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An investigation into the role of human capital competences and their pay-off

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Keywords *Human capital, Competences, Labour market*

Abstract *In this paper, the role of three different types of competences in the labour market for higher education graduates is investigated. The article distinguishes discipline-specific competences, general academic competences and management competences, the first being an example of competences acquired at school, which are of direct use in the labour market, the second being a type of competences also acquired in school, but which fulfil an indirect role by facilitating the acquisition of new competences after graduation from school, and the third, management competences, being an example of competences acquired mainly in a working context and, like discipline-specific competences, being of direct use in that context. This paper shows that, first, the level of discipline-specific competences obtained in higher education offers a comparative advantage for graduates working inside the own discipline-specific domain, and therefore has a pay-off for those graduates who are able to find a job in this domain; second, the management competences are valued in the labour market but seem to be more likely acquired in a working context than in higher education, and third, the general academic competences acquired in higher education do not pay off directly, but have a significant supportive role when learning competences that have a direct pay-off in the labour market, like management competences, but are more likely acquired outside education.*

1. Introduction

There are several well-known reasons to transfer the generation of knowledge and skills partially from the initial schooling phase to the working life later on. One of them is the uncertain future application possibility of specific knowledge and skills obtained during the educational career. Another reason is that some groups of knowledge and skills can be generated more efficiently in a context combining working and learning or, in general terms, when one possesses more life experience. Considering this transfer, one has to take into account that the effectiveness of a postponed learning process is partially determined by the amount of knowledge and skills obtained during the initial schooling.

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To get insight into what can be learned in the initial schooling and what can be generated in the post-initial phase, it is of importance to analyse the type of knowledge and skills to be considered and their effect on allocation and pay-off during the transition period from higher education to the labour market. In this paper, we try to gain insight into the different roles and the pay-off of three specific groups of competences: discipline-specific competences, as an example of competences that can be learnt effectively in initial education, management competences, as an example of competences more likely to be acquired in a working context, and general academic competences, as an example of competences that improve the learning process in initial education or in later training. To start with, a short literature review will provide some insight into the research done so far and the criticism on it.

Changes in the modern workplace, brought about by technology, management innovations, and increased competition in the global marketplace, have led to many concerns about the adequacy of workforce competences (Stasz, 1998). Discussions on this problem often emphasize the importance of certain competences and blame the educational system for inadequately providing them. Labour market parties thereby too easily relate the competences needed to function in a job and to achieve a high salary with what initial education should generate. This is the idea one gets when looking at studies (Bishop, 1995) in which the central question is whether general competences or rather occupation-specific competences pay off on the labour market.

In the current debate on occupation-specific versus general education and training, Bishop (1995)[1] strongly advocates that education should focus on occupation-specific competences rather than on general academic competences. According to Bishop, "research shows that productivity derives directly from social abilities (such as good work habits and people skills) and cognitive skills that are specific to the job and occupation, not from reading, writing, and mathematics skills". Bishop hereby departs from the premise that academic competences are mere tools for developing specific competences but not a good substitute for occupation-specific competences. "While learning a new skill is easier when the worker has good basic skills, a foundation of job knowledge and occupational skills is usually even more essential", according to Bishop. In an earlier article, Kang and Bishop (1989) argue that for high school graduates who enter the labour market, vocational and academic education in high school are complements rather than substitutes. The more recent research literature (Altonji, 1995; Campbell and Laughlin, 1991; Mane, 1999) also tends to find stronger positive effects of vocational course work on labour market outcomes.

While these authors stress the importance of occupation-specific competences, other authors underline the importance of general (or generic) competences. Stasz *et al.* (1993) state that "Employers and workers note the need for generic competences, such as problem solving, communication and the ability to work in teams". Furthermore, Duncan (1968) already mentioned that

"Verbal and quantitative skills are especially significant outcomes of higher education, not only because they are valuable in their own right but also because they facilitate learning of all kinds in college and throughout life". In line with this, Bowen (1977) sees that "the important substantive aims of higher education do lie in the realm of residues ... [and that] ... the residues also consist of the skills and perspectives that enable students in later life to learn or relearn detailed knowledge in a variety of fields as occasion demands and to fit this knowledge into a framework of larger principles and concepts".

In addition to the discussion on general academic versus discipline-specific competences, the past few decades have been characterized by a growing need for university graduates who are properly prepared for management positions in a postindustrial economy with global competition. Universities responded to the need for graduates by starting a variety of graduate and postgraduate courses in management topics. The actions, which are according to Whetten and Cameron (1995) of critical importance for effective management, refer thereby to personal skills (e.g. creative problem solving), interpersonal skills (e.g. motivating others or managing conflicts) and group skills (e.g. empowering and delegating). The effectiveness with which management skills can be acquired in classrooms is thereby discussable. Milter and Stinson (1995) argued that traditional management and business education falls short in educating leaders for the new competitive environment. In line with that, McCall *et al.* (1988) found that most of the development of management competences takes place on the job, and not in seminars, classrooms or MBA programs.

In deriving competences to be taught in initial education from the competences required in the workplace, important points are often neglected. First, the notion that some competences are acquired more likely in combination with work than in a purely educational context. In this respect, Becker (1962) already argued that "some types of knowledge can be mastered better if simultaneously related to a practical problem; others require prolonged specialization". This argument is further supported by studies of Ducatel (1998), Green *et al.* (2001) and Heijke *et al.* (2002).

