Discipline-Specific or Academic? Acquisition, Role and Value of Higher Education Competencies

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Abbreviations used

Countries

IT	Italy
ES	Spain
FR	France
AT	Austria
D	Germany
NL	Netherlands
UK	United Kingdom
FI	Finland
NO	Norway

Higher education institutions

ITU	Italian Universities
ESU	Spanish universities
FRU	French universities
FRGE	French Grande Écoles
ATU	Austrian universities
DU	German universities
DFH	German Fachhochschulen
NLU	Dutch universities
NLHBO	Dutch higher vocational institutions
UKU	United Kingdom old universities
UKNU	United Kingdom new universities
FIU	Finish universities
NOU	Norwegian universities
NOC	Norwegian university colleges (former state colleges)

Field of study

AH	Arts and humanities studies
SS	Social sciences studies
BU	Business studies
LA	Law studies
NS	Natural sciences studies
EN	Engineering studies
HE	Health sciences studies

Glossary

Some definitions to facilitate the reading of this thesis

Competence: Learnable group of skills forming the condition to perform complex and varying tasks inside and outside the working sphere.

Discipline-specific competencies: Cognitive prerequisites that students acquire, which allow them to perform adequately in a given, but mostly restricted, substantive area.

Generic competencies: Label used to cover a diversity of concepts, all indicating the subject, discipline or occupation independence of such competencies.

Academic competencies: Subset of generic competencies related to higher thinking and learning competencies

Higher education institute: Label used for a particular university or school of higher education (e.g. University of Maastricht)

Higher education institution: Label used for particular type of higher education (e.g. Fachhochschulen or Grande Écoles)

Occupational domain: Group of occupations in the labour market requiring the same type of competencies

Conventional teaching style: Fairly passive learning environment, in which faculties talk and students listen

Activating teaching style: Learning environment in which students gain concrete experience with learning independently, working in groups and approaching problems systematically

Chapter 1
Introduction

« Education … has produced a vast population able to read but unable to distinguish what is worth reading »
G.M. Trevelyan

« Es ist nicht genug zu wissen, man muss auch anwenden; es ist nicht genug zu wollen, man muss auch tun »
Johann Wolfgang Goethe

1.1 Motivation and aim

To take advantage of new and rapidly changing opportunities in a knowledge-driven economy, the acquisition and maintenance of competencies that are valued in the labour market are crucial for school-leavers in general and higher education graduates in particular. Changes in the modern workplace, brought about by the high rate of technological, economical, social and cultural changes in the last decennia, intensified the debate concerning the kind of competencies that are required in the labour market and the kind of competencies that are best acquired in education. Concerns have been raised about the adequacy of workforce competencies (Stasz, 1998), and discussions have emphasized the importance of certain competencies, blaming the education system for failing to provide them adequately. In line with this, the attention of policy-makers and analysts has recently shifted to the quality dimension of schooling and the understanding of the impact of quality differences in human capital on a graduate's labour market success (see e.g. Hanushek, 2002, 2004).

The objective of this thesis is to add to this ongoing discussion on the measurement of human capital. More specifically, we propose a human capital output measurement of higher education that distinguishes explicitly between two types of competencies acquired by students: discipline-specific competencies and academic competencies. Discipline-specific competencies refer to the cognitive prerequisites that students acquire in higher education and that allow them to perform properly in a given, but mostly restricted, substantive area. The term 'academic competencies' is used to label a group of abilities such as problem-solving abilities, knowing how to (re)learn or how to deal with information and ideas. Academic competencies are a subset of generic competencies that are generally applicable in the whole range of occupations open to graduates. In this sense, academic competencies are discipline- and/or occupation-independent, enabling graduates to adapt easily and flexibly to changes in the labour market and to acquire new competencies, as needed.

The measurement that we propose is derived directly from the actual level and type of competencies acquired by graduates. It is both flexible and makes it possible to break open the black box of higher education output, which is otherwise generally covered by static labels such as the field of study or the type of higher education. Accordingly, it enables us to discuss in greater detail the acquisition of different types of human capital in higher education, their role in the transition to the labour market and their value in the labour market.

Before presenting the objectives of this thesis and its setup in more detail, we will briefly place the discussion in a broader context.

1.2 Knowledge society and the role of higher education

The change which the Western world has made towards a knowledge society has often been described as a paradigm change. As a successor for the agricultural, the industrial and the service sector stage, the non-location-bound knowledge-oriented economy has become an apparent and full-featured part of highly developed countries in the twenty-first century. The evolvement of Information and Communication Technology (ICT) not only changed the rules of the game, but its high rate of innovation has (and will continue to have) major

implications for the economy as a whole. Everywhere, people will be confronted with these innovations. Looking into the crystal ball, we can still see in the near future that streets are cleaned by street sweepers and children taught by teachers. However, it all involves new processes and techniques made available by the extraordinary progress in ICT.

Higher education, by its expansion in the 1990s[1], made a major contribution to the establishment of the knowledge society: a society in which lifelong learning is seen as crucial and the polarization between the 'knowledge haves' and the 'knowledge have-nots' is recognized as a serious threat (OECD, 2004). Learning is no longer the privilege of the young, nor the monopoly of some specialized institutions, but lifelong learning and permanent education are necessary for everyone, to keep up with technological changes that are taking place more rapidly than ever before (Albeda, 1998). Large parts of this prolonged learning will not necessarily be formal and structured, but consist of learning-by-doing at the workplace. Accordingly, the widespread consensus in policy circles is that better education and training inevitable yield economic success:

« The central issue for discussion in each and every industrialized country is therefore the manner in which education and training systems can be improved and skills raised. Invest in more and better skills... and prosperity will follow » (Ashton and Green, 1996)

Education not only benefits the individual, but may benefit society as a whole: National income rises directly due to higher productivity of workers with more and better skills; better educated individuals are generally more civically involved and are more informed and responsible voters (Hanushek, 2002). An increase in the level of education is also associated with a reduction in crime rates (see e.g. Ehrlich, 1975, Lochner and Moretti, 2001) and with better health. Moreover, several studies have argued that the benefits for society are larger than merely the sum of individual benefits and that education accelerates the growth rate of the economy[2].

In this context, higher education is given a crucial role. More precisely, higher education is expected to progress on the frontier of knowledge, providing a substantial contribution to the basic knowledge that paves the roads to continued economic growth. Living in a global economy that enables manufactures of goods and providers of services to locate their operations wherever they expect the largest competitive advantage, a nation's human capital, in addition to renewable natural resources, is increasingly the stable source that industrialized countries need to rely on.

« For countries in the vanguard of the world economy, the balance between knowledge and resources has shifted so far towards the former that knowledge has become perhaps the most important factor determining the standard of living - more than land, than tools, than labour. Today's most technologically advanced economies are truly knowledge-based » World Bank, 1998

1. The number of tertiary education students in the European Union increased by more than 40% in the last decade (EC, 2002).
2. For examples, see the analyses by Lucas, 1988; Romer, 1990; Barro, 1991; Jorgenson and Fraumeni, 1992; Barro and Sala-I-Martin, 1995; The question with respect to the direction of the causality between education and economic growth is addressed by, for instance, Bils and Klenow, 2000.

Acknowledging these developments and the crucial role that higher education plays in this process, this thesis focuses on the acquisition of competencies in higher education and their role and pay-off during the transition from higher education to the labour market.

1.3 Higher education graduates and their competencies

Higher education is given the key task to prepare the highly talented among the young to fulfil highly qualified roles in the labour market. Successful labour market performance of graduates is generally associated with the acquisition of the correct competencies[3]. Education as an individual investment is a viewpoint dating back to the 17th century and the writings of Sir William Petty (1662), and includes later work by Adam Smith (1776). The idea was formalized and brought into mainstream economics by Schultz (1961), Becker (1964) and Mincer (1970, 1974).

To grasp these benefits, it is of crucial importance for individuals to understand and recognize the rapidly changing opportunities and to acquire and maintain the related competencies. Given the breadth of the 'knowledge economy' concept, it is not surprising to find different conceptions of what a knowledge economy is and ambiguity of what is required from higher education graduates when they enter the labour market. Undoubtedly, high-quality education in a particular discipline can still prepare graduates for a high level of performance on entering the labour market, where advanced and often highly specialized knowledge is required. Law graduates are expected to know the law, graduates in architecture are expected to know how to build a house and economics graduates are expected to understand the reasons behind inflation. However, higher education needs to realise that firms expect more than just a graduate with narrow discipline-specific competencies. Sternberg (2003) proposes that the future needs a "*generation of experts, whose expertise will extend well beyond technical knowledge*" and hence, experts that possess competencies with which they can use the technical knowledge. In other words, the labour market expects to see responsible graduates who are able to address and judge unforeseen circumstances, who possess analytical knowledge, address problems in a creative manner and have a broad view on a variety of topics. Graduates should be able to expand and adapt the potentialities of an existing job, shaping it proactively. Moreover, in a world in which discipline-specific knowledge is rendered obsolete at an increasing rate by the pace of technological progress (Teichler, 1999), graduation from higher education is no longer the final stage of schooling but should prepare for lifelong learning.

The tension between the demand for discipline-specific specialists, with their high direct productivity, and the 'active agents', with their (long-term) flexibility is not new to economic literature. In fact, it relates to the question of specialist vs. generalist that dates back to pre-industrialization literature. Whereas Adam Smith (1776), addressing the division of labour, stated:

3. Although nomenclature does not matter a great deal if everybody agrees on what is meant, Borghans, Green and Mayhew (2003) correctly argue that it is of central concern for discussions on competencies in the light of the significant changes in the meaning of the term and its different uses in a variety of research fields. We will return to this point in Chapter 2, where we will discuss how human capital should be defined and measured if we regard certificates/qualifications no longer as ideal measures of the capabilities acquired in education.

« The greatest improvement in the productive powers of labour, and the greater part of the skill, dexterity, and judgment with which it is any where directed, or applied, seem to have been the effects of the division of labour » (Smith, 1776)

Say (1802) warned that such specialization often goes hand in hand with inflexibility:

« A man, whose whole life is devoted to the execution of a single operation, will most assuredly acquire the faculty of executing it better and quicker than others; but he will, at the same time, be rendered less fit for every other occupation, corporeal or intellectual ... » (Say, 1802)

Higher education faces the dilemma of how much emphasis to place on discipline-specific (vocational) competencies and how much emphasis on generic competencies. The former refers to cognitive prerequisites which an individual requires in order to perform properly in a given substantive area (Weinert, 2001), and hence to theoretical and methodological knowledge of a particular discipline. The latter term ('generic') is used to indicate the subject independence of such competencies. Generic competencies are often called 'transversal'[4], indicating that they are not context-bound and can be applied to a range of areas and settings. Do we prepare graduates for a particular type of occupation, providing them with a comparative advantage in this occupation or do we prepare them to be active, flexible, well-rounded and responsible academic agents? Like a pendulum, opinions have shifted between advancing one or the other of the two extremes. Recently, swings have been more strongly away from the narrow training of discipline-specific competencies and have placed greater emphasis on generic competencies (see e.g. Bowden and Marton, 1998, Teichler, 1999)[5].

1.4 The stage of transition from higher education to work

We will restrict this study to the transition from higher education to work. In this sense, we focus on a rather short working life period, namely the first three to four years. Although the inevitable result of this restriction is that certain relevant aspects are neglected, such as the obsolescence of competencies, the impact of dropping out of the labour market for a certain

4. According to Rey (1996), the term 'transversal' does not refer to elements common to different subject-based competencies, but strictly to the additional, subject-independent content of these competencies useable in other fields.

5. Although the evolvement of the knowledge economy may have restrengthened the discussion on the design of the curriculum, it is by no means new. Medieval universities were already prepared, if necessary, to adapt to the professional and business needs of the community, but without allowing their basic academic function to be compromized. Furthermore, the Aristotelian distinction between intellectual and manual skills led to a situation in which technology, applied science and manual training – such as surgeons, architects, farmers or bookkeepers – were excluded from the university curriculum for long time. After teaching of technology had taken place at some Dutch and Italian universities in the 16th and 17th centuries, a binary system developed throughout Europe, in which technology and training for manual skills were confined to specialized school at a non-university level (e.g. the school for surgery was established in Paris in 1698 and in Berlin in 1724). In the 18th century, however, the influence of the scientific revolution and the revaluation of manual skills by the Enlightment grew, together with the ambitions of engineers, surgeons and administrators, initiating a process of institutional upgrading that sooner or later resulted in the incorporation of engineering in the university system.

period of time, and factors influencing the long-term employability of graduates, we believe that a concentration on the transition from higher education to the labour market in itself makes it possible to address particular aspects related to the outcome of higher education programmes more coherently. Several features are crucial in this respect.

First, the period after graduation is the time when the link between competencies acquired in higher education and competencies required/used in the workplace is strongest. Due to a lack of extended labour market experience, employers rely heavily on information retrieved from the employee's educational career. With the accumulation of labour market experience, the weight attached to the initial educational career will fade out. By focusing on the transition stage, it is possible to examine coherently what education provides and what its role is in the labour market. It also avoids the danger of too much noise creeping in from the graduate's working experience.

Second, at that stage, the match between education and occupation is crucial. Both graduates and employers face crucial decisions. Graduates have to assess the occupational domain in which their competencies and personal characteristics are best utilized and must consider the additional efforts to be undertaken to achieve the required performance. Employers are forced to assess the extent to which various personal and educational backgrounds of graduates match with the requirements of the vacancy and what adjustment costs in form of additional training will be incurred. Mismatches between what education taught and what the occupation requires might trigger costly adjustments in form of additional training to compensate for skill deficiencies (see e.g. Barron, Black and Lowenstein, 1989; van Smoorenburg and van der Velden, 2000; Wolbers, 2003), or provide incentives to change jobs (see e.g. Allen and van der Velden, 2001; Wolbers, 2003) as job mismatches form an important cause of job dissatisfaction (see e.g. Tsang and Levin, 1985; Burris, 1983). The match itself consists of two dimensions: a vertical one and a horizontal one. The former is related to the educational level attained at graduation and the educational level required by the occupation. The latter relates generally to the field of study graduated from and the field of study required. Although the match of the education level is important, this study focuses in particular on the horizontal match. Considering the vertical match, common labour market theories assume that higher educated workers are preferred, either due to their higher direct productivity or because they are more easily trainable, if it were not for their higher wage requests or their greater likelihood to resign from less challenging occupations (van de Werfhorst, 2002). However, the same theories also lead to the expectation that the value of a field of study strongly depends on the congruence in competencies between the field of study and the occupation. Hence, whereas a higher level of education generates more productive power, the productive power of graduates from a particular field of study depends on the congruence between the field of study and the occupation.

Third, choices made at the beginning of a career may have long-term effects for the employee due to hysteresis. Suboptimal matches between occupation and graduates may not allow graduates to keep abreast of developments with respect to the core competencies in which they invested. Moreover, to the extent that the principal of 'use it or loose it' applies for the graduates, we may expect such graduates to be more likely to be confronted with competence obsolescence. This will hold in particular for graduates from fields of study with a high turnover rate of discipline-specific competencies due to rapid technological progress. What is

common to these situations, is that they may create negative signals to potential employers, making a move towards a matching occupation more difficult. Evidence for this point can be found in, for example, VSNU (2003): The labour market position of Dutch higher education graduates seems to be strongly related to their situation immediately after graduation. In particular, initial unemployment, the level of the first occupation, and the match between the field of education graduated from and the field of education preferred by the first employer, are found to be determining factors for later career situations.

Lastly, making choices, as indicated above, would not be very difficult if the labour market for graduates worked as a textbook example of a perfect competitive market. But reality is different. Graduates and employers search in a labour market where information is costly, asymmetrically distributed and sometimes scarcely available. The heterogeneity and opacity on both sides make it difficult to achieve the perfect match between the characteristics of the graduates and the requirements of the job they need to perform. To avoid costly mismatches between desired and realized performance, we can expect a growing importance of group membership of the graduates as a source of conveying information with respect to individual graduates.

Concluding, it can be stated that the restriction to the transition period from higher education to the labour market makes it possible to analyze a crucial period in the labour market careers of graduates, and to investigate more thoroughly the role and value of particular competencies acquired in higher education programmes.

1.5 The place of this thesis in the literature, its aim, and some subquestions

This is unquestionably not the first study on the quality dimension of schooling and the understanding of the impact of quality differences in human capital (for a detailed overview of previous research, see Hanushek, 2002 and 2004). So far, two streams of research literature in particular have appeared.

The first concerns research that concentrated on identifying cognitive competencies as a central dimension of educational quality. Generally, this research addresses the question whether a student's performance in standardized tests, as a proxy for cognitive competencies, is correlated with the individual's performance later on in the labour market. Examples of studies indicating substantial income advantages for graduates scoring higher on standardized tests are Bishop (1989, 1991), O'Neill (1990). Grogger and Eide (1993), Blackburn and Neumark (1993, 1995), Murnane, Willet and Levy (1995), Neal and Johnson (1996), Murnane, Willet, Duhaldeborde and Tyler (2000), Altonji and Pierret (2001), Murnane, Willet, Braatz and Duhaldeborde (2001)[6].

The second concerns research that analyzes the impact of the field of study on the labour market success of higher education graduates. This type of research argues that the field of study plays a key role in mediating the link between participation in higher education and the educational outcome (Müller, Steinmann and Ell, 1998), or that the field of study becomes

6. These studies analyze the impact of individual cognitive competencies based on standard Mincerian earnings functions. Most of them are based on surveys among American High School graduates. A good overview is given in Hanushek (2004).

increasingly important as a selection criterion as the overall participation in tertiary education grows (Kim and Kim, 2003). Authors generally conclude that graduates from more professionally oriented disciplines (e.g. engineering or business) tend to have higher than average wages, while those in disciplines such as arts and humanities tend to have lower than average earnings (see e.g. Rumberger and Thomas, 1993; Berger, 1988a, 1988b; James, Alsalam, Conaty and To, 1989; Finni and Frenette, 2003).

Although both streams of research generally do not deny the various components of competencies acquired in higher education, much of early and ongoing empirical work concentrates on unidimensional indicators of human capital, treating education largely as a black box. Research on the market value of particular types of competencies, allowing for differentiation in the returns to education, started only recently. Noteworthy studies include Green (1998), Heijke, Koeslag, and van der Velden (1998), Allen and van der Velden (2001), Green, Ashton and Felstead (2001), McIntosh and Vignoles (2001), Shaughnessy, Levine and Cappelli (2001), Stasz (2001), ter Weel (2002), Lazaear (2003) and Heijke, Ramaekers and Ris (2005). In this thesis, we will follow this research and intend to address directly the heterogeneity of graduates and education programmes according to the competencies acquired by higher education students. More precisely, we will discuss the role given to discipline-specific and generic competencies in the transition from higher education to work. In doing so, we intend to contribute to the debate on what type of competencies should be emphasized in educational curricula. For that reason, the study addresses in particular the following subquestions:

1. How to define and measure the human capital acquired by higher education graduates?
2. To what extent are the level and the mix of competencies acquired in higher education determined by a student's time allocation and the learning environment?
3. What are the specific roles with respect to allocation, on-the-job training and productivity of discipline-specific competencies and generic competencies during the transition stage from higher education to the labour market?
4. To what extent can differences in the design of higher education programmes (e.g. specific versus generic competence orientation) explain the allocation and performance of graduates?

We believe that discussing these kinds of questions is of critical importance and answers to them will facilitate an efficient transformation of education, and higher education in particular, into the 21st century. Moreover, within the European context considered in this thesis, these questions may gain importance in the light of the Bologna Declaration that marks a turning point in the history of European higher education. Although not directly setting out a path towards a high degree of standardization or harmonization of European higher education, the aim of the Bologna Declaration to create an overall convergence by ironing out some of the least compatible characteristics of national higher education institutions will have a major impact. It will undoubtedly succeed in achieving further convergence. However, it remains to be seen if adopting a similar Bachelor/Master system will have an impact on the differences in the underlying process of competency acquisition or whether it is merely a matter of using the same wrapping paper. In other words, if the results of the analyses in

this study contribute to the discussion on a new structure of higher education institutions, it is restricted to the question how to reshape the content of the individual programmes concerned and not the Bachelor/Master structure as such.

1.6 A guide through the thesis

This section concludes the introduction by providing a guide through this thesis. The study consists of 7 chapters. Chapters 2 and 3 are partially preparatory chapters for the empirical studies and partially have a goal of their own. Chapters 4 until 6 present the empirical studies. Finally, Chapter 7 concludes the thesis. Figure 1.1 gives an overview over the setup of the study.

The left-hand side focuses on the competence transformation process in higher education. The process is assumed to be influenced in particular by individual characteristics of the students, the students' pre-higher education schooling career, the students' choice for a particular field of study and type of higher education, and the students' time allocation while studying. The latter factors may to some extent also be determined by particular student characteristics. Programme characteristics, such as the learning environment within which the study takes place, also influence the transformation process.

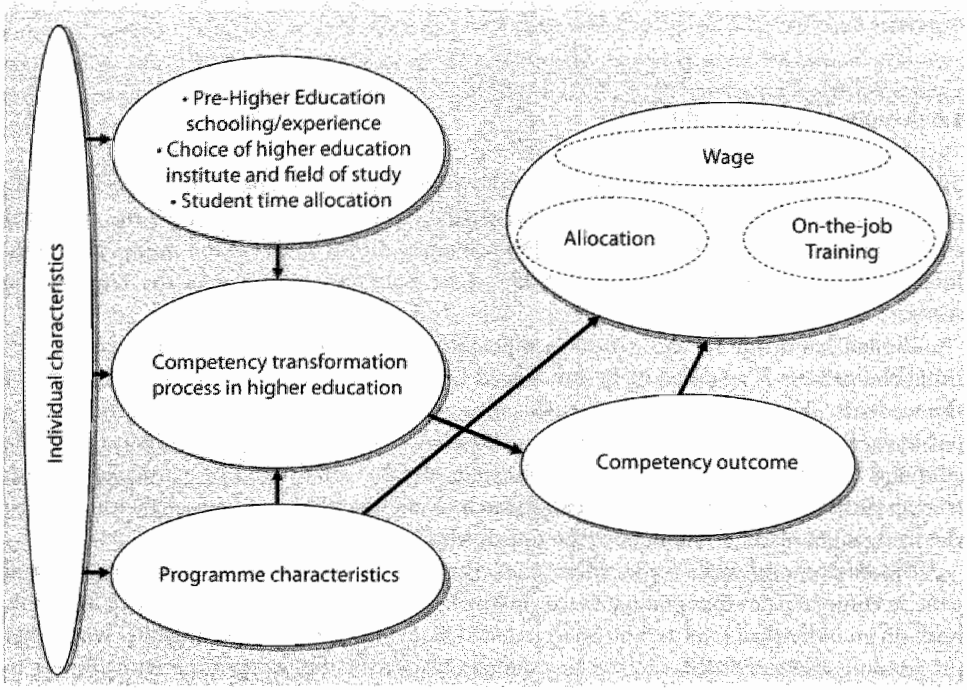
The outcome of higher education is measured by the level of discipline-specific and generic competencies that graduates acquire during their studies. The competence outcome, both on an individual level and on an aggregated study programme level, together with other programme characteristics, such as the standardization of the programme with respect to the competencies taught, are expected to determine the labour market success of graduates. To analyze the labour market outcome and success, and thereby explicitly the role of the competencies in it, we have not only measured the monetary returns but also investigated the allocation over different occupational domains with different comparative advantages and the decision to follow further on-the-job training aimed at reducing any type of competence lacks experienced during the transition stage.

The general content and main findings/insights of the chapters are as follows:

Chapter 2: Human Capital – Qualifications – Competencies: A conceptual approach. The aim of this chapter is twofold. First, it provides the reader with a brief overview of different theoretical approaches with respect to the impact of education on labour productivity. We propose that particularly models based on the assignment theory provide useful insights for this study.

However, we claim that the way in which education is measured in research is generally recognized as unsatisfactory. Following that, we will address subquestion (1) and introduce the competence concept, reveal its relevance in research on the transition from higher education to the labour market, and discuss different types of competencies. We will conclude the chapter by proposing a distinction between discipline-specific and academic (a particular type of generic) competencies, to be set at the centre for analyses on the transition from higher education to the labour market. The former type measures the cognitive prerequisites that enable a graduate to perform well in a given, but mostly restricted, substantive area, while the latter type measures the abilities of a graduate to (re)learn, to adapt to changes and to deal with information.

Figure 1.1
Setup of study



Chapter 3: CHEERS survey and measurement of academic and discipline-specific competencies. In this chapter, we will introduce the reader to the CHEERS data set (**C**areers after **H**igher **E**ducation: a **E**uropean **R**esearch **S**tudy) used in the empirical studies of this thesis. The full English Questionnaire is included at the end of this thesis. Next, we will return to subquestion (1) and discuss a flexible way to measure the output of higher education in terms of acquired academic and discipline-specific competencies. The measurement makes it possible to gain clear insight into the heterogeneity of graduates, given a particular study programme. Moreover, the measurement is flexible and is able to cope with changes in the competence mix taught in higher education and required in the labour market. Lastly, in addition to capturing the individual heterogeneity, the measurement provides an innovative way to characterize higher education programmes and higher education systems. More specifically, we will show that higher education systems in the Netherlands, Germany and Austria, in line with their occupation-oriented labour market, are discipline-specifically oriented and that higher education systems in the United Kingdom, France, Finland and Spain are academically oriented, fitting well the expectations of an internal labour market. Testing the measurement with respect to its validity shows that it is internally reliable and satisfactory with respect to its validity.

Chapter 4: Student time allocation, the learning environment and the acquisition of competencies. In this chapter, we will address the question how academic and discipline-

specific competencies are actually acquired in higher education in Europe (subquestion 2). In contrast to the vast majority of analyses addressing the link between financial resources and educational production outcomes, we will address in this chapter two factors that form a central part of the core of the production process: the learning environment and student time allocation. With respect to the former characteristic, we will analyze in particular the question to what extent new didactic methods, such as problem-based learning, are more effective in teaching competencies. With respect to the latter, we have analyzed the effects of such differences between as the numbers of hours spent in the classroom and hours spent on self-study, on the efficiency with which the two types of competencies are acquired. Key findings of this study were that the learning environment is an important factor in determining both the level and the type of competencies that students acquire. Activating learning environments are clearly superior when it comes to teaching academic competencies. Moreover, they do not harm the effectiveness with which discipline-specific competencies are acquired. For an optimal provision of both types of competencies, however, an activating learning environment must be combined with a teacher transferring discipline-specific competencies to the students, when needed. With respect to the students' time allocation, this study shows that discipline-specific competencies are mainly acquired inside the classroom, by self-study or by paid working experience which is related to the study. The latter two activities also enhance the acquisition of academic competencies, whereas no impact was found from following formal education.

Chapter 5: Fitting to the job: the role of academic and discipline-specific competencies in adjustment and performance. Using the Netherlands as a case study, we investigated empirically the role and pay-off of discipline-specific and academic competencies during the transition period (subquestion 3). We will first deal with the literature that investigates the pay-off of different human capital competencies acquired in education by introducing them directly in wage estimations. We will show that in this approach the role of competencies is difficult to reveal and, moreover, that it may bias the results towards discipline-specific competencies. Next, we will develop an empirical model in two steps, first analyzing simultaneously the role of competencies on the allocation and on-the-job training, and second, taking the first step into account, analyzing the monetary return to competencies. This makes it possible to reveal the different roles of academic and discipline-specific competencies and their distinctive values. The results indicate, first, that the extent to which Dutch graduates are matched to an occupation in congruence with their field of study is influenced to a great extent by the level of discipline-specific competencies that they possess. As these occupations are better paid, being selected for them is important for the graduates from a monetary point of view. Second, we will show that academic competencies acquired in higher education play a major role in the question who is selected for further training and who is not. In other words, training and the level of academic competencies are established as complements. As a matter of fact, the results indicate that academic competencies are used to adjust the discipline-specific competencies of graduates to the requirements of the labour market.

Chapter 6: The effects of higher education programme characteristics on the allocation and performance of graduates. This chapter addresses the question to what extent characteristics of higher education programmes provide information and/or signals to potential employers with respect to the knowledge acquired in higher education (subquestion 4).

Considering that the transition period is filled with asymmetric and private information and hence uncertainty, one can expect employers to rely on such group characteristics. For that reason, five characteristics of higher education programmes are discerned, which according to literature can be regarded as crucial: the competence orientation of a programme, the standardization of programmes with respect to the competencies distinguished, the international character of the programme, the level of co-operation between working and studying which a programme provides, and the possibility that a programme provides exclusive access to particular occupations. Key findings of this study are that both the competence orientation of the programme and the standardization of the programme with respect to the two types of competencies are crucial determinants of the graduates' labour market outcomes. Whereas the competence orientation has a great influence on the allocation outcome of graduates, it was found that standardization of the competence outcome provides employers with better information on the true productive power of graduates, reducing selection and adjustment costs and allowing for a higher remuneration of the workers.

Chapter 7: Concluding remarks. This chapter concludes the thesis. We will return to the objectives that we tried to achieve, provide an overview over the main insights from this thesis, indicate their policy implications and discuss fruitful lines for future research.

Chapter 2

Human capital – qualifications – competencies: A conceptual approach

« How much trouble is spent in awarding people different classes of degrees in universities and polytechnics and yet for most of them absolutely nothing depends on it in later life. As a society we take it very seriously. But that is not what education is about; the difference between a Two One and a Two Two. Education is about the experience that went into that degree and the skills that were developed »

C.J.E. Ball, MA, Warden, Keble College, Oxford,
1987 Cited in Leckey and McGuigan, 1997

2.1 Introduction

The last 50 years have seen a clear change in the way in which education is considered. Whereas prior to the human capital revolution, which started in the 1960s, education was generally considered a consumption good (see e.g. Alstadsaeter, 2003), it has now gained the status of an investment good with above-average expected returns. Even though research on the impact of education on labour market success has accumulated considerably over the past decades, economic literature is still not unanimous with respect to the precise relevance of the school-to-work relationship and the processes involved in it.

In this chapter, we propose the idea that for further research on the transition from school-to-work it is necessary to drop the assumption that qualifications or graduation in a particular field of study imply a homogeneous standard of competencies across graduates. Accordingly, we claim that it is crucial to address directly the different types of competencies which graduates possess when leaving higher education. These competencies, forming a central part of the graduates' human capital, are seen as more accurate and reliable indicators of individual labour market performance.

To do so, this chapter has the following structure. First, Section 2.2 briefly addresses the question of the impact of education on labour productivity in economic theories. More in particular, it discusses the central assumptions and implications of the human capital theory, the job competition model, and basic aspects of the assignment theory. Then, Sections 2.3 and 2.4 deal with the question how to define and measure the human capital acquired by higher education graduates in terms of assets that are traded in the labour market. First (Section 2.3), we will introduce the competence concept, discuss the problems involved in using it and provide a working definition in line with the main objectives of this thesis. Second (Section 2.4), we will address the question what type of competencies can be regarded as core elements of higher education programmes. For this reason, we will discuss the literature on discipline-specific and generic competencies. Finally, Section 2.5 concludes the chapter.

2.2 Impact of education on labour productivity: different approaches

Schultz (1961) proposed that we should treat education as an investment in man and to treat its results as a form of capital: "*Since education becomes part of the person receiving it, I shall refer to it as human capital*". Accordingly, individuals are assumed to choose the optimal amount of human capital improvement by investing into, for example, education up to the point where the marginal costs[1] of further additions equalize the discounted value of the future marginal income to which it gives rise. Hence, the human capital theory assumes that education provides the student with capabilities of productive value in the labour market. To estimate the value of education, Mincer's model of earnings (Mincer, 1974) has played a key role in empirical economics (Willis, 1986, Heckman, Lochner and Todd, 2003). It specifies the natural logarithm of the wage rate as:

1. Such as tuition fees, costs of books as well as the indirect costs of forgone income.

$$(2.1)\quad \ln[w(s,x)] = a + \rho s + \beta_0 x + \beta_1 x^2 + \varepsilon$$

where $\ln[w(s,x)]$ is the natural logarithm of the wage paid to a worker with education level s and working experience x, ρ is the rate of return to years of schooling assumed to be constant among different levels of schooling and ε is an iid. error term. Mincer's framework implies a linear increase in wage rates due to prolonged education. However, the experience-earnings profile is assumed to be concave, reflecting that age - due to the decreasing time left to capture the return - has a negative effect on the probability of on-the-job training participation. This approach has been used widely as a basis for empirical estimations on the returns to schooling or the impact of experience on the wage gap between male and female workers[2]. In recent years, the original approach has been criticized for not allowing the incorporation of qualitative differences of one year of schooling according to, for example, the type of education followed (e.g. Wössmann, 2002).

The strong supply side orientation in determining labour productivity has also caused serious doubts. Implicitly, the wage competition model assumes that individuals holding a particular level of human capital, irrespective of the occupation to which it is matched, provide a certain level of productivity (Green and McIntosh, 2002). Several economists (including Duncan and Hoffman, 1981, Rumberger, 1987, and Hartog and Oosterbeek, 1988) questioned whether firms were actually able to fully adapt their production technology to the supply of human capital. The substantial increase in the supply of higher education graduates in the last decades (see e.g. EC, 2002), institutional rigidities (see Green, McIntosh and Vignoles, 1999) or costly and asymmetrically distributed information can be named as factors scrutinizing this assumption. In all of these cases, productivity - and hence earnings - crucially depends on occupational characteristics (di Pietro and Urwin, 2002).

In this respect, a major competitor of the human capital theory is the job competition model (Thurow, 1975). In its most extreme case, productivity is explained entirely by occupational characteristics and not by individual characteristics. Thurow argues that, although school-leavers enter the labour market with a variety of background characteristics, such as different levels of educational attainment, these background characteristics do not constitute a group of skills with an immediate productive value. More likely, they determine the costs of the on-the-job training needed to acquire what is required in the occupation. Prolonged education results in more human capital, implying better trainability, and allows the individual to advance in the labour queue. It has to be noted that Thurow himself states that in reality there is a continuum between the importance of occupational and individual characteristics and that the assumption to neglect supply side characteristics in the determination of productivity, is made to isolate the role of job competition from supply side factors.

Both the Mincerian wage model and the job competition model in their original versions seem too restricted to one side of the market. Approaches that allow explicitly for an interaction between supply and demand side characteristics are generally known as assignment models[3]. Assignment models assume that the supply side consists of heterogeneous indi-

2. For a more elaborate discussion of Mincer's approach and empirical results based on it, see Heckman, Lochner and Todd, 2003.
3. For an overview of different assignment models and their distinctive features with respect to matching models, as for instance proposed by Mortensen (1986), or search theories (e.g. Jovanovic, 1979), see Dupuy (2004).

viduals with knowledge and skills acquired in education or training. The demand side is given by occupations differing according to the knowledge and skills they require. It is argued that education provides the student with productive capabilities but that it is the interaction between these capabilities and the ones required in the occupation that determines productivity. The better the match, the higher productivity. Along this line of argumentation, diversification in the labour market, given by the division of labour in society, and diversification in education come to play central roles. Considering higher education, diversification takes place along a vertical and a horizontal dimension. Vertical diversification relates to, often country-specific, differentiation in levels of higher education. Horizontal diversification relates in particular to different disciplines or fields of study offered in higher education. Allocation and productivity outcomes hinge therefore on vertical and horizontal sorting[4] and hence on the existence of comparative advantages. Simple stated, "*comparative advantage occurs if the productivity ratios between two different individuals are not constant, but depend on the activities (or jobs) where the comparison is made*" (Hartog, 1992 p.107).

If it were not for their higher wage requests or their increased likelihood of resigning from less challenging occupations, employers, independently of the educational level best fitting to the vacancy, prefer highly educated workers. In case of the wage competition model this is because of their higher level of productive capabilities, and in case of the job competition model because of their better trainability. Whereas different levels of higher education are ranked easily by employers, different fields of study are difficult to rank, as their ranking depends on the congruence between the type of knowledge and skills acquired in education and the type of knowledge and skills required in the occupation (see also van de Werfhorst, 2002). In this respect, different authors argue that the field of study deserves more attention when it comes to analyzing the labour market success of higher education graduates. Müller, Steinmann and Ell (1998) argue that the field of study plays a key role in the link between participation in higher education and educational outcomes. Kim and Kim (2003) believed that the field of study would get increasingly important as a selection criterion for the future prospects of graduates, as overall participation in tertiary education grows. What is perhaps the most interesting point for our objectives is the fact that the field of study may provide information on the value of different types of human capital which the various disciplines represent. Studies on the American NLS72 and High School and Beyond databases show firstly that there are statistically significant and quantitatively large differences in earnings levels by discipline, and secondly that particularly graduates from the more professionally oriented disciplines (such as engineering and business) tend to have higher than average wages, while those in disciplines such as arts and humanities tend to have lower than average earnings (see e.g. Rumberger and Thomas, 1993; Berger, 1988a, 1988b or James, Alsalam, Conaty and To, 1989). Similar findings were presented by Finnie and Frenette (2003) for recently graduated Canadian students. However, the study of Finnie and Frenette also provides evidence of a large remaining variation in earnings between graduates of a particular field of study. Even in the case of engineering and computer science graduates, presumably representing a relatively homogeneous group of graduates that faces similarly well-defined job

4. Vertical sorting relates to the match between the level of education graduated from and the level of education required in the occupation. Horizontal sorting relates to the match between the type of competencies acquired in higher education and the type of competencies required in the occupation.

opportunities in a well-structured job market, the graduates' actual earnings deviate from the regression-predicted values on average by 18%. Hence, relying just on the title of a qualification, neglects the fact that, like the name of a particular Indian curry, it only reveals its real variety of ingredients when consumed. Unless the qualification is focused on a single task (such as switching on the light when the sun goes down), it rather reflects a vector of a graduate's heterogeneous potential capacities to perform tasks corresponding to activities along an array of jobs (Cedefop, 2001). As not all of these ingredients (capabilities) are easily expressed, reading just the menu denies us access to the whole stream of knowledge. In other words, neither the title of an educational qualification nor the title of the occupation held by the worker is an ideal measure of the capabilities actually acquired or used (see Ashton and Green (1996) for a detailed critique). Moreover, according to the Report of the Expert Panel on Skills (2000), the use of these rather static labels cannot do justice to the constantly evolving and expanding mix of technical, management and essential skills and attributes sought by employers and provided by education. In recent years, in particular Green and McIntosh (2002), proposing a heterogeneous skills approach[5], and Lazaear (2003), postulating a skills weight approach, tried to tackle this problem. Common to both approaches is their explicit rejection of the assumption that qualifications or occupation titles represent a homogeneous standard of skills and abilities acquired/required across individuals/tasks[6].

The objective of this study is to enhance the knowledge on this point. Rather than proposing a new and better economic theory on the impact of education on labour market success in general and productivity in particular, we propose a more detailed way of measuring education. In doing so, we intend first to allow explicitly for heterogeneity between graduates with the same qualification and second, to differentiate between the return to education according to this heterogeneity. To do so, we will introduce in the next section the competence concept and address particular types of competencies assumed to play a central role in higher education programmes.

2.3 The competence concept

Although nomenclature may not matter very much when everybody agrees on what is meant, we will follow Borghans, Green and Mayhew (2001) and argue that the question 'what is in a word' is pivotal to a discussion on competencies. This holds in particularly because the concept has undergone significant changes in meaning and there has been a tendency to widen the use of the term including personal attributes, which once would not have been thought in this manner (Payne, 2000). These changes in definition and meaning are partially the result of the fact that the term is being used as a relevant concept by a number of research fields, each with its own disciplinary roots, and partially the result of the usage of the concept inside a research field, as either interchangeable with terms such as 'skill' or as a separate concept.

5. The heterogeneous skills approach postulated by Green and McIntosh (2002) is based on the argumentation of Allen and Van der Velden, 2001.
6. Similarly, Planas, Giret, Sala and Vincences (2000) argued that it is of crucial importance to recognize and certify the assets behind a certificate that are actually exchanged in the labour market.

Weinert (2001), contributing to the OECD project 'Definition and Selection of Competencies' (short: DeSeCo), provides a comprehensive state of the art with respect to the competence concept in the different research areas. He argues that even if one restricts the focus to the use of the word 'competence' in developmental sciences, psychology, linguistics, sociology, political science and economics, this would still yield a wide variety of definitions. Nonetheless, the term 'competence' is used in all of these disciplines to indicate a specialized system of individual and/or collective abilities, proficiencies or skills necessary to reach a particular goal. Although Weinert concludes that a theoretically based definition of the concept 'competence' is a bridge too far at the moment, he provides clear indicators as to what such a definition should take into account:

- The term 'competence' should refer to necessary prerequisites for successful handling of complex tasks. Hence, it has to be a demand-oriented or functional approach (see also Rychen and Salganik, 2003) and the primary focus must be on the results that the individual achieves given the demand.
- The term must be used if successful handling requires cognitive factors as well as social components. Moreover, in most cases, motivational and ethical aspects form a further component of the action.
- The term implies that the task to be handled is above a critical level of complexity. Simple and to a large extent automated conditions must be classified as skills.
- Learning processes are a necessary condition to acquire conditions required to handle the task successfully.
- The term 'key competencies' has to be sharply distinguished from the term 'metacompetencies'. The former should be reserved for competencies that are useful in the handling of a diversity of tasks, the latter for the declarative or procedural knowledge over one's own competencies.

The distinction between the terms 'skill' and 'competence' was also adopted by Rychen and Salganik (2003). Although the latter authors admit that the term 'skill' is occasionally used in a way similar or even identical to the notion of 'competence', in most cases it carries a meaning that is, strictly speaking, different from the competence connotation. 'Skill' labels an ability to perform complex motor and/or cognitive acts with ease, precision, and adaptability to changing conditions. The term 'competence' is used to designate a complex action system encompassing cognitive skills, attitudes and other non-cognitive components. Along this holistic perspective, the term competence assumes that a range of mental prerequisites must be mobilized (Rychen and Salganik, 2003). Hence, the term includes more than just the skill of knowing how to typewrite but also the ability to bring the written words together in poetry[7].

Contrary to this, economic literature is generally more pragmatic, using the two terms 'skill' and 'competence' as synonyms. Levy and Murnane (2001), contributing from the

7. Similarly, Rainbird (1994) and Bijornavold and Tissot (2000) distinguish between 'skill' and 'competence'. In their view, the former is closely related to the performance of a specific task, whereas the latter is the proven and individual capacity to use know-how, skills, qualifications or knowledge in order to meet both familiar and evolving situations.

economic science perspective to the DeSeCo project, therefore embraced a broad definition of skills, including not only cognitive skills but also non-cognitive skills such as perseverance. Similarly, Mertens (1999) argued that competencies and skills are interchangeable terms, relating both to certain aspects of knowledge and capacity, represented by a qualification needed to achieve results in a given situation. Considering the general use of the terms 'skill' and 'competence' in the English literature, this pragmatic approach is not surprising. Consulting the Collins English Language Dictionary (1990) reveals that 'skill' is the knowledge and ability that enable you to do something such as a job, game or sport very well, whereas 'competence' is the ability to do something well or effectively.

Despite the pragmatic approach taken in most of the economic literature, this thesis follow the approach of Weinert (2001) and Rychen and Salganik (2003) and distinguishes the term competency from the term skill. More specifically, the term 'competency' is reserved for a group of skills, referring to a single underlying dimension and forming the condition to fulfil complex and varying tasks inside and outside the working sphere. In this sense, the ability to heat up the oven, the ability to cut the meat, and the ability to name different herbs are regarded as skills, whereas their combined knowledge is what makes a cook competent.

2.4 Competence outcomes of higher education

What does it mean to talk about competencies in the light of a knowledge-intensive economy? And more precisely, what types of competencies are crucial for higher education students to acquire? Given that the term 'knowledge economy' is rather a widely used metaphor than a clear concept, it is not surprising to find different conceptions of what the knowledge requirements are for school-leavers in general and for higher education graduates in particular. Lundvall and Johnson (1994), for example, distinguish four types of knowledge that they regard as of key importance in a knowledge-based economy: know-what, know-why, know-how and know-who. Know-what refers to factual knowledge that is easily stored and transferred. Know-why refers to scientific understanding and the impact of science on mankind. Know-how is the capability of performing certain tasks, while know-who refers to knowing the people who possess the other three knows. Implicit in this classification is the often recurring distinction between 'codified' and 'tacit' knowledge. The former can be expressed in language or symbols and is easily stored. The latter is linked directly to its bearer and is as such not readily transferable. It is the stock of knowledge that enables the person to select, interpret and develop the codified knowledge (Eurydice, 2002a).

In terms of educational outcomes, codified knowledge very often reflects the discipline-specific competencies of the study field graduated from, while tacit knowledge may also refer to generic competencies that are not content-bound. As the name suggest, the term 'discipline-specific[8] competencies' refers to cognitive prerequisites that an individual requires in order to perform properly in a given substantive area (Weinert, 2001). The term generic is used as a label covering a diversity of concepts, of which some of the better-known are intelligence, information-processing models, metacompetencies and key competencies (Allen,

8. Throughout this thesis, the term 'discipline-specific' will be used as a synonym of 'vocational'

Ramaekers and Van der Velden, forthcoming). In recent years, higher education faces to an ever larger degree an increased demand for such generic competencies. Generic competencies provide graduates with abilities that are not only useful in addressing problems in a creative manner but can also be used to expand and adapt the potentialities of an existing job.

2.4.1 Discipline-specific competencies

If asked, students who enter higher education programmes prefer to indicate that their objective is to become an 'economist', 'lawyer' or 'engineer', than an 'academic' in general. This is not surprising, because higher education studies have been and generally continue to be organized around a particular scientific field or in some cases around a particular profession. Hence, teaching discipline-specific competencies has always been a central objective of higher education. Students at a faculty of economics learn the 'consumption theory', are given instruction about different models of exchange rate determination, and discuss what money is. Undoubtedly, high quality in methods and theories of a particular discipline continue to be of importance for the graduate's high level of performance on entering the labour market, where advanced and often highly specialized knowledge is required.

Research intended to reveal the value of such discipline-specific competencies in higher education is relatively scarce. As discussed above, most research on this topic relies on differences in labour market outcomes according to the field of study. In spite of the fact that the field of study determines the type of discipline-specific competencies that constitute the core set of the study, the name of a field of study is an inappropriate indicator for the level of discipline-specific competencies and neglects the fact that students not only acquire discipline-specific competencies during their study. Research that explicitly looked at discipline-specific competencies so far mostly focused on pre-higher education. Bishop (1992, 1995), analyzing US high school graduates, provided perhaps the strongest evidence on the value of discipline-specific competencies in the labour market. According to him, occupational competencies are essential in achieving productivity in most jobs. On the basis of a survey among members of the National Federation of Independent Business in the United States, asked to rank abilities according to their influence on hiring decisions, he showed that 54% ranked 'occupational/job skills' first or second, while only 41% did so with 'ability to learn new occupational and job skills'[9]. The greatest rival for occupational skills is work habits, which were ranked within the top two places in 67% of the cases and only in 3% of the cases at the bottom. Bishop's findings seem to indicate that the best jobs tend to go to graduates who took vocational courses and/or worked part-time during the school year and hence, to graduates who already possessed occupational/job skills. Moreover, keeping demographics and employer evaluations of other traits constant, Bishop found that the workers thought to have 'much better' occupational skills started with a 12% higher wage, were judged to be 10.7% more productive after holding the job for about 1 year, and were making 14% extra at that moment of time. He concluded that productivity derives directly from social abilities,

9. Interestingly, prior knowledge in occupational/job skills was also ranked by 20% of the respondents as least important. According to Bishop (1995), this was related to the fact that these jobs generally tend to hire less skilled service and clerical workers, operatives and sales clerks. In those lower level jobs, work habits were ranked at the top, followed by the ability to learn new occupational and job skills.

such as good work habits and people skills, as well as from cognitive skills that are specific to the job and occupation, and not from reading, writing and mathematics skills or the ability to learn new occupation and job skills. In doing so, he departed from the premise that academic competencies are mere tools for developing specific competencies, rather than a good substitute for occupation-specific competencies. According to Bishop, "*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.*"

The results found by Bishop (1991, 1995) are supported by other recent research literature (e.g. Campbell and Laughlin, 1991; Altonji, 1995; Mane, 1998), which also tends to find stronger positive effects of vocational course work on labour market outcomes. Even though this research focused mainly on high school graduates entering the labour market, and not on graduates of higher education as the present study does, the results are of interest as they indicate the role generally given to discipline-specific competencies acquired in education. More in particular, discipline-specific competencies are seen as a mediating factor in hiring decisions, allowing the school-leavers to be directly productive in the labour market. Even though discipline-specific competencies acquired in higher education may be more abstract than the ones acquired at lower education levels, and hence less directed towards a particular occupation, we may expect them to continue these roles.

2.4.2 Generic competencies

Employers undoubtedly expect law graduates to have a solid knowledge of the law and medicine graduates of the anatomy of the human body. However, higher education has in recent years been facing increasing expectations of firms to provide more than just narrowly discipline-specifically educated graduates. Sternberg (2003) proposes that the future needs a "*generation of experts, whose expertise will extend well beyond technical knowledge.*" This is confirmed by the British Skills Survey 2001, which focused on an update and improvement of the knowledge on competencies used at the British workplace. Although the changes since the Skills Survey 1997 that are reported are small, the consistency of their direction of change is strongly suggestive of a steady ongoing transformation in the British labour market (see Felstead, Gallie and Green, 2002). Occupations increasingly demand competencies that are not by definition applicable only in a small area but that are useful in a broad range of occupations. Along this line, recent reviews of education propose generic competencies that are applicable in a variety of occupations and across different life contexts, as desirable and key outcomes of education.

« *If you do not know what the future situation will be, then teach students some fundamental skills which they can apply to any situation* » (Bowden and Marton, 1998)

Is this strong emphasis on generic competencies new? The answer is clearly No. As a matter of fact, it is far from correct to state that the interest in non-discipline-specific competencies acquired in higher education is new. Duncan (1968) in the 1960s, and hence long before the 'knowledge economy' term conquered the political area, 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." Similarly, Bowen (1977) found 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*[10]*."*

Table 2.1
Terms used in various countries to describe generic competencies

Country	Term used
United Kingdom	Core, Key, Common
New Zealand	Essential
Australia	Key, Employability, Generic
Canada	Employability
United States	Basic, Necessary, Workplace know-how
Singapore	Critical enabling
France	Transferable
Germany	Key
Switzerland	Trans-disciplinary goals
Denmark	Process-independent qualifications

Source: Australian National Training Authority, 2003.

Reviewing the literature on generic competencies reveals that neither is there a definitive list of generic competencies, nor is the term 'generic' used globally. Table 2.1 provides an overview of some of the terms used to indicate generic competencies in various countries[11]. Common to all these terms is that they are used to indicate the subject, discipline or occupation independence of the competencies considered. 'Generic competencies' are regarded as transversal. The term 'transversal' does not refer to elements common to different subject-based competencies but strictly to the additional, subject-independent content of these competencies that is useable in other fields (Rey, 1996).

A variety of reports and surveys intending to establish a list of concrete generic competencies have been published in recent years. Generally, all addressed the question 'what are the relevant competencies to succeed in a modern economy?' Some of the better-known include the survey conducted by the Secretary's Commission on Achieving Necessary Skills

10. In line with these ideas, Squires (1987) presented arguments for a broadening of higher education beyond specialized knowledge. First, as graduates differ socially from non-graduates in terms of power, wealth and opportunity, it would be desirable for them to be aware of these differences and to use them responsibly. Second, as special knowledge creates special intellectual limitations, it is valuable to learn to see one's own expertise from outside as well. Third, knowledge about knowledge helps one become aware of the norms, values and assumptions that underpin one's work and helps one relativize them and perceive alternatives. Finally, learning can help graduates to reflect how their expertise is linked to their self-concept and identity. Hence, recent technological evolvement and, inherent to it, changes in the managing of organizations increased the emphasis rather than invented it.

11. In some countries, generic competencies are specifically employment-related, while in other countries more emphasis is placed on their social relevance.

(SCANS) in the United States, the Employability Skills Profile of the Conference Board of Canada (CBOC), and the British Columbia Employability Skills survey[12]. Table 2.2 provides an overview over six elements that are common to all aforementioned surveys.

We will briefly consider these six common elements to arrive at a more narrow definition of generic competencies that can be used for this study. Let us keep in mind that our focus is on higher education and hence on higher-order thinking skills rather than on lower-order ones, as distinguished in Bloom's taxonomy of educational objectives (Bloom, 1956). In this sense, we search for aspects that can be regarded as crucial elements of the generic competence package that higher education graduates take with them when they enter the labour market, by asking "are they specific to higher education?" and "can they be taught in higher education?"

Table 2.2
Common elements of various listings of generic competencies

Element	Examples
Basic/fundamental skills	Literacy, using numbers, using technology
People-related skills	Communication, interpersonal, teamwork, customer service skills
Personal skills and attributes	Being responsible, resourceful, flexible, able to manage one's own time, having self-esteem
Skills related to the business world	Innovation, entrepreneurial skills
Skills related to the community	Civic or citizenship knowledge and skills
Conceptual/thinking skills	Collecting and organizing information, problem-solving, planning and organizing, learning-to-learn, thinking innovatively and creatively, system thinking

Source: Australian National Training Authority, 2003.

With perhaps the exception of the aspects labelled in Table 2.2 as *'skills related to the community'* all of the elements include items that provide a direct value in the labour market.

A basic[13] level in, for example, reading and mathematics (*Basic/fundamental skills)*, the ability to communicate effectively both orally and in writing, as well as to interact with others, (*People-related skills)*, is often named as central in determining the long-term labour market outcomes (see e.g. Levy and Murnane, 2001). However, considering our focus on higher education graduates, in particular with respect to the former element, the following side-note is noteworthy. The acquisition of an expertise level in mathematics, for example, is strongly inherent to a particular discipline at higher education levels and hence it is inconsistent with our functional approach on generic competencies.

The third element (*personal skills and attributes)* refers to human characteristics such as 'being responsible' or 'having self-esteem'. Although their relevance for the student's success in the labour market is undisputed, these aspects should be regarded as a by-product of education rather than its central objective. As a matter of fact, the level that students possess at the time of graduation is determined to a large extent by factors such as the childhood of

12. For a brief overview and discussion of these and other approaches, see Australian National Training Authority, 2003.
13. It is important to note that the term 'basic' does not a priori refer to low-level skills. It is often used to indicate that these skills constitute a basis for other skills, rather than a particular level of complexity.

the student, his past and current family situation, activities carried out outside education, and by the general cultural context in which he or she lives.

