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Public–private partnerships in TVET: adapting the dual system in the United States*

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ABSTRACT

Around the world, governments, educators and employers have expressed growing interest in German-style methods of technical and vocational education and training (TVET). In such countries, schools and firms share responsibility for providing technical and vocational education, a model often called the 'dual system of vocational training and education.' The dual system means that occupational training occurs at two linked sites, educational institutions and workplaces. Dual education aims at matching the demands of a dynamically changing economy with the skill profiles of those graduating from educational institutions. To a large extent, dual education systems enable young people to acquire not simply technical and occupational skill, but broadly defined competencies that serve as the foundation for rewarding careers and social esteem. Little wonder that many countries have turned with renewed interest to the dual TVET system. However, *actual* implementation of the dual system outside the core Germanic countries in Europe has proven to be extremely challenging. Successful examples of institutional transplantation are rare. However, in some countries, local partnerships embracing elements of dual education have formed, uniting educational institutions, government entities and firms in partnerships to upgrade TVET. This paper discusses some of the characteristic patterns of such partnerships in the U.S.

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1. The problem of skill mismatches

Ineffective technical and vocational education and training (TVET) systems result in significant mismatches between the demand for and supply of skill in a national

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or regional labour market. Scholars argue that one reason some countries remain trapped at the middle-income level of development is severe unevenness across sectors and regions in the quality of TVET (Doner and Ross Schneider 2016). In the United States and other advanced industrial countries, employers and labour market experts decry the mismatch between the availability of and demand for skilled employees (Capelli 2014; Deloitte and Manufacturing Institute 2015; Fuller et al. 2014; McGowan and Andrews 2015; OECD 2016; Wright 2013). The OECD reports that in OECD countries, about 21% of workers are over-qualified for their jobs and 13% more underqualified (OECD 2013). As recognition of the importance of well-functioning systems of skill formation has risen, policy-makers in many countries in international organisations have called for devoting more attention to upgrading the quality and effectiveness of vocational education and training (TVET). In particular, policy-makers have urged closer cooperation between employers and schools (e.g. see OECD 2010). Policy-makers in many countries – among them Russia, China and the United States – are seeking to adapt elements of the German and other continental systems where apprenticeships are the most common pathway leading from school to jobs.[1] Dual TVET serves both economic and social purposes: it helps to ensure a continuous supply of qualified workers matching the employment demands of technologically advanced industrial economies. At the same time it helps to integrate society by easing the transition from school to employment. The youth unemployment rate in Germany in 2016, for example, at 7%, was less than half that of the EU average of 18.75% (https://data.oecd.org/unemp/youth-unemployment-rate.htm).

Dual TVET systems in the German-speaking countries rest on a series of partnerships operating at the macro-, meso- and micro-levels. At the macro-level, they are the outcomes of bargaining among business, labour and government over the distribution of the costs and benefits of investment in training. At the meso-level of regions, industrial associations and branch-based labour unions, they reflect the delegation of public functions to organisational actors, such as industrial-trade and crafts business chambers that administer and supervise TVET. At the micro-level of firms, schools and individuals, dual education resolves a series of types of collective action dilemmas, particularly coordination among firms over professional standards and training obligations, and those tieing firms to state bodies such as education departments and schools. As the classical economic literature on human capital formation argues, firms are typically reluctant to devote resources to general training beyond the immediate needs of the firm out of a reasonable fear that other firms can free-ride on their training efforts (Acemoglu 1997; Acemoglu and Pischke 1998, 1999). Deeper co-investment by individual employees and firms in job-specific and industry-specific training may require some guarantee to both sides that the resources invested in training will yield a longer-term return; social insurance mechanisms protecting the value of such skill against the loss of employment income may help induce such joint investment (Busemeyer and Trampusch 2012; Estevez-Abe, Iversen, and Soskice 2001;

Iversen and Soskice 2001). However, in many countries lacking the thick fabric of institutional complementarities characteristic of European-style coordinated market economies, alternative institutional mechanisms may help to motivate joint investment in sector-specific skill by market actors. Instead of institutional complementarities, therefore, we may look for institutional substitutes of various kinds and local modifications of the classic dual TVET model.

A premise of this paper is that large, regionally heterogeneous countries are more likely to feature such alternative arrangements than are the smaller and more homogeneous societies of western Europe, but to do so through regional and local innovations and adaptations. This is for three reasons, a permissive national institutional environment, cross-regional economic and political competition, and geographic asymmetries. In polities where subnational units exercise substantial administrative responsibility for regulating education and labour markets, the absence of central-level coordinating and bargaining mechanisms to set TVET policy allows local and regional actors to devise their own arrangements for linking TVET with local labour markets. Second, regional economic competition may motivate regional leaders to build regional economic development strategies around upgrading the skill level of the workforce. Regional crises and downturns may serve as a further stimulus to such efforts. From the standpoint of the competitive political arena, leaders in such regions may regard local success as a means of generating policy successes. Finally, geographic asymmetries in the distribution of natural, infra-structural and locational assets across regions encourage efforts to take advantage of local comparative advantage. Institutional innovation in one region may then spur neighbouring regions to emulate and adapt successful practices to their own needs.

For these reasons, countries such as the United States, Russia and China present opportunities to analyse the emergence of heterogeneous regional arrangements for matching TVET with labour markets. Precisely because central-level institutional complementarities among labour market regulation, skill formation, social protection and collective bargaining are absent, other localised institutional substitutes in the form of partnerships among government, educational institutions and employers may facilitate cooperation in developing institutionally demanding arrangements such as dual TVET. Note that in all three cases, there is cross-regional competition both in factor markets (capital and labour) and the political arena (electoral competition in the U.S.; bureaucratic competition in Russia and China [Rochlitz et al. 2015]). All three also feature large variation in the geographic distribution of assets such as infrastructure, climate, proximity to global markets and natural resources. Therefore, although this paper concentrates specifically on the case of the United States, many of the observations are, perhaps surprisingly, relevant to the Russian and Chinese cases as well.

In recent years in the United States, experts and government officials have been calling for a major shift in public educational spending to more vocationally oriented programmes. These ideas are not new. Over the past few decades, a

succession of presidential administrations has declared that improving the system of vocational training is a priority if the United States is to meet the challenges of global competition for high-technology, skill-intensive production. Each administration announces new initiatives designed to improve the match between the demand for skill and the supply of it. However, jurisdictional battles among federal agencies and congressional offices lead to fragmentation of these programmes, and momentum for them flags when the next administration takes over (Hamilton 2017; Martin 2000).[2] For this reason, much of the impetus for adopting dual TVET methods has come at the regional and local levels.

The drive for improving school-employer coordination in TVET is driven by both economic and social pressures. Economically, there is rising recognition of a mismatch between the available supply of skilled labour and the demand for it; socially, rising inequality has created greater barriers to social and geographic mobility by deepening the gap across residential neighbourhoods, schools and social networks (Chetty and Hendren 2016a and 2016b; Chetty, Hendren, and Katz 2016; Fryer and Katz 2013; Putnam 2016; Reardon 2011; Chetty et al. 2014, 2017). Ever fewer teenagers in American society have any exposure to after-school or summer jobs – only a quarter of 16–19 year olds are getting any experience of work. This problem is concentrated among those at the bottom of the income scale. Among urban low-income minority youth, only 10% were holding any job, with the lowest employment among those from the poorest families. The growing disengagement from both school and work has left some three million young people in America between the ages of 16 and 24 neither in school nor employed (Hoffman and Schwartz 2017, 64, 157). Although unemployment has fallen in the United States, the rate of non-participation in the workforce has grown alarmingly, as Figure 1 indicates. So have underemployment and long-term unemployment.

Over the decade from 2007 to 2017, all the net new jobs created in the U.S. economy were filled by individuals with college degrees, while the number of Americans in the workforce with no higher than a high school education fell by nearly three million (Shapiro 2018). At first blush, this might seem to argue for the importance of ensuring that all individuals acquire four-year college degrees, but a growing body of evidence suggests otherwise.

