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**Insights into the Economic Benefits of
VPET for Individuals: Theoretical and
Empirical Results for Researchers and
Practitioners**

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Insights into the Economic Benefits of VPET for Individuals: Theoretical and Empirical Results for Researchers and Practitioners

Uschi Backes-Gellner, March 2021

One of the aims of the research on Vocational and Professional Education and Training (VPET) is to investigate the three important players of any national VPET system, i.e. firms, individuals, and the state/institutional framework. Studying these players is important to understand the conditions under which a VPET-system can be in sustainable high-quality equilibrium and well prepared for future challenges.

This Working Paper is a preprint of “Chapter 4 Preview and Ongoing Research: Benefits of VPET for Individuals” and covers research (mostly from the Swiss Leading House on Economics of Education) that analyzes individuals’ choices and outcomes before, during or after participation in VPET. The research includes theoretical and empirical analyses on both the decision to start VET and on the career and labor market outcomes of VPET graduates as compared to workers with other types of education. This preprint of “Chapter 4 Preview and Ongoing Research: Benefits of VPET for Individuals” focuses on published articles analyzing individuals as a main player of a VPET system and is published as in Backes-Gellner et al. (2020: 347-352 and 578-586).

The first part of this preprint “Chapter 4 Preview: Benefits of VPET for Individuals” (Chapter “Preview” in Backes-Gellner et al. 2020: 347-352) discusses the articles that are reprinted in their original layout in the printed book/ebook by permission of the publishers—each preceded by a non-technical summary (cf. Chapter 4.1 to Chapter 4.10 in Backes-Gellner et al. 2020: 353-577). The second part of this preprint “Chapter 4.11 Ongoing Research: Benefits of VPET for Individuals” (Chapter “Ongoing Research Individuals” in Backes-Gellner et al. 2020: 578-586) briefly summarizes new research—not published at the time of the printed book, but available online as working papers (cf. links for open access versions).

Preview: Benefits of VPET for Individuals

In this chapter we document our research on the individual as one of the main actors within a Vocational and Professional Education and Training (VPET) system. This research covers (a) young adolescents (and their parents) before they decide to enter a VET path and, e.g., sign an apprenticeship contract; (b) the apprentices and VET students during their training; and (c) VET graduates immediately after graduation and during the course of their educational and working careers. Given that the individuals themselves decide for or against choosing a VET path after compulsory schooling, their decisions are what matter for the success of the VPET system. Our research results, as documented in this chapter, show that both short- and long-term positive returns to VET—e.g., monetary returns, social status, or employment stability—are crucial for individual’s decisions, with varying importance over the individual’s life course. Without a promise of employment and career prospects, educational upgrading opportunities, occupational flexibility, and a reputable social status, neither parents nor young adolescents (particularly high-ability and ambitious students) will choose a VET pathway. In turn, firms would have difficulties recruiting and training apprentices and would be less willing to participate in the system.

Occupational Choice Decisions before the Start of an Apprenticeship or VET path

Two important issues need resolving before an apprenticeship program can even start: (a) apprentices need to apply for an apprenticeship place in a particular occupation at a particular firm that is looking for an apprentice and (b) firms need to solve information asymmetries in the recruitment process and find the best apprentice for each apprenticeship place. The combination of the two decisions determines the likelihood of young adolescents finding an apprenticeship place. When employers recruit

apprentices, they try to learn as much as possible about learners' skills. However, whether these employers use more than formal test results and directly observable characteristics (e.g., age or gender) and how their decision-making affects their recruitment decisions had long remained unknown.

Mueller and Wolter's empirical results (2014) in Chapter 4.1 show that employers indeed incorporate more than directly and easily observable information in the decision-making process, like gender, migration status or age. Given that employers use an intensive screening process to assess the non or hard to observe characteristics of an applicant, they are less likely to hire individuals with the same directly observable characteristics but with hard-to-observe personal characteristics (like skills) that deviate from the expectations an employer would form if relying only on the easily observable information. Thus, in addition to easily observable educational outcomes, objective measures of skills as well as personal characteristics (such as secondary positive qualities or behaviors such as punctuality) are important factors in hiring decisions.