'Innovation' or 'entrepreneurial skills', aspects included in the fourth element '*skills related to the business world*', relate to the growing need of graduates in general and higher education graduates in particular to be properly prepared for management positions in a post-industrial economy with global competition. Higher education responded to this need and started a variety of graduate, and in particular postgraduate, courses in management topics. The effectiveness of teaching such skills in classrooms is questionable. Milter and Stinson (1995) argued that traditional management and business education falls short in educating leaders for the new competitive environment. McCall, Lombardo and Morrison (1988) found that most of the development of management competencies takes place on the job, and not in seminars, classrooms or MBA programmes. A similar result was found by Heijke, Meng and Ramaekers (2003), who showed that the level of management competencies to be handled by higher education graduates entering the labour market was more strongly related to the amount of general academic competencies than to the amount of management competencies acquired in higher education.

The sixth element '*conceptual/thinking skills*' includes items such as 'collecting and organizing information', 'problem-solving' but also 'learning-to-learn'. Items inside this element, which is often referred to as 'academic competencies', are strongly linked to the concept of 'metacognitive competencies' on the one hand, and the literature on 'critical thinking' on the other. Metacognitive competencies relate to the expertise about oneself as a knower, learner and actor (Weinert, 2001). Ennis (1987) defined 'critical thinking' as '*reasonable reflective thinking that is focused on deciding what to believe or do.*' It involves '*formulating hypotheses, alternative ways of viewing a problem, questions, possible solutions, and plans for investigating something.*' Accordingly, critical thinking is in particular associated with verbal-reasoning skills, argument-analysis skills, thinking skills such as hypothesis testing, thinking in terms of likelihood and uncertainty, decision-making and problem-solving skills (Halpern, 1988). Its distinction from lower-order thinking skills with their main focus on knowledge, comprehension and/or application, thus follows the aforementioned taxonomy of educational objectives as given by Bloom (1956). Items belonging to the element of critical thinking in this sense are inherent parts of higher education programme outcomes.

Reconsidering the objectives for discussing the six common elements found in surveys on generic competencies, we conclude that, in particular, aspects related to 'conceptual/thinking skills' are of great relevance to the narrow focus on higher education graduates. By this, we do not intend to make a normative statement with respect to the relevance of particular skills or competencies that have not been selected. Rather, we want to argue that aspects of the selected element are most in line with the focus on the acquisition and use of competencies by higher education graduates. The relevance of these items is also supported by their central role in the so-called 'Dublin descriptors', developed by the Joint Quality Initiative Network[14] to indicate the required competencies of Bachelor and Master graduates in European higher education

14. The Joint Quality Initiative network consists of representatives from twelve European countries. Their general aim is to improve international co-operation in education. For more information, please refer to www.jointquality.org.

and by findings of Harvey (1993)[15]. Harvey asked both a group of university academics and a group of potential employers of university graduates in the United Kingdom to rank different criteria according to their relevance by which the labour market assesses graduates. The rankings were quite comparable and in both groups, items such as 'problem-solving abilities' and 'analytical competencies' were placed among the top criteria[16]. Accordingly, we conclude that a group of skills relating to further learning, solving problems and working with information and data, is best suited to the focus of this study. In the remainder of this thesis, this group of skills will be referred to as 'academic competencies'.

By restricting the focus to 'academic competencies', we also link the research directly to the concept of 'lifelong learning', currently placed at the centre stage by policy advisors. 'Lifelong learning' made its appearance in the early 1970s on the basis of two basic elements: the extension of post-compulsory education to cover the entire lifespan and the idea of organizing the system in order to cover all aspects of life in recurring fashion (CEDEFOP, 2001). Its implementation was disrupted by the economic recession of the 1970s and the concept had more or less to be reinvented in the 1990s. This time, its appearance went hand in hand with another revival, that of the term key competencies[17], and was inherently related to economical and demographical factors. Economically, the evolvements in information and communication technology (ICT) played a trigger role. The awareness that progress in ICT has made it possible to access and transfer codified knowledge more and more rapidly and that at the same time the pace of technological progress may render it obsolete at an increasing rate (see e.g. Teichler, 1999), shifted the focus of attention towards competencies that enable one to select, process and apply the knowledge store. This shift seems even more pressing for European countries considering the ageing population, rising migration, increasingly complex career paths, consistently high levels of unemployment, and the associated risk of social exclusion (Eurydice, 2002a).

Taking stock, we have argued that generic competencies in general and academic competencies in particular are relevant with respect to two features. First, they are a necessary condition for graduates to react on changes taking place in the labour market as a result of technological changes, as well as the related changes in the way organizations are managed. They therefore determine the graduate's adjustment potential. Second, but related to the same underlying factors, the increased uncertainty with which discipline-specific competencies can be applied in the labour market, requires from graduates that they are able to continue learning and/or to acquire new or different types of competencies after graduating from

15. Other surveys are discussed in, for example, Harvey, Burrows and Green (1993), Burrows, Harvey and Green (1993), and Stasz et al. (1993).

16. In contrast to the findings of Bishop (1992, 1995), 'specialist subject knowledge' is ranked at the bottom. Harvey (1993) noted that the low rating of specialist subject knowledge may be explained by employers taking a minimum level of specialist subject knowledge for granted or the respondents focusing on 'specialist' rather than on 'subject' when giving their answers. The latter explanation indicates the potential danger inherent to the vagueness and/or ambiguity in survey questions. This kind of error is potentially very damaging, since it not only leads to an increase in random noise, but may lead to systematic errors. We will return to this point in Chapter 3, when discussing the data used for the empirical analyses and the way in which information on competencies was extracted.

17. Since Mertens (1974) in Germany and Pratzner (1978) in the USA used it, the term 'key competencies' has been given a central place in the discussion on matching education and work. Mertens (1974) used the German word 'Schlüsselqualifikationen'.

higher education. Investments in academic competencies during higher education therefore provides a kind of option value to be cashed in in case the discipline-specific competencies are of reduced value.

Considering the above argumentation with respect to the increased emphasis on generic competencies in general and academic competencies in particular, a legitimate question is if in the near future the role of discipline-specific competencies will become marginalized to the material needed to acquire generic competencies[18]. This is undoubtedly a too pessimistic view. First, discipline-specific competencies will continue to play an important role as competencies of direct value in the labour market. In this sense, basic anatomy will continue to be an important part of medicine curricula. Second, there are clear indications that the need for generic competencies revealed by surveys is endemically overestimated. Teichler (1999), for example, referred to the finding that "*employers' statements or analyses of employers' expectations underscoring the role of general competencies may tend to underestimate the weight specific skills have – inter alia because general managers and the staff of personnel departments are more likely to be asked than the specialists in the various other departments, who have constant direct experience of the details of graduate work. Furthermore, general job requirements tend to be similar across a variety of job tasks and are therefore more likely to be mentioned frequently than are the specific skills needed for various professional areas.*" Hence, we can expect discipline-specific competencies to continue playing a central role in higher education as well as in the labour market. However, it may have to share its place with generic competencies.

2.5 Concluding remarks

The objective of this chapter was to discuss different types of competencies acquired by higher education graduates and to propose them as an accurate way of describing the human capital assets that are traded in the labour market.

To do so, we briefly discussed the mainstream economic theories on the impact of education on the productivity of graduates in the labour market. We stated that, in particular, models based on the assignment theory provide useful insights for this study. However, we claim that the way in which education is measured in research is generally recognized as unsatisfactory. More specifically, we propose that we should address a qualification as a summary of heterogeneous competencies. As a result, we introduced the competence concept.

Notwithstanding the pragmatic approach usually followed in economic theories, we propose that we treat the terms 'skill' and 'competency' as distinct terms. We refer to 'skills' to indicate individual abilities such as the ability to switch on a computer, the ability to typewrite, or the ability to save a document. The term 'competency' is used to denote a group

18. Reviewing the literature reveals that teaching generic competencies in general needs to be rooted in teaching discipline-specific competencies. Bowden and Masters (1993), for example, argued that "*educational goals such as communication or problem-solving abilities necessarily must be related to communicating something or to solving some particular kinds of problem.*" Stephenson (1992) argued similarly by suggesting that the fundamental objection to a stand-alone concept of generic competencies is that it denies "*the holistic nature of capability, the essential integration of personal qualities, skills and specialist knowledge, which enables students to be effective.*"

of skills that refers to one underlying dimension and forms the condition for handling a complex task. Hence, writing poetry on a computer, using the above skills, is a competency. Lastly, we propose that the distinction between discipline-specific and academic competencies is a crucial one for research on the transition from higher education to work. The former measures the field-specific knowledge of the graduate, which is of direct productive value in the labour market. The latter measures the graduate's higher thinking abilities and readiness to learn and to adapt to changing circumstances. In contrast to the applicability of discipline-specific competencies which are restricted to occupations that are in congruence with the field of study graduated from, academic competencies are context-independent and hence useful across the entire range of occupations in which graduates might be employed.

Chapter 3

CHEERS survey and definition of academic and discipline-specific competencies

« Frankly, I find it hard to conceive of a poorer measure of the marketable skills a person acquires in school than the number of years he has been able to endure a classroom-environment. My only justification for such a crude measure is that I can find nothing better »

Welch, 1975, p. 67

3.1 Introduction

Chapter 2 addressed the questions what it means to talk about competencies in the light of a knowledge-intensive economy and what types of competencies can be regarded as crucial for higher education graduates to possess. We argued that higher education has in recent years been confronted with a graduate labour market asking not only for a substantive level of discipline-specific competencies but also for an increasing level of generic competencies. With respect to the latter, in particular academic competencies, such as 'problem-solving abilities' or 'reflective thinking' are crucial. The focus on different types of competencies is based on the finding that static labels generally used to describe higher education output, such as the study field or the type of higher education (e.g. Fachhochschulen), cannot cope with the constantly evolving mix of competencies demanded in the labour market and taught in higher education programmes.

In this chapter, we will put the theory into practice. We will discuss and propose a flexible way to measure the output of higher education in terms of the level of academic and discipline-specific competencies acquired by graduates. The measurement is derived directly from the actual level and type of competencies which students possess at the time of graduation. The measurement not only makes it possible to characterize programmes or higher education systems according to their competence orientation, but also to capture the heterogeneity between graduates from a specific programme.

Classifying education systems in terms of their academic or discipline-specific (vocational) orientation is not new in itself. Germany, in line with its occupational labour market (see e.g. Gangl, 2001), has had a long tradition of occupationally oriented education, and hence is a representative of the latter type. At the tertiary level, in particular studies at Fachhochschulen, provide qualifications that are as closely related to vocational activities as are qualifications traditionally provided at the secondary level, for example through apprenticeships[1]. Moreover, the general aim of the German higher education system is to prepare students for a field of professional activity (Eurydice, 2002b). Accordingly, studies at universities also comprise specialized scientific training for a profession, in addition to more general academic qualifications. In contrast, the higher education system in the United Kingdom is generally seen as highly academically oriented and matches well the expectations of an internal labour market. "*The concept of an education that provided training in abstract thought and that valued knowledge for its own sake has always been present in higher education in the United Kingdom*" (Eurydice, 2002b). In line with this, the Dearing Report (1997) considered the intellectual and cultural purpose of higher education in the United Kingdom as crucial and stated that the aim of higher education should be to 'sustain a learning society'.

So what is new about approach proposed here? It is not the terminology per se (academic versus discipline-specific) but the intention to explicitly expose the competencies that hide behind this terminology and hence, to give the typology a clear content. Accordingly, the measurement used here will be capable of indicating more directly the output of a study at the tertiary level. Moreover, this measurement makes it possible to locate graduates, programmes or even entire higher education systems along a continuous scale from academic competen-

1. A similar situation exists in the Netherlands, with studies at higher vocational education (HBO) institutes.

cies orientation to discipline-specific competencies orientation instead of merely allocating them to either of the two poles (academic or discipline-specific). In this sense, the measurement is able to capture directly any changes that take place within a programme or higher education system and provides the flexibility required to discuss the labour market success of higher education graduates.

The structure of the chapter is as follows. First, Section 3.2 provides general information on the CHEERS (**C**areers after **H**igher **E**ducation: a **E**uropean **R**esearch **S**tudy) survey. The section also forms a preparatory part for the empirical studies presented in Chapters 4 to 6 and introduces the reader briefly to the data set used throughout this thesis. Section 3.3 then discusses the way in which the CHEERS survey was used to create the two constructs (academic and discipline-specific competencies) that were used to measure the higher education output. These constructs are submitted to different validity tests. Section 3.4 addresses some possible sampling problems in relation to the data used. Section 3.5 concludes the chapter.

3.2 The CHEERS survey[2]

An essential element for a study that addresses the acquisition of competencies by higher education graduates and their value in the labour market is the availability of high quality data allowing detailed analyses. The empirical studies of this thesis make use of the CHEERS survey. This survey was partially financed by the European Commission's Targeted Socio-Economic Research programme[3] and partially by the participating countries themselves. In total, 12 countries took part, 10 of these being countries of the current European Union (Italy, Spain, France, Austria, Germany, the Netherlands, United Kingdom, Finland, Sweden and the Czech Republic), one EFTA country (Norway) and Japan. Central co-ordination was done by the Centre for Research on Higher Education and Work of the University of Kassel. Professor Ulrich Teichler and Harald Schomburg were the co-ordinators of the project, both in terms of the administration of the project and the research process, notably the graduate survey. The survey (including the collection of addresses, mailing, and documentation of the coding) was carried out by the 12 national research teams[4]. In each of the 12 countries, a representative sample (according to field of study, type of degree and/or type of higher education institution and gender) was drawn from the cohort of graduates who graduated between the autumn of 1994 and the summer of 1995 from a course in higher education. The sample size was determined separately in each country, on the basis of an anticipated response rate, so as

2. Information provided in this section was partially retrieved from the CHEERS homepage: http://www.uni-kassel.de/wz1/tseregs.htm.
3. The Targeted Socio-Economic Research programme is part of EU's 5th Framework for research on social sciences and humanities.
4. For contact addresses of and further information on these local research teams, please refer to the above-mentioned CHEERS homepage.

to arrive at a dataset per country of approximately between 3,000 and 3,500 graduates[5]. The graduates drawn were asked to respond on a standardized mail questionnaire in the autumn of 1998. As a result, the survey was directed primarily at the situation of the graduates up to three to four years into the labour market. The major themes addressed are given in List 3.1[6]:

List 3.1
Themes addressed in the CHEERS graduate questionnaire survey

- Socio-biographic and early education background variables
- Enrolment and study conditions and provisions
- Study achievements
- Job search and transition period
- Employment during the first three years after graduation
- Regional and international mobility
- Work content and use of qualifications
- Work motivation and job satisfaction
- Further professional education/training
- Career prospects

Source: http://www.uni-kassel.de/wz1/tseregs.htm

Although the study took place in 12 countries, the data of only nine countries was used. Sweden, the Czech Republic and Japan were left out. The Swedish case lacked data on competencies, which is the key issue in this thesis. The Czech Republic and Japan were left out because the specific situations in these countries did not allow a useful comparison with the other countries.

The data covers graduates from all types of higher education institutions in these nine countries. With respect to the countries under consideration, a simple classification can be made on the basis of the question whether a country provides a binary higher education system or a unitary higher education system.

Germany[7], *the Netherlands* and *Norway* have binary systems. Higher education courses in these countries can be divided between those taught in the relatively more scientifically oriented university sector and those in the more vocationally oriented non-university sector. In Germany, the latter consists of programmes taught at Fachhochschulen, in the Netherlands at higher vocational education institutes (HBO), and in Norway at university colleges. The Norwegian university colleges, established after a reorganization and merging of 98 former

5. The response rates of the questionnaires were: Italy (unknown), Spain (15%), France (33%), Austria (45%), Germany (43%), Netherlands (47%), United Kingdom (34%), Finland (46%) and Norway (50%). With the exception of Spain, the response rate can be seen as acceptable to high, considering that this was an 18-page mail questionnaire with no incentives offered to the graduates for their response. According to the national reports of the field phase of the study, the quality of the returned questionnaires seems to have been high. The profile of the respondents was compared with the profile of all 1994/1995 graduates according to national statistics in the countries. As it differed slightly, a final weighing was performed to create a representative data base that is also used in this thesis.
6. The English Master questionnaire is included at the end of this thesis.
7. Information with respect to the Higher Education system in the different countries is based on the Eurydice Database on Education (www.eurydice.org).

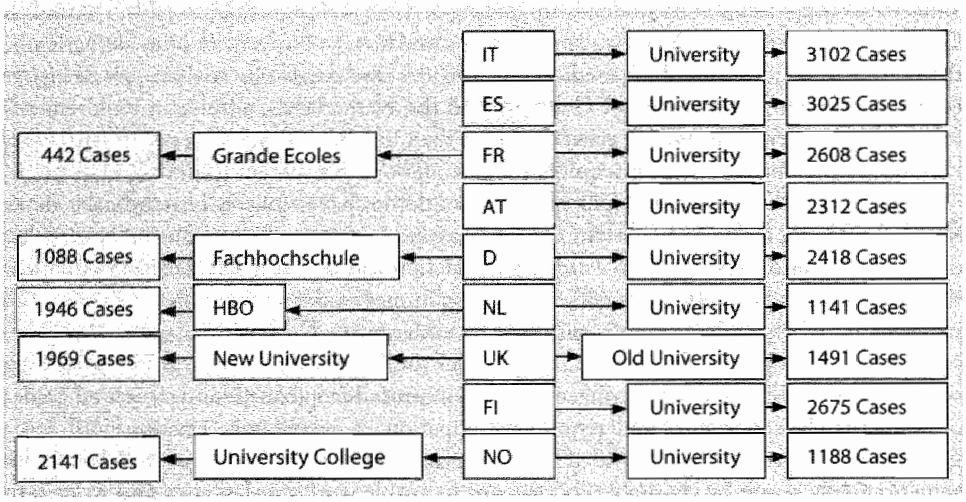
regional and vocational colleges, were until recently known as 'state colleges'. The new term 'university college' reflects an academic upgrading of these institutes since 1994. In contrast to Germany, where the majority of students enter universities, in Norway and the Netherlands, the non-university sector of higher education provides teaching for more than 50% of higher education students. In the case of Germany and the Netherlands, admission requirements for the non-university sector are generally lower than for the university sector. In particular, entrance to the university sector requires a higher and one year longer secondary education.

Even though France and the United Kingdom do not have a binary system in the above sense, their higher education system can be characterized by a distinction in the prestige of higher education institutes. In *France*, a distinction can be made between higher education programmes at public universities and programmes at the 'elitist' Grande Écoles. The majority of French students follow courses at the universities. Universities in general provide open-access programmes. In contrast, institutes of the Grande Écoles institution, providing courses in selective fields, have stringent admission procedures (e.g. secondary school grades or numerus clausus exams) and require participation in preparatory classes. Until 1992, universities and polytechnics provided higher education in the *United Kingdom*. Polytechnics were originally set up by charitable endowment to enable working-class men and women to advance their general knowledge and industrial skills on a part-time or full-time basis. Their role changed with the 1966 White Chapter 'A plan for the Polytechnics and Other Colleges', describing the polytechnics as regional centres of higher education linking industry with business. Lastly, the 'Further and Higher Education Act 1992' allowed all higher education institutions in England and Wales that satisfied prescribed criteria to apply for permission to include the word 'university' in their names. All polytechnics were allowed to do so and only one (Anglia Polytechnic University) choose to retain the word 'polytechnic' in its name. Although these changes seem to render a distinction between education programmes taught at 'old universities' and 'new universities' (the former polytechnics) redundant, we differentiated between these two institutions when needed. The reasons were, first, that the respondents started their studies before 1992, and hence before the 'Further and Higher Education Act' was implemented, and second, because old universities still differ with respect to their status and admission requirements, as reported by the Sunday Times League Table (Sunday Times, 2003).

Austria, *Finland*, *Italy* and *Spain* make no distinction between different higher education institutions. In the latter two cases, no significant non-university higher education institution exists. Austria and Finland have recently implemented changes. Both countries reacted to labour market demands and introduced a more vocationally oriented non-university higher education sector (Fachhochschulen in Austria and Polytechnics in Finland) in the mid-1990s. However, the data used here do not yet cover graduates from these higher education institutions.

Summarizing, Figure 3.1 gives an overview over the types of higher education and number of respondents per higher education institution covered by the data.

Figure 3.1
Countries, Higher education institutions and number of respondents



3.3 Discipline-specific and academic competencies

Chapter 2 addressed different types of competencies. Reviewing the literature, we proposed that in particular the acquisition of two types of competencies, namely discipline-specific and academic competencies, can be seen as central objectives of higher education programmes. In this section, we will analyze the CHEERS data to see to what extent the two concepts are visible in the answers given by the higher education graduates. Having established that two clusters of skills, reflecting well the theoretical construct, exist, we will then test their validity and address solutions to deal with potential measurement errors.

3.3.1 Competence measurement

The CHEERS survey used a direct and subjective approach to measure the knowledge and skills acquired by higher education graduates and required in the labour market. More precisely, the graduates were asked to indicate on a five-point Likert scale, ranging from 1 ('not at all') to 5 ('to a very high extent')[8], both the extent to which they possessed a particular item at the time of graduation and to what extent this item was required in their current work. In total, the questionnaire distinguished between 36 individual items (see Figure 3.2 below)[9].

8. In the original questionnaire, the answers were coded from 1 ('to a very high extent') to 5 ('not at all'). To simplify the reading of the empirical analyses we recoded the answers to range from 1 ('not at all') to 5 ('to a very high extent').
9. Appendix 3A of this chapter provides an extract of the original questionnaire reporting on the exact question and the competency items in detail.

Box 3.1
Ward's hierarchical clustering method

Generally, the hierarchical clustering method starts from the finest partition possible (each skill item forms a cluster) and groups them. The agglomerative algorithm used is:

1. Construct the finest partition.
2. Compute the distance matrix *D*.
3. Find the two clusters with the closest distance
4. Put those two clusters into one cluster
5. Compute the distance between the new groups and obtain a reduced distance matrix *D* until all clusters have been agglomerated into 1 cluster.

More in detail, if two items, say *X* and *Y*, are united, the distance between this new cluster (*X*, *Y*) and a remaining item *Z* is computed according to:

$$d(X+Y,Z)=\delta_1 d(X,Z)+\delta_2 d(Y,Z)+\delta_3 d(X,Y)$$

where δ_i, the weighting factors and d, the squared Euclidean Distance measure $(d(X,Y)=\sum_i (X_i-Y_i)^2$. The weighting factors are given by

$$\delta_1=\frac{\eta_Z+\eta_X}{\eta_X+\eta_Y+\eta_Z},\quad \delta_2=\frac{\eta_Y+\eta_Z}{\eta_X+\eta_Y+\eta_Z} \text{ and } \delta_3=-\frac{\eta_Z}{\eta_X+\eta_Y+\eta_Z}$$

where $\eta_Y=\sum_{j=1}^{n} I(x_j \in Y)$ the number of objects in group *Y*. The values of η_X and η_Z are defined analogously.

Handling all the individual items provided by the data set separately not only hampers a clear interpretation of results but also ignores the fact that individual items may be closely related and that their value as a group is larger than the sum of individual items. The latter argument is in line with the proposition made in Chapter 2 that the term 'competency' should be used to designate a complex action system and not an individual ability. Accordingly, we are interested in sets of skills that belong together and referee to one dimension, namely either the academic competencies dimension or the discipline-specific competencies dimension. To do so, we approached the individual skills measured in the CHEERS survey by means of cluster analyses (see Box 3.1). Cluster analysis allows the large group of items to be divided into smaller ones, whereby items within a group are similar in nature and observations in different groups are relative dissimilar in nature (see e.g. Latin, Carroll, Green, 2003).

The individual items were clustered according to the extent to which they were required in the graduate's current occupation. Alternatively, one could use the extent to which the graduates possessed the aspect at the time of graduation as starting levels for the cluster analyses. We believe that our approach is justified in the sense that we intend to analyze the role of academic and discipline-specific competencies in the labour market. Hence, we will

start with the question what combinations the labour market requires and then ask to what extent higher education produces them. For the purpose of this thesis, namely the distinction between academic and discipline-specific competencies, both approaches would actually lead to highly comparable solutions. Figure 3.2 shows the dendogram output of Ward's hierarchical clustering method analyses which attempts to minimize the variance within clusters. The algorithm begins with each item forming its own cluster (left part of figure) and then searches for objects that can be grouped together while minimizing the increase in the sum of residuals squared, so with minimum within-group variance (Latin, Carroll, Green, 2003). The distance between the items is measured by the squared Euclidean Distance, the most familiar distance measurement method for variables measured on an interval indicating their close relationship.

Let us consider the dendogram output of the cluster analyses, keeping in mind the discussion in Chapter 2 and the notions stated above. Starting at the left side of the dendogram, and hence where each skill forms its individual cluster, we find that at a first stage the two items 'Field-specific theoretical knowledge' (in Figure 3.2 termed F-S theoretical knowledge) and 'Field-specific knowledge of methods' (F-S knowledge of methods) are brought together, indicating their close relationship. These two items undoubtedly constitute the centre of our discipline-specific competencies dimension. A comparable grouping takes place with respect to two pairs of skills seen in Chapter 2 as highly relevant components of an academic competence construct: 'learning abilities' and 'reflective thinking' on the one side, and 'problem-solving abilities' and 'analytical competencies'[10] on the other. According to the cluster analysis, the two pairs a cluster of skills in a subsequent step, to which the item 'documenting ideas and information' also belongs. These five items so far seem to reflect well the idea of an academic competency construct.

What about the other skills considered? The cluster analysis reveals that other interesting sets of skills are formed. First of all, at the top of the dendogram, a group of skills ('initiative' until 'written communication') is starting to be brought together. This group of skills was labelled in Chapter 2 (see Table 2.3) as *personal skills and attributes* and *people-related skills*, all belonging to the group of generic competencies. At a later stage, these skills are brought together, first with a second group of generic skills ('getting personally involved' until 'tolerance) and later with the above-mentioned five items, reflecting the idea of an academic competence construct, forming a large group of generic competencies.

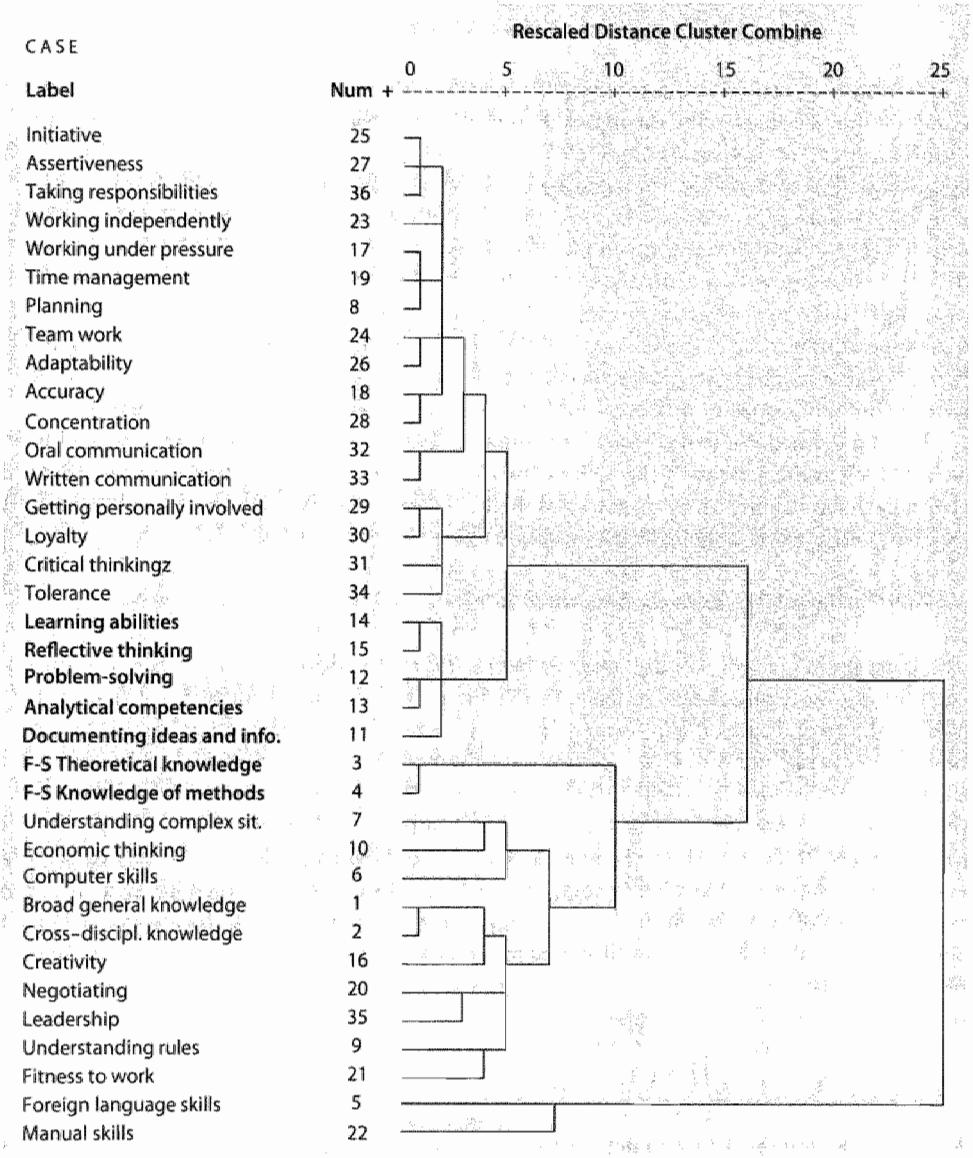
At the bottom of the dendogram, a further cluster of skills is starting to emerge. It incorporates items such as '*broad general knowledge*', '*cross-disciplinary knowledge*' but also '*creativity*', '*negotiating*' and '*leadership*'. All of these items seem to be highly relevant components of *managerial or entrepreneurial competencies*. Interestingly, this group of skills, even though best labelled as generic skills, are at a later stage brought together with our discipline-specific skills before being added to the large group of generic skills discussed above.

Concluding so far, we may state that the cluster analyses show on a rather disaggregated level that we can form clusters of individual skills based on the answers of higher education graduates which are strongly comparable to the different types of competencies elements discussed in Chapter 2. According to the rather narrow focus on discipline-specific compe-

10. The usage of the term competencies in the latter case indicates that the term 'analytical competencies' already refers to a group of individual skills needed to act.

tencies and academic competencies used here and to keep the clusters of skills as homogeneous as possible, two clusters are singled out (see List 3.2), reflecting best the idea of discipline-specific and academic competencies.

Figure 3.2
Dendogram of competency items required in current occupation



List 3.2
Individual skills nested in the competency clusters

Discipline-specific competencies	Academic competencies
Field-specific theoretical knowledge	Learning abilities
Field-specific knowledge of methods	Reflective thinking assessing one's own work
	Problem-solving abilities
	Analytical abilities
	Documenting ideas and information

Consequently, when referring to discipline-specific competencies, we implicitly refer to the combination of field-specific theoretical knowledge and field-specific knowledge of methods. Similarly, the term academic competencies will be used to refer to a combination of learning abilities, reflective thinking and assessing one's own work, problem-solving abilities, analytical abilities and documenting ideas and information. We are aware that, in doing so, we are restricting the focus with respect to possible competencies very much. At the same time, we do not intend to make a normative statement with respect to the relevance of particular skills or competencies not selected. However, the approach is in line with our argumentation in Chapter 2 with respect to the relevance of different competencies on a higher education level. Moreover, the focus allows a more detailed analysis with respect to the two selected competencies (discipline-specific and academic). Consequently, we trade breadth for depth.

Having defined the two competence concepts that are central in this thesis, we will have a closer look at the validity of these two constructs. In particular, the subsequent section tests their internal reliability, their content and their construct validity. This addresses the question to what extent we actually measure what we believe to measure (Baker, 1988).

3.3.2 Testing the validity of our competence constructs

The most basic form of validity is the *content validity*. To address it, one needs to critically examine the measure of the concept in the light of its intended meaning. Taking a first look at the two clusters distinguished above, we can state that they seem to represent to a high degree what was intended. There is no doubt that the combination of field-specific theoretical knowledge and field-specific knowledge of methods constitute the core of discipline-specific competencies. On the other hand, aspects such as problem-solving abilities or learning abilities, as well as the knowledge how to document ideas and information, are relevant components of academic competencies. A second check closely related to the first validity is to examine the internal consistency of the two data clusters. To test it, Cronbach alphas will be calculated. This indicates how well a set of items measures a single one-dimensional construct:

$$\alpha = \frac{n\bar{r}}{[1+(n-1)\bar{r}]} \tag{3.1}$$

where n is the number of items used in the cluster and $\bar{r}$ is the average inter-item correlation among the n items. The coefficient has a range from 0 to 1. Generally spoken, alphas of 0.9 and larger are considered to indicate a very good level of scale reliability, but values of 0.7 or

more are generally regarded as acceptable (Nunually, 1978). Table 3.1 reports on the alphas for the two clusters, both when measured as competencies possessed by the students at the time of graduation and when measured as competencies required in the current occupation. In both cases, the internal consistency of the clusters is acceptable. Moreover, deleting individual items from the academic competencies cluster leads to a decrease in the internal consistency[11]. These findings reveal that the individual items forming the discipline-specific competency construct and the individual items that form the academic competency construct belong to each other and refer to one dimension.

Table 3.1
Internal consistency: Cronbach Alpha

	Cronbach Alpha
Possessed at time of graduation	
Discipline-Specific competencies	0.73
Academic competencies	0.74
Required in current occupation	
Discipline-specific competencies	0.77
Academic competencies	0.77

Table 3.2
Internal consistency: Cronbach Alpha – Strata: Country

	IT	ES	FR	AT	D	NL	UK	FI	NO
Possessed at time of graduation									
Discipline-specific competencies	0.75	0.78	0.60	0.65	0.69	0.76	0.77	0.71	0.71
Academic competencies	0.76	0.81	0.75	0.70	0.73	0.71	0.75	0.74	0.70
Required in current occupation									
Discipline-specific competencies	0.83	0.85	0.64	0.75	0.72	0.79	0.83	0.77	0.75
Academic competencies	0.85	0.84	0.78	0.73	0.76	0.72	0.79	0.75	0.71

Note: IT = Italy; ES = Spain; FR = France; AT = Austria; D = Germany; NL = Netherlands; UK = United Kingdom; FI = Finland; NO = Norway.

It is of crucial importance that the internal consistency of the two clusters not only holds on a European level but also within individual countries or individual education programmes. Table 3.2 reports on the internal consistency coefficients calculated at the country level, while Table 3.3 does the same at the education programme level.

The reported coefficients show that on a country level, only four out of the 36 coefficients are slightly below the acceptable cut-off level. In the case of the education programme analyses, all coefficients are above the acceptable cut-off level.

Taking stock, we can state that first, the data reveals two competency clusters very much in line with the theoretical constructs. Second, the internal consistency indicates that the individual aspects forming a particular competency construct refer to one dimension, both

11. Data not shown.

in higher education studies and as requirements of the labour market. Third, the internal consistency is comparable between countries and between fields of study.

Table 3.3
Internal consistency: Cronbach Alpha – Strata: Field of study

	AH	SS	BU	LA	NS	EN	HE
Possessed at time of graduation							
Discipline-specific competencies	0.71	0.75	0.72	0.70	0.74	0.72	0.74
Academic competencies	0.72	0.73	0.82	0.76	0.77	0.75	0.75
Required in current occupation							
Discipline-specific competencies	0.80	0.78	0.76	0.75	0.78	0.71	0.76
Academic competencies	0.78	0.81	0.78	0.78	0.79	0.75	0.77

Note: AH = Arts and Humanities, SS= Social Sciences, BU=Business, LA= Law, NS=Natural Sciences, EN=Engineering, HE=Health Sciences.

In addition to the content validity, it is crucial to test the *construct validity* of the two constructs. This validity is based on testing hypotheses about the constructs that are being measured (Baker, 1988)[12]. To do so, we formulated the following three hypotheses:
(1) The reported average of the required level of competencies is dependent on the level of education that is required by the employer to fulfil the occupation[13]: The higher the educational level required, the higher the competence requirement.
(2) Controlling for the educational level required, graduates holding an occupation not closely related to the field of study from which they graduated[14] (e.g. a graduate from a law faculty working as currency trader) on average report a lower level of required 'discipline-specific competencies' than graduates holding an occupation closely linked to their own field of study.
(3) Controlling for the educational level required, the reported required level of academic competencies is independent of the relation between the occupation and the field of study graduated from.

Table 3.4 reports on the average academic competence requirements according to the educational level assigned to the occupation and the relation between the field of study and the occupation in terms of match in the type of discipline-specific competencies. Table 3.5

12. A related and more stringent validity test would be to address the predictive validity (see e.g. Allen and Van der Velden, 2005). However, to do so, one would need objective benchmark measures, such as competence measurements by job analysts or submission of graduates/workers to a series of test (e.g. assessment centre method). To the extent that such external measurements are neither available nor easily applicable for a set of more than 25,000 graduates, We are unable to test for the predictive validity of these constructs.
13. We measured the level of education required in the occupation by the following question that graduates were asked: "What is the most appropriate level of course of study/degree for your employment and work compared to that which you graduated from in 1994 or 1995?"
14. We measured the relation between the field of study and the occupation by the following question that the graduates were asked: "How would you characterise the relationship between your field of study and your area of work?" We defined a strong relation as one in which the students answered that their own field of study or a related field of study best prepared for the areas of work. A weak relation was defined as a situation in which either another field of study would have been more useful or in which the field of study did not matter very much.

does the same for the average of the required discipline-specific competencies. The results presented in Table 3.4 confirm hypothesis 1 and hypothesis 3 with respect to academic competencies. Not only does the required academic competencies level depend strongly on the level of education required in the current occupation, but in three out of the four occupation types, the level does not depend on the relation between the occupation and the field of study graduated from.

Table 3.4
Academic competencies: Mean required level (standard deviation in brackets)

	Relation between occupation and field of study: Strong (a)	Weak (b)	Difference (a-b) significantly different from zero on... significant level	Total
Educational level required				
1. Higher than graduated from	4.22 (0.55)*	4.24 (0.59)*	Not significant	4.23 (0.56)*
2. Same as graduated from	4.08 (0.59)*	4.09 (0.61)*	Not significant	4.08 (0.59)*
2. Lower higher education level	3.84 (0.64)*	3.81 (0.75)*	Not significant	3.82 (0.69)*
3. No higher education level	3.63 (0.78)*	3.40 (0.97)*	1%	3.44 (0.93)*

Note: * indicates that the average differs significantly on a 1% level from the average reported in a row above and below.

Turning to the required level of discipline-specific competencies (see Table 3.5), we can see that hypotheses 1 and 2 are confirmed. In line with the required level of academic competencies, the reported required level of discipline-specific competencies is dependent on the level of education required in the current occupation. Moreover, and this time in contrast to the results reported in Table 3.4, we can see that graduates holding an occupation with a weak link to their own field of study report a significantly lower level of required discipline-specific competencies.

Table 3.5
Discipline-specific competencies: Mean required level (standard deviation in brackets)

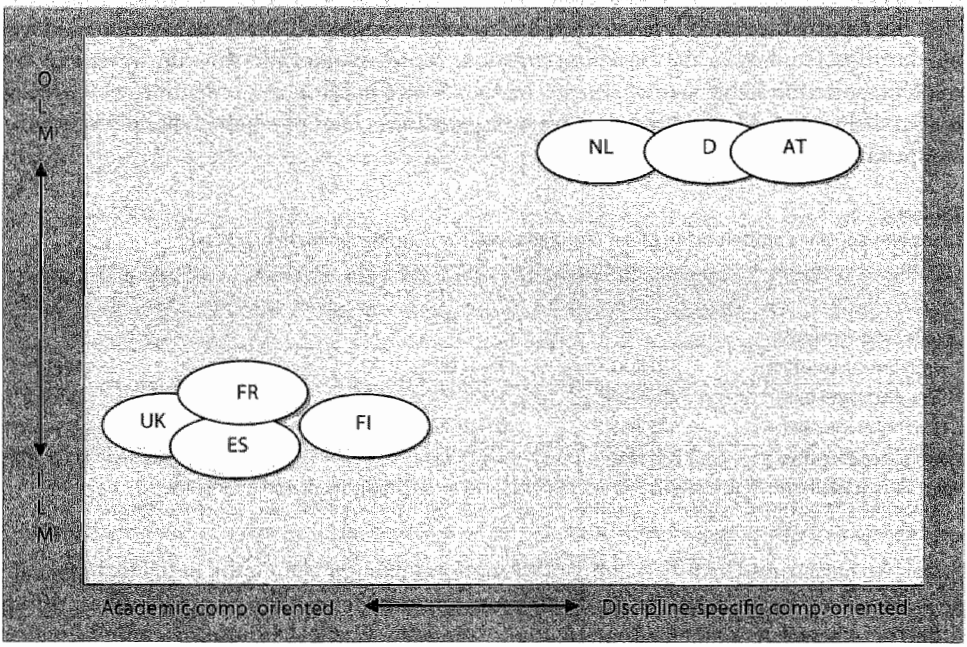
	Relation between occupation and field of study: Strong (a)	Weak (b)	Difference (a-b) significantly different from zero on... significant level	Total
Educational level required				
1. Higher than graduated from	4.21 (0.83)*	3.95 (1.06)*	1%	4.06 (0.87)*
2. Same as graduated from	4.05 (0.87)*	3.59 (1.14)*	1%	3.79 (0.94)*
2. Lower higher education level	3.75 (0.95)*	3.14 (1.16)*	1%	3.24 (1.08)*
3. No higher education level	3.55 (0.99)*	2.70 (1.20)*	1%	2.75 (1.21)*

Note: * indicates that the average differs significantly on a 1% level from the average reported in a row above and below.

So far, we have considered the validity of the output measurement on the individual graduate level. However, we proposed earlier that the measurement should also be capable of capturing differences between competence orientations (discipline-specific versus academic) of higher education programmes or even higher education systems. An interesting application of the latter is illustrated in Figure 3.3. we contrasted the location of different higher education systems according to the measurement with the location of the countries along the line of *internal labour market* (ILM) to *occupational labour market* (OLM). The distinction between

these two types of labour markets is generally seen in the institutional rules of access to skilled workers' positions, which are defined as positions requiring task-specific competencies. Educational credentials, such as the field of study, provide little guidance in the allocation of individuals to occupations in case of ILMs, as they lack occupational specificity. School-leavers start at entry port occupations and are trained in firm-specific competencies, allowing mobility into higher positions. Accordingly, we expect higher education in these countries to be rather academically oriented, providing graduates with a strong basis for further learning. In contrast, in OLMs there is a strong linkage between discipline-specific competencies acquired in education and the ones asked for by employers. As a result, we expect the acquisition of discipline-specific competencies in higher education to play a key role in these countries. Even though occupational and internal labour markets may co-exist in a country, the relative weight between the two institutional arrangements varies strongly between countries (see e.g. Eyraud, Marsden and Sylvestre, 1990). Along this line, Gangl (2001) used Marsden's criteria (see Marsden, 1990) to divide European countries into OLM and ILM countries. Of the countries included in this thesis, the United Kingdom, France, Finland and Spain are representatives of the ILM country group and Austria, Germany and the Netherlands of the OLM country group.

Figure 3.3
OLM versus ILM and the competence orientation of the higher education system



Note 1: Horizontal axis: competence orientation is measured as the average level of discipline-specific competencies acquired by students minus the average level of academic competencies acquired by students. Note 2: The classification into ILM (internal labour market) countries and OLM (occupational labour market) countries is based on research by Gangl (2001). Note 3: Italy and Norway were left out as they are not classified according to the distinction between ILM and OLM. On the horizontal axis, Italy would be located close to UK and Norway close to AT. Note 4: Distinguishing between countries on the basis of different types of higher education (e.g. Fachhochschulen versus Universities) does not change the picture in a qualitative sense.

Contrasting this distinction with the output measurement for higher education, we found, as expected, that higher education in ILM countries on average produces graduates that are academically rather than discipline-specifically oriented. Comparably, higher education in OLM countries produces graduates with a discipline-specific orientation. As a result, the output of higher education according to our measurement fits in well with the central type of competencies graduates are expected to possess when entering the labour market. In later chapters, we will return to these two country groups when discussing the acquisition of competencies in higher education and the role and value of these competencies in the labour market. For terminology reasons, we will then refer to the United Kingdom, Spain, France and Finland as *academic countries* and to the Netherlands, Germany and Austria as *discipline-specific countries.*

Concluding this section, we can state that the two competence clusters forming the measurement for the higher education output are both satisfactory considering their internal reliability, content and construct validity. Moreover, the measurement makes it possible to differentiate between countries' higher education systems that fit in well with the institutional setting of the labour market.

3.3.3 Potential measurement errors and solutions used

The main attractiveness of the self-assessment method used in this study to measure the level of acquired and required competencies, lies in the fact that graduates/workers may be the ones knowing best what they know and what they need to know to fulfil a particular task in a department/organization. The main disadvantage is related to the significant possibility of measurement errors[15].

First, by asking graduates/workers to judge themselves, one risks getting answers biased towards pompousness or exaggerated modesty. Moreover, the answers may be influenced by other variables, such as working conditions. Second, one needs to deal with a potential error related to vagueness and/or ambiguities in the question. This may lead to systematic errors due to the fact that certain graduates interpret an item differently than others. The interpretation of a particular aspect may for instance be culturally influenced. Moreover, we have to deal with the possibility that different graduates (i.e. graduates from different countries or different education programmes) use different 'yardsticks' when answering the questions. In theory, some kind of reference point could be built into the question, in which graduates are asked to rate their competency levels. However, this would make the instrument much more cumbersome, and there would be no guarantee that the frame of reference provided corresponds to any clear-cut categories in the graduates' own cognition. "*In fact, it seems likely that answers given by graduates spontaneously and off-the-cuff will contain fewer errors than those given to a more complex type of question with detailed explanations.*" (Allen, Ramaekers and Van der Velden, forthcoming, p.15).

15. A good overview over these problems is given in Allen, Ramaekers and Van der Velden (forthcoming) and Allen and Van der Velden, 2005.

Table 3.6
Acquired and Required level of competencies

		Acquired		Required	
Country	Type	Academic	Discipline-specific	Academic	Discipline-specific
IT	U	3.60	3.34	3.99	3.51
ES	U	3.61	3.42	3.91	3.71
FR	GE	3.77	3.39	4.04	3.74
FR	U	3.60	3.38	3.91	3.58
AT	U	3.71	3.80	4.03	3.54
D	FH	3.44	3.58	3.80	3.70
D	U	3.64	3.75	3.96	3.61
NL	HBO	3.54	3.63	3.83	3.72
NL	U	3.69	3.71	3.98	3.48
UK	NU	3.88	3.60	4.01	3.56
UK	OU	3.83	3.47	4.10	3.61
FI	U	3.66	3.62	4.17	3.74
NO	UC	3.69	3.74	4.13	3.98
NO	U	3.93	4.09	4.21	3.78

Note 1: Note: IT = Italy; ES = Spain; FR = France; AT = Austria; D = Germany; NL = Netherlands; UK = United Kingdom; FI = Finland; NO = Norway.
Note 2: U = university, GE= Grande Écoles, FH = Fachhochschulen, HBO = Higher vocational education, NU = new university, OU = old university, UC = university college.

Considering the reported averages in Table 3.6, the potential errors restrict us in interpreting and comparing the absolute figures. As a matter of fact, the outcome that Italian university graduates score significantly lower on both types of competencies than graduates from Norwegian universities may be related to, first, the fact that the Italian universities are less efficient in teaching these competencies, second, that Italian respondents exaggerate less than Norwegian ones, or, third, that Italian graduates use a different yardstick. In the latter two cases, the true average score may be equal and not as reported in advantage of the Norwegian graduates.

To control as much as possible for the potential measurement errors indicate above, we will use some safety net approaches in the empirical studies, wherever appropriate. This holds in particular for Chapters 4 and 6, where we will make use of a pooled international data set. In Chapter 4, when analyzing the acquisition of discipline-specific and academic competencies, we will normalize the competencies score with respect to the average score of the student's direct peer group and its distribution. In doing so, we control as much as possible for the fact that there may be heterogeneity in the student's level of competencies (the dependent variable) that is related to the country, the higher education institutions, institutes or programmes in which the respondent graduated. In Chapter 6, addressing the impact of programme characteristics on the labour market outcome, we will use the difference between the level of academic competencies and the level of discipline-specific competencies as independent variables. The applied safety net solutions are conservative, in the sense that they reduce differences in competencies rather than increase them.

3.4 Who works and who doesn't

To conclude this chapter, we will address a potential problem that is inherent to the fact that the empirical analyses cover only a subgroup of the randomly drawn selection of higher education graduates. In particular, the studies reported later on in this thesis intend to relate higher education achievements to the labour market situation of graduates. For that reason, we have selected respondents who worked at least 12 hours a week on their main assignments[16] and hence ignored not only graduates who did not work at all, but also graduates who had minor occasional jobs. Moreover, as we were interested in the performance of the graduates, non-response as to salary further reduced the research population. Table 3.7 reports on the overall number of respondents, the percentage of respondents working at least 12 hours and lastly, on the percentage of working respondents providing information on their salaries.

Overall, 76% of the respondents worked at least 12 hours on their main assignments, while 70% also reported on their salaries. This figure is strikingly lower in Mediterranean countries, where between 48% (Italy) and 63% (France) worked at least 12 hours compared to Western and Northern European countries where between 80% (Norway) and 92% (Netherlands) held an occupation for at least 12 hours.

If higher education graduates not having a job or not reporting on the issue of salaries differed in their higher education achievements, and in particular in the acquisition of academic and discipline-specific competencies, the empirical analyses in the later studies may be biased. To test for this, we analyzed the odds of having a job for at least 12 hours a week and reporting on the salary (the 'selected group') by logistic regressions, including personal characteristics variables in addition to school-related ones. Table 3.8 reports on the country-individual logistic regressions[17].

Table 3.7
Research population and final selection

	Total	% Working at least 12 hours	% Working at least 12 hours and providing information on salary
IT	3102	48	41
ES	3024	63	52
FR	3051	55	50
AT	2312	84	77
D	3506	83	79
NL	3087	92	87
UK	3460	82	79
FI	2675	84	81
NO	3329	80	87
TOTAL	27547	76	70

Note: IT = Italy; ES = Spain; FR = France; AT = Austria; D = Germany; NL = Netherlands; UK = United Kingdom; FI = Finland; NO = Norway.

16. We followed the definition of Statistics Netherlands.
17. We also ran logistic regression analyses within the group of respondents working at least 12 hours a week, to investigate to what extent personal, educational and occupational characteristics could explain the decision not to answer the question regarding salary (data not shown here). In none of the countries, this decision seemed to be related to the level of discipline-specific or academic competencies possessed at the time of graduation. Moreover, the estimations also generally showed no significant impact from other variables.

Table 3.8
Logistic regression on having a job for at least 12 hours a week and reporting on salary

	IT	ES	FR	AT	D	NL	UK	FI	NO
Personal characteristics									
Gender: male respondent	0.249***	0.426***	-0.010	-0.024	-0.077	0.158	-0.004	0.264	-0.070
Age at time of survey	0.011	0.047***	0.065***	-0.034***	0.028*	0.005	-0.021***	-0.012	0.018
Having children	-0.011	-0.418***	0.395*	0.290	-0.049	-0.313	0.047	-0.013	0.572**
Mother	-0.606**	-0.258***	-1.036***	-1.980***	-1.826***	-0.799**	-1.181***	-0.505**	-1.354***
Having a partner	0.361***	0.597***	0.234***	0.145	0.259***	0.313**	0.452***	n.a.	0.496***
Pre-higher education schooling									
Academic secondary education	-0.373***	0.050	-0.031	-0.330***	-0.004	0.312**	0.172	-0.198	-0.052
Medium grades	0.178	0.339***	-0.007	0.153	0.181	-0.117	-0.032	-0.585*	0.689**
High grades	0.406***	0.651***	0.325**	0.083	0.433	0.082	-0.068	-0.487	0.995***
Type of higher education									
University	—	—	0.998***	—	-0.248*	0.339*	-0.224*	—	0.014
Field of study									
Arts and Humanities	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Social Sciences	0.288*	0.899***	0.751***	0.279	0.215	0.560**	-0.117	0.686***	0.613**
Business	0.424***	0.982***	0.662***	0.705***	0.623***	0.692***	0.450**	0.443***	1.519***
Law	-1.00***	-0.533***	0.378**	0.782***	-0.362**	1.291***	0.302	0.376	0.657**
Natural Sciences	0.349**	0.867***	0.224*	0.124	0.453***	1.150***	0.009	0.293	0.504*
Engineering	0.147	1.106***	0.521***	0.381**	0.742***	0.750***	-0.071	0.951***	0.816***
Health Sciences	-0.549***	0.389***	—	0.073	0.280	0.677***	0.463**	0.546**	0.556***
Competencies acquired									
Discipline-specific	-0.140***	0.036	-0.165***	-0.038	-0.014	-0.150	-0.089	0.061	0.097
Academic	-0.020	-0.067	0.053	-0.034	-0.330***	-0.123	0.019	-0.140	-0.104

Note 1: Dependent variable is 'working at least 12 hours a week on main assignment and reporting on salary earned'. Note 2: *** significant at 1% level, **significant at 5% level, * significant at 10% level. Note 3: — Variable not used (No distinction between different higher education institutions). Note 4: n.a. Not asked. Note 5: IT = Italy; ES = Spain; FR = France; AT = Austria; D = Germany; NL = Netherlands; UK = United Kingdom; FI = Finland; NO = Norway.

With respect to the personal characteristics variables, we can see that in Italy and Spain male respondents are more likely to belong to the selected group. Moreover, a general finding was that female respondents with children were less likely to belong to the selected group but that respondents living together with a partner were more likely to belong to it.

Of crucial interest were the findings with respect to the variables indicating the level of discipline-specific and academic competencies. The coefficients indicate that with the exception of Italy and France (regarding the level of discipline-specific competencies) and with the exception of Germany (regarding the academic competencies), the level of competencies acquired in higher education did not influence the odds of belonging to the selected group. Moreover, if anything, the selected group possessed at time of graduation a lower level of competencies than the graduates not selected. This finding may be related to the fact that

graduates with higher levels of competencies were more likely to proceed in further full-time studies and hence had not yet entered the labour market.