For one thing, the gap between employers' demand for skills and the skill inventory available to them is worsening (Holzer 2015). A report produced by the Harvard Business School in collaboration with Accenture and Burning Glass (Fuller et al. 2014) found employers severely hampered by a scarcity of workers possessing both the required technical and behavioural/communications ('soft' or 'social') skills.[3] Even as the number of traditional mid-skill jobs (such as production jobs in manufacturing) is shrinking, employers report that it is increasingly difficult to fill middle-skill jobs (Fuller et al. 2014, 6). The report found that as traditional middle-skill jobs in occupations such as manufacturing are threatened by globalisation and technological change, individuals are 'de-skilling,' i.e. moving to lower-skill and lower-wage jobs. Yet at the same time, only minority of firms are willing to invest in

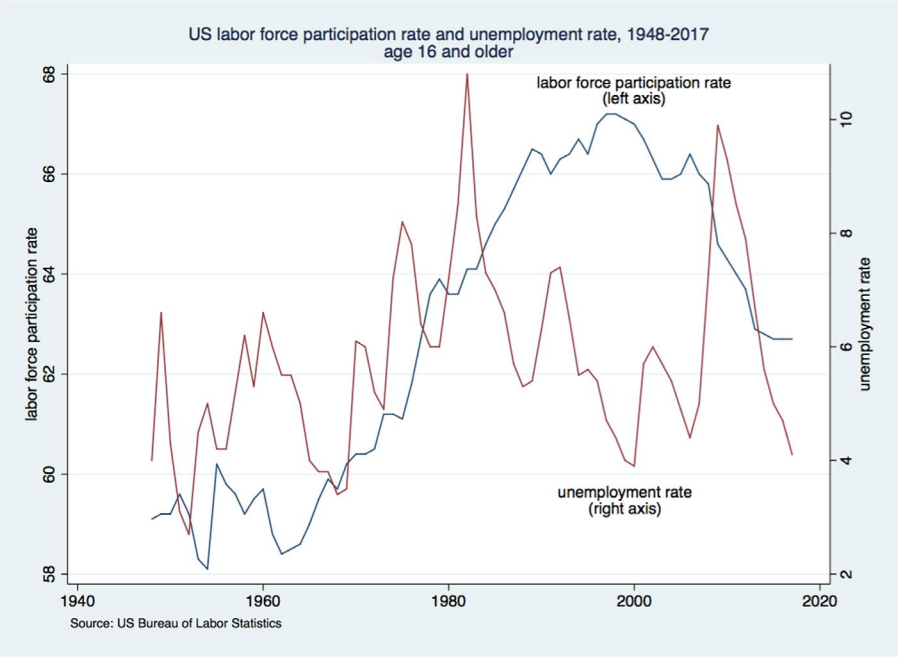

Figure 1. US Labor Force Participation Rate and Unemployment Rate, 1948–2017 (age 16 and older).

training themselves (Fuller et al. 2014, 8). Thus, despite the severe skills gap, neither market pressure nor government intervention has been successful in bridging it.

One problem is the strong social norm that all students should go to college. Although nearly 90% of high school seniors express an aspiration to go on for some kind of postsecondary education, 40% of those who enrolled in a four-year college or university degree programme failed to obtain a bachelor's degree within six years of matriculation. By the time they have reached the age of 27, only about 40% of young people have earned an associate's degree or higher. Another 10% or so have earned a certificate (Schwartz 2016, 742–4). Experts have called those remaining 'the forgotten half' (Halperin 1988).

Moreover, in many cases, those who do complete four-year degree programmes end up underemployed, or employed and earning wages lower than those with technical skills. The New York Federal Reserve estimates that over 40% of recent college graduates are working in jobs that do not require a college degree, and another 9% are unemployed, while a large number of good jobs (defined as jobs paying median wages of $55,000 annually) that do not require a four-year degree are in fields such as health and financial services (Carnevale, Strohl, and Ridley 2017; Fuller et al. 2014; New York Federal Reserve 2018). Indeed, over a quarter of employees with post-secondary credentials such as licences and certificates, short of an associate's degree – earn higher wages than the average four-year college graduate (Symonds, Schwartz and Ferguson 2011, 3).

A 2011 report by the Harvard Graduate School of Education, entitled 'Pathways to Prosperity,' emphasised that many of the new jobs that will be created in coming decades will require high levels of knowledge and skill, but that the existing system of education was failing to produce the numbers and types of graduates needed. Meantime, the nearly half of young people who lack any usable postsecondary educational credentials are suffering declining wages and employment (Symonds et al., 2011). As the Harvard report observes, the share of teens and young adults holding jobs is at the lowest point since the end of the Great Depression of the 1930s, and a majority of young adults lack even an associate's degree (Symonds et al., 2011, 1–2; Holzer 2015). As globalisation and technological change have advanced in recent decades, the population has seen declining starting wages and slowing wage growth, particularly for men (Guvenen et al. 2017).

The Harvard report helped stimulate a national movement to forge new educational models in order to make high school students 'college-and-career-ready.' Supporters of these programmes – often termed 'pathways' programmes – believe in expanding opportunities for high school students to earn college credits in order to increase their chances of proceeding to postsecondary education, and, at the same time, to acquire real-world work experience through dual TVET and other forms of workplace-based learning. This movement has attracted controversy because it explicitly rejects the ideal of 'college for all.' The 'college for all' norm aims at providing all students a general, non-vocational, education in order to equip all students to receive a college education. It rejects tracking on the grounds that tracking replicates social inequalities. It also implies that vocational tracks are for students who cannot succeed in academic education.

However, the acute mismatch between the American educational system and the demands of the labour market has been undermining the assumptions on which 'college for all' is based. As the Harvard report emphasised, recent data on employment suggest that the problem in the U.S. is less one of a 'skills shortage' than a 'skills mismatch' – too many people with qualifications that are poorly suited to the job market or who have inadequate opportunity to obtain the right skills in the first place (Capelli 2014; Stern 2015). Many experts, including the authors of Harvard Pathways project, have therefore been working actively to promote 'career-plus- college readiness pathways' programmes throughout the country. Many believe the U.S. should adopt apprenticeship programmes, as in Germany and Switzerland (Greenstone and Looney 2011; Hamilton 1999, 2017; Hamilton and Hamilton 1997; Helmer and Conway 2014; Hoffman and Schwartz 2015, 2017; Hoffman 2011; Holzer 2015, 2017; Lerman 2013, 2016; Newman and Winston 2016; Schwartz 2016; Stern 2015; Symonds et al., 2011). Modified apprenticeship-type programmes are springing up around the country, organised around partnerships between schools and employers. These initiatives are based on the premise that high schools should provide students both with postsecondary-level academic credits equipping them for college if they choose, and with real-world practical experience and training provided by firms (Hoffman and Schwartz 2017; Schwartz

2016; Stern 2015). Supporters of these efforts have therefore urged employers, governments and schools to work together cooperatively to upgrade training and match skill formation with the changing demands of the labour market. In nearly all cases, the advocates of college-plus-career pathways call for modification of school curricular programmes, deeper involvement by employers in setting curricular and occupational standards and in providing workplace-based training, active support by local government, and the formation of a coordinating body to serve as intermediary among schools, employers and government.

This paper describes some of the efforts to establish such cooperative institutions for improving the effectiveness of TVET in the United States. These examples adapt elements of the dual system of TVET to environments lacking the web of institutional complementarities characteristic of coordinated market economies. They operate at the regional or subregional level. Below I offer a general typology of such cooperative arrangements, provide illustrations from regional cases in the United States, and suggest possible explanations for the observed variation.

Before turning to the specific cases, however, it is worth reviewing the core elements of the German apprenticeship system.[4]

2. Dual education in the German-speaking world[5]

Dual TVET refers to the practice of dividing vocational education and training between school-based and workplace-based sites. In Germany, dual TVET grew out of a long history of guild-based apprenticeships, class conflict and bargaining, industrial modernisation during and after the Second World War, and multiple refinements in recent decades (Thelen 2004; Kathleen Thelen and Busemeyer 2012; Deissinger 2015a, 2015b). The system is highly regulated. Under federal law, 70% of the time spent by trainees is devoted to practical training (both on the job and in dedicated training facilities) and 30% in school. The breakdown of the curriculum is also roughly 2/3 occupational (following a 'framework curriculum for TVET), 1/3 general subjects.

Individuals enter dual TVET programmes from several paths. Some start after completing a lower secondary school degree (*Hauptschule* or *Realschule*), others after completing a higher secondary (*Gymnasium*) or even (although more rarely) after some post-secondary study. A smaller number start careers after attending a full-time technical school rather than a dual education programme. Altogether, around half of those starting a career have gone through dual education. Of the workforce between the ages of 25 and 40, over half have received TVET training in the dual education system, another 10% have other technical school degrees, around a quarter have higher educational degrees, and only 13% lack a specific occupational qualification. Although the number of apprenticeship contracts signed each year has been steadily declining for the last 15 years, the dual education system remains the principal way young people acquire occupational qualifications.

Only about 20% of firms offer apprenticeships. Most of these are small and medium-sized firms, few of which maintain their own dedicated training facilities. Only large firms such as Volkswagen, Siemens and Bosch can afford to run separate training academies and workshops. Most companies that do offer training contract out the work to specialised training companies such as inter-firm training centres, or use part-time trainers. Nonetheless, the scale of the national commitment to TVET may be judged by the fact that some 16% of the total workforce in the country work as trainers on a full- or part-time basis. Moreover, dual education system serves a large number of sectors, not just manufacturing. Although 60% of apprentices work in manufacturing, over quarter are in crafts production, and smaller numbers work in the free professions, agriculture, public services and other occupations. Dual TVET is offered in 329 occupations. It is important to recognise that these are defined broadly. Particular attention is given to providing 'competencies' rather than narrow skill profiles.[6] Competencies are understood to refer to the ability to apply knowledge to a range of tasks rather than to be able to perform a single job-specific or industry-specific task.

