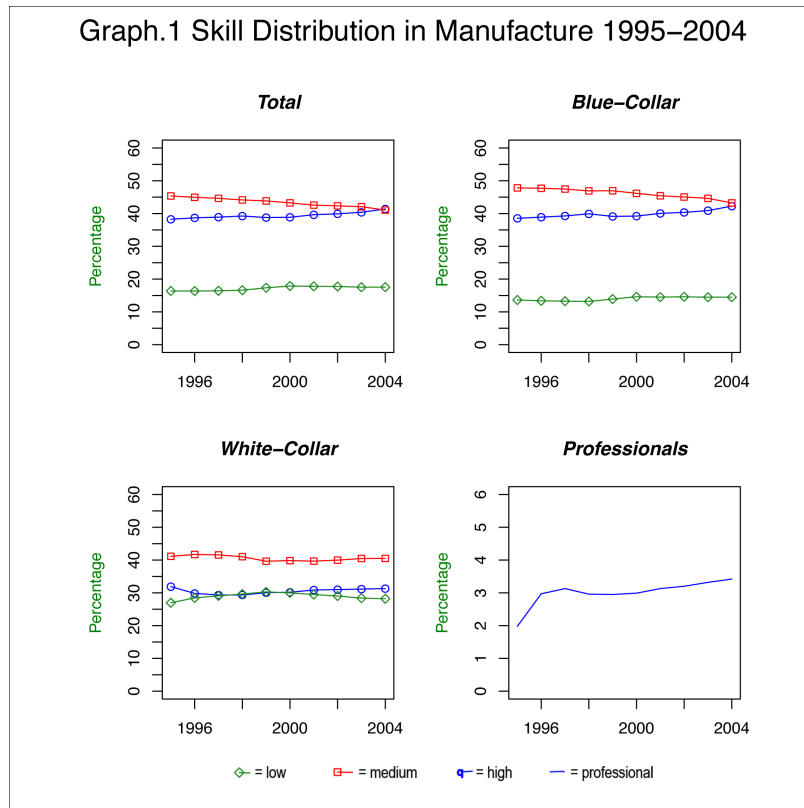
Box 1 in Graph.1 shows a general increase in the portion of high skilled workers across years, whereas the rate of medium skilled workers decrease consistently during the whole period and the percentage of low skill workers remains quite constant overtime. The same trend is observable for the distribution of the skills in the blue-collar category (Box 3), where the high skill workers increase from 38,6% in 1995 to 42,4% in 2004. In the same years, the medium skill workers decrease from 48,85% to 43,8% and low skilled pass from 14,4% to 15%. For what concern the white-collar workers (Box 2), the percentage of high skilled workers decrease and the percentage of the low skilled workers increase from 1995 to 2000, until they overlap. From 2000 to 2004 the trend changes and the curve of the high skilled workers increase, l of low skilled workeres decrase. The curve of medium skilled workers follows the trend of the low skilled workers. Box 4 shows the trend of the professionals, which grow from 2% to 3,5%.

Graph. 2 Skill distribution by spell duration (avg 1995 2004)
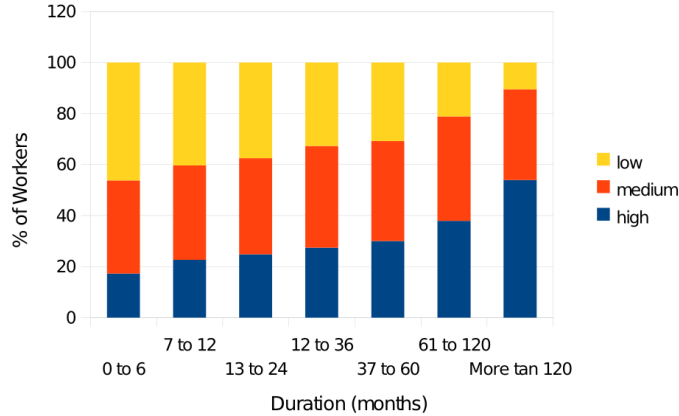
Another important issue concerning the skill distribution regards its form. Indeed, for all the categories, what we observe is not a pyramide, with a large basis that decrease until the top, but instead a distribution where the majority of the workers are concentrated in the medium skill and just few workers are at the beginning of the pyramide. To understand this phenomena, we need to refer to the specific industrial relation system. For what concern Italian law about collective agreements, the law states that social partners define automatic wage increase related to the experience acquired by the workers over the time, but they cannot define automatic qualificational increase. But since the "medium" skill level is not related to acquiring a formal training, it can be achived through the age of experience of the workers. Indeed, as shown in Graph. 2, if we look at the skill distribution by the duration of the employment spell, the skill level increase with the duration of the employment spell.