3.5 Concluding remarks

The objective of this Chapter was twofold. First, to introduce the reader to the CHEERS survey that provided the data for the empirical studies in this thesis. Second, to propose an output measurement for higher education, based on the competence concept introduced in Chapter 2.

The output measurement we proposed, consists of two competence constructs labelled as academic and discipline-specific. It is derived directly from the actual level of these competencies. Its originality lies mainly in two particular features. First, it allows getting a clear insight into the heterogeneity of graduates given a particular study programme. Second, it is flexible and can cope with the constantly evolving mix of competencies taught at higher education and required in the labour market. Tests carried out show that it can be applied across Europe and that it is internally reliable and satisfactory with respect to content and construct validity.

In addition to capturing the individual heterogeneity in output achievements of graduates, measuring higher education output in terms of academic and discipline-specific competencies provides an innovative way of characterize higher education programmes and higher education systems. Previous typologies located programmes or systems only on two extreme poles (academic or discipline-specific). The approach described here also locates them on the continuous scale between these two extreme poles. According to this measurement, in particularly Germany, Austria and the Netherlands come out as having discipline-specifically oriented higher education systems that fit well with their occupationally oriented labour market. The United Kingdom, Spain, France, and to a lesser extent Finland, can be classified as countries with academically oriented higher education systems that are in line with the characterization of their labour markets as internal labour markets.

Appendix 3A: The competencies questions in the CHEERS survey

E. Competencies and Their Application

E1 Please, state the extent to which you had the following competencies at the time of graduation in 1994 or 1995 and to what extent they are required in your current work. ***If you are not employed please answer only (A).***

A. Possessed at time of graduation 1994 or 1995 To a very high extent 1 2 3 4 5 Not at all	Knowledge, skills and competencies	B. Work requirements To a very high extent 1 2 3 4 5 Not at all
☐☐☐☐☐	a. Broad general knowledge	☐☐☐☐☐
☐☐☐☐☐	b. Cross-disciplinary thinking/knowledge	☐☐☐☐☐
☐☐☐☐☐	c. Field-specific theoretical knowledge	☐☐☐☐☐
☐☐☐☐☐	d. Field-specific knowledge of methods	☐☐☐☐☐
☐☐☐☐☐	e. Foreign language proficiency	☐☐☐☐☐
☐☐☐☐☐	f. Computer skills	☐☐☐☐☐
☐☐☐☐☐	g. Understanding complex social, organisational and technical systems	☐☐☐☐☐
☐☐☐☐☐	h. Planning, co-ordinating and organising	☐☐☐☐☐
☐☐☐☐☐	i. Applying rules and regulations	☐☐☐☐☐
☐☐☐☐☐	j. Economic reasoning	☐☐☐☐☐
☐☐☐☐☐	k. Documenting ideas and information	☐☐☐☐☐
☐☐☐☐☐	a. Problem-solving ability	☐☐☐☐☐
☐☐☐☐☐	b. Analytical competencies	☐☐☐☐☐
☐☐☐☐☐	d. Learning abilities	☐☐☐☐☐
☐☐☐☐☐	e. Reflective thinking, assessing one's own work	☐☐☐☐☐
☐☐☐☐☐	f. Creativity	☐☐☐☐☐
☐☐☐☐☐	g. Working under pressure	☐☐☐☐☐
☐☐☐☐☐	h. Accuracy, attention to detail	☐☐☐☐☐
☐☐☐☐☐	i. Time management	☐☐☐☐☐
☐☐☐☐☐	j. Negotiating	☐☐☐☐☐
☐☐☐☐☐	k. Fitness for work	☐☐☐☐☐
☐☐☐☐☐	l. Manual skills	☐☐☐☐☐
☐☐☐☐☐	m. Working independently	☐☐☐☐☐
☐☐☐☐☐	n. Working in a team	☐☐☐☐☐
☐☐☐☐☐	a. Initiative	☐☐☐☐☐
☐☐☐☐☐	b. Adaptability	☐☐☐☐☐
☐☐☐☐☐	c. Assertiveness, decisiveness, persistence	☐☐☐☐☐
☐☐☐☐☐	d. Power of concentration	☐☐☐☐☐
☐☐☐☐☐	e. Getting personally involved	☐☐☐☐☐
☐☐☐☐☐	f. Loyalty, integrity	☐☐☐☐☐
☐☐☐☐☐	g. Critical thinking	☐☐☐☐☐
☐☐☐☐☐	h. Oral communication skills	☐☐☐☐☐
☐☐☐☐☐	i. Written communication skills	☐☐☐☐☐
☐☐☐☐☐	j. Tolerance, appreciating of different points of view	☐☐☐☐☐
☐☐☐☐☐	k. Leadership	☐☐☐☐☐
☐☐☐☐☐	l. Taking responsibilities, decisions	☐☐☐☐☐

Chapter 4

Student time allocation, the learning environment and the acquisition of competencies[1]

« The primary learning environment for undergraduate students, the fairly passive lecture-discussion format where faculty talk and most students listen, is contrary to almost every principle of optimal setting for student learning »

Guskin (1994, cited in Barr and Tagg, 1995)

1. This chapter is an extended version of Meng and Heijke (2005). We would like to thank Lex Borghans, Wim Gijselaers, Jeannette Hommes, Ben Kriechel, Karl-Ulrich Mayer, Cees van der Vleuten, the conference participants at TIY (2004, Nuremberg), ORD (2005, Gent), EALE/SOLE (2005, San Francisco), the participants at two Maastricht University seminars (2004) and a seminar at ZEW (2005, Mannheim) for their comments and discussions on earlier drafts of the paper version.

4.1 Introduction

Successful labour market performance of higher education graduates is generally associated with the acquisition of the correct knowledge and competencies. High-quality education in a particular discipline is still seen as important for preparing graduates for a high level of performance on entering the labour market, where advanced and often highly specialized knowledge is required. However, higher education needs to be aware of the increased expectations of firms, who look for graduates resembling 'active agents'. Such active agents not only address problems in a creative manner, but are able to expand and adapt the potentialities of an existing job. They look beyond the strict borders of their tasks and understand what is needed for a proper functioning of the organization of which they are part. Moreover, in a world in which subject knowledge is rendered obsolete at an increasing rate by the pace of technological progress (Teichler, 1999), active agents are expected to be prepared for lifelong learning. In line with this, Albeda (1998) argued that learning is no longer the privilege of the young, nor the monopoly of schools and that lifelong learning and permanent education are clear necessities for any type of career. Hence, higher education is confronted with an increasing demand for graduates with a high level of generic competencies. This is also reflected in the statement by the Australian Government Department of Employment Education and Training (1987) that *"the major function of education is [...] to increase the individuals' capacity to learn, to provide them with a framework with which to analyze problems and to increase their capacity to deal with new information."* In line with this, we argued in Chapter 2 that in particular academic competencies, as a subgroup of generic competencies, are central to higher education programmes. Accordingly, the question arises how curricula in higher education should be adapted to achieve this goal.

Given that time, manpower and capital used in higher education are available in limited quantities, the tension between the need for a high level of discipline-specific competencies and at the same time the need for a high level of academic competencies may force a trade-off with respect to the curriculum setup in higher education. Shall higher education provide courses aimed at preparing graduates for a particular but narrow type of occupation or rather courses to prepare graduates as active, flexible and well-rounded academic professionals? Like a pendulum, opinions have swung between advancing either of the two extremes. In the 1960s, Becker (1964) for instance concluded that the long pay-off period to education "*increases the advantage of an education that is useful in many kinds of economic environments*" (p. 204). In contrast, Rosen, (1983) argued that specialization in education is beneficial in particular when the costs of competence acquisition are separable. More recently, the swings have been more strongly away from the narrow education of discipline-specific competencies towards an increased emphasis on generic competencies (see e.g. Bowden and Marton, 1998, Teichler, 1999).

The growing demand for generic competencies in general and academic competencies in particular in the labour market, together with rising criticism on traditional teaching styles, has led to the widespread establishment of activating learning methods in the last decades. These activating learning methods constitute the visible surface of a much deeper paradigm shift that is taking place in higher education. The change that we can observe is the shift from higher education institutes as places that exists to provide instruction, to higher education

institutes that exists to produce learning. In the former case, the means is the end. In the latter case, the means and the end are separated and the end governs the means (Barr and Tagg, 1995). In line with that shift, the actor who plays the leading role in higher education studies is changing too. Whereas in the traditional style, the central figure was the teacher who controlled the learning process and delivered the knowledge in small pieces to passive receivers, activating learning methods expect the learner (student) to be an active discoverer. By stimulating the active discoverer in the student, activating learning environments are expected to promote the acquisition of generic competencies, such as 'gathering information', 'interpersonal competencies', 'team working' or 'problem-solving abilities' (see e.g. de Corte, 1990; Everwijn, 1999; van Woerden, 1997).

Considering these newer didactic methods, the question arises if an implementation of them just trades the acquisition of discipline-specific competencies for the acquisition of academic competencies or provides a win-win situation in which higher education graduates acquire both types of competencies at a higher level. To address this question, the students' time allocation over different types of study activities, which may partially be endogenous to the didactic method used by the higher education institute[2] they attend, needs to be addressed as well. As a matter of fact, earlier findings (see e.g. Romer, 1993; Durden and Ellis, 1995; Dolton, Marcenaro and Navarro, 2001[3]) that attending formal education is of crucial importance for the learning outcomes of higher education graduates question the implementation of activating learning methods, such as problem-based learning, where lectures are mostly traded-off for more self-learning time.

Analyzing explicitly the learning environment in combination with the students' time allocation will provide us with further insight on the competence acquisition in higher education. Moreover, we are able to confront the current setup of a country's higher education with our findings and see to what extent adaptations are required to address the challenges of a knowledge-driven society. Is further implementation of activating learning environments in discipline-specific oriented countries necessary to compete on the knowledge level with academically oriented countries? Should universities increase their pressure on students to attend lectures? Should universities worry in case students increase the number of hours they work for money alongside their studies to cope with higher study costs?

To address these features, we distinguish learning environments from each other according to (1) the emphasis placed on the teacher as the main source of information, and (2) the emphasis placed on activating learning methods such as problem-based learning. With respect to the time allocation of the students, we distinguish between time spent on (1) formal education, (2) self-study, (3) extra-curricular activities, and (4) paid work.

The remainder of this chapter is structured as follows. Section 4.2 discusses the competence transformation process that takes place in higher education. In particular, we will address the role of the learning environment and the role of student time allocation in the acquisition of academic and discipline-specific competencies. Section 4.3 introduces the data

2. We use the term 'institute' to refer to a particular university or school (e.g. University of Maastricht). In contrast to that, we use the term 'institution' to refer to a particular type of higher education (e.g. universities or Fachhochschulen)

3. These studies are all restricted to a particular type of learning environment. For a brief discussion, see Section 4.2.3

used for the analyses and provides a first descriptive overview over the different types of learning environment and the student time allocation. The empirical analyses are discussed in section 4.4. Finally, Section 4.5 concludes the chapter and formulates, on the basis of the findings, policy advice for an adaptation of the higher education system.

4.2 Competence transformation at Higher Education

4.2.1 The production process

From an economic point of view, education can be regarded as a production process in which a variety of inputs are used to create a multidimensional output. The multidimensionality addressed here refers to the distinction between academic and discipline-specific competencies, as defined in Chapter 3. Formally, the outcome of higher education in terms of competencies acquired (C) by student i written as a combination of discipline-specific competencies (DS) of type s (e.g. law) and of academic competencies (A)[4]

$$(4.1)\quad C_{is} = C_1(DS_{i,s}, A_i)$$

In order to analyze the educational performance of students on the two competencies, we will consider a general multiple output production function:

$$(4.2)\quad (DS_{i,s}, A_i) = C_2(S, I, R, D, T, X) + \varepsilon$$

where S = students inputs (e.g. pre-higher education schooling achievements), I = institutional/programme factors (e.g. exam formalities, nominal study time), R = resource inputs (e.g. public money spent per student), X = other inputs (e.g. family inputs, peer inputs but also factors outside the classroom), and ε = a stochastic term. Moreover, we will add explicitly *the two factors that will play a key role in later analyses, namely D = didactic techniques* (e.g. activating learning methods) and T = student time allocation (e.g. time spent on formal education or on self-study).

At the centre of this production process is the student himself. However, students entering a higher education programme are not empty boxes that can be filled with competencies. Rather, they have already passed through a long formation trajectory by parents, family, or – in general terms – through their social environment and several years of pre-higher education schooling. Hence, the stock of discipline-specific and academic competencies already settled down constitutes the basis on which additions and changes during the study at the higher education institute take place. Moreover, the initial level of competencies can have a major impact on the effectiveness with which additional competencies are acquired. This may hold in particular with respect to academic competencies to the extent that they reflect the initial

4. We have not added a subscript (s) to A to index the program in which academic competencies are acquired, indicating that this does not matter. In other words, we use the term academic competencies not to refer to elements common to different subject-based competencies but strictly to the additional, subject independent content of these competencies useable in other fields (see also Chapters 2 and 3).

learning ability level of the student. We will return to these points of concern when discussing the empirical results in Section 4.4. Next, student characteristics such as their motivation, learning style or locus of control influence the competence transformation process. However, it is questionable to what extent they can be seen independently of the initial competencies.

Most studies on educational performance (for an overview see Hanushek, 2002) focus on the resources available to the schooling system. More specifically, they intend to measure the effects of (1) real resources of the classroom (teacher education, teacher experience, class size or teacher-student ratios), (2) financial resources (expenditure per student or teacher salaries) and, (3) measures of other resources in schools (specific teacher characteristics, administrative inputs or facilities). We acknowledge the economic importance of these input factors, but believe that such studies underscore the importance of a crucial aspect of the production process: the didactic technique. In contrast to the other aspects that constitute the learning context, the didactic method used is at the heart of the production process[5]. Of equal importance for the contribution to the higher education outcomes may be the student's individual time allocation to different study activities. This aspect seems of particular interest at higher education level, as students at this level are generally given a large amount of freedom in this respect.

We agree that our shift of focus to the effects of didactic techniques and student time allocation relocates the window in the black box rather than creating a new one. Nevertheless, we believe that this helps us further on the journey towards an understanding of the crucial mechanisms inside the competence transformation process of higher education. In what follows, we will briefly address the role of the learning environment, and in particular the roles of activating learning methods and student time allocation. After that, we will present a simple theoretical framework to address the main questions involved.

4.2.2 Learning environment

Traditionally, higher education programmes are organized around lectures that intend to help the students to understand the literature. At the end of the study (course), an examination is held in which the students have to demonstrate their understanding of the content of the literature. This traditional style of teaching has met with a variety of criticism. Guskin (1994, cited in Barr and Tagg, 1995) argued that "*The primary learning environment for undergraduate students, the fairly passive lecture-discussion format where faculty talk and most students listen, is contrary to almost every principle of optimal setting for student learning.*" More specifically, Gerritsen (1999) argued that the traditional setting bears risks that students acquire knowledge that is meaningless to them and hence will soon be forgotten after the examination. Schmidt and Bouhuijs (1985) criticized this type of learning environment because it divides the material up into distinct disciplines, whereas the reality that graduates encounter in their professional careers is organized around problems, which have to be addressed using knowl-

5. An important sidenote is that we do not address the possible impact of a change in the learning environment on resources such as labour or infrastructure costs. As a matter of fact, activating learning methods are more labour-intensive and need a large number of small rooms. To what extent an increase in financial costs or a reduction in research output reduces possible benefits of activating learning methods presented in this chapter will be an interesting line of research for the future.

edge from a range of disciplines. These critics have in the last decades given rise to the emergence of a growing number of applications of activating learning methods.

Activating learning environments

An element that all types of activating learning environments share, is their student-centred approach, requiring the student to be an active discoverer who is directly involved in the learning process rather than being fed passively by the teacher. Hence, activating learning environments include didactic styles that help and motivate students to learn and that promote an active engagement of students with the subject matter, their desire to understand it and their ability to actively apply it. The best-known examples of activating learning environments are project-based learning and problem-based learning[6]. The problem-based learning approach started in medical teaching at the McMaster University in Canada. Its key characteristics can be described as follows: "*Problem-based learning is the learning that results from the process of working toward the understanding or solution of a problem. The problem is encountered first in the learning process*" (Barrows, Tamblyn, 1980). Although problem-based learning was initiated in the 1970s, its roots can be traced back to the beginning of the 20th century and in particular to the work of Dewey (1916). Dewey[7] proposed that '*Methods which are permanently successful in formal education ...go back to the type of situation which causes reflection out of school in ordinary life. They give pupils something to do, not something to learn; and the doing is of such a nature as to demand thinking, or the intentional noting of connections; learning naturally results*" (Dewey, 1916, p.154). In line with this, and nearly 100 years later, Vaatstra and de Vries (2003) concluded on the basis of a literature review that the underlying theoretical point of view is that activating learning methods allow students to acquire the subject matter in an active way, resulting in a better recall of it. Moreover, as they are experienced to apply theoretical knowledge to solve cases, these graduates are expected to be better able to apply this knowledge in practice. Finally, by stimulating the active discoverer in the student, activating learning environments should promote the acquisition of generic competencies, such as 'gathering information', 'interpersonal competencies', 'team working' or 'problem-solving abilities' (see e.g. de Corte, 1990; Everwijn, 1999; van Woerden, 1997). Comparable ideas are presented in three recent books on learning and teaching (Prosser and Trigwell, 1999; Biggs, 2003; Ramsden, 2003). The general conclusion of these authors is that the teacher has to create an activating learning environment that stimulates the student to acquire knowledge in an active manner. This will enhance deep learning and a higher level of understanding.

The large majority of previous empirical research on the effectiveness of activating learning methods concentrated on the field of medicine (e.g. Dochy, Segers, van den Bossche and Gijbels, 2003; Norman and Schmidt, 2000). Some studies focused on different disciplines, such as the study by van den Bossche, Segers, Gijbels and Dochy (2001) who investigated

6. According to van Woerden (1997), there are great similarities between problem-based and project-based learning. In both types of environments, students gain concrete experience with learning independently, working together in groups (education is generally organized around small group meetings under guidance of a tutor), and approaching problems systematically.

7. Dewey belonged to the progressive education movement in America. This movement had its sources in the philosophies of Jean Jacques Rousseau, Johann Pestalozzi, and Friedrich Froebel.

the effects of problem-based learning environments on the results of economics students. What all of these studies generally conclude is that students who have worked in problem-based learning environments are better at applying knowledge than students from a conventional learning environment. However, what is not clear is whether there are other differences in the acquired type and level of competencies between students from these two types of learning environment. Moreover, by focusing the analyses on a particular field of study or even a particular higher education institute, the possibility to generalize the results is greatly restricted. Finally, these studies mostly neglect the impact of time allocated by students to formal education, self-study and other study activities and hence, the possible close relationship between learning environment and time allocation. A broader approach, using data on Dutch university graduates, was carried out by Vaatstra and de Vries (2003). Vaatstra and de Vries concluded that graduates who study in an activating learning environment during their university education, possessed more general and reflective competencies at time of graduation than graduates who completed a more traditional type of education. On the other hand, they could not establish a relationship between the type of learning environments and the amount of discipline-specific competencies.

Concluding this section, we can state that previous research established that activating learning methods seem in particular to stimulate competencies necessary to apply the knowledge acquired in higher education and competencies related to addressing problems and reflecting on one's own work.

4.2.3 Time allocation

Compared to secondary education, students at higher education institutes have a considerable amount of freedom in their decisions on how to allocate their time to different activities. The situation that students are obliged to spend strictly scheduled periods of time in class rooms together with a strict control of their attendance is the exception rather than the rule[8]. The way in which the available time is best allocated between these different activities (e.g. self-study or attending lectures) is of crucial importance from the perspective of the individual student.

Surprisingly, in spite of the crucial impact of time allocation by students on the outcomes of the educational production process, research on this topic is scarce. Moreover, most of the studies that control for the student time do so by measuring total time devoted to the course, a variable frequently found to be insignificant. Schmidt (1983) argued that this finding could be explained by the fact that the intensity of study varies so much among students that the assumption of time homogeneity is strongly refuted or that such a time variable is overly aggregated, as students not only allocate scarce time among courses and leisure but also ration time among alternative study modes within a course.

The available previous research consists in particular of case studies carried out in the United States, such as Schmidt (1983), who used data from an experiment run in the autumn of 1970 at the University of Wisconsin-Madison. The data included 216 students of the

8. Even in cases such as the economic programs at Maastricht University, where students are officially required to attend up to 100% of all meetings, students have a backdoor option and can trade the attendance for an additional written assignment.

Macroeconomic Principles course. Using different econometrical approaches, he found that hours of classroom attention are more productive than hours of self-study. Romer (1993), using data from three U.S. schools (the full sample size was 195 students), ran regressions of student performance on the fraction of lectures attended, both excluding and including proxies for motivation. He found in all estimations that the effect of classroom attendance was positive and significant, although the inclusion of proxies for motivation reduced the magnitude greatly. Durden and Ellis (1995), using a sample of 346 students in a Principle of Economics course, found that '*the typical student is not adversely affected by a few absences ... but excessive absenteeism is associated strongly with poor academic performance* (p. 345). Similar results were also found by Devadoss and Foltz (1996), who found that motivation positively affected attendance and that attendance positively affected class performance, and by Chan, Shum and Wright (1997), who found a significant positive relationship between attendance and student performance in a Tobit model and an insignificant relationship using a Heckman selection procedure to control for the students' survival process in the course. What is common to these U.S. studies is their focus on the relationship between classroom attention and student performance, omitting the question of time allocated to self-study.

Two studies that did look at time allocated to self-study in addition to the time allocated to the attendance of classes are Dolton, Marcenaro and Navarro (2001) and Bratti and Staffolani (2002). Dolton et al. (2001), analyzing a sample of 3,722 first- and final-year students from the University of Malaga, found that time allocated to lectures is between twice (using a stochastic production frontier approach) and four (using OLS) times as productive as time allocated to self-study. Bratti and Staffolani (2002) estimated an academic performance regression for first-year undergraduate students of economics at the University of Ancona. They found evidence that, once they controlled for time allocated to self-study, the positive and significant effect of lecture attendance for some courses disappeared.

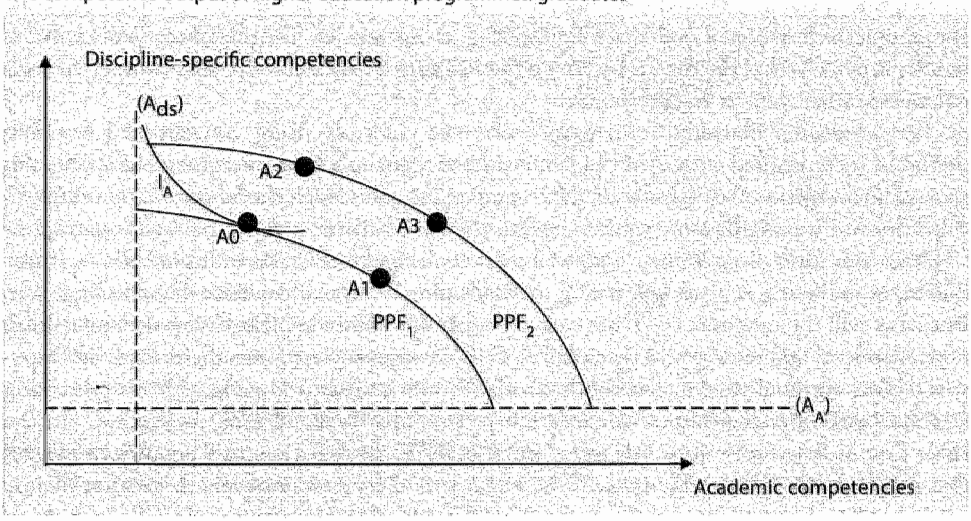
The scarce availability of literature directly addressing the relationship between the allocation of time and student performance itself can be seen as a rationale for further empirical studies that attempt to shed more light on this aspect. Moreover, what is generally omitted in the previous research is the impact that the learning environment may have on student time allocation and the different productivities of student time within a particular learning environment. In other words, studies investigating the impact of time allocation on educational outcomes without explicitly considering the didactic teaching methods used, ignore the possible link between time allocation and the learning environment.

4.2.4 A simple theoretical approach

Those responsible for higher education, together with the students, try to maximize the competence outcome. Under the assumption that study length and monetary resources available are limited and that the marginal costs of producing academic and discipline-specific competencies are progressively related to the intended level, the production possibility frontiers receive a convex shape. Graphically, production possibility frontiers indicate the maximum level of one type of competencies that can be produced in higher education for every possible level of production of the other type of competencies. We have shown two possible production possibility frontiers (PPF_1 and PPF_2) in Figure 4.1. The location of PPF_2

to the right of PPF_1 indicates a higher production possibility frontier, as a similar level of academic competencies can be produced with a higher level of discipline-specific competencies and vice versa. A step from PPF_1 to PPF_2 requires an increased level of input resources available or, at a given level of inputs, the use of a better production method, such as a more effective learning environment.

Figure 4.1
The competence output of higher education programmes/graduates



The two dotted lines (A_{ds} and A_A) restrict the possible outcomes to combinations with both a minimum level of academic competencies and a minimum level of discipline-specific competencies. Programmes that do not conform to these minimum standards are expected to be *discontinued either by losing their accreditation, and hence their official status, or by market forces*[9]. Secondly, the location of the dotted lines is determined by the fact that it is neither possible to acquire a high level of discipline-specific competencies without the acquisition of a minimum level of academic competencies ('without knowing how to learn, you can not learn') nor to acquire academic competencies without learning a discipline[10].

Assuming that the demand for higher education graduates consists of firms that produce their goods using academic and discipline-specific competencies, we can expect education programmes at least partially to aim at the competencies mix asked by these firms. We have

9. The demand of students for such programs will decrease as a result of continuous unsuccessfulness of the graduates in the labour market.

10. That the acquisition of academic competencies needs to be rooted in content, that is, that educational goals such as communication or problem-solving abilities necessarily must be related to communicating something or to solving some particular kinds of problems, has been argued by Bowden and Masters (1993). Stephenson (1992) expressed similar ideas to those of Bowden and Masters when he suggested that the fundamental objection to a separate generic skill, which he referred to as 'bolt-on capability', is that it denies 'the holistic nature of capability, the essential integration of personal qualities, skills and specialist knowledge which enables students to be effective' (Stephenson, 1992).

illustrated the demand of the firms in Figure 4.1 by the isoquant I_A, representing different combinations of academic and discipline-specific competencies yielding the same level of output. The concave shape assumed in Figure 4.1 reflects the option of firms to substitute between the two competencies. The substitution is assumed to become more difficult, and hence more expensive, the more of a particular type of competency the firm intends to use. Education programme Ao[11] is assumed to respond to the labour market demand with respect to the competence mix that an average graduate acquires. Programme Ao, responding to a discipline-specific competencies-oriented mix asked by the production sector, directs its students at the learning of such discipline-specific competencies. The role of academic competencies is perceived as the means by which the learning of discipline-specific competencies is enhanced rather than as an end in itself.

Let us assume that education programme Ao, currently using conventional teaching methods, is confronted with a shift in labour market demand. As a consequence of changes in the way firms operate, we assume that the competence mix which the labour market requires shifts drastically towards more value being attached to academic competencies. Those responsible for education programme Ao now face the challenge to react. As indicated above, introducing or enforcing activating learning methods may be a possible route that can be taken. But what will the outcome be? Does such a change force a trade-off between the acquisition of academic competencies and discipline-specific competencies or are these methods superior to conventional teaching methods? In the former case, introducing activating learning methods will move the output of education programme Ao along PPF_1 to (e.g.) $A1$. In the latter case, it may move outwards to for instance PPF_2. In that case, two possible outcomes that can be achieved, are $A2$ or $A3$. If the new method increases only the level of academic competencies that students possess at the time of graduation, programme Ao will reach $A3$. If these methods not only increase the level of academic competencies but also the level of discipline-specific competencies, our programme may find its place in $A2$. The question what the outcome will be of such a change in the learning environment and to what extent activating learning methods help higher education programmes to solve the dilemma that they are in, will be investigated empirically in Section 4.4.

Although we argued above that the time allocation of students will be determined partly by the learning environment used, we may still expect to find some heterogeneity between students within a leaning environment with respect to time allocated to, for example, formal education or self-study. This relates back to the brief literature review, in which we stated that it is necessary to treat time allocated to different study activities separately rather than aggregated as overall time spent on studying. Considering the interest in the level and type of competencies acquired by students at the time of graduation, which is a broader outcome

11. We ignore for the moment the fact that within an education program there may be heterogeneity between graduates with respect to the academic and discipline-specific competencies that they possess at the time of graduation. Hence, the outcome may also be drawn as a larger area instead of the point that we have drawn. Illustrating it by an area would indicate that the education programme may try to achieve a particular point for the average student but that better students are able to score higher, and vice versa for the less intelligent students. Moreover, the size of such an area would at least partially reflect the standardization within a program with respect to the level of academic and discipline-specific competencies. In Chapter 6, we will discuss to what extent the standardization itself is an important factor in the transition from higher education to the labour market.

measurement than a particular grade achieved in a course, we have to include more types of study activities than simply the time spent in lecture halls or time spent reading books. As a matter of fact, paid working time as well as time spent on extra-curricular activities may also be of importance.

Let us assume that each student is able to convert time spent on self study (ST[12]), time spent on formal education (e.g. lectures, seminars) (F), time spent on extra-curricular activities (EC), and time spent on paid work (W) into additional competencies (*C*)[13].

$$(4.3) \quad C = C(F, ST, EC, W / S, I, R, D, X)$$
subject to: $F+ST+EC+W = T$ (Time available)

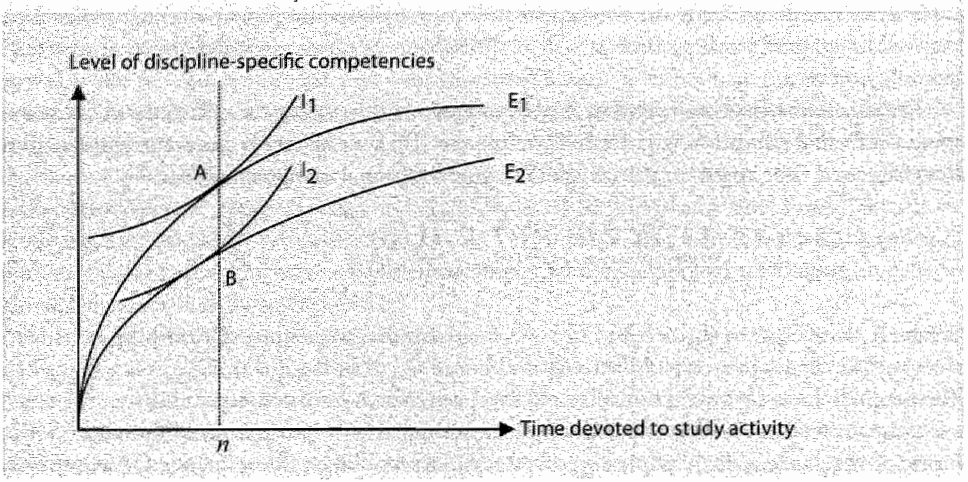
Where $C_F \geq 0$, $C_{ST} \geq 0$, $C_{EC} \geq 0$ and $C_W \geq 0$. Furthermore, we assume diminishing returns to the time devoted to any type of activity and hence $C_{FF} \leq 0$, $C_{STST} \leq 0$, $C_{ECEC} \leq 0$, $C_{WW} \leq 0$. The precise relation between time devoted to a particular type of activity and the competence outcome, as well as the degree to which diminishing returns occur, is conditional on *S*, the input of the student such as pre-higher education schooling achievements, *I*, institutional or programme factors such as the exam formalities, *R*, resource inputs, *X*, other inputs (e.g. family inputs) and *D*, the learning environment.

This simple theoretical approach is sophisticated enough to explain why the competence outcomes of two graduates, investing the same total time in competence acquisition (*T*), may differ as a result of the different allocation of the total time over the different ways of competence acquisition. Figure 4.2 illustrates this point.

Let us consider the case of an individual student attending a higher education programme at an institute that uses a conventional teaching method. For simplicity reasons, we assume that the level of discipline-specific competencies can only be influenced by attending lectures and/or by self-study. E_1 represents the competence transformation line of time spent in lecture halls and E_2 for time devoted to self-study. In both cases, more time allocated to the activity increases the final competence outcome but with decreasing marginal returns. The situation in Figure 4.2 was drawn according to the findings of previous research that we have reported on (e.g. Dolton et al., 2001), namely that spending a particular amount of time on attending lectures is more effective in acquiring discipline-specific competencies than spending the same amount of time on self-study. Hence, our student can achieve a higher level of utility (reflected by a higher indifference curve I_1[14]) by attending *n* hours of lectures than by spending *n* hours on self-study (I_2).

12. We have omitted the subscript indicating the individual student for simplicity reasons.
13. We have omitted the decision of the student to enroll in higher education instead of starting to work. Furthermore, the trade-off between formal class (and/or self-study) time and time devoted to paid work during the study at a higher education institute, is not regarded as a trade-off decision between study performance and money in this paper, but rather as a trade-off decision between different activities influencing the competencies output.
14. The upward-sloping curvature of the indifference curve indicates the trade-off between the 'good' of acquiring competencies and the 'bad' of spending time on studying instead of having leisure time.

Figure 4.2
Transformation of time into competencies



Note: The level of academic competencies to be acquired is set at the level possessed when entering higher education.

However, several questions arise. What does the picture look like when we consider the acquisition of academic competencies instead of discipline-specific competencies? Might the return to formal education be related to the amount of self-study time to prepare for the class? Is time spent on working alongside the study time lost for the acquisition of competencies or not? These types of questions, together with the question of the effectiveness of learning environments addressed above, will form the focus in the empirical analyses that we turn to now.

4.3 Data and a first descriptive view

The research data for this chapter were obtained from the Europe-wide postal survey among 1994/1995 higher education graduates carried out in 1998, introduced in Chapter 3. The data provide, among a whole set of personal characteristics and the competencies possessed at the time of graduation, a rich set of information with respect to the study programme followed at a higher education institute. In particular, the data allows us to analyze the effects of learning environments and student time allocation for approximately 19,000 graduates in nine European countries (Austria, Finland, France, Germany, Italy, Norway, Spain, The Netherlands and United Kingdom) covering all types of higher education institutions[15].

In what follows, we will discuss and present the operationalization of, first, the competencies acquired by the graduates of higher education and secondly, the part of the data used to define the learning environment and the time allocation of the students.

15. Hence, the data not only covers university graduates but also graduates from HBO institutes (Netherlands), Fachhochschulen (Austria), Grande Écoles (France) and University colleges (Norway).

4.3.1 Discipline-specific and academic competencies

The data contains information with respect to different competencies representing different types of knowledge supplied by graduates. Graduates were asked to indicate on a five-point scale, ranging from 1 ('not at all') to 5 ('to a very high extent')[16], the extent to which they had a given competency at time of graduation (in 1994 or 1995). Using a hierarchical clustering method, we retained two clusters of competencies representing best our idea of academic competencies and discipline-specific competencies[17]. The two clusters consist of the following individual items:

Academic competencies
» Learning abilities
» Reflective thinking, assessing one's own work
» Problem-solving abilities
» Analytical competencies
» Documenting ideas and information

Discipline-specific competencies
» Field-specific theoretical knowledge
» Field-specific knowledge of methods

For our analyses, we then simply calculated an average of the competence clusters possessed at the time of graduation. As the individual items were measured on a five-point scale ranging from 1 ('not possessed at all') to 5 ('possessed to a very high extent') the graduates' scores on a cluster is also bound to between 1 and 5.

4.3.2 Learning environment

To define the learning environment, we relied on the respondents' self-report on the emphasis laid by the higher education institute on particular curriculum aspects. More precisely, we used information on the following two questions:

> *« If you look back to your course of study you graduated from in 1994 or 1995, to what extent were the following modes of teaching and learning emphasized by your institution of higher education and its teachers? »*

a. Teacher as the main source of information and understanding?
b. Project- and problem-based learning?

16. In the original questionnaire, the answers were coded from 1 ('to a very high extent') to 5 ('not at all'). To simplify the reading of the empirical analyses, we recoded the answers to range from 1 ('not at all') to 5 ('to a very high extent').
17. For a more detailed discussion on the clustering method, some descriptives with respect to the competencies clusters and validity tests of the two constructs, see Chapter 3.

For both questions, the respondents could indicate their answers on a five-point scale, ranging from 1 ('not at all') to 5 ('to a very high extent'). On the basis of the answers by the graduates to these two questions, we distinguished four types of learning environments (see Matrix 4.1).

Matrix 4.1
Four different learning environments

		Emphasis on problem-based learning	
		Weak	Strong
Emphasis on teacher as main source of information	Weak	Traditional (45%)	PBL without teacher (20%)
	Strong	School-class (25%)	PBL with teacher (10%)

The first two learning environments that we distinguished, do not use activating learning methods, at least not on a significant level (approximated by answer categories 4 and 5). The third and fourth learning environments distinguished apply activating learning methods to a significant extent.

1) Traditional style (answer on Teacher: 1-3; answer on PBL: 1-3)
This style is characterized by the fact that the higher education institute neither puts strong or very strong emphasis on 'teacher as main source of information' nor on 'problem-based learning'. Roughly 45% of all graduates were taught according to this style.

2) School-class style (answer on Teacher: 4-5; answer on PBL: 1-3)
In this case, the graduates indicated that the teacher played a strong or very strong role as central source of information, but that less emphasis was placed on 'problem-based learning'. This type of teaching resembles the situation to which students from pre-higher education are used, where the teacher talks and the students listen. Given the research population, 25% of the respondents indicated that this was the case in their higher education institute. In contrast to the traditional teaching style, we expect the school-class style to rely relatively more on classroom attention and relatively less on self-study.

3) PBL without teacher style (answer on Teacher: 1-3; answer on PBL: 4-5)
The third style that we distinguish, is a situation in which 'problem-based learning' played a strong or very strong role, but where the teacher was not a major source of information. 20% of the respondents experienced such a learning environment. This style resembles most likely the original idea of problem- or project-based learning, in which the role of the teacher is seen as process- rather than content-oriented.

4) PBL with teacher style (answer on Teacher: 4-5; answer on PBL: 4-5)
The final learning environment that we distinguish, mixes a strong or very strong role of the teacher as a central source of information with a strong or very strong emphasis on problem-based learning. In contrast to the *PBL without teacher style,* this style gives the teacher a role beyond mere process monitoring. 10% of the respondents belonged to this group.

Table 4.1 reports the use of different learning environments in the countries and higher education institutions considered. In all countries providing two types of higher education institutions, the non-university institutions are more likely to provide teaching according to activating learning methods. However, in Norway, Germany and the Netherlands, the non-university institutions also score higher on teacher-centred learning environments. Overall, the four learning environments are represented in all countries and higher education institutions available in comparable patterns.

Table 4.1
% of students in learning environment; Strata: Higher education institution

	IT	ES	FR	AT	D	NL	UK	FI	NO	TOTAL
University type of higher education										
Traditional	52	41	57	55	64	61	37	42	57	51
School-class	32	37	18	26	17	19	18	33	17	25
PBL with teacher	7	10	10	7	4	5	14	5	6	7
PBL without teacher	9	12	15	13	15	16	31	21	20	16
Total	100	100	100	100	100	100	100	100	100	100
Other type of higher education										
Traditional			23		41	43	28		25	33
School-class			6		36	26	14		21	22
PBL with teacher			25		9	13	17		20	16
PBL without teacher			47		14	18	41		34	29
Total			100		100	100	100		100	100

Note: Empty cells mean 'not available', in the sense that this institution is not available. Other type of higher education is in France the Grande Écoles, in Germany the Fachhochschulen, in the Netherlands the HBO schools, in the United Kingdom the 'new universities'[18] and in Norway the 'state colleges'.

4.3.3 Student time allocation

The information on student time allocation was based on the question:

> « *During your study at the higher education institute, approximately how many hours a week did you time spend on the following activities during term?* »

The activities distinguished were 'attending formal education of the main subject', 'self-study on the main subject', 'following a second subject', 'extra-curricular activities (e.g. student association)' and 'employment'. Table 4.2 shows the average weekly time allocation. The findings show that on average students spend roughly 32 hours a week on their main study. Following a second study is the exception rather than the rule, as can be seen from the fact that the average student spent about 1 hour and 30 minutes per week on this activity, which

18. The reason why we treat the new universities (the former polytechnics) in the United Kingdom separately from the old universities, was based on their striking differences in entrance requirements and status as measured for instances by the Sunday Times League Tables (Sunday Times, 2003). Moreover, the students in this study started their studies before the 1992 Higher Education Act was implemented in the United Kingdom.

is only one third of the time spent on extra-curricular activities, such as working for a student organization. Finally, students spent roughly 2 days a week on paid work.

Dolton et al. (2001) addressed the difficulty of getting respondents to correctly remember their time allocation. They referred to Juster and Stafford (1991), who suggested that the best way to do this is by asking people to keep a diary[19]. However, Juster and Stafford (1991) also mentioned that the mistake was reduced by asking respondents to indicate 'daily work patterns'. As the weekly time allocation is not expected to fluctuate sharply, we used this argument as some reassurance for the approach used here. Moreover, less than 1% of the respondents reported a weekly time that required them to spend more than 16 hours in total per weekday as students. Excluding extra-curricular activities which students might rather count as leisure time, the percentage of respondents reporting weekly time in line with a workload of 12 or more hours a weekday drops to below 1%.

Table 4.2
Student time allocation

	Average weekly time (hrs and min)
Attending formal education of main subject	17 h 35 min
Self –study for main subject	14 h 49 min
Study time of second subject	1 h 35 min
Extra curricular activities	4 h 47 min
Employment	16 h 20 min

Table 4.3
Time allocation: Strata: Higher education institution

	IT	ES	FR	AT	D	NL	UK	FI	NO
University type of higher education									
Attending lectures of main subject	17h50m	20h05m	20h40m	11h41m	20h00m	12h30m	16h00m	12h00m	13h00m
Self –study for main subject	24h30m	16h59m	12h08m	17h05m	12h29m	14h35m	13h32m	12h29m	21h40m
Study time of second subject	00h00m	02h20m	00h49m	01h45m	01h31m	03h30m	01h7m	05h15m	00h21m
Extra-curricular activities	07h00m	04h19m	03h37m	05h50m	05h22m	03h58m	05h15m	02h03m	04h40m
Employment	07h49m	03h30m	16h37m	16h20m	15h24m	14h14m	22h24m	21h07m	21h56m
Other type of higher education									
Attending lectures of main subject			29h10m		20h36m	18h00m	17h00m		20h20m
Self –study for main subject			10h23m		11h33m	12h15m	15h03m		09h02m
Study time of second subject			00h35m		00h21m	03h30m	01h03m		00h07m
Extra-curricular activities			04h18m		05h15m	07h00m	06h33m		03h51m
Employment			07h42m		18h01m	13h18m	21h53m		22h32m

Note: Other type of higher education is in France the Grande Écoles, in Germany the Fachhochschulen, in the Netherlands the HBO schools, in the United Kingdom the 'new universities' and in Norway the 'state colleges'.

19. Dolton et al (2001) mentioned that this approach also has a potential bias, referring to Mulligan, Schneider and Wolfe (2000), who suggested that time budget studies using diaries are subject to sampling biases as participating in such projects does not take place randomly.

When discussing the educational production process in Section 4.2, we argued that time allocation may be influenced by the learning environment in which the study takes place.

Table 4.3 reports the weekly time allocation of students, separately for the nine countries considered and, if available, for the different higher education institutions. Students following their higher education study at a Grande Écoles institute in France on average spent more than 29 hours in the classroom, which is nearly three times more than their colleagues at Austrian universities (almost 12 hours). Although Austrian students compensated for this by allocating roughly seven hours more to self-study than the students at Grande Écoles do, the large number of classroom attendance hours of the French students led to a great reduction in hours spent on employment/jobs. Students in the United Kingdom and the two Scandinavian countries allocated the highest number of hours (between 21 and 23 hours) to paid work, whereas students in Spain allocated on average only three and a half hours to paid work. Considering extra-curricular activities, Italian and Dutch HBO students - with seven hours a week – spent most time on these activities. Finally, Finnish students used significantly more time on studying for a second subject than their colleagues in other countries.

Table 4.4 presents the weekly time schedule of our European graduates, according to the learning environment in which the study takes place. Students taught according to the 'problem-based learning with teacher' method, on average spent 20 hours and 40 minutes in the classroom, which is roughly 2 hours more than their colleagues in a 'school-class' or 'PBL without teacher' learning environment and more than 4 hours more than students in a 'traditional' learning environment[20]. Partially, the increased attendance is traded-off against a reduced allocation of time to self-study.

Table 4.4
Time allocation: Strata: learning environment

	Traditional	School class	PBL with teacher	PBL without teacher
Attending formal education of main subject	16 h 20 m	18 h 20 m	20 h 40 m	18 h 05 m
Self –study for main subject	15 h 17 m	14 h 28 m	13 h 46 m	14 h 35 m
Study time of second subject	01 h 45 m	01 h 59 m	01 h 38 m	01 h 45 m
Extra-curricular activities	04 h 54 m	04 h 40 m	04 h 54 m	04 h 54 m
Employment	16 h 16 m	15 h 24 m	15 h 59 m	17 h 58 m

4.4 Empirical analyses

The objective of this chapter is to relate information with respect to the learning environment in which the study takes place and the time allocation of the student over different study activities to the outcomes of the production process, namely the level of academic and discipline-specific competencies. In this section, we will first address the empirical method used for the analyses and secondly, discuss the results.

20. As expected, we found that students in the school-class method spent relatively more time in the classroom and relatively less time on self-study than students in the traditional method.

4.4.1 The stochastic frontier model

In the previous sections, we addressed the choice of the higher education institute to apply a certain learning environment and the choice of students in allocating their time over the different possible activities to a firm that tries to obtain a particular output by the use of different input materials. If $y = f(x)$ defines such a relationship between inputs, x, and the maximum potential output, y, then the textbook proposition that a production function is a theoretical ideal implies that the observed value of y must by definition be smaller than or equal to f(x). For an empirical estimation model, this implies that in a formulation such as $y = f(x|\beta) + \mu$, with μ representing the error term, μ has to be negative and should be interpreted as inefficiency (see e.g. Greene, 2000). The stochastic production frontier function that makes it possible to address this problem, was proposed independently by Aigner, Lovell and Schmidt (1977), and Meeusen and van den Broeck (1977). The original specification involved a linear production function which had an error term with two components, one to account for random effects and another to account for technical inefficiency. Formally, such a model can be written as:

$$(4.4) \quad y_i = x_i\beta + v_i - \mu_i$$

where y_i is the output of the i-th student, x_i a vector of input quantities, β a vector of unknown parameters, v_i a random variable assumed to be iid. $N(0,\sigma_v^2)$ that is independent of μ_i, a non-negative random variable accounting for technical inefficiency. The model is a generalization of the standard regression model with μ_i as the distinguishing feature.

The underlying idea of the model is that the student's attainment in academic and discipline-specific competencies is affected by two types of random factors, which are unobservable for us:

The first type (v_i) has a normal distribution. Dolton et al. (2001) referred to the assignment to an inspiring teacher, being a member of a good mutual or self-help study group, and finding the ideal textbook to study from, as examples for this type of random factor.

The second type of random factor (μ_i) relates to the inherent ability that restricts the student's achievement potential. With respect to the second type of random factors, it may be appropriate to expect it to have an asymmetric distribution. Considering the research population of higher education students, this asymmetric distribution can be related to the admission and selection requirements inherent to higher education. As a matter of fact, only the top 30-40% of the population of pupils completing secondary education enters higher education. Even when the student, and the higher education institute he attends, use the most effective mix of ingredients, the achieved outcome will be less than the maximum potential outcome, unless the student's innate ability is highest, allowing the most efficient conversion of input factors into the desired outcome. Aigner, Lovell and Schmidt (1977) suggested two possible distributions, namely the absolute value of a normally distributed variable ('the so-called half-normal model) and an exponentially distributed variable. However, Battese and Coelli (1988) indicated that the half-normal specification is the most useful formulation for the kind of data considered here[21].

21. Estimating the model, assuming an exponentially distributed variable, does not significantly change the findings that we will present in the next section.

Two last problems need to be addressed. First, we have to consider the heterogeneity of the graduate's level of competencies that is related to unobserved factors, such as higher education institutions, institutes' or programmes' selection and entry standards, assessment methods or resources available to them. If such factors differ significantly between education programmes, higher education institutions or countries, the level of competencies indicated by student A in programme 1 cannot be compared directly to the level of competencies indicated by student B in programme 2. Moreover, we have to consider that the level of competencies reported by graduates may be related to the amount of self-criticism of the student and to the cultural dimensions of a country. To consider that these aspects imply that a particular score may be strongly biased by the education programme, the higher education institute, the higher education institution or the country the respondent graduated in, we used normalized scores as dependent variables. A first best approach would be to distinguish between different institutes of higher education and between highly disaggregated fields of study. Unfortunately, the data does not allow us to follow such a first best approach. We are forced to use a second best approach and aggregate the data over narrowly defined education programmes and individual institutes providing these programmes[22]. For the former, we made use of the information on the individuals' educational fields provided by the International Standard Classification of Education (ISCED, 3 digits). We recoded the 3-digit ISCED into 7 education fields, namely 'arts and humanities', 'social sciences', 'business', 'law', 'natural sciences', 'engineering' and 'health'. In total, we distinguished 91 different education programmes, nested in 14 different higher education institutions that are nested in 9 different countries. Formally, this is written as:

$$(4.5)\quad A_{i,normalised} = (A_i - A_{shc}) / A_{shc}^{st.dev.}$$

where A_i is the student's individual level of academic competencies, A_{shc} the average level of academic competencies in study programme s in higher education institution h of country c and $A_{shc}^{st.dev.}$ the standard deviation of academic competencies within study programme s in institution h and country c and, similarly,

$$(4.6)\quad DS_{i,normalised} = (DS_i - DS_{shc}) / DS_{shc}^{st.dev.}$$

where DS_i is the student's individual level of discipline-specific competencies, DS_{shc} the average level of discipline-specific competencies in study programme s in higher education institu-

22. Even though this makes it possible to control, for example for exaggeration of students between countries, higher education institutions or education programs, there is still the danger that students of a particular learning environment (e.g. PBL without teacher) exaggerate in their answers. Logically, it is impossible to control for that directly in the analyses. We tested if similar patterns as reported hereafter between the four learning environments were also visible for all other competence types measured in the data (e.g. foreign-language competencies). The results (data not shown) of these tests show that there are no significant differences between the level of foreign-language competencies between graduates of different learning environments. At the same time, we found the intuitive logical results that female graduates possess a higher level of foreign-language competencies and that graduates in Italy, Spain, France (with the exception of Grande Écoles graduates) and in particular graduates from the United Kingdom score below average on foreign language competencies. We used these results as some reassurance that graduates from a particular learning environment do not a priori exaggerate more than graduates from a different learning environment.

tion h of country c, and $DS_{shc}^{st.dev.}$ the standard deviation of discipline-specific competencies within study programme s in institution h and country c.

Hence, we did do not only normalize regarding the average score of the students' direct peers, but also took the standard deviation and thereby the distribution into account. Doing so, we assumed that scoring above (or below) average indicated something different in an education programme in which the final outcome varied more than in an education programme with a very harmonized outcome.

The second problem that we had to address, relates to the fact that the acquisition of one type of competencies may not take place independently of the other type of competencies. This holds in particular for the acquisition of discipline-specific competencies. The way we defined academic competencies, as a group of competencies providing a strong base for learning, indicates that these help to increase the effectiveness with which discipline-specific competencies are learned. In other words, the level of academic competencies that students acquire may be a significant explanatory variable of the discipline-specific competencies level that they acquire. For this reason, we will control for the acquisition of academic competencies in the discipline-specific competencies model.

To summarize, the model that we have estimated in the following section consists of the following two equations:

$$(4.7)\quad A_{in} = \alpha_A + X_i \beta_A + Y_i \delta_A + W_i \chi_A + Z_i \gamma_A + \nu_{iA} - \mu_{iA}$$

$$(4.8)\quad DS_{in} = \alpha_{DS} + X_i \beta_{DS} + W_i \chi_{DS} + Z_i \gamma_{DS} + \hat{A}_{in} \zeta_{DS} + \nu_{iDS} - \mu_{iDS}$$

where A_{in} and DS_{in} represent - respectively - the normalized score of academic and discipline-specific competencies possessed by graduate i at the time of graduation, α[23] is a constant, X_i a vector that comprises factors characterizing the student's pre-higher education school career and personal characteristics of the student, Y_i an additional vector of pre-higher education and personal characteristics of the student assumed only to influence the level of academic competencies, W_i a vector that indicates the learning environment in which the student completed his study, Z_i a factor of variables indicating the student's time allocation ν_i, a random variable assumed to be iid. $N(0,\sigma_\nu^2)$ that is independent of μ_i, a non-negative random variable assumed to be a half-normal distributed variable. Moreover, we have added in (4.8) the predicted normalized level of academic competencies as an explanatory factor $\hat{A}_{in}$. The predicted valued was extracted from applying ordinary least square regressions on equation 4.7. We will return to this point in more detail after having discussed the results on the acquisition of academic competencies.

In what follows, we will discuss the results of our empirical analyses in two parts. First, we will pool the data over all four learning environments to discuss the impact of the learning environment and student time allocation. Second, we will re-estimate the analyses per learning environment to analyze in greater detail the impact of student time allocation in a learning environment.

23. The subscripts 'DS' and 'A' indicate that the parameters belong to the discipline-specific competence model and the academic competence model, respectively.

