

Degree Differentiation and Changing Career Outcomes of Higher Education Graduates in Germany: A Matter of Specialization, Extracurricular Activities or Labor Market Segmentation?***

Abstract: With the introduction of Bachelor's/Master's programs, the higher education system in Germany profoundly changed from having a one-tier to having a two-tier degree structure. So far, however, there is surprisingly little evidence on how the introduction of the new degree system has changed students' employment outcomes. This paper therefore asks 1) whether we can observe over time rising labor market inequalities in terms of wages and adequate employment between graduates holding Bachelor's, Master's and traditional degrees, and, if yes, 2) how these labor market differentials between different degree holders might be explained. By applying human capital, signaling and labor market segmentation theory we develop hypotheses on differentiated labor market outcomes. These are tested by estimating linear regression models and Blinder-Oaxaca Decompositions based on two graduate cohorts from the DZHW Graduate Panel Study, who graduated in the years 2009 and 2013. Results indicate that Bachelor graduates earn less and have lower job adequacy than traditional (for example *Diplom*, *Magister*, *Staatsexamen*) and Master's degree holders. These labor market differentials are partly explained by internal labor market segments and extracurricular qualifications, mostly in form of study-related student jobs, while gaining specific human capital through higher education seems to matter less.

* Martina Kroher, Leibniz University Hannover: Leibniz Center for Science and Society and Department of Sociology, Schneiderberg 50, 30167 Hannover, E-Mail: m.kroher@ish.uni-hannover.de, martina.kroher@lcss.uni-hannover.de as well as German Centre for Higher Education Research and Science Studies (DZHW), Lange Laube 12, 30159 Hannover, E-Mail: kroher@dzhw.eu.

** Kathrin Leuze, Friedrich Schiller University Jena, Carl-Zeiß-Straße 3, 07743 Jena, E-Mail: kathrin.leuze@uni-jena.de.

*** The authors would like to thank Gregor Fabian for his valuable help in every respect concerning the data. We also thank the two anonymous reviewers and the editors for their helpful suggestions, which greatly improved this work. We are thankful to the German Centre for Higher Education Research and Science Studies for providing the data. This study is part of the research project "Evaluation of the Consequences of the Reform of Program Structures and University Expansion for Labor Market Returns of University Graduates", which was supported by the Leibniz Center for Science and Society (LCSS). Earlier versions of this paper were presented, among others, at the 32. ECSR Conference (2021), the SOCEDUC (2021) and the 40th Congress of the German Sociological Association (2020). We wish to thank all participants for their helpful comments and suggestions.

Keywords: labor market returns, higher education, wages, adequate employment, Bachelor/Master degree

Warum unterscheiden sich die Arbeitsmarkterträge unterschiedlicher Hochschulabschlüsse in Deutschland? Zur Bedeutung von beruflicher Spezialisierung, außercurricularen Aktivitäten und Arbeitsmarktsegmentierung

Zusammenfassung: Mit der Einführung von Bachelor- und Master-Studiengängen wurde das Hochschulsystem in Deutschland grundlegend von einer einstufigen zu einer zweistufigen Studienstruktur reformiert. Bislang gibt es jedoch erstaunlich wenig Erkenntnisse darüber, wie die Einführung der neuen Hochschulabschlüsse die Beschäftigungschancen von Absolvent:innen verändert hat. Dieser Beitrag geht daher den Fragen nach, ob 1) sich im Zeitverlauf zunehmende Ungleichheiten auf dem Arbeitsmarkt in Bezug auf Löhne und adäquate Beschäftigung zwischen Absolvent:innen mit Bachelor-, Master- und traditionellen Abschlüssen beobachten lassen, und falls ja, 2) wie ungleiche Arbeitsmarkterträge zwischen den verschiedenen Hochschulabschlüssen erklärt werden können. Anhand von Humankapital-, Signal- und Arbeitsmarktsegmentationstheorie werden Hypothesen zu möglichen Einflussfaktoren entwickelt, die mit Hilfe von linearen Regressionsmodellen und Blinder-Oaxaca-Dekompositionen auf Basis von zwei DZHW Absolventenkohorten aus den Jahren 2009 und 2013 überprüft werden. Die Ergebnisse zeigen, dass Bachelor-Absolvent:innen weniger verdienen und eine geringere Beschäftigungsadäquanz aufweisen als Absolvent:innen traditioneller Abschlüsse (z.B. Diplom, Magister, Staatsexamen) und mit Masterabschlüssen. Diese Arbeitsmarktunterschiede lassen sich zum Teil durch interne Arbeitsmarktsegmente und außercurriculare Qualifikationen, vor allem in Form von fachbezogenen Studierendenjobs, erklären, während der Erwerb von spezifischem Humankapital durch Hochschulbildung selbst weniger wichtig zu sein scheint.

Stichworte: Arbeitsmarkterträge; Hochschulbildung; Löhne; adäquate Beschäftigung; Bachelor/Master Abschlüsse

1. Introduction

In 1999, 29 European countries joined forces to create the European Higher Education Area (EHEA) for promoting students' mobility and employability as well as the competitiveness of higher education systems in Europe (Bologna Declaration 1999). As a consequence of this so-called Bologna Process, member states agreed to implement specific structural elements in their national higher education systems.

Probably the best-known reform was the introduction of the two-cycle degree system with consecutive Bachelor's and Master's programs (Bologna Declaration 1999).¹

In Germany, the Bologna Process profoundly changed higher education: While the traditional degrees, namely so-called *Diplom*, *Magister* and *Staatsexamen* (state examinations), comprised one long cycle lasting four to five years, the Bologna Process introduced a two-cycle degree system with three-year Bachelor's and two-year Master's degrees (Eurydice 2010). In contrast to other countries with previous one-cycle systems, such as Italy and Portugal, which adopted the two-cycle degrees very rapidly within two or three academic years (Kroher/Leuze/Thomsen/Trunzer 2021), the implementation process in Germany extended over a much longer time period (see Figure 1). This leads to a gradual increase in Bachelor's degree holders from 2002 onward, with stronger growth rates occurring only after 2008, while the Master's degree was implemented even more slowly, particularly after 2009. In 2012, Bachelor's degree holders for the first time constituted the majority of graduates from German higher education, while the long degrees from the traditional one-cycle system steadily decreased. The remaining traditional degrees are mainly found in the form of state examinations for classic professions, such as medicine and law.²

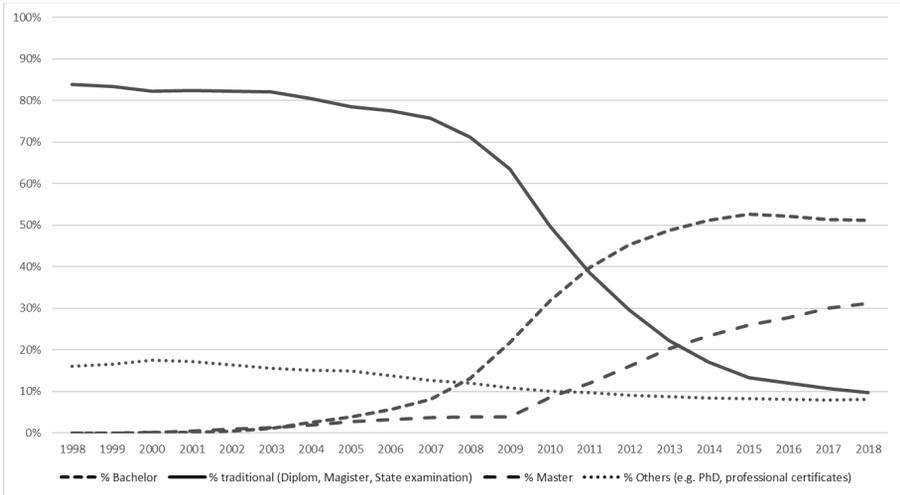
Institutionally, the introduction of Bachelor's and Master's degrees meant a change from a horizontally differentiated to a vertically differentiated degree structure in German higher education (Leuze 2010). Since the traditional degrees of *Diplom*, *Magister* and state examination were rather similar in length and setup, they did not result in stratified labor market outcomes, but mostly differed in terms of the labor market segments that graduates worked in. However, comparisons with traditionally vertically differentiated two-tier degree systems, such as that of the UK, indicate that Bachelor's degree holders have lower labor market returns and work in different segments than those holding a Master's degree (Leuze 2010; Leuze 2011). Therefore, it is likely that the introduction of a two-tier degree system in German higher education also changes the labor market outcomes of different degree holders. In the following, we therefore investigate 1) whether we can observe rising labor market inequalities between graduates holding Bachelor's, Master's and

1 At the Ministerial Conference Berlin 2003, the doctoral level was included as a third cycle of the new degree system (Berlin Communiqué 2003). However, since the purpose of this article is to look at the effects of the Bologna reform for the majority of students, we focus only on the first two cycles (Bachelor's & Master's) and will therefore refer to the "two-cycle system" throughout the paper.

2 These traditional state examinations provide training for future medical doctors and law professionals, both of whom are often employed in the public sector. They never changed to the two-cycle degree structure, since the related professional associations as well as state agencies argue that certification is based on a well-established system and requires at least five years of training, ensuring immediate entrance into the respective professions.

traditional degrees over time, and, if yes, 2) how these labor market differentials between different degree holders might be explained.

Figure 1: Degrees Obtained in German Higher Education (1998–2018)



Source: Autorengruppe Bildungsberichterstattung 2020: Tab. F5–10web, authors' illustration.

In the following, we address these questions by focusing on the wages and the adequate employment³ of graduates holding a significant first job after graduation. Accordingly, our paper scrutinizes career paths outside academia, which are pursued by the majority of higher education graduates in Germany. Looking at empirical studies since the implementation of the Bologna Process, surprisingly few investigated the consequences of the Bologna Process for students' employment outcomes (see Kroher/Leuze/Thomsen/Trunzer 2021 for an overview). Those studies reveal rather mixed evidence. On the one hand, mostly cross-sectional studies indicate that graduates with a Bachelor's degree tend to have lower wages (Alesi/Schomburg/Teichler 2010; Neugebauer/Weiss 2017; Trennt 2019), lower occupational prestige (Neugebauer/Weiss 2017) and less adequate employment (Fabian/Quast 2019; Grotheer 2019; Noelke/Gebel/Kogan 2012) than those hold-

³ The analysis of adequate employment scrutinizes whether graduates hold a job matching their higher education degree, either in terms of the vertical position they obtain (vertically adequate employment) or whether the content of their work matches the knowledge and skills acquired in higher education (horizontally adequate employment) (Fehse/Kerst 2007). We include both aspects and investigate whether graduates are both vertically and horizontally adequately employed, which we therefore label adequate employment in the following. While such a focus is common in German research on graduate employment (Fabian/Quast 2019; Grotheer 2019), the international literature more often examines inadequate employment, such as education and skills mismatches (Levels/van der Velden/Allen 2014) or overeducation (Di Stasio/Bol/van de Werfhorst 2016; Verhaest/van der Velden 2013).

ing traditional or Master's degrees. On the other hand, one longitudinal study finds no strong increases in wage differentials between Bachelor's and Master's degrees over time, while students' socioeconomic background and extracurricular qualifications obtained during higher education, such as studying abroad or having a study-related job, matter more (Lörz/Leuze 2019).