Business chambers play a central role in the dual TVET system. There are 80 such chambers in all, some organised by industry, others by craft. Chambers combine sectoral and regional principles of organisation (for example, the Stuttgart industry-trade chamber represents the industries of Stuttgart, of which the automobile-manufacturing cluster is particularly important). Each chamber has a specialised council for overseeing skill development, and some skills councils oversee multiple professions. The combination of sectoral and regional organisation within the chambers helps promote sharing of information and perspectives across industries. It also reinforces the concept that a profession need not be confined to a particular industry.

Chambers are public law bodies with the right of self-government. Businesses are required by law to belong to chambers and in turn federal law assigns the chambers substantial autonomy and regulatory power. The chambers, through their member dues, provide a little over half of the total financing of TVET, with government providing the balance.[7] Trainees do not pay for their own training. The chamber system has a number of consequences: it ensures standardisation of training methods and content, independent assessment of the qualifications of individuals during the course of and at the end of the training period, and provision of a pool of workers with industry-recognised qualifications. The chamber system helps ensure that the interests of small and medium-sized firms are not overshadowed by large enterprises. The costs and benefits of the dual education system are thus broadly shared by all firms in a given sector. Chambers have their own skills councils that oversee examinations and issue certifications that are recognised by the federal government. They also train and evaluate the trainers, monitor the training carried out by firms, register the training contracts with individual apprentices, and mediate disputes between trainees and companies. Critically, the chamber system overcomes the temptation for individual firms to

shirk from providing training in the fear that other firms will poach their trainees. All firms, large and small, benefit from the existence of a pool of skilled labour in their sector and region. Individual firms take advantage of the fact that they have the opportunity to observe the performance of individual trainees; two thirds of trainees end up being hired by the company where they did their practical training. Chambers thus play a critical role as intermediaries among schools, individual employers, government and individual apprentices. Formation of a pool of workers possessing a similar body of industry-specific skill in a given region helps to alleviate the problem of poaching of skilled workers by one firm from another.

The negotiated compromises among the stakeholders in dual TVET distribute the costs and benefits of training across employers, employees and taxpayers. For example, the training allowances paid to apprentices are closely regulated. Trade unions want to protect their members and ensure that apprentices are not used to displace full-time workers. Companies want to recoup the cost of training. Under federal guidelines, therefore, companies and labour unions bargain over the training allowance paid to apprentices, setting it in rough proportion to the value contributed by the apprentice to production each year. The interests of apprentices are protected through training contracts regulated by the chambers. Companies spend approximately 18,000 Euros per year on each apprentice. The total cost of TVET is over 25,000 Euros per year, taking all employers and government expenditures together (about 13.4 billion Euros per year for slightly over a half million apprentices each year). Nationally, then, dual TVET represents an enormous social investment. The Federal Institute for Vocational Training (Bundesinstitut für Berufsausbildung, or BIBB) acts as a kind of 'VET parliament,' where all the major stakeholders are represented – the federal and Land governments, trade unions and employer associations. BIBB develops policy recommendations reflecting the common interests of the stakeholders.

In short, the dual system in Germany – as in the other countries where it is the predominant method for skill development – rests on a series of partnerships among governments at different levels, schools, firms and employer associations, and trade unions (Hoffman 2011; Busemeyer and Schlicht-Schmälzle 2014; Deissinger 2015a). At the national level, a government body such as an education ministry ensures that education meets uniform quality standards. Government delegates to sectoral and regional business associations the responsibility for determining the qualifications required for occupations in their branches of the economy, and the chambers oversee the training and assesssment of competence to ensure that training meets the established standards. Trade unions and enterprise-level works councils represent the interests of trainees and employees. A strong culture of consensus-seeking attentuates frictions and encourages cooperative solutions to conflicts of interest among the social partners (Deissinger 2015a). Complementary social institutions, such as generous social insurance and old-age income schemes, help to guarantee that the costly co-investment in TVET by employers, workers, and taxpayers will pay off in the event of economic downturns

(Busemeyer and Trampusch 2012). The contemporary system, moreover, is rooted in Germany's guild tradition, as well as in the widely felt imperative in postwar society to minimise social conflict for the sake of national economic growth.

In view of the closely interlocking and historically co-evolved institutional complementarities that underpin the dual TVET system in Germany and other similar countries, the question arises of how equivalent partnerships among firms, schools and governments might form in countries lacking such a framework.

3. Building partnerships between employers and schools

As the literature on fiscal federalism has shown, regional decentralisation can encourage local experimentation if economic and political leaders of regional units compete for investment resources or political advancement (Weingast 1995). In countries such as the United States, China and Russia, competitive pressures induce regional actors to devise new institutional arrangements to foster economic development by improving the match between TVET and local labour markets. Where they are established, such arrangements can supply local solutions to the collective dilemmas outlined above. Even in countries where large-scale national programmes to upgrade TVET have fallen short of their goals, local partnerships among firms, schools and governments may succeed.

Examination of such partnerships suggests that they vary along two dimensions – breadth or scope of participation, and depth of commitment on the part of the organisational partners. In 'broad' arrangements, multiple firms cooperate with government to align the common TVET needs of a group of firms in the same industry with the TVET provided by local educational institutions. Multi-firm cooperation in training helps to form a pool of skilled labour from which all firms, large and small, can recruit and allows firms to avoid competing for labour on wages. Broad partnerships can vary as to how costly is the investment made by individual firms and schools. Those that are both broad and deep are sometimes called 'collectivist' or 'solidaristic' (cf Busemeyer and Trampusch 2012; Swenson 2002; Thelen 2004) because they commit multiple firms to contributing to practical training in cooperation with school-based training. This alleviates the problem of underprovision of training out of employers' fear of poaching.

Depth refers to the costliness of the commitment made by firms and schools to cooperation in training. Deep commitments require both sides to make an investment of time, effort and material resources in matching their training efforts that may be recouped only over a long period of time. Firms may supply training equipment to schools, provide hands-on practical training at training centres or on the production floor, provide specialists for instruction at schools, collaborate with schools in revising curricular content and standards, evaluate the proficiency of graduates, and help meld occupational proficiency standards with the curricular requirements set by government education bodies. Deep investment by the schools is also required, as they revise their educational programmes, retrain

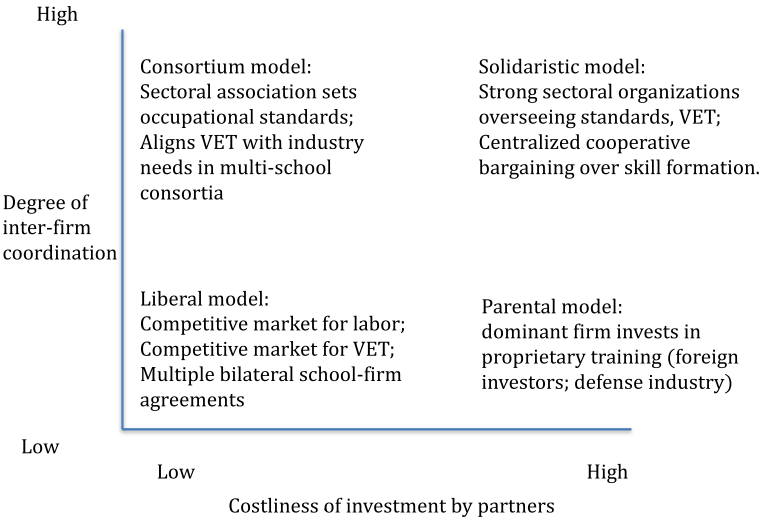

Figure 2. Dimensions of TVET partnerships.

instructors, and place greater emphasis on practical training of students. For many schools, such collaboration with employers forces them to emphasise their role in economic development at the expense of their social responsibilities as schools of last resort for problem students and sources of retraining for laid-off workers.

Plotting the depth and breadth dimensions against each other yields a two-by-two matrix of four ideal types (see Figure 2).[8]

In the upper right quadrant are solidaristic European models of TVET, as found in Germany, Austria, Switzerland, Denmark, Norway, Netherlands and other countries. Solidaristic systems with high commitment on the part of employers, schools, government and society, tend to arise in countries whose economies depend on high value-added exports. Historically, bargaining among centralised associations of employers and trade unions has played out at the national level. As Peter Katzenstein showed, in smaller northern European states that are highly dependent on global exports tend to build institutions to share the gains and costs of maintaining internationally competitve industries across business and labour (Katzenstein 1985). In such systems, intermediary organisations, such as business chambers play a central role in coordinating the interests of individual firms, regional and national government agencies, schools and labour. Intensity of commitment characterises solidaristic models: school curricula and schedules are matched to the workplace-based training that provides opportunities to practice and improve work-related competences. Employers pay for such training both directly and through chambers. Professional standards are aligned with educational standards. Government regulates training as part of labour market regulation, modifying occupational and educational standards in response to the collectively negotiated agreements among the social partners. Solidaristic systems require costly investment by society to TVET.

