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Three Worlds of Vocational Education: Specialized and General Craftsmanship in France, Germany, and The Netherlands

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Abstract

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 micro-data from France, Germany, and The Netherlands, we show that there are different ways by which the VET sector establishes school-to-work linkages. Linkages between school to work are on average stronger in systems with a dual VET sector compared to a full school-based model. However, an important reason why linkages are stronger is because of compositional differences, as in dual VET 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. These results suggest that there is still room for occupationally oriented schooling.

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 work life, such as rapid technological change and globalization, call for a reconsideration of the organization of VET systems in developed economies, especially because specific skills are argued to reduce employability during the career (Hanushek *et al.*, 2017). 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 (Wolbers, 2007; Bol *et al.*, 2019). 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). The main advantage of this system would be that there is a closer connection with the labour market than in systems where education occurs in school. Students would sooner start to work in the sector in which they are educated and followed a traineeship. In other words, there would to be a closer link between educational programs and occupations. But, are students in dual-systems really more likely to be sorted in the same type of occupations, even when we take compositional differences in the size of occupations and educational programmes into account? And does this closer link between educational programs and occupations explain the smoother transition to the labour market?

Following recent scholarship on assessing the level of linkage between educational qualifications and occupational positions (DiPrete *et al.*, 2017; Bol *et al.*, 2019; Rözer and Bol 2019), we study the sorting of persons from educational qualifications to occupational positions. We do this for vocational education programs at the upper secondary level (ISCED-97 levels 3 and 4a) 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 may be 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 more detailed linking process of vocational qualifications to labour market positions in different countries.

More specifically, we expand on previous research in three ways. First, in contrast to DiPrete *et al.* (2017) who also studied the sorting of students different educational systems, we use a different set of countries (The Netherlands, France, and Germany), and more recent data. We selected these countries to compare the school-based with the dual system. Second, in contrast to previous studies (e.g. Forster, Bol and Van de Werfhorst, 2016; DiPrete *et al.*, 2017; Bol *et al.*, 2019; Rözer and Bol, 2019), we specifically zoom in on the upper secondary level, because discussions whether systems should be more vocational exactly focus on this level. For example, studies argue that especially on this level a strong school to work linkage can work as a 'safety net' and help students to make the transition to the labour market (e.g. Shavit and Müller, 1998). Third, where previous studies studied the association between the specificity of educational degrees and labour market returns for one country (Forster, Bol and Van de Werfhorst, 2016; Rözer and Bol 2019), we study this association for three countries. We specifically examine whether the labour market returns vary over the life cycle, contributing to the growing number of studies that examine whether there is a trade-off between early career advantage and late career disadvantage of occupation-specific skills (e.g. Brunello and Rocco, 2017; Golsteyn and Stenberg, 2017; Hanushek *et al.*, 2017; Forster and Bol, 2018; Rözer and Bol, 2019). This allows us to test whether an educational program with a strong connection to the labour market results in more favourable labour market outcomes over the life cycle in a school-based or dual system.

Our study helps 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.

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 (Maurice *et al.*, 1986; Allmendinger, 1989; 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, most important for our study, the level of vocational specificity (Allmendinger, 1989; Shavit and Müller, 1998; Bol and Van de Werfhorst, 2013).

Vocational educational systems can, according to Busemeyer and Trampusch (2012), be classified 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). According to the Varieties of Capitalism approach, coordination between employer organizations, trade unions, and the state, is one way in which uncertainties are reduced (Hall and Soskice, 2001).

All three countries that we study are usually seen as coordinated market economies, but the specific skills generated in the German system are 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 labelled 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. In a mixed system like the Dutch, there is a clear view on the types of programmes that would best be taught in a dual setting, and which in a school-based setting.

Vocational Education and the Transition to the Labour Market

The vocational specificity of educational systems is argued to have a large influence on the labour market outcomes of school-leavers. In general, a vocational education is argued to smoothen the transition to the labour market, as students would have obtained specific skills that make them immediately productive, and have gained useful social networks, for example because they took an apprenticeship (Shavit and Müller, 1998; Breen,

2005; Biavaschi *et al.*, 2012; Noelke, Gebel and Kogan, 2012; Di Stasio and Van de Werfhorst, 2016; Rözer and Bol, 2019).

Yet, the degree in which a vocational education translate in favourable labour market returns would also depend on the size and form of the vocational system. 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 vocational education would signal high productivity and school leavers consequently found jobs more quickly. In addition, school-leavers 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 would be more stigmatizing and therefore offers worse prospects in the labour market.

The German model is in this respect often used as an example. The successful German model of youth integration in the labour 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. However, it is probably 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 the comparative literature, one would expect that, on a micro-level, especially those who graduated from vocational education benefit from strong VET sectors. However, this presumed micro-level association between educational track and labour 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). Among those who could, some support the idea that the VET sector was particularly good for those who had been enrolled in vocational education (e.g. Levels, Van der Velden and Di Stasio, 2014). However, most did not found such a strong, or even opposite, results (e.g. Scherer, 2001, 2005; Iannelli and Raffe, 2007; Wolbers, 2007; Andersen and Van De Werfhorst, 2010). For example, 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.

Thus, 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.

Differences within the Vocational Sector

But besides differences between vocational systems, and vocational and general programs, recent scholarship has argued that there is a lot of variation *within* countries concerning the linkage strength of educational qualifications, also within the vocational and general sector (Allen *et al.*, 2000; DiPrete *et al.*, 2017; Forster and Bol, 2018; Rözer and Bol 2019). 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 sorted into 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 sciences. It is important to acknowledge the 'granular linkage structure' (DiPrete *et al.*, 2017) within and across societies to make sense of different types of vocational education and the related labour market advantages associated to them.