Table 4.7
The impact on academic competencies

	Model 0		Model 1a		Model 1b		Model 2		Model 3	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Constant	0.264***	0.072	0.539***	0.073	0.113	0.079	0.400***	0.079	-0.210**	0.082
Personal and pre-higher education characteristics										
Higher educated parents	0.033**	0.016	0.032**	0.016	0.023	0.016	0.023	0.016	0.023	0.016
Gender: man	-0.080***	0.016	-0.081***	0.016	-0.078***	0.016	-0.080***	0.016	-0.070***	0.016
Age	0.010***	0.002	0.010***	0.016	0.010***	0.002	0.010***	0.002	0.008***	0.002
Academic pre-education	0.094***	0.020	0.108***	0.020	0.093***	0.020	0.106***	0.020	0.112***	0.020
Low secondary grades	Ref.		Ref.		Ref.		Ref.		Ref.	
Medium secondary grades	0.098***	0.021	0.100***	0.021	0.091***	0.021	0.094***	0.021	0.088***	0.020
High secondary grades	0.272***	0.024	0.276***	0.024	0.248***	0.024	0.255***	0.024	0.245***	0.023
Learning environment										
PBL without teacher			Ref.				Ref.		Ref.	
Traditional			-0.331***	0.021			-0.325***	0.021	-0.208***	0.021
School-class			-0.330***	0.023			-0.324***	0.023	-0.206***	0.024
PBL with teacher			0.056**	0.028			0.055*	0.029	0.027	0.028
Time allocation										
Formal education					-0.002**	0.001	-0.002**	0.001	-0.002*	0.001
Required formal education					0.003***	0.001	0.002**	0.001	0.001	0.001
Self-study					0.006***	0.001	0.006***	0.001	0.004***	0.001
Study of second subject					0.007***	0.002	0.006***	0.002	0.005***	0.002
Extra-curricular					0.001	0.001	0.001	0.001	0.001	0.001
Work					-0.001*	0.001	-0.001	0.001	-0.001	0.001
Study-related work					0.004***	0.001	0.003***	0.001	0.002***	0.001
Other time allocation										
Short internship					-0.021	0.019	-0.028	0.019	-0.036	0.018
Long internship					0.004	0.023	-0.013	0.023	-0.030	0.023
Time spent abroad					0.057***	0.018	0.057***	0.018	0.063***	0.017
Additional curriculum aspects										
Facts and practical knowledge									0.142***	0.016
Theories and concepts									0.177***	0.017
Attitudes and interpersonal skills									0.128***	0.019
Independent learning									0.248***	0.015
Freedom to choose courses									0.088***	0.016
Direct acquisition of work experience									0.033	0.020
Out-of-class communication with other students									0.106***	0.021
Writing a thesis									0.122***	0.017
Regular detailed assessment									0.145***	0.020
Σ (=$(\sigma_u + \sigma_v)^{0.5}$	1.27		1.25		1.26		1.25		1.20	
σ_u	0.96		0.95		0.92		0.90		0.89	
σ_v	0.82		0.82		0.82		0.81		0.81	
λ	1.17***		1.16***		1.26***		1.17***		1.09***	
-Log L	26395		26178		26324		26115		25677	
N-cases	18532		18532		18532		18532		18532	

Note 1: All models also include dummies for the nine countries, dummies for the different higher education institutions in a country and dummies for seven education programmes. None of these dummies shows a significant impact, indicating that the normalization was successful in taking away country-specific effects. Note 2: *** significant at a 1% level, ** significant at a 5% level, * significant at a10% level. Note 3: λ is a measure of the relative weight of the inefficiency in the empirical estimation. In all our estimations, the λ is highly significant different from zero, indicating that the use of the frontier production functions is appropriate. In case of an ordinary linear regression with a normal distributed error term, λ would be zero.

4.4.2 Results I: Acquisition of academic and discipline-specific competencies

Let us start off by discussing the results with respect to the level of academic competencies[24]. Table 4.7 presents the results of five models. Model 0[25] includes variables reflecting personal characteristics (a dummy for having higher educated parents, dummies for being male and for age) and variables approximating the student's pre-higher education schooling career (a dummy for academic secondary school and dummies indicating the grades with which students passed secondary school). Model 1a adds to these variables dummies for the learning environment, while Model 1b adds the time allocation variables plus information on possible internships/work placements during the study and on periods of time spent abroad. With respect to the variables representing the time allocation, we have added two interaction terms. First, we added an interaction ('required formal education') between the hours spent in formal education and a dummy that is 1 if the higher education institute put a great deal of emphasis on the requirement of student attendance. The second variable ('study-related work') represents an interaction between the hours allocated to paid work and a dummy that is 1 if the employment was to a high or very high extent related to the field of study[26]. Whereas the former interaction variable allows controlling for if formal education hours are more effective when they are 'required', the latter allows us to distinguish the impact of work related to the study from work not related to the study. Model 2 adds the variables on the learning environment and on the study time allocation. Finally, in Model 3, we have controlled for additional curriculum aspects. As some of these curriculum aspects may apply to one of the four learning environments more than once, we can expect them to take over some of the differences explained by learning environments.

Considering the personal characteristics, we found that female students and more mature students performed better (see Table 4.7). The impact of the student's age may be related to the fact that these students spent some time between secondary school and higher education on activities (e.g. foreign experience) that more likely broaden one's horizon than focusing on the topic one intends to study later on. Moreover, we found in Model 0 and Model 1a that students with higher educated parents performed better, which implies that some kind of knowledge transfer between generations takes place[27].

Considering the pre-higher education schooling, the results indicated that students with an academic secondary education performed better with respect to academic competencies. As academic secondary education teaches more academic competencies than vocational secondary education, this result may also simply indicate that these students started their higher education studies with a higher academic competence level. Lastly, we found that the secondary education grades had a strong positive relation with the final outcome of higher

24. Appendix 4A defines the variables used.
25. All models also include dummies for countries, higher education institutions and education programmes.
26. We used the following question from the survey: 'to what extent did your working experience tie up with the content of your study?' Respondents were given an answer scale from 1 (not at all) to 5 (to a very high extent). We combined answer categories 4 (to a high extent) and 5 (to a very high extent) to measure a strong relation between study and work.
27. To what extent such a transfer is genetic or just the result of the fact that higher educated parents are more likely to be able to help their children by instructing them how to learn or how to address a problem, is clearly beyond the scope of this analysis.

education. With the exception of the dummy for higher educated parents, the impact of the personal and pre-higher education characteristics stayed robust when entering other variables in Model 1 through Model 3. The findings considering the personal and pre-higher education characteristics will later on be very helpful to instrument the level of academic competencies in the empirical analyses of the discipline-specific competencies.

After entering in Model 1a the dummies indicating the type of learning environment in which the study took place, the results show the superiority of learning environments that include some type of activating learning method. In Model 1a, the most effective learning environment is the 'PBL with teacher style'. However, its effect in relation to the 'PBL without teacher style' is lost in Model 2 (at least on a reasonable significance level) and Model 3.
In Model 1b, we replaced the dummies for the learning environment by the time allocated to different study activities. The first finding was that formal education (at least when not required) actually reduced the effectiveness with which academic competencies were acquired. Hence, it seems that academic competencies were not most likely to be acquired in the classroom. Time spent on self-study and time spent on studying a second subject increased the performance of students with respect to academic competencies. Paid work, at least when it is related to the study followed, also added to the acquisition. Lastly, we found no significant impact of time allocated to extra-curricular activities[28]. With respect to time allocated to internships or time spent abroad, we found that graduates only benefited from staying abroad for some time. Generally, all results of the time allocation remained very robust when in Model 2 the dummies for the learning environments were added, which indicates that time allocation is not a priori endogenous to the learning environment.

Lastly, considering the impact of other curricular aspects[29], we observed that, although most have a significant and positive impact, it was in particular an increased emphasis on 'independent learning' that increased the student's effectiveness. Moreover, their inclusion sharply reduced the effects of our learning environment variables.

Let us continue the discussion with the results of the level of discipline-specific competencies (see Table 4.9). The setup of the models follows closely the setup discussed above. However, we added the predicted value of academic competencies as an explanatory variable. The predicted valued was extracted by applying ordinary least square regressions on equation 4.7. As instrumental variables, we used the dummy for higher educated parents, the age of the students, the dummy for academic secondary schooling, and the two dummies indicating the grades with which the students passed their secondary education exams. Hence, these variables of the academic competencies estimation do not turn up in the discipline-specific competencies models. The selection of these five variables was based on the findings presented in Table 4.7 and on preliminary results with respect to the level of discipline-specific competencies[30]. Moreover, different tests confirmed the validity of these variables as instruments (see Table 4.8). First, we provided an F-test statistic in order to test the correlation between these five variables and the level of academic competencies acquired. The resulting coefficients are strongly significant and provide a first validation of the instruments used. Second, we tested

28. We tested for diminishing returns to the time devoted to any type of activity, but were unable to establish such.
29. All of these variables are dummies which are 1 when the respondent indicated that the higher education institute put great or very great emphasis on this aspect and 0 otherwise.
30. Data not reported in this chapter.

by means of a Hausman t-test if OLS and IV coefficients were significantly different from each other. This test was implemented by including the residuals obtained from the regression of academic competencies on the instruments as a regressor in the discipline-specific equation and testing its significance. If it was significant, the null hypotheses (OLS estimate = IV estimate) was rejected. With the exception of Model 3, the t-statistic was significant on a 5% level validating again the instruments. Lastly, we tested if the instruments were orthogonal to the error term of the discipline-specific regression. In order to test this, the Sargan miss-specification was implemented. The null hypotheses for valid instruments clearly cannot be rejected. Hence, we may conclude that the instruments are highly valid for this purpose.

Table 4.8
Tests for the validity of instrument variables

Test	Model 0	Model 1a	Model 1b	Model 2	Model 3
F-test on excluded variables	37.64***	40.44***	33.87***	34.64***	33.95***
Hausman t-test of exogeneity	-2.009**	-2.069**	-2.095**	-2.047**	-1.835*
Sargan's identification test	7.87	8.04	7.93	7.67	8.75

Note: All tests were based on 2SLS regressions .

Let us first turn to the result with respect to the remaining personal characteristic. Similar to the finding with respect to academic competencies, we can see that male students performed less effectively in the acquisition of discipline-specific competencies than female students. However, the impact this time is clearly smaller and only significant at a 10% level. Moreover, it loses its significance when other aspects are entered (see Model 1 through Model 3).

Entering in Model 1a the variables representing the different learning environments reveals that the 'PBL with teacher style' is clearly the most effective one. On the other hand, no significant differences are found between the 'PBL without teacher style' and the 'traditional style' or between the 'PBL without teacher style' and the 'school class style'. However, the 'school class style' is slightly more efficient than the 'traditional style'. These findings remain robust when entering in Model 2 the information on time allocation and in Model 3 the information on additional curriculum aspects[31]. In other words, the results seem to indicate that there is an important role in the acquisition of discipline-specific competencies for the teacher in transferring information to the students.

Turning to Model 1b, we can see that attending formal education is an effective way of time allocation[32, 33]. Moreover, the coefficient for the 'required formal education' indicates that the effectiveness of class attention is strongly influenced by the question if the institute that one attends for one's study puts a great deal of emphasis on student attendance or not.

31. In Model 3, the school-class style becomes more efficient at a 10% significance level than the PBL without teacher style.
32. It is important to note that we was unable to distinguish between the number of hours the student attended class and the number of class hours offered by the higher education institute. Hence, an alternative explanation of this result is that higher education institutes should increase the number of class hours offered.
33. We tested to what extent the return to formal education was dependent on the amount of self-study used as preparation time for the formal education. As an increased amount of formal education might reduce the average time available for preparation, one could expect the return to formal education per hour self-study to be diminishing. However, no such impact was found.

More precisely, one hour of class attendance is approximately twice as effective when the institute puts an emphasis on attendance than when the institute does not. In addition, attending required formal education is more effective than self-study. Neither time allocated to studying a second subject[34] nor time allocated to extra-curricular activities show a significant impact. Lastly, we can see that time allocated to paid work is not by definition time taken away from the acquisition of discipline-specific competencies, at least not as long as the work is closely related to the study followed. The findings with respect to the time allocation variables remained robust when entering in Model 2 the learning environment and in Model 3 additional curriculum aspects.[35] No significant impact was found from variables indicating that the student participated in a short or long internship during his study, but a significant negative impact was found if the student spent some time abroad. In other words, and combining this result with the impact of staying abroad on academic competencies as presented above, we can see that even though students who spent some time abroad increased their level of academic competencies, which by itself helped increase the effectiveness in the acquisition of discipline-specific competencies, they ended up with a reduced level of discipline-specific competencies compared to students who stayed home. Hence, time spent abroad takes time away from the acquisition of discipline-specific competencies.

Concluding our discussion on the findings of Table 4.9, let us have a short look at the additional curriculum aspects entered in Model 3. The results indicate that in particular attention to 'facts and practical knowledge' and attention to 'theories and concepts' had a great impact.

Before presenting some concluding remarks with respect to the first results, some important features will be discussed. First, we tested the extent to which the approach to normalize the dependent variables influences the story and compared the stochastic frontier approach with simple OLS estimations (see Appendix 4B). Moreover, we tested the robustness of the results by applying a Cobb-Douglas functional form instead of the linear functional form underlying the results presented in Table 4.7 and Table 4.9 (see Appendix 4C). All of these tests indicated that the main results are robust to changes in the functional form and the way the dependent variable is measured.

Second, we tested the robustness of the model with respect to two subtypes of higher education, namely university education and higher vocational education. For this reason, we re-estimated the analyses on the one hand for all respondents who graduated from a university in the nine countries and on the other hand for graduates in Germany, the Netherlands and Norway who graduated from a higher vocational education institute[36] (Appendix 4D reports on the main results). With respect to the learning environment, the results for these two subtypes of higher education are strongly comparable and in line with the overall findings presented above. However, some slight differences were found with respect to the time allocation coefficients. The fact that students at higher vocational education institutes generally possess less freedom

34. We would like to remind the reader that we measured the discipline-specific competencies of the main subject. Hence, this result does not indicate that time allocated to a second subject is not useful in acquiring discipline-specific competencies of the second subject.

35. We tested for diminishing returns to the time devoted to any type of activity, but could not establish it.

36. In Germany, this consists of Fachhochschulen graduates, in the Netherlands of graduates from higher vocational education (HBO) and in Norway of graduates from state colleges. We did not include in this group the French graduates from Grande Écoles, as contrary to the other three countries, the Grande Écoles institutes form a higher and more elite type of higher education than university education (see also Chapter 3).

in allocating their time to different study activities (e.g. formal education is to a larger part predetermined) yields that the time coefficients are less significant for this group.

Third, we tested the robustness of the results with respect to two subgroups of countries (countries with a more discipline-specific oriented higher education system (AT, D, NL, NO) and countries with a more academically oriented higher education system (IT, ES, FR, UK)) and with respect to subgroups of education programmes (e.g. graduates from economics and business administration or graduates from health studies). The results of these estimations[37] do not differ qualitatively from the results presented above and confirm again the robustness of this model.

Fourth, the stochastic frontier approach makes it possible to examine the decomposition of the variance into its two parts: v_i, the random variable assumed to be iid. N $(0,\sigma_v^2)$ and μ_i, the non-negative random variable accounting for technical inefficiency. According to Greene (2000), the variance of the composite error ε_i is given by

$$(4.9)\quad \sigma_{\varepsilon_i}^2 = \left[(1-2/\pi)*\sigma_{\mu_i}^2\right] + \sigma_{v_i}^2$$

In case of the discipline-specific competencies estimation (Model 3) around 57% and in case of the academic competencies estimation (Model 3) around 30% of the total variance of ε_i is accounted for by the variance of μ_i, and can hence be attributed to technical inefficiency[38]. As in the case of academic competencies more than two thirds of the variance has to be attributed to unexplained, but normally distributed, variance, one may wonder if using a stochastic production frontier, in contrast to a simple linear regression, adds value to the empirical estimation. To address this, we had a look at the λ reported in Table 4.7 and Table 4.9. λ is a measure of the relative weight of the inefficiency in the empirical estimations:

$$(4.10)\quad \lambda = \sigma_{\mu_i}^2 / \sigma_{v_i}^2$$

In all estimations, the λ parameter is very significantly different from zero[39], indicating that the use of the frontier production functions is appropriate.

Let us return to the initial dilemma between the acquisition of academic competencies and the acquisition of discipline-specific competencies. We have reached a stage where we are able to address the question if a higher education programme confronted with a change in the relative weight attached to one of the two competencies in the labour market is able to react on it without having to accept a trade-off between the two competencies types. To simplify the main conclusions, Table 4.10 summarizes in qualitative terms the change with which a standard student will be confronted through a change in the learning environment.

The results summarized in Table 4.10 show that for both conventional styles, namely the 'traditional style' and the 'school class style', more effective alternatives are available. In the former case, this will be the 'PBL without teacher style' or the 'PBL with teacher style' (although this would imply a change of both didactic instruments discussed here). In the latter case, implementing the 'PBL with teacher style' would provide a pareto improvement.

37. Data not reported in this Chapter
38. These figures differ not significantly among the five models estimated.
39. In the case of an ordinary linear regression with a normal distributed error term, λ is zero.

Table 4.9
The impact on discipline-specific competencies

	Model 0		Model 1a		Model 1b		Model 2		Model 3	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Constant	0.918***	0.035	0.927***	0.060	0.869***	0.042	0.856***	0.046	0.622***	0.059
Personal and pre-higher education characteristics										
Gender: man	-0.029*	0.017	-0.025	0.017	-0.020	0.017	-0.018	0.017	-0.017	0.016
Learning environment										
PBL without teacher			Ref.				Ref.		Ref.	
Traditional			-0.018	0.030			-0.007	0.030	0.012	0.025
School-class			0.045	0.031			0.040	0.031	0.047*	0.026
PBL with teacher			0.127***	0.027			0.109***	0.027	0.083***	0.027
Time allocation										
Formal education					0.003***	0.001	0.003***	0.001	0.002**	0.001
Required formal education					0.003***	0.001	0.002***	0.001	0.002**	0.001
Self-study					0.002***	0.001	0.003***	0.001	0.003***	0.001
Study of second subject					0.000	0.002	0.000	0.002	0.000	0.002
Extra-curricular					-0.001	0.001	-0.001	0.001	-0.001	0.001
Work					-0.002***	0.001	-0.002***	0.001	-0.001***	0.000
Study-related work					0.003***	0.001	0.003***	0.001	0.003***	0.001
Other time allocation										
Short internship					0.002	0.018	0.001	0.018	-0.006	0.018
Long internship					-0.019	0.022	-0.019	0.022	-0.037	0.022
Time spent abroad					-0.063***	0.018	-0.062***	0.018	-0.051***	0.018
Additional curriculum aspects										
Facts and practical knowledge									0.144***	0.018
Theories and concepts									0.146***	0.021
Attitudes and interpersonal skills									0.019	0.020
Independent learning									0.014	0.024
Freedom to choose courses									-0.013	0.016
Direct acquisition of work experience									0.039**	0.020
Out-of-class communication with other students									0.014	0.021
Writing a thesis									0.071***	0.019
Regular detailed assessment									0.064***	0.021
Academic competencies	0.451***	0.068	0.452***	0.068	0.457***	0.074	0.458***	0.018	0.423***	0.073
$\Sigma (=(\sigma_u + \sigma_v)^{0.5}$	1.40		1.39		1.39		1.39		1.36	
σ_u	1.24		1.24		1.23		1.23		1.20	
σ_v	0.65		0.64		0.65		0.64		0.63	
λ	1.90***		1.92***		1.91***		1.92***		1.90***	
-Log L	25810		25711		25712		25629		25262	
N-cases	18532		18532		18532		18532		18532	

Note 1: All models further include dummies for the nine countries, dummies for the different higher education institutions in a country and dummies for seven educational programmes. None of these dummies shows a significant impact, indicating that the normalization was successful in taking away country-specific effects. Note 2: *** significant at a 1% level, ** significant at a 5% level, * significant at a10% level. Note 3: λ is a measure of the relative weight of the inefficiency in the empirical estimation. In all our estimations, the λ is highly significant different from zero, indicating that the use of the frontier production functions is appropriate. In case of an ordinary linear regression with a normal distributed error term, λ would be zero.

In the case of the 'PBL without teacher style', those responsible may consider strengthening the role of the teacher in transferring information to the students. However, one has to be careful to keep the active discovering student and not to reach the 'school-class style'.

Considering the impact of time allocation across different study activities, Table 4.11 gives a qualitative summary based on the results of Model 3. Considering only marginal changes in the time allocated to a particular study activity and hence allowing an increase in time in one activity without having to reduce the time spent on another activity, we may conclude the following: Whereas increasing the time spent on formal education that is not required yields a move along the initial production possibility frontier towards more discipline-specific competencies and less academic competencies, an increase in time spent on required formal education allows a move out to a higher production possibility frontier. Such an outward move is also possible by allocating more time to self-study, study of a second subject (however, in this case only the academic competencies level increases) and through allocating more time to study-related work. Lastly, no change in the location on the production possibility frontier takes place if the student allocates more time to extra-curricular activities but the student moves inwards by increasing the time spent on work that is not related to the study.

Table 4.10
A change in the learning environment

New Style / Old style	Traditional A	Traditional DS	School-class A	School-class DS	PBL without teacher A	PBL without teacher DS	PBL with teacher A	PBL with teacher DS
Traditional			0	+	+	0	+	+
School-class	0	-			+	(-)	+	0
PBL without teacher	-	0	-	(+)			0	+
PBL with teacher	-	-	-	0	0	-		

Note: The first sign indicates a change in academic competencies; the second sign indicates a change in discipline-specific competencies. () indicates that a change is significant only at a 10% level.

Table 4.11
Impact of student time allocation on competencies

	Discipline-specific competencies	Academic competencies
Formal education	+	(-)
Required formal education	+	0
Self-study	+	+
Study of second subject	0	+
Extra-curricular activities	0	0
Work	-	0
Study-related work	+	+

Note: () indicates that change is only significant at a 10% level.

4.4.3 Results II: Mechanisms working inside a learning environment

In the section above, we discussed the impact which the learning environment has on the competency outcomes of higher education graduates. Moreover, we analyzed on an aggre-

gated level the impact of student time allocation. Considering that a change in the learning environment involves a large set of decisions and hence a long time period, and that there may be differences between the impact of time allocated to a particular study activity, depending on the learning environment, two specific questions arise. First, given a specific learning environment, is the student himself able to influence the competence outcome once studying? In other words, is there enough freedom inside a learning environment to allocate time to different study activities in order to stimulate a particular type of competencies[40]? Second, are lecturers in the higher education programme able to partly change the learning environment and influence the competencies outcome by, for example, increasing the emphasis put on independent learning without having to change the learning environment as a whole? To address these questions, we will analyze in this section the acquisition of academic and discipline-specific competencies within a given learning environment.

Table 4.12 reports on two frontier models estimated to explain the acquisition of academic competencies within a specific learning environment, while Table 4.13 does the same with respect to the discipline-specific competencies. Model A includes the personal characteristics, the pre-higher education schooling variables, and the time allocation of the student. Model B adds the additional curriculum aspects. Moreover, in line with the discussion in the section above, we will use the predicted value of academic competencies as an additional explanatory variable in the discipline-specific competencies equation.

Let us first have a brief look at the personal and pre-higher education schooling variables. Although most of them are in line with the general results presented above, some slight but interesting differences can be seen. In particular, male students seem not to perform less effectively than female students with respect to the acquisition of academic competencies in the 'school-class' style. Moreover, we find that age does not play a role in the 'PBL with teacher' style and that the pre-higher education type of schooling does not play a role in either type of activating learning method.

Let us now focus on the question to what extent students in a particular learning environment are able to influence their competencies outcome by allocating their time differently over the distinct study activities. In particular, we will address the question if students in a conventional learning environment ('traditional' or 'school-class' style) are able to increase their level of academic competencies without harming their acquisition of discipline-specific competencies and vice versa for students in an activating learning environment[41].

40. It is important to note that all results can only be interpreted as a marginal shift and cannot be extrapolated over the entire time available to the student, as we do not know what the minimum number of hours allocated to a particular activity (e.g. attending formal education) is, so that the student passes the minimum exam requirements. The reader has to keep in mind that all respondents passed their final exams.

41. We will focus on the results presented in Model A, although in general terms the results reported in Model B are qualitatively comparable.

Table 4.12
Production of academic competencies per learning environment

	Traditional				School- Class				PBL with teacher				PBL without teacher			
	Model A		Model B		Model A		Model B		Model A		Model B		Model A		Model B	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Constant	0.090	0.120	-0.375***	0.123	-0.077	0.154	-0.657***	0.160	0.808***	0.233	0.120	0.239	0.244	0.184	-0.321*	0.189
Personal and pre-higher education characteristics																
Higher educated parents	0.044*	0.024	0.042*	0.024	0.011	0.033	0.047	0.033	-0.070	0.049	-0.050	0.048	0.032	0.034	0.037	0.033
Age	0.011***	0.003	0.010***	0.003	0.012***	0.003	0.011***	0.003	0.002	0.004	-0.002	0.004	0.008**	0.003	0.006*	0.003
Gender: man	-0.086***	0.024	-0.073***	0.024	-0.023	0.033	-0.019	0.032	-0.136**	0.054	-0.106**	0.053	-0.119***	0.035	-0.108***	0.034
Academic pre-education	0.124***	0.031	0.126***	0.031	0.148***	0.043	0.156***	0.042	0.102*	0.060	0.100*	0.059	0.024	0.041	0.035	0.040
Low secondary grades	Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.		Ref.	
Medium secondary grades	0.074**	0.032	0.072**	0.031	0.129***	0.043	0.115***	0.042	0.164***	0.064	0.160***	0.062	0.063	0.045	0.059	0.043
High secondary grades	0.252***	0.037	0.244***	0.036	0.234***	0.049	0.217***	0.048	0.307***	0.075	0.306***	0.073	0.263***	0.052	0.258***	0.050
Time allocation																
Formal education	-0.002	0.002	-0.002	0.001	0.000	0.002	0.000	0.002	-0.006*	0.003	-0.004	0.003	-0.002	0.002	-0.002	0.002
Required formal education	0.001	0.001	0.000	0.001	0.002	0.002	0.001	0.002	0.002	0.002	0.000	0.002	0.003**	0.002	0.001	0.002
Self-study	0.005***	0.001	0.003***	0.001	0.008***	0.001	0.005***	0.001	0.004**	0.002	0.003	0.002	0.008***	0.002	0.006***	0.002
Study of second subject	0.007**	0.003	0.006*	0.003	0.008**	0.004	0.008**	0.004	0.004	0.005	0.000	0.005	0.003	0.004	0.003	0.004
Extra-curricular	0.001	0.002	0.000	0.002	0.001	0.003	0.001	0.003	-0.003	0.005	-0.003	0.004	0.003	0.003	0.002	0.003
Work	0.000	0.001	0.000	0.001	0.001	0.001	0.001	0.001	-0.001	0.002	-0.000	0.002	-0.003***	0.001	-0.003***	0.001
Study-related work	0.004***	0.001	0.003***	0.001	0.002	0.001	0.002	0.001	0.002	0.002	0.001	0.002	0.003**	0.002	0.002	0.001
Other time allocation																
Short internship	-0.030	0.028	-0.045	0.028	0.003	0.038	-0.012	0.037	0.006	0.059	0.021	0.058	-0.081	0.041	-0.070	0.040
Long internship	0.011	0.038	-0.010	0.037	0.052	0.046	0.021	0.046	-0.106	0.065	-0.107	0.064	-0.064	0.046	-0.071	0.045
Time spent abroad	0.051**	0.027	0.049**	0.026	-0.071**	0.037	0.092***	0.036	0.009	0.058	0.003	0.057	0.068*	0.038	0.076**	0037
Additional curriculum aspects																
Facts and practical knowledge			0.122***	0.024			0.102***	0.033			0.179***	0.049			0.192***	0.032
Theories and concepts			0.155***	0.026			0.189***	0.035			0.206***	0.055			0.193***	0.036
Attitudes and interpersonal skills			0.151***	0.031			0.152***	0.040			0.083	0.052			0.100***	0.037
Independent learning			0.231***	0.023			0.262***	0.031			0.284***	0.050			0.248***	0.036
Freedom to choose courses			0.085***	0.024			0.042	0.033			0.161***	0.048			0.099***	0.033
Direct acquisition of work experience			0.040	0.036			-0.001	0.044			0.120**	0.052			0.055	0.036
Out-of-class communication with other students			0.151***	0.038			0.067	0.045			0.115**	0.051			0.076**	0.038
Writing a thesis			0.092***	0.026			0.191***	0.034			0.025	0.054			0.156***	0.036
Regular detailed assessment			0.175***	0.034			0.140***	0.041			0.119**	0.052			0.141***	0.036
$\Sigma (=(\sigma_u+\sigma_e)^{0.5}$	1.27		1.22		1.22		1.16		1.30		1.24		1.20		1.17	
σ_u	0.96		0.90		0.92		0.83		1.07		0.99		0.92		0.89	
σ_e	0.83		0.83		0.81		0.81		0.74		0.74		0.78		0.76	
λ	1.15***		1.08***		1.14***		1.01***		1.43***		1.34***		1.18***		1.17***	
-Log L	11930		11762		6153		6041		2634		2569		5319		5209	
N-cases	8352		8352		4409		4409		1888		1888		3383		3883	

Note 1: All models further include dummies for the nine countries, dummies for the different higher education institutions in a country and dummies for seven education programmes; Note 2: *** significant at a 1% level, ** significant at a 5% level, * significant at a10% level.

Table 4.13
Production of discipline-specific competencies per learning environment

	Traditional				School – Class				PBL with Teacher				PBL without Teacher			
	Model A		Model B		Model A		Model B		Model A		Model B		Model A		Model B	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Constant	0.830***	0.061	0.605***	0.090	0.901***	0.081	0.813***	0.146	0.980***	0.135	0.742***	0.185	0.855***	0.113	0.749***	0.153
Personal and pre-higher education characteristics																
Gender: man	-0.029	0.025	-0.023	0.024	-0014	0.031	-0.014	0.031	-0.070	0.057	-0.061	0.052	0.016	0.040	0.015	0.039
Time allocation																
Formal education	0.002	0.001	0.002	0.001	0.003	0.002	0.002	0.002	0.001	0.003	0.000	0.003	0.005**	0.002	0.004**	0.002
Required formal education	0.003**	0.001	0.002*	0.001	0.003*	0.001	0.002*	0.001	0.002	0.002	0.000	0.002	0.001	0.002	0.001	0.002
Self-study	0.003***	0.001	0.003***	0.001	0.002	0.002	0.002	0.002	0.006**	0.002	0.005**	0.002	0.001	0.002	0.000	0.002
Study of second subject	0.002	0.003	0.002	0.003	-0.007	0.004	-0.005	0.004	0.001	0.005	-0.001	0.005	0.001	0.004	0.001	0.004
Extra-curricular	-0.001	0.002	-0.001	0.002	-0.005**	0.003	-0.005**	0.003	0.002	0.004	0.004	0.004	0.001	0.003	0.001	0.003
Work	-0.001*	0.001	-0.001*	0.001	-0.002**	0.001	-0.002	0.001	-0.003*	0.002	-0002	0.002	-0.001	0.001	-0.001	0.001
Study-related work	0.002**	0.001	0.002*	0.001	0.002	0.001	0.002	0.001	0.007***	0.002	0.006***	0.002	0.003**	0.001	0.003**	0.001
Other time allocation																
Short internship	0.022	0.027	0.008	0.027	-0.035	0.037	-0.042	0.037	0.017	0.056	0.006	0.055	-0.001	0.041	0.001	0.041
Long internship	-0.018	0.035	-0.025	0.035	-0.006	0.047	-0.024	0.046	-0.050	0.066	-0.074	0.065	-0.075	0.046	-0.069	0.046
Time spent abroad	-0.033	0.027	-0.024	0.026	-0.100***	0.038	-0.090**	0.039	-0.095*	0.053	-0.092*	0.053	-0.077**	0.038	-0.071*	0.038
Additional curriculum aspects																
Facts and practical knowledge			0.150***	0.026			0.128***	0.038			0.188***	0.057			0.101**	0.043
Theories and concepts			0.137***	0.030			0.075	0.047			0.320***	0.066			0.103**	0.045
Attitudes and interpersonal skills			0.039	0.033			-0.055	0.045			0.076	0.049			0.001	0.039
Independent learning			-0.015	0.034			-0.014	0.051			0.085	0.069			-0.022	0.051
Freedom to choose courses			0.010	0.024			-0.028	0.032			-0.017	0.057			-0.043	0.035
Direct acquisition of work experience			0.034	0.034			0.106**	0.044			0.053	0.056			-0.009	0.037
Out-of-class communication with other students			0.011	0.038			0.000	0.043			0.018	0.051			0.023	0.038
Writing a thesis			0.081***	0.027			0.022	0.045			0.061	0.051			0.051	0.042
Regular detailed assessment			0.118***	0.038			0.016	0.044			0.089	0.055			-0.004	0.041
Academic competencies	0.427***	0.103	0.396***	0.105	0.705***	0.155	0.667***	0.161	0.210	0.192	0.179	0.185	0.540***	0.146	0.535***	0.146
$\Sigma (=(\sigma_u + \sigma_v)^{0.5}$	1.37		1.34		1.39		1.35		1.50		1.44		1.36		1.34	
σ_u	1.20		1.17		1.24		1.20		1.40		1.34		1.21		1.19	
σ_v	0.66		0.66		0.62		0.62		0.54		0.54		0.62		0.61	
λ	1.80***		1.78***		2.00***		1.95***		2.56***		2.50***		1.94***		1.93***	
-Log L	11601		11446		6056		5967		2618		2561		5292		5224	
N-cases	8352		8352		4409		4409		1888		1888		3883		3883	

Note 1: All models further include dummies for the nine countries, dummies for the different higher education institutions in a country and dummies for seven education programmes. Note 2: *** significant at a 1% level, ** significant at a 5% level, * significant at a10% level.

Conventional learning environments

In both types of conventional learning environments, we find that at the margin an increase in time allocated to self-study or time devoted to the study of a second subject increases the effectiveness with which academic competencies are acquired. Moreover, students in the traditional style may achieve a similar result by engagement in work that is related to their study. Considering that a significant increase in time allocated to one of these study activities implies a reduction in time allocated to one of the other activities, we have to ask to which activity less time should be allocated.

For students in the traditional learning environment, it holds that time allocated to 'required formal education', to 'self-study' and to 'study-related work' increases the effectiveness with which discipline-specific competencies are acquired. None of the other activities have a significant impact on the acquisition of discipline-specific competencies. Hence, students in the traditional style can reallocate time from one of the latter activities to one of the academic competencies-enhancing activities without harming their acquisition of discipline-specific competencies[42]. Preferably, they should reallocate time from non-study-related work[43] to self-study as this not only increases their level of academic but competencies also their level of discipline-specific competencies.

For students in the 'school-class' style, no activity shows up as significantly positive in Table 4.13[44]. However, time spent on extra-curricular activities and time spent on non-study-related work seems to harm the acquisition of discipline-specific competencies. Hence, students in the 'school-class style' should preferably reallocate time from the latter two activities to self-study or the study of a second subject[45].

Finally, it must be stated that spending some time abroad also enhances the acquisition of academic competencies, but that this applies only in the case of the 'school-class' style combined with a reduction in discipline-specific competencies.

Summarizing, we can state that students in a conventional learning environment seem to have enough freedom to allocate their time in a way that increases their effectiveness with respect to the acquisition of academic competencies.

Activating learning methods

Let us turn to students in an activating learning method. In contrast to students in the conventional learning environments, these students on average graduate with an academically oriented competence mix. Hence, the question that we will address is to what extent these students are able to increase their discipline-specific competencies without harming their academic competencies.

42. To what extent students are able to free time from studying a second subject without harming the acquisition of these discipline-specific competencies, is impossible to state.
43. Non-study-related work reduces the efficiency with which discipline-specific competencies are acquired at a 10% significance level.
44. The finding that 'required formal education' only shows up on a 10% significance level, may be related to the fact that students in the 'school-class' style have less freedom in choosing the amount of time they intend to spend in the class room. The same holds with respect to students in the 'PBL with teacher' style (see Table 4.13)
45. We ignore that time spent on extra-curricular activities may add to the level of other competencies that are not measured in this study, or may help the students to build up a network that will later prove beneficial in finding an occupation.

The results in Table 4.12 indicate that in both types of activating learning environments, time spent on self-study enhances the acquisition of academic competencies. Moreover, for students inside the 'PBL without teacher' style, the same holds for attendance in required formal education[46] and for time spent on study-related employment. Finally, non-study-related work is harmful for the acquisition of academic competencies. Hence, we see that students in both types of activating learning environment, but in particular in the 'PBL with teacher' learning environment, have ample possibilities to reallocate time without harming the acquisition of academic competencies. But where to reallocate to?

For a student in a 'PBL without teacher' learning environment, two attractive possibilities are attending more formal education or allocating more time to study-related employment. In the latter case, students will not only see their acquisition of discipline-specific competencies enhanced but also their acquisition of academic competencies. Higher education institutes may help by providing to students a network of employers offering closely related work, enabling students to trade their non-study-related employment for study-related employment.

According to Table 4.13, students in the 'PBL with teacher' learning environment are able to enhance their acquisition of discipline-specific competencies either by self-study or by study-related employment. As the former also stimulates the acquisition of academic competencies, students are able to achieve a win-win situation for example by reducing formal education and increasing self-study.

Finally, we can see that in both activating learning environments, in contrast to the discipline-specific oriented conventional learning environments, time spent abroad does not enhance the acquisition of academic competencies and that it harms the acquisition of discipline-specific competencies in particular in the case of a 'PBL without teacher' style. The former may be related to the fact that activating learning environments provide the most effective environment to acquire academic competencies and hence, there is no point in spending some time abroad.

So far, we have discussed the possible reallocation of time from a student's point of view, but some of the results indicate possibilities for higher education institute administrators. The findings reveal again the importance of 'study-related work' not only with respect to the acquisition of academic competencies (in 2 out of 4 cases) but also with respect to the acquisition of discipline-specific competencies (in 3 out of 4 cases). Hence, stimulating, but also helping, students to obtain such jobs may be of crucial self-interest for higher education institutes.

Let us finally turn to the question if teachers, given a particular learning environment, are able to fine-tune the competence outcomes of their students. We can see that in the case of discipline-specific competencies a strong emphasis on 'facts and practical knowledge' and on 'theories and concepts' seems to be important. Whereas the former holds for all learning environments, the latter does not hold for the 'school-class' style. With respect to the acquisition of academic competencies, we found that nearly all additional curriculum aspects turn up positive and strongly significant. This may indicate that the acquisition of academic compe-

46. The 'PBL without teacher' style is thus the only learning environment in which attending formal education enhances the acquisition of academic competencies. This may be related to the fact that in this learning environment formal education implies discussing topics with other students and hence enables one to acquire academic competencies easily during class time.

tencies is in particular stimulated by good teaching. However, clearly the greatest influence comes from enhancing 'independent learning'.

4.5 Concluding remarks

The objective of this chapter was to analyze the impact of the learning environment and the student's time allocation on the acquisition of academic and discipline-specific competencies. This poses the question whether higher education institutes should implement activating learning environments, such as problem-based or project-based learning, and what would be an effective use of time for students in higher education studies.

To conclude this chapter, we will consider the European situation and use the results presented in this study to indicate how the higher education system in various countries can be adapted to address the challenges of a knowledge-intensive economy and maintain its competitive level. More specifically, we will compare the situation in the two country groups defined in Chapter 3. The first group consists of the United Kingdom, Spain, France and Finland and was labelled *academic countries*, the second group consists of the Netherlands, Germany and Austria and was labelled *discipline-specific countries*. We will focus on three outstanding features of the large variety of results presented in this paper, namely the use of activating learning environments, the emphasis placed on class attention, and the relation between paid employment alongside the study and the study itself[47].

A first clear result is that to prepare graduates for the requirements of a knowledge-intensive economy more activating learning environments are needed to provide not only a substantive level of discipline-specific competencies, but also a high level of academic competencies. The percentage of students taught in the discipline-specifically oriented countries according to activating styles is 25% in the Netherlands (universities: 21%, HBO institutes: 31%), 21% in Germany (universities: 19%, Fachhochschulen: 23%) and 20% in Austria. This is low, compared to countries such as the United Kingdom (55%), France (32%) or Finland (27%), all of which are representatives of the academically oriented countries. The relatively limited use of activating learning environments in the discipline-specifically oriented countries fits the requirements of their traditionally occupation-oriented labour market. However, if one wishes to adjust to a gradual change in the weight attached to academic competencies in the labour market, the implementation of activating learning environments in these countries needs to be stimulated. Interestingly, both in Germany and in the Netherlands, institutes (Fachhochschulen and HBO institutes, respectively) that formally provide more occupationally oriented programmes than universities are in a better starting position than universities in these countries. Unless universities catch up, graduates from HBO and Fachhochschulen institutes may become serious competitors to university graduates for academic-competence-oriented occupations that form a central part in a knowledge-intensive economy.

47. Two remarks need to be made. First, the reader needs to keep in mind that we are unable to analyze the cost side of, for example, an implementation of an activating learning environment. The cost side includes both financial costs and a reduction in the research output of the higher education institute. Accordingly, our conclusions were based on cost-neutral changes. Second, the analyses were restricted to extracting impacts on the level of academic and discipline-specific competencies only.

Another result of these analyses is that attendance in formal education is particularly effective for acquiring discipline-specific competencies when universities place a strong emphasis on class attendance (measured as time spent on 'required formal education'). A similar result can be observed for academic competencies when 'problem-based learning without teacher' is used. It was interesting to see again that the situation at Dutch, German and Austrian universities is less than optimal. In contrast to the United Kingdom, where 60% of all class attendance takes place at institutes placing a strong emphasis on it or in Spain with 48%, the score of 30% is only half the percentage for universities in the Netherlands, Germany or Austria. This is particularly surprising as the latter countries provide on average a discipline-specifically oriented type of higher education. Regardless of the fact whether the change towards activating learning environments is made or not, universities in the Netherlands, Germany and Austria need to increase the pressure on students to attend classes frequently. If no activating learning environments are implemented, it increases the effectiveness with which discipline-specific competencies are acquired. If 'problem-based learning without teacher' is implemented, it increases the effectiveness with which academic competencies are acquired.

In contrast to the two features discussed above, the situation with respect to paid employment activities alongside the main study is much better in the discipline-specifically oriented countries. The results show that study-related paid employment is not only an effective way of acquiring academic competencies but also discipline-specific ones. 35% of paid work done by Dutch higher education students matches well their field of study. Slightly lower but still relatively high ratios were found for the other discipline-specifically oriented countries German and Austria (both 25%). In contrast, the ratio in academically oriented countries is significantly lower: 14% in the United Kingdom, 12% in France and only 7% in Spain. It is clearly important for the outcome of higher education in the discipline-specific countries to keep this preferred situation and for academic countries to work on their situation. If study costs in the Netherlands, Germany or Austria are increased (e.g. through higher tuition fees or lower/shorter grants), the students' need to react with an increased number of hours working for money will put pressure on the ratio. This holds as the supply of matching occupations may be restricted or finding such occupations needs an additional effort on the part of the students. In that case, higher education institutes should react and facilitate the matching of their students with these occupations. In doing so, higher education institutes may prevent the negative impact of higher study costs on the discipline-specific competence outcome.

To conclude, with respect to two out of the three features singled out (weak on activating learning environments and strong on study-related paid work activities) the setup of higher education in the Netherlands, Germany and Austria fits well with its discipline-specifically oriented aim and the occupational labour market for which graduates have been prepared. Similarly, the setup of higher education in the United Kingdom, France and Spain (strong on activating learning environments combined with being strong on class attendance requirements and weak on study-related paid work activities) fits its academic aim and the internal labour market that graduates enter. However, if the labour market in the first group of countries gradually starts to resemble the labour market in the second group, adaptations are necessary and in specific further implementations of activating learning environments are required.

Appendix 4A: Definitions of variables used

Dependent Variables

Discipline-specific competencies	Normalized average of items
Academic competencies	Normalized average of items

Independent variables

Higher educated parents	Dummy if mother and/or father has higher education diploma
Gender: man	Dummy if respondent is male
Age	Age in years at the time of the survey
Academic pre-education	Dummy if respondent complete an academic secondary education before higher education
Medium (High) secondary grades	Dummy if respondent graduated from secondary school with medium (high) average grades
PBL without teacher	Dummy if study took place in PBL without teacher learning environment
Traditional	Dummy if study took place in traditional learning environment
School class	Dummy if study took place in school-class learning environment
PBL with teacher	Dummy if study took place in PBL with teacher learning environment
Formal education	Hours per week spent on attending classes/lectures/meetings
Required formal education	Hours per week spent on attending classes/lectures/meetings if attendance was required
Self-study	Hours per week spent on self-study
Study of second subject	Hours per week spent on studying a second subject
Extra-curricular	Hours per week spent on extra-curricular activities
Work	Hours per week spent on paid employment
Study-related work	Hours per week spent on paid employment if work was related to study
Facts and practical knowledge	Dummy if HE institute put great or very great emphasize on this aspect
Theories and concepts	Dummy if HE institute put great or very great emphasize on this aspect
Attitudes and interpersonal skills	Dummy if HE institute put great or very great emphasize on this aspect
Independent learning	Dummy if HE institute put great or very great emphasize on this aspect
Freedom to choose courses	Dummy if HE institute put great or very great emphasize on this aspect
Direct acquisition of work experience	Dummy if HE institute put great or very great emphasize on this aspect
Out-of-class communication with other students	Dummy if HE institute put great or very great emphasize on this aspect
Writing a thesis	Dummy if HE institute put great or very great emphasize on this aspect
Regular detailed assessment	Dummy if HE institute put great or very great emphasize on this aspect

Appendix 4B: Alternative estimations >>

Table 4.B1
Basic alternative estimations

Dependent Variable	D-S		A		D-S		A		D-S		A	
Normalized	YES		YES		NO		NO		NO		NO	
Model	TSLS		OLS		TSLS		OLS		Frontier		Frontier	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Constant	-0.346***	0.060	-0.919***	0.079	0.745**	0.347	3.054***	0.048	1.706***	0.327	3.518***	0.049
Personal and pre-higher education characteristics												
Higher educated parents			0.026	0.016			0.014	0.009			0.014	0.009
Gender: man	-0.006	0.017	-0.070***	0.016	-0.004	0.014	-0.052***	0.010	-0.009	0.014	-0.051***	0.009
Age in years			0.008***	0.002			0.006***	0.001			0.006***	0.001
Academic pre-education			0.110***	0.020			0.057***	0.012			0.056***	0.012
Low secondary grades			Ref.				Ref.				Ref.	
Medium secondary grades			0.092***	0.021			0.059***	0.012			0.055***	0.012
High secondary grades			0.254***	0.024			0.157***	0.014			0.151***	0.014
Learning environment												
PBL without Teacher	Ref.		Ref.		Ref.		Ref.		Ref.		Ref.	
Traditional	0.014	0.026	-0.212***	0.021	0.020	0.022	-0.144***	0.012	0.021	0.021	-0.141***	0.013
School-class	0.054**	0.027	-0.207***	0.023	0.050**	0.023	-0.135***	0.014	0.047**	0.022	-0.133***	0.014
PBL with Teacher	0.074***	0.028	0.022	0.028	0.063***	0.023	0.005	0.017	0.071***	0.022	0.008	0.017
Time allocation												
Formal education	0.003***	0.001	-0.001	0.001	0.003***	0.001	-0.001**	0.001	0.002***	0.001	-0.001**	0.001
Required formal education	0.002**	0.001	0.001	0.001	0.002**	0.001	0.000	0.000	0.002***	0.001	0.000	0.000
Self-study	0.003***	0.001	0.004***	0.001	0.002***	0.001	0.003***	0.000	0.002***	0.001	0.003***	0.000
Study of second subject	0.002	0.002	0.005***	0.002	0.000	0.002	0.004***	0.001	-0.001	0.002	0.004***	0.001
Extra-curricular	-0.001	0.001	0.001	0.001	-0.001	0.001	0.000	0.001	-0.001	0.001	0.000	0.001
Work	-0.001***	0.001	-0.001	0.001	-0.001***	0.000	-0.000	0.003	-0.001***	0.000	-0.000	0.000
Study-related work	0.003***	0.001	0.002***	0.001	0.002***	0.001	0.001***	0.000	0.002***	0.001	0.001***	0.000
Short internship	0.003	0.019	-0.041**	0.019	0.008	0.016	-0.033***	0.011	-0.002	0.015	-0.033***	0.011
Long internship	-0.025	0.023	-0.032	0.023	-0.026	0.019	-0.015	0.014	-0.034*	0.018	-0.014	0.014
Time spent abroad	-0.061***	0.018	0.063***	0.018	-0.060***	0.015	0.035***	0.011	-0.051***	0.014	0.035***	0.011
Additional curriculum aspects												
Facts and practical knowledge	0.150***	0.019	0.145***	0.016	0.119***	0.015	0.083***	0.009	0.114***	0.015	0.081***	0.009
Theories and concepts	0.149***	0.022	0.183***	0.017	0.125***	0.019	0.120***	0.010	0.122***	0.018	0.115***	0.010
Attitudes and interpersonal skills	0.018	0.021	0.134***	0.018	0.010	0.018	0.098***	0.011	0.006	0.017	0.094***	0.011
Independent learning	0.011	0.025	0.250***	0.016	-0.007	0.020	0.154***	0.009	-0.004	0.019	0.153***	0.009
Freedom to choose courses	-0.017	0.017	0.086***	0.016	-0.028**	0.014	0.058***	0.009	-0.024*	0.013	0.059***	0.009
Direct acquisition of work experience	0.045**	0.021	0.033	0.021	0.058***	0.017	0.018	0.012	0.050***	0.016	0.019	0.012
Out-of-class communication with other students	0.007	0.022	0.109***	0.021	0.002	0.018	0.070***	0.012	0.004	0.017	0.068***	0.013
Writing a thesis	0.077***	0.019	0.132***	0.017	0.038**	0.017	0.104***	0.010	0.032*	0.017	0.098***	0.010
Regular detailed assessment	0.063***	0.022	0.146***	0.019	0.050***	0.019	0.096***	0.012	0.050***	0.018	0.094***	0.012
Academic competencies	0.447***	0.076	—		0.668	0.102			0.640***	0.096		
Σ $(=(\sigma_u+\sigma_v)^{0.5}$									1.13		0.73	
σ_u									1.01		0.56	
σ_v									0.51		0.48	
λ									1.96***		1.18***	
-Log L	25551		25728		22020		16297		21721		16237	

Note 1: D-S = Discipline-specific competencies; A = Academic competencies; Normalized: 'yes' indicates that dependent variable is normalized as discussed in main text, 'no' indicates that dependent variable is not normalized; TSLS = Two-stage least squares, OLS = Ordinary least squares, Frontier = Stochastic frontier approach. Note 2: All models further include dummies for the nine countries, dummies for the different higher education institutions in a country and dummies for seven education programmes. Note 3: *** significant at a 1% level, ** significant at a 5% level, * significant at a 10% level.

Appendix 4C: Cobb-Douglas Functional Form

Table 4.C1 reports on the stochastic production frontier estimations assuming a Cobb-Douglas functional form instead of the linear one assumed in the main text. we will concentrate on the results with respect to Model 3. The results for the discipline-specific competencies are reported in Column 2, while the results for the academic competencies are reported in Column 3.

Table 4.C1
Stochastic production frontier assuming a Cobb-Douglas Functional Form

Dependent Variable	Discipline-specific		Academic	
	Coef.	S.E.	Coef.	S.E.
Constant	0.146	0.083	0.011	0.125
Personal and pre-higher education characteristics				
Higher educated parents			0.012	0.009
Gender: man	-0.015	0.016	-0.069***	0.010
Age in years			0.008***	0.002
Academic pre-education			0.111***	0.033
Low secondary grades			Ref.	
Medium secondary grades			0.087***	0.023
High secondary grades			0.245***	0.031
Learning environment				
PBL without Teacher	Ref.		Ref.	
Traditional	0.018	0.030	-0.207***	0.021
School-class	0.052**	0.026	-0.207***	0.024
PBL with Teacher	0.082***	0.027	0.027	0.028
Time allocation				
Formal education	0.015	0.010	-0.032***	0.001
Required formal education	0.015***	0.001	0.005	0.005
Self-study	0.013*	0.006	0.036***	0.002
Study of second subject	0.002	0.002	0.027***	0.002
Extra-curricula	-0.009	0.006	-0.002	0.002
Work	-0.015***	0.001	-0.009*	0.004
Study related work	0.030***	0.001	0.025***	0.001
Other time allocation				
Short internship	-0.003	0.018	-0.037*	0.016
Long internship	-0.034	0.022	-0.032	0.023
Time spent abroad	-0.053***	0.018	0.064***	0.017
Additional curriculum aspects				
Facts and practical knowledge	0.141***	0.018	0.142***	0.016
Theories and concepts	0.142***	0.022	0.178***	0.017
Attitudes and interpersonal skills	0.014	0.019	0.127***	0.020
Independent learning	0.008	0.023	0.250***	0.015
Freedom to choose courses	-0.018	0.016	0.087***	0.016
Direct acquisition of work experience	0.036*	0.020	0.031	0.021
Out of class communication with other students	0.011	0.021	0.107***	0.022
Writing a thesis	0.066***	0.019	0.122***	0.018
Regular detailed assessment	0.063***	0.021	0.146***	0.020
Academic competencies	0.454***			
$\Sigma (=(\sigma_u + \sigma_v)^{0.5}$	1.36		1.20	
σ_u	1.43		0.66	
σ_v	0.63		0.77	
λ	1.90***		1.08***	
-Log L	25272		25681	
N-cases	18532		18532	

Note 1: All models further include dummies for the nine countries, dummies for the different higher education institutions inside a country and dummies for the seven education programs. Note 2: *** significant at a 1% level, ** significant at a 5% level, * significant at a 10% level.

Appendix 4D: University versus higher vocational education

This appendix reports on the results of Model 2 for two separate types of higher education graduates: university graduates and higher vocational education graduates.

