Three worlds of vocational education: Craftsmanship and the school-to-work linkage in France, Germany and The Netherlands

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SAMENVATTING IN HET NEDERLANDS

Een van de grootste uitdagingen in het inrichten van opleidingen is hoe het beroepsonderwijs moet worden ingericht voor de arbeidsmarkt van de toekomst. Moet er meer worden ingezet op specialistische vakmensen die worden klaargestoomd binnen smalle opleidingen, of moet er meer worden ingezet op generieke vakmensen met "21st century skills" die breder zijn opgeleid? En moeten deze studenten met name worden opgeleid in een schoolsetting (zoals Frankrijk), in een duaal systeem (zoals Duitsland), of iets daartussenin (zoals Nederland)?

In deze studie vergelijken wij de schoolsystemen binnen het beroepsonderwijs van Frankrijk, Duitsland en Nederland. Specifiek kijken wij naar de hoe sterk opleidingen linken aan bepaalde beroepen; des te sterker de link, hoe meer opgeleiden in een beperkt aantal banen werken en des te smaller de opleiding zal zijn. Daarnaast bestuderen we de relatie tussen de linksterkte en de kans op werkloosheid. Hiervoor maken we gebruik van drie arbeidsmarkt surveys: voor Frankrijk de Enquête Emploi 2003-2012, voor Frankrijk de Mikrozensus 2006 en voor Nederland de Enquête Beroepsbevolking 2003-2012.

Het blijkt dat de gemiddelde linksterkte van opleidingen in Duitsland groter is dan in Frankrijk, terwijl Nederland een middenpositie inneemt. Veel van deze verschillen zijn echter compositoneel van aard. Zo clusteren Duitse studenten meer in beroepen die sterk linken aan een beperkte set opleidingen dan Franse en Nederlandse studenten.

Los van deze gemiddelde linksterktes tussen de landen zijn er grote verschillen tussen specifieke opleidingen binnen landen. Zo komen leerlingen in de gezondheidszorg, zoals verpleegkunde, vrijwel altijd in de zorg terecht (een sterke link), terwijl leerlingen met een commerciële of management opleiding veel vaker diverse beroepen bekleden (een zwakke link). Echter, hierbij zijn er sterke verschillen tussen landen. Zo zijn de technische opleidingen in Duitsland veel smaller in linksterkte dan die in Frankrijk, vermoedelijk vanwege de sterke relatie tussen techniekopleidingen en de arbeidsmarkt in Duitsland. Er is dus veel ruimte in hoe breed of smal een bepaalde opleiding wordt ingericht.

Het gevolg van een smalle opleiding in het beroepsonderwijs is dat deze leerlingen minder vaak werkloos zijn dan leerlingen met een brede opleiding. Met name in Duitsland zijn de verschillen groot. Het verschil in werkloosheidscijfer is hier tussen de 2.5 (voor mannen) tot 4.5 (voor vrouwen) procentpunt. Het lijkt dat een smalle opleiding bescherming kan bieden tegen werkloosheid, vooral in een duaal systeem.

SUMMARY

One of the biggest challenges in the design of educational systems concerns how vocational education and training (VET) systems are best organized for the labour markets of tomorrow. Do we need more specialized craftsmen with practical and specific skills that tightly link to specific occupations, or do we need a shift towards broader craftsmen with more general skills? Using microdata from France, Germany, and The Netherlands, we show that there are different ways by which the VET sector establishes school-to-work linkages. Linkages are on average stronger in systems with a dual VET sector compared to a full school-based model. However, an important reason why linkage are stronger in dual VET systems is because of compositional differences, as in such systems more students tend to be enrolled in strongly linking educational programs. Moreover, VET systems are far from homogeneous, and there are large differences in how strong educational programmes link to occupations within and between countries. In general, employment is highest among the stronger linking programs, and this effect is strongest in dual VET systems.

Keywords: vocational education, educational systems, linkage, craftsmanship; labor market.

INTRODUCTION

One of the biggest challenges in the design of educational systems concerns how vocational education and training (VET) systems are best organized for the labour markets of tomorrow. Structural changes in worklife, such as rapid technological change and globalization, call for a reconsideration of the organisation of VET systems in developed economies, especially because specific skills are argued to reduce employability during the career (Hanushek et al. 2016). At the same time, the vocational training sector is still living up to its expectations in delivering smooth transitions from school to work, suggesting that the VET sector still deserves a solid place in contemporary educational systems. Indeed, in countries without a strong VET sector such as the United States, scholars call for the adoption of a German-style occupationally specific education system, in order to improve the preparation of youngsters for the world of work (Hoffman 2011).

Given the large variety of VET systems across the Western world, the current debate would benefit from a comparison of how well different systems prepare for work. Countries differ in how VET systems are organized precisely on dimensions that are considered relevant for possible adaptations of vocational education. In particular, a major dimension on which VET systems differ is the extent to which vocational education takes place in the dual system or in schools. The typical success story of the German system is considered to be the large dual sector, in which work-based learning has a prominent place (Culpepper and Thelen 2008; Busemeyer and Trampusch 2012). Is the connection between education and the labour market better in the German dual system than it is in systems in which vocational education is organized in schools? Or can strong connections between educational programs and occupational destinations equally well be achieved through school-based vocational training?

Following recent scholarship on assessing the level of linkage between educational qualifications and occupational positions, we study the sorting of persons from educational qualifications to occupational positions (DiPrete et al. 2017). We do this for vocational education programs at the upper secondary level (ISCED-97 levels 3 and 4) in three countries: one system acclaimed for its strong dual system (Germany), one system with a purely school-based vocational training sector (France), and a system that takes an intermediate position regarding the provision of dual and school-based forms of vocational education (the Netherlands). Moreover, studying the sorting process from educational qualifications to occupations we examine differences across educational programs within countries, as differences within countries are at least as prominent as differences between countries. While most of the existing research examines differences between vocational and general types of

education, and compares countries based on the vocational orientation of systems, our interest is in the linking process of vocational qualifications to labour market positions in different countries. Which type of vocational education is most able to smoothen the transition from school to work?

Using decomposable entropy-based measures of linkage strength, we study the following four research questions: (1) how strongly linked are different educational programs (i.e. combinations of sub-levels of vocational education and fields of study) within upper secondary vocational education to occupational destinations in the three countries? (2) To what extent do we see different overall patterns of sorting of vocationally-educated workers into the labour market in the three countries? (3) To what extent do these differences result from structural differences in linkage strength between specific educational qualifications and the occupations in which graduates work, or from compositional differences between countries with regard to strongly linking or weakly linking educational programs? And finally, (4) does being educated in a strongly linking educational program help or harm students in terms of their employment probabilities?

Answers to these questions help us to think of the place of vocational education in contemporary educational systems. Given the prime strength of VET systems to engage students in a work-specific learning process, it is important to know whether this engagement is more effectively done in a dual system or in a school-based system. Comparing countries enables us to look at the importance of dual versus school-based systems from an institutional, rather than individual perspective. Such a perspective is relevant for education policies. Moreover, we contribute to the literature by linking the institutional differences to different conceptions of craftsmanship, specifically how broad or small they are educated. According to some scholars the craftsman with specialized and practical knowledge and occupational identification is crucial for innovation and economic growth (Sennett 2008). By contrast, according to others the broader craftsman who flexibily adjusts to 21st century skills is important as (s)he contributes to the "learning economy" (OECD 2013). While the broader and smaller craftsman do not fit one-to-one with the different vocational educational and training systems in France, Germany and the Netherlands, we see different accents in the different societies, placing more emphasize on the smaller craftsman in Germany and on the broader craftsman in France, with the Netherlands in between.

THEORETICAL BACKGROUND

Vocational education as part of education systems

With the internationalization of the field of social stratification research, and the growing availability of comparable datasets in different countries, a research agenda has been developed on the relevance of national institutional regulations for patterns of stratification and social mobility. This institutional focus has included the study of life course transitions more generally, and in particular the school-to-work transition. Several contributors have started to discover more or less simultaneously that the way educational systems were organized had direct repercussions on how easily young school leavers get integrated in the labour market (Allmendinger 1989; Maurice et al. 1986; Rosenbaum and Kariya 1989; 1991).

Educational systems are held to vary on several important dimensions, including the form and timing of between-school tracking, various forms of standardization, and the level of vocational specificity (Allmendinger 1989; Shavit & Müller 1998; Bol and Van de Werfhorst 2013). In a large comparative project on thirteen countries, Shavit and Müller (1998) concluded that the vocational specificity of educational systems was conducive to a smooth transition from school to work. In systems with stronger VET sectors school leavers found jobs more quickly, and graduates from vocational education were able to avoid unskilled work, and found skilled trade occupations more easily instead. In countries with a weak VET system, by contrast, vocational education is more stigmatizing and offers worse prospects in the labor market.