Thus, it remains an open question whether the introduction of the two-tier degree structure actually changed the labor market returns of different degree holders and, if yes, how these labor market differentials might be explained. Theoretically, we apply human capital, signaling and labor market segmentation approaches to develop hypotheses on the labor market returns of different degree holders. Our empirical analyses are based on two graduate cohorts from the Graduate Panel Study conducted by the German Centre for Higher Education Research and Science Studies (DHZW), who graduated in the years 2009 and 2013. To investigate differences in labor market returns by degree obtained and the empirical contribution of relevant covariates, we model the log hourly wage and the adequacy of the first employment position after graduation by means of linear regression and decomposition analyses.

2. State of Research

Empirical evidence on how the Bologna Process affects the employment outcomes of students remains surprisingly scarce. In the following, we give a brief overview on general changes occurring in German higher education as a consequence of the Bologna Process, before we review existing evidence on how labor market returns changed through the introduction of a two-tier degree structure. We predominantly focus on Germany, but provide additional evidence for other countries where available (for an encompassing review see Kroher/Leuze/Thomsen/Trunzer 2021).

Just like all over the world, we can observe an enormous increase in higher education enrolment rates over the past 50 years in Germany (see Schindler 2012). The proportion of those holding higher education entry certificates rose from 36 % in 1995 to more than 50 % in 2018 (Autorengruppe Bildungsberichterstattung 2020: 183), so that today about 45 % of an age cohort enrol in higher education (Autorengruppe Bildungsberichterstattung 2020: 190). However, studies investigating whether the Bologna Process has further increased higher education enrolment are inconclusive (Horstschräer/Sprietsma 2015; Neugebauer 2015). Horstschräer and Sprietsma (2015), for example, do not find any differences in the overall numbers of first-year students at German higher education departments in the pre-reform and post-reform period, yet effects differ across fields of study. In contrast, there is evidence that the introduction of the two-tier degree system has led to new inequalities in German higher education. Today, about 90 % of the Bachelor graduates at universities enrol in a Master's degree compared to about 40 % at universities of applied sciences (Autorengruppe Bildungsberichterstattung 2020: 196). How-

ever, graduates from less privileged family backgrounds tend to have lower probabilities of starting a Master's degree than those from more privileged families (Auspurg/Hinz 2011; Lörz/Quast/Roloff 2015; Lörz/Quast/Roloff/Trennt 2019; Neugebauer 2015; Neugebauer/Neumeyer/Alesi 2016). This points towards unintended consequences of the Bologna Process, namely that the introduction of the two-cycle degree structure rather increases than decreases social inequalities in higher education participation.

One major goal of the Bologna process was to increase the employability of higher education graduates in Europe. Generally, higher education graduates have considerably better employment prospects than degree holders from lower educational levels across Europe. Higher educational attainment increases employment rates (OECD 2020: 81, 84), reduces the likelihood of working part-time (OECD 2020: 74) and strongly decreases the risk of being unemployed (OECD 2020: 83). Moreover, higher educational attainment is accompanied by increasing monetary rewards (OECD 2020: 89). Yet this earnings advantage for highly-educated workers varies considerably by level of tertiary attainment. In most European countries, workers with a Master's or traditional degree earn more than those with a Bachelor's degree, who in turn earn more than those with a short-cycle tertiary degree or vocational education and training (OECD 2020: 88).

Only a few studies investigated whether the structural change from a formerly one-tier to a two-tier degree system in the course of the Bologna Process actually changed the labor market returns of higher education graduates in Germany. Regarding wage differentials, most cross-sectional studies on Germany find that Bachelor's degree holders earn less than graduates with Master's or traditional degrees (Alesi/Schomburg/Teichler 2010; Dill/Hammen 2011; Neugebauer/Weiss 2017; Trennt 2019) and thus confirm international findings (Glauser/Zangger/Becker 2019; Raudenská/Mysíková 2020; Sciulli/Signorelli 2011). In contrast, Müller and Reimer (2015) only find a persistent earnings gap between Bachelor graduates and graduates holding traditional degrees in three out of seven investigated fields of study (namely humanities, natural sciences, and engineering) in the German federal state of Bavaria. Comparing the wage returns of three different graduate cohorts from 2001 to 2009 five years after graduation, Lörz and Leuze (2019) also find no clear-cut wage differentials between Bachelor's and Master's degree holders, while graduates' socio-economic background and extracurricular qualifications, such as studying abroad or having a study-related job, seem to matter more. Related to this, Glauser et al. (2019) show that in Switzerland only the returns to a Bachelor's degree decreased between subsequent cohorts, while the returns to a Master's degree are quite stable over time. Thus, while cross-sectional evidence points towards clear wage differentials between pre- and post-reform degrees, results from more longitudinal designs are not as straightforward. Moreover, even if wage differences are observed, studies mostly focus on describing them, but do not seek to explain them. An exception is the study by Trennt (2019),

showing that graduates with a Master's degree earn higher wages than those with a Bachelor's degree since the former work more often in large firms and are more often adequately employed. Yet these factors only explain a small fraction of the observed wage differential.

Even less empirical evidence exists on the non-monetary labor market outcomes of graduates with different degrees. In this regard, studies for Germany find that Bachelor graduates, especially those from universities, take longer to find permanent employment (Grotheer 2019) than graduates holding Master's or traditional degrees. Moreover, Bachelor graduates from German universities (but not from universities of applied sciences) have higher risks for unemployment than those graduating from vocational education and training (Neugebauer/Weiss 2018). Regarding the adequacy of employment, about 60 percent of German graduates are adequately employed about one year after graduation (Fabian/Quast 2019: 419) and German graduates have lower risks of overqualification in general when compared to other European countries (Verhaest/van der Velden 2013). At the same time, studies point towards a higher risk of inadequate employment for Bachelor graduates compared to those holding Master's and traditional degrees (Fabian/Hillmann/Trennt/Briedis 2016; Fabian/Quast 2019; Grotheer 2019; Rehn/Brandt/Fabian/Briedis 2011). Inadequate employment seems to be most prevalent for Bachelor graduates from universities, while Master's graduates generally face lower risks even when compared to graduates holding traditional degrees (Grotheer 2019). Again, very few studies sought to explain these differentiated outcomes in adequate employment. They find that having a study-related job and working in the internal labor market play an important role in this regard, while studying abroad seems to matter less (Fabian/Quast 2019). A longitudinal analysis of how the adequacy of employment changed for different degree holders during the course of the Bologna Process is largely missing so far for Germany. Therefore, in the following we develop hypotheses on how wages and adequate employment might have changed between graduates holding different degrees and how we might explain these differentiated labor market returns.

3. Theoretical Background

As theoretical bases of our analyses we use the human capital theory (Becker 1962; 1964), Spence's signaling theory (Spence 1973; Spence 1974), and labor market segmentation theory (Doeringer 1967; Doeringer/Piore 1985).

3.1 Human Capital Theory

The human capital approach is often used to explain labor market differences between different educational groups (Becker, 1962; 1964). Its central assumption is that workers differ in their productivity determined by their knowledge, skills and abilities, the so-called human capital. According to this perspective, more

investment in human capital leads to higher productivity, which in turn results in higher labor market returns, especially higher wages, but possibly also adequate employment. Investments in human capital can take place via general schooling, vocational training, work experience, further education, or, as in this paper, higher education. In the following, we differentiate between the quantity and the quality of human capital, which are both suited to explaining the labor market returns of different degree holders (Leuze/Strauß 2009; Lörz/Leuze 2019).

The quantity of human capital refers to the time invested in education. Individuals invest continuously in their own human capital over the life course until the returns to investment are lower than its costs. With regard to higher education, for example, the investment decision to continue with a Master's course after finishing a Bachelor's degree depends on whether students are able to afford the longer study duration of a Master's program or not (Lörz/Quast/Roloff 2015). Since Bachelor's programs typically last for three years and Master's degree courses for an additional two years, this longer investment in the quantity of human capital should increase graduates' individual productivity and thus also future labor market outcomes. Moreover, as the study duration of traditional degrees in Germany is rather similar to a combined Bachelor's and Master's study duration, particularly at universities (Autorengruppe Bildungsberichterstattung 2020: 195), they should result in a similar quantity of human capital to a Master's degree, and in similar labor market returns accordingly. Therefore, *immediately after graduation, graduates of Master's and traditional degrees should have higher labor market returns than Bachelor graduates (H1)*.

However, it might be that with the expansion of higher education, not only the quantity of human capital, but also more qualitative aspects of education become increasingly important for labor market outcomes. From the perspective of human capital theory, students have the opportunity to invest in general or specific human capital (Becker 1962). While general human capital is acquired primarily through formal education, firm-specific human capital is built up in particular through work experience (on-the-job training) in a specific firm. In addition, a third form of human capital is of central importance for describing the German labor market, namely occupation-specific human capital (Estevez-Abe/Iversen/Soskice 2013), which is acquired for specific occupations. Since both firm- and occupation-specific human capital can only be used in particular work contexts, their investment is more costly. Accordingly, both forms of specific human capital are more positively related to income and further labor market returns than is general human capital, which is applicable in a broad array of different work contexts (Becker 1962; Estevez-Abe/Iversen/Soskice 2013).

In higher education research, these qualitative differences are often associated with different fields of study (Leuze/Strauß 2009) or higher education institutions (Leuze 2011; Reimer/Pollak 2010), arguing that fields of study transferring appli-

cable knowledge for particular occupations and universities of applied sciences provide graduates with more specific human capital. In line with this reasoning we assume that returns to different degree types might also stem from different investments in specific human capital. While the newly introduced Bachelor's degree offers a broad knowledge base for the respective discipline, a Master's degree aims at providing more specialized knowledge, sometimes focusing only on specific sub-disciplinary areas. Therefore, the knowledge, skills and abilities acquired through Master's degree courses should be per se more specific than those gained in a Bachelor program.