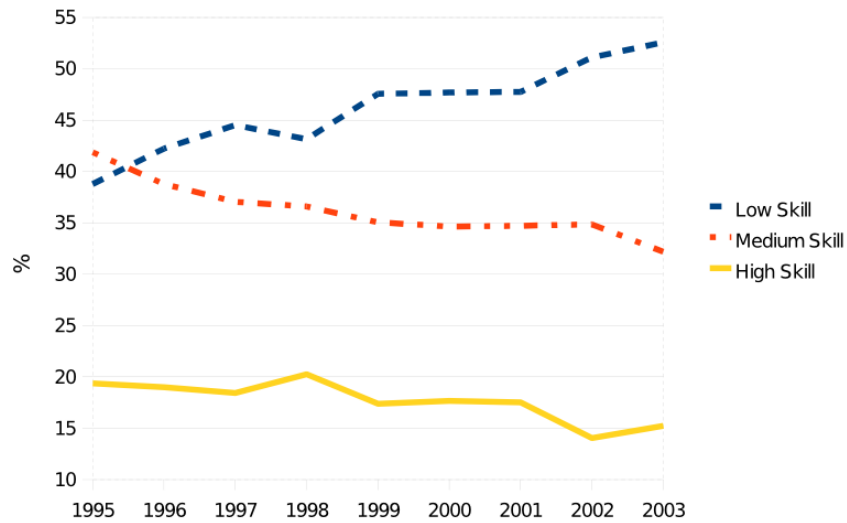Graph. 3 shows the skill distribution by workers'age.

Graph.3 Skill distribution by age, Italy avg(1995 2004)
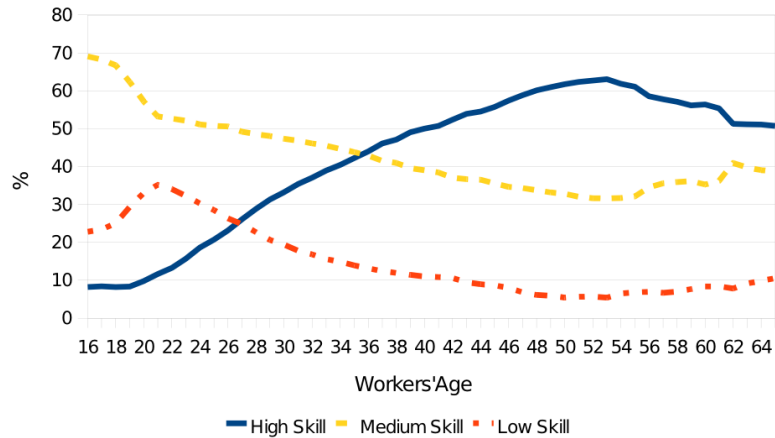
The distribution of the skills by age show different dynamics by skill level. In fact, the low and medium skills has two picks. For the low level, the pick is around 20 years old, which identify young workers that probably do not have a strong experience in the labour market. The portion of low skilled workers decrease constantly overtime. The pick of the medium skill level is translated of few years before, reaching a pick when the workers are around 16 years old. The medium skilled workers curve exibit a similar dynamics of the low skilled workers curve. In fact, the portion of the medium skill workers decrease overtime. The portion of medium skilled workers represents the largest component of the workforce until the workers are 35 years old, then the curve of the high skilled workers overtake the medium skilled curve. The high skill distribution exibit an opposite dynamics. The curve increase overtime and reach its pick around 35 years, and then growths until 54 years old (which represents the central age class).

The skill distributions shown in graphs. 2-3 seems to be affected by the workers'age and the job tenure of the workers. Furthermore, this phenomena is reinforced by the ageing of the Italian workforce (Contini,2005). To overcome the problem of the *"automatic"* increase in the skill classificational level given by the ageing of the workers, I first focused on the skill distribution of the new entrants in the labour market in the period between 1995-2003.

Graph.4 New Entrants Skill Distribution, Italy 1995 2003

Graph.4 shows the skill distribution of the new entrants in Italy in the period between 1995 to 2003. In this case, the distribution is not affected nor by the large component of ageing worker, neither by the long job tenure of the workers in the manufacture industry. In this graphic, we focused on the hire dynamics of the period 1995-2003. The resulting picture is quite different compared to the general skill distribution in the manufacturing sector. Indeed, there is a clear decreasing trend of the high and medium skilled workers, which pass, respectively, from 19% to 15% and from 42% to 33%; whereas the percentage of low skilled workers increase from 38% to 53%. This trend is confermed in the next graph, where we observe the overall skill composition in the manufacture industry by class age.