Recognizing this within-country variation, students of the same educational program in countries—like Germany, The Netherlands, and France—may be highly similar in their vocational specificity. Moreover, it may well be that some educational programs in France actually link stronger to the labour market than the same educational programs in Germany. In this respect, the strong German vocational system may be explained by the size of several typical vocational sectors. For example, the big car companies may have created a demand for technical vocational programs with a strong link to the labour market in the form of apprenticeships. Thus, structural and compositional differences in the size of occupations and educational programs may explain the differences between countries in how strongly linked their educational programmes are linked to the labour market.

Furthermore, how strong educational programs link to the labour market may determine the labour market outcomes of their graduates (Forster and Bol, 2018; Rözer and Bol 2019). Traditionally the idea is that the stronger an educational program links to the labour market, accomplished for instance through apprenticeships, the smoother the transition to the labour market may be for their graduates. This idea fits nicely into the traditional idea of a craftsman that is specialized in his/her work and enjoys a high employment protection (Hall and Soskice, 2001; Iversen and Soskice, 2001). This conception can be called a *specialized craftsman*.

Yet craftsmanship is increasingly 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. These craftsmen would more easily adapt to changes in the labour market and in their career, making their labour market perspectives be solid over their career (e.g. Hanushek *et al.* 2017; Rözer and Bol 2019). A broad type of specialization is paralleled with a high level of autonomy in this perspective. This conception can be labelled *broad craftsmanship*.

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 *granular 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 trade-off to emerge: specialized craftsmanship (i.e. strong linkage) should then limit opportunities to find a job, and may especially lead to a reduced employability later in the career. This would lead to *the trade-off hypothesis* of a negative association between linkage strength and employment probability, especially in the later career.

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, also in later phases of the career.

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 analyse labour force microdata for Germany, The Netherlands, and France. For Germany, we use the Mikrozensus of 2015. The Mikrozensus is a random sample of roughly 1 per cent of German households with about 70 per cent of these cases available for analysis in the anonymized scientific use file. All household members who are 15 years or older are interviewed.

For The Netherlands, we use the Enquete Beroepsbevolking (EBB), which is the labour force survey of Statistics Netherlands. In the EBB respondents are approached for five consecutive interviews over a period of 12 months. Detailed information on occupations and educational programs is filled until 2012. We use all unique observations matching our schooling restrictions from the years 2010–2012 in order to increase sample size.

For France, we use the Enquête Emploi, which is a quarterly labour force survey of 60–80,000 household members. The Enquête Emploi uses a rotating format, where all respondents in principle participate in six quarters (1.5 years). We use all unique observations matching our schooling restrictions from the years 2013–2016.

We selected respondents between 18 and 65 who were not enrolled in school at the time of the survey (i.e. did not go to school), whose highest educational qualification was a upper secondary vocational qualification. After this selection, the analytical sample is 240.519 in Germany, 91,257 in The Netherlands, and 74,851 in France.

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. It includes respondents who were not enrolled in the educational system at the time of the survey. 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 general fields, we distinguish 18 different fields of study (see Supplementary Appendix SA). 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 fields of the EBB were classified as 'other'. This happened with less than 1 per cent of the cases. In combination with the two educational levels, this procedure resulted in 36 level-field combinations.

To get detailed information about occupations, we harmonized ISCO 2008 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 94 detailed occupations.

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

Table 1. Description and classification of types of vocational education

	ISCED		Type	Perc	Total
France (FR)	High	3a	Bac technologique	4	
		3b	Bac professionnel	3.9	
		3c	Brevet de technicien, brevet professionnel	2.7	10.6
	Low	3c	BEP/CPAutres diplômes de niveau CAP-BEP/	22.8	22.8
Germany (DE)	High	4a	Hoch-/fachhochschulreife and Lehrausbildung: with specialization	10.8	
	Low	3b	Berufsfachschule, kollegschule and Lehrausbildung	47.7	
Netherlands (NL)	High	3a	MBO 4	18.0	18.0
	Low	3c	MBO 2/MBO 3	14.7	14.7

Notes: Percentages of total.

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 (educational level and field) to certain occupations in the labour market. Moreover, we obtain a *local segregation measure* that indicates how strongly linked each detailed vocational qualification is to certain occupations. These two measures enable us to study both the between-country and within-country differences in linkage strength. As the granular 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. Entropy can be defined as the expected gain in information by actually observing someone's education (or occupation), and be written as:

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

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 education.

M equals this change in information, weighted by the proportional size of every educational group:

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

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 can be further decomposed in a between-within decomposition (Frankel and Volij, 2011). The within part is the weighted average of segregation in each cluster, weighted by the size of the cluster. Fields of education are clustered in levels of education, while detailed occupations (second and third digit of the ISCO code) are clustered in major occupations (first digit of the ISCO code).