Yet, specific human capital might additionally be obtained through practical training in the course of higher education studies, mostly through internships (Trennt 2019). In the course of the Bologna Process, mandatory internships have been established in most degree courses, both at the Bachelor's and Master's level (Fabian/Hillmann/Trennt/Briedis 2016: 67f.). Since Master's students often have to undertake a second internship in the course of their study, which is probably even more tailored to their future occupational area, they acquire more specific human capital through practical training than do Bachelor graduates. Internships should also increase the specific knowledge of students doing traditional degree courses, simply because these courses last longer and give more room for internships (Fabian/Quast 2019). Accordingly, *due to their lower acquisition of specific human capital, Bachelor students should have lower labor market returns than graduates holding Master's or traditional degrees (H2).*

3.2 Signaling Theory

Labor market returns of different degrees might not only depend on the human capital acquired, but also on the signals of productivity associated with them (Spence 1973; Spence 1974). Signaling theory rejects the assumption of human capital approaches that employers have knowledge about the productivity of applicants even before hiring. Rather, they use observable characteristics of the applicants as indications of their productivity potential—so-called 'signals', such as educational qualifications.⁴ According to Spence (1973), employers associate certain performance expectations with certain signals, which ultimately determine related labor market returns: Signals that promise high productivity bring with them higher returns and vice versa. Employers' signal-related productivity expectations result from their previous experiences on the labor market, for example by observ-

⁴ Spence (1973: 357) subsumes all characteristics that can be directly manipulated by the individual, such as educational attainment, under the term 'signals'. Characteristics that are observable, but unalterable by individuals, such as gender, age or socio-economic background, are labeled indices. Even though both are considered by employers in the hiring process to assess the productivity of applicants, we focus on signals as direct investments of students to discuss their explanatory power for differentiated labor market returns. Indices, in contrast, are merely considered as control variables in the statistical models.

ing the productivity of hired employees with certain signals. High-performing individuals will invest in the acquisition of signals promising higher returns, which in turn confirms the existing productivity expectations of employers and generates an informal “feedback loop” (Spence 1973: 359). From this perspective, obtaining a Master’s degree does not increase productivity, but appears as a mere signal of a priori higher performance that is comparatively easy for employers to observe (Spence 1973). Employers should base their productivity expectations of Master’s degree holders on the fact that they are more similar to the long traditional degrees and accordingly offer higher labor market returns, which again support H1.

However, in view of the steadily growing number of higher education graduates in the course of educational expansion, who in many cases have technically equivalent qualifications due to the Bologna reform, it seems necessary for employers to resort to further signals. Therefore, students might increasingly strive to acquire additional signals in the course of their studies in order to distinguish themselves from other applicants when seeking a job. These further signals could be investments in extracurricular additional qualifications, such as studying abroad or a study-related student job. International student mobility might serve as a signal for increased achievement, motivation and cross-cultural competences, which is why graduates with such experience are rewarded by employers with higher labor market returns, both in terms of wages (Kratz/Netz 2018) and adequate employment (Fehse/Kerst 2007). This should also hold true for study-related student jobs: Rather than working in non-study-related jobs—for example as waitress or shop assistant—which merely serve to earn money, gaining practical professional knowledge for the future occupational area through a study-related job should also serve as signal of productivity. This should particularly hold true in the German labor market, where occupation-specific knowledge is particularly important for labor market returns (Estevez-Abe/Iversen/Soskice 2013). Employers might therefore associate study-related student jobs with engagement and more specific knowledge, which again should result in higher labor market returns (Sarceletti 2007).

In the case of the new degree programs, Bachelor graduates have less time to acquire these additional extracurricular qualifications as signals due to the shorter duration of their studies compared to graduates of a Master’s degree or traditional program. Therefore, the share of Bachelor graduates that were not internationally mobile and did not have a study-related student job is lower than that of graduates holding Master’s (Fabian/Hillmann/Trennt/Briedis 2016) or traditional (Rehn/Brandt/Fabian/Briedis 2011) degrees. Adding to this, Bachelor students studying abroad more often proceed with a Master’s degree (Lörz/Quast/Roloff/Trennt 2019), which again increases the productivity expectations for Master graduates. By implication, *due to their lower acquisition of extracurricular qualifications, Bachelor students should have lower labor market returns than graduates holding Master’s or traditional degrees (H3).*

3.3 Labor Market Segmentation

Finally, it might be the case that some aspects of current employment are more important than others for differentiated labor market returns. The theoretical notion of labor market segmentation implies that the labor market is divided into several segments, all of which offer specific career prospects, while mobility between the segments is restricted (Doeringer 1967; Doeringer/Piore 1985). For analyzing the labor market returns of different higher education programs, we differentiate between internal and external labor market segments. An external labor market is assumed to function in line with the neoclassical market logic, where pricing, allocation and training decisions are controlled directly by mechanisms of labor demand and supply. An internal labor market, on the other hand, is “governed by a set of institutional rules which delineate the [its] boundaries [...] and determine its internal structure” (Doeringer 1967: 207). Recruitment from the external labor market ideally takes place only once, when external applicants are employed for a restricted number of job positions, which constitute “ports of entry” (Doeringer/Piore 1985: 2) to the internal labor market. Since employees are recruited not only for the position at hand, but for a specific career ladder building up on the initial position, the screening process at this first stage strongly depends on education credentials, which constitute important signals for employers to assess the suitability of applicants. Therefore, we assume that higher education degrees should be particularly relevant for recruitment at such ports of entry.

On the one hand, internal labor market segments are often found within a particular firm (firm-internal labor markets) (Doeringer 1967). Large companies have specific entry ports and thereafter provide mobility along specified career paths. At the same time, they pay higher wages and offer stronger wage increases. Small firms, by contrast, do not provide such sheltered career ladders, which makes mobility between firms more likely and results in a shorter job tenure, with more market-driven wages. When hiring to firm-internal labor markets, employers seek to employ applicants most suitable for proceeding up the internal career ladders. For doing so, they should use higher degrees as signals in the hiring process. Since in the course of the Bologna process, employers have less experience with the productivity of Bachelor graduates, while Master graduates are comparable to those holding traditional degrees, Bachelor graduates will either start at lower entry positions or are not hired at all. Therefore, *due to their lower probability of working in large firms, Bachelor students should have lower labor market returns than graduates holding Master’s or traditional degrees (H4a)*.

On the other hand, graduate labor markets are to a large extent segmented along the axis of public and private sectors (Leuze 2010). In the literature, public sectors have often been identified as the prototype of internal labor markets, i.e., with explicitly defined “ports of entry” at the lower end of the job hierarchy, stable employment relationships and calculable promotion schemes. As a consequence,

employment in the public sector is even more strongly protected from market competition than are the firm-internal labor markets in the private sector (Becker 1993). Historically, direct ties between German universities and the public sector ensured that traditional higher education qualifications gave the holder the right to apply for particular employment positions in the public sector (Becker 1993; Leuze 2010). Today, a Master's degree gives access to the same positions in the public sector as does a traditional degree, with similar pay scales and chances for promotion. The Bachelor's degree, by contrast, gives access only to lower-level positions in the public sector, with accompanying lower wage levels (Bundesverwaltungsamt 2019; KMK 2000). Therefore, *due to their lower probability of working in the public sector, Bachelor students should have lower labor market returns than graduates holding Master's or traditional degrees (H4b)*. Yet, since wages paid in the public sector are generally lower than those paid in the private sector, it might also be the case that this type of firm-internal labor market only explains the employment adequacy of different degree holders and not their wages.

4. Data and Methods

4.1 Data and Operationalization

To analyze labor market differences between graduates with Bachelor's, Master's and traditional degrees, we use data from the DZHW Graduate Panel, a survey conducted every four years for investigating the transition from higher education to work. The data for each graduation cohort are collected about one, five and ten years after graduation. Since this paper focuses on the development and change of labor market returns in the course of the Bologna Process, we first use the cohorts 1997 to 2013 to describe the development of labor market returns of different degree holders over time. However, to analyze possible explanations, we need a sufficient number of graduates holding the new Bachelor's and Master's degrees. Therefore, our multivariate analyses only consider the cohorts 2009 and 2013, since a sizeable share of Bachelor graduates entered the labor market only after 2008, and Master graduates are only observable in cohorts 2009 and 2013.⁵ The Stata do-file for variable codings and the statistical analyses is available upon request at the Research Data Centre for Higher Education Research and Science Studies (FDZ-DZHW)⁶.

To assess the influence of different higher education degrees, we look at the first significant job held about one year after graduation. We operationalize labor market returns in two different ways: first, objectively in the form of hourly wages and second, as a subjective assessment of the job adequacy. Measurement of hourly wages is based on graduates' reported gross monthly income, which we deflate to prices from 2015 and convert into gross hourly wages by means of the contrac-

5 The graduate cohort of 2013 is the most recent cohort available as scientific-use file.

6 <https://doi.org/10.21249/DZHW:kroher2023:1.0.0>

tual work hours. Additionally, we take the natural logarithm due to the strongly skewed wage distribution to achieve better modeling properties of this dependent variable (Petersen 1989). For better interpretation of the results from the log hourly wage regressions, we present predicted exponentiated coefficients, which represent differences in Euro for a one-unit change of the independent variable. To ensure that graduates obtained a first significant job after graduation, we further restricted our sample by excluding graduates with marginal part-time work, i.e., who either received monthly wages lower than €400 (2009) and €450 (2013) or worked less than 15 hours per week. Furthermore, we do not consider hourly wages of less than five Euros due to possible measurement error. Although these restrictions lead to a strongly reduced sample, they are deemed necessary to ensure that we analyze only graduates who successfully entered the labor market.⁷

To draw a more complex picture of labor market returns, we further analyze the subjective assessment of the adequacy of the first job after graduation. We use three variables to address the different dimensions of adequacy: Respondents indicate whether their first job matches their higher education qualification in terms of 1) their professional position, 2) their level of the work tasks and 3) the content of their field of study on a five-point Likert scale. For each graduate, we computed the mean of these three items, thereby generating a metric variable of subjective job adequacy, ranging from 1 to 5. Higher values indicate more adequate employment. Finally, we applied the same sample restrictions as for the wage sample to ensure that graduates obtained a first significant job.