Individual Decisions during a VET Program

Although rare in Switzerland, one problem that crops up during the VET training period is that some apprentices drop out of their initial VET program. Such a drop-out increases the likelihood that the apprentice never finishes either a VET degree or any other type of post-compulsory education. Therefore, one important research question is how to motivate apprentices (e.g., financially) to put more effort into an education that they have already started and to thereby increase their likelihood of not dropping out. Oswald and Backes-Gellner's empirical results (2014) in Chapter 4.2 show that while financial incentives work in this context, they do not have the same intensity for all types of apprentices. Oswald and Backes-Gellner show that apprentices who are offered a financial bonus by their firms for receiving better grades in their VET classes have, on average, better first- and second-year grade point averages. Strikingly, the effect is much stronger for highly impatient apprentices (i.e., those whose low future-orientation makes them need short-term incentives the most) than for relatively patient apprentices. This finding suggests that financial incentives could be most valuable at the beginning of an educational program, when the benefits of studying hard (i.e., better labor market prospects) are too far in the future to motivate impatient apprentices.

Short-Term Outcomes after VET: Transitions into the Labor Market

After finishing a VET program, the next individual-level problem is making a smooth transition to finding a job. Bertschy, Cattaneo, and Wolter (2009) deal with these problems in Chapter 4.3. They investigate the question of whether school performance before the start of a VET program (measured by PISA scores in compulsory schooling) still has an effect on the individual's transition into the labor market or whether success in the VET program can override the effect of prior school performance. Their empirical results show that five years after completion of compulsory schooling no direct effect remains of compulsory school performance on the transition into the labor market after VET. In other words, completing a VET program compensates for differences in pre-VET school performance; only the successful completion of the VET program counts for the transition into the labor market. Nonetheless, compulsory school performance has an indirect effect on transition results, because it is an important factor in explaining which students are more likely to be recruited into an intellectually demanding VET program, which in turn positively affects a smooth transition into the labor market.

Long-Term Labor Market Outcomes

One question heavily discussed in the international literature on individual returns to education is whether a vocational education as opposed to an academic one (college) later restricts graduates in their career options, thereby leading to lower income prospects. In Chapter 4.4, Backes-Gellner and Geel (2014) investigate a variety of labor market outcomes for all graduates acquiring a tertiary education degree, whether vocational or academic. They study this question for Switzerland, where more than two thirds of the workforce start with a VET secondary degree and where a substantial number continue to tertiary education through a university of applied sciences (UAS) degree. They compare monthly earnings, the risk of being unemployed, and variation in earnings (reflecting financial risk) for UAS

graduates with those who earned their degree from an academic university. They study these outcomes at both career entry and later.

Their empirical results show that, at career entry, while the unemployment risk is equally low for both paths, the average earnings are higher and the financial risk (earnings variance) is lower for vocational graduates. At later career stages, the higher average earnings of vocational graduates disappear, but their risk of unemployment becomes lower than that of academic university graduates. Thus the availability of both vocational and academic paths for tertiary education offers their graduates different valuable options, allowing them to self-select into an educational path that best matches not only their individual talents and occupational interests, but also their individual risk preferences.

However, an important question remains: What happens to those individuals who start their education on one path but later decide to transition into the other path, i.e., individuals who undergo a mixed educational path that started either with VET and finished with an academic tertiary degree, or vice versa? The question is whether the labor market considers such mixed educational paths either as detours leading to lower income prospects or as a favorable combination of complementary skills, perhaps leading to better income prospects. In Chapter 4.5, Tuor and Backes-Gellner (2010) ask and answer this question for Switzerland. They calculate net return rates for mixed education in comparison to pure academic or pure vocational paths, all leading to tertiary educational degrees. They find that mixed educational paths have higher rates of return than pure paths, thereby providing evidence for the existence of complementarities between vocational and academic education. Therefore, the permeability of a national education system—i.e., the ease with which individuals can change between paths—is a very important educational policy issue.

