Fuelling Germany's Mittelstand with complementary human capital: the case of the Cooperative State University Baden-Württemberg

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ABSTRACT

While research on universities is well elaborated within the field of higher education, less effort has been made to study other institutions of tertiary education. Complementary to the need of hybrid (specific and general) human capital for German Mittelstand firms, the system of tertiary dual education in Germany has succeeded in hitting two birds with one stone. Though Germany has often been criticized for its low rate of university graduates, the critique has largely failed to acknowledge the differentiation of Germany's dual tertiary education model. By highlighting the case of Baden-Württemberg and its Cooperative State University system, we illustrate the diversity of Germany's landscape of higher education institutions. It appears that the availability of a large pool of tertiary dual educated students contributes in particular to the advantage of Mittelstand firms in Baden-Württemberg.

KEYWORDS

Vocational education; cooperative education; Mittelstand; hidden champions; human capital

1. Introduction

Research on higher education focusing on universities has been highly spotlighted by academics, thus having nurtured a plethora of literature elaborating their intent, purpose and behaviour. Placing an emphasis on universities as institutions of interest is often associated with the knowledge-based economy that relies on universities for a number of reasons. Much of the literature linking universities to economic growth pointed out that universities: (i) contribute to knowledge spill overs in regional clusters (Audretsch, Hülsbeck, and Lehmann 2012; Anselin, Varga, and Acs 1997), (ii) serve as a major source of gravity to attract and retain talent (Florida 1999) and (iii) carry out research in industry or academic collaborations and commercialize knowledge through technology-transfer (Siegel, Waldman, and Link 2003; Slaughter and Leslie 1997; Shane 2002), which fosters third party innovation output or spinning-off start-ups (Fini et al. 2011). Therefore, universities serve as a major driver of entrepreneurship and innovation to stimulate economic growth. The OECD has long been critical of Germany for its low rate of university graduates over the years (OECD 2017; Powell and Solga 2011). Germany's rate for tertiary education graduates (traditional universities and Universities of Applied Sciences) reached

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31% in 2016, ranking far below the OECD average of 43%. However, this criticism of the low rate of university graduates in Germany overlooks the diversity and peculiarities of national education systems and the human capital needs of each respective economy, which are both context and path dependent with its institutions that have grown accordingly.

Did the high interest for higher education and universities give rise to an one-sidedness of academic topics, therewith overlooking the complementarity of different models of entrepreneurship that rely on other institutions of tertiary education? Germany's small and medium-sized enterprises (SMEs) serve as a major pillar within the German economy and are an essential engine of economic growth, exports and innovation (Audretsch and Lehmann 2016; Welter, Baker and Wirsching 2019; Audretsch, Lehmann, and Schenkenhofer 2018). A subgroup of these firms became known as *hidden champions*. They pursue distinguished niche strategies and thus most often operate in quasi-monopolistic business-to-business markets (69%), which naturally entitles them world market leadership (Simon 2012). These firms primarily require both technically trained specialists as well as theoretically educated university graduates, for which the Cooperative State University of Baden-Württemberg (DHBW) seems to provide complementary human capital. Within higher education, this institution is the largest in the state of Baden-Württemberg[1] and ranks among the top 20 in Germany, as measured by student enrollment. Founded in 2009, it is also the youngest institution within the ranking.

This study aims at delineating the Cooperative State University of Baden-Württemberg within the German system of higher education. The system of tertiary dual education combines general and specific human capital in a hybrid form, expanding pure subject-specific skills with those of a more intellectual nature. This hybrid character of dual training in both the vocational and educational training (VET) and the tertiary dual education system complements the human capital requirements of German SMEs. Its complementarity seems to be pronounced particularly within the state of Baden-Württemberg, where most of the German hidden champions (Simon 2012) and the biggest and oldest institutions for tertiary dual education are located. We assume that a concentration of hybrid human capital (a mix of both general and firm-specific) seems to benefit the emergence of Mittelstand companies.

Past research has primarily targeted dual education in terms of the VET System. In a long-term historical perspective, Jacob and Solga (2015) study how the participation of youths in VET has evolved over time and how individuals' behaviour in education affects institutional changes regarding the support of both low and high-achieving youths. Gessler (2017) investigates future challenges for the German VET system through researching the lack of collaboration between companies and schools in the German apprenticeship system. Similar research already focused on vocational academies and their potential to equip Germany's workforce for the future through a modernized training system. Still rather broadly, so far, literature has pointed to the duality on an academic level, thus combining vocational training and higher education (Dessinger 2000; Graf 2013). While Heikkinen (2004) makes a cross-cultural comparison of vocational education paradigms, Greinert (1990; 2004) introduces a typology of VET systems distinguishing a rather liberal-market driven model (US, UK, Japan), a bureaucratic model (France, Italy, Scandinavia) and the German dual model.

Research on dual education is generally well developed, with Haddara and Skanes (2007, 68) remarking that the 'serious questioning of the validity of the cooperative education model and its impact on post-secondary education started in the late 1950s'. Explicitly, research on cooperative education focused on the impact it has on grades, the subjective-wellbeing, learning outcomes, the academic performance, starting salaries of students and their time to graduation (Blair, Millea, and Hammer 2004; Dressler and Keeling 2004; Parsons, Caylor, and Simmons 2005; Ramirez et al. 2014). Ramirez et al. (2014) identify the determinants of participating in engineering-related cooperative study programs, with cumulative Grade Point Average (GPA) at the end of the second semester being among them. Some studies investigate the impact of cooperative education on increased self-efficacy, which in turn benefits academic performance and post-graduation success (Reisberg et al. 2012). Raelin et al. (2014) found students of cooperative education programs to have a higher certainty about career choices. Earlier studies have already pursued a case study approach targeting a single institution–firm relationship (Reinhard, Satow, and Sisco 2007).