The second point of neglect is the notion that education is the best place to generate competences needed to improve the efficiency with which additional competences can be generated later on. In general, more educated workers train more because the available human capital is an input in the production of new human capital or because individuals who are better "learners" will invest more in both schooling and training (Bartel and Sicherman, 1998). Similar argument is found in the works of Johnson (1979), Stasz (2001) and van Smoorenburg and van der Velden (2000).

The third point relates to the data availability. As a consequence, educational indicators (such as tenure, grades, courses) are often used as proxies for a worker's available competences. However, in today's knowledge economy with its emphasis on continuous learning, these kinds of indicators

are no longer sufficient for measuring or predicting career success. For instance, Allen and van der Velden (2001), Green (1998), Green *et al.* (2001), Heijke and Ramaekers (1998), Heijke *et al.* (1998), McIntosh and Vignoles (2001), O'Shaughnessy *et al.* (2001) and Stasz (2001) have done research into the labour market value of particular work competences, which can be seen as a more accurate and reliable way for estimating individual labour market capacities.

This paper, following in particular the line of research set out by Green (1998) and Heijke and Ramaekers (1998), contributes to the these discussions by analysing the role of discipline-specific, general academic and management competences, acquired in higher education.

In general terms, university education can be seen as organized around disciplines. However, in university education students acquire not only discipline-specific competences, but also general academic competences[2]. General academic competences are needed to acquire a coherent body of discipline-specific competences. Vice versa, by learning discipline-specific competences, students also acquire general academic competences, which in turn increase the effectiveness of the learning process through which discipline-specific competences are acquired. Furthermore, general academic competences not only further the acquisition of discipline-specific competences, but also foster the development of other competences, either during the higher education process or later on, valued in the labour market (e.g. management competences).

To examine the relationship between education and the labour market, and hence the role of these competences during the transition period, the pay-off of these competences will be estimated through two indicators: wages and job match quality (i.e. the allocation of graduates to positions inside and outside their discipline-specific domain). The latter is thereby based on the assignment theory (for an overview, see Sattinger, 1993), which takes explicit account of the interaction between characteristics of the worker and the job. This theory shows how heterogeneous individuals are allocated to jobs that require varying competences on the basis of the competences that they possess. It is assumed that the competences which individuals possess give them comparative advantages in certain types of occupations. Hence, graduates of some fields of education have better job opportunities in occupations strongly related to their field of education (Hartog, 1992).

To investigate these issues, we use data from a survey designed to collect detailed information on formal education attained, including information on competences, additional training followed, and job requirements. As the data concern young Italian higher education graduates interviewed three years after graduation, they allow analysing the allocation and pay-off in the early labour market careers of the graduates.

The results outline the different roles of general academic discipline-specific and management competences. We find, first, that discipline-specific

competences influence positively the chance of graduates being matched to a job inside the own discipline-specific domain, where these graduates are better paid. Secondly, the management competences are directly valued in the labour market, but seem to be more likely acquired in a working context than at university. Finally, the general academic competences have a significant supportive role as a base upon which graduates can fall back to train especially those competences (e.g. management competences) that are acquired more likely outside education. General academic competences therefore only pay-off indirectly.

The structure of the paper is as follows. In Section 2, we describe the data that were used for this paper, the concepts and their operationalisation, and we characterize the graduates by their personal characteristics, educational attainments, and several job-related characteristics.

Section 3 will provide a first explorative look at human capital competences. Hence, we will turn our attention to the amount of general academic competences, discipline-specific competences and management competences built up during the university education and to the level at which these competences are required within the actual working situation (measured three years after graduation). Consequently, Section 3 will focus on the differences between supervisory and non-supervisory jobs and on the differences between jobs inside one's own discipline-specific domain and outside one's own discipline-specific domain.

In Section 4, a general wage regression will be analysed to measure the extent of the direct pay-off of human capital competences, as they are required in the current job, while in Section 5 the indirect pay-off of human capital competences obtained during higher education will be discussed. The paper will be concluded in Section 6 by a summary of the main findings.

2. The data

The research data for this paper were obtained from a postal survey among 1994/1995 higher education graduates from 11 European countries, carried out in 1998 within the context of the EU's Targeted Socio-Economic Research (TSER) programme. In this paper, we will concentrate on the results found for Italian university graduates, in particular those from Northern Italy[3]. We concentrate on Italian graduates because clear information is available for them with respect to possible management positions. Although formal education in Italy has always been organized at the national level, school quality and the state of the labour market show significant regional differences. In combination with a substantial immobility of the resident population (according to Brunello *et al.* (2000), regional out/inflows are less than 1 per cent of the regional population), this indicates that the regional situation may differ considerably, in particular between the North and the South of Italy[4]. As our target is not to explain regional differences in Italy, we will restrict our analysis to the northern part of Italy.

Since the survey is held some three years after graduation, the study observes graduates at the beginning of their professional career. In total, 2,318 Italian graduates responded to this survey. However, this paper covers only 734 graduates. The reason is that the paper will only include graduates who are at least working 12 hours a week on their main working assignment and, as indicated earlier, are employed in the northern part of Italy. All respondents covered in this paper completed degree courses (*corsi di laurea*), which make up the bulk of higher education in Italy (there are currently 88 different types of degree courses). Table I characterizes the paid working graduates by a number of variables that are relevant for this paper.