Table 4.D.1
The impact on competencies: University versus Higher vocational education

	University type				Higher vocational type			
	Academic		Discipline-specific		Academic		Discipline-specific	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Constant	0.433***	0.088	0.849***	0.050	0.442**	0.177	0.840***	0.093
Personal and pre-higher education characteristics								
Higher educated parents	0.031*	0.018			-0.023	0.036		
Gender: man	-0.092***	0.018	-0.020	0.019	-0.051	0.040	-0.007	0.039
Age	0.010***	0.002			0.007**	0.004		
Academic pre-education	0.110***	0.025			0.093**	0.037		
Low secondary grades	Ref.				Ref.			
Medium secondary grades	0.081***	0.023			0.119***	0.047		
High secondary grades	0.240***	0.026			0.290***	0.059		
Learning environment								
PBL without teacher	Ref.		Ref.		Ref.		Ref.	
Traditional	-0.337***	0.023	-0.005	0.035	-0.282***	0.045	0.026	0.063
School-class	-0.335***	0.027	0.043	0.036	-0.283***	0.050	0.070	0.062
PBL with teacher	0.023	0.034	0.118***	0.032	0.132**	0.055	0.090*	0.054
Time allocation								
Formal education	-0.002**	0.001	0.003***	0.001	-0.003	0.002	0.002	0.002
Required formal education	0.002**	0.001	0.002***	0.001	0.002	0.002	0.002	0.001
Self-study	0.006***	0.001	0.003***	0.001	0.007***	0.002	0.001	0.002
Study of second subject	0.005**	0.002	0.001	0.002	0.011**	0.005	-0.005	0.005
Extra-curricular	0.001	0.001	-0.001	0.001	-0.002	0.004	-0.004	0.003
Work	-0.001*	0.001	-0.002***	0.001	0.002	0.001	-0.002**	0.001
Study-related work	0.003***	0.001	0.003***	0.001	0.002	0.001	0.002	0.001
Other time allocation								
Short internship	-0.023	0.021	-0.016	0.020	-0.048	0.043	0.072	0.040
Long internship	-0.032	0.026	-0.033	0.026	0.006	0.045	0.011	0.041
Time spent abroad	0.052	0.019	-0.059***	0.019	0.055	0.046	-0.071	0.045
Academic competencies	-----		0.424***	0.081	-----		0.691***	0.156
Σ (=$(\sigma_u + \sigma_v)^{0.5}$	1.25		1.39		1.24		1.37	
σ_u	0.97		1.24		0.89		1.20	
σ_v	0.64		0.63		0.86		0.66	
λ	1.21***		1.39***		1.04***		1.81***	
-Log L	20784		20477		5320		5149	
N-cases	14820		14820		3713		3713	

Note: University type: this estimation includes the university graduates in all nine countries; higher vocational type: this estimation includes graduates from HBO, Fachhochschulen and university colleges (Norway). All models further include dummies for the countries and dummies for seven education programmes. Moreover, the discipline-specific models include the predicted academic competencies level as an additional factor.
*** Significant at a 1% level, ** significant at a 5% level, * significant at 10% level.

Considering the learning environment, we can see that the results are very similar for the two types of higher education. Considering the time allocation, we found that for graduates of higher vocational education the significance of the coefficients is clearly smaller. This finding is related to the fact that higher vocational education students generally have less freedom in allocating their time than university students.

Chapter 5

Fitting to the job: the role of academic and discipline-specific competencies in adjustment and performance[1]

« *The direction in which education starts a man will determine his future life* »

Plato

1. This chapter is a combined and extended version of two papers: Heijke, Meng and Ramaekers (2003) and Heijke, Meng and Ris (2003). We would like to thank Lex Borghans, Bart Golsteyn, Harald Schomburg, Maarten Vendrik, Bruce Weinberg, Gerard Pfann, two referees of Labour Economics and two referees of the International Journal of Manpower for their comments on earlier versions of these two papers. Furthermore, We benefited a great deal from discussions with participants at ROA seminars (2002), at the ROA/SKOPE conference (2001, Maastricht),at the ILM (2002, Aberdeen), at the 5th IZA summer school (2002, Munich), the EALE conference (2002, Paris) and TIY conference (2002, Florence).

5.1 Introduction

In the transition period from education to the labour market, graduates from different educational backgrounds apply for jobs in which they can use the competencies acquired at school. The process that matches heterogeneous graduates to heterogeneous jobs within this transition period has received much attention in the literature (e.g. Jovanovic, 1979, 1984; Barron and Loewenstein, 1985; Topel, 1986). If this match is not perfect, additional learning by training and/or job experience is needed to improve or adjust the initial competencies acquired in education. Indeed, the importance of on-the-job training for improving competencies has long been emphasized (Becker, 1964; Mincer, 1974), and there have been many debates on its impact on productivity and wages (Brown, 1989; Lynch, 1992, Acemoglu and Pischke, 1998, Pischke, 2000). In addition to a less than perfect match, there are other well-known reasons for transferring the generation of competencies partially from the initial schooling phase to later working life. One of these is the uncertain future application possibilities of specific competencies obtained during the educational career. Another reason is that some types of competencies can be generated more efficiently in a context combining working and learning or, in general terms, when one has more life experience[2]. Two features with respect to this postponed learning process are of crucial importance.

First, the effectiveness with which graduates are able to adjust or improve their competencies according to the labour market requirements is determined by the level and type of competencies acquired in initial education. The importance of initial education can be found in the discussion on whether on-the-job training and initial education are complements or substitutes. Analyses provide evidence of complementarity between education and on-the-job training (Barron et al., 1989; Brunello, 2001). Indeed, an implication of the human capital theory is that individuals who learn quickly, that is the ones with the highest level of education, are more likely to take part in training since they are associated with lower costs for learning (see e.g. van Smoorenburg and van der Velden, 2000).

Second, the actual adjustments to be made depend on the outcome of the graduate-job match. Considering the allocation of higher education graduates over jobs, in particular the match between the field of study required and the field of study graduated from (congruence in type of competencies) influences the required adjustment and the costs involved with these adjustments. Whereas graduates matched to an occupation closely linked to their field of study may need to adjust their level of competencies (vertical sorting), graduates matched to

2. 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 according to Whetten and Cameron (1995) are of critical importance for effective management, refer to personal competencies (e.g. creative problem-solving), to interpersonal competencies (e.g. motivating others or managing conflicts) and to group competencies (e.g. empowering and delegating). The effectiveness with which management competencies can be acquired in classrooms is disputable. Milter and Stinson (1995) argued that traditional management and business education falls short in educating leaders for the new competitive environment. In line with this, McCall, Lombardo and Morrison (1988) found that most of the development of management competencies takes place on the job, and not in seminars, classrooms or MBA programs and Heijke, Meng and Ramaekers (2003) showed that the level of management competencies required in occupations is closely related to the amount of general academic competencies rather than to the amount of management competencies acquired in higher education.

an occupation not linked to their field of study also have to adjust the type of competencies (horizontal sorting).

Having established in Chapter 4 what the most efficient ways are to acquire discipline-specific and academic competencies, this chapter focuses on the role and pay-off of these competencies during the transition from higher education to the labour market.

In the current debate on occupation-specific versus general education and training, Bishop[3] (1995) strongly advocates that education should focus on occupation-specific competencies rather than on general academic competencies. 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.*" In doing so, Bishop departs from the premise that academic competencies are mere tools for developing specific competencies but not a good substitute for occupation-specific competencies. "*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, Bishop and Kang (1989) argued that for high-school graduates who enter the labour market discipline-specific and academic education in high school are complements rather than substitutes. The more recent research literature (e.g. Campbell and Laughlin, 1991; Altonji, 1995; Mane, 1998) also tends to find stronger positive effects of discipline-specific course work on labour market outcomes.

While these authors stress the importance of occupation-specific competencies, other authors underline the importance of generic competencies[4]. Stasz et al. (1993) stated "*Employers and workers note the need for generic competencies, 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) believed 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 deriving competencies to be taught in initial education from the competencies required in the work place, important points are often neglected. Firstly, the notion that some competencies are more likely to be acquired in combination with work than in a purely educational context. In this respect, Becker (1962) already argued in the early sixties 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, Ashton and Felstead (2001) and Heijke, Ramaekers and Ris (2005).

The second point of neglect is the notion that education is the best place to generate competencies needed to improve the efficiency with which additional competencies can be generated later. 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).

3. Bishop used US data on high-school graduates in the 1980s.
4. For an extensive discussion on the different types of generic competencies, please refer back to Chapter 2.

Similar argumentation was found in Johnson (1979), van Smoorenburg and van der Velden (2000), and Stasz (2001).

The third point relates to the availability of data. Educational indicators (such as tenure, grades or courses) are often used as proxies for a worker's available competencies. 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[5]. For instance, Green (1998), Heijke, Koeslag, and Van der Velden (1998), Allen and Van der Velden (2001), Stasz (2001), Green, Ashton and Felstead (2001), McIntosh and Vignoles (2001), Shaughnessy, Levine and Cappelli (2001), ter Weel (2002) and Lazaear (2003) have all done research into the labour market value of particular work competencies, which can be seen as a more accurate and reliable way for estimating individual labour market capacities.

The objective of this chapter is to contribute to these discussions. More specifically, we will analyze the role of academic and discipline-specific competencies in the allocation process, with respect to the required adjustment to job requirements and the monetary return of these competencies. We will focus on the Netherlands. Hence, we need to keep in mind that the previous chapters have characterized the Netherlands as a country similar to Austria and Germany, which on average provide relatively discipline-specifically oriented higher education systems preparing graduates for an occupationally oriented labour market. Where necessary, we will point out differences that can be expected when analyzing the role and value of academic and discipline-specific competencies in relatively academically oriented countries such as the United Kingdom or France.

The structure of the chapter is as follows. To start with, Section 5.2 presents the data used and then provides a brief overview of some stylized facts with respect to the acquisition of discipline-specific and academic competencies by Dutch higher education graduates and their use in the labour market. Section 5.3 describes the literature that investigates the pay-off of different human capital competencies acquired in education by introducing them directly into wage estimations. Having established that by this approach the role of competencies acquired in higher education is difficult to reveal and may yield biased results, we will develop in Section 5.4 a model in different steps, first investigating simultaneously the role of the discipline-specific and academic competencies on allocation and on-the-job training, and then, taking the first step into account, we will investigate again the wage rates paid to the graduates. Section 5.5 reports on the empirical analyses, while Section 5.6 concludes the chapter.

5.2 The data[6]

This chapter concentrates on the Dutch part of the international CHEERS survey discussed in Chapter 3. Since the survey was held some three to four years after graduation (in 1998), the study observed graduates at the beginning of their professional careers. In the Netherlands,

5. See also the discussion in Chapter 2.
6. For a more detailed discussion of the data set used throughout this thesis, the way the two clusters of competencies are constructed through hierarchical clustering methods, and the validity of the constructs, please refer to Chapter 3.

a division can be made between university education (WO) and higher vocational education (HBO). Universities provide academic education and intend to provide their graduates with scientific knowledge in a particular field or discipline. Higher vocational education institutes, on the other hand, provide higher professional education and intend to provide their graduates with knowledge that is directly linked to a particular occupation. All respondents covered in this chapter completed degree courses from one of the two types of higher education institution.

The data also contains information with respect to different competencies representing demands for and supplies of knowledge. Graduates were asked to indicate on a five-point scale, ranging from 1 ('not at all') to 5 ('to a very high extent')[7], the extent to which they had a given competency at the time of graduation (in 1994 or 1995) (*the acquired level of competency*) and the extent to which this given competency was required in their current work (*the required level of competency*). Using a hierarchical clustering method, we retained two clusters representing best the idea of academic competencies and discipline-specific competencies. The two clusters include the following individual items:

List 5.1
Clusters of competencies

1. *Academic competencies*
» Learning abilities
» Reflective thinking, assessing one's own work
» Problem-solving abilities
» Analytical competencies
» Documenting ideas and information
2. *Discipline-specific competencies*
» Field-specific theoretical knowledge
» Field-specific knowledge of methods

The internal consistency of the discipline-specific competencies (academic) cluster is supported by Cronbach's alpha of 0.79 (0.72) when measured as required items and 0.76 (0.71) when measured as acquired items.

For this analysis, an average was calculated for each individual of the competence clusters possessed at the time of graduation and of the competence clusters required in the current occupation. In addition to the actual level of competencies possessed at the time of graduation, the analysis will also focus on the distance between the required and the acquired level or type of competencies. With respect to the discipline-specific competencies, we distinguish between a *vertical mismatch* (mismatch of the level) and a *horizontal mismatch* (mismatch in type). The former is simply calculated by subtracting the acquired level of discipline-specific competencies from the required one. The latter is based on the relationship between the graduate's field of study and his or her area of work. More precisely, a horizontal mismatch occurs if the graduate reported that neither '*the own field of study*' nor '*a related field of study*'

7. In the original questionnaire, the answers were coded from 1 ('to a very high extent') to 5 ('not at all'). To simplify the reading of the empirical analyses, we recoded the answers to range from 1 ('not at all') to 5 ('to a very high extent').

would have been the best preparation[8]. Finally, we also measured the difference between the level of academic competencies required in the occupation and the level of academic competencies acquired in higher education (mismatch of the level). As academic competencies are assumed to be context-independent, a horizontal mismatch in academic competencies is not possible.

5.2.1 A descriptive look at two types of competencies[9]

To what extent does the acquisition of competencies by higher education graduates in the Netherlands match the labour market requirements? To address this question, we will present a descriptive look in this section at academic and discipline-specific competencies. In particular, we will focus on the level of competencies built up during the tertiary education study and on the level of competencies that is required in the current working situation (see Table 5.1).

Table 5.1
Academic and discipline-specific competencies

	Present (at graduation)	Required (current occupation)	Mismatch between required and acquired (vertical mismatch)
Academic	3.605^{+++}	3.896^{+++}	0.291***
Discipline-specific[1]	3.685	3.641	-0.044*

Note: */*** = significantly different from 0 at a 10% level / 1% level; $^{+++}$ = acquired (required) academic competencies level is significantly different from acquired (required) discipline-specific competencies level on a 1% significance level.; [1] = both the acquired and the required level of discipline-specific competencies is measured in terms of the type of discipline-specific competencies acquired in higher education.

On average, Dutch higher education graduates have a slightly, but significantly, higher level of discipline-specific competencies than academic competencies. In contrast, the labour market seems to ask for a competence mix that is more directed towards academic competencies, resulting in a situation where on average the level of discipline-specific competencies acquired by Dutch higher education graduates is more in line with the requirements than their acquired level of academic competencies. To what extent this is a twist of the data by not allowing us to measure any other type of discipline-specific competencies than the one that was acquired in higher education, is the question that we will turn to now. In Table 5.2, we distinguished between two different types of occupations. First of all, occupations for which the own field of study or a related field of study prepares best (from now on called an occupation "inside one's own educational domain"), and second, occupations for which a different field of study than the one graduated from prepares best or for which the field of study does not matter (from now on called occupation "outside own educational domain").

8. Unfortunately, the data do not allow us to measure directly any other type of discipline-specific competencies required in the current occupation next to the type of discipline-specific competencies acquired in the higher education field of study. Hence, measuring the horizontal mismatch in this manner can only be seen as a crude proxy of the actual mismatch.
9. Appendix 5A gives a descriptive overview of other characteristics of the graduates, the education they followed and the occupation they are allocated to.

If the graduate is matched to an occupation in the latter domain, one expects the level of the acquired type of discipline-specific competencies that is required to be significantly lower than if the graduate works inside the own educational domain.

Table 5.2
Academic and Discipline-specific competencies; Strata: Working inside own educational domain

	Present (at graduation)	Required (current occupation)	Mismatch between required and acquired (vertical mismatch)
Inside own domain			
Academic	3.587^{+++}	3.898	0.310***
Discipline-specific	3.718^{+++}	3.797^{+++}	0.078***
Outside own domain			
Academic	3.685	3.888	0.203***
Discipline-specific	3.539	2.950	-0.589***

Note: *** indicates that the mismatch is significantly different from zero at a 1% level. Note: $^{+++}$ indicates that the measured level inside the own educational domain differs significantly at a 1% level from the one measured for graduates working outside the own domain.

Considering first the required level of competencies in the current occupation, we can see that the required level of academic competencies is independent of the occupational domain in which the graduate works but that graduates matched to an occupation not closely resembling the field of study from which they graduated, have to accept that for the type of discipline-specific competencies they acquired there is a relatively smaller demand[10]. To the extent that the principal of 'use it or loose it' applies for these graduates, we may expect these graduates to be more likely to be confronted with competencies obsolescence. This will hold in particular for graduates from fields of study with a high turnover rate of discipline-specific competencies due to rapid technological progress. Hence, the figures in Table 5.2 confirm the approach used in Chapter 2, where we argued that academic competencies, as a subgroup of generic competencies, are context-independent whereas discipline-specific competencies have a restricted range of applicability. Comparing the required levels with the competence levels which the graduates acquired in higher education (vertical mismatch), we can see that for graduates matched to an occupation in their own educational domain both the initial level of academic competencies and the initial level of discipline-specific competencies are merely a starting level, and that they have to continue learning. A similar situation exists for graduates matched to an occupation outside their own educational domain, although the lack of the type of discipline-specific competencies required in the occupation is not immediately visible. Moreover, their higher initial level of academic competencies implies that these graduates are confronted with a smaller lack of academic competencies than the average fellow graduate working in the own educational domain. So far, the figures reported seem to indicate that graduates are allocated at least partially according to the type and level of competencies and their applicability/usefulness for the task of a particular occupation.

10. The finding that graduates matched to an occupation outside their own educational domain are still required to use some of their discipline-specific competencies indicates that our distinction into two different occupational domains is an artificial one and only approximates reality.

Given their level of academic and discipline-specific competencies, the initial competence level of Dutch graduates falls short compared to what the labour market requires them to possess approximately three years after graduation. To what extent does this trigger further on-the-job training? Table 5.3 splits the data according to the question whether or not graduates participated in on-the-job training in the first three years on the labour market. Overall, approximately two out of every three graduates participated in further training[11]. With respect to the discipline-specific competencies (measured solely for graduates working in the own educational domain) we can see that graduates with a greater lack of this type of competencies seem more likely to follow further training (the average initial mismatch of those who followed further training was 0.081 compared to 0.065 for graduates who did not take part in any training). Considering the distinction between occupations inside and outside the own educational domain, and hence the question whether the graduate-occupation match produced a mismatch in the type of discipline-specific competencies, we can see that 71% of the graduates matched to an occupation in which their own type of discipline-specific competencies was not asked, took part in further training compared to only 65% of the graduates matched to an occupation inside the own educational domain. Turning to the second type of competencies, we can see that a mismatch in academic competencies seems to be no major reason for taking further training. However, graduates who were selected for further training seem to have had a slightly higher initial level of academic competencies.

Table 5.3
Competencies, mismatches and training followed

	Academic competencies acquired	Vertical mismatch in discipline-specific competencies (only for graduates working in their own domain)	Vertical mismatch in academic competencies	Working in their own domain	Working outside own domain
Took no further training	3.59	0.065	0.28	35%	29%
Took further training	3.61	0.081	0.28	65%	71%

Note: Graduates working outside their own domain differed significant (5% level) from graduates working inside their own domain with respect to the percentage taking part in further training. Neither the initial level of academic competencies nor the vertical mismatch in discipline-specific or academic competencies differed significantly between graduates who took further training and graduates who did not.

Concluding, the descriptive view seems to indicate that both the acquired levels of discipline-specific and the acquired level of academic competencies are determinants of allocation, and that mismatches in the type and the level of discipline-specific competencies, as well as the acquired level of academic competencies, are determinants of on-the-job training selection decisions. We will return to these points later.

11. See also Appendix 5A.

5.3 The return to academic and discipline-specific competencies

5.3.1 Theoretical notion I

Let us assume that the income that a graduate may obtain in a particular occupation is given by the set of discipline-specific competencies and academic competencies he or she offers to the employer.

$$(5.1) \quad y_{ij} = C_i(DS_{is}, A_i)$$

where y_{ij} is the income received by graduate i in occupation j, C_i the competence set offered by graduate i, DS_{is} the offered level of discipline-specific competencies of type s, and A_i the level of academic competencies offered. Assuming that the set offered is a linear combination of the different types of competencies and taking into account the different types of discipline-specific competencies which graduates may have acquired, we can write[12]:

$$(5.2) \quad y_{ij} = \eta_j * \left[\sum_{s=1}^{n} (\mu_s * DS_{is})\right] + (1-\eta_j) * A_i$$

where

$$(5.3) \quad \sum_{i=1}^{n} \mu_s = 1 \text{ and } 0 \leq \eta_j, \mu_s \leq 1$$

Equation (5.2) indicates that the income is a function of the mix of competencies offered, given by the sum of discipline-specific competencies (*DS*) of the different types *s* and the level of academic competencies (*A*). The term μ_s measures the weight given to a particular type of discipline-specific competencies inside the package of required discipline-specific competencies, while the term η_j measures the weight given to the whole package of discipline-specific competencies.

For simplicity, we will assume the horizontal difference between a particular type of discipline-specific competencies and all other types of discipline-specific competencies to be a constant[13].

$$(5.4) \quad \overline{DS_{s=m} DS_{s\neq m}} = c_s$$

In other words, we assume that the step to be taken made from discipline-specific competencies in business administration to the discipline-specific competencies in law to be the same as the one to be taken from discipline-specific competencies in business administration to the discipline-specific competencies in medicine. In this sense, c_s is determined by the closeness of a particular education programme to the others and hence by the broadness of discipline-specific competencies that a graduate acquires. From the viewpoint of graduates from education programme *m*, we can then write:

12. The approach used in equation 5.2 is similar to Lazaear's skills weight approach (Lazaear, 2003).
13. This assumption allows us to add up the level of discipline-specific competencies required, but not acquired in the study program graduated from, ignoring the fact that they are of different types.

$$(5.5)\quad y_{ij} = \eta_j * \left[\mu_{s=m} * DS_{i,s=m} + (1-\mu_{s=m}) \sum_{s=1}^{n} DS_{i,s\neq m} \right] + (1-\eta_j) * A_i$$

Considering that graduates may lack particular competencies and that such a mismatch between the required level/type of competencies and the acquired level/type may have a distinct impact on the income received, we extend and rearrange equation 5.5 as follows[14]:

$$(5.6)\quad y_{ij} = [\eta_j * \left[\mu_{s=m} * DS^r_{s=m} + (1-\mu_{s=m}) \sum_{s=1}^{n} DS^r_{s\neq m} \right] + (1-\eta_j) * A^r] -$$
$$[\eta_j * \mu_{s=m} * \chi_1 * MMDS_{i,s=m} + \eta_j * (1-\mu_{s=m}) * \chi_2 * MMDS_{i,s\neq m} + (1-\eta_j) * \chi_3 * MMA_i]$$

where $MMDS_{i,s=m}$ is the mismatch in the type of discipline-specific competencies acquired in higher education, $MMDS_{i,s\neq m}$ the mismatch in any other type of discipline-specific competencies and MMA_i the mismatch in academic competencies. Moreover, we replaced the acquired level of competencies by the required one ($DS^r_{s=m}$, $DS^r_{s\neq m}$ and A^r). Lastly, we have introduced χ_1, χ_2 and χ_3 as parameters that allow the weight that a particular competence mismatch (e.g. $MMDS_{i,s=m}$) has in the income determination to differ from the weight of the competency (e.g. $DS^r_{s=m}$) itself.

5.3.2 Results I: Wage rate

To investigate whether the acquisition of academic and discipline-specific competencies in higher education pays off in the labour market, we will consider in this section three simple linear models based on equations 5.5 and 5.6 which try to explain the wage rate paid to graduates approximately three years after graduation:

$$(5.7)\quad \ln(y_{ij}) = \alpha_1 + \alpha_2 DS_{i,s} + \alpha_3 A_i + \alpha_4 X_i + \varepsilon_{ij}$$

$$(5.8)\quad \ln(y_{ij}) = \alpha_7 + \alpha_8 DS_{i,s} + \alpha_9 A_i + \alpha_{10} X_i + \alpha_{11} Z_i + \sigma_{ij}$$

$$(5.9)\quad \ln(y_{ij}) = \beta_1 + \beta_2 DS^r_{i,s} + \beta_3 A^r_i + \beta_4 MMDS_{i,s=m} + \beta_5 MMDS_{i,s\neq m} + \beta_6 MMA_i + \beta_7 X_i + \alpha_8 Z_i + \mu_{ij}$$

In Model 1 (equation 5.7), we have explained the logarithm of the gross hourly wage rate in particular by $DS_{i,s}$ the acquired level of discipline-specific competencies and A_i the acquired level of academic competencies. Moreover, we controlled for several school experience features X_i (e.g. field of study). In Model 2 (equation 5.8), we have added aspects related to the occupation Z_i (e.g. type of contract, training taken). In Model 3 (equation 5.9), we have replaced the acquired level of competencies by the required ones and added the discipline-specific competence mismatch of the type of discipline-specific competencies acquired in higher education $MMDS_{i,s=m}$, the mismatch in the type of discipline-specific competencies $MMDS_{i,s\neq m}$

14. Note that $MMC = C\text{-}C$.

(approximated by a dummy indicating that the graduate worked in an occupation not closely related to the field of study graduated from), and the mismatch in academic competencies MMA_i as additional explanatory variables. To control for the fact that a mismatch in the own type of discipline-specific competencies may be particularly harmful when the occupation puts great weight on this type of competencies, we included $MMDS_{i,s=m}$ interacting with a dummy indicating the educational domain in which the graduates worked. We expected α_2, α_3, β_2 and β_3 to be positive and β_4, β_5 and β_6 to be negative. Table 5.4 reports on the results found.

Table 5.4
Linear Regression analyses of the gross hourly wages (ln)

	Model 1		Model 2		Model 3	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Personal Characteristics						
Age at the time of the survey (1998)	0.005***	0.001	0.012***	0.002	0.011***	0.003
Gender: male	0.052***	0.016	0.016	0.011	0.017	0.011
Competencies acquired						
Discipline-specific	0.016	0.010	0.009	0.007		
Academic	-0.020	0.014	-0.008	0.009		
Competencies required						
Discipline-specific					0.000	0.010
Academic					-0.018	0.013
Competence mismatch						
Discipline-specific*working in own domain					-0.014**	0.007
Discipline-specific*working outside own domain					0.001	0.008
Academic					-0.012	0.008
Working outside own domain					-0.076**	0.031
Education level						
HBO	-0.129***	0.017	-0.104***	0.013	-0.105***	0.013
Job Characteristics						
Part-time contract			0.054***	0.015	0.059***	0.016
Permanent contract			0.062***	0.013	0.058***	0.013
Educational level required: same			Ref.		Ref.	
Educational level required: higher			0.036**	0.017	0.039**	0.017
Educational level required: lower			-0.108***	0.015	-0.107***	0.015
Working experience						
Tenure (in months)			0.015***	0.000	0.015***	0.000
Tenure (in months) * working outside own domain					0.001*	0.001
Internship between 1 and 6 months during study	0.001	0.014	0.001	0.013	0.003	0.013
Internship longer than 6 months during study	0.009	0.013	0.009	0.013	0.009	0.013
Employment related to study between 1 and 6 months during study	0.010	0.021	0.020	0.014	0.017	0.014
Employment related to study longer than 6 months during study	0.104***	0.022	0.064***	0.017	0.065***	0.017
Training						
Participated in on-the-job training			0.038***	0.011	0.039***	0.011
Participated in on-the-job training * working outside own domain					0.011	0.028
Organization characteristics						
Private sector			0.005	0.012	0.005	0.012
Firm size (/10000)			0.005**	0.002	0.005**	0.002
Constant	2.013***	0.119	1.916***	0.118	2.010***	0.125
Field of study dummies included	YES		YES		YES	
Economical sector dummies included	NO		YES		YES	
Adj. R-squared	0.12		0.28		0.28	
Number of observations	1751		1751		1751	

Note: ***/**/* indicates that the coefficient is different from zero at a 1%/5%/10% level of significance.

Controlling for the usual covariates[15], the reported results indicate that neither the acquired (required) level of academic competencies nor the acquired (required) level of discipline-specific competencies seems to be rewarded directly in the labour market. This holds in all three Models. However, we can see that the inclusion of control variables relating to the occupation which the graduates holds, or his or her labour market experience, greatly reduces the impact of both the initial level of academic competencies and the initial level of discipline-specific competencies (see Model 1 and Model 2). Turning to the question whether graduates lacking the required competencies had to accept a lower wage rate, the results of Model 3 show that this was the case with respect to discipline-specific competencies. For graduates working in their own educational domain, and hence in occupations in which the acquired discipline-specific competencies are of crucial importance, a lack of discipline-specific competencies reduced the wage rate significantly. Comparable to this, a mismatch in the type of discipline-specific competencies ('working outside own domain') reduced the wage rate too. No penalty seemed to be given for a lack of academic competencies, even though this mismatch was on average larger than the discipline-specific one. These results seem to be intuitive, considering our characterization of the Dutch labour market as a rather occupationally, and hence discipline-specifically, oriented one. Running comparable analyses for other countries[16], we found that the findings for the Netherlands were qualitative similar to those for Germany and Austria. However, no impact of the vertical discipline-specific competence mismatch on the wage was found in academic countries (e.g. the United Kingdom, Spain or France). Moreover, in the United Kingdom we found that a lack of academic competencies reduced the wage rate significantly. Interestingly, the results confirm again the distinction made in Chapter 3 between discipline-specific countries with an occupational labour market (Austria, Germany and the Netherlands) and academic countries with an internal labour market (France, United Kingdom and Spain).

We also evaluated the impact of an educational level mismatch on wages. Following previous studies (Sicherman, 1991; Cohn and Kahn, 1995; Hartog, 2000), we found that wages were not only determined by individual characteristics but also by job level. Overeducated graduates received lower returns than similar graduates who had a job that matched their educational level. On the other hand, undereducated graduates received more than similar graduates who had a matching job[17]. As noted by Allen and van der Velden (2001), '*although higher education raises productivity in general, the actual level of productivity realized is also determined by the match between educational level and job level*'. As, for example, working in a job below one's own level imposes a limitation on the utilization of skills, the lower level of the job imposes a ceiling on the worker's productivity, resulting in lower wages.

Taking stock, these results do not confirm that in recent years the increasing emphasis on the acquisition of academic competencies yields a significant positive return for higher

15. We also tested for decreasing returns of tenure. The fact that no evidence with respect to decreasing returns to tenure was found, is probably related to the fact that the survey only enables us to observe a maximum of 3 years of tenure.

16. Data not shown.

17. These results are close to those reported by Cohn and Kahn (1995) for overeducated graduates, who earned 11% less than similar graduates who worked in an occupation for which they were adequately educated. However, for undereducated graduates, the results here are lower than those from Cohn and Kahn (1995) (3.8% compared to 10–14%).

education graduates. As a matter of fact, the results rather indicate that for graduates working in their own educational domain, and hence for roughly four out of five Dutch higher graduates, an increased acquisition of discipline-specific competencies would have been preferable. Does this mean, at least in a traditionally discipline-specifically oriented country such as the Netherlands, that the role of academic competencies in the transition period from school to work is nil and that the role of discipline-specific competencies drops to zero if the graduate is allocated to an occupation not closely linked to his own field of study? Can we conclude that higher education should concentrate on teaching discipline-specific competencies? This would clearly be premature. Rather, we have to change our focus from the possibility that competencies provide a direct return in the sense of a higher wage rate to the possibility that competencies influence crucial decisions during the transition period and hence influence the wage rate indirectly. With respect to this, we already mentioned in section 5.2.1 that the level of discipline-specific competencies and academic competencies may influence the allocation of graduates over different occupational domains. Moreover, as training is needed to adjust the acquired competencies to the required ones, the competencies acquired, and in particular a lack of them, may be a crucial determinant for on-the-job training. Lastly, considering our definition of academic competencies, we can expect them to be decisive in on-the-job training selection, which, as reported in Table 5.4, increases the wage rate.

5.4 Allocation to on-the-job training and the return to competencies

5.4.1 Theoretical notions II

In the previous section, we established that neither academic nor discipline-specific competencies seem to have a direct impact on the wages paid to higher education graduates in the Netherlands. However, we found that graduates matched to an occupation that was closely linked to the field of study from which they graduated earned significantly higher wages. In terms of equation 5.10 (a copy of equation 5.6), these graduates worked in occupations in which $\eta_j * \mu_{s=m}$ was close or equal to one. Hence, the question arises who is selected for such occupations?

$$(5.10)\ y_{ij} = [\eta_j * \left[\mu_{s=m} * DS^r_{s=m} + (1-\mu_{s=m}) \sum_{s=1}^{n} DS^r_{s\neq m} \right] + (1-\eta_j) * A^r] -$$
$$[\eta_j * \mu_{s=m} * \chi_1 * MMDS_{i,s=m} + \eta_j * (1-\mu_{s=m}) * \chi_2 * MMDS_{i,s\neq m} + (1-\eta_j) * \chi_3 * MMA_i]$$

Moreover, in Model 3, we found that a lack of discipline-specific competencies when working in one's own educational domain (in terms of equation 5.10: $MMDS_{i,s=m}$) reduced the performance and hence the wage rate. Accordingly, we can expect that if the graduates' endowment with respect to the level and/or type of competencies does not match perfectly the requirements of the occupation, employees need to invest more in the acquisition of these competencies, and that the amount of additional learning (e.g. on-the-job training but also informal learning-by-doing) is positively related to the actual mismatch in competencies. Moreover, we expect the return to on-the-job training and to learning-by-doing, measured in terms of

an increase in competencies (C), to be determined by the quality of the graduate as a learner, and hence in particular by the graduate's level of academic competencies.

$$(5.11)\quad \frac{d(C_{i,t=1} - C_{i,t=0})}{dt} = \theta_c(A_i) \text{ with } \frac{d\theta_c}{dA} \geq 0$$

Where t reflects the time spent in on-the-job training or used for learning-by-doing. Assuming that employers intend to reduce an initial competence mismatch of their employees step by step over time, we can write the mismatch in competencies (MMC) at time t as a function of the initial mismatch (MMC_o), the time period passed t and the factor $\theta_c(A_i)$, reflecting the percentage by which the initial mismatch is reduced per time unit.

$$(5.12)\quad MMC_{i,t} = MMC_{i,t=o} - \theta_c(A_i) * t * MMC_{i,t=o}$$

Inserting 5.12 into 5.10, we obtain an extended version of the basic competence weight approach:

$$\begin{aligned}(5.13)\quad y_{ij,t} = {} & [\eta_j * \left[\mu_{s=m} * DS^r_{s=m} + (1-\mu_{s=m}) \sum_{s=1}^{n} DS^r_{s\neq m} \right] + (1-\eta_j) * A^r] - \\ & [\eta_j * \mu_{s=m} * \chi_1 * (MMDS_{i,s=m,t=0} - \theta_{s=m}(A_i) * t * MMDS_{i,s=m,t=0})] - \\ & [\eta_j * (1-\mu_{s=m}) * \chi_2 * (MMDS_{i,s\neq m,t=0} - \theta_{s\neq m}(A_i) * t * MMDS_{i,s\neq m,t=0})] - \\ & [(1-\eta_j) * \chi_3 * (MMA_{i,t=0} - \theta_A(A_i) * t * MMA_{i,t=0})]\end{aligned}$$

Considering that both employers and graduates, when hiring/applying a graduate for an occupation, intend to maximize the return to the competencies acquired in higher education, we can write the partial first derivatives of 5.13 with respect to the acquired level of discipline-specific and academic competencies[18]:

$$(5.14)\quad \frac{dy_{ij,t}}{dDS_a} = \eta * \mu_{s=m} * \chi_1 - \eta * \mu_{s=m} * \chi_1 * t * \theta_{s=m}(A_i) = \eta * \mu_{s=m} * \chi_1 * [1 - t * \theta_{s=m}(A_i)]$$

$$\begin{aligned}(5.15)\quad \frac{dy_{ij,t}}{dA_i} = {} & [\eta * \mu_{s=m} * \chi_1 * t * MMDS_{i,s=m,t=0} * \frac{d\theta_A}{dA_i}] + [\eta * (1-\mu_{s=m}) * \chi_2 * t * MMDS_{i,s\neq m,t=0} * \frac{d\theta_A}{dA_i}] + \\ & [(1-\eta) * \chi_3] + [(1-\eta) * \chi_3 * A^r * t * \frac{d\theta_A}{dA_i}] - [(1-\eta) * \chi_3 * t * \theta_A(A_i)] - [(1-\eta) * \chi_3 * t * A_i * \frac{d\theta_A}{dA_i}] \\ = {} & [\eta * \mu_{s=m} * \chi_1 * t * MMDS_{i,s=m,t=0} * \frac{d\theta_A}{dA_i}] + [\eta * (1-\mu_{s=m}) * \chi_2 * t * MMDS_{i,s\neq m,t=0} * \frac{d\theta_A}{dA_i}] \\ & + [(1-\eta) * \chi_3 * t * \frac{d\theta_A}{dA_i} * MMA_{i,t=0}] + [(1-\eta) * \chi_3 * (1 - t * \theta_A(A_i))]\end{aligned}$$

18. Note that $MMC = C\text{-}C$.

The implications of equation 5.14 for the value of discipline-specific competencies are quite straightforward. Ceteris paribus, the value of discipline-specific competencies acquired in higher education increases as more weight is attached to them by the occupation ($\eta * \mu_{s=m} * \chi_1$ increases). However, the marginal value decreases with an increased level of academic competencies, which determines the speed with which any possible competence mismatches are reduced. The same holds for the length of the time period taken into consideration. The longer it is, the more the initial level of discipline-specific competencies is in line with the required one. The importance of the academic competencies for the value of discipline-specific competencies is illustrated in Figure 5.1a and 5.1b. Figure 5.1a assumes a lower level of academic competencies than Figure 5.1b, which is reflected in a steeper income line in Figure 5.1b (The slope of the income-time line is given by $\theta_{s=m}(A)$. The gain from an increased initial level can be read as the area between the two income-time lines. It is immediately visible that the gain is larger in the case of lower academic competencies.

Figure 5.1a
The income gain of an increased level of discipline-specific competencies with low academic competencies

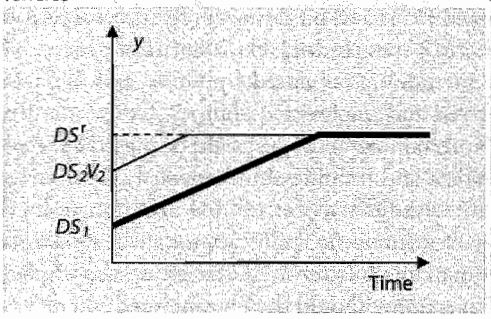
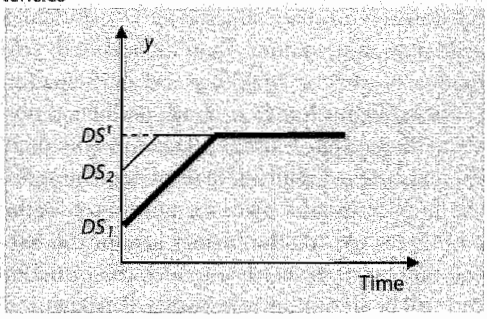


Figure 5.1b
The income gain of an increased level of discipline-specific competencies with high academic competencies



As expected, the value of academic competencies is not restricted to a particular type of occupation. The first two terms of equation 5.15 show the value of academic competencies in helping to reduce a possible discipline-specific competence mismatch. The third term remains the same for a mismatch in academic competencies. Whereas the first two are positively related to η, the latter is negatively related to it. Lastly, the fourth term indicates that the marginal value of academic competencies increases with the weight attached to it by the firm, but, comparable to the marginal value of discipline-specific competencies, the marginal value decreases with an increased initial level of academic competencies.

Concluding this section, the following expectations with respect to the role of academic and discipline-specific competencies during the transition period can be established. First, given a certain level of required competencies, we expect the graduate's level of discipline-specific competencies at the time of graduation to be positively related with the graduate's probability to be matched to an occupation closely linked to the field of study from which he or she graduated. The reason is that a higher level of discipline-specific competencies increases the direct productivity of the graduate in this type of occupations and reduces the need for further costly training. Second, both a mismatch in the type and a mismatch in the level of

discipline-specific competences are expected to increase the likelihood of the graduate having to complete further on-the-job training. Third, the impact of the academic competencies on the allocation outcomes seems at first sight to be neutral. However, given that the empirical analyses will solely distinguish occupations for which $\eta * \mu_{s=m}$ is close to 1 or close to 0, and hence distinguish occupations closely linked to the own field of study versus other occupations, equation 5.15 implies that we can expect, ceteris paribus, graduates with an increased level of academic competencies to be more likely to be matched to an occupation outside the own educational domain. In this type of occupations, academic competencies have both a direct productive and indirect supportive value. Lastly, we expect to find a clear-cut direction of the impact of academic competencies on training participation. A high level of academic competencies is equivalent to be a good learner and hence should increase the probability of taking part in further training, independently of the occupation to which one is allocated.

5.4.2 Empirical specification

To evaluate both the impact of having an occupation not closely linked to one's own educational domain and the impact of training, running a simple OLS regression, as presented in Section 5.3, on the characteristics of graduates and firms and on dummies for the allocation outcomes and training, cannot deal with selection issues. Indeed, the allocation process of graduates over occupations and participation in training, as noted by Goux and Maurin (2000), obviously rely on both graduates' observed and unobserved abilities. Consequently, the estimated effect of the allocation outcomes and training on wages could be biased because the unobserved abilities determine wage, allocation and training simultaneously. Moreover, the impact of allocation on training is undoubtedly different for trained and non-trained employees. As for the former group, the effect of a suboptimal allocation can be small, as training has been used to reduce the initial mismatch, while for the latter group the impact can still be significantly negative. Participation in training should then be analyzed as a determinant of the allocation impact on wages. To take this into account, not only the training variable but also the allocation-training interaction must be analyzed as a wage determinant. If graduates are also likely to be selected for training depending on their allocation, we may further expect to find a correlation between training and allocation. In order to deal with these two selectivity criteria, we have developed a wage model with two selection functions, one for the allocation and one for training. This will make it possible not only to identify the allocation process of graduates and the training selection mechanism, but also the impact of competencies on wages.

Let $MMDS_{s\neq m,ij}$ be the dummy that denotes that graduate i is assigned to a job j which does not match his type of discipline-specific competencies (and hence to an occupation outside the own educational domain), TR_{ij} is the dummy that denotes that graduate i takes part in further training while holding job j, and lny_{ij} is the logarithm of wages. Let us then consider the following system of simultaneous equations

$$(5.16)\quad MMDS^{*}_{s\neq m,ij} = \gamma_1 W_{ij} + \varepsilon_{1ij}$$

$$(5.17)\quad MMDS_{s\neq m,ij} = 1 \text{ if } MMDS^{*}_{s\neq m,ij} > 0 \text{ and } 0 \text{ otherwise}$$

(5.18) $TR^{*}_{ij} = \delta_1 Z_{ij} + \varepsilon_{2ij}$

(5.19) TR_{ij} = 1 if $TR_{ij} > 0$ and 0 otherwise

(5.20) $\ln y_{ij} = \tau_1 X_{ij} + \tau_2 MMDS_{s\neq m,ij} + TR_{ij}(\tau_3 MMDS_{s\neq m,ij} + \tau_4) + \mu_{ij}$

where W_{ij} is a vector of independent variables that influence the allocation over jobs, such as individual and educational characteristics, and Z_{ij} is a vector of independent variables that influence participation in training. As discussed above, determinants of training may include measures of competence mismatches, the competence set acquired in higher education and other individual characteristics. X_{ij} is a vector of individual, educational, occupational and organizational characteristics that determine the wage rate. Coefficient τ_2 makes it possible to identify the impact of allocation on wages. τ_3 captures the difference between the impact of allocation for trained and non-trained graduates.

To take endogeneity with respect to the allocation and the training process into account, we assume ε_{1ij}, ε_{2ij} and μ_{ij} to be correlated and normally distributed. Consequently, we have used an extension of the two-step treatment effect method discussed by Barnow, Cain & Goldberger (1981), derived from Heckman (1976) and Maddala and Lee (1976). First, we estimated the allocation process and training participation using a bivariate probit model. Second, we estimated the wage equation and added $\lambda_{1ij} = E(\varepsilon_{1ij} / MMDS_{s\neq m,ij}, TR_{ij})$ and $\lambda_{2ij} = E(\varepsilon_{2ij} / MMDS_{s\neq m,ij}, TR_{ij})$ as additional independent variables to control for selectivity. These ratios were provided by the estimate of the bivariate probit. To assure identification of the parameters, we needed variables that could be expected to be correlated with allocation and training but not with the unobserved determinants of the wage rate. First, in both the allocation and the training function, we used *the level of academic competencies as possessed at the time of graduation* and *the level of discipline-specific competencies as possessed at the time of graduation*. The assumption here is that graduates undoubtedly increase their level of competencies through additional training or work experience during the first years in the labour market. Hence, the possessed levels of competencies at the time of graduation characterize the graduates' knowledge three years before the wage rate is reported. It is therefore assumed that these levels have changed since graduation, and we may obviously expect that the increase differs between graduates[19]. The initial levels of competencies are therefore expected to determine the allocation process and training participation, both of which determine the way in which competencies will change.

Furthermore, we included variables that described the *graduate's home situation at the time of graduation* as specific determinants of allocation and training. Living with a partner or one's parents at the time of graduation may relax the graduate's financial constraints and allow him or her to search longer for an occupation that matches closely the type of education taken. On the other hand, having children (in particular for female graduates) may restrict graduates with respect to the time available for investment in further training. Moreover, as regressors for the allocation function, we used a vector of variables that influences $MMDS_{s\neq m,ij}$ but not TR, such as *the importance given to the possibility of using knowledge and skills acquired*

19. This is also supported by the findings in section 5.3.2, where we did not find a significant impact on the wage rate of the possessed level of competencies at the time of graduation.

in higher education, and the extent to which graduates reported that they possessed *adaptability* as a competence at the time of graduation[20]. Whereas the former provides information over the graduate's unwillingness to accept an occupation outside the own educational domain, the latter gives information on the ease with which such a switch could take place. Lastly, to identify the training effect, we also used the *number of firms offering training courses for firms* in the region in which the graduate worked. An increased supply of training courses in the region may increase the training opportunities for firms and hence enable on average more employees to actually participate in training.

5.4.3 Empirical results II: Allocation and Training

We will start by discussing the results of the bivariate probit model, simultaneously estimating the allocation outcome and the training participation. Table 5.5 presents the results[21]. Turning first to the allocation estimation part, we can see that the results clearly indicate the importance of the two distinct types of competencies for the probability of being matched to an occupation outside the own educational domain. A higher level of discipline-specific competencies decreases the probability of being matched to an occupation outside one's own educational domain, which confirms the field-limited usefulness of discipline-specific competencies. In contrast to this finding, a higher level of academic competencies increases the chance of obtaining such a job, indicating first of all that academic competencies are not context-bound. Second, as academic competencies are defined as a combination of learning abilities, analytical abilities and problem-solving abilities, they provide competencies for dealing with new problems in a wide range of domains and are needed in particular outside the domain to learn the newly required competencies. Qualitatively comparable results were again found for other discipline-specifically oriented countries (e.g. Austria and Germany). However, the impact of the acquired level of discipline-specific competencies on the allocation outcome is significantly smaller in academic countries, such as the United Kingdom, Spain or France[22]. Hence, the results are in line with our theoretical expectations as illustrated in Figures 5.1a and 5.1b. Furthermore, we can see that graduates with study-related working experience during their study time have a higher probability of finding an occupation matching closely their type of discipline-specific competencies. Investing in contact with potential employers during one's study seems to help during the job search stage. With respect to the field of study, graduates from law, natural sciences and health have an higher probability of finding an occupation inside the own educational domain compared to the reference group (graduates from arts and humanity faculties). As discussed above, we also included as instrumental variables the home situation, the importance attached to the use of the acquired competencies and the acquired level of adaptability competency. In particular the latter two seem to be important factors. Whereas the importance given to the use of the competencies acquired in higher education positively influences the probability of getting matched to an occupation inside one's own educational domain, a high level of adaptability,

20. For the last two variables, graduates were asked to give their answers on a five-point scale, ranging from 1 ("not at all") to 5 ("to a very high extent").
21. Appendix 5B provides some insight into robustness tests for the allocation-training estimation.
22. Data not shown.

on the other hand, positively influences the probability of being matched to an occupation outside one's own educational domain.

Table 5.5
Bivariate probit analysis for training and allocation

Independent variables	Coefficient	S.E.
Dependent variable : Working outside own domain ($MMDS_{s \neq m,i}$)		
Competencies possessed		
Academic	0.399***	0.079
Discipline-specific	-0.229***	0.049
Experience during study		
Internship (1-6 months)	0.134	0.102
Internship (>6 months)	-0.009	0.098
Employment related to study (1-6 months)	-0.313**	0.123
Employment related to study (> 6 months)	-0.263*	0.136
Level of education		
HBO graduate	0.002	0.094
Field of study graduated from		
Arts and Humanities	Ref.	
Social Sciences	-0.027	0.140
Business	-0.176	0.115
Law	-0.845***	0.212
Natural Sciences	-0.749***	0.194
Engineering	-0.316**	0.135
Health	-0.685***	0.151
Personal characteristics		
Age at time of survey	0.044**	0.018
Gender: man	-0.119	0.080
Home situation		
Living as a single	Ref.	
Living with partner	-0.134	0.098
Living with parents	-0.157	0.109
Living with other person	-0.091	0.105
Importance given to usage of skills	-0.283***	0.058
Adaptability	0.115**	0.052
Intercept	-1.475**	0.655
Dependent variable: Training participation (TR_i)		
Competencies possessed		
Academic	0.188**	0.084
Discipline-specific	-0.008	0.063
Competence mismatches		
Working outside own domain ($MMDS_{s \neq m,i}$)	-0.283	0.355
$MMDS_{s \neq o\, m,i}$ * vertical discipline-specific mismatch	0.093*	0.056
Working inside own domain * vertical vocational mismatch	0.023	0.043
Academic competence mismatch	0.072	0.055
Educational level mismatch		
Same educational level required	Ref.	
Higher educational level required	-0.112	0.102
Lower educational level required	-0.083	0.099
Personal characteristics		
Age at time of survey	-0.012	0.015
Gender: Man	-0.028	0.072
Mother	-0.287*	0.162
Job characteristics		
Full-time job	0.110	0.099
Permanent job	0.246***	0.078
Organization characteristics		
Private employer	-0.020	0.078
Firm size (/10000)	0.025*	0.014
Number of firms offering training courses (/100)	0.021*	0.012
Intercept	-1.258	0.839
Correlation (allocation and training)	0.298	0.194
Number of observations	1751	
Log-likelihood	-1814	

Note 1: The estimation function for the training incidence also includes dummies for 16 economic sectors. Note 2: * Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level. Note 3: The correlation of the residuals from the two models (0.298) is not significantly different from zero, indicating that the two equations are not strongly interrelated.

Let us now turn to the results on training incidence. We can see that the level of academic competencies, as possessed at the time of graduation, has a significant and positive influence on training participation. On the other hand, the level of discipline-specific competencies seems to have no impact on training incidence. Hence, complementarity between initial education and on-the-job training can be established, but only for a certain kind of educational outcome, namely academic competencies. Comparable results were found for other countries independently of their competence orientation[23]. This is in line with the idea that academic competencies acquired in higher education reduce the costs of further learning by providing higher learning abilities to graduates. As introduced in the previous section, we may expect competence mismatches to be costly because of the resulting productivity loss. In this sense, the amount of on-the-job training needed is expected to be positively related to the actual discipline-specific competence mismatches, as training is needed to adjust the acquired competencies to the required ones. The results show that the horizontal mismatch resulting from being matched to an occupation outside one's own educational domain has no additional impact on participation in training. This indicates that graduates who are matched to an occupation inside their own educational domain are as likely to be trained as graduates matched to an occupation outside their own domain. However, it needs to be recalled that graduates who experienced a horizontal mismatch, on average had a higher level of academic competencies which had a positive effect on overall participation in training. Moreover, it was impossible to distinguish between training used solely for eliminating a competence mismatch and training used partially for promotion to higher job levels. Hence, if graduates inside the own educational domain were more likely to get promotion training, the finding could still indicate that a horizontal mismatch in discipline-specific competencies triggered an higher level of training participation used for competency adjustments. In addition to this horizontal mismatch, graduates may also face a vertical discipline-specific competence mismatch. The results indicate that an increase in the level of this vertical mismatch for graduates inside their own educational domain did not significantly increase training participation. This may indicate that graduates, if matched to an occupation closely linked to their field of study, benefited from a suitable work environment to eliminate an existing disciplines-specific competence mismatch partially by learning-by-doing. Contrary to this finding, we can see that for graduates matched to an occupation outside the own educational domain, an increasing vertical discipline-specific competence mismatch had a positive influence on training participation (on a 10% significance level). Hence, when the match between field of study and occupation was suboptimal, graduates did not benefit from such a work environment and obviously were in need of formal training to reduce the mismatch. Lastly, a mismatch in academic competencies did not seem to trigger on-the-job training[24].

We also introduced a measurement for the educational level match between graduates and their jobs. Neither in the case of under-education nor in the case of over-education did we find a significant impact on training participation. Over-educated graduates, whose learning capacities are already explicitly taken into account by their level of academic competencies, did not need to follow additional formal training. For under-educated graduates,

23. Data not shown.

24. Testing for differential impacts of an academic competence mismatch between the two occupational domains did not reveal qualitatively different results.

additional training did not seem to be provided by firms to substitute any lacking educational level. Lastly, female graduates with children were less likely to participate in training (on a 10% significance level) and the number of firms offering training courses in the province in which the graduate worked had a positive influence on the chance of actually participating (at a 10% significance level).

Table 5.6
The wage equation (revisited)

Independent variables	Coefficient	S.E.
Allocation		
Working outside own educational domain ($MMDS_{i \neq m,j}$)	-0.108**	0.045
Training		
Training participation (TR_{ij})	0.058***	0.018
TR_{ij}*$MMDS_{i \neq m,j}$	0.032	0.031
Competence mismatch		
$MMDS_{i \neq m,j}$ * vertical discipline-specific competence mismatch	0.003	0.007
Working inside own domain * vertical discipline-specific competence mismatch	-0.014**	0.005
Educational level mismatch		
Same educational level required	Ref.	
Higher educational level required	0.038**	0.017
Lower educational level required	-0.108***	0.016
Experience during study		
Internship during study (1-6 months)	0.002	0.013
Internship during study (> 6 months)	0.008	0.013
Employment related to study (1-6 months)	0.018	0.014
Employment related to study (> 6 months)	0.065***	0.017
Personal characteristics		
Age at time of survey	0.011***	0.003
Gender: Man	0.016	0.011
Job characteristics		
Full-time job	-0.058***	0.015
Permanent job	0.058***	0.013
Tenure (in months)	0.002***	0.000
$MMDS_{ij}$ * Tenure	0.001*	0.001
Organization characteristics		
Private employer	0.004	0.012
Firm size (/10000)	0.049**	0.019
λ_1 (misallocation)	0.018	0.024
λ_2 (training)	0.049*	0.027
Intercept	1.905**	0.116
Number of observations	1751	
Adjusted R^2	0.28	
F-statistics	14.26	

Note 1: Dependent variable: log hourly wages measured on the basis of the reported gross monthly wage rate and the reported number of working hours as stated in the contract. The estimation also includes 9 dummies for degrees achieved, 6 dummies for job titles and 16 dummies for economic sectors. To estimate λ_1 and λ_2, we used the probit model presented in Table 5.4; standard errors have been adjusted using the Murphy and Topel (1985) correction (the selection model estimation was conducted under LIMDEP 7.0; see Greene, 2000). Note 2: * Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level.