Although M is not composition invariant, country differences in M can be decomposed (Mora and Ruiz Castillo, 2011). It can be decomposed in differences in the educational (or occupational) entropy (ΔO_g), differences in the occupational marginal distribution (ΔE_g), and the net segregation as differences in rows/columns (i.e. within educations/occupations) (ΔN_g). More formally,

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

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

$$\Delta N_g = 0.5 * \sum_{g=1}^{g} \pi_g * EP_{g, c1} - EP_{g, c2},$$

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 between-within 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. School-leavers from the vocational education and training system are most clearly aligned with detailed occupational destinations in Germany (*M* = 0.870), followed by the Netherlands (*M* = 0.799), and finally France (*M* = 0.710). The German system thus provides the strongest link of school-leavers to a small set of specific occupations. This indicates that the specialized craftsman is most common in Germany, while the broader craftsman is more common in the Netherlands and particularly France. Thus, the dual system hypothesis is corroborated.

Most of the country differences result from the first (A) and second component (B), that calculates the share of total linkage that is due to the sorting to occupations from detailed fields of study within levels of attainment. Especially much variation occurs on the most detailed level: between minor occupations within major occupations. This is also in line with the comparative perspective that often emphasizes the clear association between detailed educational programmes and detailed occupational destinations in the German model (e.g. Shavit and
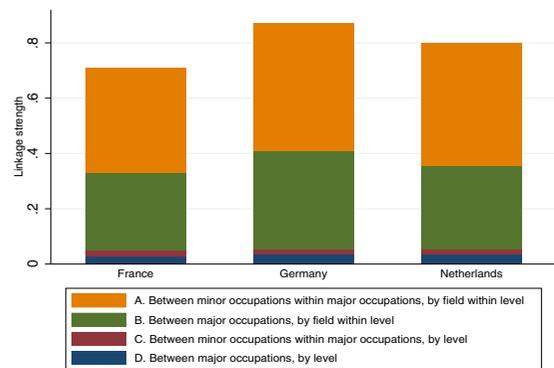
Figure 1. Decomposition of global linkage strength between educational qualifications and occupations. *Notes*: only upper secondary education vocational programmes at ISCED3-level, *Sources*: Enquête Emploi (2013–2016), EBB (2010–2012), Mikrozensus (2015).

Müller, 1998; Culpepper and Finegold, 1999; Müller and 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. As expected given the fact that we only study two levels within ISCED level-3 and level-4a vocational qualifications, the share of total linkage that is due to linkage by level of education is very small (components C and D). Thus, the school-based model of craftsmanship (France) is less able to connect to major occupations fields (component B), let alone to more specific minor occupations than the dual system (Germany) or the mixed system (the Netherlands) (Component A).

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.

Invariance Decomposition of the Global Linkage Strength

To compare the three countries further it is important to look at the differences in the educational/occupation

Table 2. A comparison of linkage strength using recent labour market entrants and the entire workforce

	All employed			Under 40		
	FR	DE	NL	FR	DE	NL
Number of educational categories	36	36	36	36	36	36
Number of occupational categories	93	93	93	93	93	93
A. Between minor and within major occupations, by field within level	0.377	0.461	0.443	0.471	0.624	0.508
B. Between major occupations, by field within level	0.282	0.356	0.303	0.283	0.478	0.357
C. Between minor and within major occupations, by level	0.024	0.016	0.019	0.027	0.021	0.025
D. Between major occupations, by level	0.027	0.037	0.035	0.036	0.048	0.040
Total linkage strength	0.710	0.870	0.799	0.818	1.171	0.930
Ratio below 40/all	1.152	1.346	1.164			
Sample size	52072	73766	76322	19928	11697	33175

Sources: Enquête Emploi (2013–2016), EBB (2010–2012), and Mikrozensus (2015).

Table 3. Invariance decomposition.

	NL versus DE	NL versus FR	NL versus FR
Forward looking			
Occupational entropy difference	0.132	−0.044	0.176
Educational marginal distribution difference	−0.007	0.042	−0.053
(Educational) composition invariant linkage	−0.194	0.092	−0.283
Total difference	−0.071	0.090	−0.160
Backward looking			
Educational entropy difference	0.319	0.040	0.280
Occupational marginal distribution difference	0.014	0.035	−0.017
(Occupational) composition invariant linkage	−0.404	0.015	−0.423
Total difference	−0.071	0.090	−0.160

Sources: Enquête Emploi (2013–2016), EBB (2010–2012), and Mikrozensus (2015).

entropy, effects of the marginal distribution, and the net segregation. Such a decomposition allows us to compare the structural and compositional differences between the countries. There are two ways to do this: (i) forward-looking and (ii) 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.

If we are looking forward, thus from educational categories to occupations, we see that workers in Germany cluster more around specific occupations than workers in the Netherlands (0.132) and particularly than in France (0.176). Thus, big occupations and industries, such as the car industry, explain part of the differences between Germany and the Netherlands and France, who

in turn resemble each other. Yet, the largest differences occur with the (educational) composition invariant linkage. This takes into account how equally students are distributed across occupations (the linkage), weighted by how big those occupations are. Within educational levels, there is far more segregation (linkage) in Germany than in France (−0.283) and also than the Netherlands (−0.194). Differences in the educational marginal distribution are smaller, meaning that strongly and weakly linked programs in Germany, France, and the Netherlands are on average comparable in size.

If we are looking backward, thus from occupations to education, we see a similar pattern, but larger differences. The Netherlands have a relatively high educational entropy; it is 0.319 higher than in Germany, and 0.040 higher than in France. 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 (0.404 difference) and France (0.423 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 than in the Netherlands and France. This is due to a combination of big occupations and educational programs in which students and workers cluster, while within educational programs and occupations there is far more segregation than in France and the Netherlands.