But such calculations have a potential shortcoming, one that has only rarely been tackled. If returns to education strongly differ across different types of individuals, average returns that are typically estimated in the literature may cover important differences, because the average return could hide a mixture of lower and higher returns for one or the other type of individual. Thus empirical studies need to examine returns separately for different types of individuals. This is what Balestra and Backes-Gellner (2017), in Chapter 4.6, have done. Their study investigates whether there are heterogeneous returns to education over the wage distribution, i.e., whether, for example, individuals at the higher end of the wage distribution have different rates of return than individuals at the lower end of the wage distribution and whether acquiring the education on a vocational or an academic path makes a difference.

Balestra and Backes-Gellner (2017) find clear evidence for heterogeneous effects. They find that the estimated average returns to education typically estimated in the literature deviate substantially from the returns that individuals may gain at the upper or lower end of the distribution. Independent of the path, the rates of return at the lower end of the wage distribution are higher than at the upper end: In other words, additional education pays more for individuals at the lower end of the wage distribution. Comparing the outcomes of vocational paths with those of academic paths, their study finds that vocational education at the lower end of the distribution brings even higher rates of return than academic education, and that only at the upper end of the distribution does academic education bring higher rates of return than vocational education. In the middle of the distribution, however, the two paths make no difference. Therefore, having an education system with different paths better serves heterogeneous individuals than a system providing just one type of educational path. A “college for all” strategy may thus not provide the best outcomes for all, while a system of diverse pathways with a high permeability provides better results for more individuals.

Specificity of VET Occupations and Labor Market Outcomes

The question now arises as to how to design VET occupations, and with what types of skills, for ensuring their graduates good long-term labor market prospects. From the individuals’ perspective, one very important question is whether, after the initial choice of occupation on a vocational path, he or she can later change occupations (e.g., if economic or labor market conditions or individual preferences change).

In Chapter 4.7, Geel, Mure, and Backes-Gellner (2010) answer this question by investigating the role of the specificity of an occupation for the likelihood of occupational changes. Drawing on Mure (2007), they apply Lazear's skill-weights approach (Lazear, 2009) to (a) measure the specificity of the skill combinations acquired in all VET occupations in Germany and (b) estimate its effects on occupational mobility patterns. Their study shows that graduates from highly specific occupations have lower mobility than those from highly general occupations. However, the study also reveals an important risk return trade-off that goes hand in hand with varying degrees of occupational specificity. In other words, while more specific occupations carry a higher long-run risk because high occupational specificity reduces re-employment options, in the short-run these more specific occupations are less costly for workers, who bear lower shares of the training costs.

Moreover, Geel and Backes-Gellner (2011), in Chapter 4.8, show that the specificity of an occupation generally determines not only occupational mobility but also the wage gains or wage losses associated with changing occupations. More importantly, their results also show that occupations should be seen as parts of wider clusters of occupations (characterized by similar skill combinations), because occupational mobility patterns strongly depend not only on the characteristics of the occupation itself but even more so on the occupational cluster to which the occupation belongs. Within occupational clusters in very specific occupations have a high probability of changing occupations. Furthermore, occupational mobility within a skill cluster results in wage gains. Yet mobility between clusters has a lower probability and results in wage losses.

Therefore, the acquired skill combination and the resulting skill cluster—rather than the occupation per se—crucially determines mobility. As long as an occupation is well positioned in a larger occupational cluster, individuals have good occupational mobility options. Thus educational policies must ensure that occupational skill clusters are large enough to be sustainable and that they contain a large enough selection of overlapping occupations with different labor market prospects. Given that graduating in a highly specific occupation carries the risk of low occupational mobility, such policies would reduce the long-term risk of occupations with a high degree of specificity.

The Eggenberger, Rinawi, and Backes-Gellner's (2018) study, in Chapter 4.9, introduces a revised and more fine-grained measure for the degree of specificity of VET occupations and applies it to data from Switzerland. This new measure, which is based on a content analysis of training curricula, calculates the distance between occupations by comparing how similar or dissimilar the skill combinations and their weights are in the different occupations. They also find clear evidence for a trade-off between higher returns in more specific occupations (as long as individuals stay in their original occupations) and the higher risks of reduced mobility options if individuals choose or need to change their original occupation. Therefore, as individuals with different risk preferences may want to choose different occupations, a VET system that provides occupations with such varying options is superior to a system that provides only one option.