5.4.4 Results III: The wage rate revisited

Let us now return to the discussion on wage rates, this time controlling explicitly for the results found in the estimation of the allocation-training model. The results are shown in Table 5.6. Although the findings presented do not differ strongly from the results of the starting wage estimation (see Table 5.4) in the sense that both the coefficient for training[25] and the coefficient for working outside the own educational domain are still significant at a 1% level and the size is comparable, we are now in a situation in which we can relate these findings to the different types of competencies acquired in higher education.

First, we found that working outside the own educational domain reduced the wage rate by approximately 11%. Moreover, the level of discipline-specific competencies is a primary determinant of the allocation outcome. Hence, there is a significant, positive return to the acquisition of discipline-specific competencies. As the impact is relatively indirect, through the allocation outcome, the basic wage estimation in Section 5.3.2 was unable to reveal it.

A similar situation exists for the acquired level of academic competencies, although the overall impact is less clear-cut than for the discipline-specific competencies. First, graduates with a high level of academic competencies (ceteris paribus) were more likely to be selected for further on-the-job training, yielding a positive monetary return. Second, graduates with a high level of academic competencies were more likely to be matched to an occupation outside their *own educational domain* that paid, on average, lower wages. Third, graduates working outside the own educational domain had a higher return on learning-by-doing (measured by tenure) due to their higher level of academic competencies (at a 10% significance level). To what extent the overall impact of a high level of academic competencies acquired in higher education is beneficial is therefore unclear.

Even though the analyses revealed several interesting results with respect to the role and value of academic and discipline-specific competencies acquired in higher education, further research will be necessary, in particular on the following two features. First, the group of occupations called 'outside own educational domain' may be very heterogeneous. As a matter of fact, they consist of both occupations for which the discipline-specific competencies of another higher education programme are required and occupations for which no particular discipline-specific competencies are required. We will return to this point in Chapter 6. Second, the value of academic competencies may be strongly related to the time period under consideration. As changes in the technology of the production process are more likely to occur in the longer run, and hence increased training and adaptability becomes of more importance over time, we may expect the return to academic competencies to increase over time. Hence, it would be of great interest to analyze longer time periods than the three to four years that could be considered here.

25. Note that the significant and positive sign of λ_2 indicates that there are unobserved factors positively influencing the training incidence and wage rate.

5.5 Concluding remarks

The objective of this chapter was to analyze the role and value of academic and discipline-specific competencies acquired in higher education. We focused on the situation in the Netherlands, keeping in mind that the Netherlands have a relative discipline-specifically oriented higher education system (comparable to Austria and Germany) and a traditionally rather occupationally oriented labour market.

To start with, we examined a possible direct link between the competencies level possessed at the time of graduation and the gross hourly wages paid three years after graduation. Neither for the level of discipline-specific nor for the level of academic competencies was it possible to establish such a link. However, we found that a mismatch in either the level or the type of discipline-specific competencies harmed productivity and hence the wage rate. Comparing these results with analyses in other countries, we can see that it is a typical situation for countries with a relatively discipline-specifically oriented higher education system (e.g. Germany or Austria), but does not hold for relatively academically oriented countries (e.g. United Kingdom, France or Spain). In other words, the first results indicate that at that moment in time, discipline-specific competencies seemed to be what mattered for higher education graduates in the Netherlands, Austria and Germany, rather than academic competencies, as is often claimed. This is the good news for these countries as it fits in well with the findings of Chapter 4 in the sense that the setup of higher education in these countries stimulates discipline-specific rather than academic competencies.

In the second part of the chapter, we analyzed other important roles for the two types of competencies considered. We found in particular that they are important criteria for allocation and further on-the-job decisions made in the labour market.

First, the extent to which Dutch graduates are matched to an occupation in congruence with their field of study is strongly influenced by the level of discipline-specific competencies the graduates possess. As these occupations are better paid, being selected for them is of importance for graduates from a financial point of view. Again, the situation is comparable in discipline-specifically oriented European countries. However, in academically oriented countries, we found that discipline-specific competencies play a significantly lesser role in allocation decisions.

Second, we showed that academic competencies acquired in higher education played a major supportive role in the Netherlands for the acquisition of further competencies. Hence, academic competencies had an indirect monetary value rather than a direct one. In contrast to the two findings discussed above, this result seems to be independent of the competence orientation of the country's higher education system or the country's labour market. This is the bad news for discipline-specifically oriented countries such as the Netherlands, Germany or Austria, in the sense that their traditional setup of higher education prepares graduates (compared to e.g. the United Kingdom) relative less well for this feature of the labour market.

The finding that academic competencies influenced the selection for on-the-job training contributes to the empirical literature on the question whether training and education are complements or substitutes. We found that training and the level of academic competencies acquired in higher education are complements, but no significant relationship was estab-

lished between the level of discipline-specific competencies and training. Actually, on-the-job training seemed to use academic competencies to adjust the discipline-specific competencies to the requirements of the labour market.

Lastly, the fact that a high level of academic competencies influenced the probability of the graduate getting/accepting an occupation outside his or her own educational domain again confirmed that academic competencies are not context-bound and hence can be applied in a wide range of occupations.

Appendix 5A: Characteristics of Dutch graduates

Table 5.A1
Characteristics of the Dutch graduates

	Mean	Std. Deviation
Personal Characteristics		
Age at the time of survey (in years)	28.9	2.30
Gender: male	0.46	
Female respondent with children	0.04	
Household at time of graduation		
Living as a single	0.28	
Living with partner	0.26	
Living with parents	0.23	
Living with friends	0.22	
Higher education followed		
Type: Higher vocational education (HBO)	0.58	
Arts and Humanities	0.16	
Social Sciences	0.10	
Business	0.27	
Law	0.06	
Natural Sciences	0.08	
Engineering	0.17	
Health Sciences	0.16	
Work experience during study		
Internship: 1-6 months	0.29	
Internship: 7 and more months	0.44	
Employment related to study: 1-6 months	0.14	
Employment related to study: 7 and more months	0.10	
Further training after graduation		
Participation in on-the-job or off-the-job training	0.67	
Current working situation		
Educational domain: working inside the own educational domain	0.72	
Occupation requires level of education graduated from	0.73	
Occupation requires lower level of education than graduated from	0.16	
Occupation requires higher level of education than graduated from	0.11	
Tenure (in months) inside the current occupation	31.9	21.02
Type of contract: permanent	0.79	
Type of contract: fulltime	0.84	
Gross hourly salary in Euros	11.58	2.87
Organizational characteristics		
Private company	0.54	
Size of the firm (number of employees)	6715	25401

Appendix 5B: Robustness of allocation-training model?

In this section, we will briefly investigate the robustness of the allocation and training model with respect to several assumptions made in the analyses. In particular, we will test the extent to which the impact of the two types of competencies on the allocation outcome is influenced by ignoring different levels of occupations in the estimation above and by ignoring the fact that the data consists both of graduates who entered the higher education system immediately after secondary school and graduates who spent some time working between

secondary school and entering the higher education system. Lastly, we will analyze to what extent differences can be found between graduates from the university sector and graduates from the higher vocational education sector. Table 5.B1 presents an extraction of results from five different model estimations. For reasons of simplicity, Model 0 is the original estimation as discussed in the main text. Model 1 restricts the research population to graduates who have an occupation that requires at least the same level of education as the one graduated from. Model 2 restricts the research population to graduates younger than 31 years at the time of the survey and hence to graduates with at least no long working period between secondary school and higher education. In Model 3, the allocation-training estimation is investigated for university graduates only, while in Model 4 the same is done for graduates from higher vocational education.

Table 5.B1
Robustness estimations

	Model 0 Basic	Model 1 No over-education	Model 2 Younger than 31 years	Model 3 Only university graduates	Model 4 Only higher vocational education graduates
Dependent variable: $MMDS_{s,e,m,j}$					
Academic competencies	0.40***	0.44***	0.31***	0.42***	0.37***
Discipline-specific competencies	-0.23***	-0.25***	-0.21***	-0.26***	-0.20***
Dependent variable: Training					
Academic competencies	0.19*	0.17*	0.17*	0.20**	0.13
Discipline-specific competencies	-0.01	-0.03	-0.06	-0.00	-0.04

Note 1: all models further include the same control variables as presented in Table 5.4. Note 2: ***/**/* significant at 1%/5%/10% level.

The results in Table 5.B1 with respect to Model 1 and Model 2 indicate clearly that controlling for a possible bias/influence due to either a situation in which the required educational level is related to the occupational domain or due to the fact that graduates before entering higher education had longer working experience, does neither qualitatively change the outcome of the allocation nor the outcome of the training model. The impact of the two different *types of competencies on the allocation outcome is not influenced qualitatively either by* the higher education sector from which the respondent graduated. For both graduates from universities and graduates from higher vocational education schools, an increased level of discipline-specific competencies does increase the odds of being matched to an occupation closely linked to the education programme graduated from, while the opposite holds for the level of academic competencies. In contrast, we found a slight difference with respect to the impact of academic competencies on training participation. Whereas for university graduates the level of academic competencies was found to be a primary determinant of training participation this did not hold for graduates from higher vocational education. To what extent this is related to the more discipline-specific orientation of programmes in the higher vocational education sector compared to the university sector, will be a question that further research needs to answer. Summarizing this section, it can be stated that our investigation with respect to the allocation and training participation outcome seems to be robust against some critical factors neglected in our basic estimation.

Chapter 6

The effects of higher education programme characteristics on the allocation and performance of the graduates[1]

1. This chapter is an extended version of Heijke and Meng (forthcoming). We would like to thank participants at the Transition in Youth Network Conference in Madeira (2003), at the EEA conference in Madrid (2004), at the EALE conference in Lisbon (2004) and participants at seminars at the University of Barcelona (September, 2003), Maastricht University (October, 2003 and December, 2003), EIM (Zoetermeer, 2004), IAB (Nuremberg, 2004) and Bamberg University (2004) for their comments on earlier drafts of the paper. Furthermore, We benefited a great deal from comments by Jim Allen, Hans-Peter Blossfeld, Lex Borghans, Josep M. Masjuan Codina, Ben Kriechel, Ferrane Mane, Jordi Planas, Inge Sieben, Alexandra Spitz and Roy Thurik.

6.1 Introduction

The transition from education to the labour market is crucial. Graduates search in a labour market about which they are relatively badly informed and where jobs may be scarce. Employers try to find the most suitable higher educated candidates for their available vacancies. In addition to the applicants' educational backgrounds and performances, employers know relative little about their specific productive capacities. Mismatches between desired and realized allocation over jobs and between expected and realized performance in these jobs may occur easily[2]. Given this context, employers may be expected to rely not only on individual characteristics of the applicant, but also on characteristics of the education programme, and hence on group features, to retrieve relevant information for hiring and/or salary decisions. To increase the knowledge on this point, we will address in this chapter the extent to which typical characteristics of higher education programmes are valued, as they either reveal the productive capacities taught to the students or as they reduce the uncertainty with respect to the type and level of competencies which the graduates possess. In both cases, the risk of high adjustment costs is reduced.

Most of the existing comparative research on the impact of educational characteristics on labour market outcomes focuses on secondary education level systems. In particular, authors considered the extent to which vocational training at this educational level is provided and the extent to which secondary education programmes within a country are standardized and stratified. Allmendinger (1988), studying career mobility patterns in the United States, Norway and Germany, proposed a typology of education systems based on the two dimensions of 'standardization' and 'stratification'. Standardization is defined as "*the degree to which the quality of education meets the same standard nationwide*" (Allmendinger, 1988, p.35). The term 'stratification' is used to reflect "*the proportion of a cohort that attains the maximum number of school years provided by the educational system and by the degree of differentiation within a given educational level*" (Allmendinger, 1988, p.35). On the basis of these definitions, Allmendinger argued that stratified and standardized systems provide clear signals on the real educational achievements of school-leavers and allow employment decisions to be based on educational credentials. Müller and Shavit (1998), analyzing school-to-work transitions in thirteen countries, added the vocational specificity of secondary education and the proportion of school-leavers with post-secondary education as additional dimensions. Other typologies have been introduced for instance by Maurice, Sellier and Sylvestre (1982), who made a distinction between 'qualificational space' and 'occupational space', or by Hannan, Raffe and Smyth (1996), who introduced the strength of the linkages between educational and labour market systems as a further dimension.

Notwithstanding their relevance for the school-to-work transition, the general focus on secondary education and their analyses on system level restricted these earlier approaches greatly. With an increasing proportion of the young Western population continuing their education into tertiary level, we are in need for indicators extending the range into tertiary education programmes and encompassing signals that these programmes provide to the labour market. Accordingly, a first line of research looked at the impact of the field of study

2. See also the discussion on this topic in Chapter 5.

on labour market success. Generally, this research argued that the field of study mediates the link between higher education participation and educational outcome (see e.g. Müller, Steinmann and Ell, 1998)[3]. However, we argued in Chapter 2 that the simple use of the higher education qualification (or field of study name) is a far from ideal indicator of the competencies actually acquired in higher education or used in the labour market. Consequently, we will consider in this chapter five characteristics of education programmes that normally remain hidden in the black box of the field of study. The objective is to reveal the effectiveness with which higher education programmes allocate their graduates over various occupational domains in the labour market and how these graduates perform in the occupation obtained.

In line with the main objective of this thesis, the first three characteristics to be investigated consider the type and level of competencies taught to the students. The fourth and fifth characteristic deal with experience outside the regular teaching process and competencies acquired in this context. More specifically, the first characteristic is the *competence orientation (discipline-specific versus academic)* of the higher education programme. This characteristic is comparable to the approach by Müller and Shavit (1998) on the vocational specificity in secondary education. The second characteristic concerns the level of *standardization* of the programme with respect to the competence level acquired by graduates, measuring the homogeneity of the graduates. In line with the findings of Allmendinger (1988) at the system level, we expected highly standardized programmes to offer clearer signals of the capacities of their graduates, reducing the uncertainty on the actual level of discipline-specific and academic competencies possessed by graduates. The third characteristic deals with the fact that certain education programmes provide *exclusive entrance* to particular occupations in the labour market. The reason for this exclusive entrance lies mainly in the fact that tasks in these occupations are considered high-risk tasks and failure produces high costs to society. Hence, employers and their customers may rely on this characteristic as a guarantee that the graduate possesses an acceptable minimum level of required discipline-specific competencies. Well-known examples are the health care and law sectors. The integration of *working and learning*, and hence the extent to which the work term is a vital part of the academic curriculum, constitutes the fourth characteristic discerned. Lastly, we investigated the impact of the degree of *internationalization* of the programme. In doing so, we incorporated in the analysis the fact that the labour market for graduates has become increasingly international due to the globalization process and the integration of markets (e.g. the European Union).

In order to trace the effects of these programme characteristics, we can look at the labour market from the perspective of a particular education programme. More precisely, three occupational domains are distinguished: A domain in which optimal fulfilling of the tasks requires graduation, and hence the discipline-specific competencies, of a particular programme, a domain in which discipline-specific competencies of another education programme offer a comparative advantage, and a domain in which graduation from a particular higher education programme is not a direct requirement and hence academic competencies are demanded[4].

The structure of the chapter is as follows. Section 6.2 discusses first the labour market framework assumed and second the five characteristics of the education programmes discerned. Section 6.3 presents the data used in this chapter. The econometric model is devel-

3. For an extended discussion on this type of literature, see Chapter 2.
4. In Chapter 5, the latter two domains were combined into one domain.

oped in Section 6.4. First, we will evaluate the impact of the education programme characteristics on allocation. Second, the influence of the education programme characteristics on the wage will be investigated. Section 6.5 concludes the chapter and relates the findings back to the earlier distinction between discipline-specifically oriented countries and academically oriented countries.

6.2 Theoretical framework

6.2.1 Labour market characterization: Three occupational domains

The main objective of this chapter is to relate variations in the initial labour market outcomes of graduates to characteristics of the higher education programme they completed. In line with Chapter 5, we will characterize occupations according to the level and set of discipline-specific and academic competencies which they require for optimal fulfilment of the tasks:

$$(6.1)\quad C^r{}_j = C^r\ (DS^r_s, A^r)$$

where $C^r{}_j$ is the required competencies set in occupation j, DS^r_j the required discipline-specific competencies of type s, and A^r the required level of academic competencies[5]. Assuming for reasons of simplicity that the required set of competencies consists of a linear combination of a package of discipline-specific competencies and of academic competencies, we can write:

$$(6.2)\quad C^r{}_j = \eta_j * \left[\sum_{s=1}^{n}(\mu_s * DS^r_s)\right] + (1-\eta_j) * A^r \text{ with } \sum_{i=1}^{n}\mu_s = 1 \text{ and } 0 \le \eta_j, \mu_s \le 1$$

Equation 6.2 implies that the required mix of competencies in a particular occupation j is given by the sum of discipline-specific competencies (DS) of the different types s and the level of academic competencies (A). The term μ_s measures the weight given to a particular type of discipline-specific competencies in the package of required discipline-specific competencies, while the term η_j reflects the weight given to the whole package of discipline-specific competencies.

The horizontal difference between a particular type of discipline-specific competencies (acquired in programme s=m) and all other types of discipline-specific competencies ($s \neq m$) is assumed to be constant[6].

$$(6.3)\quad \overline{DS_{s=m}\ DS_{s\neq m}} =$$

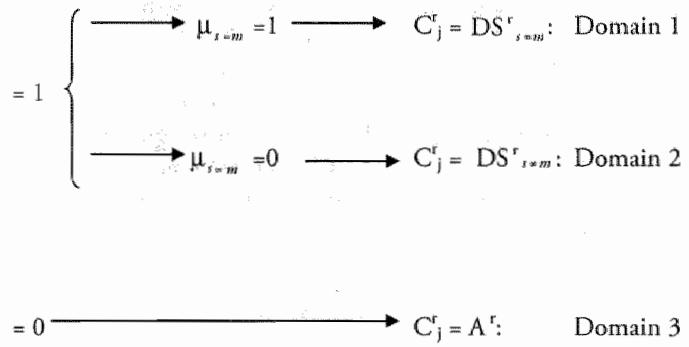
5. We will not add an index (s) to term A reflecting the field of study in which they are acquired, as we assume academic competencies to be transversal. Hence, the term 'academic' does not refer to elements common to different discipline-specific competencies but to the additional subject-independent content of these competencies (for a more detailed discussion on this point, see Chapter 2).
6. This assumption makes it possible to add up the level of discipline-specific competencies required but not acquired in the study program graduated from, ignoring the fact that they are of different types.

Hence, we assume that the step to be taken from, for example, discipline-specific competencies in business administration to the discipline-specific competencies in law to be the same as from discipline-specific competencies in business administration to the discipline-specific competencies in medicine. In this sense, c_s is determined by the closeness of a particular education programme to the others and hence by the broadness of the discipline-specific competencies that a graduate acquires. Combining (6.2) and (6.3), we get:

$$(6.4)\quad C_j^r = \eta_j * \left[\mu_{s=m} * DS^r{}_{s=m} + (1-\mu_{s=m}) \sum_{s=1}^{n} DS^r{}_{s\neq m} \right] + (1-\eta_j) * A^r$$

Restricting the overlap in an occupation between different types of discipline-specific competencies to $\mu_{s=m}$=1 or $\mu_{s=m}$=0 and/or between discipline-specific competencies and academic competencies to η_j=1 or η_j=0, we can classify the occupations from the perspective of education programme *m* into three domains:

(6.5)



Domains 1 and 2 include occupations in which importance is given to discipline-specific competencies. From the point of view of graduates from education programme m, Domain 1 is the group of occupations closely related to their own education programme (*the own discipline-specific competencies domain*), while Domain 2 is the group of occupations that require the discipline-specific competencies of another education programme (*the discipline-specific competencies domain of another education programme*). Domain 3 consists of occupations in a market segment that is characterized by a less strong link between occupations and a particular education programme. The focus of attention in this market segment is on academic competencies rather than on a particular type of discipline-specific competencies (*the academic competences domain).* However, these occupations still require a higher education diploma. This does not a priori imply that discipline-specific competencies are not important in this domain, but rather that either the discipline-specific competencies required in this domain are less likely to be acquired in higher education or that they are so new that they have not yet been incorporated in the higher education programmes.

6.2.2 Education programme characteristics

This section discusses the five indicators discerned to characterize the education programmes. It also formulates the expected relation between these indicators and the labour market situation, in terms of allocation and performance, of graduates.

a) Discipline-specific versus academic competencies

Higher education programmes are generally organized around a particular discipline or higher professional field and hence around the learning of discipline-specific competencies. However, in higher education, students acquire not only discipline-specific competencies but also academic competencies. In line with the characterization of occupations, we will write the outcome of higher education (C^a_i)[7] of student i graduating from programme s as a mix of these two types of competencies:

$$(6.6)\quad C^a{}_{i,s} = C^a{}_{i,s}(DS_{i,s}, A_i)$$

In spite of a possible symbiotic process between the acquisition of discipline-specific and academic competencies (see Chapter 4) that might take place in higher education, education programmes differ with respect to the weight of discipline-specific competencies and academic competencies as major or minor outcomes of the programme. In this sense, the particular mix of competencies which a representative student acquires during the study, is restricted by the placement of the education programme on the spectrum from discipline-specific to academic competence orientation. Assuming the competence mix outcome to be a linear combination, we can write:

$$(6.7)\quad C^a{}_{i,s} = \lambda_i * DS_{i,s} + (1-\lambda_i) * A_i$$

where λ_i is the weight given by the education programme completed by the graduate to the acquisition of discipline-specific competencies as a major learning outcome.

Structuring the education programme towards a *planned learning outcome of discipline-specific competencies* (λ_i close to 1), and hence perceiving the role of academic competencies solely as the means by which the learning of discipline-specific competencies is enhanced rather than an end in itself, provides the graduates on average with a relatively greater share of discipline-specific competencies[8]. To the extent that these competencies have a direct productive application value in occupations closely linked to the education programme completed ($\mu_{i=n}$ and η_j in equation 6.4 are close or equal to 1), we may expect these graduates to have an greater probability of finding their way into the own discipline-specific competencies domain (see also Chapter 5). Furthermore, we may expect these graduates to have a relatively greater comparative advantage when matched to an occupation in the own discipline-specific domain but a relative greater loss in the application of their discipline-specific competencies in other cases. In other words, whereas these graduates can be expected to find relatively

7. We use *a* to indicate the acquired level of competencies, as distinct from *r*, indicating the required level.
8. According to the findings in Chapter 4, these types of educational programmes may use rather traditional teaching styles and require from the students to attend a great deal of formal education.

higher wages inside the own discipline-specific domain, their wages are expected to be lower in other cases, and particularly to drop considerably when matched to an occupation in the discipline-specific domain of another education programme.

Structuring the education programme towards a *planned learning outcome of academic competencies* (λ_i close to 0) provides the graduates on average with a relatively greater share of academic competencies[9]. These programmes use the acquisition of discipline-specific competencies as the material needed to enhance the acquisition of academic competencies. The non-context-bound characteristics of academic competencies can be applied in a wide range of occupations and hence it is expected to find a more dispersed allocation of these graduates across the different occupational domains distinguished, with a tendency towards the academic competencies domain. Moreover, the allocation dependence of the wages is expected to be less.

b) Standardization of the competencies provided

In a world of complete and freely available information, employers can be expected to search for graduates who offer a mix of competencies resembling as closely as possible the mix of competencies required to optimize performance of their tasks. Conversely, graduates search for these occupations to maximize their wage rates. Unfortunately, the matching of higher education graduates to vacancies in the labour market does not take place in such a perfect world. In spite of an accurate perception of their competencies, characteristics and possibilities, graduates have only a vague notion of the exact working requirements. Similarly, employers, knowing what the working requirements are, are relative badly informed as to what extent the characteristics of the graduates match the requirements. Given this asymmetric distribution of information and its private character, employers face a time-consuming and costly evaluation of an applicant's productivity. In this sense, the standardization of education programmes with respect to the competencies taught can be an important cost-determining factor.

Let us assume that both the graduates' level of discipline-specific competencies and the level of academic competencies acquired in higher education are not perfectly measurable during the application procedure. More precisely, we can write:

$$(6.8)\quad DS_{i,s} = DS^{e}_{i,s} + \delta_{DSs}$$

$$(6.9)\quad A_i = A^{e}_{i} + \delta_{As}$$

where $DS^{e}_{i,s}$ and A^{e}_{i} are the revealed level of discipline-specific competencies of type s (indicating the higher education programme graduated from) and academic competencies of applicant (i), respectively, $DS_{i,s}$ and A_i are the real level of discipline-specific and academic competencies acquired by the graduate, respectively, and δ_{DSS} and δ_{AS} the measurement error unknown to the employer, assumed to be normally distributed around zero.

Inserting 6.8 and 6.9 into 6.7, the competencies mix offered by a graduate, from the employer's point of view looks as:

9. Chapter 4 showed that these types of educational programmes are more likely to provide activating learning environments in which self-study and addressing problems in group meetings play a central role.

$$(6.10)\quad C^{a}_{i,s} = \lambda_i * (DS^{e}_{i,s} + \delta_{DSs}) + (1 - \lambda_i) * (A^{e}_{i} + \delta_{As})$$

Equation (6.10) implies that graduates, after having been selected for an occupation, may reveal productive capabilities above or below the level initially measured. Both situations, a productivity lower or a productivity higher than the targeted one, may be regarded as undesirable by the employer, as they involve further costs at least partially to be born by him. If actual productivity is lower than targeted, the employer faces the decision between continuing the work contract and ending it. In the first case, the employer needs to invest in employee training. In the second case, he needs to restart the costly search process for a more suitable candidate. If actual productivity is higher than targeted, the employer may first profit from the situation. But he will be confronted to an increasing extent with an unsatisfied employee, who either demands higher wages or quits the job and forces the employer to restart the costly search for a new candidate.

A reduction in the measurement error is beneficial both for the employer, as it reduces the expected costs involved in hiring a graduate, and for the graduate, as it increases the wages offered. To address this problem, employers may prolong the application procedure and run more tests, or rely on information gathered through experience or accessed externally. In the latter case, the importance attached to the group membership of the graduate, as a source of conveying information with respect to the individual graduate, increases. The more homogeneous the group of students graduating from a particular education programme, the more information their group membership reveals about the individual graduate. In our case, a strong index[10] for this homogeneity is the standardization of an education programme with respect to the level of discipline-specific competencies or the level of academic competencies. The more standardized an education programme, the less variation between graduates' levels of competencies and hence the smaller the expected measurement error.

Concluding, it was found that the higher the degree of standardization of the education programme with respect to the competencies taught, the lower the expected transaction costs involved in hiring a particular graduate and hence the higher the wage rates offered to such graduates. The question arises if employers/graduates profit more from a standardization of discipline-specific competencies or from the standardization of academic competencies. The answer is related to the importance attached to one of the two competencies in the occupation to which the graduate is matched (see equation 6.4). If the vacancy offered matches the type of discipline-specific competencies which the graduate acquired in higher education, the standardization of the discipline-specific competencies will be of interest. If the graduate applies for an occupation outside the own discipline-specific competencies domain, and hence will have to acquire new types of competencies, the standardization of academic competencies, providing information with respect to the graduate's learning ability, plays a more important role.

c) Exclusive entrance

Our third characteristic concerns the fact that certain education programmes provide an exclusive possibility to enter certain labour market occupations. This holds in particular for

10. We follow Spence (1973) and refer to observable attibutes (which cannot be altered by the graduate) as indices, reserving the term *signals* for observable characteristics attached to the individual that are subject to manipulation by him.

law and health science studies. To be employed as a lawyer, one has to graduate in law and to be employed as surgeon, a medical study is a prerequisite. This guarantees employers and potential customers that the job holder has the necessary competencies to fulfil the tasks. Considering our intention to analyze the allocation of graduates over different occupational domains, this characteristic can undoubtedly be regarded as important.

d) Integration of learning and working

The increasing importance of knowledge in society and economy, and the implied shift from the importance of a classical scientific knowledge structure in disciplines towards specific contextualized knowledge (Hövels, 2003) stimulate larger interactions between learning in the classroom and economic life. In an economy in which knowledge capital adds more value than classical factors, such as physical capital, raw materials and physical labour, it seems less and less useful to distinguish between exclusive classroom education and learning that takes part outside the classroom (see e.g. Kessels, 1998). Higher education cannot afford to take a passive stand, but should initiate possibilities for co-operative education, providing opportunities for connecting the traditional higher university campus to the work environment. This helps students to acquire competencies "*that are difficult to acquire in the traditional university lecturing room, such as communication skills, the ability to work together in a team and being comfortable in a work environment*" (Kessels and Van Wijngaarde, 2003).

Strengthening the link between classroom teaching and direct acquisition of working experience imposes a trade-off between time spent on classical teaching of competencies and time spent on generating work habits and out-of-classroom competencies, contributing to a smooth integration of graduates into their first occupation. Co-op education not only enables graduates to apply their theoretical knowledge to real working situations, but also to take the new information and extended knowledge back to the classroom. Moreover, contacts established between employers and students and the information transfer taking place may help solve the information asymmetry during the transition period.

The strongest positive effects of co-op education can be expected for graduates who have actively participated in work placements or internships. However, the set-up of a co-op education programme can produce positive spillover effects for non-participating peers. First of all, stimulating and providing students with possibilities of internships or work placements outside the campus, generally goes hand in hand with structuring the curriculum itself in a more practically oriented way, allowing the two-way transfer of knowledge by graduates to be maximized. Second, non-participants may benefit at the time of graduation from the non-exclusive network with employers established by the educational institute they attended. Firms may contact lecturing staff with information on vacancies or firms may generally prefer students from a particular programme due to good experience with interns of this programme. Concluding, co-op education programmes may be expected to give graduates an increased probability of finding an occupation closely linked to the discipline taught and hence an occupation in which their central competencies are required.

e) Internationalization

"Internationalization" and "Globalization" are widespread terms in economic textbooks of the past 15 years. Mergers and acquisitions are no longer restricted by the frontier of a country or

continent. Contacts with foreign partners or customers have become the daily work of a large number of employees. Not surprisingly, we can see in the labour market a growing demand for graduates with knowledge of international affairs, international economics, international law or more generally, with the knowledge of foreign languages and cultures. In recent years, the internationalization of economic life is being reflected more and more in the internationalization of education. An increasing number of higher education students complete part of their studies in a foreign country. Moreover, education at home gets more and more internationalized by, for example, teaching part of the courses in a foreign language. The confrontation of graduates with this internationalization of education programmes may have its impact on the level of competencies of all graduates of the programme.[11] However, it may be of even more importance that it broadens the horizon with which graduates enter the labour market. As the labour market increasingly asks for "international" graduates, we expect the return to this asset to be positive.

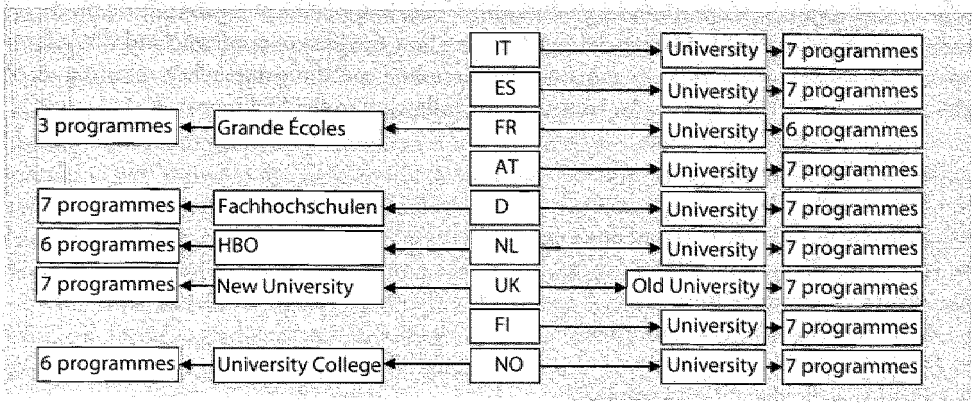
6.3 Data

We make use in this chapter of the pooled international data set described in Chapter 3. To control for differences between programmes of different higher education institutions in a country, we distinguish in France between university and Grande Écoles programmes, in Germany between university and Fachhochschulen programmes, in the Netherlands between university and higher vocational education programmes, in the United Kingdom between old and new universities, and in Norway between university and university colleges programmes. In Spain, Italy, Austria and Finland, no distinction is made. Although in Austria and Finland Fachhochschulen and Polytechnics, respectively, were introduced in the mid-1990s, the data used here do not cover graduates from these higher education institutions.

Considering our focus on education programmes and their characteristics, a first best approach would be to analyze narrowly defined education programmes (e.g. econometrics, business administration, economics, etc.), and to distinguish between the institutes offering these programmes (e.g. Econometrics at the University of Maastricht, Econometrics at the University of Amsterdam). Unfortunately, the data does not allow for such a first best approach and forces us to use a second best approach. We therefore aggregated over institutes in a particular higher education institution (e.g. university type higher education in the Netherlands) and over narrowly defined study programmes. For the latter, we made use of the information on the individuals' educational field provided by the International Standard Classification of Education (ISCED 3 digits). We recoded the 3-digit ISCED into 7 education fields, namely 'arts and humanities', 'social sciences', 'business', 'law', 'natural sciences', 'engineering' and 'health sciences'. Aggregating individual institutes could weaken the relevance of the results if individual institutes attracted/selected different types of students and such differences were not reflected in differences between the fields of study. Concluding, the data allows us to distinguish between a total of 91 different higher education programmes nested in 14 higher education institutions and nine countries (see Figure 6.1).

11. In Chapter 4, we showed that higher education students spending some time abroad during their studies have a higher level of academic competencies at the time of graduation, but at the same time a lower level of discipline-specific competencies.

Figure 6.1
Countries, Higher education institutions and programmes



Note: The Dutch HBO and the Norwegian University College institution do not provide a solid law programme. The French Grande Écoles institution teaches in particular business, natural sciences and engineering programmes. The number of respondents from French university health programmes is too small to be taken into account.

6.3.1 The measurement of the occupational domain

In Section 6.2, we proposed a division of occupations into three occupational domains, namely a domain in which optimal fulfilling of tasks requires graduation, and hence discipline-specific competencies of a particular programme, a domain in which discipline-specific competencies of another education programme offer a comparative advantage, and a domain in which in particular academic competencies are demanded. To group the graduates' occupations, we relied on the following question in the survey: *"How would you characterize the relationship between your field of study and your area of work?"* We assumed that the graduate worked in the own discipline-specific competencies domain if he answered that either "*my own field of study is the only/best preparation*" or *"a related field could as well prepare."* Graduates were assumed to work in the discipline-specific competencies domain of another programme if they answered that "*another field would have been more useful.*" Lastly, graduates were assigned to the academic competencies domain if they indicated that "*the field of study does not matter very much.*" Overall, a clear majority of graduates worked in their own discipline-specific competencies domain (75%), approximately 10% work in the domain of another education programme, and 15% in the academic competencies domain.

6.3.2 The measurement of the education programme characteristics[12]

a) Competence orientation of the programme
To measure the discipline-specific competence orientation of the education programme, we have used the information in the data set with respect to different competencies, representing demands for and supplies of knowledge. Graduates were asked to indicate on a five-point

12. The figures for the five educational programme characteristics are presented in Appendix 6A.

scale, ranging from 1 ('not at all') to 5 ('to a very high extent')[13], the extent to which they had a given competency at the time of graduation. Using a hierarchical clustering method, we retained two clusters of competencies representing best the idea of academic and discipline-specific competencies needed to measure the discipline-specific competence orientation of the programme[14]. The two clusters consist of the following individual items:

1. Academic competencies
» Learning abilities
» Reflective thinking, assessing one's own work
» Problem-solving abilities
» Analytical competencies
» Documenting ideas and information
2. Discipline-specific competencies
» Field-specific theoretical knowledge
» Field-specific knowledge of methods

For the analyses, we first calculated an average of the competence clusters possessed at the time of graduation per education programme. Second, we calculated the difference between the level of discipline-specific competencies and the level of academic competencies that an education programme provides to its graduates[15]. Hence, the competence orientation of a particular programme can range from −4 (extremely academically oriented) to 4 (extremely discipline-specifically oriented). On average, the education programmes scored slightly academically oriented (average score over all programmes is -0.05), ranging from -0.70 (law programme in the Old University institution of the United Kingdom) to 0.38 (health science programme at Austrian Universities). Moreover, the figures presented in Table 6.A1 of Appendix 6A indicate a strong country effect with respect to the competence orientation of programmes. As a matter of fact, programmes in Austria, Germany, the Netherlands and Norway scored strikingly more discipline-specifically oriented than programmes in other countries. Lastly, there were also some differences between higher education institutions inside a country. In particular, non-university higher education institutions on average scored slightly more discipline-specifically oriented. However, the relative ranking of an education programme is quite similar across the fourteen higher education institutions.

13. In the original questionnaire, the answers were coded from 1 ('to a very high extent') to 5 ('not at all'). To simplify the reading of the empirical analyses, we recoded the answers to range from 1 ('not at all') to 5 ('to a very high extent').
14. For a detailed discussion on the clustering method used, an overview of some descriptives with respect to the level of academic and discipline-specific competencies acquired by higher education graduates and required in the labour market, as well as for a discussion on the validity of the two constructs, please see Chapter 3.
15. The reason for not just simply taking the average level of discipline-specific competencies and the average level of academic competencies separately in the analyses, is that graduates in particular countries or in particular higher education institutions can be expected to score high (low) on both clusters depending on the extent of self-criticism. Using the difference between the two scores was a possible way to circumvent the problem of possible bias in the level of reported competencies.

b) Standardization

The standardization of an education programme was introduced as a measurement for the homogeneity of the graduates with respect to the competencies obtained during their studies. A simple way of measuring this was given by the variance of the discipline-specific competencies acquired by the graduates of a particular education programme and by the variance of the academic competencies. Being unaware of the institute concerned, it was necessary to be careful not to measure the variation between institutes but, as far as possible, the variation related to the heterogeneity between graduates. For this reason, we used the 'within' variance estimator extracted from an ANOVA analysis. To simplify the reading of the results, we then used the inverse of this as a measurement for the standardization of a programme.

The standardization figures reported in Appendix 6A (Table 6A.2a and 6A.2b) indicate that, on average, graduates are more homogeneous with respect to academic competencies than with respect to discipline-specific competencies.

c) Exclusive entrance

The third characteristic is based on the fact that certain education programmes exclusively offer entrance to certain labour market occupations. This holds in particular for studies in 'law' and 'health sciences'. To control for this in the empirical analyses, we explicitly used a dummy indicating whether the respondent graduated from either of these two fields of study. In total, 21% of the respondents graduated from these two fields of study, namely 8% from a law faculty and 13% from a health science faculty.

d) Work-learning relation

The data contains different questions with respect to the work-learning relation of the programme. Graduates were asked to indicate if they have completed an internship/work placement during their study as part of their degree course and were also asked to rank their programme with respect to the importance given to the direct acquisition of working experience. To circumvent the problem of cultural bias with respect to the second question and the problem that graduates might rank their programme depending on the extent to which their expectations were fulfilled, we used the percentage of graduates that took part in an internship/work placement as a measure for the extent of co-op education.

On average, 41% of the graduates completed an internship/work placement as part of their degree course. The lowest percentage was found for respondents that graduated from law faculties in Italy (only 1% followed an internship/work placement) and the highest percentage for engineering graduates of the French Grande Écoles institutions (92%).

e) Internationalization

The final education programme characteristic was the international orientation of the education programme. The only possible indicator provided by the data was the percentage of graduates that completed part of their study programme abroad. On average, 23% of the graduates spent some time abroad during their studies. The highest percentage was found for health sciences in the Dutch University institutions (56%), the lowest percentage for natural sciences in the Norwegian College institutions (4%).

Concluding this section, Table 6.1 reports on the correlation between the five programme characteristics. The results show that there are, in particular, positive relations between the discipline-specific competence orientation, the standardization of discipline-specific competencies, the standardization of academic competencies and the work-learning relation.

Table 6.1
Correlation between programme characteristics

	Discipline-specific competence orientation	Standardization of discipline-specific competencies	Standardization of academic competencies	Work-learning relation	Internationalization	Exclusive entrance
Discipline-specific competence orientation	1	0.42***	0.064	0.32***	0.04	0.06
Standardization of discipline-specific competencies		1	0.41***	0..29***	0.03	0.15
Standardization of academic competencies			1	0.22**	0.18	0.17
Work-learning relation				1	0.18	0.00
Internationalization					1	-0.09
Exclusive entrance						1

Note: ***/** correlation is significant at a 1%/5% level. Number of programmes included: 91.

6.4 Empirical Analyses

6.4.1 The empirical model

Our objective was to relate differences with respect to the allocation outcome of graduates across the three occupational domains and with respect to the wage rates paid to higher education programme characteristics. As these characteristics vary across the education programmes, but are by construction constant among the graduates belonging to the same programme, including them jointly in an estimation with individual characteristics ignores the possible stochastic properties of the parameters at the education programme level and is likely to bias the estimation results and the error term (see Moulton 1986). To address this problem, we followed Card and Krueger (1992), Heckman, Layne-Farrar and Todd (1996) and Case and Yogo (1999) and applied a two-stage procedure[16]. In the first stage, we estimated differences in the allocation outcome and wage rate between graduates from different education programmes. We estimated these effects with a fixed-effects model, and hence did not allow the individual covariates to differ according to the country or the higher education institutions from which the respondent graduated. We will return to this assumption in Appendix 6C when the model is tested for robustness. In the second stage, we regressed

16. According to Card and Krueger (1992), this approach provides a convenient reduction of the data and facilitates highly general models of, for example, the earnings function. Moreover, Heckman, Layne-Farra and Todd (1996) stated that this model has the 'beauty' of being derivable from a 'richly interpretable economic model of how quality affects earnings' (p. 599).

these 'fixed effects' on the programme characteristic indicators. In more detail, the empirical approach for allocation and income looks as follows.

a) Allocation

As there is, a priori, no explicit order between the three labour market domains discerned, we used in the first stage a multinomial logit model, which provided fixed effects for the education programmes comparing the probabilities of being allocated to an occupation inside a particular domain ("the domain of another programme" or the "academic competencies domain") with the probabilities of being allocated to an occupation in the reference domain ("the own discipline-specific competencies domain"). Formally, the model makes it possible to compute the log-odds ratios as follows:

$$(6.15)\quad \ln\left[\frac{P_{id}}{P_{i(d=0)}}\right] = \alpha_d + S_m * \gamma_{md} + X_i * \beta_d + \varepsilon_{id}$$

where $d=0,1,2$ indicates the own discipline-specific domain, the domain of another education programme and the academic competencies domain, P_{id} is the probability that individual i is allocated to an occupation inside domain d, $P_{i(d=0)}$ is the probability that individual i is allocated to an occupation in the reference domain, α a constant, S_m are the dummies for the education programmes m, X_i is a matrix of variables characterizing individual i, and β_d and γ_{md} are row vectors of coefficients for category d. To control the programme effects from influences on the individual level, we included as covariates the age of the respondent, gender, dummies for the pre-higher education grades, the socio-economic background of the student, the level of academic competencies, the level of discipline-specific competencies, dummies for internships and work placements, a dummy for spending part of the study in a foreign country, the self-reported level of adaptability, the importance given to the use of the competencies acquired in higher education and the family situation at the time of graduation. In the second stage, we regressed the fixed effects (γ_{md}) on the indicators discerned[17]:

$$(6.16)\quad \gamma_{md} = \delta_d + M_m * \phi_d + H_u * \eta_d + \Psi_{dm}$$

where γ_{md} is the fixed-effects log-odds ratios of the first stage, M_m a vector comprising the five education programme characteristics, H_u a vector with dummies identifying the higher education institutions graduated from (e.g. Dutch university) and Ψ_{dm} an i.i.d. error term.

b) Wage

The setup of the wage analyses is analogous to the allocation model approach. First, we estimated the education programmes' fixed-effects on wage rates, and second, we related these findings to the education programme characteristics. To take into consideration that the individual, as well as the education programme characteristics, might have different impacts,

17. Because the fixed effects that we tried to explain in the second stage regression were estimated coefficients, we weighted the least square regressions in the second stage by the inverse sampling variance of the first stage to take the preciseness of the first stage estimation into account.

depending on the occupational domain in which the graduate worked, we estimated the wage analyses for each of the three occupational domains separately[18].

$$(6.17)\quad Y_{id} = \omega_d + S_m * \nu_{md} + Z_{id} * \kappa_d + \varsigma_{id}$$

where Y_{id}, is the log hourly wage rate paid to graduates in occupational domain 0,1,2, ω_d a constant, S_m are the dummies for the education programmes, Z_i is a matrix of variables characterizing individual i and of his job and ς_{id} an i.i.d. error term. As covariates on an individual/occupational level, we included the age of the respondents, gender, dummies for the pre-higher education grades, the socio-economic background of the student, a dummy for having children, dummies for internships and work placements, a dummy for spending part of the study in a foreign country, the competence mismatch between the required and the acquired level, dummies for educational level mismatches, the tenure inside the occupation, dummies indicating part-time and permanent jobs, a dummy for private employers, a dummy indicating whether the graduate completed additional on-the-job training, the size of the firm and dummies for 16 different economic sectors.

Since we are interested in the way in which the discerned programme characteristics influence the wage of graduates in a particular domain, we rewrote in the second stage ν_{md} as an equation in which these characteristics were included:

$$(6.18)\quad \nu_{md} = \chi_d + M_m * \theta_d + H_u * \xi_d + \tau_{md}$$

where ν_{md} represents the domain-specific fixed effects of the education programmes on the wage rate, M_m a vector comprising the education programme characteristics, H_u a vector with dummies identifying the higher education institutions graduated from (e.g. Dutch university) and τ_{md} an i.i.d. error term[19].

6.4.2 Results

6.4.2.1 Allocation[20]

The first-stage estimation yields the fixed effects of the education programmes that we intend to analyze in this section. Table 6.B1 in Appendix 6B reports on the first-stage estimation findings, while Tables 6.B2 and 6.B3 do the same on the fixed effects found in it. We will first discuss the findings on the probability of working in the domain of another education

18. Although there is a substantial amount of literature on possible unobserved selection bias through variables influencing both allocation and wages (see Chapter 5), we assumed that unobserved variables in the allocation model were not correlated with the rate of return conditional on the other variables in the equation. We made this assumption to keep the estimation tractable, and because we focussed on educational program characteristics, which are unobservables in most studies of the return to education.
19. Comparably to equation 6.16, we used weighted least square to estimate 6.18. See also footnote 17.
20. We tested to what extent the results for the allocation model were influenced by not being able to control for the fact that graduates not working inside their own educational domain might also be more likely to work below their educational level. Restricting the analysis to graduates working at least on a higher education level did not qualitatively change the results presented in this chapter (data not shown).

programme relative to the probability of working inside the own educational domain. Next, we will address the relative probability of working in the academic competencies domain versus the own educational domain. Lastly, we will provide a combined discussion.

Table 6.2
Impact on the relative probability to work in *domain of another educational programme* versus *own discipline-specific domain* (standard errors in brackets)

	Model								
	0	1	2	3	4	5	6	7	8
Discipline-specific orientation		-1.02*	-1.80***						-1.54***
		(0.55)	(0.62)						(0.56)
(Discipline-specific orientation)^2			-3.97**						-2.42*
			(1.64)						(1.46)
Standardization of discipline-specific competencies				0.17					0.29
				(0.74)					(0.69)
Standardization of academic competencies					0.14				0.12
					(1.07)				(1.03)
Work-Learning						-0.01*			-0.003
						(0.004)			(0.003)
Abroad							-0.55		-0.65
							(0.88)		(0.78)
Dummy for law and health sciences								-0.68***	-0.75***
								(0.15)	(0.15)
Institutions dummies included	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adj. R2	0.40	0.42	0.46	0.39	0.39	0.42	0.39	0.53	0.58
N-cases	82	82	82	82	82	82	82	82	82

Note 1: All models further include an unrestricted constant and were estimated using WLS with the inverse sampling variance as weight.
Note 2: *** significant at 1% level, ** significant at 5% level, * significant at 10% level.

Table 6.2 presents findings of a series of regression models fitted to the estimated differences in the odds ratios comparing the probability of being matched to an occupation inside the domain of another education programme with the probabilities of being matched to an occupation inside the own discipline-specific domain. All models include not only the education programme characteristics, but also unrestricted dummies for the 14 higher education institutions distinguished, and a constant. Model 0, the baseline model, only includes dummies for the higher education institutions. Thereafter, the education programme characteristics are first introduced individually in Models 1 through 7, and second, jointly in Model 8. Tests with respect to the linearity in the estimated relation established that only for the discipline-specific orientation, the inclusion of the square measurement increased the fit. To keep all the following models comparable, we included the square of the discipline-specific orientation as an additional explanatory factor independent of being significant or not.

Entering the variables individually, we found that three characteristics, namely the discipline-specific orientation (and its square), the work-learning relation and the dummy for the 'special' programmes of law and health science showed a significant correlation with the dependent variable. When entered jointly, the discipline-specific orientation and the dummy for the 'special' programmes keep their significance while the work-learning relation loses

it. Whereas the latter effect simply proves the existence of borders around occupations in the health and law sectors[21], the impact of the competence orientation is of more interest. Graduates from both extreme types of course design, either highly academic or highly discipline-specifically oriented, have a decreased probability of working inside the domain of another education programme. We will return to this finding when discussing the results with respect to fixed effects of the probability of working in the academic competencies domain relative to working in the own educational domain. No impact was found for the internationalization indicator and the standardization indicators.

Table 6.3
Impact on the relative probability of working in *academic competencies domain* versus *own discipline-specific domain* (standard errors in brackets)

	Model								
	0	1	2	3	4	5	6	7	8
Discipline-specific orientation		-1.44**	-2.06***						-1.08*
		(0.57)	(0.65)						(0.58)
(Discipline-specific orientation)2			-2.59*						0.48
			(1.38)						(1.23)
Standardization of discipline-specific				0.64					0.13
competencies				(0.86)					(0.77)
Standardization of academic					0.48				-0.14
competencies					(1.21)				(1.11)
Work-Learning						-0.01*			-0.003
						(0.005)			(0.004)
Abroad							0.61		-0.55
							(1.01)		(0.81)
Dummy for law and health sciences								-1.05***	-1.07***
								(0.16)	(0.18)
Institutions dummies included	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adj. R2	0.36	0.39	0.42	0.36	0.35	0.37	0.35	0.62	0.62
N-cases	86	86	86	86	86	86	86	86	86

Note 1: All models further include an unrestricted constant and were estimated using WLS with the inverse sampling variance as weight.
Note 2: *** significant at 1% level, ** significant at 5% level, * significant at 10% level.

Let us turn now to the fixed effects of the probability of working in the academic competencies domain relative to working in the own educational domain. Table 6.3 reports on the second-stage results.

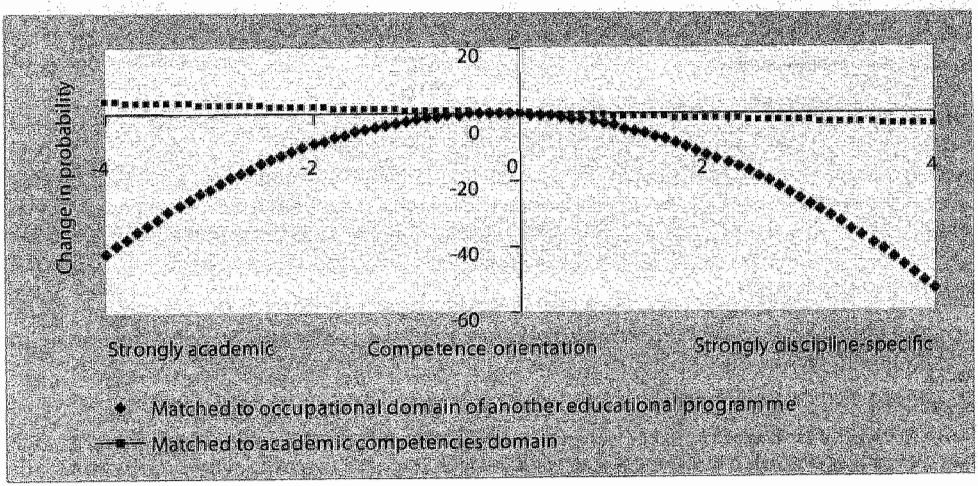
Entering the indicators individually, the competence orientation of the programme, the work-learning interaction and the dummy for the law and health sectors had a significant impact on the relative probability. Considering the work-learning co-operation, we can see that the results confirm the expectation that co-op education provides a closer link to occupations inside the own discipline-specific competencies domain. However, when entered jointly, the work-learning indicator loses its significance. Moreover, Model 8 reveals that, in contrast to the results presented in Table 6.2, the relation between the competence orientation and the outcome is purely linear. Hence, graduates from academic-competencies-oriented

21. Distinguishing in the models between the health and the law sectors does not qualitatively change the findings.

programmes have an increased probability of being matched to an occupation inside the academic competencies domain where their central competencies are of high value.

Combining the results presented in Table 6.2 and Table 6.3, we may conclude the following (see Figure 6.2). Graduates from highly academically oriented programmes are most likely to be matched to an occupation inside the academic competencies domain. Moving from the left to the centre, and hence towards programmes providing a balanced competencies approach, the probability of being matched inside the academic competencies domain relative to the own discipline-specific competencies domain is reduced. At the same time, the relative probability of being matched to an occupation in the domain of another education programme increases. Hence, graduates from balanced education programmes most likely have to accept an occupation in the domain in which neither their discipline-specific competencies nor their academic competencies are regarded as central. Lastly, moving further to highly discipline-specifically oriented programmes, we can see that both the relative probability of being matched to an occupation in the academic competencies domain and the relative probability of being matched to an occupation in the domain of another education programme is reduced. Hence, the allocation outcome seems to be very much in line with the implications of a comparative advantage approach. Graduates are matched, when possible, to activities that make use of the acquired competencies on a large scale. Moreover, the results indicate that if the labour market, as is often argued, is shifting towards academic competencies, programmes offering a highly discipline-specific competencies education need to change their programmes considerably, in order to avoid that their graduates have to accept occupations in which neither their type of discipline-specific competencies nor their academic competencies are valued highest.