Contrarily, less research has explored how education systems are linked to national specifics with regard to the typology of the corporate landscape. What universities in the US are for the innovative capacity of the Silicon Valley model of entrepreneurship and its unicorns (Acs et al. 2017) – are vocational schools for the German Mittelstand, whose companies are less dependent on research focused universities (Lehmann, Schenkenhofer, and Wirsching 2019). An analysis through the lens of human capital theory, so far, has been scarce in both fields of research. Therefore, this study contributes to the human capital debate and the question of what kind of human capital, whether general or firm-specific, gains importance with regard to context and the system of education (Weisbrod 1962; Lepak and Snell 1999; Bozeman, Dietz, and Gaughan 2001; Wallenborn 2010; Blundell et al. 1999; Blöndal, Field, and Girouard 2002).

The state of Baden-Württemberg is home to the highest share of hidden champions throughout Germany, while the Cooperative State University of Baden-Württemberg is another special feature of the state, providing complementary human capital to local firms. Since this is the state's largest institution of tertiary education, with consistently growing numbers in terms of student enrollment and collaborating firms, it is a case worth to be studied. In previous studies on the German education system, as well as on human capital for German Mittelstand firms, this institution mostly has been neglected. This paper aims at filling this gap in research by investigating it in an explorative approach. By doing so, we want to learn more about the relationship between it and German Mittelstand firms. In addition, this paper should help policymakers and higher education researchers around the world to get a better understanding of the German education system and, in particular, the Cooperative State University.

This study is structured as follows. While Section 2 introduces the German Mittelstand and its subtype firms, hidden champions, Section 3 uses the lens of human capital theory to analyse the incentives of both employers and employees to invest in general or specific human capital. This latter part points out how Germany's education system complements the human capital need of Germany Mittelstand firms. The German education system in general, including the systems of vocational education and training as well as the tertiary education system is described in more detail in Section 4. The case of Baden-Württemberg

is analysed in Section 5 and illustrates how it succeeded in creating its own profile of tertiary dual education. Section 6 concludes.

2. The German Mittelstand

Recently, interest in the German Mittelstand has been on a steady rise for researchers and policymakers around the world (Welter, Baker and Wirsching 2019; Audretsch, Lehmann, and Schenkenhofer 2018). Especially after the financial crisis in 2008, Germany recovered faster from the recession than other leading economies, which was partly credited to Germany's highly specialized and flexible Mittelstand (Audretsch and Lehmann 2016; Jahn 2018). Within this section, we contribute to further investigate its special nature. Although the term Mittelstand is widely recognized in the media as well as in the academic literature, a broadly accepted definition is still missing. However, most scholars agree that the German Mittelstand is characterized by family-owned German SMEs (Audretsch and Elston 1997; Berghoff 2006; Berlemann and Jahn 2016; Block and Spiegel 2011; De Massis et al. 2018; IfM 2018a). Nevertheless, a dispute remains, how an SME is defined by quantitative measures. The so-called *German definition* by the IfM (2018b) considers all firms as SMEs that do not employ more than 500 people and have a maximum turnover of 50 million Euro. The EU (2003) definition, which is important to those firms who want to claim EU funding as a SME firm, does not consider firms with more than 249 employees and more than 50 million Euro turnover or 43 million Euro balance sheet total as an SME. In order to meet the broader definition, we avoid setting qualitative characteristics and define German Mittelstand firms as family-owned SMEs. Therefore, the general characteristics of family firms like generational continuity and long-term focus apply (Habbershon and Williams 1999; Lumpkin and Brigham 2011; Sirmon and Hitt 2003; Zahra, Hayton, and Salvato 2004). In addition, the German Mittelstand is also known for a family-like corporate culture, strong regional ties, a high investment in its workforce, a low fluctuation rate and a high participation in the VET System (Audretsch, Lehmann, and Schenkenhofer 2018).

A subset of German Mittelstand firms is known as hidden champions. They are Mittelstand firms that pursue distinguished niche strategies and thus most often operate in quasi-monopolistic business-to-business markets (69%), what in turn naturally grants them world market leadership (Simon 2012). The majority of hidden champions are manufacturing firms, foremost in mechanical engineering, electronics, medical engineering and metalware (Rammer and Spielkamp 2015). Above all, it is down to their often rural location and knowledge-intensive, high-quality products that explains the struggle hidden champions commonly face to acquire a sufficient supply of complementary human capital (Audretsch, Lehmann, and Schenkenhofer 2018; Lehmann, Schenkenhofer, and Wirsching 2019; Simon 2012; Venohr and Meyer 2007; Witt and Carr 2014; Yoon 2013). This study uses hidden champions as a manageable and accessible sample of Mittelstand firms analysing its regional distribution within Germany.

3. Providing complementary human capital for the German Mittelstand

Given the manufacturing and engineering nature of many of the Mittelstand companies (Audretsch, Lehmann, and Schenkenhofer 2018), human capital proves to be a strategic

resource in the production of technologically demanding and highly specialized products. Acquiring and retaining skilled employees is a challenge in its own respect for Mittelstand companies, as their geographic spread is often highly decentralized and thus mostly rural (Simon 2009). The supply of complementary human capital becomes even more decisive for firms, when operating in niche markets (Sorge 1991). Hidden champions tailor products with a high degree of value added, while manufacturing complex high-quality products with advanced technologies. In particular, their high R&D expenses (6.0% of revenue compared to 3.6% of Global Top 1000 firms) point to the knowledge intensity of their offer and amounts to continuous efforts to innovate incrementally. Simon (2009) estimates hidden champions to own 31 patents per every 1000 employees on average, which compares to the number of 6 for large corporations. Therefore, it is obvious that manufacturing and engineering sectors call for a well-trained workforce and are committed to long-term investments in a worker's stock of human capital. Dual education thus serves as a complementary vehicle to allow for investments in specific human capital. Immediately after leaving school, companies can begin to shape their young apprentices and dual students from an early stage on. This mutual commitment in turn strengthens the bond of the workforce to the company and increases organizational identification (Mael and Ashforth 1992). The high loyalty of the employees towards medium-sized companies results in a strong employee retention, therewith enlarging planning periods on both sides, thus implying an insurance against possible hold-up (Grossman and Hart 1986; Hart and Moore 1990).