	% (*n*)
Current region of employment	
Piemonte	12.4 (91)
Valle d'Aosta	0.5 (4)
Liguria	4.0 (29)
Lombardia	43.2 (317)
Trentino-Alto Adige	1.6 (12)
Veneto	18.1 (133)
Friuli-Venezia-Giulia	11.3 (83)
Emilia-Romagna	11.3 (83)
Personal characteristics	
Gender: male	52 (382)
Average age at time of survey (1998)	31.02 years (SD 3.45)
Parents highest educational level: higher education	10.4 (73)
Field of study	
Arts and humanities	18.3 (134)
Social sciences	11.9 (87)
Business	21.4 (157)
Law	6.7 (49)
Natural sciences	12.1 (89)
Engineering	21.8 (160)
Health	7.9 (58)
Job characteristics	
Permanent contract	79.5 (543)
Full-time contract (at least 32 hours)	83.9 (616)
Job at university level	64.0 (465)
Job in own domain	76.6 (562)
Supervisory job	35.7 (262)
Average number of weekly working hours	36.37 (SD 6.89)
Average gross hourly wage (Euros)	11.08 (SD 9.3)
Working for a private employer	69.4 (509)
Working experience	
Job tenure in current job (in months)	19.85 (SD 8.9)
Total working experience since graduation (in months)	26.24 (SD 7.4)
Number of employers since graduation	2.52 (SD 2.4)

Table I.
Characteristics of respondents, working within a paid job for at least 12 hours a week

The largest percentage of the respondents works in the region of Lombardia (43.2 per cent), followed by Veneto (18.3 per cent) and Piemonte (12.4 per cent)[5]. With respect to the field of study[6], the table shows that most respondents have a major in engineering (21.8 per cent), followed by business (20.4 per cent) and arts and humanities (18.3 per cent).

Table I also shows that 52 per cent of the respondents are male and that the graduates are on average 31 years old at the time of the survey (about three years after graduation). At the time of the survey, most graduates had a full-time and a permanent working contract, a job that matched their educational level[7] (64.0 per cent) and a job in their own educational domain (76.6 per cent). A job inside their own educational domain is thereby defined as a job for which their own field of study or a related field of study is by far the best preparation. About one out of three (35.7 per cent) worked in a supervisory job[8].

The data also contain information with respect to 36 different competences representing demands for and supplies of knowledge, skills and attitudes. Graduates were asked to indicate on a five-point scale, ranging from 1 ("not at all") to 5 ("to a very high extent"), the extent to which they had a given competency at time of graduation (the acquired level of competency) and the extent to which this given competency is required in their current work (the required level of competency). Using a hierarchical clustering method[9], we retain three clusters of competences representing best our idea of general academic competences, discipline-specific competences and management competences. The three clusters consist of the following items:

(1) *General academic competences*
- broad general knowledge;
- cross disciplinary thinking/knowledge;
- problem-solving ability;
- analytical competences;
- reflective thinking, assessing one's work;
- learning abilities;
- power of concentration;
- critical thinking;
- written communication skills.

(2) *Management competences*
- planning, coordinating and organizing;
- leadership;
- economic thinking;
- creativity;
- oral communication skills;

- tolerance, appreciating different points of view;
- initiative;
- taking responsibilities, decisions.

(3) *Discipline-specific competences*

- discipline-specific theoretical knowledge;
- discipline-specific knowledge of methods.

The findings of Quinn *et al.* (1990) support our grouping of competences into the management cluster. According to Quinn *et al.* (1990), it may be expected that the following directive competences (leadership, initiative), coordinative competences (planning and organizing), innovative competences (creativity, taking decisions) and human relations competences (oral communication skills, appreciating different points of view) are of crucial importance for managerial leaders. Furthermore the internal consistency of the clusters is also supported by Cronbach's alpha[10]. For the cluster of "general academic competences", we find a Cronbach's alpha of 0.80 when measured at the time of graduation, or 0.85 when measured at the time of survey. For the cluster of "discipline-specific competences", the alphas are 0.75 and 0.83, and for the cluster of "management competences" 0.75 and 0.83 respectively.

3. A first descriptive look at three different types of human capital

In this section, we will have a first descriptive look at the three different types of human capital competences distinguished in this paper. We focus our attention on the level of competences built up during one's university education and to the level of competences required within the actual working situation (measured three years after graduation). This section focuses on differences between supervisory (position in top-level or middle-level management) and non-supervisory (low-level management or professional without management tasks) jobs and on the differences between jobs inside one's discipline-specific domain and outside one's discipline-specific domain. The grouping of low-level managers into the class of non-supervisory jobs is based on the fact that preliminary analysis of the data, in particular with respect to the different management competences, did not produce any significant differences between low-level managers and professionals without management tasks. On the other hand, there are clear differences between low-level management on the one side and middle- and top-level management on the other[11].

To start with, Table II presents the correlations between the three competences clusters (measured at the time of graduation). The positive and significant (on a 1 per cent level) correlations between the three competences clusters indicate that within the university education process, a symbiotic situation emerges between the acquisition of the three different types of competences. The strongest correlations are thereby found between general

academic competences and management competences and between general academic competences and discipline-specific competences.

We compare the level of competences possessed at the time of graduation and the level of required competences in the current job position. For that reason, we calculate for each graduate an average of the competences items inside the clusters as they were possessed at the time of graduation and as they were required in the current job.

Table III gives a first insight into the extent to which the students possessed the competences at the time of graduation and to which extent these are required in the current job.

As the results in Table III show, the extent to which the competences are required in the current job is significantly higher for all the three groups than the extent to which the competences were present at the time of graduation. Considering the whole population, we can therefore conclude that our graduates have to continue learning after university, either by working experience or by on- and off-the job training. The increase to be mastered is thereby highest with respect to management competences, supporting the argument that management competences have most likely to be learned in a working context.

Turning our attention to two different groups of respondents, namely those who were working in a job within their discipline-specific domain and those who were working in a job outside their discipline-specific domain, the following picture emerges.