Figure 6.2
Change in probability of being matched to ... relative to being matched to own education domain



Note: The figures were drawn for the full possible range of competence orientation (-4 to +4). The reader should bear in mind that the programmes under consideration have a range from -0.70 to +0.38.

Taking stock at the end of our first result section, we may conclude the following. The only two indicators of real relevance for the allocation outcome of the graduates, are the boundaries around the health and law sectors and the competence orientation of the education programme they followed. However, we would like to remind the reader that the first-stage results presented in Appendix 6B indicate that both participation in an internship or work placement and spending some time abroad during one's study, influence the allocation outcome of an individual graduate. In other words, the non-significance of these indicators in the second stage indicates that there are no spillover effects on the non-participating peers.

6.4.2.2 Wages

Analogously to the discussion on the allocation outcome, we will present the results of the second-stage wage analyses step by step[22]. We will start with the wages paid to graduates working inside the own discipline-specific domain, followed by a discussion of the findings for graduates working in the discipline-specific domain of another education programme and lastly, we will have a closer look at the wages paid to graduates working in the academic competencies domain. A point to be taken into account during the discussion of the results is the fact that graduates working inside the discipline-specific competencies domain of another education programme (the academic competencies domain) on average earn approximately 11% (4%) less than graduates working inside the own discipline-specific competencies domain.

Table 6.4
Impact on wages when working inside one's own domain (standard errors in brackets)

	Model								
	0	1	2	3	4	5	6	7	8
Discipline-specific orientation		-0.02	-0.05						0.03
		(0.07)	(0.07)						(0.09_
(Discipline-specific orientation)2			-0.26						-0.13
			(0.18)						(0.20)
Standardization of discipline-specific competencies				0.28**					0.18*
				(0.11)					(0.10)
Standardization of academic competencies					0.24				0.13
					(0.16)				(0.19)
Work-Learning						-0.001			-0.001
						(0.001)			(0.001)
Abroad							0.06		0.10
							(0.13)		(0.13)
Dummy for law and health sciences								-0.04**	-0.02
								(0.02)	(0.03)
Institutions dummies included	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adj. R2	0.90	0.90	0.90	0.91	0.90	0.90	0.90	0.90	0.91
N-cases	91	91	91	91	91	91	91	91	91

Note 1: All models further include an unrestricted constant and were estimated using WLS with the inverse sampling variance as weight.
Note 2: *** significant at 1% level, ** significant at 5% level, * significant at 10% level.

22. Table 6.B4 in Appendix 6B reports on the first-stage estimation findings, while Tables 6.B5, 6.B6 and 6.B7 report on the fixed effects extracted.

We will start by discussing a number of estimation models (Table 6.4) fitted to the estimated wage differentials between graduates of different education programmes, all working inside their own discipline-specific domain. Including the characteristics individually first (Models 1 through 7) results in the outcome that two characteristics reveal a significant influence on the wage rate. First, and in line with the expectations, we found that graduates from more standardized discipline-specific programmes on average receive higher wages. Second, we found that graduates from law and health faculties on average start with lower wages. No significant impact was found for the other characteristics, namely the discipline-specific orientation, the standardization of academic competencies, the work-learning relation and internationalization. Entered jointly, the negative impact of the dummy for law and health graduates is no longer significant, whereas the result with respect to the standardization of the discipline-specific competencies does not change qualitatively.

Table 6.5

Impact on wages when working in the domain of another educational programme (standard errors in brackets)

	Model								
	0	1	2	3	4	5	6	7	8
Discipline-specific orientation		-0.03	-0.10						-0.05
		(0.12)	(0.14)						(0.14)
(Discipline-specific orientation)2			-0.36						-0.28
			(0.38)						(0.36)
Standardization of discipline-specific competencies				0.29					0.24
				(0.231)					(0.17)
Standardization of academic competencies					0.65***				0.45*
					(0.22)				(0.26)
Work-Learning						-0.001			-0.001
						(0.001)			(0.001)
Abroad							-0.23		-0.18
							(0.19)		(0.19)
Dummy for law and health sciences								-0.06	-0.03
								(0.04)	(0.04)
Institutions dummies included	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adj. R2	0.83	0.84	0.84	0.84	0.88	0.83	0.82	0.82	0.88
N-cases	82	82	82	82	82	82	82	82	82

Note 1: All models further include an unrestricted constant and were estimated using WLS with the inverse sampling variance as weight.
Note 2: *** significant at 1% level, ** significant at 5% level, * significant at 10% level.

Table 6.5 reports on a series of models fitted to the estimated wage differentials between graduates of different education programmes, all working in the domain of another education programme. Entering the characteristics in a first step individually reveals the significant importance of one characteristic. We found that the standardization of academic competencies now takes over the role of the standardization of discipline-specific competencies in the estimations above. Hence, employers accepting graduates from education programmes not directly linked to the discipline-specific competencies of the occupation, profit from an increased standardization of academic competencies, which they at least partially transfer to the employee in the form of higher wages. No significant impact was found for the discipline-

specific competence orientation of the programme, work-learning interrelation, the internationalization of the programme, or the dummy for the studies of law and health sciences. When entered jointly, the individual impact of the standardization with respect to academic competencies did not change qualitatively.

Lastly, turning to a series of models (Table 6.6) fitted to the estimated wage differentials for graduates working in the academic domain, we found that the standardization of the academic competencies, as in the case above, again played a significant role in the determination of wage rates. Furthermore, when entered individually, the standardization of discipline-specific competencies also showed a significant impact. However, the individual impact of the academic competencies standardization was roughly twice as large as the impact of the standardization with respect to discipline-specific competencies. When entered jointly, the correlation between the two standardization measures, together with the fact that they both individually showed a slightly positive correlation with the wage rate, resulted in a loss of significance for both characteristics[23]. Comparing the results of Table 6.6 with the findings in Tables 6.4 and 6.5, we can see that the impact of the standardization of discipline-specific competencies, when taken individually, is smaller than inside the own discipline-specific competencies domain and that the same holds for the standardization of the academic competencies when compared to the results inside the discipline-specific competencies domain of another educational domain.

None of the other characteristics showed an impact on the graduates' wages in the academic competencies domain, either individually or when entered jointly.

Table 6.6
Impact on wages when working in academic domain (standard errors in brackets)

	Model								
	0	1	2	3	4	5	6	7	8
Discipline-specific orientation		0.02	-0.06						0.01
		(0.13)	(0.15)						(0.16)
(Discipline-specific orientation)2			-0.34						-0.34
			(0.31)						(0.21)
Standardization of discipline-specific competencies				0.21*					0.04
				(0.13)					(0.21)
Standardization of academic competencies					0.47*				0.46
					(0.26)				(0.30)
Work-Learning						-0.001			-0.001
						(0.001)			(0.001)
Abroad							0.05		-0.33
							(0.21)		(0.22)
Dummy for law and health sciences								-0.02	0.00
								(0.04)	(0.05)
Institutions dummies included	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adj. R2	0.91	0.91	0.91	0.91	0.92	0.91	0.91	0.91	0.92
N-cases	86	86	86	86	86	86	86	86	86

Note 1: All models also include an unrestricted constant and higher education institution dummies and were estimated using WLS with inverse sampling variance as weight. Note 2: *** significant at 1% level, ** significant at 5% level, * significant at 10% level.

23. Inserting in Model 8 both the other characteristics and only one of the standardization measures, does not qualitatively change the results presented in Models 3 and 4.

Taking stock at the end of this discussion on wage results, the following picture emerges. We proposed that standardizing the competencies outcome of students is a way in which an education programme may help improve the information provided to potential employers. These results clearly confirm this. More in detail, and considering the findings with respect to the allocation outcome, the results show that for graduates from an education programme that provides rather narrowly oriented discipline-specific competencies education, a high degree of standardization in discipline-specific competencies is profitable, and that for graduates from academically oriented programmes a comparable finding holds with respect to academic competencies. However, in the latter case this only applies when the characteristics are taken as the exclusive explanatory variable.

Considering the competence orientation of the programme, we expected graduates from discipline-specifically oriented programmes to lose considerably in terms of competencies applicability when not matched to an occupation inside the own discipline-specific competencies domain. The findings did not confirm this hypothesis. However, as these programmes are generally also more standardized with respect to discipline-specific competencies, their graduates do not benefit from it in contrast to their fellow-graduates working inside the own discipline-specific competencies domain. Moreover, the reader should bear in mind that competence orientation played a significant role in the allocation process and that the allocation outcome influences the average wages. Graduates working inside the own educational domain on average were paid highest, followed by graduates working in the academic competencies domain and graduates in the domain of another education programme.

With respect to the characteristics that measure how international an education programme is or how strongly it combines learning with working, we could not establish any positive spillover effects. However, we need to bear in mind that in two out of the three domains, spending some time abroad during the study period increases the wage rate on an individual level (see results presented in Appendix 6B, Table 4). Lastly, we did not find any evidence that graduates from the two special studies of law and health sciences were penalised extra when matched outside their highly regulated own educational domain. However, these graduates were more likely to find an occupation inside their own educational domain.

6.5 Concluding remarks

The objective of this chapter was to investigate to what extent specific characteristics of higher education programmes influenced the transition of graduates to working life. Key elements were the effectiveness of programmes in allocating graduates across various occupational domains and how graduates performed in the occupations they obtained.

We showed that programmes providing a highly discipline-specifically oriented outcome were most likely to place their graduates in the occupational domain with a related type of competencies. Similarly, programmes providing a highly academically oriented outcome placed their graduates in the academic competence domain. Independently of the country concerned, the results confirmed the strong reflection of the competence requirements on the labour market in the outcome of higher education programmes. Moreover, as shown in Chapter 3, programmes in discipline-specifically oriented countries (e.g. the Netherlands,

Austria, Germany) are on average more discipline-specifically oriented and programmes in academically oriented countries (e.g. the United Kingdom, France, Spain or Finland) are on average more academically oriented. This observation reasserts that higher education programmes target their output in line with the general institutional setup of the labour market, that is internal or occupational. So far so good. But the analyses also showed that graduates from programmes attempting a balanced mix in the competence outcome, were most likely to have to accept a lower-paying occupation, neither valuing their type of discipline-specific nor their academic competencies properly. This result indicates in particular a clear danger for programme designers in traditional discipline-specifically oriented countries. If the labour markets in these countries, as is often claimed, are changing gradually to a more academic-competence-oriented one, creating upward pressure for the demand and wages of higher education graduates in the academic competence domain, higher education programmes need to make a drastic adjustment with regard to the central competencies in their programmes.

The second result is that it is not enough for a programme to focus on a particular type of competence (academic or discipline-specific), but programmes must also produce a group of graduates that is highly harmonized with respect to this type of competence. Standardization of the competence outcome provides employers with better information on the actual productive capabilities of the graduates, reducing selection and adjustment costs and allowing higher remuneration of workers. Hence, in occupational labour market countries (e.g. Austria, Germany and the Netherlands) the preparation of graduates for the discipline-specific labour market has to go hand in hand with a standardized outcome in discipline-specific competencies. In countries with a strong internal labour market (e.g. the United Kingdom, France, Spain or Finland), it seems that preparing graduates for the academic orientation of this labour market type needs to go hand in hand with a standardized outcome in academic competencies.

Appendix 6A: Education programme characteristics

Table 6A.1
Discipline-specific competence orientation

	AH	SS	BU	LA	NS	EN	HE
ITU	-.21	-0.38	-0.30	-0.46	-0.16	-0.22	-0.40
ESU	-0.09	-0.34	-0.12	-0.34	-0.05	-0.30	0.07
FRU	-0.15	-0.24	-0.23	-0.22	-0.18	-0.29	N.A.
FRGE	N.A.	N.A.	0.54	N.A.	-0.30	-0.58	N.A.
ATU	0.02	-0.10	0.11	-0.04	0.15	0.19	0.38
DU	0.14	0.14	0.10	0.16	0.15	0.10	0.02
DFH	0.09	N.A.	0.27	0.23	-0.11	0.07	0.14
NLU	-0.06	0.15	0.07	-0.21	0.06	0.15	0.11
NLHBO	0.17	0.16	0.04	N.A.	0.15	0.05	0.13
UKU	-0.34	-0.41	-0.46	-0.70	-0.20	-0.30	0.22
UKNU	-0.25	-0.39	-0.38	-0.54	-0.34	-0.24	0.13
FIU	0.06	-0.10	-0.17	-0.23	0.00	-0.07	0.20
NOU	0.10	0.10	-0.32	0.38	0.19	0.04	0.34
NOC	0.23	0.37	0.03		0.00	-0.069	0.10

Note: Measured as (average of discipline-specific competencies) – (average of academic competencies) N.A.: not available; ITU = italian universities, ESU= Spanish universities, FRU = French universities, FRGE = French Grande Écoles, ATU = Austrian universities, DU = German universities, DFH = German Fachhochschulen, NLU = Dutch universities, NLHBO = Dutch higher vocational institutes, UKU = United Kingdom old universities, UKNU = United Kingdom new universities, FIU = Finish universities, NOU = Norwegian universities, NOC = Norwegian university colleges.

Table 6.A2a
Standardization of discipline-specific competencies

	AH	SS	BU	LA	NS	EN	HE
ITU	1.05	0.66	0.67	1.11	0.76	0.66	0.85
ESU	0.77	0.67	0.66	0.66	0.68	0.74	0.72
FRU	0.79	0.66	0.54	0.90	0.70	0.78	N.A.
FRGE	N.A.	N.A.	0.60	N.A.	0.52	0.59	N.A.
ATU	0.65	0.64	0.51	0.70	0.57	0.48	0.64
DU	0.55	0.59	0.63	0.63	0.51	0.53	0.74
DFH	0.64	N.A.	0.62	0.80	0.76	0.48	0.51
NLU	0.54	0.70	0.60	0.46	0.53	0.41	0.68
NLHBO	0.61	0.58	0.65	N.A.	0.60	0.49	0.56
UKU	1.15	0.92	0.94	0.97	0.95	1.07	0.99
UKNU	0.99	0.79	0.85	0.90	0.97	0.75	0.79
FIU	0.60	0.56	0.52	0.54	0.66	0.60	0.59
NOU	0.64	0.49	0.40	0.64	0.52	0.60	0.49
NOC	0.53	0.51	0.49	N.A.	0.32	0.59	0.54

Note: Measured as within variance of discipline-specific competencies; N.A.: not available.

Table 6.A2b
Standardization of academic competencies

	AH	SS	BU	LA	NS	EN	HE
ITU	0.36	0.40	0.36	0.48	0.40	0.40	0.44
ESU	0.57	0.40	0.42	0.49	0.41	0.42	0.48
FRU	0.43	0.45	0.32	0.45	0.41	0.41	N.A.
FRGE	N.A.	N.A.	0.32	N.A.	0.30	0.26	N.A.
ATU	0.40	0.36	0.40	0.44	0.29	0.35	0.45
DU	0.40	0.38	0.32	0.33	0.33	0.27	0.47
DFH	0.56	N.A.	0.38	0.34	0.14	0.35	0.27
NLU	0.37	0.32	0.25	0.27	0.03	0.26	0.34
NLHBO	0.39	0.42	0.28	N.A.	0.39	0.26	0.29
UKU	0.46	0.37	0.31	0.35	0.35	0.38	0.48
UKNU	0.50	0.29	0.32	0.32	0.45	0.47	0.47
FIU	0.37	0.39	0.35	0.34	0.38	0.34	0.39
NOU	0.35	0.30	0.28	0.30	0.33	0.35	0.38
NOC	0.42	0.33	0.26		0.22	0.34	0.37

Note: Measured as within variance of academic competencies; N.A.: not available.

Table 6.A3
Work-learning relation

	AH	SS	BU	LA	NS	EN	HE
ITU	3	7	8	1	5	14	14
ESU	41	38	24	7	19	30	51
FRU	23	37	69	28	48	69	N.A.
FRGE	N.A.	N.A.	86	N.A.	91	92	N.A.
ATU	27	36	20	7	17	25	65
DU	57	59	45	67	40	73	77
DFH	47	N.A.	45	78	77	47	71
NLU	57	67	68	46	63	74	52
NLHBO	57	87	82	N.A.	81	81	77
UKU	18	16	35	7	15	34	56
UKNU	23	19	34	7	35	43	52
FIU	31	51	14	5	27	46	44
NOU	17	14	23	17	9	30	35
NOC	58	61	5	N.A.	20	19	76

Note: Measured as the percentage of graduates who participated in an internship (or work placement) as part of their degree courses. N.A.: not available.

Table 6.A4
Internationalization

	AH	SS	BU	LA	NS	EN	HE
ITU	35	24	24	7	14	17	13
ESU	24	17	13	17	13	17	6
FRU	25	9	16	15	11	11	N.A.
FRGE	N.A.	N.A.	50	N.A.	23	28	N.A.
ATU	31	23	36	18	17	30	30
DU	27	23	23	23	19	33	42
DFH	20	N.A.	12	0	13	10	10
NLU	44	37	34	26	741	48	58
NLHBO	25	12	29	N.A.	16	28	11
UKU	37	19	28	27	18	21	49
UKNU	21	17	31	14	14	26	14
FIU	26	22	36	19	19	31	19
NOU	39	34	34	22	25	22	20
NOC	10	24	13	N.A.	4	9	11

Note 1: Measured as the percentage of graduates who completed part of their study programmes abroad. Note 2: N.A.: not available.

Table 6.A5
Exclusive entrance

	%
ITU	16
ESU	24
FRU	15
FRGE	N.A.
ATU	25
DU	18
DFH	13
NLU	22
NLHBO	18
UKU	15
UKNU	11
FIU	12
NOU	22
NOC	49

Note 1: Measured as the percentage of graduates who studied law or health sciences. Note 2: N.A.: not available.

Appendix 6B: First-stage model

a) First-stage estimation of allocation model

Table 6.B1

Multinomial logit analyses on allocation outcome

	Another domain		Academic domain	
	Coefficient	s.e.	Coefficient	s.e.
Constant	0.493	0.416	-0.112	0.394
Man	0.055	0.068	-0.005	0.063
Age	0.000	0.007	0.004	0.007
Low secondary grades	Ref.		Ref.	
Medium grades	0.035	0.081	0.054	0.079
High grades	-0.045	0.096	0.078	0.090
Higher educated parents	-0.236***	0.068	-0.088	0.062
Academic competencies	0.041	0.057	0.235***	0.054
Discipline-specific competencies	-0.266***	0.040	-0.213***	0.037
Short internship	-0.097	0.080	-0.064	0.075
Long internship	-0.193**	0.097	-0.349***	0.094
Short related employment	-0.366***	0.095	-0.187**	0.083
Long related employment	-0.317***	0.086	-0.348***	0.083
Time spent abroad	0.161**	0.079	0.017	0.074
Adaptability	-0.022	0.036	0.020	0.033
Importance to use own skills	-0.289***	0.040	-0.476***	0.036
Living with partner	-0.111	0.095	-0.099	0.085
Living with parents	-0.060	0.095	-0.032	0.087
Living with others	-0.124	0.106	0.023	0.095
-Log likelihood	-8228.95			

Note: Reference domain: own educational domain. Note: The model also includes 92 dummies for the different education programmes. Note: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 6.B2

Log odds: relative probability of being matched to an occupation inside the domain of another education programme to being matched to an occupation inside the own discipline-specific domain

	AH	SS	BU	LA	NS	EN	HE
ITU	Ref.	-0.16	-2.15	-1.11	-0.22	-1.54	n.e.
ESU	-0.04	-0.57	-0.86	-0.11	-0.30	-0.18	-0.68
FRU	-0.04	0.04	-0.51	-0.53	0.12	0.47	n.a.
FRGE	n.a.	n.a.	-0.96	n.a.	-0.33	-0.37	n.a.
ATU	-0.64	-0.02	-1.07	-0.98	-0.64	-0.63	-2.75
DU	-0.50	-0.73	-0.57	-0.86	-0.16	-0.52	-1.46
DFH	-1.49	n.e.	-0.96	-2.01	-0.44	0.00	-1.88
NLU	0.60	0.22	-1.14	-.10	-0.87	-0.17	-2.06
NLHBO	-0.40	-1.67	-0.36	n.a.	-1.80	-0.53	-0.87
UKU	-0.38	0.16	-1.46	n.e.	-0.24	-0.29	n.e.
UKNU	-0.54	-0.07	-0.44	-1.60	-0.25	-0.47	-1.42
FIU	-0.81	-0.53	-1.10	-1.00	-0.37	-0.49	-2.10
NOU	-0.68	-1.33	n.e.	n.e.	-0.82	-0.39	n.e.
NOC	-3.13	n.e.	-1.22	n.a.	n.e.	-1.18	-2.40

Note: N.A.: not available; N.E.: not estimated as no graduates worked in the domain of another programme.

Table 6.B3
Log odds: relative probability of being matched to an occupation inside the academic competencies domain to being matched to an occupation inside the own discipline-specific domain

	AH	SS	BU	LA	NS	EN	HE
ITU	Ref.	0.05	-0.74	-0.21	-0.39	-1.02	n.e.
ESU	-0.09	-0.66	-0.29	-0.64	-0.49	-0.79	-1.14
FRU	0.24	0.63	0.04	-0.31	-0.12	-0.17	n.a.
FRGE	n.a.	n.a.	0.02	n.a.	0.59	0.82	n.a.
ATU	0.38	0.46	0.75	-1.03	-0.09	0.47	-1.62
DU	0.67	0.48	0.11	-1.19	0.32	0.40	-1.81
DFH	0.24	n.e.	-0.09	-1.47	n.e.	-0.37	-0.34
NLU	1.30	0.72	0.28	-0.43	-0.38	0.39	-1.69
NLHBO	-0.19	0.90	0.48	n.a.	-2.00	-0.58	-1.10
UKU	1.50	1.58	0.92	0.12	0.83	0.42	-0.96
UKNU	0.30	1.42	1.11	-0.63	-0.02	-0.18	-0.68
FIU	-1.83	0.12	-0.26	-1.98	-0.85	-0.78	-3.08
NOU	-0.50	-0.49	n.e.	-1.07	-0.84	-0.58	-1.71
NOC	-1.68	n.e.	-0.65	n.a.	-1.14	-0.96	-1.92

Note: N.A.: not available; N.E.: not estimated as no graduates worked in academic competencies domain

Table 6.B4
First-stage wage analyses (OLS)

	Own domain		Domain of another programme		Academic competencies domain	
	Coefficient	s.e.	Coefficient	s.e.	Coefficient	s.e.
Constant	2.09***	0.034	1.99***	0.124	2.05***	0.122
Low secondary grades	Ref.		Ref.		Ref.	
Medium secondary grades	0.009	0.009	0.051*	0.028	0.018	0.029
High secondary grades	0.016	0.010	0.060*	0.033	0.012	0.033
Higher educated parents	0.016**	0.007	0.005	0.024	-0.006	0.023
Man	0.077***	0.007	0.091***	0.024	0.048**	0.023
Age	0.005***	0.001	0.012***	0.003	0.002	0.003
Short internship	-0.010	0.008	-0.019	0.028	-0.030	0.028
Long internship	-0.010	0.009	0.011	0.034	-0.011	0.034
Short related employment	0.009	0.009	-0.031	0.033	-0.009	0.030
Long related employment	0.033***	0.008	0.018	0.030	0.061**	0.030
Time spent abroad	0.006	0.008	0.101***	0.027	0.059**	0.026
Discipline-specific comp. Mismatch	-0.015***	0.003	0.007	0.007	0.013*	0.007
Higher education level required	0.006	0.010	0.060	0.039	-0.048	0.045
Lower education level required	-0.106***	0.009	-0.109***	0.024	-0.182***	0.023
Tenure	0.001***	0.000	0.000	0.000	0.002***	0.000
Part-time job	0.162***	0.010	0.090**	0.038	-0.081**	0.038
Private organization	0.025***	0.009	0.021	0.032	0.062**	0.030
Training followed	0.041***	0.007	0.084***	0.024	0.011	0.023
Children	0.017**	0.008	-0.014	0.030	0.069**	0.032
Organization size	-0.000***	0.000	0.000*	0.000	0.000	0.000
Adj. R-squared	0.40		0.45		0.39	

Note: All models also include dummies for the education programmes and dummies for 16 different economic sectors. Note: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 6.B5
Fixed-effects rate of returns for graduates working inside the own discipline-specific domain

	AH	SS	BU	LA	NS	EN	HE
ITU	Ref.	0.14	0.22	0.10	0.05	0.19	-0.10
ESU	-0.06	-0.08	-0.25	-0.13	-0.05	0.04	-0.17
FRU	0.38	0.30	0.32	0.26	0.44	0.39	n.a.
FRGE	n.a.	n.a.	0.56	n.a.	0.65	0.54	n.a.
ATU	0.53	0.48	0.66	0.36	0.52	0.52	0.33
DU	0.78	0.75	0.87	0.62	0.78	0.88	0.75
DFH	0.68	n.a.	0.69	0.49	0.83	0.80	0.57
NLU	0.37	0.49	0.58	0.55	0.46	0.53	0.54
NLHBO	0.32	0.28	0.32	n.a.	0.42	0.36	0.33
UKU	0.47	0.63	0.58	0.63	0.54	0.68	0.61
UKNU	0.43	0.28	0.54	0.49	0.63	0.59	0.69
FIU	0.59	0.47	0.63	0.63	0.55	0.61	0.63
NOU	0.78	0.79	0.90	0.85	0.79	0.85	0.88
NOC	0.62	0.64	0.86	n.a.	0.81	0.74	0.68

Note: N.A.: not available.

Table 6.B6
Fixed-effects rate of returns for graduates working inside the domain of another education programme

	AH	SS	BU	LA	NS	EN	HE
ITU	Ref.	0.24	0.23	0.07	0.36	0.06	n.e.
ESU	-0.21	-0.15	-0.09	-0.16	0.08	0.00	-0.22
FRU	0.16	0.21	0.38	0.28	0.42	0.27	n.a.
FRGE	n.a.	n.a.	0.45	n.a.	0.69	0.63	n.a.
ATU	0.53	0.65	0.61	0.51	0.59	0.80	0.72
DU	0.78	0.87	0.93	0.68	0.90	0.85	0.59
DFH	0.93	n.a.	0.72	0.31	0.88	0.90	0.52
NLU	0.41	0.44	0.37	0.72	0.41	0.44	0.37
NLHBO	0.27	0.31	0.32	n.a.	0.41	0.25	0.18
UKU	0.61	0.47	0.66	n.e.	0.61	0.64	n.e.
UKNU	0.37	0.49	0.67	0.76	0.38	0.58	0.63
FIU	0.49	0.55	0.55	0.67	0.45	0.56	0.77
NOU	0.73	0.85	n.e.	n.e.	0.88	0.92	n.e.
NOC	0.42	n.e.	0.87	n.a.	n.e.	0.75	0.61

Note: N.A.: not available; N.E.: not estimated as no graduates worked in the domain of another programme.

Table 6.B7
Fixed-effects rate of returns for graduates working inside the academic competencies domain

	AH	SS	BU	LA	NS	EN	HE
ITU	Ref.	0.04	0.37	0.58	0.11	0.44	n.e.
ESU	-0.16	0.12	0.02	0.08	-0.07	0.26	0.02
FRU	0.49	0.57	0.51	0.57	0.57	0.65	n.a.
FRGE	n.a.	n.a.	0.76	n.a.	0.94	0.81	n.a.
ATU	0.66	0.66	0.85	0.78	0.85	0.96	0.36
DU	1.13	0.94	1.12	1.15	1.12	1.13	0.62
DFH	0.65	n.a.	1.02	0.71	n.e.	1.11	0.79
NLU	0.65	0.71	0.79	0.92	0.77	0.86	0.78
NLHBO	0.45	0.55	0.49	n.a.	1.19	0.61	0.53
UKU	0.80	0.79	0.84	0.36	0.78	0.73	0.69
UKNU	0.62	0.61	0.74	0.89	0.81	0.63	0.96
FIU	0.52	0.75	0.86	0.46	0.87	0.80	0.79
NOU	1.05	1.08	n.e.	1.17	1.02	1.17	1.19
NOC	0.97	n.e.	1.04	n.a.	1.56	1.00	0.91

Note: N.A.: not available; N.E.: not estimated as no graduates worked in academic competencies domain.

Appendix 6C: Robustness Tests

A critical assumption in the first-stage estimations, in which we tried to explain the allocation outcome and wage rate by individual/occupational characteristics and by the dummies for the different education programmes, is the use of fixed-effects models. In this way, we force the covariates to have a homogeneous impact for graduates from different education programmes. This assumption may harm the analyses in cases in which an existing differential impact is at least partially taken over by the education programme dummies that we try to explain in the second stage. To test to what extent the extracted fixed effects of the education programmes are biased by this restriction, we re-estimated the allocation function and wage analyses separately for each of the higher education institutions and then extracted from these analyses the fixed effects for the education programmes. Logically, the first best approach would have been to estimate the allocation function for each education programme in each higher education institution separately. Unfortunately, this approach is not possible, as the number of respondents per education programme is too small, considering they are also allocated over three labour market domains.

Table 6.C1 presents the correlation coefficients between the fixed effects of an education programme when extracted from a pooled estimation with all higher education institutions included ('Extraction 1'), and the fixed effects of an education programme when extracted from estimations separately for each higher education institution ('Extraction 2').

Table 6.C1
Correlations

		Extraction 2				
		Pao	Pgo	Wo	Wa	Wg
Extraction 1	Pao	0.89				
	Pgo		0.94			
	Wo			0.87		
	Wa				0.89	
	Wg					0.93

Note: All correlations are significant at a 1% level
Note: P_{ao}: Probability of working inside the domain of another education programme versus Probability of working inside the own domain
P_{go}: Probability of working inside the academic competencies domain versus Probability of working inside the own domain
W_o: Wage rate paid to graduates working inside the own domain
W_a: Wage rate paid to graduates working inside the domain of another educational programme
W_g: Wage rate paid to graduates working inside the academic competencies domain

In all cases, we can see that the correlations between the fixed effects, as used in this chapter, (Extraction 1) and the fixed effects extracted from first-stage analyses carried out for each higher education institution individually are on a very high level. In other words, although using a fixed-effect model forces the covariates to behave in a homogeneous way over all higher education institutions, this has no real impact on the fixed effects that were extracted and used in the second stage as dependent variables.

Chapter 7

Concluding remarks

The acquisition and maintenance of competencies valued in the labour market is crucial for school-leavers in general and for higher education graduates in particular. Changes in the modern workplace have intensified the debate concerning the kind of competencies that are required in a knowledge-driven economy and the kind of competencies that are best acquired in education. As a result, political and analytical interest have started to focus on the quality dimension of schooling and the impact of quality differences in human capital on the labour market success of graduates (e.g. Hanushek, 2002, 2004).

The objective of this thesis is to add to the ongoing discussion on the measurement of human capital. More specifically, we propose a human capital output measurement of higher education that explicitly distinguishes two specific types of competencies that are acquired by students. On the one hand, there are the discipline-specific competencies based on the cognitive knowledge of the graduate that allow him to perform productively in a restricted labour market area. On the other hand, there are the academic competencies that cover the ability of knowing how to (re)learn, how to address problems and how to deal with information and ideas. In contrast to discipline-specific competencies, academic competencies enable the graduate to adapt easily and flexibly to changes in the labour market and to acquire, where necessary, new competencies. Accordingly, this measurement covers competencies that are crucial for higher education graduates in order to succeed in a knowledge-driven economy. Moreover, they are of strong relevance during the transition period from higher education to the labour market, as discussed in this thesis. In the case of discipline-specific competencies because they provide direct productive knowledge, and in the case of academic competencies because they support a graduate in closing any remaining gaps between what the labour market currently asks and what the graduate has acquired in higher education. Lastly, the relevance of these two types of competencies has long historical roots, as indicated by the following quotation from a speech by Condorcet before the French National Assembly in 1792:

> *« Education has to be universal, i.e. it has to reach every citizen. In different levels, education should embrace the entire realm of human knowledge and provide humans at every stage of their life with the ability of conserving their knowledge and acquire new competencies. We will teach the people new laws, observations in agriculture, economic methodology one should not ignore: we will show them the art of learning by themselve »*
> (Cited in Werquin, 2002)

The proposed measurement makes it possible first to address in more detail the production process in higher education. In particular, we have analyzed the way in which higher education may stimulate the acquisition of discipline-specific and academic competencies and to what extent the stimulation of one type of competencies induces a reduced effectiveness in the acquisition of the other type. Second, the measurement makes it possible to investigate the relevance of the two key types of competencies for a successful transition from higher education to the labour market. In this light, we related findings from our research to the often stated claim that the weight which the labour market attaches to academic competencies is increasing, and we have asked what responses are needed to enable higher education

graduates to be well-prepared for a knowledge-intensive economy. The four main insights from this study are as follows:

The *first main finding* (Chapter 3) shows an original way to measure higher education output in terms of discipline-specific and academic competencies on the basis of self-reported competence levels. The measurement provides clear insights into the competencies acquired by graduates and is flexible enough to cope with changes in the set of both acquired and required competencies. Furthermore, its Europe-wide applicability provides an innovative way of characterizing higher education programmes and higher education systems along a continuous scale, ranging from academically to discipline-specifically oriented. We have shown that higher education systems in the Netherlands, Germany and Austria, in line with their occupationally oriented labour markets, are discipline-specifically oriented and that higher education systems in the United Kingdom, France, Finland and Spain are academically oriented, matching well the expectations of an internal labour market. Our approach also makes it possible to spot differences in the relative competence orientation of Bachelor and Master programmes in the future. Future research may provide more detailed insight into the outcomes of the two higher education phases currently being introduced in all European countries, and facilitate the matching of graduates with occupations.

The *second insight* (Chapter 4) is that both the learning environment at the higher education institute and the time allocation of students over different study activities, determine to a great extent the type and level of competencies that students have at the time of graduation. When aiming higher education at a discipline-specific output, the teacher needs to be given a central role in transferring cognitive knowledge, attending formal education needs to be stimulated and higher education institutes need to facilitate students in finding work that is closely related to the field of study followed at that moment of time. On the other hand, when targeting higher education at an academic competence output, there is a clear need for activating learning environments. It is also of relevance to observe that implementing an activating learning environment does not harm the acquisition of discipline-specific competencies and, as a matter of fact, combining an activating learning environment with a strongly present teacher enables a shift beyond the learning frontier with respect to both academic and discipline-specific competencies, compared to conventional lecture-based teaching methods.

The policy implications of these findings are fairly clear-cut. First, the claim that academic competencies are increasingly being regarded as of crucial value in the labour market should be combined with strong stimulation of activating learning environments in higher education. This holds in particular in traditional discipline-specifically oriented systems (e.g. in the Netherlands, Germany and Austria). Second, the finding that activating learning environments promote the acquisition of academic competencies, providing a strong basis for further learning, needs to be taken into consideration when deciding on reshaping the curriculum contents according to the setup of a Bachelor/Master structure. Applying activating learning environments in the Bachelor phase allows students to enter the Master phase with a strong basis of academic competencies, yielding an effective acquisition of the specialized discipline-specific competencies taught at that level.

The *third main finding* (Chapter 5) is that discipline-specific and academic competencies play a distinct role in the transition from higher education to work. Their role seems to be related to the institutional rules of the labour market, that is, internal versus occu-

pational labour market. We found that in an occupational labour market setting (e.g. the Netherlands, Austria or Germany), the discipline-specific competence level of graduates is a primary determinant in the allocation outcome. Moreover, a lack with respect to either the level or the type of discipline-specific competencies reduces productivity considerably, and hence also the wage rate. In contrast, we found that in internal labour market countries (e.g. the United Kingdom or France), the discipline-specific competence level does not influence the allocation outcome, nor does a lack in the required level of discipline-specific competencies affect the wage rate. The role of academic competencies, independently of the labour market setting, is that of enabling the graduate to be flexible and to get access to further learning situations, that is, on-the-job training. Accordingly, these results indicate that there is a complementary relation between the level of academic competencies taught in higher education and further on-the-job training.

The finding that in countries with an occupationally oriented labour market, the level of discipline-specific competencies that graduates possess still plays a relatively more important role than the level of academic competencies, must not be interpreted as a reassurance that higher education institutes would do well to focus on discipline-specific competencies. Rather, combining a strong teacher presence with an activating learning environment, helping to increase the effectiveness with which both academic and discipline-specific competencies are acquired, would allow the matching between graduates and occupations to work further in an effective manner and at the same time prepare students in these countries better for changes that are taking place.

Lastly, the *fourth insight* (Chapter 6) seems to reassert that higher education programmes target the competencies taught to their students in line with labour market requirements. We found that higher education programmes that provide a strong discipline-specific outcome are more likely to place their graduates in the occupational domain with related competencies. Programmes that provide a strong academically oriented outcome place their graduates in the domain that asks for academic competencies. However, to guarantee an effective transition from higher education to the labour market, it is not enough just to focus on one type of competencies, but institutes also need to target a standardized output. The analyses show that reducing the variability between graduates, in terms of the level of competencies they possess, improves the information provided to employers. This reduces selection and adjustment costs and facilitates a higher remuneration of the graduates.

Considering the distinction between countries with an occupational labour market and countries with an internal labour market, our findings seem to indicate in particular the following: higher education institutes that prepare graduates for an occupational labour market should focus on the acquisition of a standardized discipline-specific competence outcome; higher education institutes that prepare graduates for an internal labour market should focus on the acquisition of a standardized academic competence level.

This study has answered several important questions with respect to the acquisition of discipline-specific and academic competencies in higher education, their role in the allocation across occupational domains, the selection for on-the-job training and their monetary value in the labour market. However, the study leaves room for relevant research in different directions in the future. We will point out some aspects for future research.

The focus of this study was on two types of competencies, namely discipline-specific and academic ones, and we restricted the analyses to the first three to four years in the labour market. In spite of the benefits of these restrictions, expanding the set of competencies and the time frame under consideration seems a fruitful area for further research.

Considering, as is often stated, the growing need for higher education graduates to be properly prepared for responsible management positions in a post-industrial economy with global competition, the question to what extent competencies characteristic for managerial behaviour, such as leadership, negotiation skills but also a variety of 'people skills', are effectively taught in higher education, is of particular interest. Are activating learning environments as effective in teaching competencies needed for managerial tasks as they are in teaching academic competencies? Does the number of hours that students attend formal education matter, as it does for discipline-specific competencies, or are such competencies acquired through extra-curricular activities and active working experience?

With respect to the short time period under consideration, we may ask to what extent these findings are influenced by this aspect. In particular, looking at the first three to four years may be too short to reveal the full impact of academic competencies, measuring the graduates' flexibility, adjustability and ability to (re)learn (new) competencies. Extending the time frame may reveal interesting findings with respect to long-term labour market careers of higher education graduates. Does a high level of academic competencies enable graduates to acquire competencies later on in their careers which are less likely to be acquired effectively in school (e.g. management competencies) but which may influence their long-term labour market success? Are graduates with a high level of academic competencies better equipped for re-entry into the labour market if they (voluntarily) drop out of the labour market for some time?

Lastly, we contrasted where appropriate the findings with the institutional labour market setting of a country, focusing on internal versus occupational labour markets. One may go further along this line and argue that cultural differences between countries resonate in many aspects of social life and steer selection and sorting processes of employees in the labour market. This is because general cultural differences at the national level influence the overall psychological construction of the self (see e.g. Kitayama, Matsumoto, Markus, Norasakkunkit, 1997). To the extent that individuals are imprinted with these values, cultural norms and values determine what people regard as important and what they value in the labour market. Employers may be inclined to design jobs with characteristics that are congruent with imprinted national cultural values and they favour employees whose characteristics and competencies fit these values. Employees may value jobs that require competencies which fit their cultural 'self' more than jobs which do not. Analyzing the extent to which work that matches the cultural 'self' of the employee is more rewarding, yielding a more productive and satisfied employee, is an interesting line for future research. Moreover, this line would allow an analysis of the extent to which internationalization and globalization of the economy reduces the cultural differences and harmonizes the labour markets in terms of, for example, job characteristics. Lastly, it allows further cross-national comparisons resulting in important insights in the chances and risks of cross-national mergers.

Summary

Research on the measurement of competencies, considered to be an accurate and reliable way of representing individual capacities valued in the labour market, seems to be a conditio sine qua non to enhance our understanding of the transition from higher education to the labour market. For this reason, this study first presents a discussion on the type of competencies that are regarded as key competencies for higher education graduates to succeed in the labour market. Second, it presents analyses on the questions how to define human capital in terms of competencies, how competencies are acquired in higher education, and what the role and value are of the competence output of higher education in the labour market, both at an individual and at a study programme level.

To start with, *Chapter 2* has a twofold objective. First, there is a discussion of the theoretical notions on the impact of education on labour productivity. Second, we addressed the topic of a qualification granted to higher education graduates as a vector of heterogeneous competencies. We indicated that common economic theories, and in particular models in line with the assignment theory, provide a good basis for this study. Nevertheless, we argued that static labels generally used in previous research to describe higher education output, such as the study field or the type of higher education completed (e.g. Fachhochschulen), cannot cope with the constantly evolving competence mix demanded in the labour market and taught in higher education programmes. As a result, we discussed the different types of competencies which make up the human capital that graduates acquire. The term 'competency' is used to indicate a group of skills, referring to one underlying dimension and forming the condition to fulfil complex tasks inside and outside the working sphere. In this way, the ability to heat up the oven, the ability to cut the meat, and the ability to name different herbs are regarded as skills, whereas the combined knowledge of these skills is what makes a chef competent. We propose that in particular a distinction between discipline-specific competencies and academic competencies is important for a study on higher education graduates. Discipline-specific competencies constitute the cognitive knowledge of a graduate, which allows him to perform productively in an often restricted labour market area. Academic competencies cover the ability of knowing how to (re)learn, how to address problems and how to deal with information and ideas. In contrast to discipline-specific competencies, academic competencies allow the graduate to adapt easily and flexibly to changes in the labour market and to acquire, if needed, newly required competencies.

In *Chapter 3*, we put theory into practice. We discussed and proposed a flexible way of measuring the output of higher education in terms of the level of academic and discipline-specific competencies acquired by graduates. To do so, we first discussed the **C**areers after **H**igher **E**ducation: a **E**uropean **R**esearch **S**tudy (CHEERS), which provided the data. The data covers students from all types of higher education in nine European countries who graduated in 1994/1995. The countries included are Italy, Spain, France, Austria, Germany, the Netherlands, the United Kingdom, Finland and Norway. As central element of this study,

the written questionnaire asked respondents to indicate the levels of different skills they possessed at the time of graduation and the levels of the skills required in their current occupation (approximately 3 years after graduation). Using hierarchical clustering methods, we established that there are two Europe-wide clusters of skills resembling the above-mentioned theoretical constructs of discipline-specific and academic competencies. The former consists of 'field-specific theoretical knowledge' and 'field-specific knowledge of methods'. The latter includes 'documenting ideas and information', 'problem-solving ability', 'analytical competencies', 'learning abilities' and 'reflective thinking, assessing one's own work'. These two competence clusters form the higher education output measurement set which is at the centre of this study. The originality of this measurement lies mainly in two particular features. First, it allows one to get a clear insight in the competence heterogeneity of graduates of a given study programme. Second, it is flexible and is able cope with the above-mentioned constantly evolving mix of competencies taught at higher education and competencies required in the labour market.

Next to capture the individual heterogeneity in output achievements, we showed that the proposed measurement provides an innovative way of characterizing higher education programmes and higher education systems. Previous typologies located programmes or systems only at two extreme poles (academic or discipline-specific). Our approach locates them on the continuous scale between these two extreme poles. According to this measurement, Germany, Austria and the Netherlands in particular have discipline-specifically oriented higher education systems that are well-suited to their occupationally oriented labour markets. The United Kingdom, Spain, France, and to a lesser extent Finland, can be classified as countries with academically oriented higher education systems, in line with the characterization of their labour markets as internal labour markets.

In *Chapter 4*, we addressed the production of discipline-specific and academic competencies in higher education. In the last decades, the upcoming criticism on traditional teaching styles has led to a widespread implementation of activating learning methods, such as problem-based or project-based learning, placing the learner at the centre and expecting him to be an active discoverer instead of a passively fed student.

Consequently, the first objective of Chapter 4 is to analyze the extent to which activating learning environments are more effective in teaching competencies in general and academic competencies in particular. In addition to the learning environment, the student's individual time allocation over different study activities (e.g. attending formal education, self-study or paid work activities) is regarded as a core element of the production process discussed. The results indicate that the setup of higher education needs to be in line with the targeted output and hence the requirements of the labour market. To prepare students for their entry in an occupational labour market (traditionally found in countries such as Austria, Germany and the Netherlands), expecting from graduates a strong congruence between the acquired type of discipline-specific competencies and the type of discipline-specific competencies required in the labour market, teachers need to transfer discipline-specific knowledge to students (independent of the question whether the institute implements activating learning methods or not), class attendance needs to be emphasized and institutes need to facilitate the matching of students with study-related occupations if students intend to work alongside to their studies. All of these aspects guarantee that students acquire a high level of discipline-specific compe-

tencies. In contrast, to prepare students for the requirements of an internal labour market, as found for example in France and the United Kingdom, activating learning environments are an obvious necessity. In addition, emphasis needs to be put on self-study and, as in the case above, on study-related paid work.

In *Chapter 5* we investigated the role and value of discipline-specific and academic competencies acquired in higher education in the labour market. We focused on the situation in the Netherlands, with its traditionally occupationally oriented labour market (similar to Austria and Germany). However, where appropriate, we pointed out differences found when considering countries such as the United Kingdom or France, with a relatively higher degree of internal labour market. To start with, we examined a possible direct link between the competence level present at the time of graduation and the wage rate received three years later. Neither for the level of academic competencies nor for the level of discipline-specific competencies was such a direct link established. However, we found that a lack in either the type or the level of discipline-specific competencies in relation to the required type or level significantly reduced the wage rate. A result that is typical for occupational labour market countries, but is not found in countries with an internal labour market.

Then we analyzed the roles of the competence constructs in the allocation of graduates over different occupational domains and on the selection of graduates for further on-the-job training. The results indicate, first, that the extent to which Dutch graduates are matched to an occupation that matches their field of study is strongly influenced by the level of discipline-specific competencies which the graduates possess. As these occupations are better paid, being selected for them is important for graduates from a monetary point of view. Comparable situations are found in other occupationally oriented European countries, but a less significant role of the acquired level of discipline-specific competencies in the allocation outcome is found in academically oriented countries such as the United Kingdom or France. Second, we showed that academic competencies acquired in higher education play a major role in who is selected for further training, which in itself increases productivity and hence wage rates. So, training and the level of academic competencies acquired in higher education are complements, and academic competencies are used to adjust the discipline-specific competencies of graduates to the requirements of the labour market. In contrast to the earlier findings in this chapter, this result is independent of the competence orientation of the higher education system or the institutional setting of the labour market.

There is no doubt that individual characteristics are crucial for success in the labour market. However, given the fact that the transition from higher education to work takes places in a context with asymmetric and private information on both sides of the market, group characteristics may provide relevant signals to employers with respect to the true productive capabilities of the applicants. To address this feature, *Chapter 6* analyses the impact of five typical characteristics of higher education programmes on the allocation outcome and the performance of graduates in the labour market. The characteristics considered are the competence orientation (discipline-specific versus academic), the standardization with respect to the acquired competencies, the extent to which the programme is international, the extent to which it integrates studying and working, and the extent to which the programme provides exclusive entrance to certain occupations (e.g. health studies).

We showed that programmes providing a strong discipline-specifically oriented outcome are most likely to place their graduates in the occupational domain with a related type of competencies. Comparably, programmes providing a strong academically oriented outcome place their graduates in the academic competence domain. As programmes in occupationally oriented countries are relatively more discipline-specifically oriented and programmes in countries with an internal labour market are relatively more academically oriented, this observation reasserts that higher education programmes target their output in line with the general institutional setup of the labour market (i.e. internal or occupational). However, it is not enough for a programme to focus on a particular competence type (academic or discipline-specific), but programmes should preferably also create a group of graduates that is strongly harmonized with respect to the central competence type. Standardization of the competence outcome provides employers with better information on the true productive capabilities of graduates, reducing selection and adjustment costs and allowing for a higher remuneration of workers. In other words, to guarantee a successful transition from higher education to the labour market in countries with an occupational labour market (e.g. Austria, Germany or the Netherlands), the preparation of graduates for the relatively discipline-specifically oriented labour market needs to go hand in hand with a standardized outcome in discipline-specific competencies. In countries with a strong internal labour market (e.g. the United Kingdom or France), preparing graduates for the academic orientation of this labour market type has to be in line with a standardized outcome in academic competencies. No significant impact on the labour market outcome was found for the *internationalization* of the study programme and its *integration between studying and working*. However, graduates from programmes providing exclusive entrance to certain occupations are more likely to be matched to occupations that correspond to their discipline-specific competencies.

Chapter 7 summarizes the main findings. We also discussed some shortcomings of the study and pointed out topics for future research. With respect to the latter point, we argued that in particular an expansion of the set of competencies taken into account (e.g. management competencies) and the time frame under consideration (e.g. 5 or 10 years after graduation) should yield fruitful areas for further research.

Samenvatting

Onderzoek naar het meten van competenties, dat wordt gezien als een nauwkeurige en betrouwbare manier om individuele capaciteiten weer te geven waarop de arbeidsmarkt prijs stelt, lijkt een conditio sine qua non voor een beter inzicht in de overgang van hoger onderwijs naar de arbeidsmarkt. Om deze reden wordt in dit onderzoek eerst besproken welke soorten competenties worden beschouwd als kerncompetenties voor afgestudeerden uit het hoger onderwijs om met succes te kunnen opereren op de arbeidsmarkt. Ten tweede worden analyses gepresenteerd met betrekking tot de vraag hoe menselijk kapitaal moet worden gedefinieerd in termen van competenties, hoe competenties worden verworven in het hoger onderwijs, en wat de rol en waarde zijn van de competenties die het hoger onderwijs levert aan de arbeidsmarkt, zowel op het niveau van individuen als van opleidingen.

Hoofdstuk 2, om te beginnen, heeft een tweeledig doel. Ten eerste worden de theoretische ideeën besproken over de invloed van onderwijs op arbeidsproductiviteit. Ten tweede gaan we in op het onderwerp van een kwalificatie toegekend aan afgestudeerden uit het hoger onderwijs die een vector is van heterogene competenties. We geven aan dat de gebruikelijke economische theorieën, en met name modellen die aansluiten bij de toewijzingstheorie, een goede basis vormen voor dit onderzoek. Niettemin beweren we dat de statische labels, die over het algemeen worden gebruikt in eerder onderzoek om de productie van het hoger onderwijs te beschrijven, zoals het vakgebied of het gevolgde type hoger onderwijs (bijv. Fachhochschulen), geen antwoord bieden voor de zich constant ontwikkelende combinatie van competenties die op de arbeidsmarkt wordt gevraagd en in het hoger onderwijs wordt onderwezen. Daarom bespreken we de verschillende soorten competenties waaruit het menselijk kapitaal bestaat dat afgestudeerden vergaren. De term 'competentie' wordt gebruikt om een groep vaardigheden aan te duiden, die verwijzen naar één onderliggende dimensie en de voorwaarde vormen voor het kunnen uitvoeren van complexe taken zowel binnen als buiten de werksfeer. Zo wordt het opwarmen van een oven, het snijden van vlees en het kunnen benoemen van verschillende kruiden aangeduid met de term 'vaardigheden', terwijl de combinatie van deze vaardigheden bepaalt of iemand zich kok mag noemen. We stellen voor dat met name een onderscheid tussen vakspecifieke en academische competenties van belang is voor een onderzoek onder afgestudeerden van het hoger onderwijs. Vakspecifieke competenties vormen de cognitieve vaardigheden van een afgestudeerde, waarmee hij productief kan opereren in een vaak beperkt deel van de arbeidsmarkt. Academische competenties staan voor de mogelijkheid om te weten hoe men moet (bij)leren, hoe problemen moeten worden aangepakt en hoe moet worden omgegaan met informatie en ideeën. In tegenstelling tot vakspecifieke competenties stellen academische competenties de afgestudeerde in staat zich eenvoudig en flexibel aan te passen aan veranderingen op de arbeidsmarkt en, indien nodig, nieuwe competenties die gevraagd worden te verwerven.

In *hoofdstuk 3* wordt de theorie in de praktijk gebracht. Daar doen wij een voorstel voor een flexibele manier om de output van het hoger onderwijs te meten in termen van het

niveau van academische en vakspecifieke competenties dat afgestudeerden bereiken. Hiertoe geven we eerst een beschrijving van de Careers after Higher Education: a European Research Study (CHEERS), waaruit de gegevens afkomstig zijn. De gegevens betreffen studenten van alle soorten hoger onderwijs in negen Europese landen, die zijn afgestudeerd in 1994/1995. De betreffende landen zijn Italië, Spanje, Frankrijk, Oostenrijk, Duitsland, Nederland, het Verenigd Koninkrijk, Finland en Noorwegen. Een centraal element van dit onderzoek is een schriftelijke vragenlijst waarin deelnemers werd gevraagd om aan te geven welke vaardigheden zij bezaten op het moment van afstuderen, alsmede welke vaardigheden nodig zijn in hun huidige beroep (ongeveer drie jaar na afstuderen). Met behulp van hiërarchische clustermethoden stellen we vast dat er op Europees niveau twee clusters van vaardigheden zijn die overeenkomen met de bovengenoemde theoretische concepten van vakspecifieke en academische competenties. De eerste bestaat uit 'vakgebiedspecifieke theoretische kennis' en 'vakgebiedspecifieke kennis van methoden'. De tweede omvat 'ideeën en informatie documenteren', 'probleemoplossend vermogen', 'analytisch vermogen', 'leervermogen' en 'bespiegelend denken, eigen werk beoordelen'. Deze twee competentieclusters vormen de productiemeetset van het hoger onderwijs die centraal staat in dit onderzoek. De originaliteit van deze meting is voornamelijk gelegen in twee specifieke eigenschappen. Ten eerste biedt de meting de mogelijkheid om duidelijk inzicht te krijgen in de heterogeniteit van competenties van afgestudeerden van een bepaalde opleiding. Ten tweede is deze flexibel en geschikt voor de bovengenoemde constant veranderende combinatie van competenties die in het hoger onderwijs worden onderwezen en de competenties die worden gevraagd op de arbeidsmarkt.