Granular Structure of Linkage within Countries

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. For example, in France the health care and social workers programmes (high level) links strong to the labour market (linkage = 2.18). Many students eventually become a hairdresser, beautician or something similar (56.7 per cent), a legal, social, or religious associate professional, for example a social worker (12.2 per cent), or a personal care worker, for example a child care worker (11.3 per cent). By contrast, the commercial programmes (low level) link weaker to the labour market. Those students start to work in a larger variety of jobs and the connection to one specific occupation is smaller. Most students end up in the domestic office and help cleaners (10.9 per cent), as a numerical clerk (8.9 per cent), or a shop sales person (6.2 per cent).

Figure 2 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 labour market. Thus, among vocational school-leavers, 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 not 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 labour 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.

Although there are some educational programs that have a strong link, there are, in contrast to the granular structure hypothesis, large differences in local linkage between the three countries. This is presented in Figure 3. First, the weighted average of the link strengths are stronger in Germany (0.87) than in The Netherlands (0.81) and France (0.71), confirming that the link from school to work is strongest in Germany. Taken this aside, particularly the correlation between the local linkage in France and Germany is low (-0.01). 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 cover only a small fraction of the population (approximately 50 respondents follow these programmes in our German sample with over 40,000 respondents). If we leave these programmes out, the correlation becomes quite strong 0.30. However, there remain wide differences. Especially the technique programmes link stronger in Germany than in France: the linkage for technology, electrical engineering, and engineering is stronger in Germany (linkage is 0.80, 1.10, and 1.00) than in France (linkage is 0.50, 0.50, and 0.80). These are the famous German vocational occupations with on-the-job training. The correlation between The Netherlands and France is higher (0.16), while the correlation between The Netherlands and Germany is also high (0.29), showing that the Dutch educational system and labour market are more similar to Germany than to France.

The next step is to compare the linkage strength of each detailed educational category between countries. Figure 4A–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 (per cent of school-leavers), the left side the ratio of the local linkage between the two countries that are compared.