The results confirm that the usage of discipline-specific competences learned at the university is strongly context-bound (Table IV). For graduates finding their way into a position inside their discipline-specific domain during the first three years on the labour market, the current job context requires on average a level of knowledge of discipline-specific theories and methods significantly

Table II.
Correlation matrix of the three types of competences possessed at the time of graduation

	General academic skills	Discipline-specific skills	Management skills
General academic skills	1	0.420	0.658
Discipline-specific skills	0.420	1	0.266
Management skills	0.658	0.266	1

Note: All correlations are significant at the 0.01 level (two-tailed)

Table III.
Competences possessed at the time of graduation and competences required in current job

	Time of graduation (1995)	Current job (1998)	Difference
Whole population			
Academic skills	3.6855	3.8040	0.1185[a]
Discipline-specific skills	3.3187	3.4594	0.1407[a]
Management skills	3.2444	3.8266	0.5822[a]

Note: [a]Indicates a significant (0.01 level) increase compared to the time of graduation

above the level that was built up during university education. After leaving university, graduates will therefore not only have to keep up their initial level of discipline-specific knowledge, but will have to increase their level of discipline-specific knowledge, either by experience in their own domain and/or by further training. On the other side of the spectrum, graduates who are unable to find a job inside their domain will be confronted with a current job context in which the knowledge of discipline-specific methods and theories studied at the university plays a minor role. Not only is the required level of own discipline-specific knowledge outside their domain significantly lower than inside it, but the level is also significantly lower than the one possessed at the time of graduation. Graduates working outside the domain will lose contact with new discipline-specific innovations and their knowledge of discipline-specific methods and theories will decrease. This will be the case in particular for studies in which the rate of innovation is both substantial and rapid. Furthermore, we find that working outside one's own domain does not require an increased level of general academic competences.

Turning our attention finally towards the distinction between supervisory and non-supervisory jobs, we are specifically interested in the question as to what extent the level of management competences required in the current job matches the level of management competences possessed at the time of graduation.

The results with respect to management competences clearly show that neither for managers nor for non-managers does the level possessed at the time of graduation match the required level in their current job position (Table V). Managers, as defined earlier, not only find themselves in a context in which they have to handle a larger required amount of management competences, but also the increase to be handled within the first three years after graduation is larger, as they start from the same level as graduates who do not find their way into the middle- or top-level management after three years. This may indicate that management competences are acquired to a higher degree in a context of work than the other two types of competences. Interestingly, we find that for

	Time of graduation (1995)	Current job (1998)	Difference
Inside own domain			
Academic skills	3.6606	3.8587*	0.1981[a]
Discipline-specific skills	3.3348	3.6673*	0.3325[a]
Management skills	3.2396	3.8644*	0.6248[a]
Outside own domain			
Academic skills	3.7291	3.4322*	−0.2969[b]
Discipline-specific skills	3.2864	2.5343*	−0.7521[b]
Management skills	3.2524	3.5255*	0.2731[a]

Notes: *Indicates that the difference between inside and outside own domain is significant at 0.01 level; [a/b]indicates a significant (0.01 level) increase (decrease) compared to the time of graduation

Table IV. Competences possessed at the time of graduation and competences required in the current job (split-up by working inside and outside one's own discipline-specific domain)

managers – besides the required level of management competences – the required level of discipline-specific and general academic competences is also higher than for graduates without a supervisory job. With respect to the discipline-specific competences, this result can be based mainly on the fact that graduates working inside their domain have a greater probability of finding their way into the middle- or top-level management of a company than graduates working outside their domain. This is supported by the data as 43 per cent of the graduates working inside their own discipline-specific domain hold a management position versus only 18 per cent of the graduates working outside their discipline-specific domain. With respect to general academic competences, the results indicate that the required investment in management competences also requires an increased level of general academic competences.

In what follows, we turn to the question of to what extent the level of our three competences clusters pays off and hence to the question of to what extent obtaining those competences during university education directly or indirectly increases the productivity of graduates.

4. The direct pay-off of human capital competences: a general wage regression

In order to find out whether human capital competences (general academic, discipline-specific and management competences) pay off, we will start with a Mincerian wage equation estimation[12] (Mincer, 1974), in which the natural logarithm of the gross hourly wage is explained in a linear equation on the basis of a number of characteristics, referring to person, education, experience, job, the organization in which the graduates work three years after leaving the university, and socio-economic background. The wage equation to be estimated takes the following form

$$\ln(w_i) = \alpha_1 + \alpha_2 S_{r1i} + \alpha_3 S_{r2i} + \alpha_4 S_{r3i} + \alpha_5 X_i + \varepsilon_i, \quad (1)$$

Table V.
Competences possessed at the time of graduation and competences required in the current job (split-up by holding either a management or a non-management position)

	Time of graduation (1995)	Current job (1998)	Difference
Managers (*top and middle*)			
Academic skills	3.6502	3.9482*	0.2980[a]
Discipline-specific skills	3.3750	3.7612*	0.3826[a]
Management skills	3.2359	3.9356*	0.6997[a]
Non-managers			
Academic skills	3.7025	3.7466*	0.0441
Discipline-specific skills	3.2763	3.2981*	0.0218
Management skills	3.2400	3.7705*	0.5305[a]

Notes: *Indicates that difference between managers and non-managers is significant at 0.01 level; [a]Indicates a significant (0.01 level) increase compared to the time of graduation

where $\ln(w_i)$ is the natural log gross hourly wage of individual i, S_{r1i}, S_{r2i} and S_{r3i} are the required levels of general academic discipline-specific and management competences respectively in the job held by individual i, X_i is a vector of variables other than S_{ryi} (with $y = 1, 2$ or 3) that influence wages (e.g. field of study, gender or years of experiences) and ε_i is an error term statistically independent of S_{rji} and X_i.