Our main independent variable is the higher education degree obtained. We differentiate between traditional degrees such as *Diplom* and *Magister* and the newly established Bachelor's and Master's degrees, but exclude state examinations and teacher training, since those were not completely reformed in the course of the Bologna process and are therefore not comparable to the other degrees. We operationalize H1 on the quantity of human capital only by means of the degrees obtained rather than by including measures on the length of study, since the latter also measures whether students finish their studies on time. The quality of human

7 From the full sample (2009: 11,155, 2013: 8,477), we first excluded all participants who have not worked since graduation (2009: 19 percent, 2013: 16 percent). Of those working, only 73 percent in 2009 and only 53 percent in 2013 have information on the hourly wage, which mainly results from a large proportion of missing values on the monthly income variable (2009: 24 percent, 2013: 44 percent) and to a smaller extent from information on weekly hours worked. Such a large number of missing values is rather common for income information, especially for income from self-employment and respondents working part-time or having higher education qualifications (Riphahn/Serfling 2005). As a consequence, we might have higher nonresponse rates at the lower and the upper tier of the income distribution; this should be kept in mind when interpreting our results. To ensure that graduates obtained a first significant job after graduation, we excluded respondents with wages lower than €400 and €450 respectively, working hours lower than 15 hours and hourly wages lower than €5, which further reduced the wage sample to 57 percent in 2009 and 48 percent in 2013.

capital (H2) is operationalized by two variables: 1) occupation-specific content taught in the course of study and 2) whether compulsory internships were part of the degree course. For the first variable, we built an index based on respondents' assessments of four items on a) the topicality of the content taught in relation to practical requirements, b) the linking of theory and practice, c) the practice of professional tasks and d) the preparation for the future occupation. The internship variable is dichotomous (yes/no) and measures whether students had to undertake mandatory internships as part of their degree course.⁸ Additional signals obtained in the course of higher education (H3) were also measured by two variables: The first asks whether or not respondents had a student job during higher education, and if yes, whether the student job was related or unrelated to their respective subject. The second indicates students' experience abroad during their studies with a dichotomous variable (yes/no). Finally, internal labor market segments (H4a and 4b) are captured by two variables: The firm size of the current workplace distinguishes between small, medium and large firms (H4a), while the second measures whether or not graduates work in the public sector (H4b).

We use further control variables relating to graduates' wages and adequate employment: 1) further human capital measurements, namely type of higher education institution (university of applied sciences/universities), graduates' field of study (grouped in eleven categories) and whether respondents completed an apprenticeship before enrolling in higher education; 2) socio-demographic indices influencing the productivity expectations of employers, namely gender (women/men), age and parental education background (parents without higher education/parents with at least one higher education degree). Finally, time trends are considered by controlling for the graduate cohort (2009 and 2013). Listwise deletion of missing cases for all variables results in a sample size of 6,032 cases for the wage sample and 5,996 for the adequacy sample.⁹ The distribution of all variables for both samples is presented in appendix table A.

- 8 Depending on the data set we use, there are slight differences between the questions addressing internships, and also experiences abroad. The corresponding questions on internships and study abroad are not asked consistently and uniformly in a way that they refer to the last study. We find the items in the section with questions about the last study program, but it is not always explicitly referred to in the question. We are aware of the problem that these questions are not clearly defined but they are the best proxy we can use.
- 9 We excluded those individuals with a degree in teacher training or with a state examination (2009: 18 percent, 2013: 21 percent) and those who worked as freelancers (2009: 2 percent, 2013: 5 percent). Our independent variables mostly have a very small number of missing values (less than 5 percent of those in employment). A higher number of missing values are found only for the employment sector (2009: 16 percent, 2013: 34 percent) and the firm size (2009: 18 percent, 2013: 35 percent). Overall, these sample restrictions and the listwise deletion of missing values on the independent variables further reduced the sample to 3,576 (wage) / 3,596 (adequacy) in 2009 and 2,436 (wage) / 2,420 (adequacy) in 2013.

4.2 *Methods and Analytic Strategy*

The analysis starts with a descriptive overview of the development of wages and job adequacy over time, first in general and then by the different higher education degrees. For doing so, we use the sample of our two cohorts and additionally include graduates from the 1997 to 2005 cohorts to cover a time span prior to the Bologna Process as well. Thereafter, we estimate linear regression models for both dependent variables for our relevant cohorts 2009 and 2013.

Our analytical strategy proceeds in two steps: In a first step, we investigate how labor market returns have changed over the cohorts and whether these changes are attributable to differences in human capital, signals and/or segmentation. This model performs a stepwise regression analysis on the pooled model with interaction effects between degrees and cohorts. We assess whether observable differences in labor market returns between different degree holders diminish once we add our theoretically relevant independent variables step by step. Model 1 (m1) serves as baseline, representing the interaction effects between the different degrees and cohorts on wages and job adequacy, while model 2 (m2) additionally includes all control variables. Model 3 (m3) adds the variables on occupation-specific human capital, model 4 (m4) the signaling variables and model 5 (m5) the variables on internal labor market segments. Finally, model 6 (m6) represents the full model with all preceding variables. Results of these analyses are presented as margin plots comparing the labor market returns of different degree holders over time. We expect that once we control for our relevant independent variables, labor market differentials between different degree holders should decrease and the lines in the graph will converge.

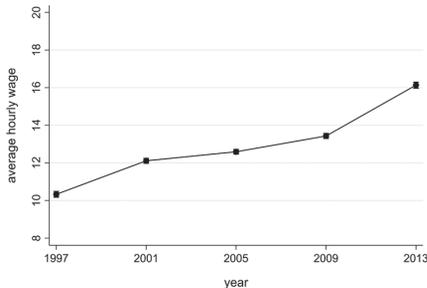
However, such a graphical representation of possible mediator effects does not indicate how much of the gross return gap between different degree holders is explained by the respective variables of interest. Therefore, in a second step we additionally estimate Blinder-Oaxaca decompositions in order to quantify the effect of the different explanatory variables on the degree wage and adequacy differentials (Jann 2008). Technically, the method is based on a so-called counterfactual model, explaining the labor market returns of Bachelor degree holders by inserting coefficients of traditional or Master's degree holders into the equation. It decomposes the overall return gap into an 'explained' part, which is based on differences in observable characteristics (also called differences in endowments) between Bachelor's and traditional/Master's degree holders, and into an 'unexplained' part, which relates to effect differences between the various degrees. Since the Blinder-Oaxaca decomposition is applicable to two groups only, we decompose first return differences between Bachelor's and traditional degrees and second between Bachelor's and Master's degrees. For both analyses, estimations are based on the pooled samples of cohorts 2009 and 2013 because the sample sizes per cohort are too small to estimate robust results, which made pooling necessary.

5. Results

5.1 Descriptive Results

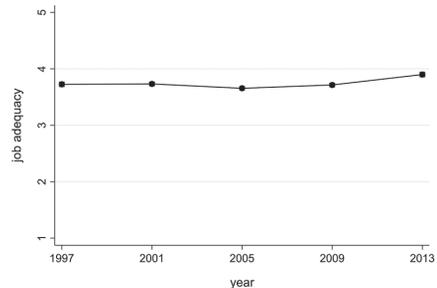
We first take a closer look at the development of labor market returns. As can be seen in Figures 2a and 2b there is an increasing trend in hourly wages and a relatively stable trend for the adequacy of the first job, albeit on a quite high level. In recent cohorts, students earn substantially more in their first job after graduation, even in constant prices of 2015, while there are only slight changes in the job adequacy. It seems that in every cohort most graduates find a job that is well suited for their level of higher education.

Figure 2a: Development Hourly Wages in General



Source: DZHW Graduate Panel (1997 to 2013), authors' illustration.

Figure 2b: Development Job Adequacy in General



Source: DZHW Graduate Panel (1997 to 2013), authors' illustration.

Estimating these average labor market returns by different types of degrees (see Figures 3a and 3b), we find a clear advantage for most cohorts of graduates holding traditional and Master's degrees. Figure 3a shows a distinct difference in the average hourly wages of graduates with a Bachelor's degree compared to those with a Master's or traditional degree for the cohorts 2009 and 2013. Even though wages for all degree holders rise over time, it seems that taking part in a Bachelor's program results in systematically lower wages, which supports previous findings for Germany (Trennt 2019) and other countries (Kroher/Leuze/Thomsen/Trunzer 2021). However, in 2005, where only a selected group of Bachelor graduates entered the labor market and Master's degrees of the new two-tier degree structure were not yet available, hardly any wage differentials are found. The picture is different for the subjective evaluation of job adequacy (see Figure 3b). Here, Bachelor graduates report from the beginning lower levels of job adequacy when compared to traditional and Master's degree holders, which again supports previous findings for Germany (Fabian/Quast 2019; Grotheer 2019). By contrast, the two other types of degrees have a similar wage level and level of job adequacy and hardly differ from each other. These merely descriptive findings support our hypothesis 1,

according to which we assumed that Bachelor's degree holders receive lower labor market returns than both traditional and Master's degree holders, due to their lower investment in human capital.

Figure 3a: Development Hourly Wages by Type of Degree

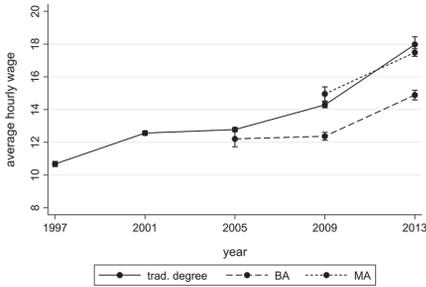
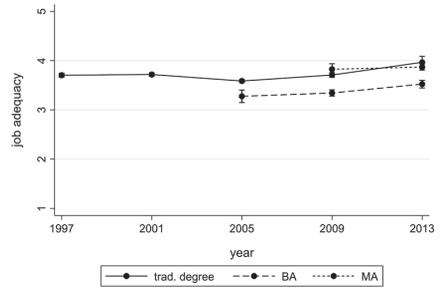


Figure 3b: Development Job Adequacy by Type of Degree



Source: DZHW Graduate Panel (1997 to 2013), authors' illustration.

Source: DZHW Graduate Panel (1997 to 2013), authors' illustration.

However, apart from the length of the respective degree courses, it remains an open question as to whether additional, more qualitative aspects differ, which might explain differentiated labor market returns. Tables 1a and 1b show the descriptive results of our relevant sample variables, first for the pooled sample, and then differentiated by cohorts and degrees. Supporting our graphical findings, the hourly wage increases quite strongly, while the adequacy of the first job rises only moderately. At the same time, the number of traditional degrees decreases over time, while the new degrees—especially the Bachelor's degree—increase. Overall, the strongest wage differences are found between Bachelor's and Master's degrees, while individuals with a traditional degree earn only slightly more than those with a Bachelor's degree. Differences in adequate employment are fairly similar, with the highest values found for Master's degree holders, followed by graduates with a traditional and then a Bachelor's degree.