Figure 4A 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 management) and technical (electrical engineer, and textile, leather etc. processing) fields link a lot stronger in Germany than in France, with ratios as close as 2. These are relatively large fields in both countries (see the right side), and hence explain a large part of the country differences.
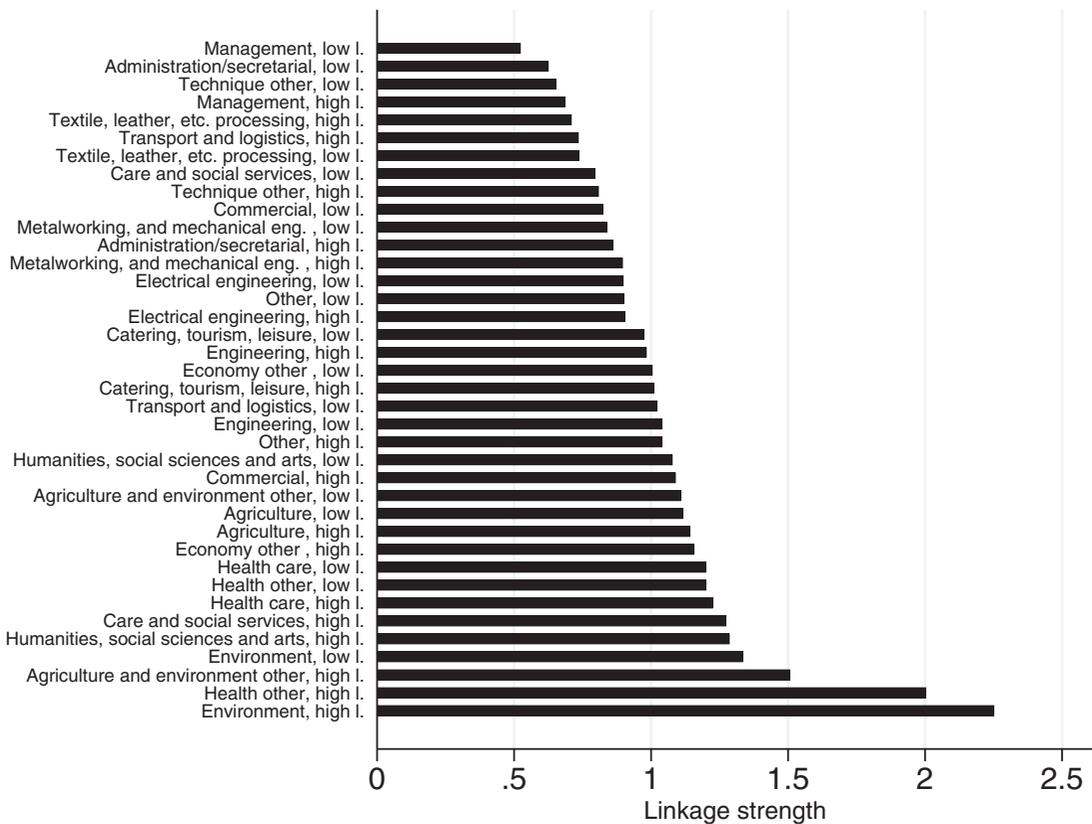
Figure 2. Local linkage per education level and field combination, averaged over Germany, France, and The Netherlands. *Sources*: Enquête Emploi (2013–2016), EBB (2010–2012), and Mikrozensus (2015).
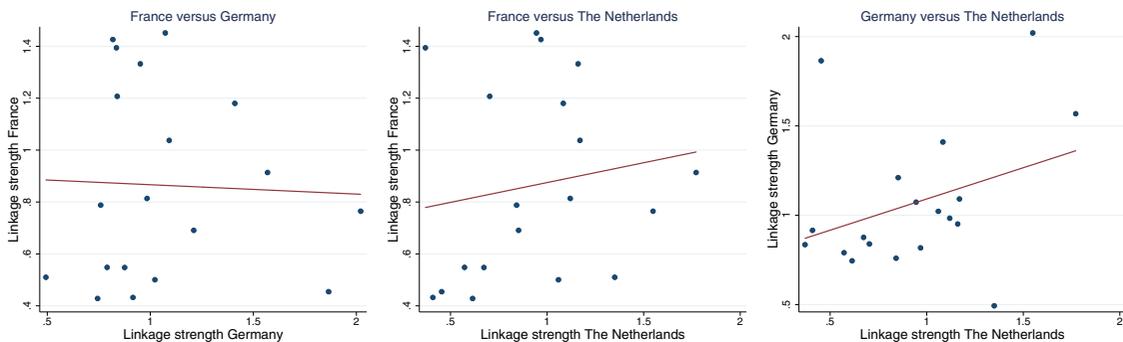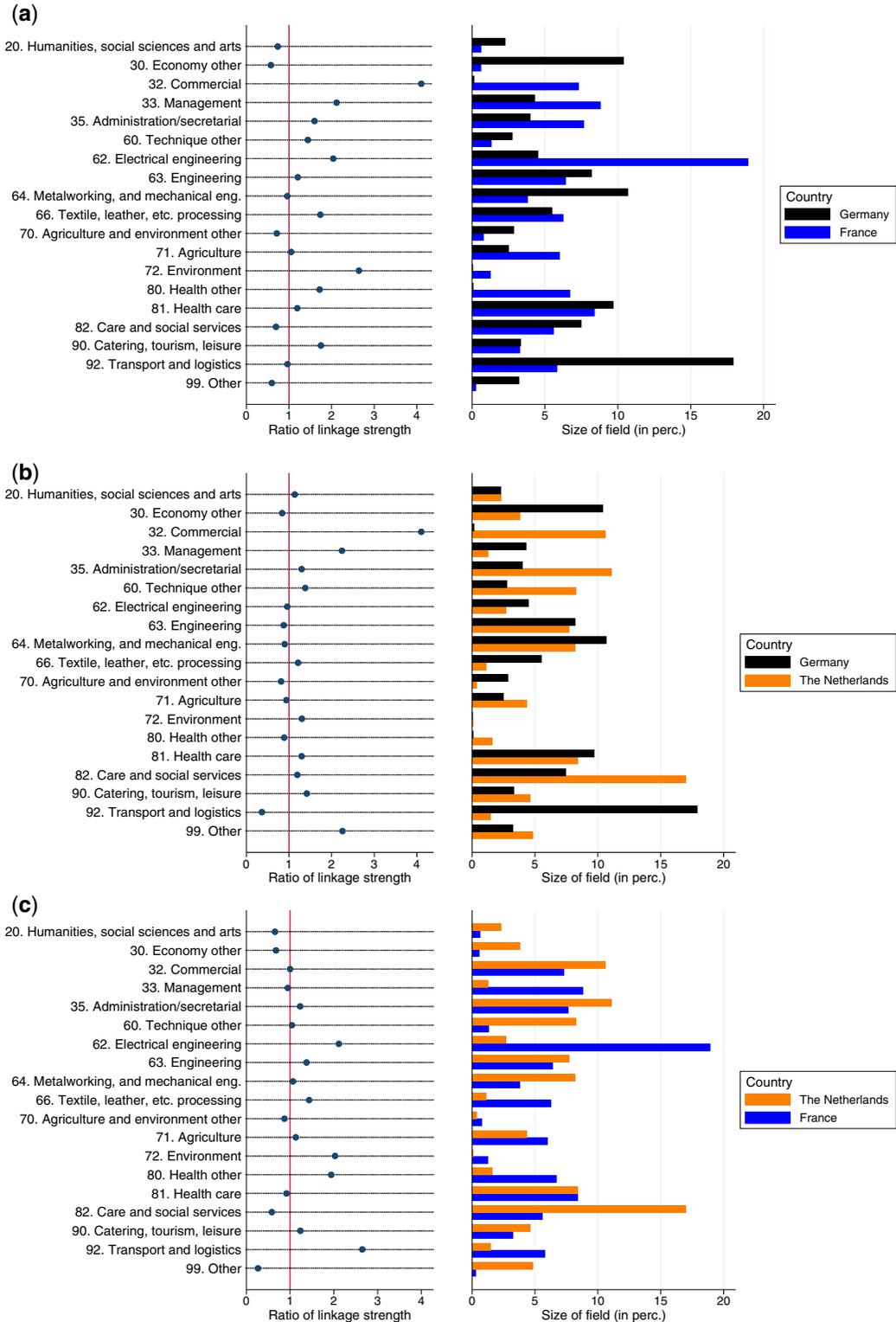

Figure 3. Scatterplot of the linkage of educational programmes in France, Germany, and the Netherlands. *Sources*: Enquête Emploi (2013–2016), EBB (2010–2012), and Mikrozensus (2015).

There are hardly any fields that link (much) stronger in France than in Germany. This shows that a school-based vocational system creates, across the board, weaker linkages to the labour market than a dual system.