However, in the very long term, returns also depend on technological developments and the nature of the acquired skills, i.e., whether they are strongly related to particular technologies or are more general (e.g., social skills). In Chapter 4.10 Janssen and Backes-Gellner (2009) show that as technologies can become obsolete over long cycles, both social skills and experience-based skills become more important for long-term income prospects over the entire working life. They also show that individuals who—throughout their working life—complemented their technology-based skills with additional social and experience-based skills have lower depreciation rates on their original human capital than individuals who remained focused on technology-based skills and tasks throughout their careers. Therefore, although technology-based skills may carry the risk of higher depreciation rates (as also recently shown in Deming, 2017 and Deming & Noray, 2019), that risk can be offset or even turned around by adding other types of more general skills, such as social or communication skills, in later career stages.

In sum, the papers in this chapter show that the key to long-term success is not only a good skill foundation, for which VET provides one very valuable option, but also—and even more so—lifelong learning and the willingness to adjust to changing environments. As no education or outcome is set in stone for a lifetime, an educational system should provide high permeability to serve changing demands.

In subsequent chapters of the book of Backes-Gellner et al. 2020 (Chapter 4.1 to 4.10) the published papers that are discussed in this preview are reprinted in their original layout by permission of the publishers. Finally, Chapter 4.11, “Ongoing Research,” briefly summarizes both new developments in research and preliminary results that were not yet available as publications but can be found online as working papers (download links are provided).

Ongoing Research: Benefits of VPET for Individuals

In addition to the published work on the individual perspective on VET provided in the previous chapters, a variety of ongoing research is investigating questions that have not been studied to date or for which the results thus far are not consistent. This body of research covers questions that arise (a) before a VET program even starts (e.g., occupational choice decision), (b) during a VET program, and (c) after VET graduation (e.g., labor market entrance and long-term labor market outcomes such as wages, mobility, or unemployment). One under-investigated issue is the role that personal characteristics play in the educational choices of young people. Ongoing studies of the pre-VET phase analyze the role of personal characteristics in the decision of young adolescents as to which educational path to choose (vocational vs. academic) or which occupational specialization to choose within a vocational educational path.

Another issue not well understood is the role of competition in the apprenticeship market or of social norms and their respective interactions with educational decisions and personal characteristics. Ongoing projects on the VET phase examine whether and, if so, how personal characteristics are malleable and can be changed during the apprenticeship training. If these characteristics are malleable, the question is how differences in the teaching of apprentices may influence the personal characteristics of those apprentices. Other ongoing studies examining the time after VET graduation focus on open questions such as what role which personal characteristics play in firms’ hiring of apprenticeship graduates. Yet another set of open questions concerns the long-term labor market outcomes of workers trained in occupations with structurally different skill bundles, for example, with more (or less) specific skill bundles. In the remainder of this chapter, we report the ongoing research that asks these questions and provides preliminary answers.

Occupational Choice Decisions before VET Starts

Personal Characteristics and Occupational Choice

Jaik and Wolter (2016) study the role of locus of control in the educational dreams and their realizations for students during and after middle school. Drawing on the “Bernese Early Career Choice Dataset,” a unique dataset of 8th and 9th graders from the Canton of Bern in Switzerland (containing detailed information on students’ early occupational dreams and realizations), they find that locus of control is an important personal characteristic. It strongly correlates with educational intentions in 8th grade but not directly with actual educational decisions in 9th grade. A stronger internal locus of control is particularly correlated with a lower intention of 8th graders to choose interim solutions that would only delay their educational choices. Indeed, one year later, the larger intentions to choose interim solutions turn into a larger number of students actually choosing interim solutions (after 9th grade) and thereby delaying their occupational decision for one more year.