In the bottom left quadrant of the matrix are 'liberal' systems where there is low cooperation between employers and schools and little coordination among firms over the content and methods of TVET. For the most part, regions in Russia, China and the U.S. fall into this quadrant. Local and regional governments, working through community or technical colleges and high schools, are the principal suppliers of TVET. Firms generally meet their skill needs by hiring from the market or providing in-house training. Consequently, in the U.S., Russia and China, governments seeking a deeper joint investment in TVET on the part of schools and employers must find functional equivalents for the elements that make dual education work in Germany. Thus, looking only at the national level, TVET in the United States tends to be located in the bottom left quadrant, where there is little coordination across firms and only limited joint investment by firms and schools. Few schools provide systematic internship opportunities, and apprenticeships are the exception rather than the rule. Currently in the U.S., only around 400,000 people are participating in registered apprenticeships, out of a workforce of 160.2 million people (Helmer and Conway 2014, 325). The United States certainly has national programmes for enhancing TVET, but these tend not to induce effective partnerships among educational institutions and employers. They are also susceptible to familiar bureaucratic problems of turf competition and fragmentation among different central government agencies over the allocation of money. For example, a Government Accountability Report report in 2011 found that the United States spent $18 billion in 2009 for workforce-oriented training through 47 programmes administered by different departments. The Labour Department administered four for veterans alone, and the VA department yet another veterans' programmes. Four separate programmes administered training funds for American Indians through three different departments. As the GAO report noted, almost none of the 47 programmes had been evaluated as to effectiveness (GAO 2011; Martin 2000).

In some *regions* of the U.S., however, we observe consortial arrangements (i.e. the top left quadrant) linking schools, employers and government authorities. With government encouragement and support, the organisational partners – firms and schools – make relatively modest joint investments of time, effort and material resources into training practices serving the needs of a set of employers. For example, groups of firms representing a particular industry located in a given region agree on the standards required for certification and licencing in their industry, and may offer internships or other forms of workplace-based learning. Coordination occurs through the formation of an organisation such as a sectoral council which then works with a group of local TVET institutions at the secondary and tertiary level to ensure that the TVET curriculum matches the needs of industry for entry-level and mid-skill jobs. In Western Massachusetts, for example, small firms in the nanotechnology and biotechnology fields have formed 'the Massachusetts Advanced Manufacturing Collaborative,' which, among other things, works to align the curriculum of TVET institutions with the needs of member firms as well as to create a pilot apprenticeship programme (Jackson 2015).

Another type of consortium arrangement is found in Greenville County, South Carolina. Here, starting in the 1950s and 1960s, in response to the long-term decline of the agriculture and textile industries, local business and government officials began looking for ways to attract foreign investment in high-skill, high-wage industries. Recognising that tax incentives alone would be inadequate to induce foreign direct investment in manufacturing, civic and business leaders at the local and state level agreed to invest heavily in postsecondary technical education. Greenville Technical College became the motor of the county's economic development strategy. Overseen by a county-appointed board on which the county school district superintendent, the county Workforce and Investment Board, and major individual firms are represented, the Technical College works closely with firms to develop curricula tailored to their needs. But rather than simply provide customised training services to particular firms, the college converts new technical courses into industry-oriented curricula that can serve multiple firms in the same industry. The county and state governments work closely together, so that successful practices at the local level can be scaled up to the state level, while state-level programmes (such as state subsidies to firms that offer apprenticeships) can be adopted locally. The county and state also tap federal workforce development and career-and-technical education funding. The Greenville example is more successful than many, but shares some common characteristics to consortial arrangements found in the U.S. South: trade unions are simply not part of the partnership; the local (publicly funded) community college is the hub of the cooperation among business, government and education; multiple firms cooperate with government for the benefit for economic development in the region; and an intense shared perception of competition with other counties helps fuel cooperation across the local, state and federal levels.[9] A county area development commission is empowered to link business and education as well as to work with prospective foreign investors to ensure that their skill needs will be met. Such a consortial arrangement differs from the solidaristic model in that firms themselves do not provide workplace-based training; they rely on the local authorities to adapt the community college curriculum to meet their needs.

An alternative partnership arrangement is the 'parental' model (the bottom right quadrant of the figure). Here, a single big firm acts as the anchor. If such a firm dominates the local labour market, poaching of skilled workers by other firms recedes as a threat. Usually with the encouragement of local government, local education authorities work with the firm to ensure that the education and training provide not only firm-specific skills, but also more generic skills and knowledge that are transferable to other firms in the industry. In the case of parental relationships, the school depends heavily on its parent firm for material support, such as training equipment, maintenance of facilities, stipends to instructions, practical instruction and employment of their graduates. Note that parental arrangements are found in Germany as well, as when smaller partner firms rely on a larger 'lead' firm (*Leitbetrieb*) to meet training needs for the industry in a given region. The

parent firm thus ensures that the classroom instruction at the school complements the workplace-based learning at the firm.

The United States has parental-type partnerships in a number of regions. A notable example is the P-TECH partnership between IBM, the New York City Education Department, and the City University of New York, to provide knowledge and practical training for mid-skill jobs in fields such as IT.[10] Designed as a six-year programme (grades 9–14), each student participating graduates with both a high school diploma and an associate (i.e. two-year postsecondary) degree in a technical field, such as computers or engineering. Students also have workplace-based learning experiences such as internships offered by partner firms. The success of the initial P-TECH programme in Brooklyn, New York, where IBM was the lead firm, has persuaded the state to replicate it throughout New York State. In Carroll County, Georgia, the large copper wire-and-cable making company Southwire has active apprenticeship programmes with the county schools, which in turn have inspired similar apprenticeship programmes in other regional firms such as the Carroll Electric Cooperative.

Such parental relationships also develop when European manufacturing firms locate plants in the United States. For example, large German firms such as Volkswagen typically seek to replicate the German system of dual education as much as possible when they invest in production facilities outside Europe. As in Germany, VW's model of training is to complement classroom instruction at the technical college with on-the-job training at training centres located at or near the production facility and 'learning stations' and master-instructor supervision on the production floor. These arrangements are quite similar wherever Volkswagen operates assembly plants outside Germany. In the U.S., where Volkswagen has established a large assembly plant in Chattanooga, Tennessee, the firm has a close and deep partnership with the Chattanooga Community College. In Russia, Volkswagen built an assembly plant in Kaluga oblast,' where it works with the Kaluga automotive industry training centre. In China, where Volkswagen has nearly 30 production facilities, it establishes partnerships with local technical colleges. In other countries where Volkswagen has built manufacturing plants, if there is not an adequate technical college available, the company either forms a training facility in collaboration with other automobiile manufacturers or does its training in-house. In every case, Volkswagen seeks an educational partner with which to collaborate in dual TVET as a condition of investment. In all cases, support from the regional governor is a critical condition of success.[11]

In recent years, dual TVET systems have even been adopted as state-wide policy in two states, among them Colorado. Recently Colorado's governor has championed a project called 'Careerwise Colorado' the premise of which is to establish effective apprenticeship programmes throughout every public school district in the state. The apprenticeships are designed as three-year training programmes involving three sites: high schools, training centres at community colleges, and on-the-job training in firms. Following completion of the apprenticeship, an

individual can choose to accept a job immediately or to continue for a two-year or four-year degree (or both). The occupational fields comprise advanced manufacturing, business operations, financial services, health care and information technology. A state-sponsored intermediary serves as the broker between employers, firms, schools and school districts, and individual apprentices. It also provides training for the in-firm trainers.[12] Because the programme is so new and its scale so small (as of June 2017, 116 apprentices and 40 employers were participating), it is still too early to judge results. However, the Colorado experiment indicates a growing interest in dual TVET systems across the United States. Several other states have adopted comparable programmes designed to improve access to TVET and connect students with employers, among them Georgia, Tennessee and South Carolina.[13]

4. The trade-off between broadening and deepening cooperation

Examination of local partnerships fostering dual TVET methods and close firm-school cooperation suggests that they tend to be *either* broad *or* deep; outside the German-speaking countries of Europe it is rare to find both. True solidaristic arrangements are institutionally difficult to achieve. The reason has to do with the classic dilemma firms face over investment in training, the trade-off between cost and control (Anderson and Hassel 2013).[14] A firm can maximise its control over the content of training, or it can minimise the cost of training, but it cannot do both. A firm that cooperates widely with other firms in coordinating the curriculum of TVET in local schools loses some control over content, because the skills taught will be broadly useful to all firms in the sector. On the other hand, a 'parental' firm that establishes a partnership with a particular TVET institution can maximise its control over the content of training, but only by investing deeply in the programme and tailoring it to its own needs by conducting much of the practical training at its own facilities. For this reason, we tend to see either broad or deep partnerships. Only in German-style solidaristic systems, where a number of complementary institutions ensure compliance with the investment of multiple firms in the same industry in TVET, do we see partnerships that are simultaneously broad and deep.