Figure 4B compares Germany and the Netherlands. Again we find that educational programs in the VET-sector in Germany link more strongly. Most fields sort quite similarly between the two countries, such as engineering, metal work, and health care, showing the resemblance between both countries. Yet, on average ratios are larger than 1, indicating stronger local linkage in Germany. Only a few fields show stronger linkage in the Netherlands, most prominently transport and logistics.

Figure 4. Comparison of linkages between each pair of countries. (A) Germany versus France; (B) Germany versus the Netherlands; (C) The Netherlands versus France. *Sources*: Enquête Emploi (2013–2016), EBB (2010–2012), and Mikrozensus (2015).

Finally, Figure 4C compares France and The Netherlands. The average linkage strength of The Netherlands lies in between France and Germany. Consequently, the differences between France and the Netherlands are less outspoken than those between Germany and France. Especially the transport and electrical engineering educational programmes link stronger in The Netherlands than in France. By contrast, the care and social services educational programmes as well as the 'other' educational programmes link stronger in France.

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

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 in Germany vocational education is often also associated with higher levels of education, needed for instance for their big technical sector. To explore these differences, we also compared the local linkage of the German, France, and Dutch educational fields by educational level. The weighted averages and ratios are presented in Table 4. In line with the Dutch and German idea about vocational education, the linkage strengths are especially large among the highest level in Germany, while in the Netherlands they are especially large among the lowest level. Among the lowest educated, the linkage strength is in the Netherlands even larger than in Germany, while the linkage strength on the lowest level in Germany is subsequently much larger than in France. By contrast, on the highest level The Netherlands resembles France more (ratio = 1.03) than Germany (ratio = 1.63). On a more fine grained level, however, we again see a wide differences in local linkage and size of the educational programmes (see Supplementary Appendix SC). For example, although the average linkage strength is much higher in Germany than in France on the highest level, the 'care and social service' educational programmes link stronger on the highest level in France than in Germany.

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 over the life cycle.

Table 4. Average linkage strengths by country and educational level.

	Low level	High level
Average linkage strength (weighted)		
Germany (DE)	0.815	1.248
The Netherlands (NL)	0.848	0.765
France (FR)	0.685	0.755
Ratio		
DE:NL	0.960	1.631
DE:FR	1.189	1.653
NL:FR	1.238	1.013

Sources: Enquête Emploi (2013–2016), EBB (2010–2012), and Mikrozensus (2015).

To test the trade-off hypothesis (hypothesis 3a) versus its opposite hypothesis 3b, we describe the association between linkage strength and unemployment rates over the life cycle. Therefore, we run a logistic model in which we included an interaction between age and linkage strength. Age is measured both as a linear and a quadratic term because it increases the model fit and results in more reliable outcomes because employability follows a U-shaped curve over the life-cycle (following Forster *et al.* 2016; Hanushek *et al.*, 2017; Forster and Bol, 2018; Rözer and Bol 2019).[2] We have included vocational specificity up to the third polynomial, because it increased the model fit and more accurately showed the impact of the extremes of the general-vocational spectrum. Likelihood ratio tests showed that for all countries interactions between vocational specificity and age increased the model fit. Thus, the effects of vocational specificity vary over the life-course.[3] For ease of interpretation, we show the results in a non-parametric way, for men and women separately (see Supplementary Appendix SC for the parametric results).