Table 1a: Descriptive Results (shares or means with standard deviations): Wage Sample

	pooled wage sample	2009	2013	trad. degrees	BA	MA
<i>hourly wage</i>	14.99 (5.33)	13.78 (5.16)	16.78 (5.07)	14.85 (5.11)	13.42 (5.10)	17.06 (5.25)
<i>log hourly wage</i>	2.64 (0.37)	2.56 (0.37)	2.77 (0.33)	2.64 (0.35)	2.53 (0.37)	2.78 (0.35)
degrees						
traditional degrees	40.95	59.57	13.46	---	---	---
BA degree	32.05	30.98	33.62	---	---	---
MA degree	27.00	9.45	52.91	---	---	---
cohort						
2009	---	---	---	86.72	57.63	20.87
2013	---	---	---	13.28	42.37	79.13
<i>occupational specificity</i>	3.16 (0.83)	3.13 (0.84)	3.22 (0.81)	3.10 (0.82)	3.17 (0.84)	3.25 (0.81)
internship(s)						
no internship	20.41	19.22	22.17	16.64	11.17	37.08
internship(s)	79.59	80.78	77.83	83.36	88.83	62.92
stay abroad						
no stay abroad	68.34	65.29	72.82	59.92	75.58	72.50
stay abroad	31.66	34.71	27.18	40.08	24.42	27.50
student job						
no student job	11.12	10.76	11.66	10.57	12.57	10.25
no subject related student job	19.73	21.64	16.91	19.27	25.87	13.14
subject related stu- dent job	69.15	67.60	71.43	70.16	61.56	76.61
sector						
private sector	66.81	64.32	70.48	65.02	72.84	62.37
public sector	33.19	35.68	29.52	34.98	27.16	37.63
firm size						
small firm	20.28	23.14	16.05	21.62	22.25	15.90
medium firm	39.59	40.46	38.30	38.42	43.46	36.77
large firm	40.14	36.40	45.65	39.96	34.30	47.33
N	6,032	3,596	2,436	2,470	1,933	1,629

Source: DZHW Graduate Panel (2009 and 2013).

Table 1b: Descriptive Results (shares respectively means with standard deviations): Adequacy Sample

	pooled adequacy sample	2009	2013	trad. degrees	BA	MA
<i>adequacy</i>	3.69 (1.20)	3.63 (1.20)	3.79 (1.18)	3.76 (1.15)	3.44 (1.26)	3.89 (1.13)
degree						
traditional degrees	41.03	59.62	13.55	---	---	---
BA degree	32.00	30.90	33.64	---	---	---
MA degree	26.97	9.48	52.81	---	---	---
cohort						
2009	---	---	---	86.67	57.58	20.96
2013	---	---	---	13.33	42.42	79.04
<i>occupational specificity</i>	3.16 (0.83)	3.13 (0.83)	3.22 (0.82)	3.10 (0.82)	3.17 (0.84)	3.25 (0.81)
internship(s)						
no internship	20.41	19.27	22.11	16.67	11.20	37.04
internship(s)	79.59	80.73	77.89	83.33	88.80	62.96
stay abroad						
no stay abroad	68.40	65.30	72.98	59.92	75.61	72.73
stay abroad	31.60	34.70	27.02	40.08	24.39	27.27
student job						
no student job	11.14	10.77	11.69	10.53	12.61	10.33
no subject related student job	19.68	21.59	16.86	19.19	25.90	13.05
subject related stu- dent job	69.18	67.65	71.45	70.28	61.49	76.62
sector						
private sector	66.74	64.23	70.45	64.96	72.75	62.34
public sector	33.26	35.77	29.55	35.04	27.25	37.66
firm size						
small firm	20.30	23.15	16.07	21.59	22.25	16.02
medium firm	39.54	40.44	38.22	38.41	43.46	36.61
large firm	40.16	36.41	45.70	40.00	34.29	47.37
N	5,996	3,576	2,420	2,460	1,919	1,617

Source: DZHW Graduate Panel (2009 and 2013).

Regarding our independent variables of interest, the occupational specificity reported is fairly stable over time; highest in the Master's degree and lowest in traditional programs, with the Bachelor's degree ranging in between. Mandatory internships, by contrast, seem to rise over time and are reported most often by Bachelor graduates and least by Master graduates. Thus, both variables only partly follow the assumed distribution between different degrees. Staying abroad while studying seems to decline over time and is found most among traditional degree holders and least among Master's degree holders. Having a subject-related student job remains fairly stable over time and is indicated predominantly among individuals holding a Master's degree, followed by those holding a Diplom or Magister. Graduates from Bachelor programs, by contrast, most often report a student job not related to their subject. Thus, the acquisition of additional signals only follows the expected distribution for subject-related student jobs, but not for staying abroad. The variables on internal labor market indicate that the majority of students are employed in the private sector, with the highest share among Bachelor degree holders and the lowest among Master graduates. Employment mostly takes place in medium and large firms, with Master graduates working most often in large firms, while Bachelor degree holders are more often found in medium firms. Interestingly, working in small firms is most common for traditional and Bachelor's degrees. Accordingly, working in internal labor markets mostly follows the predicted distribution among different degrees. Overall, there are hardly any differences in the two samples regarding our independent variables of interest.

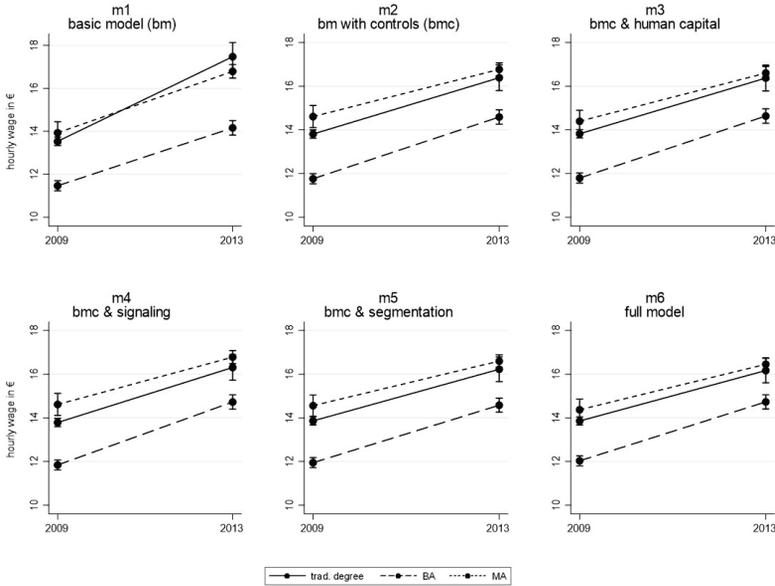
5.2 Regression Analyses: Mediation

To test whether these observed descriptive differences between degree holders also contribute to differentiated labor market returns, we first run several linear regression models with a stepwise introduction of relevant covariates. The coefficients of the wage regressions can be read as difference in Euro of hourly wages, while the coefficients of the regressions on job adequacy indicate a change in scale points.

Figure 4a displays the results of all six wage models as margins plots. As with Figure 3a, the basic model comprises only the degrees, cohorts and their interactions, but this time models the log hourly wage. The remaining models add the control variables (m2) and the theoretically relevant independent variables separately (m3-m5), before estimating the full model (m6). If our dependent variables mediate the effect between degree and wages, the lines of the respective graphs should converge, i.e., the predicted wages of Bachelor graduates should draw closer to the predicted wages of the other two degrees. However, this is not the case. According to Figure 4a we observe a small convergence of predicted wages in the full model (m6), especially in 2013. Nevertheless, the gap between graduates holding Bachelor's degrees and those with Master's or traditional degrees remains substantial and hardly changes once the relevant mediator variables are considered. Accordingly, none of our included

independent variables are capable of closing the gap—or in other words none can explain this gap.

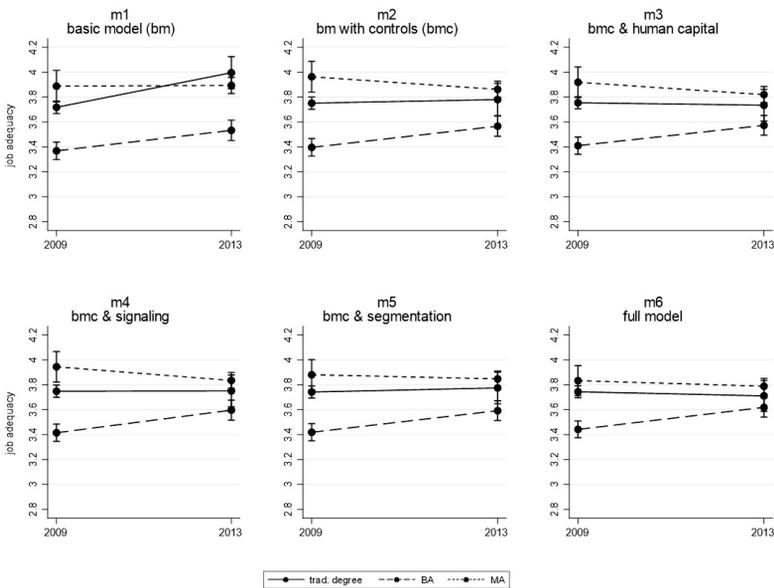
Figure 4a: Regression Analyses on the Hourly Wage of the First Job



Source: DZHW Graduate Panel (2009 and 2013), authors' illustration.

Comparing the regression models for the adequacy of employment, a slightly different picture evolves (see Figure 4b). Here, the gap between Bachelor's degree holders and holders of the other degrees closes more firmly, once specific human capital, additional signals and internal labor market segments are controlled, leading to a stronger convergence of the predicted job adequacy, particularly for cohort 2013. In the full model (m6), Bachelor's graduates are only slightly more inadequately employed compared to traditional and Master's graduates. Interestingly, Master's graduates were initially also more adequately employed than traditional degree holders in 2009, yet these differences diminish in 2013.

Consequently, we conclude that over time wages increase for all degree types, but the gap between the different degrees remains relatively stable even when adding other explanatory factors. In contrast, Bachelor's students can take matters into their own hands in terms of job adequacy and find careers suitable for their education through specific human capital, additional signals and when working in internal labor markets. However, it remains an open question as to which groups of variables have the highest explanatory power in this regard.

Figure 4b: Regression Analyses on the Adequacy of the First Job

Source: DZHW Graduate Panel (2009 and 2013), authors' illustration.

5.3 Regression Analyses: Decomposition models

In the following, we therefore examine the contribution of each variable group by decomposing the labor market gap between different degree holders. Table 2a presents results from the Blinder-Oaxaca decompositions of the wage differentials, comparing Bachelor's graduates first with traditional degree holders and then with Master's degree holders. Both decompositions are based on the full models including all relevant variables of interest and the control variables. The wage regressions, which form the basis of these analyses, can be found in the appendix, Table B1.

Results indicate that graduates with a Bachelor's degree earn significantly less compared to those with a traditional or a Master's degree, however the gap is much higher in comparison to Master's graduates. A closer look at the wage difference shows that individuals holding a traditional degree earn about 11.0 percent higher wages than Bachelor's graduates, while those with a Master's receive a wage premium of 25.3 percent.

Looking at the explanatory power of our relevant variables, we find some support for our theoretical assumptions, yet not always for all types of degrees. Regarding the relevance of occupation-specific human capital, a higher reported occupational specificity in higher education indeed increases wages (see appendix Table B1), but does not contribute to wage differentials by degree. Contrary to our expecta-

tion, mandatory internships are accompanied by lower wages when comparing the Bachelor's degree to traditional degrees (see appendix Table B1). Since Bachelor graduates report mandatory internships more often than the other two degree groups, this contributes to the wage gap between Bachelor's and traditional degrees. Yet both findings are not in line with our theoretical considerations and thus do not support hypothesis 2.