Busemeyer and Trampusch (2012) classify vocational educational systems based on the "public commitment" (i.e., whether vocational schools are part of the publicly funded schooling system), and the "statist versus collective skill formation" (i.e., what the role of employers, industries and companies are in the organization of VET). While the three educational systems analyzed here are very similar with regard to a strong public commitment, they differ substantially with regard to employer involvement (Westerhuis 2017).

Skill formation is, according to the Varieties of Capitalism approach, one of the many areas in which uncertainties are reduced by means of coordination between employer organizations, trade unions and the state (Hall and Soskice 2001). Such coordination is, according to this approach, only effective in societies where these interest groups can solve uncertainties outside a market setting. Interestingly, all three countries that we study are usually seen as coordinated market economies, but the specific skills generated in the German system is not typical in all three countries due to its strong involvement of employers. In France, skill formation, also in the vocational education and training system, is much more

determined by the state, and much less influenced by employers. France can therefore be labeled as a *school-based* vocational education system, while Germany can be seen as a *dual* vocational training system. The Netherlands fares in between, with employer organizations being involved in the school boards of Regional Education Centers responsible for most upper secondary vocational education ("Regionale Opleidingscentra, ROC's"), but with large fractions of vocational education being offered in the school-based, rather than dual, part of the system.

The successful German model of youth integration in the labor market, nicely paraphrased as the "German Skills Machine" (Culpepper and Finegold 1999), has a large apprenticeship system where students are enrolled in a dual system of work-based and school-based learning. It is particularly the size of the dual system, rather than the mere size of the vocational sector, that reduces youth unemployment rates (Breen 2005; Bol and Van de Werfhorst 2013). As Rosenbaum and Kayira (1989) demonstrate, also in Japan, a country without a strong VET sector, linkages between school and work are improved by institutionalized collaborations between firms and (non-vocational) schools.

Based on this comparative literature, one would expect that, on a micro-level, especially those who graduated from (dual) vocational education benefit from strong VET sectors. However, one weakness of the literature to date is that this presumed micro-level association between educational track and labor market outcomes is not always found.

First of all, many comparative studies have not been able to distinguish between vocational and general/academic forms of education at the individual level (Gangl 2002; Müller and Gangl 2003). But more importantly, also studies that were able to make this empirical distinction did not always find strong evidence that the VET sector was particularly good for those who had been enrolled in vocational education. A study of 20 European societies did find that the dual system works best for those with a vocational qualification (Levels et al. 2014). However, Wolbers (2007) studied the duration to the first significant job after leaving school, and found that strong apprenticeship systems were particularly harmful for graduates from lower secondary education or less. The job search period in countries with large dual systems was reduced for graduates from upper secondary vocational, upper secondary academic, and tertiary education alike. Iannelli and Raffe (2007) demonstrate with school-leaver surveys that graduates from vocational programmes in the Netherlands are more likely than graduates from upper-secondary academic education to go to work rather than to further education, and that this gap is smaller in three other countries with a weaker VET sector (Ireland, Scotland and Sweden). Yet, no such country differences were found in the

vocational-academic gap in the avoidance of unemployment. Using national panel data on three European countries, Scherer (2005) demonstrated that graduates from vocational programmes found employment more quickly than students graduating from general/academic types of education, but this pattern was found in all three countries that differed significantly with regard to the organization of vocational education (Germany, Italy and Britain). Using a sequence analysis on Germany and Britain, Scherer (2001) found that graduates from general/academic education were even closer to finding permanent employment than vocationally qualified school leavers in Germany. Andersen and Van de Werfhorst (2010) studied occupational attainment and found that the gaps between vocational and general forms of education – to the disadvantage of vocational education – were *larger* in educational systems with stronger VET sectors.

Summarizing, the evidence is mixed on the micro-level foundation of more efficient transitions from school to work in countries with strong (dual) vocational training systems. The size of the vocational sector, and in particular the dual system, is clearly related to efficient transitions, but the impact of the educational system is not confined to those who were educated in the vocational sector, at least not when they are considered as one homogeneous group of school leavers.

Moreover, recent scholarship has argued that there is a lot of variation *within* countries concerning the linkage strength of educational qualifications, also within the vocational sector (Allen et al. 2000; DiPrete et al. 2017). Some fields of study connect very strongly to the labour market, in the sense that the occupational structuring according to educational qualifications is very strong. Graduates from health fields, for instance, are highly segregated in health professions, and are relatively seldom employed outside their sector. In other fields, the segregation into specific occupations is less evident, for instance in the humanities or social services. It is important to acknowledge the 'granual linkage structure' (DiPrete et al. 2017) within and across societies to make sense of different types of craftsmanship and the related labour market advantages associated to them.

Forms of Craftsmanship

While the literature has gone far in studying cross-national and within-country differences in the link between education and the labour market, little work has been done on the different types of craftsmanship that can be discerned. Generally craftsmanship can be defined on the basis of a skill to carry out independent work as a combination of "hands and head", for which thorough training is required, and that provides a certain level of pride to the worker. But

within this broad description, there is a wide variety. One major dimension is how specific the skills are that students learn (Petit and Rözer 2017).

Traditionally, craftsmanship has been linked to a narrow specialization. This type of craftsmanship gets somewhere close to the German-style model of vocational education as described in the Varieties of Capitalism literature. Students are willing to be educated with high level of specialization, thereby confining their employment opportunities, in exchange for employment protection (Iversen & Soskice 2001, Hall & Soskice 2001). Craftsmanship emerges through apprenticeships that foster the identification with the profession. This conception of craftsmanship can be labeled as specialized craftsmanship.

Currently, craftsmanship is increasingly be associated with a much broader form of education, in which students or workers obtain generic skills that promote worker flexibility, and contribute to the learning of the organization. In this perspective, craftsmanship is enhanced through the acquisition of "21st century skills" that foster further trainability and adaptability (Sprenger, 2011). A broad type of specialization is paralleled with a high level of autonomy in this perspective. This conception can be labeled *broad craftsmanship*.

The conception of linkage is perfectly connected to these two types of craftsmanship. Specialized craftsman have probably followed an educational program that links strongly to a specific set of occupations as it requires training in specific skills that are only transferable to a limited number of jobs. The broader craftsman, by contrast, has probably followed an education that is not directly link to a set of occupations as they have more general skills that are transferable to a variety of jobs.

Types of craftsmanship within and between countries

Combining the comparative literature with the different conceptions of craftsmanship, we can expect clear differences between and within countries in how craftsmanship is fostered in vocational education and training in Germany, France and the Netherlands. Ideal-typically, the dominant form of craftsmanship underlying the institutional structure of the German vocational education is the specialized craftsman. A high level of job autonomy and identification is fostered in a highly developed and institutionalized apprenticeship system. The linkage between educational qualifications and occupational destinations should be comparatively strong. In France, by contrast, the ideal-typical model of craftsmanship is broad craftsmanship, with fewer occupational forms of identification emerging in the system. We would expect weaker linkages between detailed vocational qualifications and occupational positions. The Dutch VET system would ideal-typically best be described from a practical

craftsmanship perspective, with elements of specialized craftsmanship. Public debates about vocational education often concern the negative stigma associated to vocational education, and policy reforms often aim to remove the negative stigma.

Nevertheless, also within countries significant differences can be expected between educational qualifications. Some educational qualifications emphasize specialized craftsmanship, as the occupational destinations of these qualifications are expected to be narrow, but without a cost of low likelihood to find descent employment. Especially the higher levels of vocational education in professional fields like health and engineering can be expected to fit this model, in all three countries. Other qualifications may be better seen as inducing broad craftsmanship, especially the higher levels of vocational programs in more generically oriented fields like the services and social studies.

It should be noted the emphasis on different conceptions of craftsmanship in educational curricula also changes over time (Westerhuis 2017). Currently, much more emphasis is placed on broad craftsmanship than before, as one serious concern with vocational education is that it creates skills that easily get obsolete (Hanushek et al. 2016; Forster et al. 2016). In this study we do not study time trends.

Hypotheses

Based on the theoretical considerations described above, we can formulate hypotheses on the linkage strength in the three countries, and the association between linkage strength and labour market outcomes (here: being employed).

First, based on the specialized craftsmanship underlying the dual German VET model, we expect the strongest linkages between educational qualifications and occupations in Germany. Weaker linkages should appear in the broad craftsmanship model of France. The Netherlands is expected to fall in between these countries. We call this the *dual system hypothesis*.

Second, the *granual structure hypothesis* holds that there is significant variation within countries with regard to the sorting from educational qualifications to specific occupations. In line with between-field differences in specialization, we expect some qualifications to be consistently more strongly linked to occupations than other qualifications, in all three countries.