Apprenticeship Market Competition and Occupational Choice

Occupational choices do not depend on personal characteristics alone. As Jaik and Wolter (2019) show, these choices also depend on market conditions, particularly on the competition for apprenticeship positions. Their study investigates whether competition for the “dream occupation” of students during 8th grade (ages 13/14) correlates with their actual occupational choices at the end of middle school in 9th grade (ages 15/16). The study uses the “Bernese Early Career Choice Dataset,” with detailed information on students’ early occupational “dreams” before they undergo any career counseling and

on their actual career choices one year later, at the end of compulsory schooling. Their results show, first, that the majority of students revise their early intentions. Second, those students who face fiercer competition for training positions in their “dream” occupation are more likely to either change their preferences and choose other occupations or choose an interim solution (i.e., another year of schooling, providing more time to search for a position in their dream occupation or—more likely—to find another occupation that may also sufficiently interest them).

In contrast, students who dreamed of an occupation with an abundant number of apprenticeship places (low competition for a position) were most likely to stay with their original dream. However, Jaik and Wolter (2019) also find a higher likelihood of premature contract terminations in occupations with low competition for apprenticeship places: Low competition for an apprenticeship occupation, with easy access to the early “dream occupation,” likely leads to too-hasty decision processes and, in turn, to higher person-occupation mismatches.

Social Norms, Social Status and Occupational Choice

In addition to personal characteristics, social norms or the social status of different educational paths or occupations may both determine and bias the educational decisions of young people. Kuhn and Wolter (2018) investigate whether social norms towards gender equality affect occupational choices. They examine whether the strength of gender norms across regions affects gender-stereotypical occupational aspirations among adolescents. Previous studies have shown that regional gender norms have substantial effects on job satisfaction in gendered occupations in Germany (Janssen & Backes-Gellner, 2016, with German data and using differences in East-West-developments as an instrument) and on the gender wage gap in Switzerland (Janssen, Tuor, & Backes-Gellner, 2016, using cantonal referenda as an instrument).

Kuhn and Wolter (2018) expect regional differences in social norms to also affect occupational choices. They hypothesize that adolescents’ occupational aspirations are more gender-stereotypical if they live in regions where social norms towards gender equality are weaker. They combine rich survey data from the “Bernese Early Career Choice Dataset” with regional data on gender equality policies in political referenda in Switzerland. Their results show that adolescents living in regions with stronger social norms towards gender equality are significantly and substantively less likely to aspire to a gender-stereotypical occupation. A more detailed analysis of potential mechanisms reveals that the association between gender norms and occupational aspirations primarily reflects the intergenerational transmission of occupations from parents to their children.

Buser, Peter, and Wolter (2017) study another gender-specific driver of occupational choices: the effect of the well-documented gender gap in willingness to compete. Drawing on incentivized choices to assess the willingness to compete in the “Bernese Early Career Choice Dataset,” they specifically examine how the gender gap in willingness to compete varies and whether this variation helps to predict heterogeneous career choices along the ability distribution. First, they find that the gender gap in willingness to compete is essentially zero among the lowest-ability students, that it increases steadily with ability, and that it reaches 30–40 percentage points for the highest-ability students. Second, they find that the variation in the willingness to compete helps predict career choices along the ability distribution according to the following pattern: At the top of the ability distribution, both boys and girls with high willingness to compete are more likely to choose a math- or science-related academic specialization. However, only girls are more likely to choose academic over vocational education. In the middle of the ability distribution, more competitive boys are more likely to choose a business-oriented apprenticeship, while more competitive girls are more likely to choose a math-intensive apprenticeship or an academic education. At the bottom of the ability distribution, more competitive students are more likely to succeed in securing an apprenticeship position.

Although gender and gender norms are clearly important drivers of occupational choice, gender-specific occupational choices are also part of an individual trade-off. Janssen and Backes-Gellner (2016) show that women in stereotypically male jobs are significantly less satisfied with their work climate and job content than women in stereotypically female jobs. Yet, at the same time, women in stereotypically male jobs are more satisfied with their income. Depending on their preferences, women either trade off

the negative consequences of stereotyping against higher income satisfaction or the other way around—and both choices have to be respected.