We will thereby in particular examine to what extent the required level of the three competence clusters influences the wage rate and how far graduates assigned to a job inside their discipline-specific educational domain have a comparative advantage.

The results of the wage analysis (Table VI) show that, if one controls for the usual variables, the only required type of human capital competences paying off are management competences. As a matter of fact, the required level of management competences even pays off if one controls for having a supervisory (top- and middle-level management) position. Independent of having a supervisory job or not, an increase in the required management competences by one point leads to an increase of the hourly wages by roughly 10 per cent. With respect to the other two human capital competences, general academic and discipline-specific competences, the wage analysis shows that the required level does not have a significant effect. For discipline-specific competences, the influence may be taken over by the dummy for working inside the own domain. Excluding this dummy, however, does not change the results qualitatively. Replacing the required level of human capital competences by the level possessed at the time of graduation yields the results that none of the human capital competence levels has a direct impact on gross hourly wages three years after graduation[13].

Having established that the required level of management competences and a good match between education and work (working inside the educational domain) have a direct positive impact on gross hourly wages, we intend to examine in the following two subsections to what extent the level of general academic competences, management competences and discipline-specific competences possessed at the time of graduation indirectly explains the wage rate. In our introduction, we have put forward that general academic competences are of specific importance as a basis for further learning and as a basis upon which graduates can fall back in a context in which their discipline-specific competences are not used. With respect to discipline-specific competences possessed at a specific moment of time, we will try to examine to what extent they influence the allocation over jobs inside and outside one's own educational domain and thus indirectly the wage rate at that moment of time (the results in Table VI show that working inside one's domain increases gross hourly wages by 14.8 per cent).

For this reason, Section 5 will first examine to what extent the required level of management competences, which has a significant positive impact

	Coefficient	*t*-value
Personal characteristics		
Gender: male	0.068	1.521
Age at the time of survey (1998)	0.006	0.758
Competences required in current job		
General academic competences	−0.037	−0.675
Discipline-specific competences	−0.027	−1.219
Management competences	0.095	2.203**
Education		
Health (reference)		
Arts and humanities	−0.058	−0.544
Social sciences	0.010	0.095
Business	0.106	1.090
Law	−0.028	−0.238
Natural sciences	−0.121	−1.140
Engineering	0.010	0.106
Job characteristics		
Full-time contract	0.111	1.420
Permanent contract	0.220	4.142***
Job at university level	0.033	0.701
Job in own domain	0.138	2.184**
Supervisory job	0.087	1.941*
Size of firm	3.4 E-06	1.669*
Working experience		
Experience inside current job (months)	−0.000	−0.334
Experience inside current job (months)^2	0.000	0.268
Total working experience (months)	0.001	0.517
Total working experience (months)^2	0.000	0.063
Organization characteristics		
Private sector	0.024	0.503
Number of employers after graduation	0.009	0.800
Parent's highest education: tertiary education	0.038	0.580
Constant	1.360	4.430***
R^2	0.190	
SE	0.461	
F-statistic	4.960***	
N-cases	534	

Notes: *Significant at the 10 per cent level; **significant at the 5 per cent level; ***significant at the 1 per cent level

Table VI.
Linear regression analysis of the gross hourly wages (ln)

on gross hourly wages, can be explained by the amount of the three different human capital competences possessed at the time of graduation. In particular, we will estimate to what extent general academic competences obtained at university are of supportive importance to learn the management competences for which the labour market clearly seems to pay. Second, we will examine to what extent the odds of working inside one's own

discipline-specific educational domain, which has a significant positive impact on gross hourly wages, can be traced back to the level of human capital possessed at the time of graduation, and in specific to the amount of discipline-specific competences. We will concentrate on the odds of working inside one's own discipline-specific educational domain, instead of the required level of discipline-specific competences, as the latter seems not to have a significant positive impact on the wage rate[14].

5. The indirect pay-off of human capital competences

The indirect pay-off of general academic competences

In order to find out whether the level of general academic competences can partially explain the level of required "management competences", a linear equation was estimated in which the level of required "management competences" in the current job is explained on the basis of a number of characteristics, referring to person, education, experience, job, and the organization in which the graduates work. The control variables are identical to the ones included in the wage regression in the previous section. The equation to be estimated takes the following form:

$$S_{r3i} = \beta_1 + \beta_2 S_{e1i} + \beta_3 S_{e2i} + \beta_4 S_{e3i} + \beta_5 X_i + \eta_i, \quad (2)$$

where S_{r3i} is the required level of management competences, S_{e1i}, S_{e2i} and S_{e3i} are the levels of general academic, discipline-specific and management competences respectively obtained during one's university education, X_i is a vector of variables other than S_{eyi} (with $y=1$, 2 or 3) that influence the required level of management competences (e.g. experience, working in a supervisory job), and η_i is an error term statistically independent of S_{eyi} and X_i.

The results presented in Table VII indicate, first, that working in a supervisory job has the expected positive effect on the management competences requirement. In contrast to graduates in non-supervisory jobs, graduates in supervisory jobs have to increase significantly their level of management competences[15]. Second, the level of management competences possessed at the time of graduation has a positive and significant impact on the required level. In other words, graduates who have acquired a higher level of management competences during their university education work, on average, three years after graduation in occupations requiring a higher average level of management competences. Third, the level of "general academic competences" acquired in education has a strong and positive impact. General academic competences are therefore of importance as supportive competences, helping the graduates to acquire further management competences, which have a strong pay-off in the labour market.