Third, it is relevant to study how linkage strength and general labour market outcomes are related. More specifically, is there a trade-off of being educated in a strongly linked field, i.e. a field that sorts narrowly to a specific (set of) occupation(s), and the chances to find a

job? Based on the call for broad craftsmanship one would expect such a tradeoff to emerge: Specialized craftsmanship (i.e. strong linkage) should then be limiting opportunities to find a job. This would lead to *the trade-off hypothesis* of a negative association between linkage strength and employment probability. On the contrary, if specialized craftsmanship can only successfully evolve if the employment opportunities are good, as the Varieties of Capitalism perspective holds (Iversen and Soskice 2001; Thelen 2004), one would expect support for the *complementarity hypothesis* that states that, within countries, strongly linked qualifications are also the ones with higher employment probabilities. Support for either the trade-off or complementarity hypothesis may vary between countries. A trade-off hypothesis may particularly arise under a practical craftsmanship model, as the workers are less well prepared to adjust to new labour market circumstances compared to other types of craftsmanship.

DESIGN

Data

We analyze large-N labor force microdata for France, the Netherlands, and Germany. For France, we use the Enquête Emploi, which is a quarterly labor force survey of 60-80,000 household members. The Enquête Emploi uses a rotating format, where all respondents in principle participate in 6 quarters (1.5 years). We use all unique observations matching our schooling restrictions from the years 2003-2012. Our analytical sample is 53,977.

For The Netherlands, we use the Enquete Beroepsbevolking (EBB), which is the labor force study of Dutch Statistics. In the EBB respondents are approached for five consecutive interviews over a period of twelve months. We use all unique observations matching our schooling restrictions from the years 2003-2012 in order to increase sample size. Our analytical sample is 205,553.

For Germany, we use the Mikrozensus of 2006. The Mikrozensus is a random sample of roughly 1% of German households with about 70% of these cases available for analysis in the anonymized scientific use file. All household members who are 15 years or older are interviewed. The analytical sample is 115,163

Educational and occupational classifications

To study the within- and between-country patterns of linkage, we use detailed classifications of educational qualifications and occupations. In education, we distinguish fields of study within two levels of upper secondary vocational education. The two levels are summarized in

Table 1. Note that we use harmonized codes so we can compare countries. However, as DiPrete et al. (2017) demonstrated, using more detailed national codes in comparison to internationally comparable classifications does little to the overall differences between countries. Hence, it is unlikely that our results would be much different if we had been able to use country-specific classifications of education and occupation.

In addition to these fields, we distinguish 19 different fields of studies (see Appendix A). Therefore, we used the broader field codes of the EBB as a reference and mapped the more fined grained field codes of the Enquête Emploi and Mikrozensus to them. Field codes of the Enquête Emploi and Mikrozensus that could not directly be mapped to one of the broader field of the EBB were classified as 'other'. This happened with less than 1 percent of the cases. In combination with the two educational level, this procedure resulted in 38 level-field combinations.

Furthermore, we harmonized ISCO 88 codes for the three countries. Therefore, we used the first three digits of the ISCO codes and collapsed them to the higher order two digit codes when the code was assigned to less than 100 respondents in one of our three datasets. This resulted in 93 detailed occupations (see Appendix B).

[Table 1 about here]

Measuring linkage strength

Our approach to measuring linkage strength starts from the idea that more strongly linked programmes sort to a limited set of occupations, while graduates from fields that link poorly to specific labour markets spread out to a wider set of occupations. It should be noted that strong linkage is not necessarily a valuable property of educational programmes if it means that a narrowly defined labour market harms the probability to find a job. Hence, we study both the pattern of linkage from school to work and the association between linkage and employment, and explicitly address a possible trade-off between strong linkage and finding employment.

Linkage is operationalized following earlier work by DiPrete et al. (2017), by using an entropy-based segregation measure. We calculate a *global linkage strength* by which we mean a country-level pattern of segregation, which is in our case from upper secondary vocational schools to the labour market. Moreover, we obtain a *local segregation measure* that indicates how strongly linked each detailed vocational qualification is. These two measures enable us to study both the between-country and within-country differences in linkage strength. As the granual linkage hypothesis argues, we expect clear differences within countries in how

strongly linked educational qualifications are to the labour market. Even within the upper secondary vocational sector, some fields sort more clearly to a limited set of occupations, while other fields have less clearly defined labour market sections.

As a global linkage measure we calculate the entropy-based measure Mutual Information Index (M). Entropy is a segregation measure: when people are more segregated across educations (or occupations), the more entropy there will be. It can be defined as the expected gain in information by actually observing someone's education (or occupation), and be written as:

$$E(P_g) = \sum_{g=1}^{G} P_g \log(\frac{1}{P_g})$$

where G indexes educational states, and P indicates the probabilities of being in each educational state. One important interest is how much the information about one's occupation increases once we know one's occupation. M equals this change in information, weighted by the proportional size of every educational group:

$$M = \sum_{g=1}^{G} P_g \left(E(P_j) - E(P_{j|g})\right)$$

where P_g is the probability to be in educational programme *g*, $E(P_j)$ the occupational entropy, and $E(P_{j|g})$ the entropy of occupation within educational programs *g*.

M is not a margin free measure of linkage. However, country differences in M can be decomposed to isolate each part contributing to M: differences in the educational (or occupational) entropy (ΔO_g), differences in the occupational marginal distribution (ΔE_g), and the change net of these effects (ΔN_g). More formally,

$$\Delta O_g = E(P_{g,c1}) - E(P_{g,c2})$$

$$\Delta E_g = .5 * \left\{\sum_{g=1}^{g} (P_{g,c1} - \pi_g) EP_{g,c1})\right\} - \left\{\sum_{g=1}^{g} (P_{g,c2} - \pi_g) EP_{g,c2})\right\}$$

$$\Delta N_g = .5 * \sum_{g=1}^{g} \pi_g * EP_{g,c1} - EP_{g,c2}$$

where *c1* and *c2* indicate the countries, π_g is an argument which terms are replaced alternately by the proportion from the $P_{g,c1}$ and $P_{g,c2}$ distribution, and $EP_g = \sum P_{j|g} \log(P_{j|g})$.[1] This decomposition allows us to compare the global linkage of Germany, France, and the Netherlands while comparing and taking out the different occupational distributions of the countries (invariance 1), and the difference in the size of the educational programs (invariance 2) when looking forward from educations to occupations, and vice versa when looking backward (Mora and Ruiz-Castillo 2011).

Local linkage is the extent to which a specific education is tied to a specific set of occupations: the more people with the same education have the same occupation, the larger its value. More formally, it can be expressed as:

$$M(ed)_g = \sum_{j=1}^{j} P_{j|g} \log\left(\frac{P_{j|g}}{P_j}\right)$$

Now, *M* can also be expressed as the sum of the local linkages weighted by the probability of each education. The local linkage can further be composed in a part attributed to 'major' and 'minor within major' occupational groups and 'educational levels' and 'educational fields within level' (see DiPrete et al. 2017).

RESULTS

Global linkage strength and its decomposition

The global linkage strength per country is reported in Figure 1, including its decomposition in four parts, A-D. As can be seen in the graph, the most strongly linking country is Germany, in line with the dual system hypothesis. Graduates from the vocational education and training system are most clearly aligned with detailed occupational destinations in Germany (M=0.829), followed by the Netherlands (M=0.748), and finally France (M=0.660). The German system thus provides the strongest link of graduates to a small set of specific occupations. This can indicate that the specialized craftsman is most common in Germany, while the broader craftsman is more common in the Netherlands and particularly France.

Most of the between-country differences result from the fourth component (D), that calculates the share of total linkage that is due to the sorting to detailed occupations from detailed fields of study within levels of attainment. This is also in line with the comparative

[1] In contrast to DiPrete et. Al. (2017), ΔE_g and ΔN_g are multiplied by .5 (the first part of the formula) because they have to be averaged over the two countries.

perspective that often emphasizes the clear association between detailed educational programmes and detailed occupational destinations in the German model (e.g. Culpepper & Finegold 1999; Shavit & Müller 1998; Müller & Gangl 2003). Similar to DiPrete et al. (2017), we find that in accounting for cross-national differences in linkage, educational fields play a major role.

Component C (the extent to which fields of study sort to different occupational levels) is much more similar between countries. Apparently, countries do not differ so much in the likelihood to enter a particular occupational level with a particular detailed field of study. Consequently, the balance between components C and D is rather different between countries. In France, the sorting from fields of study to levels of occupation is stronger than the sorting from fields of study to specific occupations, while the balance goes to the other direction in Germany and the Netherlands. Hence, the school-based model of craftsmanship may be less well able to connect to specific occupations than the dual system (Germany) or the mixed system (the Netherlands).

As expected given the fact that we only study two levels within ISCED level-3 vocational qualifications, the share of total linkage that is due to linkage by level of education is very small (components A and B).

[Figure 1 about here]

The global linkage strength as reported in Figure 1 is calculated on the complete labour force in employment, i.e. workers of all ages. There is a practical reason to this: in order to calculate linkage measures, a large sample size is important. However, linkage is likely to be stronger among younger workers, as they have experienced much less occupational mobility. Table 2 therefore shows the results of a robustness check, where we compare the linkage strength of the total working population and workers younger than 40 years of age. As expected we find slightly stronger linkage scores for the younger age group (which could result from smaller sample sizes, stronger linkage, or both), but the overall pattern of the four components is very similar with what has been reported in Figure 1. One notable difference is, however, that the fourth component (D), that measures the linkage strength that is due to the sorting of detailed fields of study to detailed occupations, is even larger in Germany if only the younger workers are selected. Hence, the comparative pattern that we described in Figure 1 is even more pronounced if younger workers are studied; a relatively large component of the total linkage

strength in Germany is found at the granular level: links from educational fields within levels to detailed occupations.