The current study expands earlier research on hidden champions and human capital and investigates cooperative study programs in addition to the vocational training system. Lehmann, Schenkenhofer, and Wirsching (2019) already point out that public investments in the education system reduce the risk of hold-ups and thus the underinvestment in relationship-specific investments. The authors show that in centralized systems, where human capital investment is provided publicly, employees are better incentivized to invest in their stock of specific human capital. The duality of both general and specific education protects the employee not to be at the mercy of the employer. Both contracting parties are interested in maintaining the investment-specific relationship, as both sides thus are able to internalize the value of the quasi-rent (Williamson 1975; Hart 1988).

The theory of specific vs. general human capital (Becker 1964) points to the dichotomy of specialized knowledge (only valuable inside a certain firm) versus general knowledge (valuable and transferable through companies and industries). Specific knowledge is tied to the specificity of company assets and the knowledge intensity of a firm, which both proves highly specific for most Mittelstand firms and especially specific for hidden champions. Human capital literature assumes that firms generally refrain from investing in an employee's skillset of general human capital as it increases the applicability of an employee for other companies on the labor market (Becker 1964; Lazear 2009). Thus employees are rather wary of investing in firm-specific human capital, because this can prove to be worthless for other companies, which in turn reduces their labor market opportunities. The question now arising is, whether both employer and employee find themselves mutually locked-in? If so, a mutual lock-in would involve interdependence and thus a safeguard for relationship-specific investments, since both contractual parties can only internalize their quasi-rents within the investment-specific relationship (Williamson 1975).

To which extent a mutual lock-in actually exists and thus creates an incentive to build up specific human capital is determined by a number of factors (and is nowhere near limited to the mere dichotomy of general and specific). Investments in general human capital increase the outside opportunities and exploitability of skills in the labour market, but also specific human capital can be remunerated outside the contract relationship, insofar as it is industry specific (Neal 1995). This proves especially feasible within the sector of manufacturing. Similarly, the transferability of one's human capital increases through centralized training being easily comparable through consistent examinations and certificates. Conversely, a lock-in effect seems likely when considering that companies with knowledge-intensive and complex products seek to invest in the product-specific skills of their employees. They do so because they need highly trained employees to manufacture their technologically sophisticated and complex products. Especially, owner-managed family firms enable a long-term planning horizon of investments and product development, and thus enable a deepening of the knowledge base and the associated accumulation of specific human capital (Lumpkin and Brigham 2011).

To this effect, a u-shaped relationship seems likely as specific investments in company-specific knowledge increases employee retention until an optimum level. Eventually, however, from a certain level on outside opportunities will become that low that the incentive to keep investing in specific human capital will decline. In any case, due to the lock-in effect, the absolute amount of the specific investments in the stock of human capital and the probability of both contracting parties to internalize the value of the created quasi-rent, increase. The situation of a mutual lock-in emerges through a number of factors, such as the specificity of training at the job, which is tied to the assets of the employer. Moreover, it results from the often rural location, where small factor and capital markets grant less access to outside opportunities for both employees and employer (Meccheri and Pelloni 2006). Long-term relationships are characterized by mutual trust, which especially characterizes the quasi-monopolistic niche markets of hidden champions, where firms and customers are bound together naturally. The long-term nature of relations also establishes deeply rooted social capital among employees and their families. In the case of rural firms, social networks of rural areas overlap business and private environments more than their urban counterpart areas (Keeble and Tyler 1995; Ziersch et al. 2009), in turn strengthening the bond to the company. This allows employees to remain rooted in the social networks of their home area, thus accepting the dependence to a rural employer more naturally. While this section has outlined the type of human capital to be beneficial for Mittelstand firms, the following section points out how the system of tertiary dual education in Germany succeeds in its complementary provision.

4. The system of vocational and tertiary dual education in Germany

4.1 The German system of higher education and vocational education

Due to the federal system that was set up after the Second World War, education systems and education policies in Germany are technically depending on the *länder*[2] (federal states). Although this leads to education systems that differ state by state, generally speaking, secondary schooling in Germany is organized in a tripartite system, as Figure 1 shows. Hereby every school allows for access to the VET System after graduation. In contrast, to