When a large firm dominates a local economy, it may calculate that the benefit of supplying public goods, in the form of training beyond what the firm can itself consume, considerably outweighs the costs. In such cases, the firm itself may take the initiative in proposing new forms of deep cooperation with local TVET institutions, with government serving as guarantor. Because it dominates the local labour market, concerns that other firms will poach labour from it are minor compared with the benefit of ensuring a steady supply of trained workers, recruited from among the most able of those it has trained. When a single firm is lacking, however, and no one firm is willing to pay a disproportionate share of the cost of supplying a pool of skilled labour to the industry, government in cooperation with a regional association or chamber of commerce is likely to persuade

multiple firms in the industry (for example, hospitality, IT, or health care) each to contribute a modest share of its resources to a collective effort to align schooling with the skill needs of the industry. If the regional economy consists of multiple smaller firms, however, government is more likely to work through the schools to create multiple career-oriented educational tracks. In the U.S., a number of states have modified their laws on academic standards for secondary school-leavers to acknowledge the possibility of 'multiple pathways' to graduation. This rule change encourages school boards to create 'career academies' and similar institutions, often in partnership with local two-year and four-year postsecondary schools and universities. In Central Ohio, 15 school districts formed a consortium with Columbus State Community College to create integrated educational tracks in fields such as advanced manufacturing, health care, IT and logistics.[15] A new state curriculum in Miami-Dade County emphasised 'career readiness.' In turn, a national educational policy organisation helped create career academies in four fields (engineering, finance, hospitality and tourism and IT) spanning 24 schools.[16] A new law in Maine permitting alternative pathways to demonstrating proficiency in state-mandated educational standards has allowed the formation of a new charter school emphasising maritime professions (marine science, marine transportation, marine engineering and marine management) (McCrea 2016).

A parental firm receives a number of benefits, notwithstanding the fact that it cannot consume all the benefit of the skill it provides through training. It acquires principal influence in determining the academic programme and acquiring specific information about each student that trains at the firm. This affords it an advantage in selecting and recruiting from among the trainees. Moreover, such firms strongly benefit by reducing adaptation time, i.e. the period during which a newly hired employee acclimates to the production process and work culture of the firm. These benefits lower the cost to the firm of losing employees to rivals. Particularly when the government uses its funding and administrative powers to induce one or more TVET institution to invest jointly with the dominant firm in training programmes where classroom instruction is complemented by on-the-job practical training, such programmes satisfy the needs of the firm while allowing the accumulation of skill on the part of workers who may subsequently depart for jobs elsewhere. The public good here is a by-product of the partnership between the government, the school, and the firm.

However, when multiple firms in multiple sectors compete in the same region for labour, fears of poaching and the small size of firms inhibits deepening of cooperation and favours broad but shallow partnerships. (For smaller firms, training costs represent a much higher share of production costs.) In that case, it is institutionally less costly for government to forge ties across educational institutions than across firms. Therefore, we are likely to see movement vertically along the left axis. Government may encourage sectoral clusters to develop common standards for professional qualifications, and then align educational programmes to meet those standards through career-oriented educational pathways. Firms'

coordination on occupational standards requires less commitment of time, effort and resources than would direct participation in instruction and training, while government can advertise the region's pool of mid- and high-skill labour in fields that it considers important for future economic development.

The three factors cited in the paper's introduction – geographic asymmetries, cross-regional competition in the economic and political arenas, and a permissive institutional environment at the national level – stand out in these examples. In many cases, politically ambitious local leaders seize on opportunities presented by the decline of one set of industries and the availability of resources to attract investment for other industries, building new public–private partnerships for the purpose of upgrading skills and attracting external investment.

In Tennessee, the mayor of Chattanooga, with strong support of local chamber of commerce (acting as quasi-official arm of government for local economic development), and support from state government, provided material and organisational assistance to Volkswagen as inducements for it to build a production facility in Chattanooga, Tennessee. After helping to bring VW to the area, Chattanooga Mayor Bob Corker then ran for Senate on the strength of his success in promoting economic development in Chattanooga. He continued to help Chattanooga through as a senator sitting on the Senate Foreign Relations Committee. In Greenville, South Carolina, successful institutional entrepreneurship helped the career of Ernest (Fritz) Hollings, who as governor played a crucial role in shifting the state's economic development strategy to one emphasising training for high-wage, high-skill jobs. He later went on to serve in the U.S. Senate for nearly 40 years. In both cases, local leaders responded to economic decline by taking advantage of local transportation infrastructure. Chattanooga's economy had suffered from deindustrialisation in the 1960s and 1970s, resulting in high unemployment and high environmental damage. Greenville was experiencing a severe decline in agriculture and textiles, two traditional sources of regional employment. Although leaders in these declining sectors fought to preserve a low-wage, low-tax social system, other business and civic leaders believed investment by foreign industrial firms would bring high-wage jobs to the region. In both cases – Chattanooga and Greenville – the development of the interstate highway system allowed civic leaders to offer outside investors access to modern transportation infrastructure. (So much German investment came in to the western part of South Carolina that Interstate I-85 was nicknamed 'the upstate Autobahn').

Indeed, the incentives for local and regional inititiative mitigate *against* the centralisation of TVET policy. Above I noted that federal efforts in the United States to establish federally funded programmes to link schooling and employment through TVET and apprenticeships have tended to run aground on partisan conflict. Indeed, as Stephen Hamilton observed in a survey of past efforts to create 'school to work' pathways, once the federal 'School to Work Opportunity Act' passed in 1994, 'the legislation swallowed the movement' because it focused the efforts of local educational and business leaders on seeking federal funding rather than mobilising local

resources; it also became a target for conservative opponents of federal involvement in education and labour markets (Hamilton 2017, 33).

These points to a broader lesson about the distinctiveness of the U.S. setting compared with that of Germany or other countries employing the dual system. In view of the strong emphasis in the Varieties of Capitalism literature on the role of partisanship in shaping systems of TVET, it is important to point out that the U.S. cases described here are developed entirely *outside* the realm of left-right contestation (Busemeyer and Schlicht-Schmälzle 2014; Iversen and Soskice 2001). The U.S. South is a particularly vivid case in point. In the south, dual TVET is politically viable precisely *because* of the strongly anti-union climate of the region. In the South, there is no tradition of 'social partnerships' or collective bargaining between organised labour and employer associations. To the contrary, it is precisely the harmonious relations among business, civic, educational and political leaders (which tend to be composed of a politically conservative and socially homogeneous elite) that have enabled a consensus around public investment in institutional partnerships between public and private entities. Interview after interview with policy-makers, educators and employers confirms that the formation of public–private partnerships for improving TVET is well removed from partisan or political competition.

In the traditionally industrialised regions of the country, such as the North-east and the upper Midwest, apprenticeship programmes have historically been the purview of labour unions and have focused almost entirely on the construction trades and manufacturing. However, in recent years, precisely as organised labour's bargaining power has declined, new partnerships among schools, employers, labour unions, and industry associations formed to rebuild and expand apprenticeship programmes in many states. These include variants such as the so-called 'youth apprenticeships' and 'pre-apprenticeships.' Increasingly, the apprenticeship system is being adapted to new occupational fields such as health care and personal services. For example, in Maine – a state with an ageing population – the Funeral Directors Association has a growing apprenticeship programme.[17]

The decentralised nature of American education and business means that the political initiative for the adoption of German-type TVET institutions lies neither in partisan competition nor in corporatist bargaining across capital and labour, but rather in the cross-regional competitive impulses inherent in the U.S. federal system. These include pressures to improve the economic competitiveness of firms and regional labour markets, as well as the political incentives for ambitious politicians to demonstrate their ability to solve problems of economic and social development. Not all regions and towns respond to these incentives, to be sure. They vary in the quality of political leadership and the structure of elite social capital (Safford 2009). This leads to wide variation in the depth, structure and effectiveness of local partnerships. Generally speaking, however, regional innovations establishing public–private partnerships for TVET rely either on deep investment by large individual firms, or through broad consortia of employers and schools with less demanding co-investment on the part of the partners. Nonetheless, particularly

in the latter case, intermediary organisations comprising government, education and employer representatives are invariably present to coordinate the efforts of the three sides.

5. Conclusions

For both firms and schools, joint investment in new types of TVET is institutionally costly. Schools may be reluctant to invest in new partnerships with business since they must adapt their curriculum, change their curriculum, upgrade the quality of instructors, and at the same time satisfy regional and national curriculum standards. Schools note that it is sometimes hard to reconcile national or regional educational requirements with the requirements of an apprenticeship system. For example, some professions recognised by firms (e.g. mechatronics) may not be recognised in the list of professions set by central government, or requirements for a particular diploma may conflict with the time spent in apprenticeships. If schools are rewarded for meeting goals such as increasing the number of diplomas awarded rather than matching their curriculum to needs of the local labour market, schools may regard it as more trouble than it is worth to reorient their curriculum to the needs of industry. Even when they are willing to do so, however, they often lack the production machinery equivalent to that which is used at firms.

Similarly, deep investment in TVET is costly for firms, especially medium- and small-size firms. In the absence of a coordinating body with the capacity to enforce commitments to the partnership agreement, it is hard to establish solidaristic TVET institutions. This can leave a dominant firm in a position to dictate the content of educational programmes, but it weakens the incentive for the school and government to shoulder the burden of implementing dual education more widely. Ultimately, this puts a dominant firm and its supplier firms at a disadvantage because the dominant firm is expected to bear most of the burden of subsidising the costs of financing training for instructors, providing equipment to schools, and creating apprenticeships.