[Table 2 about here]

Invariance decomposition of the global linkage strength

The global linkage strength *M* depends on (a) the extent to which educational programs link to occupations, (b) the compositional differences between educational groups, and (c) the occupational entropy. If we want to compare the global linkage strength between the three countries under study, it is therefore crucial to isolate these factors. Such a decomposition allows us to compare the structural and compositional differences between the countries. There are two ways to do this: (1) forward-looking, and (2) backward-looking. Forward-looking means that we look from education to occupation, and see how strong education segregates individuals over occupations. Backward-looking means that we start from the occupations and look how homogenous the occupational workers are with respect to their educational background. Table 3 presents the decompositions of the differences between the three countries for both scenarios.

[Table 3 about here]

If we are looking forward, thus from educational categories to occupations, most of the difference between Germany and the other countries can be explained by a difference in overall occupational entropy. The occupational entropy is far higher in Germany than in the Netherlands (.110) and in France (.104), indicating that workers in Germany are more evenly spread over all possible occupations than in the Netherlands and France. The educational difference distribution shows that in the Netherlands educational programs that link strongly to the labor market are relatively of equal size compared to Germany. This means that the reason of stronger linkage in Germany than in the Netherlands is not that there are more students in the strongly linking programs. We do see such a difference between France and the Netherlands (0.074): the difference in global linkage strength between these two countries can almost fully be explained by the higher numbers of students enrolled in more strongly linking programs in Netherlands compared to France.

Finally the composition invariant linkage component depicts if – net of all the distributional and compositional differences – vocational programs in Germany link more

strongly than in France or the Netherlands. We find that this is the case for France: here almost half of the total difference is due to the tighter link between educational programs in Germany compared to France. However, the difference between Germany and the Netherlands is very small (0.01), indicating that educational programs in Germany link almost as strongly as in the Netherlands.

If we are looking backward, thus from occupations to educations, we see larger differences. The Netherlands have a relatively high educational entropy; it is .312 higher than in Germany, and .174 higher than in French. Thus, students are more evenly spread over vocational educational programs in the Netherlands than they are in France and Germany. Once we isolate this difference in educational entropy and the differences in occupational distributions (in which we see little differences), we observe a far stronger link between occupations and educational programs in Germany than in the Netherlands (0.406 difference) and France (0.341 difference). The interpretation is that in Germany in detailed occupations, workers are very similar with respect to their educational background, and there is far less heterogeneity in the educational qualifications of these workers than in France and the Netherlands.

To summarize, the global linkage is stronger in Germany, but, when looking forward, compared to the Netherlands this is largely because of compositional differences. There are few structural differences between the Netherlands and Germany in how strong educational programs link to the occupational structure. If we are looking backwards, there is more structural segregation in occupations in Germany and the Netherlands, as well as between Germany and France. The Netherlands and France are more or less comparable in this respect.

Granual structure of linkage

While countries thus differ in how the vocational education and training sector links to the labour market, it is also likely that there are strong differences between fields of study. Figure 2 demonstrates the connection between local linkages scores for two typical educational programmes in Germany. The health educational programmes (high level) links strong to the labor market. Many students eventually become a nurse or associate professional (29.5%) or a health professional (20%). By contrast, the transport and logistics (low level) programmes link weaker to the labor market. Those students start to work in a larger variety of jobs and the connection to one specific occupation is smaller, although still 20 percent starts to work as a salesperson or demonstrator (20%).

[Figure 2 here]

Figure 3 presents an overview of the local linkage per fields of education and level, averaged over the three countries. While there is a large diversity within levels, on average, the higher educational level shows a stronger linkage to the labor market. Thus, among vocational graduates, those with a higher education more often find similar jobs. By contrast, vocational students with a low level diffuse among a wider set of occupations, possibly because they have learned enough specific skills to be attractive for a specific set of occupations. Also commercial oriented occupational programs (e.g., management, administration) typically link weakly to the labor market. By contrast, the health programmes show a strong linkage; those who are trained as a nurse, for instance, almost always start working in the health care sector. Unexpectedly, the linkage of the technical educational programmes (e.g., electro technique, engineering) is only moderate strong. Apparently, on a vocational level, also within these fields of study a lot of people get to work in different sectors. The 'other' categories also show a low linkage, but this is almost true per definition as these categories are composed of respondents with a (further) unclassifiable education and thus differ a lot from each other.

[Figure 3 here]

Although there are some educational programs that have a strong link, there are large differences in local linkage between the three countries. This is presented in Figure 4. Particularly the correlation between the local linkage in French and Germany is low (.07). However, this is largely attributed to two outliers in the case of Germany; the high linkage of the environmental programs (high and low level). These programmes are only a small fraction of the population attend (approximately 100 respondents follow these programmes in our German sample with over 100.000 respondents). If we leave the environmental sector out, the correlation increases to a moderate strength of .15. However, there remain wide differences. For instance, the health (low level) and technique (high level) programmes link way stronger in Germany (1.6 and 1.4 vs .8 and .6, respectively) than in French, while agricultural programmes (low and high) link stronger in French than in Germany (1.4 and 1.6 vs. .9 and .8, respectively). The correlation between The Netherlands and French is higher (.193), as well as those between The Netherlands and Germany (.223). Nonetheless, they remain only modest. The main take-away message is that the three countries are widely different in what

educational programs link strongly (have a high local linkage) and which link weakly (have a low local linkage).

[Figure 4 over here]

The next step is to compare the linkage strength of each detailed educational category between countries. Figure 5 (panels A, B and C) shows the results of this comparison. It sets off the local linkage strength for each qualification for two countries at a time. The right side of each panel displays the size of the field (% of graduates), the left side the ratio of the local linkage between the two countries that are compared.

Panel A compares Germany to France. Most of the ratios are larger than 1, indicating that educational programs link more strongly in Germany than in France. The commercial (commercial and economy) and technical (electrical engineer, and textile, leather etc. processing) fields link a lot stronger in Germany than in France, with ratio's as close as 2. These are relatively large fields in both countries (see the righ side), and hence explain a large part of the country differences. Remarkably, there are hardly any fields that link (much) stronger in France than in Germany, showing that a school based vocational system creates along the line weaker linkages to the labor market than a dual system. This clearly indicates that the transition from school to work in more strongly coordinated along education-occupation linkages in France than in Germany.

Panel B compares Germany and the Netherlands. Again we find that educational programs in the VET-sector in Germany link more strongly. Almost all ratios are larger than 1 (indicating stronger local linkage in Germany), and in particular in the management and commercial fields the linkage is much stronger in Germany than in the Netherlands, from twice to up to four times as strong. Some fields sort quite similarly between the two countries, such as engineering, metal work, and health care. Only a few fields show stronger linkage in the Netherlands, most prominently transport and logistics. With respect to the sizes of the fields, we find interesting differences. In the Netherlands many more respondents are graduated from fields in care and social services than in Germany, a pattern that we also find for commercial and administration. In Germany, in contrast, relatively more students graduate from transport, and metal working and engineering fields.

Finally, Panel C compares France and the Netherlands. The linkage strength of the educational programmes is far more comparable; for some fields (such as transport and logistics) the linkage is stronger in The Netherlands, while for others (such as those in care

and social services) it is stronger in France. The differences between France and the Netherlands are thus far less pronounced than between Germany and the other two countries.

In sum, there are wide differences in local linkage and size of the educational categories in Germany, France, and the Netherlands. However, in Germany almost all fields link stronger than comparable fields in the Netherlands and France, underscoring the strong linkage of educational programs to the labour market in Germany's dual VET system.

[Figure 5 about here]

Differences in local linkage between the three countries may differ per educational level. For instance, in The Netherlands a specialized education is often seen as a safety net for the lowest educated, and therefore incorporated at this level, while there is a trend to broaden the higher levels and to incorporate more general 21st century skills (Petit and Rözer, 2017). To explore these differences, we also compared the local linkage of the German, France, and Dutch educational fields by educational level (see Appendix D). The largest differences between Germany and The Netherlands and France indeed occur on the highest educational level. There are no remarkable differences in the local linkages within the levels between France and The Netherlands.

Trade-off between linkage strength and unemployment probabilities?

One of the major concerns about the vocational education and training sector is that a narrow specialization harms employment opportunities. Given that we assess the linkage strength only for the employed population, our results could be biased if strongly linking fields are also the ones with which it is hard to find a job. More specifically, there may be a trade-off between strong linkage and employment probabilities. To test the trade-off hypothesis (hypothesis 3a) versus its opposite hypothesis 3b, we describe the association between linkage strength and unemployment rates. We do this in a non-parametric way, for men and women separately. The shape of the effects can be called statistically significant (see Appendix C for the parametric results).