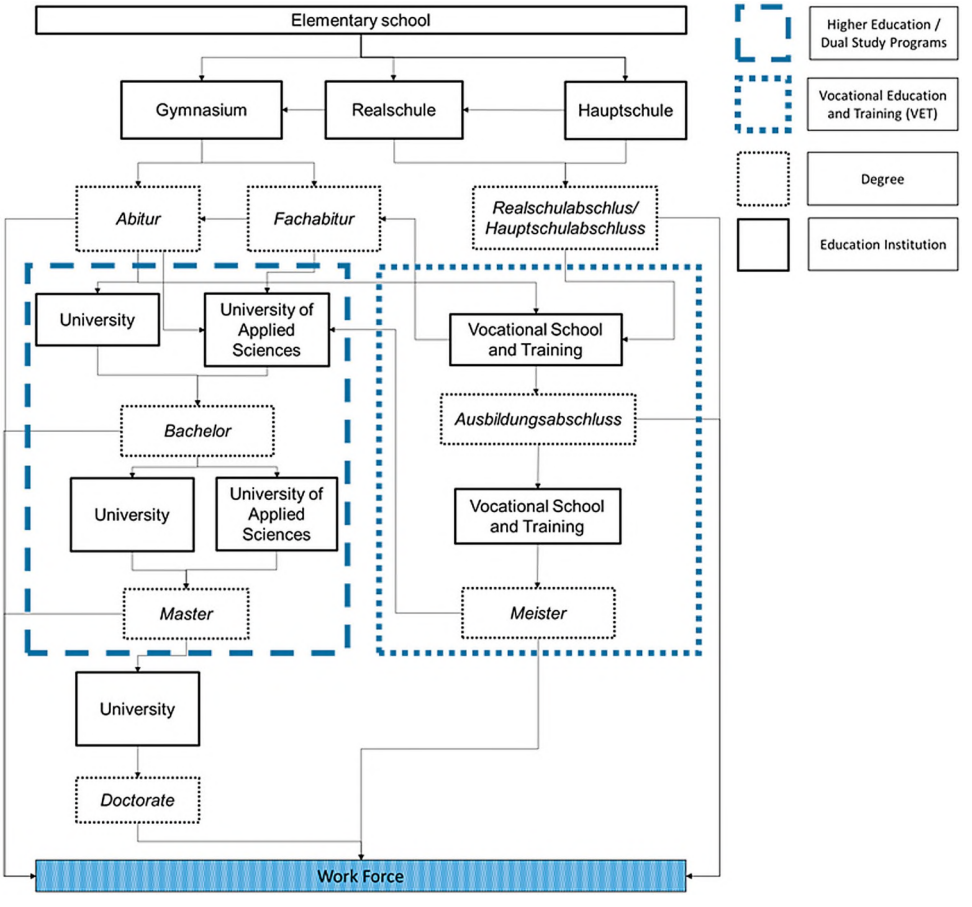

Figure 1. Description of the German Education System as an extension to Enders (2001, p. 14). Source: Own depiction.

study after secondary school, several ways to obtain a higher education entrance qualification (the *Abitur* or the *Fachabitur)* exist. By completing the *Gymnasium* a pupil obtains the *Abitur*, which is in general needed to enroll at a German University. However, the *Fachabitur* from a *Fachhochschule* or a Fachgymnasium usually give access just for the University of Applied Sciences, which are subject-specific and practice-oriented and generate rather specific and hybrid human capital than purely general human capital – as universities do.

The system of vocational education has its historic roots in the system of guilds dating back to the tenth century (Greinert 2004) and thus relies on a century-old tradition. At the time, guilds appeared as professional associations and enforced uniform regulations of schools, professions and education. They organized the training of trade and commercial professions between master and apprentice. The aim was also to establish quality standards for goods and production methods, which became the benchmark for the master craftsman's examination. Whereas entrance criteria for higher education very much depend on local policies, the vocational training in Germany was standardized through

the Trade Code of 1953 and the Vocational Training Act of 1969. On the one hand, apprentices are trained in vocational schools, where they take classes in general and vocational subjects thus gaining theoretical knowledge. On the other hand, they learn by working in companies, where they have an employment contract and receive a salary (and, above all, develop specific human capital and apply knowledge in practice). Here, it is key that the training contract equips both contracting parties with precisely specified rights and obligations. Thus the individual training content and training periods are specified to the trainee, while the hours trainees spend in the vocational school count as working hours. What's more, vocational education is free of costs for the trainees and attending classes is strictly compulsory. The trainees spend 1–2 days a week or in a week-to-week changing block training at school, writing a final exam at the end of the training period organized by the semi-public chambers of commerce (Greinert 2004). These chambers of commerce (IHK) control, if companies participating in vocational training meet the requirements, e.g. whether participating companies have certified trainers on-site at the company. In addition, these chambers control training contracts for accuracy and completeness. It qualifies the training staff and supports the companies in their search for trainees. The IHK also organizes the central, intermediate and final examinations and, through a uniform certification system, ensures standardization and quality control, in turn increasing comparability and transparency in the training market. Comparing educational systems worldwide, a few other examples of dual vocational education include Austria, Switzerland, South Korea and Denmark (Ebner, Graf, and Nikolai 2013).

The German apprenticeship system trains graduates with theoretical (general) and practical (firm-specific knowledge), and thus ensures a technological skill base in the workforce needed to support the manufacturing of high-quality services and products. The system is designed to achieve high quality, especially through its state-centralized organization. Although the participation in it is voluntary for companies, if they decide to join, they commit themselves to strictly adhere to the legal requirements for vocational training. The state and the economy are thus equally involved and jointly share the expenditures for the dual vocational training system. In 2015, the cost of dual vocational training totalled € 2.9 billion for 1600 vocational schools and € 2.5 billion for management, monitoring and support measures (state-funded), while the firms spent € 7.7 billion on pure training costs. A decisive factor here is that approximately 76% of the investments are directly amortized by the productivity contributions of the trainees (BIBB 2015).

Since 2009, a master craftsman's diploma *(Meisterbrief)* grants admission to study at a higher educational institution. Depending on the local policy of the *länder*, a *Meister* in most cases allow access only for the University of Applied Sciences. Within the higher education system, more and more higher education institutions in Germany start to offer tertiary dual studies programs, where students obtain an academic degree, but also gain working experience. The Cooperative State University of Baden-Württemberg, which is explained in more detail in Section 5.1, is, technically seen, a University of Applied Science. Although the share of dual students has risen consistently in Germany, research mostly just targeted vocational schools in the field of dual education (Solga et al. 2014). Universities of Applied Science, pursuing a rather specialized orientation, originate from the former engineering schools and are the core institution for cooperative study

programs. Cooperative study programs are currently available at 225 institutions, of which 70% are located at Universities of Applied Sciences (such as Baden-Württemberg's Cooperative State University), 23% are at vocational colleges and only 7% are located at universities, while 94% of all of the dual study programs are bachelor programs. Germany's education system on a tertiary level exhibits a strong dual character, which can be found both in the vocational education and in the cooperative study programs (WDS 2018).

4.2 Cooperative study programs: a systemic fit for German Mittelstand firms?

While the vocational education system in Germany has received some attention from academia and policymakers, interest in tertiary dual study programs in Germany is gradually growing alongside the increasing number of enrolled students and established programs (Waldhausen and Werner 2005; Kupfer and Mucke 2010; Mucke and Schwiedrzik 2000; Minks, Netz, and Völk 2011). Despite a growing interest from international scholars, a leading definition of a tertiary dual study program is still missing. However, on a broader perspective, the literature on education systems in general distinguishes between programs that are considered as VET and others, which are seen as part of the Higher Education (HE) system (Graf 2013). In fact, the tertiary dual education system locates somewhere in between and combines vocational training and higher education. Due to this fact, the German education and higher education policy is placed in the hands of the federal states and various types of this hybrid educational form can be observed. In general, tertiary dual study programs combine organizational and curricular elements of vocational and higher education systems, linking companies with universities or academies as the places of learning. The *Wissenschaftsrat* (WR, Council of Science and Humanities), acting as an advisory commission to the German Federal Government, and the *länder* governments shed light on the different forms of dual higher education programs in 2013 and gave recommendations for further policy decisions (Wissenschaftsrat 2013).