Graph.5 Skill distribution by age class and year, Italy 1995-2004
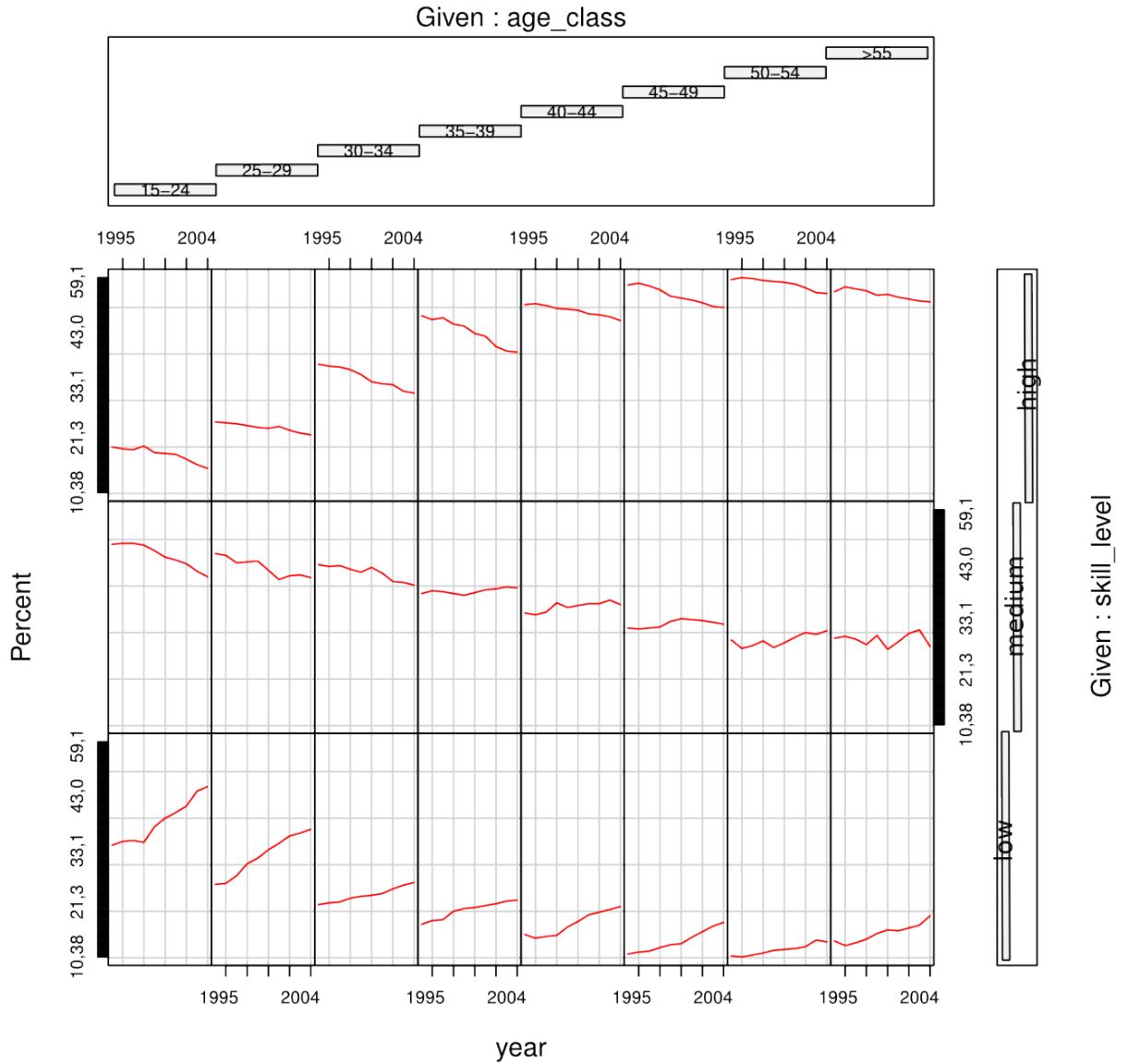
Graph.5 shows the skill distribution trend by age class in the period between 1995-2004. As already mentioned above (graph.3), there are several differences in the skill composition between different age classes. Indeed, the percentage of high skill level increase with the age class, passing from about 20% for the youngest workers to 59% for the oldest workers; an opposite trend is observable for the low skill level, which decrease with the age class. Conversely, the general trends overtime are quite similar in all the age classes. The percentage of high skilled workers decrease overtime in all the categories, whereas the percentage

of low and medium skilled workers strongly increase. The slopes are pronounced in all the categories, and particularly in the class 15-24.

This preliminary analysis of the data concerning the workers' skill distribution in our sample have shown that, on the one hand there is a general increase (decrease) in the percentage of high (low and medium) skilled workers during the period covered in the manufacture sector, and on the other hand, that, if we control for the age composition of the workforce and the job tenure, there are evidence of a general trend of dequalification of the workers, both in terms of workers employed in the labour market and new entrants.

4.1 Conclusion

In this article, we exploited the national collective agreement to create a skill level variable for the Workers History Italian Panel. Through the occupational classification scheme as defined by the social partners, we interpreted the information about occupations as indicators of the skills that have been held by the workers. Indeed, we considered the set of tasks involved in the job is an indicator of the skills required to get classified in a specific occupational level. We end up with a detailed classification of the skill level for white-collar, blue-collar and professional. Through our methodology we were able to classified the occupational skill level of the 75% of the workers in the manufacture industry and the 57% in the overall economy. We explore the skill dsitribution of the workers in the manufacture industry in the period between 1995 to 2004.

As a first look, the data seems to show a general increase in the high skill positions, together with an decrease in the low and medium skill jobs. Due to the particular italian industrial relation system, which can create a sort of "*automatic*" mechanism of carrier increase, and the italian ageing of the workforce, we control for job tenure and workers'age. Through the introduction of these controls, the evolution of the skill composition of the workforce has been resulted quite different. Indeed, the trends in the labour market in terms of skills composition, as well as in terms of new entrants exibit a general pattern of dequalification.

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