The results are displayed in Figure 6 for men and women. Among men, we see that in all three countries the predicted unemployment rates are lower among the high linking fields, such as health and agriculture, than among the low linking fields, such as management and administration. In France the predicted unemployment rate is almost 1.5 percent lower in the higher linking fields, while it is almost 2.5 percent lower in Germany and The Netherlands.

Interestingly, this trend is steeper in Germany, particularly compared to France in which the predicted unemployment does not decline further when a local linkage of approximately 1.3 are reached. This is in line with the idea that specific educational programs are more effective in protecting laborers in countries with strong apprenticeship systems (Breen 2005; Levels et al. 2014).

For women the results are comparable to those of men; the predicted unemployment level are lowest among the highest linking fields. However, differences are higher than among men. Predicted unemployment rates are approximate 2.6 percent higher among the weaker than the stronger linking fields in The Netherlands and French, and 4.5 percent in Germany. Again, the declines in unemployment with rising linkage levels are steepest in Germany.[2]

In sum, there is no evidence for a trade-off between linkage strength and employment probabilities. It is not the case that more strongly linked fields form a threat to overall labour market opportunities. By contrast, people with a degree of strong linking educational programs are less often unemployed. This effect seems to be strongest in Germany with its strong apprenticeship system.

[Figure 6 about here]

CONCLUSION AND DISCUSSION

Our results showed evidence of three distinct worlds of vocational education. It matters for the linkage between qualifications and occupations how vocational education is organized; the linkages are on average stronger in systems with a dual VET sector compared to a full school-based model. In line with the comparative perspective (e.g. Culpepper & Finegold 1999; Shavit & Müller 1998; Müller & Gangl 2003), the stronger linkage in Germany was particularly due to the sorting process by fields of study into detailed occupations.

A large part of the differences in global linkage, however, are compositional; German students cluster more in specific occupations than Dutch and France students. Once this is taken into account, the net linkage between Germany and the Netherlands is almost equal.

Besides these between country differences, there is a large variation within countries in how education is sorted into the labour market. Not all vocational qualifications are the same,

[2] In The Netherlands being educated in the most high linking educational program even seems to decline the chance of having a job. However, the increase in unemployment starts at around a linkage score of 1.5, which is above the maximum linkage score for this country, which is 1.3.

and some programmes sort much more clearly to well-defined sections of the labour market than others. This is in line with recent studies that argue that there is a lot of variation within countries concerning the linkage strength of educational qualifications (Allen et al. 2000; DiPrete et al. 2017). Particularly studies related to health show a strong linkage; a large part of these students start to work in the health sector and for instance become a nurse or health professional. However, besides the country similarities, there appeared to be wide differences in the extent to which fields of study within the VET sector sort to a restricted set of occupations. For instance, technical studies link far stronger to specific educations than in France, possibly because the connection with employers in the form of apprenticeships is particularly strong among these studies in Germany (Culpepper and Thelen 2008; Busemeyer and Trampusch 2012). Hence, there are wide differences in how similar educational programmes are organized, leaving teachers and policy makers room to organize them as they wish.

One important characteristic on which educational programmes are assessed are their labor market outcomes (Van de Werfhorst 2014). We explored the chances of being unemployed. Our data showed no support for a trade-off between a strong linkage and being employed. Instead, stronger linked occupations still seem to protect students from becoming unemployed. This safety net function was particularly strong in Germany, showing that it is most effective in countries with a strong apprenticeship system (Levels et al. 2014). This supports the call for the adoption of a occupationally specific education system (Hoffman 2011).

Translating these findings to discussion about craftsmanship, we find that the three countries produce different types of craftsmen. On average Germany seems to place most emphasize on the specialized craftsman, while France on the broader craftsman that has more general skills. Our empirical results indicate that the combined school- and work-based system of the Netherlands creates craftsmen that fall in between. Despite a call for broad craftsmanship and general skills (e.g. Hanushek et al. 2016) specialized craftsman still are more often employed.

A couple of weaknesses have to be discussed. First, we have not been able to distinguish between dual and school based programmes at the individual level, as it would not allow us to compare countries with harmonized classifications of education and occupation. More fine grained data will result in a greater accuracy and wider variation in local linkage, probably strengthening our effects. Related to this issue, different categorization of educational fields among countries made harmonization difficult, and increased the chance

that respondents are wrongly classified. As the Dutch categories served as a reference, mismatches are most likely to occur in Germany and France. This may form one explanation for the low correlation in local linkages between those countries.

Second, selection into vocational education and specific linkage levels may be different across countries. For instance, people with a low socio-economic background may more often opt for the certainty of strongly linking programmes, choosing for a 'real occupation training'. These selection effects may actually result in an underestimation of our findings (with respect to the chances of having a job), as they would explain why the strong linking fields would show higher unemployment levels.

Third, we studied only a limited number of (labor market) returns, while for instance wages, job status, and citizenship are important outcomes of educational programmes as well. Moreover, there may be important age and period effects that were not taken into account, including a later-career downfall and a growing importance of broader skills in recent periods (Hanushek et al, 2016, but see Forster et al. 2016, and Rözer and Bol 2017).

All in all, linkages are on average stronger in systems with a dual VET sector compared to a full school-based model, despite that many differences between systems can be explained by compositional differences. However, there are many differences in how strong educational programmes link to occupations within and between countries. In general, employment is highest among the stronger linking programs, and probably strongest in strong apprenticeship systems.

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Table 1. Description and classification of types of vocational education

Country	Level	ISCED	Type	Perc.	Tot.
FR	High	3a	Bac technologique	3.1	
		3b	Bac professionnel	2.2	
		3c	Brevet de technicien, brevet professionnel	1.9	7.2
	Low	3c	BEP	6.6	
		3c	CAP	13.5	
		3c	Autres diplômes de niveau CAP-BEP	0.9	21
GR	High	4a	Hoch-/fachhochschulreife and Lehrausbildung: with specialisation	4.5	
	Low	3b	Berufsfachschule, kollegschule and Lehrausbildung	38.2	
NL	High	3a	MBO 4	18.0	18.0
	Low	3c	MBO 2 / MBO 3	14.7	14.7

Note: percentages of total.

Table 2. A comparison of Linkage Strength using Recent Labor Market Entrants and the Entire Workforce

	All Employed			Under 40		
	FR	GR	NL	FR	GR	NL
Number of educational categories	38	38	38	38	38	38
Number of occupational categories	93	93	93	93	93	93
A. Between major occupations, by level	.024	.035	.027	.034	.051	.352
B. Between minor & within major occupations, by level	.012	.010	.018	.015	.014	.021
C. Between major occupations, by field within level	.316	.315	.287	.311	.371	.327
D. Between minor & within major occupations, by field within level	.309	.469	.416	.350	.594	.450
Total linkage strength	.660	.829	.748	.709	1.030	.833
Ratio Below 40/ all	1.074	1.243	1.113			
Sample size	53977	115163	205553	23571	45443	100551

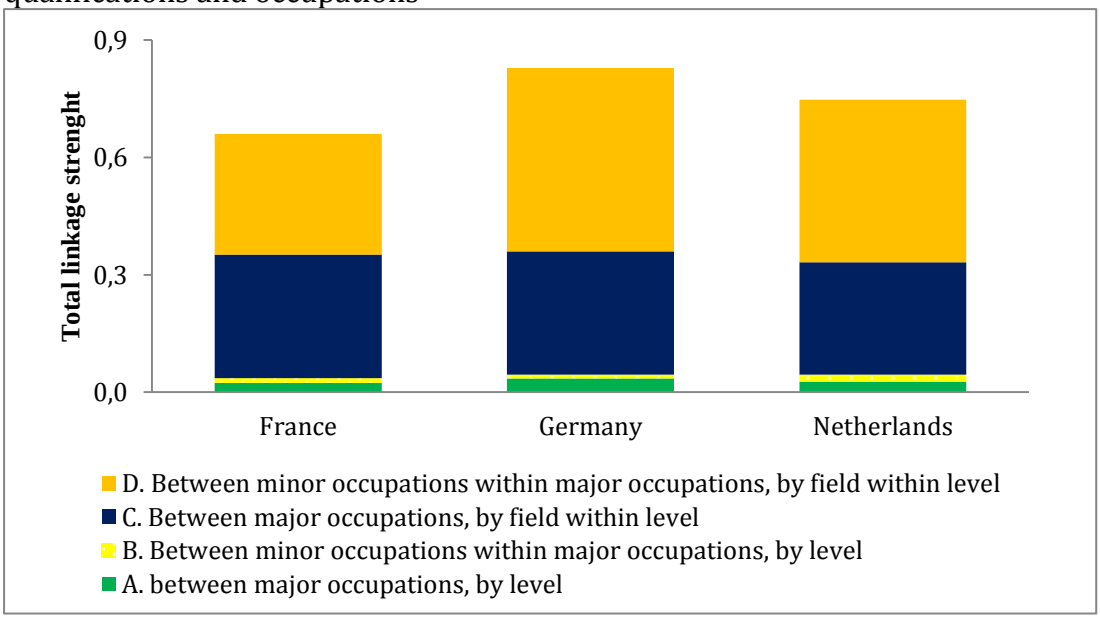
Sources: Enquête Emploi (2003-2012) , EBB (2003-2012), Mikrozensus (2006).