First, the Wissenschaftsrat (2013) addressed the definition problem by defining the term *dual* in dual studies as the link between two places of learning – the academic education in the university or academy as well as the vocational education in a company. The *Wissenschaftsrat* does not consider the other types of education that do not follow this definition of dual studies. In addition, the Wissenschaftsrat (2013) provides a framework to classify the different forms of dual studies into four general types. Here, they consider the educational stage – whether or not it is first post-secondary education, the academic degree and the study format. So-called training-integrated dual degree programs – which in some cases involve a vocational school and are a first post-secondary education – are usually completed with a recognized degree from the German VET system and a bachelor's degree. In addition to this original type, there are practice-integrated programs as a first post-secondary education as well as work-integrated and part-time dual study programs as second or third post-secondary education. All of these programs work according to the basic principle of systematic content and organizational linking of theoretical and practical phases. While the courses integrating training and practice are primarily aimed at initial vocational training for those with a higher education entrance qualification, the courses integrating work and part-time work are primarily geared to

Table 1. The German system of higher education at a glance.

Educational stage	Higher education degree		Study format
First post-secondary education	Bachelor and formal VET	VET integrated	Formal VET under German *Berufsausbildungsgesetz* VET Act, combining individual and fixed professional education
	Bachelor	Practice-integrating/ internship integrated	Education and internship within the partner company As professional education with high flexibility by company
Second or third post-secondary education	Bachelor or Master	Work-integrated/ occupation integrated	Night and tele-schooling, formal restrictions by school regarding employee minimum (Bachelor/Master)
	Bachelor or Master	Part-time integrated/ internship integrated	Education and internship within the partner company as professional education with high flexibility by company

Source: Own depiction following Graf (2012), BIBB (2014), Wissenschaftsrat (2013).

continuing vocational training for those already in employment (Wissenschaftsrat 2013; Graf 2012), as Table 1 illustrates.

Although dual higher education study programs started their success story in the 1970s, they have become popular only recently. Since they do not have a long tradition, the recent popularity arose during a time of major decentralization of educational policy. Accordingly, the continuing expansion of dual study programs is less controlled from above by federal education policy. Rather, it follows a bottom-up approach through the cooperation of local, mostly medium-sized, companies and universities or academies with the intention to build an innovative, specific and state of the art study program. Companies have a high incentive to be engaged in these programs, since they help them not only to attract young, highly skilled professionals, but also to face the feared shortage of skilled workers in upcoming years (Graf 2012). Furthermore, dual study programs meet the expectations of the growing number of people with higher education entrance qualifications, who are looking for a demanding, fast-paced and practically orientated academic education with high chances to get (well-remunerated) occupation with a company after graduation. In addition, the growing number of dual studies graduates and programs can also be explained by the Bologna process, which has led to the improvement of the international and national recognition of this degree (Kupfer and Mucke 2010). The German state of Baden-Württemberg is an interesting case to study when it comes to dual education programs, since it is the first state that introduced such an institutionally integrative program and has Germany's largest dual higher education system institution, the Baden-Württemberg Cooperative State University.

5. The case of Baden-Württemberg

5.1 Baden-Württemberg Cooperative State University

The State of Baden-Württemberg is one of Germany's 16 federal states and is well known for its strong economic performance and world-leading companies (Staber 1996). Hosting large enterprises like SAP or Daimler, as well as hidden champions like Freundenberg, Tognum or Mann + Hummel, the state became a role model for policymakers around

the world. Due to the long-term orientation of these firms with innovative and high-quality products, these companies are highly reliant on well-trained human capital.

Founding the University of Cooperative Education (Berufsakademie Baden-Württemberg) in 1974, the state of Baden-Württemberg is the first and so far only state in Germany to set up a public hybrid higher education system to support these companies (Göhringer 2002). The DHBW is the largest higher education institute in the state with approximately 33,000 enrolments across three campuses and over 9000 different cooperating enterprises (DHBW 2017). Regarding the framework of the Wissenschaftsrat (2013), the DHBW offers mostly practice-integrated bachelor programs in stage of first post-secondary education.

To be enrolled in the DHBW, students do not only need a university entrance qualification (Abitur, advanced technical college or subject-related entrance qualification certificate), they also need an indenture (training contract) from a cooperating enterprise. In this contract, the company agrees to fulfil the schools requirements (DHBW 2018a) and to pay the student a monthly income. Usually, dual students earn more than those who are participating in a VET program. All undergraduate study programs offered by the DHBW are intensive academic degree programs with 210 ECTS points. The University consists of three Schools, namely the School of Business, the School of Engineering or the School of Social Work. Depending on the program as well as the school, graduates obtain on of the following degrees: Bachelor of Arts (B.A.), Bachelor of Science (B.Sc.) or Bachelor of Engineering (B.Eng.). Since 2006, all study programs are accredited by the German Central Agency for Evaluation and Accreditation (ZEvA) (DHBW 2018b). The regular curriculum on the Cooperative State University is organized as follows: the academic year usually consists of two semesters. The first part, in the classroom, usually lasts for 3 months and the second part, where students fulfil their training-on-the-job, another 3 months. The school is mainly funded by the state of Baden-Württemberg so that no tuition fees apply for the students or the cooperating companies. In this system, the firms gain highly skilled and academically trained workers, who usually start working at the company after graduation. In addition, the dual students benefit from this system. Since the company pays monthly, no student loan, scholarship or other forms of financial support are needed. The high likelihood of a permanent employment after successful graduation as well as the link between academics and practice is highly attractive to most students. Although this program is highly specialized enough in their field where most graduates stay in this field or area of employment, thanks to the academic degree, graduates are still flexible and open for job change, whenever the job market forces them to do so. Resulting in low fluctuation rates and a strong and efficient educated work force, this system is in favour of all three major stakeholders: the cooperative state university, the participating firms and students. The firms benefit from an easy access to highly skilled workers. The student benefits from a reliable yet free, or even paid, education. Naturally, this is in the interest of public policy, who is financing the cooperative state university system, since this system spurs low unemployment rates and economic development.