Having established a direct link between the management competences required in the current job and the gross hourly wages paid, and an indirect

	Coefficient	*t*-value
Personal characteristics		
Gender: male	0.022	0.380
Age at the time of survey (1998)	− 0.013	− 1.303
Competences possessed at the time of graduation		
General academic competences	0.183	2.460**
Discipline-specific competences	0.034	1.037
Management competences	0.117	1.925*
Education		
Health (reference)		
Arts and humanities	0.112	0.777
Social sciences	0.217	1.493
Business	0.097	0.744
Law	0.017	0.107
Natural sciences	− 0.014	− 0.095
Engineering	0.052	0.393
Grade at graduation		
Job characteristics		
Full-time contract	0.296	2.817***
Permanent contract	0.076	1.090
Job at university level	0.307	4.982***
Job in own domain	0.129	1.558
Supervisory job	0.176	3.100***
Size of firm	− 6.2 E-06	− 2.378**
Working experience		
Experience inside current job (months)	0.000	0.188
Experience inside current job (months)^2	− 0.000	− 0.463
Total working experience (months)	− 0.000	− 0.241
Total working experience (months)^2	0.000	0.377
Number of employers after graduation	− 0.003	− 0.165
Parent's highest education: tertiary education	− 0.032	− 0.636
Constant	2.311	5.276***
R^2	0.199	
SE	0.606	
F-statistic	4.672**	
N-cases	534	

Notes: *Significant at the 10 per cent level; **significant at the 5 per cent level; ***significant at the 1 per cent level

Table VII.
Linear regression analysis of the required level of management competences in the current job

link between both management and general academic competences possessed at the time of graduation and the gross hourly wages, we will analyse in the following section to what extent the discipline-specific competences possessed at the time of graduation determine the allocation of graduates over jobs inside and outside their own domain when leaving university, and the allocation realized three years after graduation.

The indirect pay-off of discipline-specific competences

The results of the wage analysis carried out in Section 4 show that the level of discipline-specific competences required in the current job does not influence the pay-off directly. Following the same analytical path as in the last section therefore yields no success. Our general wage regression incorporated the educational domain required for the current job. The findings confirmed the idea that working inside one's own discipline-specific educational domain creates a comparative advantage and hence is better paid. Graduates working inside their own discipline-specific educational domain are not only better paid (Table VI) but are also required to handle a higher level of discipline-specific competences (Table IV). Hence, the following analysis on the odds of finding a job inside one's own discipline-specific domain also discusses indirectly the impact of human capital competences obtained at school on the required level of discipline-specific competences.

To start, we try to estimate whether discipline-specific competences learned at university are of importance in explaining the odds of working inside the educational domain three years after graduation (model 1, Table VIII). For controlling reasons, some personal characteristics (age and gender), the field of study, the number of jobs after graduation until the moment of the survey, the months of experience inside the current job, and the months of total working experience, are also included in the analysis. Formally, the probability of working inside one's own domain after graduation is given by

$$P(D_{si}) = (e^{f(Dsi)})/(1 + e^{f(Dsi)}) \tag{3}$$

where $P(D_{si})$ is the probability of individual i working inside his or her own domain after graduation and[16]

$$f(D_{si}) = \gamma_1 + \gamma_2 S_{e1i} + \gamma_3 S_{e2i} + \gamma_4 S_{e3i} + \gamma_5 X_i + \phi_i \tag{4}$$

where X_i is a vector of variables that influence the probability of working inside one's own domain (e.g. the field of study), and S_{e1i}, S_{e2i} and S_{e3i} represent the obtained level of general academic, discipline-specific, and management competences, and ϕ_i is an error term with the usual characteristics.

The results of model 1 indicate that neither the discipline-specific competences acquired in higher education nor the other distinguished human capital competences have a significant influence on the probability of working inside the own educational domain three years after graduation. The strong and significant negative impacts from the dummies for the different fields of study are thereby related to the fact that almost all health graduates (reference group) are working in a job inside their own educational domain.

Although our focus is on the work situation three years after graduation, the finding that discipline-specific competences acquired in higher education are of no importance with respect to the allocation at that moment of time might indicate that the current situation is to a large part determined by the situation

	Model 1		Model 2		Model 3	
	Coeff.	SE	Coeff.	SE	Coeff.	SE
Personal characteristics						
Gender: male	0.045	0.033	0.043	0.032	0.026	0.033
Age at the time of graduation	0.015	0.004***	0.015	0.036***	0.014	0.004***
Competences possessed at the time of graduation						
General academic competences	−0.000	0.000				
Discipline-specific competences	−0.000	0.000				
Management competences	0.000	0.000				
Education						
Health (reference)						
Arts and humanities	−0.388	0.100***	−0.383	0.100***	−0.443	0.130***
Social sciences	−0.304	0.106***	−0.307	0.107***	−0.394	0.142***
Business	−0.178	0.104*	−0.178	0.105*	−0.251	0.140*
Law	−0.231	0.117**	−0.219	0.118*	−0.260	0.142*
Natural sciences	−0.277	0.105***	−0.280	0.106***	−0.369	0.143***
Engineering	−0.184	0.107*	−0.200	0.108*	−0.322	0.157**
Initial job after graduation						
Inside own domain			0.098	0.0317***	0.417	0.195**
Λ					−0.201	0.121*
Working experience						
Experience inside current job (months)	−0.001	0.002	−0.001	0.002	−0.001	0.002
Experience inside current job (months)^2	0.000	0.000	0.000	0.000	0.000	0.000
Total working experience (months)	−0.000	0.002	−0.000	0.003	−0.001	0.002
Total working experience (months)^2	0.000	0.000	0.000	0.000	−0.000	0.000
Number of employers after graduation	−0.002	0.014	−0.005	0.013	−0.007	0.013
N-cases	534		534		534	
−2 log likelihood	−201.100		−201.994		−200.668	

Notes: *Significant at the 10 per cent level; **significant at the 5 per cent level; ***significant at the 1 per cent level

Table VIII.
Marginal effects on working inside own educational domain three years after graduation

occurring directly after graduation. For that reason, we turn our attention in a next step to the allocation over jobs inside the own educational domain and outside the own educational domain directly after graduation.