Additional signals, such as experience abroad or having a study-related student job, indeed come along with higher wages (see appendix Table B1), but again only partly contribute to the degree wage gap. Since individuals with traditional degrees gain more experience abroad than Bachelor's degree holders, this partly explains their wage differentials, while with a Master's degree international student mobility does not contribute to the wage gap. In contrast, graduates with both traditional and Master's degrees more often have study-related student jobs, while Bachelor's degree holders have student jobs not related to their subject. The positive signal of a study-related job therefore explains part of the wage penalty incurred by Bachelor's graduates, thus partly supporting hypothesis 3.

Finally, the two hypotheses on internal labor markets are also partly confirmed, mainly regarding the firm size (hypothesis 4a). Since graduates with traditional and Master's degrees work more often in large firms than do Bachelor's degree holders, this has an impact on the degree wage gap. Additionally, Bachelor's graduates earn less than Master's graduates since the former more often work in small firms. Public sector employment, in contrast, does not contribute to the degree wage gap (hypothesis 4b).

Table 2a: Blinder-Oaxaca Decompositions of the Wage Differences Between Different Degrees

	log hourly wage BA vs trad.		log hourly wage BA vs MA	
		%		%
log hourly wage trad. / MA graduates	2.639*** (0.007)		2.782*** (0.009)	
log hourly wage BA graduates	2.529*** (0.009)		2.529*** (0.009)	
difference	0.110*** (0.011)	100	0.253*** (0.012)	100
explained	-0.009 (0.011)	-8.18	0.102*** (0.016)	40.32
unexplained	0.120*** (0.014)	109.09	0.152*** (0.018)	60.08
<i>explained in detail</i>				
control variables	0.014 (0.007)		0.007 (0.012)	
occupational specificity	-0.001 (0.001)		0.001 (0.001)	
internships (ref.: no internship)	0.003* (0.001)		0.007 (0.004)	
experience abroad (ref.: no stay abroad)	0.006** (0.002)		0.001 (0.001)	
student job				
no student job	0.001 (0.001)		-0.001 (0.001)	
not study related student job	0.002** (0.001)		0.009*** (0.002)	
study related student job	0.004*** (0.001)		0.007*** (0.002)	
public sector (ref.: private sector)	-0.001 (0.001)		0.002 (0.002)	
firm size				
small firm	0.001 (0.001)		0.006*** (0.001)	
medium firm	0.001 (0.001)		0.001 (0.001)	
large firm	0.005*** (0.001)		0.014*** (0.002)	
year (ref.: 2009)	-0.041*** (0.006)		0.049*** (0.007)	
N	4,403		3,562	

Source: DZHW Graduate Panel (2009 and 2013).

Note: ref = reference category. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$. Standard errors in parentheses.

Overall, the relevant independent and control variables explain about 40 percent of the wage differentials between Bachelor's and Master's degrees. Even though rather similar factors explain the wage gap between graduates holding traditional and Bachelor's degrees, their explanatory power is offset by controlling for cohort differences. Cohort effects decrease the wage gap between traditional and Bachelor's degrees, indicating that their wages become more similar over time. In contrast, cohort effects increase the degree gap over time, which implies rising wage inequalities between Bachelor's and Master's degree holders.

A somewhat different picture emerges if we look at the decomposition models for job adequacy (see Table 4b). The regressions on adequate employment, which form the basis of these analyses, are found in the appendix, Table B2. Overall, Bachelor degree holders report lower levels of job adequacy than those with a traditional (0.317 scale points) or Master's (0.454 scale points) degree. The occupation-specific content of studies increases adequate employment in both models (see appendix Table B2), yet contributes to both gaps in the opposite direction. In accordance with hypothesis 2, Master's degree holders gain more occupation-specific knowledge through their studies than Bachelor's degree holders, which partly explains the adequacy gap. However, since traditional degrees provide less occupation-specific knowledge than do Bachelor programs, this decreases rather than explains the adequacy gap. Mandatory internship also increases the adequacy of employment (see appendix Table B2), yet does not explain differences between short and long degrees, since the former more often report mandatory internships. Accordingly, our data lend only weak support to hypothesis 2, just as was the case for wages.

Since experience abroad does not increase the adequacy of employment, it cannot contribute to degree differentials and thus does not serve as an additional signal. In contrast, study-related student jobs increase the job adequacy of graduates when compared to student jobs not related to the field of study. Since Bachelor's graduates more often reported the latter, they have lower levels of adequate employment, which supports hypothesis 3. Accordingly, a study-related student job might indeed serve as a signal for future employers, thereby increasing the adequacy of employment for traditional and Master's graduates.

Finally, both variables on internal labor markets point in the assumed direction: Working in large firms (hypothesis 4a) and in the public sector (hypothesis 4b) increases the adequacy of employment. Since both traditional and Master's graduates work more often than Bachelor graduates in the public sector and in large firms, both forms of internal labor markets contribute to the gap in adequate employment. Overall, about 47–48 percent of the observed disadvantage of Bachelor's graduates in adequate employment can be explained by the respective independent and control variables.

Table 2b: Blinder-Oaxaca Decompositions of the Job Adequacy of Degrees

	job adequacy BA vs trad.		job adequacy BA vs MA	
		%		%
job adequacy trad. / MA graduates	3.755*** (0.023)		3.893*** (0.028)	
job adequacy BA graduates	3.439*** (0.029)		3.439*** (0.029)	
difference	0.317*** (0.037)	100	0.454*** (0.040)	100
explained	0.149*** (0.035)	47.00	0.217*** (0.051)	47.80
unexplained	0.167*** (0.048)	52.68	0.237*** (0.061)	52.20
<i>explained in detail</i>				
control variables	0.084*** (0.024)		0.072 (0.038)	
occupational specificity	-0.015** (0.006)		0.022** (0.008)	
internships (ref.: no internship)	-0.006 (0.004)		-0.023 (0.014)	
experience abroad (ref.: no stay abroad)	0.015* (0.007)		0.001 (0.002)	
student job				
no student job	0.001 (0.001)		-0.001 (0.001)	
not study related student job	0.012*** (0.004)		0.033*** (0.008)	
study related student job	0.017*** (0.004)		0.030*** (0.007)	
public sector (ref.: private sector)	0.031*** (0.007)		0.059*** (0.011)	
firm size				
small firm	0.001 (0.001)		0.008* (0.003)	
medium firm	-0.001 (0.002)		0.001 (0.003)	
large firm	0.005* (0.002)		0.017*** (0.005)	
year (ref.: 2009)	0.008 (0.021)		-0.001 (0.025)	
N	4,379		3,536	

Source: DZHW Graduate Panel (2009 and 2013).

Note: ref=reference category. *** p < 0.001, ** p < 0.01, * p < 0.05. Standard errors in parentheses.

6. Discussion and Conclusion

The Bologna Process introduced a two-tier degree structure into the formerly one-tier degree system in German higher education. Even though its implementation proceeded only gradually, the majority of graduates today hold Bachelor's and Master's degrees, while only a small fraction of graduates still finish with traditional degrees, mainly in the form of state examinations. Since the introduction of a two-tier degree structure changed the German higher education system from a horizontally differentiated to a vertically differentiated one, this paper set out to analyze whether this structural change is accompanied by more stratified labor market returns for different degree holders, thus focusing on graduate careers outside academia.

Based on human capital theory, we assumed that graduates holding a Bachelor's degree, with a study duration of about three years, receive lower labor market returns, while graduates with a Master's degree should receive similar returns to those holding traditional degrees, due to the comparable length of both degree courses. However, it might be the case that not the degree per se, but rather associated aspects are more relevant. First, since Bachelor programs aim at providing rather broad undergraduate education, while Master's and traditional degrees provide more specialized degree profiles, it might be that occupation-specific human capital in the form of occupation-specific knowledge, gained through higher education and mandatory internships, is more important for understanding vertically differentiated labor market returns. Second, obtaining extracurricular qualifications, such as studying abroad or gaining practical work experience through study-related student jobs, is easier in degree courses of longer duration, which might send additional signals to employers. Third, longer degree types might provide better access to internal labor market segments found in large firms or in the public sector, which also might explain labor market differentials between degree holders.

We tested our hypotheses based on two DZHW graduate cohorts entering the labor market in 2009 and 2013. More specifically, we modeled the log hourly wage and the adequacy of the first job by applying linear regression and decomposition techniques. Descriptive evidence indicates a clear advantage of graduates with traditional and Master's degrees when compared to Bachelor's degree holders, both in terms of wages and in terms of a more subjective assessment of adequate employment. The assumed explanatory factors, however, only partially contribute to our understanding of differentiated labor market returns. The most robust findings are related to internal labor market segments. For both wages and adequate employment, working in the internal labor market of large firms is beneficial. Since Bachelor's graduates have lower chances of starting their work life in larger firms, this partly explains their labor market disadvantages. Apparently, both traditional and Master's degrees serve as relevant certificates for entering firm-internal labor markets, while a Bachelor's degree is not sufficient. Regarding adequate employ-

ment, this also holds true for firm-internal labor markets in the public sector, where graduates with traditional and Master's degrees have better employment prospects.

But signals acquired in addition to higher education also support the better labor market returns of long degrees. While studying abroad is particularly beneficial for the wages of traditional degree holders, having a study-related student job benefits the employment prospects of both traditional and Master's graduates. Apparently, with longer durations of study it becomes easier to obtain a student job directly related to the content of study. This might, on the one hand, serve as an important signal to future employers, but it also might increase graduates' occupation-specific labor market experience and possibly establish networks for successful labor market entry. Even though our results indicate that study-related student jobs currently disadvantage Bachelor's graduates, they also open the road for their advancement. Labor market prospects should also increase for Bachelor's graduates, if they work in study-related student jobs while studying.

In contrast, gaining occupation-specific knowledge through higher education itself or through mandatory internships does not systematically and consistently increase labor market differentials between different degree holders. Both findings might be related to measurement problems. Regarding occupation-specific knowledge, our index is based on very broad questions on the connection between higher education and the labor market, resulting in very little variation between the different degree holders. Moreover, mandatory internships are reported less often by Master's degree holders, which might be related to the placement of this question within the questionnaire, referring only to the last degree obtained. Therefore, future research should apply more theoretically-driven indicators on the occupation-specific knowledge gained in higher education and its relation to the labor market.