The results are displayed in Figure 5. We can see that there is no labour market penalty for students from strong linking programmes. Yet, the exact benefits of a strong linking program differ between countries and across age. For the Netherlands, there is almost no difference in unemployment rates based on linkage strength for all age groups, perhaps because of ceiling effects as the probability of being unemployed is low in The Netherlands compared to France and Germany. Unemployment rates for Dutch students from strong linking programmes are only significantly lower among young men (around age 20) and middle-aged women (around age 40). For France, we also see that the predicted unemployment rates for high linking fields are only significantly lower for young men and middle-aged women, but these effects are slightly larger than in The
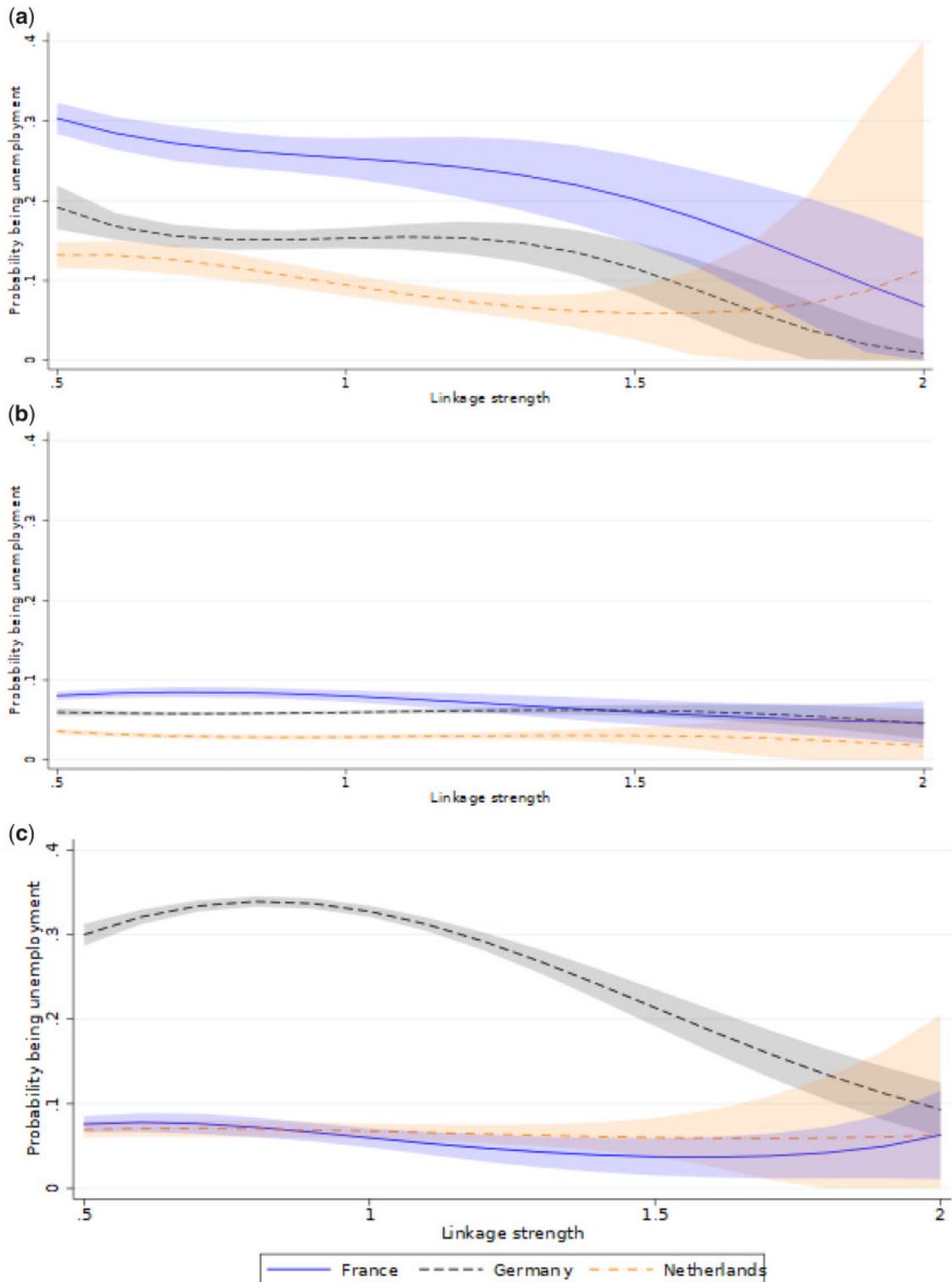
Figure 5. Unemployment rates across levels of linkage strength. (A) Results for men, age 20; (B) Results for men, age 40; (C) Results for men, age 60; (D) Results for women, age 20; (E) Results for women, age 40; (F) Results for women, age 60.
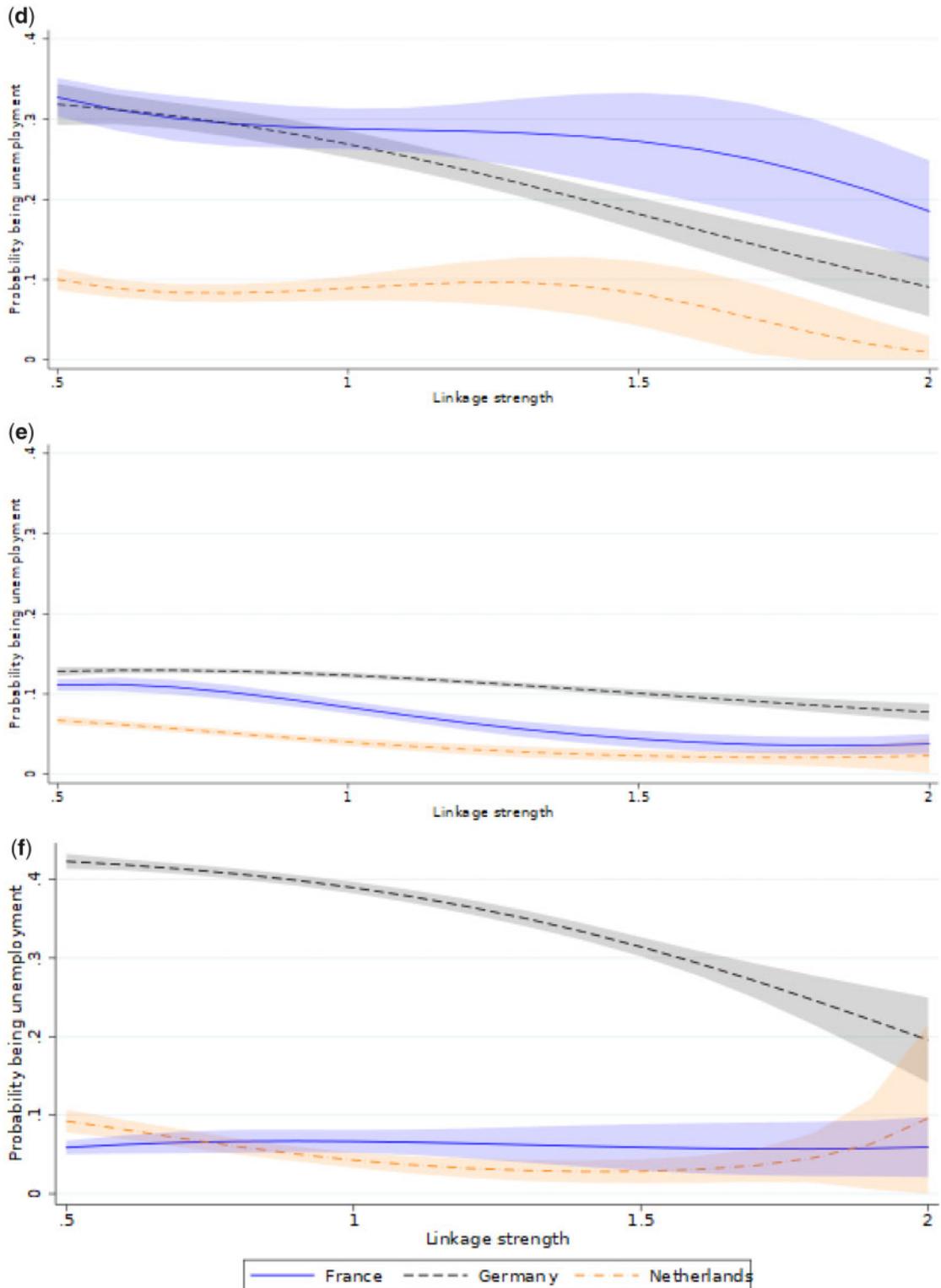
Figure 5. Continued