As the data do not provide us with precise information on the domain in which graduates find their first jobs after graduation, we can only approach the issue in this step. Fortunately, the data provide us with information on the importance of different aspects for the employer in recruiting the graduates for

their initial employment after graduation[17]. We will concentrate on the answer "importance of main subject/specialization". Assuming that the main subject/specialization is only inside one's discipline-specific domain of importance, we approximate finding a job inside this domain by graduates answering that the main subject/specialization was important or very important for their first employer when recruiting them. By means of logit regression, we estimate whether the amount of discipline-specific competences possessed at the time of graduation has a significant impact on the probability of finding the initial job inside one's own domain. We control for the level of general academic and management competences possessed at the time of graduation, for the field of study, and for personal characteristics (gender and age at the time of graduation).

The results in Table IX indicate that the probability of finding a first job in which the main subject/specialization is of great importance (resembling a job inside the discipline-specific domain) depends on the level of discipline-specific competences possessed at the time of graduation, even if one controls for personal characteristics and the field of study.

So far, we have established that the level of discipline-specific competences possessed at the time of graduation is of importance for the allocation of graduates to different initial jobs. What is missing is a link between the initial allocation and the allocation found three years after graduation. To achieve

	Coefficient	SE
Personal characteristics		
Gender: male	0.047	0.047
Age at the time of graduation	−0.022	0.009**
Competences possessed at the time of graduation		
General academic competences	−0.000	0.000
Discipline-specific competences	0.004	0.002**
Management competences	−0.000	0.000
Education		
Health (reference)		
Arts and humanities	−0.067	0.101
Social sciences	0.013	0.110
Business	−0.055	0.095
Law	−0.155	0.131
Natural sciences	0.015	0.102
Engineering	0.124	0.094
Constant	0.550	0.302*
N-cases		534
−2 log likelihood		−342.066

Notes: *Significant at the 10 per cent level; **significant at the 5 per cent level; ***significant at the 1 per cent level

Table IX.
Marginal effects on first job inside own domain

this, we re-estimate whether graduates have jobs that optimally match their qualifications three years after graduation, including thereby a dummy for having found the initial job inside or outside one's educational domain. To circumvent the problem of multi-colinearity, the three competence clusters are not included in the estimation. The results of this logit estimation are shown as model 2 in Table VIII.

The results of the logit estimation show that, even after controlling for the variables mentioned earlier, the domain of the initial job after graduation has a significant positive influence on the probability of working inside one's own discipline-specific domain three years after graduation. As we have controlled for the number of jobs that graduates had in the first three years after graduation, the impact of the initial job is gleaned from the fact that graduates who find their initial job inside the domain may not change the job as often as graduates who start working outside their domain[18].

A clear problem of the set-up of model 2 is that the coefficient found for the dummy "initial job after graduation: inside own domain" might be biased, as both the initial allocation and the allocation three years after graduation could be influenced by the same unobserved factors. To clear our estimation from this possible bias, model 3 (Table VIII) includes next to the original dummy for the first allocation also the inverse Mills ratio (lambda), provided by the logit estimation reported in Table IX. To ensure identification, we need at least one variable that can be expected to be correlated with the first allocation outcome but not with the allocation outcome three years after graduation. The estimation results reported as model 1 in Table VIII and the estimation results in Table IX clearly show that the level of discipline-specific competences acquired in higher education fulfils these criteria.

The results of the model 3 estimation confirm the findings of model 2 and furthermore indicate that the initial allocation is also of strong importance when one controls for possible unobserved factors that influence both the initial allocation and the allocation three years after graduation. The negative and significant sign of lambda thereby indicates that that there are unobserved factors influencing positively (negatively) the allocation over the first job after graduation and (negatively) positively the allocation found three years after graduation.

Combining the results of this part, we can therefore conclude that, in line with the job-matching theory, it pays off for graduates to work in jobs that match their education three years after leaving university. Although the level of discipline-specific competences either required for the job or possessed at the time of graduation does not pay off directly, we found that the odds of having a job inside one's own domain depends greatly on the level of discipline-specific competences built up during university education, as it influences the initial allocation of graduates to the jobs available.

6. Conclusions

In this paper, we examined the different roles and pay-offs in the labour market of three different types of human capital competences, namely general academic skills, discipline-specific skills and management skills. We argued that university education produces a mix of all three types of human capital, in which the discipline-specific skills play a central role.

We have found that management competences are valued in the labour market and investing in the acquisition of these pay-offs. We also found some evidence that management competences are more likely learned in the context of work, either by experience in a supervisory job or by on-the-job or off-the-job training, than in the context of the discipline-specific guided university education.

With respect to the general academic skills obtained in university education, we found that they do not seem to pay off directly, as a simple empirical analysis could not produce a significant impact of general academic skills on gross hourly wages. Building upon the theoretical notions, we showed that general academic skills play a major supportive role, instead of a direct productivity increasing one. The level of general academic skills acquired in university education positively influenced the level of management skills required three years after graduation and hence, indirectly the wage level of graduates.