5.2 Descriptive statistics

The last part of this paper compares the distribution of students of tertiary dual education among the 16 federal states in Germany. Baden-Württemberg is home to the by far largest number of dual students in Germany, 36,529, thus accounting for 36.3% of all dual students in Germany. Corrected for size effects, Baden-Württemberg still leads far ahead

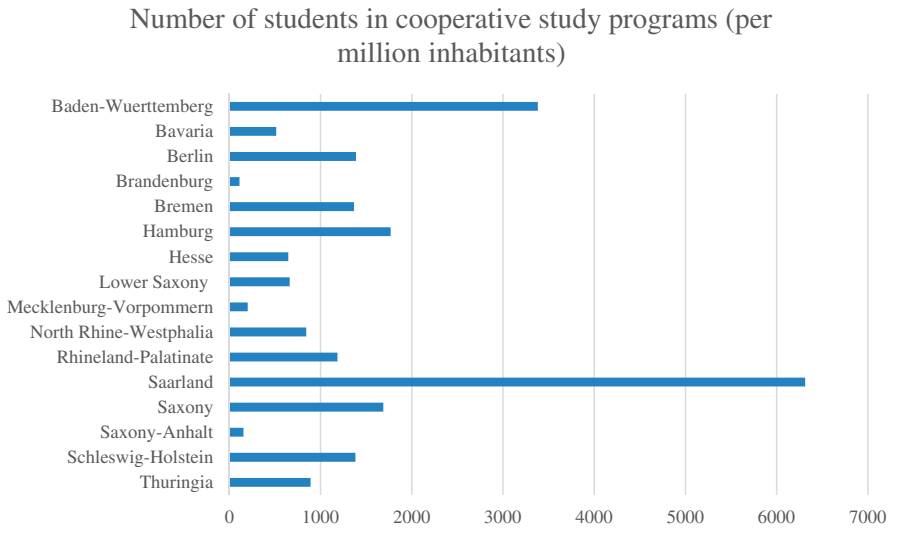

Figure 2. Number of students in cooperative study programs (per million inhabitants). Source: BIBB (2017).

of almost all other federal states, while only the Saarland has more dual students per one million inhabitants, as Figure 2 shows. It seems that Baden-Württemberg exhibits a particularly strong collection of Mittelstand firms because of being able to draw on a large pool of dually educated students, and thus on a vast mass of potential workforce. Figure 3 seems to reinforce this impression. In terms of the number of hidden champions per million inhabitants, Baden-Württemberg is the federal state with the highest share of Mittelstand world market leaders (28.0), followed by Hamburg (25.0) and Hesse (22.8). The distribution of hidden champions in Germany shows that hidden champions spread in a decentralized manner across the country and do not necessarily settle

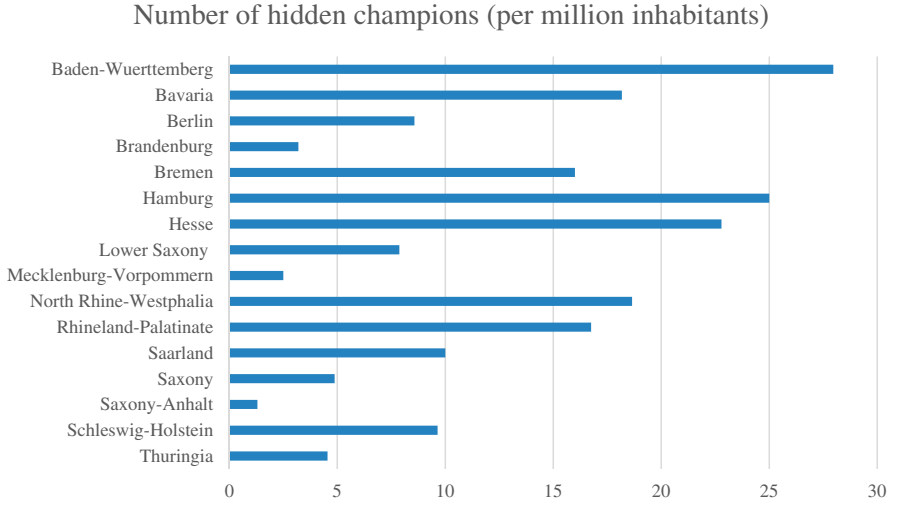

Figure 3. Number of hidden champions (per million inhabitants). Source: Simon (2012).

around urban agglomerations or universities (Simon 2012). Above all, the few urban concentrations can be observed in the states of Hamburg, Berlin and Bremen, next to Munich and Nuremberg. Simon's (2012) data also reveal a considerable east–west divide. The high ranking of Hamburg might be explained by a study of the ZEW revealing that most German family businesses are headquartered in Hamburg (4.4%), thus indicating a strong breeding ground for family businesses (ZEW 2017).

Analysing the number of dual study programs, a similar picture emerges. Baden-Württemberg ranks third here with 275, only behind North Rhine-Westphalia (311) and Bavaria (321). Looking at the number of vocational students, Baden-Württemberg (410,572) is ranked second, ahead of Bavaria (384,750) and only behind North Rhine-Westphalia (566,398). When correcting for size, Baden-Württemberg is the territorial state with most trainees per million inhabitants, only behind the city–state of Bremen (Figure 4). It is particularly interesting now to take a closer look at the numbers of university students. Figure 5 shows that Baden-Württemberg only ranks 9th, correcting for size. It seems that Baden-Württemberg succeeds in shaping its own educational profile, thus consciously promoting its educational system in a way that particularly benefits the human capital needs of its strong Mittelstand. Still, the overall results are rather mixed. Though the Saarland by far has the highest number of students within cooperative study programs, only a small number of hidden champions reside there. Moreover, though Hesse ranks third in the number of hidden champions, the supply of students, enrolled in cooperative programmes, is rather low. This altogether reduces the generalizability of our results and shows that our descriptive data leaves out a number of factors that a multivariate analysis is better suited to cover.