Therefore government's efforts to build new partnerships between TVET institutions and employers tend either to align multiple firms and multiple schools around training in particular regionally advantageous occupational fields, but with little commitment on the part of firms to delivering training; or towards the construction of a system of TVET designed to serve the needs of a particular large firm. In the latter case – the 'parental' model – there are often spillover benefits from the partnership as those who have acquired the education and training take advantage of their industry-specific skills to take jobs elsewhere. Such parental arrangements provide a public good because the benefit to the firm from a well-designed TVET programme outweigh the risk of losing some skilled workers.

Government plays an essential role in all of these partnership arrangements. Government underwrites agreements between firms and schools (or industrial associations and consortia of schools). In the U.S., state governments have primary

responsibility for funding secondary and tertiary TVET, so therefore can orient the schools to meet governmental economic and social policy objectives. At the same time, government can create favourable conditions to recruit or retain industry, not only by promising attractive tax regimes, but also by ensuring that TVET programmes will provide industry with a pool of well-trained labour. Government often enters partnership contracts as a third party. Government is motivated to the extent that government officials believe that they can take advantage of opportunity, in a politically competitive environment, by mobilising available administrative and social resources.

Government plays the critical role of intermediary in some cases; in others, government works through sectoral associations or community colleges. In the United States, a number of organisations may serve as intermediaries; these may include a local Chamber of Commerce, a Workforce Development Board, a community college, or a mayor's office. Generally speaking, intermediary bodies more often form through the adaptation of existing organisational resources than by being created ex nihilo. Whatever body plays the role of intermediary organisation, its effectiveness depends upon its ability to enforce commitment to the partnership. Dual TVET is an institutionally demanding system, requiring sustainable institutional solutions to multiple collective dilemmas. The deeper and broader the partnership, and the more that the partners must devote real time, effort, and material resources to it, the greater must be the monitoring and enforcement capacity of the intermediary.

Luiz Carlos Bresser-Pereira, a Brazilian social scientist and former government minister, once observed that 'institutions can at most be imported, never exported.' (Quoted in Przeworski 2004, 540). Although countries such as the United States, Russia and China are unlikely to be able to import the German-style dual system for TVET whole cloth, because it is so deeply intertwined with the fabric of German history, society, and polity, they can certainly adapt elements of it to their own environments by creating institutional arrangements that take advantage of local and regional social networks, physical and human capital assets, and pressures for economic and political competition.

Notes

1. On Russia's effort to adopt German-based dual education methods in TVET, see Agentstvo Strategicheskikh Initsiativ (ASI) 2014, 2015, 2016; Remington 2017; Remington and Marques 2014.

   On efforts in China to improve the effectiveness of TVET, including through the adoption of German-style dual education methods, see Benner, Zhengtao, and Tao 2017; Loyalka et al. 2015; Bünning et al. 2011; Barabasch, Huang, and Lawson 2009; Pilz and Li 2014; Wu 2009; Stewart 2015; Li Jun 2015; Cooke 2005; Pilz and Li 2014; Rauner and Zhao 2009; Shi 2012).

   On studies of apprenticeship and other programmes intended to link training and employment in the United States, see below.

2. Likewise President Donald Trump declared his support for large-scale federal support for apprenticeships, issuing an executive order to this effect in June 2017. However, the increased funding was to come by diverting spending from other federal training programmes and would remove some of the authority over training programmes exercised by the Department of Labour. The initiative was to be overseen by the president's daughter, Ivanka. At the time of writing, legislation establishing and funding the initiative has not been enacted.
3. The term 'soft skills' is often used but loosely defined. See Deming 2017 for a rigorous examination of what the term means and how soft skills interact with 'hard skills.'
4. Dual TVET is characteristic of a number of German-speaking countries and countries with a similar heritage of apprenticeship-based training, such as Austria, Switzerland, Denmark, and Netherlands, as well as Germany. Organisational details vary somewhat across countries. Rather than generalising broadly, I will concentrate on the German system.
5. There is a sizable scholarly literature on the German apprenticeship system. Recent accounts include Anderson and Hassel 2013; Busemeyer and Schlicht-Schmälzle 2014; Deissinger 2015a, 2015b; Deissinger and Hellwig 2005; Ebner 2015; Kuhlee 2015; Pilz 2007, 2012; Rauner and Maclean 2008; Thelen 2004; Thelen and Busemeyer 2012. In addition to the secondary literature, I have consulted materials published by the German Office for International Cooperation in Vocational Education and Training (GOVET) which contain useful basic statistical information [https://wwwbibbde/govet/en/54878php]. I also rely on interviews with officials and experts in Germany at the Bundestinstitut für Berufsausbildung (BIBB), the Gesellschaft for Internationale Zusammenarbeit (GIZ), and Volkswagen company officials in Wolfsburg, Chattanooga, Kaluga and Beijing I benefited as well from a conference on 'Work-Based Learning as a Pathway to Competence-Based Education,' sponsored by BIBB and UNEVOC, Bonn, Germany, June 22–23, 2017
6. Both economic pressure and the influence of EU educational harmonisation are placing pressure on the German system towards greater 'modularisation' of training (i.e. differentiating specific skills sets and the training curricula associated with them) as well as towards more two-year apprenticeships rather than the traditional 3+ year terms. One result is to reinforce the dualism between workers with high-skill, high-wage jobs and those with lower levels of training performing lower-paide jobs. On these trends, see Thelen and Busemeyer 2012, Deissinger 2015b, and Rauner 2008.
7. The government's funding is split between direct support for schools – representing about 54% of the total – and oversight and administration of the system.
8. Note that this typology is related to but differs somewhat from the matrix proposed by Busemeyer and Trampusch (2012), which makes the level of government involvement one of the two axes. Here the focus is on the scope of cooperation among schools and employers in relation to the costliness of the resources (time, organisation, material) invested by the partners in the cooperation.
9. This summary is based on collaborative research with Richard Doner, Michael Rich, and Crawford Schneider.
10. http://www.jff.org/initiatives/pathways-prosperity-network/new-york.
11. Based on interviews with Volkswagen representatives, government officials, and experts in Chattanooga, Kaluga, Changchun, Beijing, and Wolfsburg.
12. Information from presentation by Ashley Carter, Chief Strategy Office of Careerwise Colorado, at the Fall 2017 Pathways to Prosperity Network Institute, Cambridge, Massachusetts, October 24–25, 2017.

13. For example, the state government of South Carolina provides a tax exemption to every employer that hires an apprentice. As a result, the number of apprenticeships in the state has expanded rapidly. [http://www.apprenticeshipcarolina.com/].
14. Mares 2003 discusses the equivalent trade-off in firm choices over social insurance schemes.
15. http://www.jff.org/initiatives/pathways-prosperity-network/ohio.
16. http://dcte.dadeschools.net/community.html.
17. http://www.maine.gov/labour/publications/MAP%202016%20Annual%20Report%20-030617%20FINAL.pdf.

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References

Acemoglu, Daron. 1997. "Training and Innovation in an Imperfect Labour Market." *The Review of Economic Studies* 64: 445–464.

Acemoglu, Daron, and Jorn-Steffen Pischke. February 1998. "Why Do Firms Train? Theory and Evidence." *The Quarterly Journal of Economics* 113 (1): 79–119.

Acemoglu, Daron, and Jorn-Steffen Pischke. 1999. "The Structure of Wages and Investment in General Training." *Journal of Political Economy* 107 (3): 539–572.

Agentstvo Strategicheskikh Initsiativ (ASI). 2014. *Sistemnyi Proekt 'Podgotovka Rabochikh Kadrov, Sootvetstvuyushchikh Trebovaniyam Vysokotekhnologichnykh Otraslei Promyshlennosti, Na Osnove Dual'nogo Obrazovaniya'* [Systemic Plan 'Training Workers according to the Requirements of High-Tech Sectors of Industry on the Basis of Dual Education]. Moscow: Russian Federation.

Agentstvo Strategicheskikh Initsiativ (ASI). 2015. *Metodicheskie Rekomendatsii Po Realizatsii Dual'noi Modeli Podgotovki Vysokokvalifitsirovannykh Rabochikh Kadrov* [Methodological Recommendations for the Realization of the Dual Model of Training of High-Skill Worker Personnel]. Moscow: Russian Federation.

Agentstvo Strategicheskikh Initsiativ (ASI). 2016. *Metodicheskie Rekomendatsii Po Realizatsii Dual'noi Modeli Podgotovki Vysokokvalifitsirovannykh Rabochikh Kadrov, Versiia 2.0*. Moscow: Russian Federation.

Anderson, Karen M. and Anke Hassel. 2013. "Pathways of Change in CME's: Training Regimes in Germany and the Netherlands." In *The Political Economy of the Service Transition*, edited by Anne Wren, 171–194. New York: Oxford University Press.

Barabasch, Antje, Sui Huang, and Robert Lawson. 2009. "Planned Policy Transfer: The Impact of the German Model on Chinese Vocational Education." *Compare: A Journal of Comparative and International Education* 39 (1): 5–20.