Individual Outcomes during and immediately after VET

Malleability of Personal Characteristics during VET and Firms' Hiring after Graduation

Another question about the relationship between individual personal characteristics and VET is whether personal characteristics are malleable at the typical VET ages (between 15 and 19). If yes, the next question is how VET affects personal characteristics and what impact this effect has on later employment options. Hoeschler, Balestra, and Backes-Gellner (2018) investigate the development of personal characteristics during VET in Switzerland. Using the “Zurich Apprenticeship Panel,” they show that Grit and three of the Big Five personality traits (conscientiousness, agreeableness, and emotional stability) significantly improve during VET. They also show that this development of personal characteristics is more strongly related to workplace characteristics than to traditional educational resources (e.g., class size or teacher time).

In a follow-up study, Hoeschler and Backes-Gellner (2018) use the same data set to investigate the relative importance of differences in apprentices' personal characteristics for the hiring decisions of firms immediately after VET graduation. They find that personal characteristics are essential for firms' hiring of VET graduates, with a positive development of personal characteristics during the three to four years of VET being particularly important. Thus firms not only contribute to a favorable development of personal characteristics by training apprentices but also appear to use positive developments as an indicator for the potential of further developments. These firms therefore base their hiring decisions on the developments they observe, particularly for students who showed large increases in important personal characteristics. Thus VET's contributions to the personal development of adolescents is likely one source of a smooth transition of adolescents into the labor market, a transition well known in countries with large dual VET sectors, such as Austria, Germany, and Switzerland (for more information, see Renold et al., 2014).

The Effect of VET Experience on the Labor Market Outcomes after Higher Education

Oswald-Egg and Renold (2019) analyzed how work experience facilitates labor market entry. Their study analyzes the effect of VET work experience on labor market outcomes immediately following higher education. To account for selection into VET, they use the cantonal enrollment rate of VET as an instrument. Their results suggest that work experience from VET leads to significantly higher wages one year after graduation, less search time for first employment, and a lower probability of doing an internship in the year after graduation. However, these positive effects do not persist over time: After five years, the effect of VET ceases to be significant for wages, unemployment, or employment positions.

Long-Term Labor Market Outcomes after VET

Labor Market Outcomes after VET

While most of the literature thus far has focused on whether the type of education—i.e., VET (including apprenticeships) or academic education (university or college)—has higher returns on investment, more recent studies have also investigated whether the subject itself may be as important as (or even more important than) the type of education. Pfister, Tuor Sartore, and Backes-Gellner (2017) show that, for Switzerland, average earnings and earnings variations depend mostly on the subject area (e.g., commercial, health), rather than on having an academic or a vocational degree. Thus future research needs to more closely examine the contents of education or training and their consequences for different labor market outcomes in the short or long term.

One important factor for labor market outcomes in a VPET system with well-defined occupational curricula is occupational specificity (which is conceptually similar to, but not to be confused with, firm specificity). One theoretical model for analyzing occupational specificity is Lazear's skill-weights approach to human capital specificity (Lazear, 2009), an approach that has been fruitfully used in a number of recent and ongoing studies.

Occupational Specificity and Labor Market Transitions after Layoffs

Drawing on Lazear's skill-weights approach and using data from Switzerland, Rinawi and Backes-Gellner (2019a) find compelling evidence for a risk-return trade-off for educational investment in VET with a higher or lower occupational specificity: Investments into more specific occupations are associated with higher returns as long as the workers remain employed in their original occupation. However, these investments are also associated with a higher risk of remaining longer in unemployment after a layoff and of greater wage losses after reemployment. Thus Rinawi and Backes-Gellner (2019a) also expect the choice between a more, or less, specific occupation to depend on workers' individual preferences, i.e., no one best solution exists for everyone. Furthermore, the optimal choice also depends on overall economic trends, which may affect the likelihood of becoming unemployed and therefore the likelihood of not being able to stay in the same occupation in the long term. One important determinant in this regard is international trade.

Occupational Specificity, International Trade, and Development of Wages

Eggenberger, Janssen, and Backes-Gellner (2020) investigate the impact of international trade for Germany, examining how international trade shocks from opening up to China and Eastern Europe affect workers' earnings and what role the specificity of their occupational skills plays. Their results show, on one hand, that the increase in import competition from China and Eastern Europe in the 1990s led to larger earnings losses for workers in more specific occupations than for workers in more general occupations. On the other hand, and more importantly, they show that the increase in exports to China and Europe led to larger earnings gains for workers in more specific occupations than for workers in more general occupations. Their findings suggest a trade-off between the potential risks and returns to more specific occupations. Again, the choice between a more or less specific occupation depends on workers' individual preferences.