6. Conclusion

This paper introduces the DHBW as a special German higher education institution to the international higher education research community. We examine how a special system of

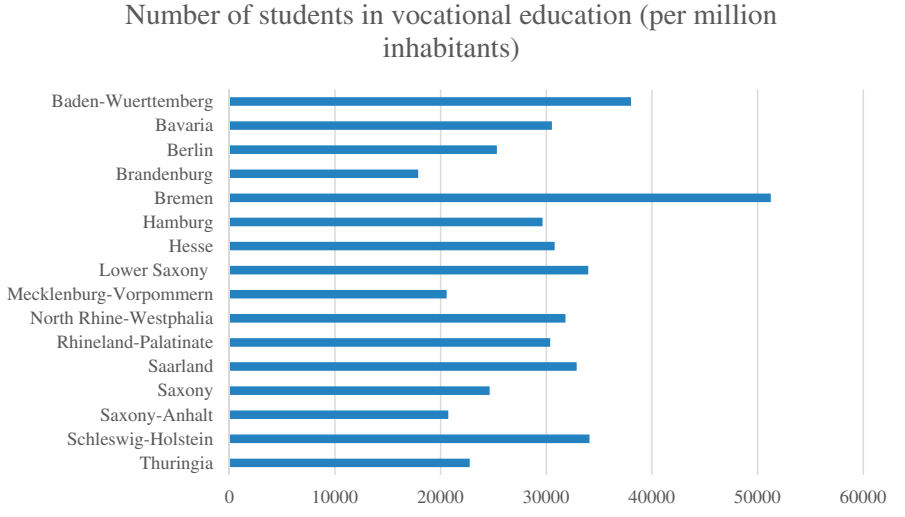

Figure 4. Number of students in vocational education (per million inhabitants). Source: Destatis (2018).

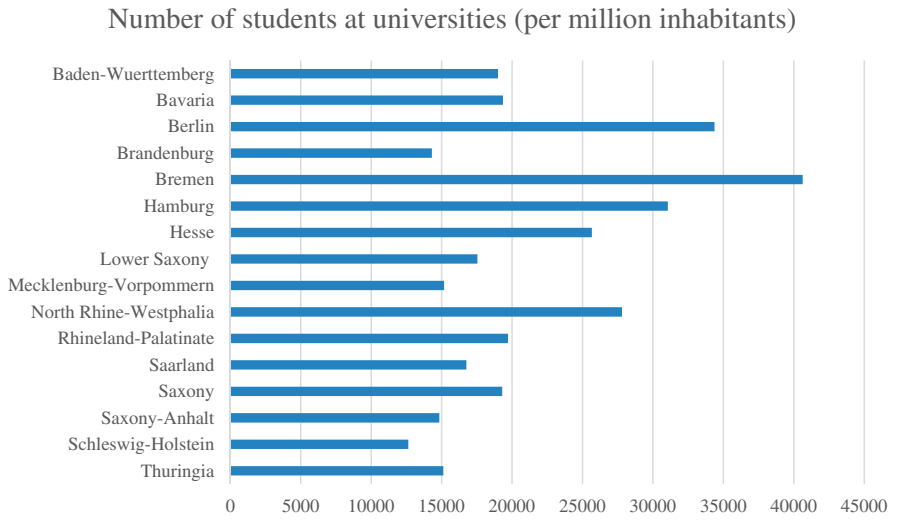

Figure 5. Number of students at universities (per million inhabitants). Source: SADBL (2018).

dual higher education creates hybrid human capital, complementarily meeting the needs of German Mittelstand companies. This line of reasoning aligns with both the studies by Audretsch, Lehmann, and Schenkenhofer (2018) and Lehmann, Schenkenhofer, and Wirsching (2019), showing that Germany is home for many hidden champions because of the provision of complementary hybrid human capital generated through a centralized and public system of dual education. With regard to the case of Baden-Württemberg, our study reflects this conclusion just the same. The public organization of cooperative education in Baden-Württemberg achieves a supply of hybrid human capital. On the one hand, it enables employees to build up specific human capital within the company and at the same time equips the workforce for rising future demands of the knowledge society – resulting from Industry 4.0 and a globalized world of higher competitive pressure. By shifting from classical vocation training to a more academic and research-driven level of higher education, Baden-Württemberg attempts a balancing act between specific and general human capital. Although this seems to be a role model to fuel Germany's hidden champions at its best, it remains doubtful whether this human capital prepares for future challenges like artificial intelligence and ongoing automation. In some ways, a universal education by a classical higher education institution with a stronger focus on research and an independency from companies, might address the future challenges more suitably.

Although the education system is a key success factor of the hidden champions, a number of other factors explain the strength of Baden-Württemberg's Mittelstand as well. Among these, Baden-Württemberg has emulated a number of strong industry clusters. Its automotive industry accounts for 25% for the whole of Germany, its mechanical and plant engineering share adds up to 20%, and finally, Baden-Württemberg is the region with the highest R&D investments (4.9% of GDP) among all 97 European regions (Block and Spiegel 2011).

Future research should include them within multivariate analyses and conduct further longitudinal studies researching the relation of human capital requirements of Mittelstand

companies and different systems of education. This article aimed at commencing a debate revolving around the heterogeneity of higher education programs to shape complementary human capital bases. Our data analysis remained descriptive to offer a first snapshot on causal relationships without being able to test them empirically. A limitation arises from the fact that our data is restricted to a sample of hidden champions. This is feasible insofar as hidden champions commonly are regarded as the spearheads of German Mittelstand companies accounting for its prominent qualitative characteristics. Further studies should take this up and examine other samples of Mittelstand companies.