Table 3. Invariance decomposition

	NL - GR	NL - FR	GR - FR
Forward looking			
Occupational entropy difference	-.110	-.006	.104
Educational distribution difference	.039	.074	-.015
(Educational) composition invariant linkage	-.010	.020	.079
Total difference	-.080	.088	.169
Backward looking			
Educational entropy difference	.312	.174	-.138
Occupational distribution difference	.013	-.026	-.035
(Occupational) composition invariant linkage	-.406	-.060	.341
Total difference	-.080	.088	.169

Sources: Enquête Emploi (2003-2012) , EBB (2003-2012), Mikrozensus (2006).

Figure 1. Decomposition of global linkage strength between educational qualifications and occupations



Note: only upper secondary education vocational programmes at ISCED3-level
Sources: Enquête Emploi (2003-2012) , EBB (2003-2012), Mikrozensus (2006).

Figure 2. Example of a strong and weak linking educational field in Germany

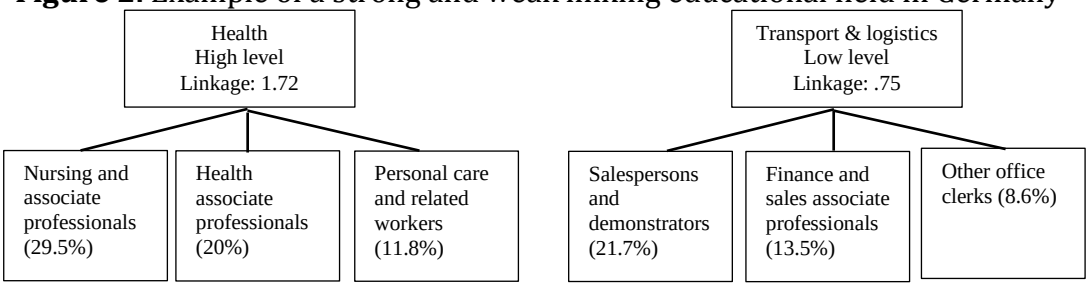
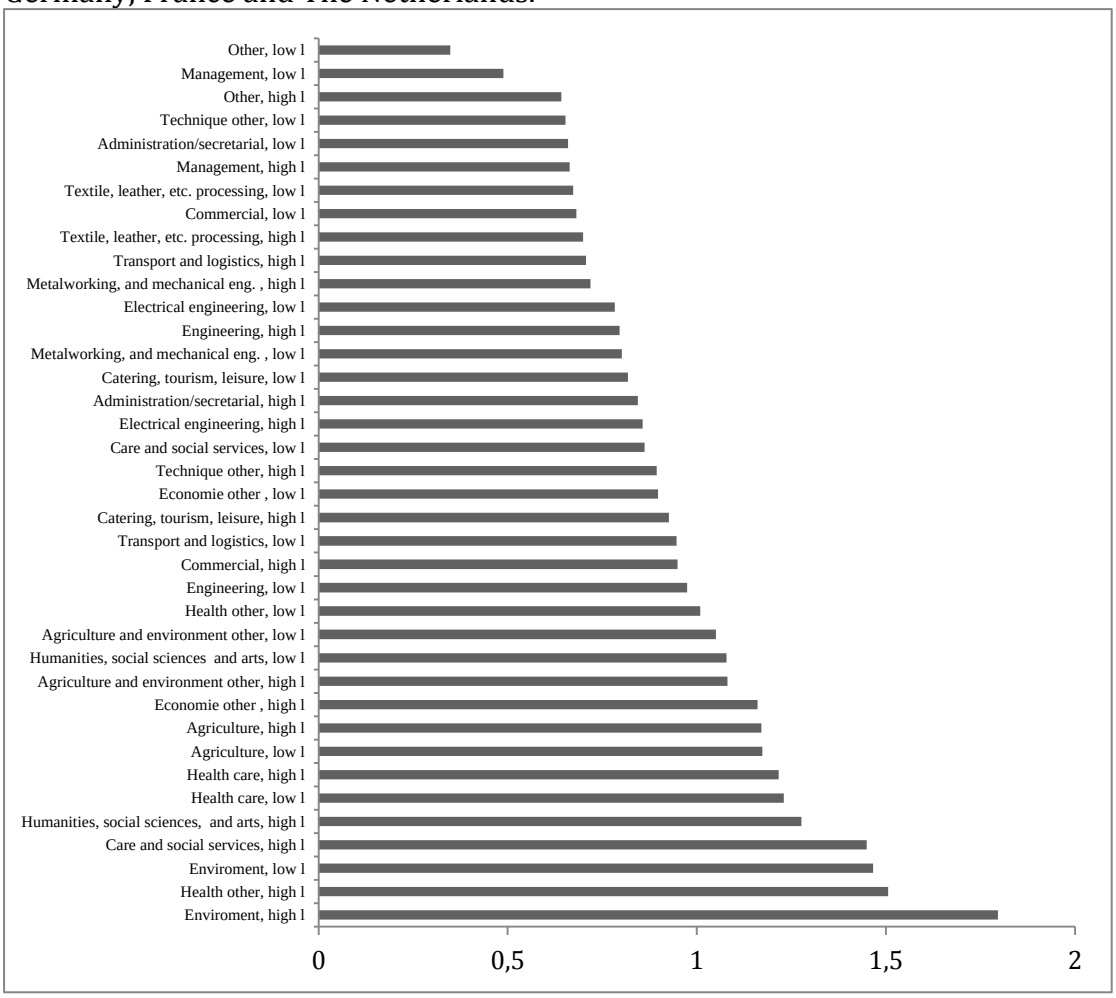


Figure 3. Local linkage per education level and field combination, averaged over Germany, France and The Netherlands.



Sources: Enquête Emploi (2003-2012) , EBB (2003-2012), Mikrozensus (2006).

Figure 4. Scatterplot of the linkage of educational programmes in France, Germany and the Netherlands.

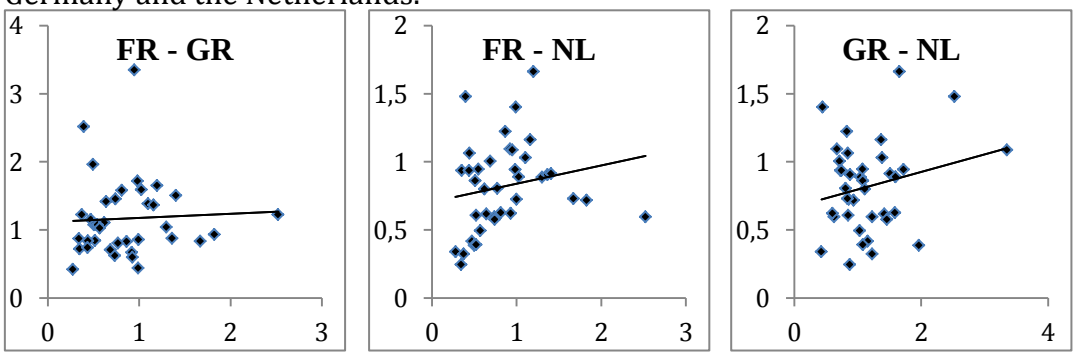
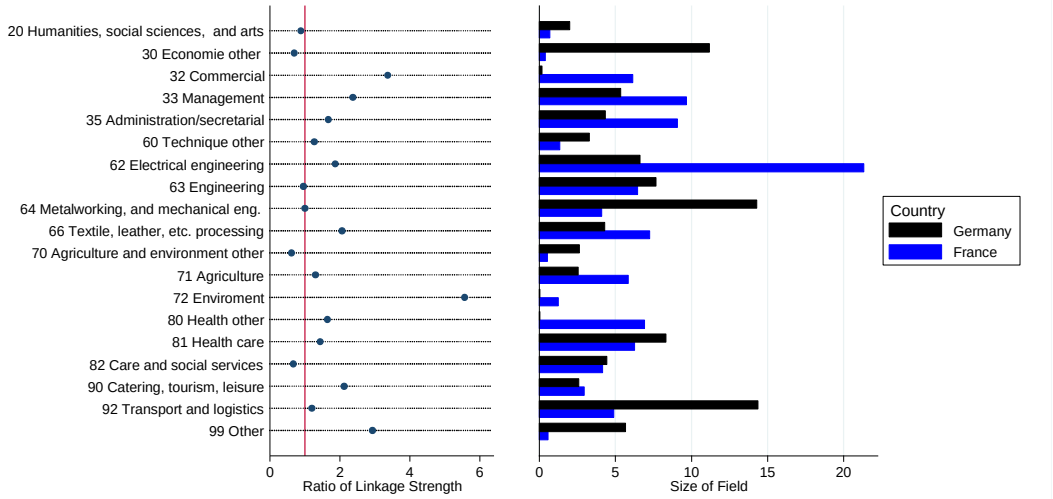
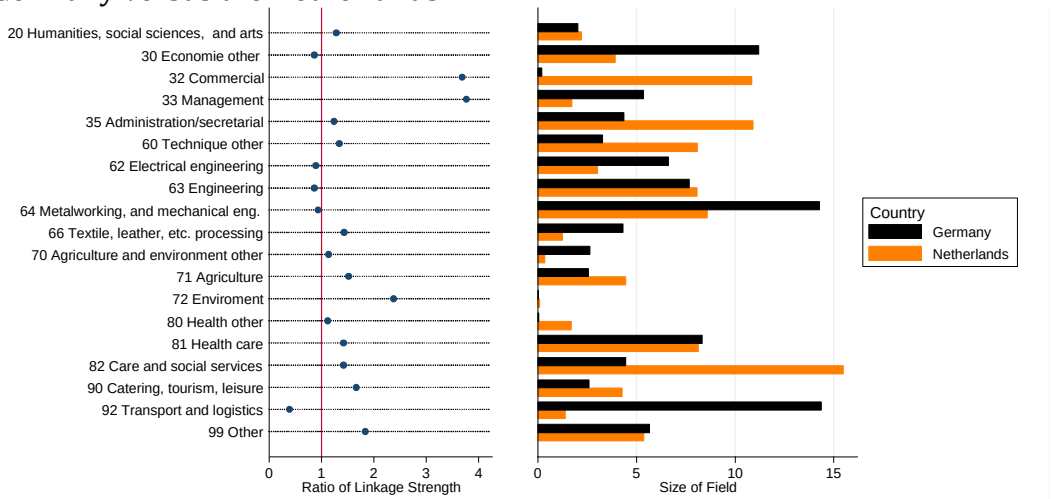