Occupational Specificity and the Particular Role of IT Skills after Involuntary Separations

Another important recent economic trend is the increased use of both information technology (hardware or software) and digital data, with all its applications (such as Industry 4.0, the Internet of Things, and Artificial Intelligence). Such developments in particular bring IT skills to the center of attention, raising important questions about the role of IT skills in long-term labor market outcomes such as unemployment (e.g., occupational mobility, reemployment, and wages).

In this context, Eggenberger and Backes-Gellner (2020) investigate the particular role that IT skills play in the skill bundle that a worker acquired during his or her VET training. They focus on how IT skills interact with the specificity of the occupational skill bundle of dual VET in Switzerland. Their results show that distinguishing between two different types of IT skills is critical for long-term labor market outcomes. First, generic IT skills can be used in many different contexts, much like a general-purpose technology that can be used in a number of contexts. These IT skills both complement other skills and make them more productive. Second, specialized (technology-related) IT skills are additive to any other single skill and can make a skill bundle even more specific.

For generic IT skills, their results show lower earnings losses after involuntary separations, especially for workers with specific occupational skill bundles. Thus generic IT skills appear to cushion the negative effects of more specific occupations and prepare workers for upcoming changes in an increasingly digitalized world. In contrast, specialized IT skills that are closely related to particular technologies or to very specialized programming languages do not have the same effects. Results do not show lower earnings losses after involuntary separations, i.e., one cannot expect specialized IT skills to have the same cushioning effects as generic IT skills. Thus future research should more carefully investigate differences in the effects that particular types of IT skills play within more or less specific occupational skills bundles.

Similar results come from Kiener et al. (2019), who introduce a novel way of measuring and classifying IT skills, based on a content analysis of the curricula of dual VET programs. They use modern computational linguistics methods to study the training content of all current VET occupations in Switzerland. Their results show, for example, that more recent and general digital skills (such as

developing applications) have higher labor market returns than more traditional types of technology-related IT skills (such as CNC, CAD, or handling control technologies). Thus future research in general should more closely investigate how different types of skills can be conceptually distinguished and empirically extracted from VET curricula.

Educational Type and the Use of Non-Cognitive Skills at Work

One important type of skill is non-cognitive skills that apprentices acquire during work-based training and that may have longer-term effects on the labor market. Bolli and Hof (2018) analyze how different types of VET programs affect “coping strategies” as one particular type of social skill. They study task-centered, emotion-centered, and avoidance-centered coping strategies. They compare how “work-based upper secondary education” (dual VET programs with large parts of firm-based VET training) and “school-based upper secondary education” (Baccalaureate schools, VET programs with full- or part-time VET schools, and other upper-secondary schools) differently affect coping strategies. Exploiting both longitudinal data and historical differences in the relative weight of school- and work-based education across Swiss cantons in 1980, they find that work-based upper secondary education affects both emotion-centered and avoidance-centered coping strategies. Thus, if non-cognitive skills become more important, future research should investigate in greater depth the effects of different types of education on the development of different types of non-cognitive skills (e.g., social skills or creativity).

Skill Composition, Skill Prices, and Long-Term Labor Market Outcomes

Rinawi and Backes-Gellner (2019b) study the development of the wages of workers with a VET degree over 35 years. Using German data, they find no evidence for a strong polarization of wages among VET workers. Instead, they find that wages have increased at the top of the distribution, decreased at the bottom, and remained largely stable in the middle. This finding differs from results from typical Anglo-Saxon studies, with wages strongly decreasing in the middle and growing at the top and the bottom. Rinawi and Backes-Gellner (2019b) also find that the observed changes for Germany are largely attributable to changes in the prices of skills, i.e., the prices for cognitive, interactive, and manual skills that have developed differently over time. This finding suggests that the demand for these skills has changed differently over time. Conversely, changes in workers’ skill compositions do not play an important role in explaining the wage changes that they observed.

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