Overall, our findings support existing empirical studies comparing the labor market outcomes of pre- and post-reform degrees. Regarding wage differentials, most cross-sectional studies on Germany confirm that Bachelor's degree holders earn less than graduates with Master's or traditional degrees (Alesi/Schomburg/Teichler 2010; Dill/Hammen 2011; Neugebauer/Weiss 2017; Trennt 2019). Moreover, studies point toward a higher risk of inadequate employment for Bachelor's graduates compared to those holding Master's or traditional degrees (Fabian/Hillmann/Trennt/Briedis 2016; Fabian/Quast 2019; Grotheer 2019; Rehn/Brandt/Fabian/Briedis 2011). Just like these studies we find a clear-cut hierarchy of labor market returns, showing that graduates holding a post-reform first-level Bachelor's degree receive lower labor market returns than both graduates with traditional, pre-reform degrees or those with post-reform second-level Master's degrees.

However, our analyses add two important findings to this field of literature: Regarding the longitudinal development, it seems that labor market inequalities between Bachelor's and Master's degree holders increase over time, particularly as regards wage differentials. Since the majority of graduates today obtain Bachelor's and

Master's degrees, this indicates rising labor market inequalities between different groups of graduates due to the vertical differentiation of degrees. Considering that graduates from less privileged family backgrounds tend to have lower probabilities of starting a Master's degree than those from more privileged families (Auspurg/Hinz 2011; Lörz/Quast/Roloff 2015; Lörz/Quast/Roloff/Trennt 2019; Neugebauer 2015; Neugebauer/Neumeayer/Alesi 2016), the Bologna Process apparently not only has unintended consequences in terms of higher education participation, but also in terms of social stratification. Increasing social inequalities in labor market outcomes among different social groups are likely to occur due to the introduction of the two-cycle degree structure. This might also apply to proceeding with a PhD and resulting academic careers thereafter, which were already highly socially stratified even before the Bologna Process occurred. Therefore, the social stratification of careers both inside and outside academia should be closely monitored in future research.

Second, while many previous studies described labor market differentials between different degree holders, they did not seek to explain them. An exception is the study by Trennt (2019), reporting that graduates with a Master's degree earn higher wages than those with a Bachelor's degree since the former work more often in large firms and are more often adequately employed. Our results complement these findings by pointing towards the importance of internal labor market segments and extracurricular qualifications obtained via study-related student jobs as signals. Even though we are able to explain about 40 percent of the observed labor market differentials between graduates holding short and long degrees, the larger proportion remains unaccounted for. One simple explanation holds that it is merely the quantity of human capital that makes the differences. However, our results show that differentiated labor market returns are mostly able to be explained by aspects of the labor market rather than through explanations related to human capital. Therefore, future research should pay close attention not only to the segments worked in by graduates, but also to the occupations they hold and the hierarchical position therein.

7. References

- Alesi, Bettina, Schomburg, Harald & Teichler, Ulrich (2010): Humankapitalpotenziale der gestuften Hochschulabschlüsse. Weiteres Studium, Übergang in das Beschäftigungssystem und beruflicher Erfolg von Bachelor- und Master-Absolventen in Deutschland, *Aktuelle hochschulpolitische Trends im Spiegel von Expertisen. Internationalisierung, Strukturwandel, Berufseinstieg für Absolventen*. Kassel: Jenior. S. 129–196.
- Auspurg, Katrin & Hinz, Thomas (2011): Master für Alle? Der Einfluss sozialer Herkunft auf den Studienverlauf und das Übertrittsverhalten von Bachelorstudierenden. *Soziale Welt* 62(1): 75–99.

- Autorengruppe Bildungsberichterstattung (2020): *Bildung in Deutschland 2020. Ein indikatorengestützter Bericht mit einer Analyse zu Bildung in einer digitalisierten Welt*. Bielefeld. <https://www.bildungsbericht.de/de/bildungsberichte-seit-2006/bildungsbericht-2020/pdf-dateien-2020/bildungsbericht-2020-barrierefrei.pdf>, Stand: 10.03.2022.
- Becker, Gary S. (1962): Investment in Human Capital: A Theoretical Analysis. *Journal of Political Economy* 70(5): 9–49.
- Becker, Gary S. (1964): *Human Capital. A Theoretical and Empirical Analysis with Special Reference to Education*. Chicago, London: The University of Chicago Press.
- Becker, Rolf (1993): *Staatsexpansion und Karrierechancen. Berufsverläufe im öffentlichen Dienst und in der Privatwirtschaft*. Frankfurt/Main: Campus.
- Berlin Communiqué (2003): *Realising the European Higher Education Area. Communiqué of the Conference of Ministers responsible for Higher Education*. Berlin.
- Bologna Declaration (1999): *The Bologna Declaration of 19 June 1999. Joint declaration of the European Ministers of Education*. Bologna.
- Bundesverwaltungsamt (2019): *Eingruppierung bei Master, Bachelor, Sonstigen Beschäftigten. Bildungsabschlüsse im TVöD Bund*. https://www.bva.bund.de/SharedDocs/Downloads/DE/Behörden/Beratung/Dialogforum_2019/191114_1400Uhr_Eingruppierung_Master_Bachelor_Sonstigen_Beschaeftigten.pdf?__blob=publicationFile&v=1, Stand: 11.03.2022.
- Di Stasio, Valentina, Bol, Thijs & van de Werfhorst, Herman G. (2016): What makes education positional? Institutions, overeducation and the competition for jobs. *Research in Social Stratification and Mobility* 43: 53–63.
- Dill, Verena & Hammen, Anke (2011): *Einkommensdifferenziale zwischen Bachelor- und Diplomabsolventen – Humankapital oder Signal?* Trier: Universität Trier, Fachbereich IV Volkswirtschaftslehre.
- Doeringer, Peter B. (1967): Determinants of the Structure of Industrial Type Internal Labor Markets. *Industrial and Labor Relations Review* 20(2): 206–220.
- Doeringer, Peter B. & Piore, Michael J. (1985): *Internal labor markets and manpower analysis*. 1971. Aufl. Armonk, NY: Sharpe.
- Estevez-Abe, Margarita, Iversen, Torben & Soskice, David (2013): Social Protection and the Formation of Skills: A Reinterpretation of the Welfare State, in: Peter A. Hall & David W. Soskice (Hrsg.), *Varieties of capitalism. The institutional foundations of comparative advantage*. Oxford: Oxford University Press. S. 145–183.
- Eurydice (2010): *Focus on Higher Education in Europe 2010: The Impact of the Bologna Process*. Brussels.
- Fabian, Gregor, Hillmann, Julika, Trennt, Fabian & Briedis, Kolja (2016): *Hochschulabschlüsse nach Bologna. Werdegänge der Bachelor- und Masterabsolventinnen des Prüfungsjahrgangs 2013*. Hannover.
- Fabian, Gregor & Quast, Heiko (2019): Master and Servant? Subjektive Adäquanz der Beschäftigung von Bachelor- und Masterabsolventinnen und -absolventen, in: Markus Lörz & Heiko Quast (Hrsg.), *Bildungs- und Berufsverläufe mit Bachelor und Master*. Wiesbaden: Springer Fachmedien. 399–436.
- Fehse, Stefanie & Kerst, Christian (2007): Arbeiten unter Wert? Vertikal und horizontal inadäquate Beschäftigung von Hochschulabsolventen der Abschlussjahrgänge 1997 und 2001. *Beiträge zur Hochschulforschung* 29(1): 72–98.

- Glauser, David, Zangger, Christoph & Becker, Rolf (2019): The Signal and the Noise. The Impact of the Bologna Process on Swiss Graduates' Monetary Returns to Higher Education. *Social Inclusion* 7(3): 154–176.
- Grotheer, Michael (2019): Berufseinstieg und Berufsverlauf mit Bachelorabschluss. Wie erfolgreich etablieren sich Graduierte verschiedener Abschlussarten am Arbeitsmarkt?, in: Markus Lörz & Heiko Quast (Hrsg.), *Bildungs- und Berufsverläufe mit Bachelor und Master*. Wiesbaden: Springer Fachmedien. 437–479.
- Horstschräer, Julia & Sprietsma, Maresa (2015): The effects of the introduction of Bachelor degrees on college enrollment and dropout rates. *Education Economics* 23(3): 296–317.
- Jann, Ben (2008): The Blinder–Oaxaca Decomposition for Linear Regression Models. *The Stata Journal* 8(4): 453–479.
- KMK (2000): *Laufbahnrechtliche Zuordnung von Bachelor-/Bakkalaureus- und Master-/Magisterabschlüssen gem. § 19 HRG. Beschluss der Kultusministerkonferenz vom 14.04.2000*. https://www.kmk.org/fileadmin/veroeffentlichungen_beschluesse/2000/2000_04_14-Laufbahn-Zuordnung-Bachelor-Master.pdf, Stand: 11.03.2022.
- Kratz, Fabian & Netz, Nicolai (2018): Which mechanisms explain monetary returns to international student mobility? *Studies in Higher Education* 43(2): 375–400.
- Kroher, Martina, Leuze, Kathrin, Thomsen, Stephan L. & Trunzer, Johannes (2021): *Did the "Bologna Process" Achieve Its Goals? 20 Years of Empirical Evidence on Student Enrollment, Study Success and Labour Market Outcomes*. Bonn. <https://ftp.iza.org/dp14757.pdf>, Stand: 10.03.2022.
- Leuze, Kathrin (2010): Interne Arbeitsmärkte und die Karrieremobilität von Akademikerinnen und Akademikern in Deutschland und Großbritannien. *Beiträge zur Hochschulforschung* 32(4): 24–47.
- Leuze, Kathrin (2010): *Smooth Path or Long and Winding Road? How Institutions Shape the Transition from Higher Education to Work*. Opladen, Farmington Hills/Michigan: Budrich UniPress.
- Leuze, Kathrin (2011): How structure signals status: institutional stratification and the transition from higher education to work in Germany and Britain. *Journal of Education and Work* 24(5): 449–475.
- Leuze, Kathrin & Strauß, Susanne (2009): Lohnungleichheiten zwischen Akademikerinnen und Akademikern: Der Einfluss von fachlicher Spezialisierung, frauendominierten Fächern und beruflicher Segregation. *Zeitschrift für Soziologie* 38(4): 262–281.
- Levels, Mark, van der Velden, Rolf & Allen, Jim (2014): Educational mismatches and skills: new empirical tests of old hypotheses. *Oxford Economic Papers* 66(4): 959–982.
- Lörz, Markus & Leuze, Kathrin (2019): Der Masterabschluss als neues Distinktionsmerkmal? Konsequenzen der Studienstrukturreform für herkunftsbedingte Einkommensungleichheiten, in: Markus Lörz & Heiko Quast (Hrsg.), *Bildungs- und Berufsverläufe mit Bachelor und Master*. Wiesbaden: Springer Fachmedien. S. 341–370.
- Lörz, Markus, Quast, Heiko & Roloff, Jan (2015): Consequences of the Bologna-Reform. Why do Social Differences Exist at the Transition from Bachelor to Master Degree Programs? *Zeitschrift für Soziologie* 44(2): 137–155.
- Lörz, Markus, Quast, Heiko, Roloff, Jan & Trennt, Fabian (2019): Determinanten des Übergangs ins Masterstudium. Theoretische Modellierung und empirische Überprüfung, in: Markus Lörz & Heiko Quast (Hrsg.), *Bildungs- und Berufsverläufe mit Bachelor und Master*. Wiesbaden: Springer Fachmedien.