Netherlands. Only the German case shows—except for middle-aged men—a consistent pattern of penalty for low linking fields of study across all ages for men and women. This is an interesting result, as it can indicate that that vocational specific skills remain only valuable over the life course in countries where high linking fields are the norm, such as Germany. But, as we cannot disentangle age from period effects, it may also be that in France vocational skills are revalued for younger employees. All in all, these results support the trade-off hypothesis and reject complementary hypothesis as the probabilities of being unemployed are lower (or at least not significantly higher) among the high linking fields, such as health and agriculture, than among the low linking fields, such as management and administration. This suggests that there is still place for specialized craftsmen.

Conclusion and Discussion

Our results showed evidence of three distinct worlds of vocational education, depending on the dominance of specialized craftsmanship (typically found in the dual system) or broad craftsmanship (typically found in the school-based system), or a combination of both (dual and school-based vocational training). The type of craftsmanship on which an educational system is oriented matters for the linkage between qualifications and occupations; 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. Shavit and Müller, 1998; Culpepper and Finegold, 1999; Müller and 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 the linkage between school and work are, however, compositional. In Germany, there are more large educational programmes and occupations than in the Netherlands and France, such as strongly linking technical studies. In line with the idea that high skilled specialized craftsmen are needed for the industry, the linkage from school to work is especially large at the highest upper secondary level in Germany. In contrast, in line with the idea that vocational education serves as a 'safety net' (e.g. Shavit and Müller, 2000), the linkages between school to work are stronger in the Netherlands on the lowest level of upper secondary education. In the France school-based system, the link between school to work are weak on both the lower and higher level of vocational education.

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, 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 work in the health sector, for instance as a nurse or health professional. However, besides the country similarities, there appeared to be substantial 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 stronger to specific educations in Germany 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 labour 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. At all ages in all three countries stronger linked occupations had at least the same probability of being employed. Yet, only in Germany there was a consistent advantage for students from strong linking programmes, while in the Netherlands and France we could only find this advantage for young men and middle-age women. Vocational specific skills might only remain valuable over the life course in countries where high linking fields are the norm, such as Germany.

Translating these findings to the conceptions of 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 with 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.*, 2017) specialized craftsmen are still associated with a greater—or at least similar—probability of being employed, for most of the career. Yet, only in Germany, where high linking fields are the norm, the benefits remained large over the life-cycle.

A couple of weaknesses need attention. 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 detailed 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. Furthermore, the measurement of the vocational specificity is based on the link between educational programs and labour-market sectors, and not on the content that is actually taught at the educational programs. It is possible that vocational programs target job sectors that are characterized by low unemployment over a sustained period, by which their students can remain working in those sectors, explaining the strong linkage of these programs and the low unemployment of their students. Although we question the strength of these tendencies, we cannot rule them out. Consequently, we may have underestimated the probability of being unemployment for strong linking programs, and are not able to draw any causal conclusion about the labour market outcomes of educational programs. Second, selection into vocational education and specific linkage levels may be different across countries. For instance, in a dual system strong linking programs might have a strong prestige and therefore attract the better performing students with a higher socio-economic background. In contrast, in a school-based system people with a low socio-economic background may more often opt for the certainty of strongly linking programmes, choosing for a 'real occupation training', while they are later—irrespective of their training—more often unemployed.

Third, we studied only a limited number of (labour market) returns, while for instance wages, job status, health, crime, and civic engagement are important potential outcomes of education 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.*, 2017, but see Forster, Bol and Van de Werfhorst, 2016; Rözer and Bol, 2019). Yet, even if we assume that there is such a time trend, we do not believe that broader skills have become of so much greater importance in the time-period of our data (2010

for the Netherlands, 2013–2016 for France and 2015 for Germany) that it would affect our results substantially. 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. Consequently, it seems that there is still a need for specialized craftsmanship and specific skills.

Notes

1. In contrast to DiPrete *et al.* (2017), ΔE_g and ΔN_g are multiplied by 0.5 (the first part of the formula) because they have to be averaged over the two countries.
2. In the instance of a logistic regression this u-shape is not entirely captured by the logit function (Rözer and Bol, 2019).
3. As a robustness check we also explored simpler forms of the model, i.e., vocational specificity up to the second polynomial and only an interaction with the main effect of age. These results were largely similar to the results of our current specification, indicating that the complexity of the model had no dramatic impact on the outcomes (e.g. due to collinearity).

Supplementary Data

Supplementary data are available at *ESR* online.

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