In the course of widespread calls for increasing focus on academic orientation, the numbers of students at both German traditional universities and Universities of Applied Sciences have risen rapidly for years, as Figure 6 illustrates. However, the German Mittelstand firms are urgently dependent on the specific human capital of their trainees and students of cooperative education. Germany therefore might risk its own hybrid human capital base and thus part of its economic advantage. A progressive academic orientation aggravates the problem regarding the shortage of skilled workers in Germany, which seems challenging also due to the demographic development. Figure 7 illustrates the decreasing number of apprentices in Germany. In this vein, the rising number of students enrolled in cooperative study programs is pleasing and might contribute to cushion the shortage of skilled workers. In an OECD comparison, Germany continues to lag behind regarding its rates of university-enrollment (OECD 2017). However, it is essential to acknowledge that the German economy, through its widespread Mittelstand, sets a specific profile of requirements for the labor market. Low youth unemployment rates in Germany (Figure 8) show that due to dual education alternatives to universities, fewer young people seem to be left behind through being offered versatile career opportunities. It does not seem to be a suitable strategy to play off the various educational systems, but instead to invest according to the requirements of the society's human capital base.

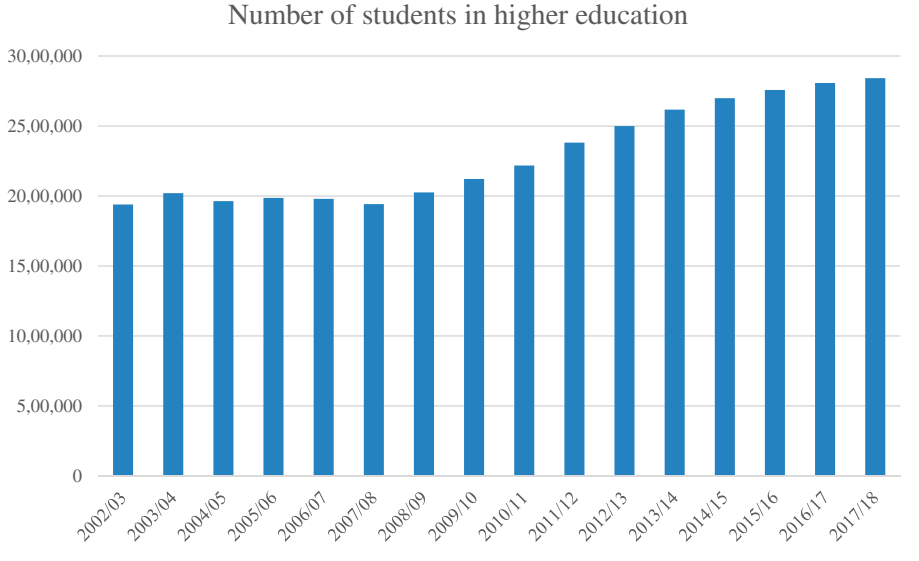

Figure 6. Number of students in higher education. Source: Statistisches Bundesamt (2018a).

Figure 7. Number of apprentices. Source: Statistisches Bundesamt (2018b).

Though academic orientation will continue to increase, public policy should not turn a blind eye on the demand of labor markets, which provide information on the requirements of the type of skills needed. In addition, it is down to academic interest to help increase the social recognition of the German dual training system and its core role to fuel the Mittelstand with complementary and critical human capital. The rising enrollment figures in the shape of cooperative study programs imply that Germany might be able to preserve its Mittelstand tradition, relying on hybrid human capital. In light of the ever-growing demands, where future workplaces bring along a more digitalized and globalized world, Germany needs to equip adequately for the future in order to protect its Mittelstand. To this effect, dual higher education indeed might prove to be a key pillar in achieving this transition.

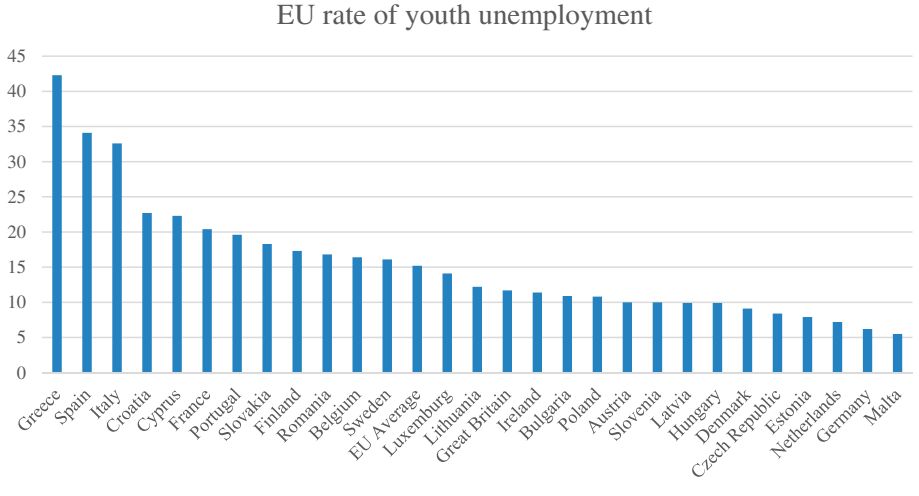

Figure 8. EU rate of youth unemployment. Source: Eurostat (2018).

Notes

1. Baden-Württemberg (BW) is one of the 16 states of Germany located in the southwest, east of the Rhine River, which forms the border with France. It is Germany's third-largest state, with an area of 13,804 sq mi and 10.8 million inhabitants. BW has also the second highest GDP per capita of all states, excluding the two city-states and port-cities Hamburg and Bremen.
2. Federalism in Germany is made of the states of Germany (the *länder*) and the federal government. The central government, the states and the German municipalities have different tasks and partially competing regions of responsibilities ruled by a complex system of checks and balances.

Disclosure statement

No potential conflict of interest was reported by the authors.

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