- Müller, Christina & Reimer, Maïke (2015): Einkommen von Bachelor und Diplomabsolventen. Die Rolle von Fach und Arbeitsmarkt. *Beiträge zur Hochschulforschung* 37(2): 88–114.
- Neugebauer, Martin (2015): The Introduction of Bachelor Degrees and the Under-representation of Students from Low Social Origin in Higher Education in Germany. A Pseudo-Panel Approach. *European Sociological Review* 31(5): 591–602.
- Neugebauer, Martin, Neumeyer, Sebastian & Alesi, Bettina (2016): More diversion than inclusion? Social stratification in the Bologna system. *Research in Social Stratification and Mobility* 45: 51–62.
- Neugebauer, Martin & Weiss, Felix (2017): *Does a Bachelor's Degree pay off? Labor Market Outcomes of Academic versus Vocational Education after Bologna*. Berlin.
- Neugebauer, Martin & Weiss, Felix (2018): A Transition without Tradition. Earnings and Unemployment Risks of Academic versus Vocational Education after the Bologna Process. *Zeitschrift für Soziologie* 47(5): 349–363.
- Noelke, Clemens, Gebel, Michael & Kogan, Irena (2012): Uniform Inequalities: Institutional Differentiation and the Transition from Higher Education to Work in Post-socialist Central and Eastern Europe. *European Sociological Review* 28(6): 704–716.
- OECD (2020): *Education at a Glance 2020. OECD Indicators*. Paris: OECD Publishing.
- Petersen, Trond (1989): The earnings function in sociological studies of earnings inequality: functional form and hours worked. *Research in Social Stratification and Mobility* 8: 221–250.
- Raudenská, Petra & Mysíková, Martina (2020): Returns to bachelor's and master's degree in tertiary education. The case of the Czech Republic after the Bologna Process. *Innovation: The European Journal of Social Science Research* Online first: 1–17.
- Rehn, Torsten, Brandt, Gesche, Fabian, Gregor & Briedis, Kolja (2011): *Hochschulabschlüsse im Umbruch. Studium und Übergang von Absolventinnen und Absolventen reformierter und traditioneller Studiengänge des Jahrgangs 2009*. Hannover.
- Reimer, David & Pollak, Reinhard (2010): Educational Expansion and Its Consequences for Vertical and Horizontal Inequalities in Access to Higher Education in West Germany. *European Sociological Review* 26(4): 415–430.
- Riphahn, Regina T. & Serfling, Oliver (2005): Item non-response on income and wealth questions. *Empirical Economics* 30(2): 521–538.
- Sarcelletti, Andreas (2007): Der Nutzen von Kontakten aus Praktika und studentischer Erwerbstätigkeit für den Berufseinstieg von Hochschulabsolventen. *Beiträge zur Hochschulforschung* 29(4): 52–80.
- Schindler, Steffen (2012): *Aufstiegsangst? Eine Studie zur sozialen Ungleichheit beim Hochschulzugang im historischen Zeitverlauf*. Düsseldorf: Vodafone Stiftung Deutschland.
- Sciulli, Dario & Signorelli, Marcello (2011): University-to-work transitions: an empirical analysis on Perugia graduates. *European Journal of Higher Education* 1(1): 39–65.
- Spence, Michael A. (1973): Job Market Signaling. *The Quarterly Journal of Economics* 87(3): 355–374.
- Spence, Michael A. (1974). *Market Signaling. Informational Transfer in Hiring and Related Screening Processes*. Cambridge, MA: Harvard University Press.
- Trennt, Fabian (2019): Zahlt sich ein Master aus? Einkommensunterschiede zwischen den neuen Bachelor- und Masterabschlüssen, in: Markus Lörz & Heiko Quast (Hrsg.), *Bildungs- und Berufsverläufe mit Bachelor und Master*. Wiesbaden: Springer Fachmedien. 371–397.
- Verhaest, Dieter & van der Velden, Rolf (2013): Cross-country Differences in Graduate Overeducation. *European Sociological Review* 29(3): 642–653.

Appendix

Table A: Descriptive Results (shares respectively means with standard deviations): Wage and Adequacy Sample

	Pooled wage sample	Pooled adequacy sample
<i>hourly wage</i>	14.99 (5.33)	
<i>log hourly wage</i>	2.64 (0.37)	
<i>adequacy of employment</i>		3.69 (1.20)
degrees		
traditional degrees	40.95	41.03
BA degree	32.05	32.00
MA degree	27.00	26.97
<i>occupational specificity</i>	3.16 (0.83)	3.16 (0.83)
internship(s)		
no internship	20.41	20.41
internship(s)	79.59	79.59
stay abroad		
no stay abroad	68.34	68.40
stay abroad	31.66	31.60
student job		
no student job	11.12	11.14
no subject related student job	19.73	19.68
subject related student job	69.15	69.18
sector		
private sector	66.81	66.74
public sector	33.19	33.26
firm size		
small firm	20.28	20.30
medium firm	39.59	39.54
large firm	40.14	40.16
type of university		
university of applied sciences	40.63	40.66
university	59.37	59.34
field of study		
humanities	3.53	3.54
linguistic and language	3.23	3.22
social sciences	14.92	14.88
law & economics	25.36	25.32
education	4.54	4.55
maths & natural sciences	9.43	9.44
medicine & health	2.93	2.95
architecture & engineering	25.10	25.17
agriculture & forest sciences & food technology	4.09	4.09
informatics	5.27	5.29
arts & music	1.57	1.57
gender		
female	52.09	52.03
male	47.91	47.97
<i>age</i>	26.60 (2.61)	26.60 (2.61)
social origin (education parents)		
no one higher education	50.22	50.22
at least 1 higher education	49.78	49.78
apprenticeship before college		
no apprenticeship	71.58	71.61
apprenticeship	28.42	28.39
N	6,032	5,996

Source: DZHW Graduate Panel (2009 and 2013).

Table B1: OLS-Regression: Full Model: Wage Sample

	log hourly wage BA vs trad.	log hourly wage BA vs MA
BA degree (ref.: trad. / MA)	-0.131*** (0.012)	-0.159*** (0.014)
cohort (ref.: 2009)	0.180*** (0.012)	0.178*** (0.016)
occupational specificity	0.022*** (0.006)	0.018** (0.007)
internship (ref.: no internship)	-0.033* (0.015)	-0.006 (0.013)
stay abroad (ref.: no stay abroad)	0.035*** (0.011)	0.034** (0.012)
student job (ref.: subject related job) no student job	-0.045** (0.015)	-0.031 (0.017)
no subject related student job	-0.065*** (0.012)	-0.069*** (0.013)
sector (ref.: private sector)	0.004 (0.011)	0.021 (0.012)
firm size (ref.: large firm) small firm	-0.173*** (0.013)	-0.186*** (0.015)
medium firm	-0.116*** (0.011)	-0.130*** (0.017)
university (ref.: univ. of applied sciences)	-0.050*** (0.012)	-0.069*** (0.013)
field of study (ref.: humanities) linguistic and language	-0.018 (0.036)	-0.034 (0.039)
social sciences	0.072** (0.027)	0.089** (0.032)
law & economics	0.221*** (0.027)	0.247*** (0.031)
education	0.165*** (0.033)	0.193*** (0.038)
maths & natural sciences	0.198*** (0.030)	0.142*** (0.034)
medicine & health	0.137*** (0.038)	0.164*** (0.039)
architecture & engineering	0.281*** (0.028)	0.297*** (0.032)
agriculture & forest sciences & food technology	0.082* (0.034)	0.126** (0.039)
informatics	0.265*** (0.034)	0.301*** (0.036)
arts & music	0.036 (0.045)	0.010 (0.051)
gender (ref.: female)	0.073*** (0.011)	0.075*** (0.012)
apprenticeship (ref.: no apprenticeship)	0.030* (0.013)	0.034* (0.014)
social origin (ref.: no one higher education)	0.015 (0.010)	0.022* (0.011)
age	0.003 (0.002)	0.005* (0.002)
N	4,403	3,562
adjusted R ²	0.274	0.362

Source: DZHW Graduate Panel (2009 and 2013).

Note: ref=reference category. *** p < 0.001, ** p < 0.01, * p < 0.05. Standard errors in parentheses.

Table B2: OLS-Regression: Full Model: Adequacy Sample

	adequacy BA vs trad.	adequacy BA vs MA
BA degree (ref.: trad. / MA)	-0.225*** (0.041)	-0.268*** (0.050)
cohort (ref.: 2009)	0.092* (0.043)	0.098* (0.042)
occupational specificity	0.228*** (0.023)	0.267*** (0.025)
internship (ref.: no internship)	0.122* (0.053)	0.171*** (0.048)
stay abroad (ref.: no stay abroad)	0.036 (0.038)	-0.024 (0.044)
student job (ref.: subject related job no student job	-0.127* (0.054)	-0.058 (0.060)
no subject related student job	-0.386*** (0.042)	-0.415*** (0.049)
sector (ref.: private sector)	0.370*** (0.039)	0.476*** (0.044)
firm size (ref.: large firm) small firm	-0.161*** (0.047)	-0.180*** (0.054)
medium firm	-0.122** (0.039)	-0.158*** (0.043)
university (ref.: univ. of applied sciences)	0.082 (0.044)	0.141** (0.048)
field of study (ref.: humanities) linguistic and language	-0.253 (0.130)	-0.025 (0.144)
social sciences	0.393*** (0.098)	0.449*** (0.115)
law & economics	0.418*** (0.097)	0.482*** (0.112)
education	0.174 (0.118)	0.166 (0.138)
maths & natural sciences	0.625*** (0.108)	0.474*** (0.125)
medicine & health	-0.041 (0.135)	0.146 (0.142)
architecture & engineering	0.707*** (0.099)	0.756*** (0.116)
agriculture & forest sciences & food technology	0.343** (0.123)	0.463** (0.144)
informatics	0.682*** (0.120)	0.875*** (0.133)
arts & music	-0.263 (0.162)	-0.019 (0.188)
gender (ref.: female)	0.043 (0.039)	0.053 (0.043)
apprenticeship (ref.: no apprenticeship)	-0.057 (0.045)	0.030 (0.050)
social origin (ref.: no one higher education)	0.060 (0.035)	0.049 (0.039)
age	-0.020** (0.007)	-0.026** (0.008)
N	4,379	3,536
adjusted R ²	0.156	0.176

Source: DZHW Graduate Panel (2009 and 2013).

Note: ref=reference category. *** p < 0.001, ** p < 0.01, * p < 0.05. Standard errors in parentheses.