Benner, Dietrich, Li Zhengtao, and Peng Tao. 2017. "Empirical Education Research on the German Vision and German Experience." *Journal of the East China Normal University, Educational Sciences* (3): 59–63. (Jiaoyu shizheng yanjiu de'deguo shiye'yu'deguo jingyan'). [In Chinese]. doi:10.16382/j.cnki.1000-5560.2017.03.017[http://eng.oversea.cnki.net.ezp-prod1.hul.harvard.edu/kcms/detail/detail.aspx?filename=HDXK201703017&DBName=cjfqtotal&dbcode=cjfq&uid=WEEvREcwSlJHSldRa1Fhb09jMjVzQmVUUDJyb25LTFpRV0xhSVpHT0VoOD0=$9A4hF_YAuvQ5obgVAqNKPCYcEjKensW4ggI8Fm4gTkoUKaID8j8gFw!!]

Bünning, Frank, Kai Gleißner, Mi Jing, and Sun Yang. 2011. "Initiatives to Foster Chinese TVET and TVET Teacher Training." GIZ (Deutsche Geselleschaft Für Internationale Zusammenarbeit (GIZ).

Busemeyer, Marius R., and Christine Trampusch. 2012. "The Comparative Political Economy of Collective Skill Formation." In *The Political Economy of Collective Skill Formation*, edited by Marius R. Busemeyer and Christine Trampusch, 3–46. New York, NY: Oxford University Press.

Busemeyer, M. R., and R. Schlicht-Schmälzle. 2014. "Partisan Power, Economic Coordination and Variations in Vocational Training Systems in Europe." *European Journal of Industrial Relations* 20 (1): 55–71.

Capelli, Peter. August 2014. "Skill Gaps, Skill Shortages and Skill Mismatches: Evidence for the US." NBER Working Paper 20382. http://www.nber.org/papers/w20382.

Carnevale, Anthony P., Jeff Strohl, and Neil Ridley. 2017. "Good Jobs That Pay without a BA: A State-by-State Analysis." Georgetown University Center on Education and the Workforce, November 13. https://goodjobsdata.org/resources/

Chetty, Raj and Nathaniel Hendren. December 2016. "The Impacts of Neighborhoods on Intergenerational Mobility I: Childhood Exposure Effects." https://scholar.harvard.edu/hendren/publications/impacts-neighborhoods-intergenerational-mobility-i-childhood-exposure-effects.

Chetty, Raj and Nathaniel Hendren. December 2016. "The Impacts of Neighborhoods on Intergenerational Mobility II: County-Level Estimates." https://scholar.harvard.edu/files/hendren/files/movers_paper2_vinterim.pdf.

Chetty, Raj, Nathaniel Hendren, Patrick Kline, and Emmanuel Saez. 2014. "Where is the Land of Opportunity? The Geography of Intergenerational Mobility in the United States." *The Quarterly Journal of Economics* 129 (4): 1553–1623.

Chetty, Raj, Nathaniel Hendren, and Lawrence F. Katz. 2016. "The Effects of Exposure to Better Neighborhoods on Children: New Evidence from the Moving to Opportunity Experiment." *American Economic Review* 106 (4): 855–902.

Chetty, Raj, David Grusky, Maximilian Hell, Nathaniel Hendren, Robert Manduca, and Jimmy Narang. 2017. "The Fading American Dream: Trends in Absolute Income Mobility since 1940." *Science* 356 (6336): 398–406.

Cooke, Fang Lee. 2005. "Vocational and Enterprise Training in China: Policy, Practice and Prospect." *Journal of the Asia Pacific Economy* 10 (1): 26–55.

Deissinger, T. 2015a. "The German Dual Vocational Education and Training System as 'Good Practice'?" *Local Economy* 30 (5): 557–567.

Deissinger, T. 2015b. "International Education Policy: Its Influence on the Conception of VET and the VET System in Germany." *Research in Comparative and International Education* 10 (4): 607–621.

Deissinger, Thomas and Silke Hellwig. 2005. "Apprenticeships in Germany: Modernising the Dual System." *Education + Training* 47 (4/5): 312–324.

Deloitte and Manufacturing Institute. 2015. "The Skills Gap in U.S. Manufacturing: 2015 and beyond". http://www.themanufacturinginstitute.org/~/media/827DBC76533942679A15EF7067A704CD.ashx.

Deming, David J. 2017. "the Growing Importance of Social Skills in the Labor Market." *The Quarterly Journal of Economics* 132 (4): 1593–1640.

Doner, Richard F. and Ben Ross Schneider. 2016. "The Middle Income Trap: More Politics than Economics." *World Politics* 68 (04): 608–644.

Ebner, C. 2015. "Labour Market Developments and their Significance for VET in Germany: An Overview." *Research in Comparative and International Education* 10 (4): 576–592.

Estevez-Abe, Margarita, Torben Iversen and David Soskice. 2001. "Social Protection and the Formation of Skills: A Reinterpretation of the Welfare State." In Peter A. Hall and David Soskice. *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*, 145–183. New York, NY: Oxford University Press.

Fryer, Jr. Roland G., and Lawrence F. Katz. 2013. "Achieving Escape Velocity: Neighborhood and School Interventions to Reduce Persistent Inequality." *American Economic Review* 103 (2): 232–237.

Fuller, Joseph, Jennifer Burrowes, Manjari Raman, Dan Restuccia, and Alexis Young. 2014. *Bridge the Gap: Rebuilding America's Middle Skills*. Harvard Business School; Accenture; Burning Glass Technologies. http://www.hbs.edu/competitiveness/Documents/bridge-the-gap.pdf.

GAO (Government Accountability Office). January 2011. "Multiple Employment and Training Programs." (GAO 11-92).

GOVET. July 2014. "Dual TVET." *BIBB*. https://www.bibb.de/dokumente/pdf/govet_presentation_on_dual_vet_en.pdf.

GOVET (German Office for International Cooperation in Vocational Education and Training). n.d. "The Engine of Dual TVET." *BIBB*. https://www.bibb.de/dokumente/pdf/Motor_der_Dualen_Berufsbildung_EN.pdf.

Greenstone, Michael and Adam Looney. November 2011. "Building America's Job Skills with Effective Workforce Programs: A Training Strategy to Raise Wages and Increase Work Opportunities." The Hamilton Project, Brookings Institution. http://www.hamiltonproject.org/papers/building_americas_job_skills_with_effective_workforce_programs_a_train/.

Guvenen, Fatih, Greg Kaplan, Jae Song, Justin Weidner. April 2017. "Lifetime Incomes in the United States over Six Decades." NBER Working Paper series, WP 23371.

Halperin, Samuel. 1988. "The Forgotten Half: Pathways to Success for America's Youth and Young Families." American Youth Policy Forum. http://www.aypf.org/wp-content/uploads/2014/12/The-Forgotten-Half-Optimized.pdf.

Hamilton, Stephen F. 1999. "Germany and the United States in Comparative Perspective." *International Journal of Sociology* 29 (1): 3–20.

Hamilton, Stephen F. August 2017. *School-to-Work and Career Pathways: Lessons Learned and to Be Learned*. Ithaca, NY: Cornell University.

Hamilton, Mary Agnes and Stephen F. Hamilton. April 1997. *Learning Well at Work: Choices for Quality*. Ithaca, NY: Cornell Youth and Work Program, School to Work Opportunities.

Helmer, Matt and Maureen Conway. 2014. "Workforce Intermediaries and the Apprenticeship System: Lessons and Implications from the Construction Industry." In *Connecting People to Work: Workforce Intermediaries and Sector Strategies*, edited by Maureen Conway and Robert P. Giloth, 325. New York, NY: Aspen Institute.

Hoffman, Nancy. 2011. *Schooling in the Workplace: How Six of the World's Best Vocational Education Systems Prepare Young People for Jobs and Life*. Cambridge: Harvard Education Press.

Hoffman, Nancy, and Robert Schwartz. 2015. *Gold Standard: The Swiss Vocational Education and Training System*. International Comparative Study of Vocational Education Systems. Washington, DC: National Center on Education and the Economy.

Hoffman, Nancy, and Robert B. Schwartz. 2017. *Learning for Careers: The Pathways to Prosperity Network*. Cambridge: Harvard Education Press.

Holzer, Harry. 2015. *Job Polarization and U.S. Worker Skills: A Tale of Two Middles*. Washington, DC: Brookings Institution.

Holzer, Harry. 2017. "The Role of Skills and Jobs in Transforming Communities." *Cityscape: A Journal of Policy Development and Research* 19: 1.

Iversen, Torben, and David Soskice. December 2001. "An Asset Theory of Social Policy Preferences." *American Political Science Review* 95 (4): 875–893.

Jackson, Sheila. February 2015. "A New Era of Alignment in Massachusetts' Advanced Manufacturing Industry." *Pathways to Prosperity Network*. http://www.jff.org/publications/new-era-alignment-massachusetts-advanced-manufacturing-industry.

Katzenstein, Peter. 1985. *Small States in World Markets: Industrial Policy in Europe*. Ithaca, NY: Cornell University Press.