Figure 5. Comparison of linkages between each pair of countries

A. Germany versus France



B. Germany versus the Netherlands



C. France versus the Netherlands

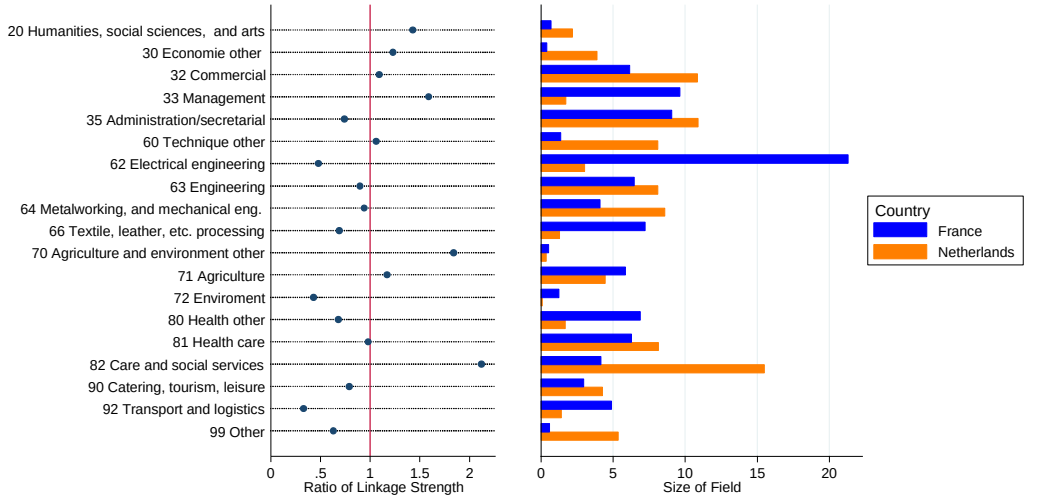
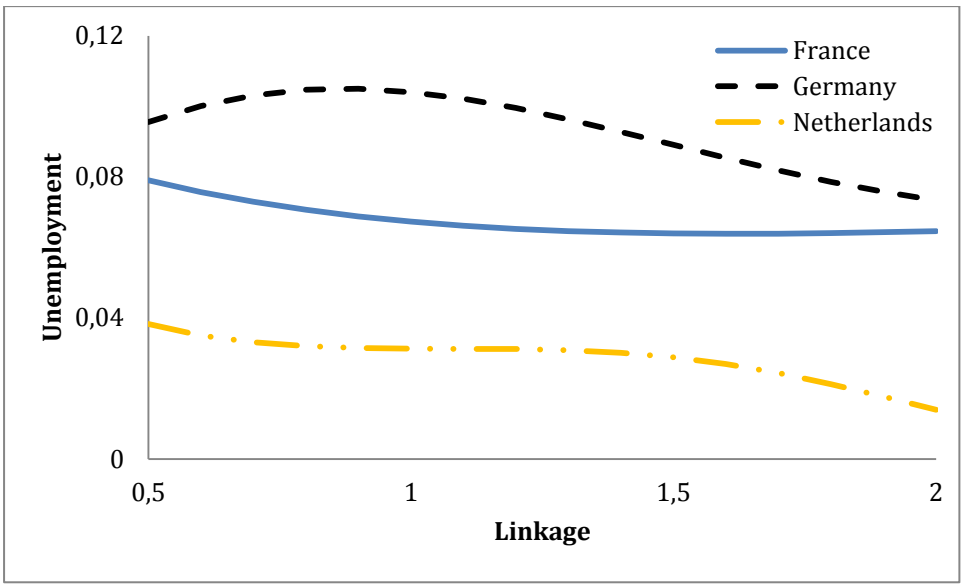
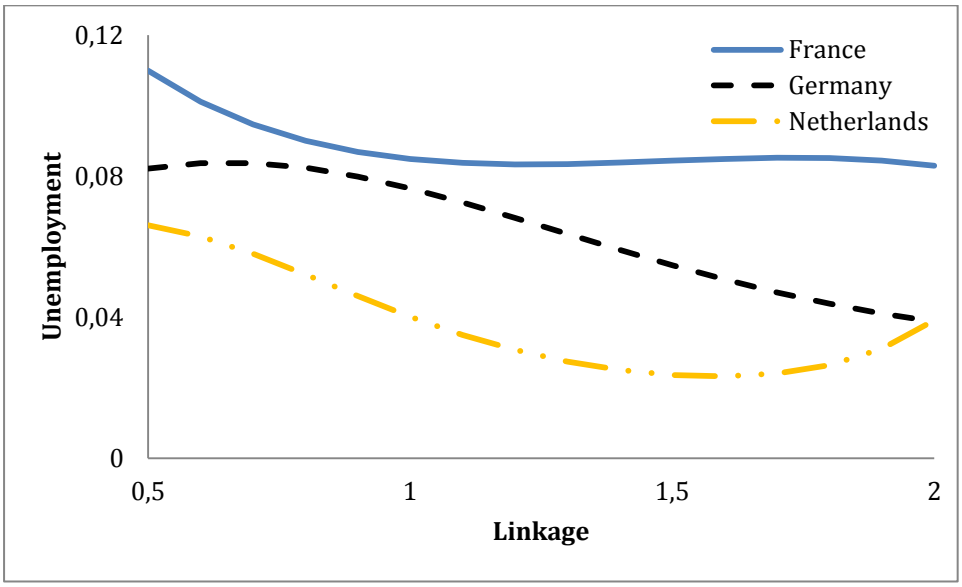


Figure 6. Unemployment rates across levels of linkage strength.

A. Results for men



B. Results for women



Appendix A. List of fields of study with corresponding labels

Code	Field
20	Humanities, social sciences and arts
30	Economy other
32	Commercial
33	Management
35	Administration/secretarial
60	Technique other
62	Electrical engineering
63	Engineering
64	Metalworking, and mechanical eng.
66	Textile, leather, etc. processing
70	Agriculture and environment other
71	Agriculture
72	Environment
80	Health other
81	Health care
82	Care and social services
90	Catering, tourism, leisure
92	Transport and logistics
99	Other

Appendix B. List of occupations

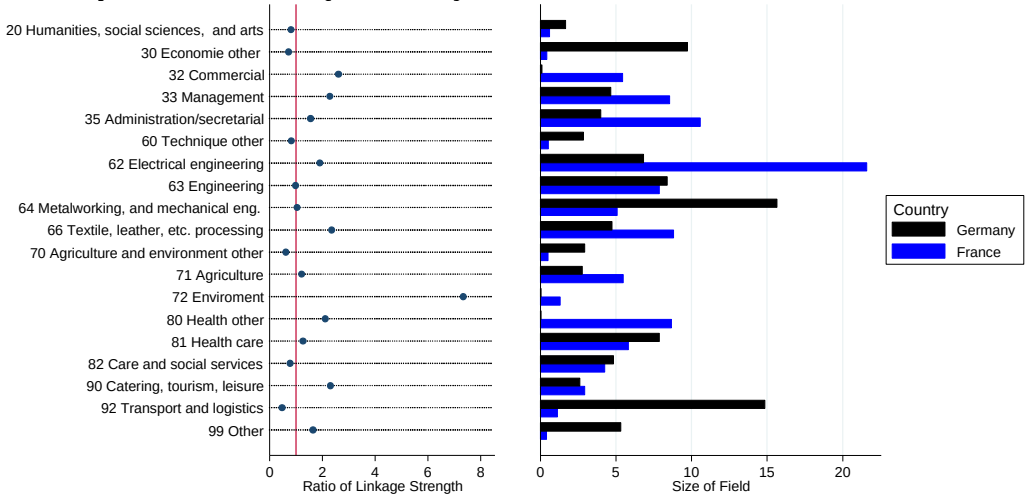
Appendix C. Logistic regression of linkage strength on (not) being employed for French, Germany and The Netherlands.