With respect to discipline-specific skills, as was the case with general academic skills, we could neither establish a direct link between the level obtained in university education and the gross hourly wages paid three years after graduation, nor between the required level of discipline-specific skills and the wage rate. As the pay-off of discipline-specific competences is strongly context-bound (wages are significantly higher if one holds a position inside one's own discipline-specific domain where the use of discipline-specific skills is significantly larger), we examined to what extent the level of discipline-specific competences obtained by initial education can explain the allocation of graduates to positions inside and outside the domain. We found that the level of discipline-specific competences possessed at the time of graduation can partially explain the initial allocation, but not the allocation found three years later. Our empirical research also pointed out that the allocation of first jobs can explain to a large extent the situation three years later. Hence, the impact of discipline-specific competences obtained by university education on the wages paid after three years is partially through the initial allocation of graduates to jobs inside and outside the discipline-specific domain.

Concluding, we can state the following:

- Discipline-specific competences obtained at university influence the initial allocation on the labour market, which determines the current allocation to jobs inside and outside one's own educational domain. As jobs inside one's own discipline-specific domain are better paid than jobs outside one's own domain, investment in discipline-specific competences indirectly pays off.

- Management competences are directly valued in the labour market, but seem to be more likely acquired in a working context than at university.
- General academic competences obtained at university have a significant supportive role as a basis on which graduates can fall back to train, especially those skills (e.g. management skills) that are more likely acquired outside education. General academic competences therefore only pay off indirectly.

The above conclusions thereby indicate the following.

- It is dangerous to derive directly from wages, which skills should be taught in initial education.
- Instead, the entire process of learning, from initial education to work, should be considered in order to find out which skills are most likely generated at which stage.
- In analysing the skills to be taught, one has to consider the fact that general academic skills may not have a direct pay-off in the labour market. However, their pay-off may be indirectly of crucial importance because they are likely to facilitate the acquisition of other competences that pay off in the job.

We should point out, however, that the research findings concern university graduates from Northern Italy and, more specifically, graduates in the very early stages of their careers. It would be desirable to include other educational levels, graduates from other countries and later stages in their careers to test for the generality of our findings. Furthermore, it would be of interest to include other types of human capital competences in the analysis.

Notes

1. Bishop uses US data on high school graduates in the 1980s.
2. For an overview of possible patterns of core and generic skills provision in higher education, see Bennett *et al.* (1999).
3. Graduates working in the following Italian regions are included: Trentino-Alto Adige, Friuli-Venezia-Giulia, Lombardia, Valle d'Aosta, Piemonte, Veneto, Liguria, Emilia-Romagna.
4. Preliminary analysis has established considerable differences between different regions of Italy.
5. From the total of 734 respondents analysed in this paper, only ten (1.2 per cent) studied in a region outside the ones considered here as Northern Italy.
6. The distinction between the different fields of study is as given in the data.
7. Job at university level is measured as job for which an education on a university level is required.
8. The distinction between supervisory and non-supervisory jobs is based on the question as to whether graduate's current job position is classified as top- or middle-level management (supervisory jobs) or as low-level management or professional without management tasks (non-supervisory jobs).

9. See Appendix for details of the hierarchical clustering method.
10. Although there is no generally agreed cut-off, usually a value of alpha of 0.7 or more is seen as acceptable (Nunnally, 1978).
11. Data not shown in this paper.
12. We do not capture the skills or other characteristics of those graduates who do not manage or who do not choose to gain employment. We intend therefore to estimate in particular the impact of obtained skills conditional on gaining employment, and hence do not include the effect of acquired skills on the probability of being employed.
13. Results are not shown in this paper.
14. As graduates working in their own discipline-specific domain on average have to handle a significantly higher level of discipline-specific skills than graduates working outside their discipline-specific domain (Table IV), we will indirectly also discuss the impact of the level of discipline-specific skills obtained in education on the required level.
15. The results presented in Table V indicated that graduates allocated to a supervisory job had the same starting level of management competences as graduates not allocated to a supervisory job.
16. $f(D_{si})$ is equal to $\ln[P(D_{si})/(1 - P(D_{si}))] = \log \text{ odds ratio}$.
17. The precise question is: how important, according to your perception, were the following aspects for your employer in recruiting you for your initial employment after graduation (measured on a five-point scale from 1 "not important at all" to 5 "very important").
18. This is also tested by comparing the number of employers one had in the first three years. Graduates starting their working career inside their discipline-specific domain had an average of 2.35 employers compared to an average of 2.50 employers for graduates who started outside their domain (the *F*-statistic of 0.879 indicates that the averages of the two groups do not differ significantly).

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Appendix. Discipline-specific, general academic and management competences clusters

From the 36 different competences available in the data, we use in this paper only competences describing the nest of discipline-specific, general academic and management competences. Using Ward's hierarchical method for cluster analysis, we formed groups of competences according to the level required in the current job. This method begins with one large cluster encompassing all objects to be clustered and then searches objects that can be grouped together while minimizing the increase in the sum of residuals squared. The hierarchical cluster analysis produced eight different clusters in the first step. Three of these eight clusters correspond to our idea of discipline-specific, general academic and management competences. To test further for the internal consistency of these three clusters, we calculated the Cronbach's alpha, which indicates how well a set of items measures a single uni-dimensional construct. The Cronbach's alphas found are therefore clearly above the usual level of acceptance of 0.7 (Nunally, 1978).