Verder tonen we aan dat de voorgestelde meting een innovatieve manier vormt om opleidingen in het hoger onderwijs en systemen in het hoger onderwijs te kenschetsen. In bestaande typologieën werden opleidingen of systemen slechts op één van de twee uiterste posities geplaatst (academisch of vakspecifiek). In onze benadering worden ze op een schaal tussen deze twee uitersten geplaatst. Op basis van deze meting hebben met name Duitsland, Oostenrijk en Nederland een vakspecifiek georiënteerd hoger onderwijssysteem dat goed aansluit bij hun beroepsgerichte arbeidsmarkten. Het Verenigd Koninkrijk, Spanje, Frankrijk, en in mindere mate ook Finland, kunnen worden gekenmerkt als landen met een academisch gericht hoger onderwijssysteem, aansluitend bij de classificatie van hun arbeidsmarkten als interne arbeidsmarkten.

In *hoofdstuk 4* behandelen we de productie van vakspecifieke en academische competenties in het hoger onderwijs. De afgelopen decennia heeft de toenemende kritiek op traditionele onderwijsmethoden geleid tot een brede invoering van activerende leermethoden, zoals probleemgestuurd en projectgestuurd onderwijs, waarbij de student centraal wordt gesteld en van hem/haar wordt verwacht dat hij/zij een actieve ontdekker is in plaats van iemand die passief met kennis wordt gevoerd. Daarom is het eerste doel van hoofdstuk 4 te analyseren in hoeverre activerende leeromgevingen doelmatiger zijn bij het aanbrengen van competenties in het algemeen en academische competenties in het bijzonder. Naast de leeromgeving wordt ook de individuele verdeling van tijd door de student over de verschillende studieactiviteiten (bijv. het bijwonen van formeel onderwijs, zelfstudie of betaald werk) gezien als een kernelement van het besproken productieproces. De resultaten geven aan dat de opzet van het hoger onderwijs moet aansluiten bij de beoogde output en dus bij de eisen van de arbeidsmarkt. Om

studenten voor te bereiden op hun toetreden tot een beroepsgerichte arbeidsmarkt (traditioneel te vinden in landen als Oostenrijk, Duitsland en Nederland), waarbij van afgestudeerden een sterke overeenkomst wordt verwacht tussen het soort vakspecifieke competenties dat zij hebben opgedaan en het type vakspecifieke competenties dat de arbeidsmarkt vraagt, moeten onderwijsgevenden vakspecifieke kennis overbrengen op studenten (los van de vraag of de instelling activerende leermethoden gebruikt of niet), moet de nadruk liggen op aanwezigheid in de les en moeten instellingen mogelijkheden bieden om studenten een koppeling te laten maken met studiegerelateerde werkzaamheden als studenten naast hun studie willen werken. Al deze aspecten garanderen dat studenten in hoge mate vakspecifieke competenties opdoen. In tegenstelling hiermee zijn activerende leeromgevingen een absolute noodzaak wanneer studenten moeten worden voorbereid op een interne arbeidsmarkt, zoals te vinden is in Frankrijk en het Verenigd Koninkrijk. Daarnaast moet de nadruk worden gelegd op zelfstudie en, zoals hierboven aangegeven, op studiegerelateerd betaald werk.

In *hoofdstuk 5* onderzoeken we de rol en waarde op de arbeidsmarkt van vakspecifieke en academische competenties die zijn verkregen in het hoger onderwijs. We richten ons daarbij op de situatie in Nederland, met een traditionele beroepsgerichte arbeidsmarkt (te vergelijken met Oostenrijk en Duitsland). Indien van toepassing, wijzen we echter ook op verschillen die we aantroffen bij het vergelijken van landen zoals het Verenigd Koninkrijk en Frankrijk, met een relatief prominentere interne arbeidsmarkt. Om te beginnen kijken we naar een mogelijk rechtstreeks verband tussen het competentieniveau dat aanwezig was op het moment van afstuderen en het salarisniveau drie jaar later. Noch voor het niveau van academische competenties, noch voor het niveau van vakspecifieke competenties kan een dergelijk rechtstreeks verband worden aangetoond. We hebben echter wel kunnen vaststellen dat een gebrek aan hetzij het type, hetzij het niveau van vakspecifieke competenties in relatie tot het gevraagde type of niveau leidt tot een aanzienlijk lager salarisniveau. Dit is een uitkomst die kenmerkend is voor landen met een beroepsgerichte arbeidsmarkt, maar niet wordt aangetroffen in landen met een interne arbeidsmarkt.

Vervolgens analyseren we de rol die de twee competentieconcepten spelen bij de toewijzing van afgestudeerden aan verschillende beroepenvelden en bij de selectie van afgestudeerden voor verdere scholing in de praktijk. De resultaten geven aan dat, ten eerste, de mate waarin Nederlandse afgestudeerden terechtkomen in een baan die past bij hun opleiding sterk samenhangt met het niveau aan vakspecifieke competenties dat de afgestudeerden bezitten. Omdat dit beter betaalde banen zijn, is het uit financieel oogpunt voor afgestudeerden belangrijk om hiervoor te worden geselecteerd. Vergelijkbare situaties worden aangetroffen in andere beroepsgerichte Europese landen, maar een minder belangrijke rol van het bereikte niveau van vakspecifieke competenties in de toewijzing is te zien in academisch georiënteerde landen, zoals het Verenigd Koninkrijk en Frankrijk. Ten tweede tonen we aan dat academische competenties die zijn verkregen in het hoger onderwijs een grote rol spelen bij de selectie voor bijscholing, hetgeen op zichzelf bijdraagt aan een verhoging van de productiviteit en derhalve het salaris. Scholing en het niveau van academische competenties die zijn opgedaan in het hoger onderwijs vullen elkaar dus aan en academische competenties worden gebruikt om de vakspecifieke competenties van afgestudeerden aan te passen aan de eisen van de arbeidsmarkt. In tegenstelling tot eerdere bevindingen in dit hoofdstuk, is dit

resultaat niet afhankelijk van de competentiegerichtheid van het hoger onderwijssysteem of van de institutionele instelling van de arbeidsmarkt.
Er bestaat geen twijfel dat individuele eigenschappen van cruciaal belang zijn voor succes op de arbeidsmarkt. Maar, gegeven het feit dat de overgang van hoger onderwijs naar werk plaatsvindt in een context met asymmetrische en onvolledige informatie aan beide kanten van de markt, kunnen groepskenmerken relevante signalen geven aan werkgevers aangaande de werkelijke productieve mogelijkheden van sollicitanten. Om hierop een antwoord te geven, wordt in *hoofdstuk 6* een analyse uitgevoerd naar de invloed van vijf veel voorkomende kenmerken van opleidingen in het hoger onderwijs op de toewijzingsresultaten en prestaties van afgestudeerden op de arbeidsmarkt. De kenmerken die worden bekeken zijn de competentierichting (vakspecifiek versus academisch), de standaardisering met betrekking tot de verkregen competenties, de mate waarin de opleiding internationaal georiënteerd is, de mate waarin studeren en werken zijn geïntegreerd, en de mate waarin de opleiding exclusief toegang biedt tot bepaalde beroepen (bijv. in de gezondheidszorg).

We tonen aan dat afgestudeerden van opleidingen met een sterk vakspecifiek gerichte output, het vaakst terechtkomen in het beroepenveld met een verwant soort competenties. Op vergelijkbare manier komen afgestudeerden van opleidingen met een sterk academisch gerichte output terecht in het academische competentieveld. Omdat opleidingen in landen met een beroepsgerichte arbeidsmarkt relatief vaker vakspecifiek gericht zijn en opleidingen in landen met een interne arbeidsmarkt relatief vaker academisch gericht zijn, bevestigt deze constatering dat opleidingen in het hoger onderwijs hun resultaten sturen overeenkomstig de algemene institutionele opzet van de arbeidsmarkt (d.w.z. intern of beroepsgericht). Het is echter niet genoeg dat een opleiding zich richt op een bepaald soort competentie (academische of vakspecifiek), maar opleidingen moeten bij voorkeur ook een groep afgestudeerden afleveren die sterk overeenkomt met betrekking tot het centrale soort competenties. Gestandaardiseerde competentieresultaten bieden werkgevers beter inzicht in de werkelijke productieve mogelijkheden van afgestudeerden, waardoor de selectie- en aanpassingskosten afnemen en werknemers een hogere beloning kunnen krijgen. Met andere woorden: om een *succesvolle overgang van het hoger onderwijs naar de arbeidsmarkt te garanderen in landen* met een beroepsgerichte arbeidsmarkt (bijv. Oostenrijk, Duitsland en Nederland), moet de voorbereiding van afgestudeerden voor de relatief vakspecifiek gerichte arbeidsmarkt gekoppeld zijn aan gestandaardiseerde resultaten in vakspecifieke competenties. In landen met een sterk interne arbeidsmarkt (bijv. het Verenigd Koninkrijk en Frankrijk) moet de voorbereiding van afgestudeerden voor de academische gerichtheid van dit soort arbeidsmarkt aansluiten bij een gestandaardiseerd resultaat op het gebied van academische competenties. Er is geen significante invloed op het resultaat op de arbeidsmarkt gevonden voor *de mate van internationalisering* van opleidingen of *de integratie van studeren en werken* hiervan. Afgestudeerden van opleidingen die exclusief toegang bieden tot bepaalde beroepen hebben echter een grotere kans om werk te vinden in beroepen die passen bij hun vakspecifieke competenties.

In *hoofdstuk 7* worden de belangrijkste bevindingen samengevat. We bespreken tevens enkele tekortkomingen van het onderzoek en geven aan welke onderwerpen in de toekomst bestudeerd zouden kunnen worden. Wat betreft het laatste voeren we met name aan dat een uitbreiding van de set competenties waarmee rekening wordt gehouden (bijv. leidinggevende capaciteiten) en de tijdsperiode die in ogenschouw wordt genomen (bijv. 5 of 10 jaar na afstuderen) gebieden voor toekomstig onderzoek kunnen zijn die vruchtbare resultaten kunnen opleveren.

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Annex: The CHEERS questionnaire

This annex shows the questionnaire of the CHEERS study that was used in the United Kingdom. Some of the examples of questions and answers presented in the questionnaire below may have been slightly adapted in other countries to match the national setup of the higher education system or training system. The original questionnaires used in Austria, Czech Republic, Germany, Spain and Sweden are available from the CHEERS website: **http://www.uni-kassel.de/wz1/tseregs.htm**. The Dutch questionnaire is available on request from the author.

Higher Education and Graduate Employment in Europe

Survey of Graduates in ... [NatCat]

(Revised Master Questionnaire, 29.10.1998)

[NatCat = where national adaptations are needed]

Dear Graduates,[NatCat the whole cover page is optional]

As heads of the research group, we request your participation in a representative survey of persons graduating in 1994 or 1995 from institutions of higher education in 11 European countries and in Japan.

In reporting the experiences you personally made in the course of your study and after graduation you might contribute to a representative feedback most valuable for those responsible in higher education and as well for those setting the framework conditions for employment and other life spheres.

The survey is undertaken in Austria, Czech Republic, Finland, France, Germany, Italy, Japan, Norway, Spain, Sweden, the Netherlands, and in the United Kingdom. In your country, researchers from the Open University [NatCat] *are responsible for the data collection and analysis. The project is financially supported by the European Commission, Directorate General XII through the Targeted Socio-Economic Research Programme.*

We assure you that your replies will be used only in the framework of this research project. The results will be published in such a way that identification of individual persons is excluded.

YOUR INFORMATION WILL BE TREATED STRICTLY CONFIDENTIALLY.

If you wish, we will send you a summary of the most important results. Please return the completed questionnaire as soon as possible to the address mentioned below.

Thank you very much for your kind support.

Signature
John Brennan [NatCat]

Signature
Prof. Dr. Ulrich Teichler

Send the questionnaire to:

[NatCat]John Brennan
The Open University, Quality Support Centre
344-354 Gray's Inn Road, WCIX 3BP London

☎ 0171.447.2506 - Fax 0171.837.0290
email j.l.brennan@open.ac.uk [NatCat]

Prof. Dr. Ulrich Teichler
Project Co-ordinator
University of Kassel,
Germany

Explanatory Notes [NatCat this notes are optional]

How long does it take to fill in the questionnaire?

Most of you will need about one hour – less than a movie. It depends of course on the kind of experiences you have made during the last years.

We have developed a high standardized questionnnaire, which mainly expect from you to mark boxes which refer to relevant answers. With this approach we hope that we have made it easy for you to answer the questions.

How to answer the questions?

Please answer all questions applicable to you. In some cases, you will note that the questionnaire suggests you to disregard some questions not applicable to you (e.g. → GO TO QUESTION ...).

Since the questionnaire will be captured with the help of a scanner, please fill it in readable.

If questions are itemised, please mark the most appropriate answer like this → ☒ .

In some questions we have employed answer scales from 1 to 5 (e.g 1 = very good to 5 = very bad).

J2 Looking back, if you were free to choose again, how likely would you ...

Very likely 1	2	3	4	Not likely at all 5	
☐	☐	☒	☐	☐	a. choose the same course of study?
☐	☒	☒	☐	☐	b. choose the same institution of higher education?

Example of a 5-point-scale:

mark one box for each item (row)

If you would like to correct your answer, make the wrong one black and mark and underscore the right one.

In some cases we ask you for numbers only, e.g. 02 / 98

and in others we leave space for you to write an answer (.....).

If you are asked for numbers, please fill in 00 *if your answer would be "zero".*

If the space for your replies is not sufficient, please include an additional sheet of paper.

Your comments and additional information are welcome

This questionnaire is used in more than 12 countries with a wide range of different fields of study and different institutions of higher education. We could not take into consideration every specific detail of study and work, which might be relevant for the survey. Therefore we would appriciate your comments and additional information.

A. Educational Background Prior to Study

Please provide information on your educational development and your work experiences before your first enrolment in higher education.

A1 What were your entry qualifications when you entered higher education *(full or part-time)* for the first time? [NatCat]

- ☐ School-type qualifications (e.g. A Levels, Highers) [Use national categories, examples here are from UK]
- ☐ Vocational/professional qualifications (e.g. ONC)
- ☐ Other qualifications (e.g. access course, entry exam)
- ☐ Course was "open entry" → *GO TO QUESTION A6*

A2 How would you rate your grades? [NatCat]

[USE NATIONAL CATEGORIES, EXAMPLES HERE ARE FROM UK, REVISE THE HEADLINE OF A2 CORESSPONDINGLY]

- ☐ High
- ☐ Medium
- ☐ Low

A3 When did you get your entry qualification?[NatCat]

|_|_| Month 19|_|_| Year

A4 How many years of *(primary plus secondary)* schooling did you spend altogether up to acquiring the entry qualification to higher education *(include years of repeating classes)*? [NatCat]

|_|_| Years of schooling altogether

A5 How many months did you spend on the following activities between obtaining the entry qualification (see A1) [NatCat] and your first enrolment in higher education? *Please state only the major activities.*

Months

- |_|_|_| Other education/training/apprenticeship: ..... (please specify)
- |_|_|_| Employment/self-employment
- |_|_|_| Child rearing, family care
- |_|_|_| Military or civilian service [NatCat]
- |_|_|_| Not employed, seeking employment
- |_|_|_| Other (please specify): .....

A6 Prior to your first enrolment in higher education, have you been employed abroad or have you received any education/training/apprenticeship abroad? *Multiple reply possible*

- ☐ No → *GO TO QUESTION B1*
- ☐ Yes, I have been employed abroad: |_|_| Years |_|_| Months Country: ..... (please specify)
- ☐ Yes, I received education/training/ apprenticeship abroad: |_|_| Years |_|_| Months Country: ..... (please specify)

B. Higher Education Courses Taken

B1 Please, provide information about all higher education courses you have ever taken *(include part-time, post graduate, and courses not completed [NatCat]). If you changed the institution, the field of study or if you took more than one degree, please fill in more than one row. If you studied in more programmes and institutions than this questionnaire provides for, please add a sheet.*

	A. Begin – End *(month/year)*	B. Major(s) studied *(please specify)*	C. Name of institution *(please specify)*	D. Kind of degree earned *(please fill in the number from the list A below)* [NatCat]	E. Class of degree/grade *(if applicable)* [NatCat]
1.	Begin ☐☐/☐☐ End ☐☐/☐☐	.....	.....	☐☐ ☐ No degree	☐ First ☐ Upper second ☐ Lower second ☐ Third ☐ Unclassified
2.	Begin ☐☐/☐☐ End ☐☐/☐☐ ☐ Not finished (yet)	.....	.....	☐☐ ☐ No degree	☐ First ☐ Upper second ☐ Lower second ☐ Third ☐ Unclassified
3.	Begin ☐☐/☐☐ End ☐☐/☐☐ ☐ Not finished (yet)	.....	.....	☐☐ ☐ No degree	☐ First ☐ Upper second ☐ Lower second ☐ Third ☐ Unclassified
4.	Begin ☐☐/☐☐ End ☐☐/☐☐ ☐ Not finished (yet)	.....	.....	☐☐ ☐ No degree	☐ First ☐ Upper second ☐ Lower second ☐ Third ☐ Unclassified

List A: Kind of degree [NatCat]

1 BA Hons
2 BA
3 BSc Hons
4 BSC Bachelor of Science
5 *Other Bachelor*
6 Master of Arts (MA)
7 Master of Science (MSc)
8 Master of Education (MEd), etc.
9 Other Master's
10 PhD
11 Other (please specify in column D)

B2 Did you spend time abroad during the time of your study *(in order to work or to study)*?

☐ No → *GO TO QUESTION B4*

☐ Yes

B3 If you stayed abroad: please state *(for each period abroad, if you have spent more than one)* **the countries, the duration and the activities.**

	A. Country *(please specify)*	B. Duration *(months)*	C. Major activity *(multiple reply possible)*
1	.....	☐☐ months	☐ Study (classes, self-study, work on thesis etc.) ☐ Work placements/internships ☐ Other *(please specify)*: .....
2	.....	☐☐ months	☐ Study (classes, self-study, work on thesis etc.) ☐ Work placements/internships ☐ Other *(please specify)*: .....

B4 How many months between first enrolment in higher education and graduation 1994 or 1995 did you spend predominantly on:

Duration (months)	
☐☐	Employment/work not related to study or possible future work
☐☐	Employment/work related to study or possible future work
☐☐	Work placement, internship (as part of your degree course) [NatCat]
☐☐	Child rearing, family care
☐☐	Military or civilian service [NatCat]
☐☐	Not employed, seeking employment
☐☐	Other: ..... *(please specify)*

B5 How long did you study in higher education for earning the degree you were awarded in 1994 or 1995 (see Question B1) and what period is normally/by law required *(including eventually required lower level diplomas and degrees in higher education and including mandatory periods of work placements/internships; excluding other studies, periods of other activities, etc.)*? **[NatCat years or semester]**

I actually studied ☐☐ Years ☐☐ Months

Normally/by law required are [NatCat] ☐☐ Years ☐☐ Months

→ *Please, notice: The following questions B6 to B9 refer ONLY to the course of study that you graduated from in 1994 or 1995.*

B6 How many hours per week during your study *(that you graduated from in 1994 or 1995)* **did you spend on average on each of the following activities?** *Please estimate*

A. During lecture period (approx. hours per week) [NatCat]	
☐☐	Major subjects: attending lectures
☐☐	Major subjects: other study activities (inc. self-studies, etc.)
☐☐	Other subjects
☐☐	Extra-curricular activities (e.g. societies, drama, sport, student union)
☐☐	Employment/work (excluding work placements/internships)
☐☐	Other *(please specify)*: .....

B. Outside lecture period (approx. hours per week) [NatCat]	
☐☐	Attending lectures (e.g. summer school) and other study activities (inc. self-studies, etc.)
☐☐	Employment/work (excluding work placements/internships)
☐☐	Other *(please specify)*: .....

B7 To what extent did your work experiences *(employment, internships etc.)* **during study tie up with the content of your studies** *(you graduated from in 1994 or 1995)*?

To a very high extent 1 2 3 4 5 Not at all — Not applicable, no work experiences 6

☐ ☐ ☐ ☐ ☐ ☐

B8 If you look back to your course of study that you graduated from in 1994 or 1995: to what extent were the following modes of teaching and learning emphasised by your institution of higher education and its teachers? *Please rate each of the applicable options on a 5-point scale*

To a very high extent 1 2 3 4 5 Not at all

☐☐☐☐☐	a. Facts and instrumental knowledge
☐☐☐☐☐	b. Theories, concepts or paradigms
☐☐☐☐☐	c. Attitudes and socio-communicative skills
☐☐☐☐☐	d. Independent learning
☐☐☐☐☐	e. Regular class attendance
☐☐☐☐☐	f. Teacher as the main source of information and understanding
☐☐☐☐☐	g. Freedom to choose courses and areas of specialisation
☐☐☐☐☐	h. Project and problem-based learning
☐☐☐☐☐	i. Direct acquisition of work experience
☐☐☐☐☐	j. Out-of-class communication between students and staff
☐☐☐☐☐	k. Writing a thesis [NatCat; Thesis or other substantial academic assignment]
☐☐☐☐☐	l. Detailed regular assessment of academic progress

B9 How do you rate the study provision and study conditions you experienced in the course of study that you graduated from in 1994 or 1995?

Very good 1	2	3	4	Very bad 5	
☐	☐	☐	☐	☐	a. Academic advice offered in general
☐	☐	☐	☐	☐	b. Assistance/advice for your final examination
☐	☐	☐	☐	☐	c. Course content of major
☐	☐	☐	☐	☐	d. Variety of courses offered
☐	☐	☐	☐	☐	e. Design of degree program
☐	☐	☐	☐	☐	f. Testing/grading system
☐	☐	☐	☐	☐	g. Opportunity to choose courses and areas of specialisation
☐	☐	☐	☐	☐	h. Practical emphasis of teaching and learning
☐	☐	☐	☐	☐	i. Teaching quality
☐	☐	☐	☐	☐	j. Chances to participate in research projects
☐	☐	☐	☐	☐	k. Research emphasis of teaching and learning
☐	☐	☐	☐	☐	l. Provision of work placements and other work experience
☐	☐	☐	☐	☐	m. Opportunity of out-of-class contacts with teaching staff
☐	☐	☐	☐	☐	n. Contacts with fellow students
☐	☐	☐	☐	☐	o. Chance for students to have an impact on university policies
☐	☐	☐	☐	☐	p. Equipment and stocking of libraries
☐	☐	☐	☐	☐	q. Supply of teaching material
☐	☐	☐	☐	☐	r. Quality of technical equipment (e.g. PC, measuring instruments, etc.)

B10 How do you rate your expertise in selected software areas at the time of graduation 1994 or 1995 and now?

At time of graduation 1994 or 1995: Very good 1	2	3	4	No expertise at all 5		Now: Very good 1	2	3	4	No expertise at all 5
☐	☐	☐	☐	☐	a. Word processor	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	b. Programming languages	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	c. Spread sheet	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	d. Data base	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	e. Subject-related software (e.g. CAD for engineers, SPSS for social scientists)	☐	☐	☐	☐	☐

B11 How do you rate your language proficiency at the time of graduation 1994 or 1995? *Please answer with respect of any listed language and tick the kind of proficiency in each row. Multiple reply possible in each row.*

	Kind of language proficiency				
	A. Capable to write professionally relevant texts	B. Capable to read professionally relevant texts	C. Capable to speak in a professionally relevant context	D. Marginal proficiency	E. No proficiency
a. English	☐	☐	☐	☐	☐
b. French	☐	☐	☐	☐	☐
c. German	☐	☐	☐	☐	☐
e. Other *(please specify)*:	☐	☐	☐	☐	☐
f. Other *(please specify)*:	☐	☐	☐	☐	☐

C9 How would you characterise and summarise your predominant activities since your graduation in 1994 or 1995?

- ☐ I have spent most of the time on a regular job
- ☐ I had various temporary jobs
- ☐ I had more than one job at the same time
- ☐ I was most of the time unemployed
- ☐ I embarked on further study/professional training
- ☐ I was predominantly engaged in child rearing or family care
- ☐ Other: .....

C10 Please inform us on your current major activity.

	Begin *(month/year)*	Kind of current major activity *(please mark one, and inform us about your further major activities in Question C11, if applicable)*	Information regarding employment: Full-time or part-time?	Information regarding employment: Type of contract?	Information regarding employment: Job title and position *(please specify)*
	A	B	C	D	E
Current situation	Since ☐☐/☐☐ (month/year)	☐ Employed ☐ Self-employed → ☐ Not employed, seeking employment ☐ Professional training ☐ Advanced academic study ☐ Child rearing, family care ☐ Other (please specify):	☐ Full-time ☐ Part-time	☐ Permanent ☐ Temporary	**Job title:** *(e.g. primary school teacher, production engineer)* ..... **Position:** *(e.g. assistant, team leader, head of department)* .....
			→ *GO TO QUESTION C11*		

C11 If your major activity has changed since graduation 1994 or 1995 *(e.g. from "unemployed" to "employed")* **or you experienced a substantial change in your job** *(e.g. new employer, new position, new work tasks)*, **please provide further information in the following table.** *Use a new section for each activity, whether undertaken sequentially or in parallel. In each section mark one box for the kind of activity only. If you have had many jobs of short duration, please summarise in one or more activities.*

	Begin - End *(month/year)*	Kind of activity *(use a new section for each new activity or for activities at the same time)*	Information regarding employment: Full-time or part-time?	Information regarding employment: Type of contract?	Information regarding employment: Job title and position *(please specify)*
	A	B	C	D	E
1.	Begin ☐☐/☐☐ End ☐☐/☐☐ ☐ Activity not finished yet	☐ Employed ☐ Self-employed → ☐ Not employed, seeking employment ☐ Professional training ☐ Advanced academic study ☐ Child rearing, family care ☐ Other (please specify):	☐ Full-time ☐ Part-time	☐ Permanent ☐ Temporary	**Job title:** *(e.g. primary school teacher, production engineer)* ..... **Position:** *(e.g. assistant, team leader, head of department)* .....
			→ *GO TO NEXT ACTIVITY*		

C9 How would you characterise and summarise your predominant activities since your graduation in 1994 or 1995?

- ☐ I have spent most of the time on a regular job
- ☐ I had various temporary jobs
- ☐ I had more than one job at the same time
- ☐ I was most of the time unemployed
- ☐ I embarked on further study/professional training
- ☐ I was predominantly engaged in child rearing or family care
- ☐ Other: .....

C10 Please inform us on your current major activity.

	Begin *(month/year)*	Kind of current major activity *(please mark one, and inform us about your further major activities in Question C11, if applicable)*	Information regarding employment: Full-time or part-time?	Information regarding employment: Type of contract?	Information regarding employment: Job title and position *(please specify)*
	A	B	C	D	E
Current situation	Since ☐☐/☐☐ (month/year)	☐ Employed ☐ Self-employed → ☐ Not employed, seeking employment ☐ Professional training ☐ Advanced academic study ☐ Child rearing, family care ☐ Other (please specify):	☐ Full-time ☐ Part-time → GO TO QUESTION C11	☐ Permanent ☐ Temporary	**Job title:** (e.g. *primary school teacher, production engineer*) ..... **Position:** (e.g. *assistant, team leader, head of department*) .....

C11 If your major activity has changed since graduation 1994 or 1995 *(e.g. from "unemployed" to "employed")* **or you experienced a substantial change in your job** *(e.g. new employer, new position, new work tasks)*, **please provide further information in the following table.** *Use a new section for each activity whether undertaken sequentially or in parallel. In each section mark one box for the kind of activity only. If you have had many jobs of short duration, please summarise in one or more activities.*

	Begin - End *(month/year)*	Kind of activity *(use a new section for each new activity or for activities at the same time)*	Information regarding employment: Full-time or part-time?	Information regarding employment: Type of contract?	Information regarding employment: Job title and position *(please specify)*
	A	B	C	D	E
1.	Begin ☐☐/☐☐ End ☐☐/☐☐ ☐ Activity not finished yet	☐ Employed ☐ Self-employed → ☐ Not employed, seeking employment ☐ Professional training ☐ Advanced academic study ☐ Child rearing, family care ☐ Other (please specify):	☐ Full-time ☐ Part-time → GO TO NEXT ACTIVITY	☐ Permanent ☐ Temporary	**Job title:** (e.g. *primary school teacher, production engineer*) ..... **Position:** (e.g. *assistant, team leader, head of department*) .....

	Begin - End *(month/year)*	Kind of major activity *(use a new section for each new activity or for activities at the same time)*	Information regarding employment		
			Full-time or part-time?	Type of contract?	Job title and position *(please specify)*
	A	B	C	D	E
2.	Begin End ☐ Activity not finished yet	☐ Employed ☐ Self-employed → ☐ Not employed, seeking employment ☐ Professional training ☐ Advanced academic study ☐ Child rearing, family care ☐ Other (please specify):	☐ Full-time ☐ Part-time → GO TO NEXT ACTIVITY	☐ Permanent ☐ Temporary	**Job title:** *(e.g. primary school teacher, production engineer)* .... **Position:** *(e.g. assistant, team leader, head of department)* ....
3.	Begin End ☐ Activity not finished yet	☐ Employed ☐ Self-employed → ☐ Not employed, seeking employment ☐ Professional training ☐ Advanced academic study ☐ Child rearing, family care ☐ Other (please specify):	☐ Full-time ☐ Part-time → GO TO NEXT ACTIVITY	☐ Permanent ☐ Temporary	**Job title:** *(e.g. primary school teacher, production engineer)* .... **Position:** *(e.g. assistant, team leader, head of department)* ....
4.	Begin End ☐ Activity not finished yet	☐ Employed ☐ Self-employed → ☐ Not employed, seeking employment ☐ Professional training ☐ Advanced academic study ☐ Child rearing, family care ☐ Other (please specify):	☐ Full-time ☐ Part-time → GO TO NEXT ACTIVITY	☐ Permanent ☐ Temporary	**Job title:** *(e.g. primary school teacher, production engineer)* .... **Position:** *(e.g. assistant, team leader, head of department)* ....
5.	Begin End ☐ Activity not finished yet	☐ Employed ☐ Self-employed → ☐ Not employed, seeking employment ☐ Professional training ☐ Advanced academic study ☐ Child rearing, family care ☐ Other (please specify):	☐ Full-time ☐ Part-time → GO TO NEXT ACTIVITY	☐ Permanent ☐ Temporary	**Job title:** *(e.g. primary school teacher, production engineer)* .... **Position:** *(e.g. assistant, team leader, head of department)* ....

D. Current Activities, Employment and Work

D1 If you are at current employed/self-employed: How would you describe your current professional situation? *Multiple reply possible*

- ☐ I have a regular employment/I am self-employed
- ☐ I have casual jobs related to my study
- ☐ I have casual jobs not related to my study
- ☐ I have more than one job
- ☐ I am currently doing military or civilian service
- ☐ Other: ..... (please specify)

D2 Have you actively tried to obtain (other) paid work in the past 4 weeks?

- ☐ No ➔ *PLEASE GO TO QUESTION D3*
- ☐ No, but I am awaiting the results of earlier job applications
- ☐ Yes, and I could start working within the next two weeks
- ☐ Yes, but I could not start working within the next two weeks

D3 How many employers *(including self-employment)* **have you worked for in the period after graduation in 1994 or 1995** *(including your present employer)*?

|_|_| Number of employers

IF YOU ARE NOT EMPLOYED/SELF-EMPLOYED → GO TO QUESTION D15

IF YOU HAVE MORE THAN ONE JOB PLEASE REFER TO YOUR MAJOR JOB

D4 Please state the kind of your current employer/institution *(if several, please refer to main employer)? Please mark one single item only*

- ☐ Public employer
- ☐ Non-profit organization
- ☐ Private employer
- ☐ Self employed
- ☐ Other: ..... (please specify)

D5 In which economic sector are you currently working? *Please state in a specific term (e.g. car manufacturing, primary school, hospital, theatre).*

..... (please specify)

D6 What is your current major area of work assignment *(e.g. R&D, data processing, sales or teaching)* **and what are your additional area(s) of activities, if applicable?**

Major area of work (please specify)

.....

.....

Additional area(s) of work (please specify)

.....

.....

D7 How many hours per week are you working on average? *Multiple reply possible*

Working hours per week

- |_|_| Contract hours of my major assignment
- |_|_| Additional working hours of my major assignment *(paid and unpaid overtime)*
- |_|_| Working hours on other assignments *(second occupation, side jobs, etc.)*
- |_|_| **Total working hours** *(incl. self-employment)*

D8 Do you work in a (big) organisation comprising branches?

- ☐ Yes, I'm working in a branch
- ☐ Yes, I'm working in the head office/central unit of an organization comprising branches
- ☐ No, I'm working in an organization comprising no branches
- ☐ Not applicable, I am self-employed

D9 Please estimate, to the best of your ability, the approximate number of people who are working in ...

a. approx. |_|_|_|_|_| the location where you currently work.

b. approx. |_|_|_|_|_| the entire organisation if there is more than one location.

D10 If you are self-employed: Which of the following characteristics are applicable to you? *Multiple reply possible*

- ☐ a. I am serving a single contractor
- ☐ b. I took over an existing firm/office etc.
- ☐ c. I established a new firm/office etc.
- ☐ d. I was asked by my former employer to work self-employed
- ☐ e. I am working at home
- ☐ f. I have no employees
- ☐ g. I have a partnership with friends/relatives
- ☐ e. Other: ..... (please specify)

D11 What is your approximate annual gross income? [NatCat local currency]:

Thousand [NatCat]

- ☐☐☐☐ a. from your current major job *(excluding overtime and extra payments)?*
- ☐☐☐☐ b. from overtime and extra payments in your major job?
- ☐☐☐☐ c. from other jobs?

D12 Did you undertake business/professional journeys abroad within the last 12 months?

- ☐ No
- ☐ Yes, altogether ☐☐ weeks

D13 To what extent do you communicate *(oral and written communication)* **with clients/external partners...**

To a very high extent 1 2 3 4 5 Not at all

- ☐☐☐☐☐ a. in a foreign language?
- ☐☐☐☐☐ b. with foreigners in your language?

D14 What percentage of your work time do you consider to have an international context?

☐☐☐ Percentage of work time (%)

D15 Have you, since graduation *(multiple reply possible)*

- ☐ a. considered working abroad?
- ☐ b. sought employment abroad?
- ☐ c. actually received an offer to work abroad?
- ☐ d. actually had regular employment abroad since graduation?
- ☐ e. actually been sent abroad by your employer on work assignments?
- ☐ f. None → *GO TO QUESTION E1*

D16 If you have worked abroad: In which country(ies) and how many months (each)?

	Duration	Country *(please specify)*
1	☐☐ months	.....
2	☐☐ months	.....
3	☐☐ months	.....

E. Competencies and Their Application

E1 Please, state the extent to which you had the following competencies at the time of graduation in 1994 or 1995 and to what extent they are required in your current work. *If you are not employed please answer only (A).*

A. Possessed at time of graduation 1994 or 1995 (To a very high extent 1 2 3 4 5 Not at all)	Knowledge, skills and competencies	B. Work requirements (To a very high extent 1 2 3 4 5 Not at all)
☐☐☐☐☐	a. Broad general knowledge	☐☐☐☐☐
☐☐☐☐☐	b. Cross-disciplinary thinking/knowledge	☐☐☐☐☐
☐☐☐☐☐	c. Field-specific theoretical knowledge	☐☐☐☐☐
☐☐☐☐☐	d. Field-specific knowledge of methods	☐☐☐☐☐
☐☐☐☐☐	e. Foreign language proficiency	☐☐☐☐☐
☐☐☐☐☐	f. Computer skills	☐☐☐☐☐
☐☐☐☐☐	g. Understanding complex social, organisational and technical systems	☐☐☐☐☐
☐☐☐☐☐	h. Planning, co-ordinating and organising	☐☐☐☐☐
☐☐☐☐☐	i. Applying rules and regulations	☐☐☐☐☐
☐☐☐☐☐	j. Economic reasoning	☐☐☐☐☐
☐☐☐☐☐	k. Documenting ideas and information	☐☐☐☐☐
☐☐☐☐☐	a. Problem-solving ability	☐☐☐☐☐
☐☐☐☐☐	b. Analytical competencies	☐☐☐☐☐
☐☐☐☐☐	d. Learning abilities	☐☐☐☐☐
☐☐☐☐☐	e. Reflective thinking, assessing one's own work	☐☐☐☐☐
☐☐☐☐☐	f. Creativity	☐☐☐☐☐
☐☐☐☐☐	g. Working under pressure	☐☐☐☐☐
☐☐☐☐☐	h. Accuracy, attention to detail	☐☐☐☐☐
☐☐☐☐☐	i. Time management	☐☐☐☐☐
☐☐☐☐☐	j. Negotiating	☐☐☐☐☐
☐☐☐☐☐	k. Fitness for work	☐☐☐☐☐
☐☐☐☐☐	l. Manual skills	☐☐☐☐☐
☐☐☐☐☐	m. Working independently	☐☐☐☐☐
☐☐☐☐☐	n. Working in a team	☐☐☐☐☐
☐☐☐☐☐	a. Initiative	☐☐☐☐☐
☐☐☐☐☐	b. Adaptability	☐☐☐☐☐
☐☐☐☐☐	c. Assertiveness, decisiveness, persistence	☐☐☐☐☐
☐☐☐☐☐	d. Power of concentration	☐☐☐☐☐
☐☐☐☐☐	e. Getting personally involved	☐☐☐☐☐
☐☐☐☐☐	f. Loyalty, integrity	☐☐☐☐☐
☐☐☐☐☐	g. Critical thinking	☐☐☐☐☐
☐☐☐☐☐	h. Oral communication skills	☐☐☐☐☐
☐☐☐☐☐	i. Written communication skills	☐☐☐☐☐
☐☐☐☐☐	j. Tolerance, appreciating of different points of view	☐☐☐☐☐
☐☐☐☐☐	k. Leadership	☐☐☐☐☐
☐☐☐☐☐	l. Taking responsibilities, decisions	☐☐☐☐☐

E2 To what extent has your study *(you graduated from 1994 or 1995)* been useful for ...?

To a very high extent 1 2 3 4 5 Not at all

a. preparing you for your present work tasks?

b. preparing you for tasks in other spheres of life?

--> IF YOU ARE CURRENTLY NOT PROFESSIONAL ACTIVE, GO TO QUESTION G2

E3 How important do you consider the following competencies for doing your current work?

Very important 1 2 3 4 5 Not at all important

a. Professional knowledge of other countries (e.g. economical, sociological, legal knowledge)

b. Knowledge/understanding of international differences in culture and society, modes of behaviour, life styles, etc.

c. Working with people from different cultural backgrounds

d. Communicating in foreign languages

F. Relationships Between Higher Education and Work

F1 If you take into consideration your current work tasks altogether: To what extent do you use the knowledge and skills acquired in the course of study *(you graduated from 1994 or 1995)*?

To a very high extent 1 2 3 4 Not at all 5

F2 How would you characterise the relationship between your field of study and your area of work?

- ☐ My field of study is the only possible/by far the best field
- ☐ Some other fields could prepare for the area of work as well
- ☐ Another field would have been more useful
- ☐ The field of study does not matter very much
- ☐ Higher education studies are not at all related to my area of work
- ☐ Others *(please specify)*: .....

F3 If you consider all dimensions of your employment and work *(status, position, income, work tasks, etc.)*:

a. To what extent is your employment and work appropriate to your level of education?

Completely appropriate 1 2 3 4 Not at all appropriate 5

b. What is the most appropriate level of course of study/degree for your employment and work in comparison to that which you graduated from in 1994 or 1995?

- ☐ A higher level than the one I graduated from
- ☐ The same level
- ☐ A lower level of higher/tertiary education
- ☐ No higher/tertiary education at all
- ☐ Others *(please specify)*: .....

F4 If you consider your employment and work as hardly appropriate and not linked to your education: why did you take it up? *Multiple reply possible*

- ☐ a. I have not (yet) been able to find a job more appropriate
- ☐ b. In doing this job I have better career prospects
- ☐ c. I prefer an occupation which is not closely connected to my studies
- ☐ d. I was promoted to a position less linked to my studies than my previous position(s)
- ☐ e. I can get a higher income in my current job
- ☐ f. My current job offers me more security
- ☐ g. My current job is more interesting
- ☐ h. My current job provides the opportunity for part-time/flexible schedules etc.
- ☐ i. My current job enables me to work in a locality, which I prefer
- ☐ j. My current job allows me to take into account family needs
- ☐ k. At the beginning of the career envisaged I have to accept work hardly linked to my study
- ☐ l. Other: ..... (please specify)
- ☐ m. Not applicable, I consider my job closely linked to my studies

F5 Taking all aspects into account, to what extent does your current work situation meet the expectations you had when you started your study?

Much better than expected 1 2 3 4 Much worse than expected 5 Not applicable, I have had no expectations

G. Work Orientations and Job Satisfaction

G1 Altogether, to what extent are you satisfied with your current work?

Very satisfied				Very dissatisfied
1	2	3	4	5
☐	☐	☐	☐	☐

G2 Please indicate the importance you placed on each of the following life goals - in the past and now.

A. At time of graduation 1994 or 1995 (Very important 1 2 3 4 5 Not at all important)		B. Now (Very important 1 2 3 4 5 Not at all important)
☐☐☐☐☐	a. Social prestige	☐☐☐☐☐
☐☐☐☐☐	b. Personal development	☐☐☐☐☐
☐☐☐☐☐	c. Varied social life	☐☐☐☐☐
☐☐☐☐☐	d. Home/family	☐☐☐☐☐
☐☐☐☐☐	e. Making money	☐☐☐☐☐
☐☐☐☐☐	f. Academic inquiry	☐☐☐☐☐
☐☐☐☐☐	g. Work	☐☐☐☐☐

G3 How important are the following characteristics of an occupation for you personally (A) and to what extent do they apply to your current professional situation (B)? *If you are not employed please answer only (A).*

A. Importance (Very important 1 2 3 4 5 Not at all important)		B. Apply to current situation (To a very high extent 1 2 3 4 5 Not at all)
☐☐☐☐☐	a. Largely independent disposition of work	☐☐☐☐☐
☐☐☐☐☐	b. Opportunity of undertaking scientific/scholarly work	☐☐☐☐☐
☐☐☐☐☐	c. Clear and well-ordered tasks	☐☐☐☐☐
☐☐☐☐☐	d. Possibilities of using acquired knowledge and skills	☐☐☐☐☐
☐☐☐☐☐	e. Job security	☐☐☐☐☐
☐☐☐☐☐	f. Social recognition and status	☐☐☐☐☐
☐☐☐☐☐	g. Opportunity of pursuing own ideas	☐☐☐☐☐
☐☐☐☐☐	h. Good social climate	☐☐☐☐☐
☐☐☐☐☐	i. Opportunity of pursuing continuous learning	☐☐☐☐☐
☐☐☐☐☐	j. High income	☐☐☐☐☐
☐☐☐☐☐	k. Chances of (political) influence	☐☐☐☐☐
☐☐☐☐☐	l. Challenging tasks	☐☐☐☐☐
☐☐☐☐☐	m. Good career prospects	☐☐☐☐☐
☐☐☐☐☐	n. Enough time for leisure activities	☐☐☐☐☐
☐☐☐☐☐	o. Co-ordinating and management tasks	☐☐☐☐☐
☐☐☐☐☐	p. Possibility of working in a team	☐☐☐☐☐
☐☐☐☐☐	q. Chance of doing something useful for society	☐☐☐☐☐
☐☐☐☐☐	r. Variety	☐☐☐☐☐
☐☐☐☐☐	s. Good chances of combining employment with family tasks	☐☐☐☐☐

H. Further Education and Training

Please provide us with some more information regarding your further education and training (not including doctoral study or other additional study you have mentioned already in Question B1.

H1 Did you undertake further education and training required in order to obtain or keep a professional qualification or another longer professional training period since graduation in 1994 or 1995 *(e.g. traineeship, Referendariat, Praktikum, "Registered Accountant", use national terms NatCat)*? [NatCat]

☐ No → *GO TO QUESTION H2*

☐ Yes, please specify:

	A. Name/kind of training *(e.g. traineeship, Referendariat, Volontariat, Praktikum)* [NatCat])	B. Duration *(please specify the number of months)*	C. Kind of certification earned *(if applicable)* [NatCat]
1.	.....	☐☐ Months ☐ Not finished yet	.....
2.	.....	☐☐ Months ☐ Not finished yet	.....
3.	.....	☐☐ Months ☐ Not finished yet	.....

H2 After your degree awarded in 1994 or 1995 did you undertake other additional/further education/training *(short courses, seminars, workshops, self-study, etc.)* **related to your career or to a future career that you might pursue?** *Exclude professional training programmes stated in response to H1 and exclude what you consider to be completely unrelated to work and career.*

☐ No → *GO TO QUESTION H10*

☐ Yes

H3 Please list the most important course(s) and indicate the total duration *(in contact hours of teaching/learning).*

	Name and type of the course/activity *(please specify)*	Duration (hours)
1	.....	☐ 1 to 10 hours ☐ 11 to 50 hours ☐ 51 and more hours
2	.....	☐ 1 to 10 hours ☐ 11 to 50 hours ☐ 51 and more hours
3	.....	☐ 1 to 10 hours ☐ 11 to 50 hours ☐ 51 and more hours

→ *The following questions H4 to H9 apply to your further education activities in general mentioned in H3.*

H4 Who is (was) responsible for providing this course/these courses? *Multiple reply possible*

☐ a. A higher education institution
☐ b. Private institute offering seminar/training
☐ c. In-company or in-service training
☐ d. Distance education/written course [NatCat]
☐ e. Other ..... (please specify)

H5 Who funded the costs for your participation in this course/these courses *(fees, transportation etc.)*?

☐ a. There were no costs
☐ b. Mainly my employer
☐ c. Mainly myself
☐ d. Mainly public funds
☐ e. I don't know
☐ f. Other ..... (please specify)

H6 Did you attend the course(s) during your paid working time?

- ☐ Yes, completely during paid working time
- ☐ Yes, partly during paid working time
- ☐ No, completely outside paid working time
- ☐ Not applicable, I was not employed

H7 Which of the following topics were covered in the course(s)? *Multiple reply possible*

- ☐ a. New scholarly knowledge in your discipline
- ☐ b. Cross-disciplinary scholarly knowledge of various fields
- ☐ c. Methodological competencies
- ☐ d. Manual skills
- ☐ e. Foreign language proficiency
- ☐ f. Computer skills
- ☐ g. Social/political or philosophical topics
- ☐ h. Competencies in business administration
- ☐ i. Management/leadership competencies
- ☐ j. Legal topics
- ☐ k. Human ecology/environmental matters
- ☐ l. Oral or written communication and presentation skills
- ☐ m. Relationships with customers/clients
- ☐ n. Other: ..... (please specify)

H8 What was the most important personal purpose of additional/further education/training when you started it? *Please mark only one*

- ☐ Enhancing career, getting promoted, etc
- ☐ Updating your knowledge
- ☐ Re-training (i.e. preparation for other occupations/careers)

H9 To what extent did your additional/further education or training actually help you afterwards ...?

	To a very high extent 1	2	3	4	Not at all 5
a. to get employed?	☐	☐	☐	☐	☐
b. to get along with the work tasks?	☐	☐	☐	☐	☐
c. to enrich the job (e.g. more interesting tasks)?	☐	☐	☐	☐	☐
d. to raise the status (e.g. promotion, higher income)	☐	☐	☐	☐	☐
e. to cope with requirements from other life spheres than employment and work	☐	☐	☐	☐	☐

H10 To what extent do you feel at present a need to update or develop your competencies further through additional/further education or training?

To a very high extent 1	2	3	4	Not at all 5
☐	☐	☐	☐	☐

H11 To what extent do you agree with the following statements regarding the need of additional/further education or training?

	Completely agree 1	2	3	4	Completely disagree 5
Additional/further education or training is necessary ...					
a. ... in order to cope with tasks which could not be envisaged at the time of initial education	☐	☐	☐	☐	☐
b. ... because of shortcomings in initial first study	☐	☐	☐	☐	☐
c. ... in order to acquire knowledge which can be learned better on the job	☐	☐	☐	☐	☐
d. Initial first study provides a sufficient training in relevant skill acquisition	☐	☐	☐	☐	☐
e. Initial first study constitutes a good basis for continuous updating of knowledge and skills	☐	☐	☐	☐	☐

H12 How often did you read subject related professional/scientific journals during the last 12 months?

At least once a week	Monthly	About every three months	Seldom	Never
☐	☐	☐	☐	☐

H13 How often did you attend professional relevant meetings/conferences during the last 12 months?

- ☐ 4 times and more
- ☐ 1 to 3 times
- ☐ Never

H14 How often did you use the internet sources for professional relevant information gathering during the last 12 months?

At least once a week	Monthly	About every three months	Seldom	Never
☐	☐	☐	☐	☐

I. Socio-Biographic data

Please provide details about yourself in order to enable us to interpret your work biography as accurately as possible

I1 Gender

☐ Male
☐ Female

I2 Year of birth

19☐☐ Year

I3 Please, provide some information about your citizenship and your country of schooling, study and work

	X	Other, please specify
a. Current citizenship	☐	.....
b. Citizenship at birth	☐	.....
c. Country where you completed secondary education	☐	.....
d. Country of first employment after graduation	☐	.....
e. Country of current employment/work	☐	.....
f. Country of current residence	☐	.....

[NatCat: x = country in which the survey in undertaken]

I4 In which region have you studied and where do you live today? *Please specify the postal code [NatCat]*

Postal code	
☐☐☐	(Main) region during time of studies
☐☐☐	Region of current residence
☐☐☐	Region of employment, if applicable

[National adaptation of boxes for postal codes or regions]

I5 Parental and partner highest education

Father	Mother	Partner	
☐	☐	☐	Compulsory school or less
☐	☐	☐	Completed (upper) secondary school
☐	☐	☐	Higher education diploma/degree
		☐	Not applicable, I do not have a partner

I6 Did/do you live ... *? Multiple reply possible*

Immediately prior to graduation in 1994 or 1995	Currently	
☐	☐	with a partner?
☐	☐	with parents?
☐	☐	with other persons?
☐	☐	as single?

I7 Are there children in your household?

☐ No → *GO TO QUESTION I8*

☐ Yes How many? ☐☐

How old are they:

1. ☐☐ 2. ☐☐ 3. ☐☐

4. ☐☐ 5. ☐☐ 6. ☐☐

I8 How many hours per week are you *(and eventually your partner)* **working in your household** *(cleaning, cooking, child care, etc.)*?

☐☐ Hours per week myself

☐☐ Hours per week my partner

I9 What is the major activity of your partner, if applicable? *Please tick only one*

☐ Not applicable, I don't have a partner
☐ Employed
☐ Self-employed
☐ Not employed, seeking employment
☐ Professional training
☐ Advanced academic study
☐ Child rearing, family care
☐ Other (please specify): .....

J Retrospective Assessment of Your Studies (you finished 1994 or 1995)

J1 To what extent did your studies help you ...?

To a very high extent 1 2 3 4 5 Not at all

- ☐☐☐☐☐ a. finding a satisfying job after finishing your studies?
- ☐☐☐☐☐ b. for your long-term career prospects?
- ☐☐☐☐☐ c. for the development of your personality?

J2 Looking back, if you were free to choose again, how likely would you ...

Very likely 1 2 3 4 5 Not likely at all

- ☐☐☐☐☐ a. choose the same course of study?
- ☐☐☐☐☐ b. choose the same institution of higher education?
- ☐☐☐☐☐ c. choose a higher degree level of higher education? [NatCat]
- ☐☐☐☐☐ d. choose a lower degree level of higher education? [NatCat]
- ☐☐☐☐☐ e. decide not to study at all?

J3 What kind of improvements in higher education would you suggest according to your experiences?

.....

.....

.....

Thank you very much for completing the questionnaire.

Curriculum Vitae

Christoph Michael Meng was born in Zürich, Switzerland, on April 4th, 1971. He attended pre-university education at the Wirtschaftsgymnasium – Kantonsschule Zürich (Switzerland), from 1986-1990. In 1997 he obtained his lic.oec.publ degree at the Faculty of General Economics, University of Zürich (Switzerland), and in 1998 his Masters' degree in International Economics at Maastricht University. Since then, Christoph Michael Meng has worked as a lecturer at the Economic Faculty of Maastricht University and since 2000 as a researcher at the Research Centre for Education and the Labour Market (ROA), where he started his PhD research.

Christoph Michael Meng is op 4 april 1971 geboren in Zürich (Zwitserland). Van 1986 tot 1990 volgde hij zijn gymnasiumopleiding aan het Wirtschaftsgymnasium – Kantonsschule Zürich (Zwitserland). In 1997 studeerde hij af aan de Economische Faculteit van de Universiteit Zürich (Zwitserland) en in 1998 aan de Economische Faculteit van de Universiteit Maastricht. Sinds 1998 is Christoph Michael Meng als docent werkzaam aan de Universiteit Maastricht en sinds 2000 als onderzoeker verbonden aan het Research Centrum voor Onderwijs en Arbeidsmarkt (ROA), waar hij zijn PhD-studie begon.

Roa Dissertation Series

1. Lex Borghans (1993), *Educational Choice and Labour Market Information*, Maastricht: Research Centre for Education and the Labour Market (ROA).

2. Frank Cörvers (1999), *The Impact of Human Capital on International Competitiveness and Trade Performance of Manufacturing Sectors*, Maastricht: Research Centre for Education and the Labour Market (ROA).

3. Ben Kriechel (2003), *Heterogeneity among Displaced Workers*, Maastricht: Research Centre for Education and the Labour Market (ROA).

4. Arnaud Dupuy (2004), *Assignment and Substitution in the Labour Market*, Maastricht: Research Centre for Education and the Labour Market (ROA).

5. Wendy Smits (2005), *The Quality of Apprenticeship Training. Conflicting Interests of Firms and Apprentices*, Maastricht: Research Centre for Education and the Labour Market (ROA).

6. Judith Semeijn (2005), *Academic Competences and Labour Market Entry; studies among Dutch graduates*, Maastricht: Research Centre for Education and the Labour Market (ROA).

7. Jasper van Loo (2005), *Training, Labor Market Outcomes and Self-Management*, Maastricht: Research Centre for Education and the Labour Market (ROA).

8. Christoph Meng (2005), *Discipline-Specific or Academic? Acquisition, Role and Value of Higher Education Competencies*, Maastricht: Research Centre for Education and the Labour Market (ROA).