Kuhlee, D. 2015. "Federalism and Corporatism: On the Approaches of Policy-Making and Governance in the Dual Apprenticeship System in Germany and Their Functioning Today." *Research in Comparative and International Education* 10 (4): 476–492.

Lerman, Robert I. 2013. "Are Employability Skills Learned in U.S. Youth Education and Training Programs?" *IZA Journal of Labor Policy* 2 (6): 3–20.

Lerman, Robert I. 2016. "Can We Develop Enough Skills for a Robust Manufacturing Industry?." *Challenge* 59 (3): 157–177.

Li Jun. March 2015. "Wo guo qi ye can yu zhi ye jiao yu de kun jing ji qi tu po – ji yu gong gong xuan ze li lun yu lao dong jing ji xue de fen xi [Predicaments and Breakthroughs in the Participation of Chinese Enterprises in Vocational Education: An Analysis Based on Public Choice Theory and Labor Economics." *Research in Educational Development*. 52–58. [in Chinese]. http://en.cnki.com.cn/Article_en/CJFDTOTAL-SHGJ201503013.htm.

Loyalka, Prashant, Xiaoting Huang, Linxiu Zhang, Jianguo Wei, Hongmei Yi, Yingquan Song, Yaojiang Shi, and James Chu. 2015. "The Impact of Vocational Schooling on Human Capital Development in Developing Countries: Evidence from China." *The World Bank Economic Review* 30 (1): 143–170.

Mares, Isabela. 2003. *The Politics of Social Risk: Business and Welfare State Development*. New York, NY: Cambridge University Press.

Martin, Cathie Jo. 2000. *Stuck in Neutral: Business and the Politics of Human Capital Investment Policy*. Princeton, NJ: Princeton University Press.

McCrea, Nick, "The State's First High School for Future Sailors is Getting Closer to Opening." *Bangor Daily News,* November 3, 2016. https://www.highbeam.com/doc/1P2-40197296.html.

McGowan, Adalet, M. and D. Andrews. 2015. *Labour Market Mismatch and Labour Productivity: Evidence from PIAAC Data*. OECD Economics Department Working Papers, No. 1209. Paris: OECD Publishing. https://doi.org/10.1787/5js1pzx1r2 kb-en.

National Medium and Long Term Education Reform and Development Plan (2010-2020). "Decision on the Acceleration of Modern Vocational Training." http://www.gov.cn/jrzg/2010-07/29/content_1667143.htm.

New York Federal Reserve. "The Labor Market for Recent College Graduates." https://www.newyorkfed.org/research/college-labor-market/college-labor-market_underemployment_rates.html.

Newman, Katherine S. and Hella Winston. 2016. *Reskilling America: Learning to Labor in the Twenty-First Century*. New York, NY: Metropolitan Books.

OECD. 2010. *Learning for Jobs (Synthesis Report of the OECD Reviews of Vocational Education and Training)*. Paris: OECD.

OECD. 2013. *OECD Skills Outlook 2013: First Results from the Survey of Adult Skills*. OECD Publishing. https://doi.org/10.1787/9789264204256-en.

OECD. 2016. *Getting Skills Right: Assessing and Anticipating Changing Skill Needs*. Paris: OECD Publishing. https://doi.org/10.1787/9789264252073-en.

Pilz, M. 2007. "Two Countries – One System of Vocational Education? A Comparison of the Apprenticeship Reform in the Commercial Sector in Switzerland and Germany." *Compare: A Journal of Comparative and International Education* 37 (1): 69–87.

Pilz, M. 2012. *The Future of Vocational Education and Training in a Changing World*. Wiesbaden: Springer VS.

Pilz, Matthias, and Junmin Li. 2014. "Tracing Teutonic Footprints in VET around the World? The Skills Development Strategies of German Companies in the USA, China and India." *European Journal of Training and Development* 38 (8): 745–763.

Przeworski, Adam. 2004. "Institutions Matter?" *Government and Opposition* 39 (4) (Autumn 2004): 527–540.

Putnam, Robert D.. 2016. *The American Dream in Crisis*. New York: Simon & Schuster.

Rauner, Felix. 2008. "European Vocational Education and Training: A Prerequisite for Mobility?" *Journal of European Industrial Training* 32 (2/3): 85–98.

Rauner, Felix, ed. 2009. *Steuerung der beruflichen Bildung im internationalen Vergleich*. Gütersloh: Bertelsmann.

Rauner, Felix and Rupert Maclean. 2008. "Vocational Education and Training Research-an Introduction." In *Handbook of Vocational and Technical Education and Training Research*, edited by Felix Rauner and Rupert Maclean, 13–23. Netherlands: Springer.

Rauner, Felix and Zhiqun Zhao. 2009. "Berufsbildung in China." ch. 8. In *Steuerung Der Beruflichen Bildung Im Internationalen Vergleich*, edited by Felix Rauner. Gütersloh: Bertelsmann.

Reardon, Sean F. 2011. "The Widening Academic Achievement Gap between the Rich and the Poor: New Evidence and Possible Explanations." In *Whither Opportunity: Rising Inequality, Schools, and Children's Life Chances*, edited by Greg J. Duncan and Richard J. Murnane, 91–115. New York, NY: Russell Sage Foundation; Chicago, Spencer Foundation.

Remington, Thomas F. 2017. "Business-Government Cooperation in VET: A Russian Experiment with Dual Education." *Post-Soviet Affairs* 33 (4): 313–333.

Remington, Thomas F. and Israel Marques. *The Reform of Skill Formation in Russia: Regional Responses*. Working Paper, Series: Political Science, WP BRP 19/PS/2014. Moscow: Higher School of Economics 2014.

Rochlitz, Michael, Vera Kulpina, Thomas F. Remington, and Andrei Yakovlev. 2015. "Performance Incentives and Economic Growth: Regional Officials in Russia and China." *Eurasian Geography and Economics* 56 (4): 421–445.

Safford, Sean. 2009. *Why the Garden Club Couldn't save Youngstown: The Transformation of the Rust Belt*. Cambridge: Harvard University Press.

Schwartz, Robert B. 2016. "The Career Pathways Movement: A Promising Strategy for Increasing Opportunity and Mobility." *Journal of Social Issues* 72 (4): 740–759.

Shapiro, Robert. 2018. "The New Economics of Jobs is Bad News for Working-Class Americans – And Maybe for Trump." Brookings Institution, January 16. https://www.brookings.edu/blog/fixgov/2018/01/16/the-new-economics-of-jobs-is-bad-news-for-working-class-americans-and-maybe-for-trump/.

Shi, Weiping. 2012. "Development of TVET in China: Issues and Challenges." In *The Future of Vocational Education and Training in a Changing World*, edited by Matthias Pilz, 85–95. Wiesbaden: Springer.

Stern, David. 2015. Pathways or Pipelines: Keeping High School Students' Future Options Open While Developing Technical Skills and Knowledge. *Background Paper for the Committee on the Supply Chain for Middle-Skill Jobs: Education, Training, and Certification Pathways*. August 29.

Stewart, Vivien. January 2015. "Made in China: Challenge and Innovation in China's Vocational Education and Training System: International Comparative Study of Vocational Education Systems." Washington, DC: Center on International Education Benchmaking (of the National Center on Education and the Economy.

Swenson, Peter A. 2002. *Capitalists against Markets: The Making of Labor Markets and Welfare States in the United States and Sweden*. New York, NY: Oxford University Press.

Symonds, William C., Robert B. Schwartz, and Ronald Ferguson. February 2011. *Pathways to Prosperity: Meeting the Challenge of Preparing Young Americans for the 21st Century*. Report issued by the Pathways to Prosperity Project, Harvard Graduate School of Education.

Thelen, Kathleen. 2004. *How Institutions Evolve: The Political Economy of Skills in Germany, Britain, the United States, and Japan*. Cambridge: Cambridge University Press.

Thelen, Kathleen and Marius R. Busemeyer. 2012. "Institutional Change in German Vocational Training: From Collectivism toward Segmentalism." In *The Political Economy of Collective Skill Formation*, edited by Marius R. Busemeyer and Christine Trampusch, 68–91. Oxford UP.

Weingast, Barry R. April, 1995. "The Economic Role of Political Institutions: Market-Preserving Federalism and Economic Development." *Journal of Law, Economics, & Organization* 11 (1): 1–31.

Wright, Joshua. March 7, 2013. "America's Skilled Trades Dilemma: Shortages Loom as Most-in–Demand Group of Workers Ages." *Forbes*. https://www.forbes.com/sites/emsi/2013/03/07/americas-skilled-trades-dilemma-shortages-loom-as-most-in-demand-group-of-workers-ages/#28d515186397.

Wu Quanquan. October 2009. "Linkages between Vocational Education and Industry in China – The Current Environment." In Linking Vocational Training with the Enterprises – Asian Perspectives (German Federal Mininstry for Economic Cooperation and Development; UNEVOC; INWent), edited by Chana Kasipar, et al., 69–76. Accessed May 14, 2017. http://www.unevoc.unesco.org/up/Link_Voc_End.pdf.