	Men						**Women**					
	FR		GR		NL		FR		GR		NL	
	b	se	b	se	b	se	b	se	b	se	b	se
Constant	1.955	.184 **	-2.054	.175 **	1.538	.293 **	2.467	.276 **	-1.496	.179 **	-2.067	.273 **
Linkage	-.654	.200 **	.735	.222 **	-.370	.014 **	-2.591	.714 **	.698	.206 **	.304	.086 **
Linkage squared	.194	.104 **	-.389	.114 **	.034	.013 *	1.802	.675 **	-.561	.109 **	-.044	.011 **
Linkage cubic					-.001	.001 **	-.406	.171 *			.001	.000 **
Age	-.193	.009 **	-.014	.007 *	-.204	.009 **	-.153	.010 **	-.033	.008 **	-.072	.009 **
Age squared	.002	.000 **	.000	.000	.002	.001 **	.001	.000 **	.000	.000 ~	.001	.001 **

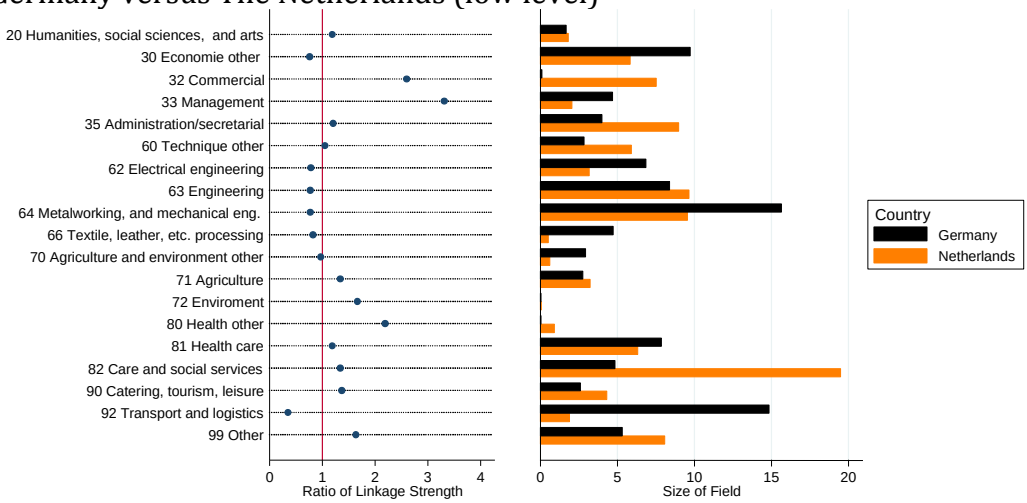
Note: year fixed effects are included for the models in which French and the Netherlands are involved; cubic effect not estimated while not being significant.
Sources: Enquête Emploi (2003-2012) , EBB (2003-2012), Mikrozensus (2006).

Appendix D. Comparison of linkages between each pair of countries (by high and low educational level)

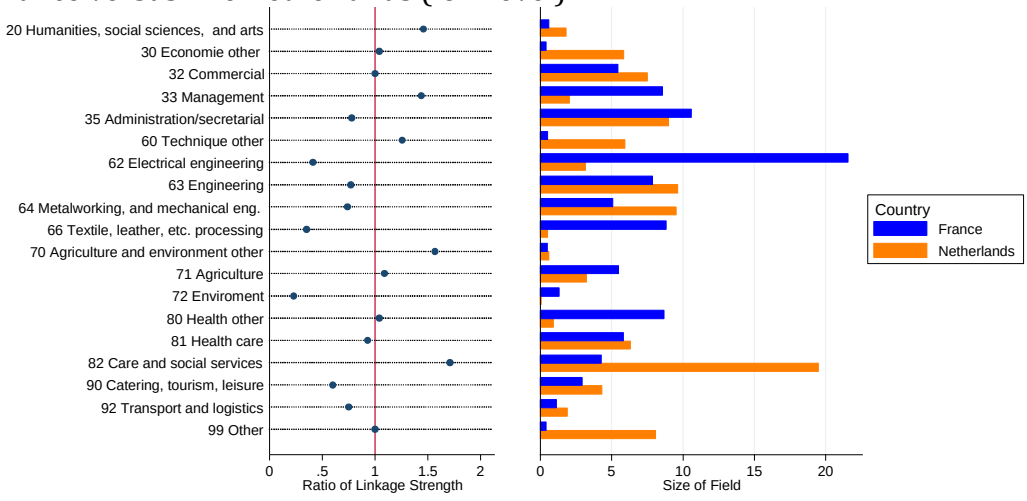
A. Germany versus France (low level)



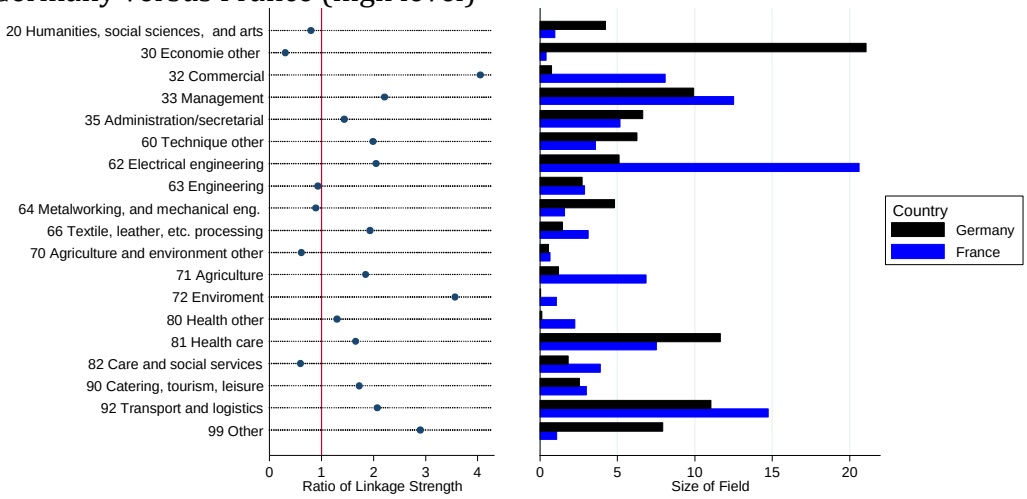
B. Germany versus The Netherlands (low level)



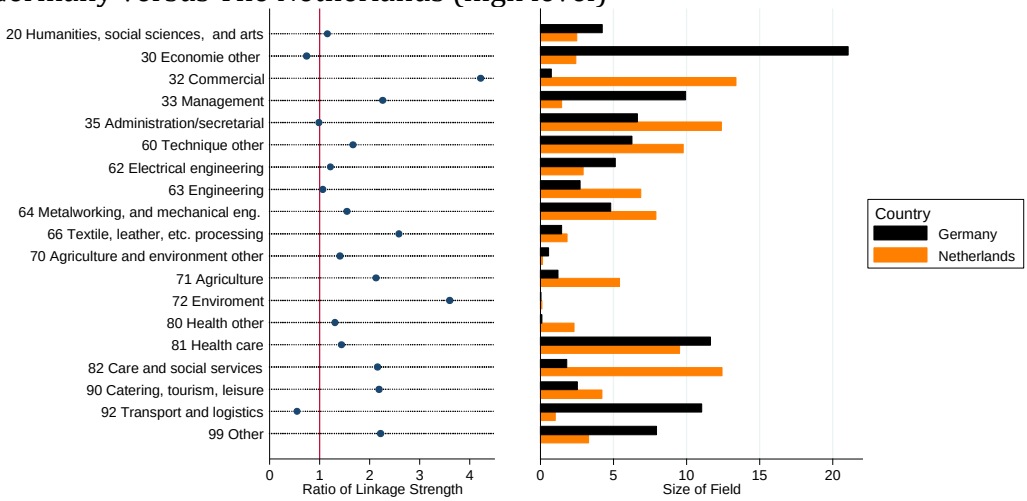
C. France versus The Netherlands (low level)



D. Germany versus France (high level)



E. Germany versus The Netherlands (high level)



F. France versus The Netherlands (high level)