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How do companies adjust their organization to national institutions: evidence from matched-pair engineering companies

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How do companies adjust their organization to national institutions: evidence from matched-pair engineering companies

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Abstract

Companies face competitive advantages or disadvantages depending on a country's national institutional setting. The question is whether and how companies with highly similar product markets and technologies are able to stay competitive if they are located in disadvantaged national institutional settings. Building on the Varieties of Capitalism approach, we analyze the effect of different national institutional settings on one important characteristic of a company's organizational structure, the span of control of production supervisors. Through plant interviews, we generated a unique dataset of matched-pair engineering companies in Germany, Switzerland, the UK, and the U.S. The findings indicate that the span of control is an important mechanism of adjustment to national institutional settings. Production supervisors in companies producing in coherently coordinated market economy like Germany have on average a broader span of control than those in coherently liberal market economy like the U.S. However, in mixed institutional settings like Switzerland and the UK, we find companies with a broad and companies with a narrow span of control, thus indicating that companies have the strategic power to adjust with their own company-level institutions to either complementing or substituting national institutions.

Key Words: Varieties of Capitalism, organizational structure, matched-pair study, QCA

JEL Classification: L23, L64, J50, I20

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INTRODUCTION

Several studies in business and political economy argue that a country's national institutional setting creates competitive advantages for particular industries (e.g., Whitley, 2007; Amable, 2003; Hall & Soskice, 2001; Lundvall, 1992; Porter, 1990). Therefore, companies in different countries are expected to concentrate on different (sub-)sectors for which the particular national institutional setting is advantageous. In the UK or the U.S., for example, companies should focus on chemicals and the development of pharmaceuticals; in Germany companies should focus on metals, machinery, and platform enabling technologies (Akkermans, Castaldi & Los, 2009; Casper & Whitley, 2004).

However, in reality companies are not perfectly sorted according to national institutional setting. We find large, research-intensive pharmaceutical companies in Germany (e.g., Bayer) and successful manufacturing companies producing turbines and machinery in the U.S. (e.g., General Electric). Therefore, the question arises how companies that produce highly similar products and compete in the same (global) product markets adjust organizationally to *different and possibly less favorable* national institutional settings to still stay competitive.

Previous comparative literature already indicated that the span of control (number of employees per supervisor) is an important mechanism of companies to adjust to the national institutional setting (Mason, 2000; Finegold & Wagner, 1998; Maurice, Sellier & Silvestre, 1986). Despite these valuable contributions, we still have an incomplete understanding of firstly, how companies adjust to more or less favorable and coherent national institutional settings and secondly, whether companies have a strategic choice in terms of shaping their *company-level* institutional setting with which they could complement or substitute national-level institutions.

We examine these questions by theoretically analyzing how companies adjust themselves to different national institutional settings via their span of control. We argue that companies have a broad span of control when three functions are fulfilled: skill foundation, skill retention, and trust between the management and employees. National institutions can provide these three functions; however, companies can also substitute national institutions with their own, functionally equivalent company-level institutions. We, therefore, derive hypotheses about potential configurations of both national- and company-level institutions associated with different spans of control and test these hypotheses empirically with production plant data gathered through interviews in matched-pair engineering companies in Germany, Switzerland, the UK, and the U.S. We chose this set of countries to include a

coherently liberal and a coherently coordinated market economy (the U.S. and Germany) according to the Varieties of Capitalism approach (Hall & Soskice, 2001) and two mixed countries that combine liberal and coordinated features to different extents (the UK and Switzerland).

Consistent with previous literature, we do find that matched-pair engineering companies differ substantially in their span of control of production supervisors, thus adjusting to the national-level institutional variables. However, only in coherently coordinated and coherently liberal market economy (Germany and the U.S.) all companies are of the same type of span of control. There is a consistent cluster of companies with a broad span of control in the coherently coordinated market economy and a consistent cluster of narrow span of control in the coherently liberal market economy. In the mixed countries (the UK and Switzerland), we find companies that have a broad and companies that have a narrow span of control.

By measuring the functionally equivalent institutions at the company level, we find that the institutional setting at the company level differ from the national institutional setting at the country level, thus explaining the different within-country results. Using the fuzzy-set qualitative comparative analysis (fsQCA, Ragin, 2000, 2008), we show that the three functions skill foundation, skill retention, and trust are indeed all necessary conditions for a broad span of control and can be ensured by the company-level institutions high-quality vocational training, strong internal labor markets, and employee representations.

The paper contributes to the existing literature in three ways. First, we provide answers to the question of how companies adjust to national institutional settings if these settings are not coherently favorable to their industry. To define whether an institutional setting is coherent and favorable, we use the VoC approach, thus taking into account Redding's call for a "thick description" (Redding, 2005: 123) of institutions by providing a broad institutional view with a simultaneous analysis of several institutional variables (Jackson & Deeg, 2008). Second, we provide further evidence for the institutional diversity that is hidden beneath the macro-institutional evidence (Schneider, Schulze-Bentrop & Paunescu, 2010). To explore this institutional diversity, we analyze institutional configurations at two levels, the national and the company level. Third, we show how companies react with their company-level institutional setting and their span of control to their national institutional setting. This direct link between institutions and organizational outcomes is a major contribution as previous national-level analyses have been criticized of not being able to show that direct relationship (Allen, 2004).

THEORY AND HYPOTHESES

As shown by a large literature, national institutional settings generate industry-specific competitive advantages (Whitley, 2007; Amable, 2003; Hall & Soskice, 2001; Lundvall, 1992; Porter, 1990). Our theorization is based on the Varieties of Capitalism approach (VoC, Hall & Soskice, 2001) one of the most influential approaches in this context and “state of the art of institutional analysis” (Howell, 2003). The VoC approach categorizes economies according to their institutions on a continuum between the two polar forms of coordinated and liberal market economies, with the U.S. and Germany as the most coherent examples.

Companies in coherently coordinated market economies (CMEs) such as Germany are embedded in a network of mediating institutions. CMEs are characterized by cooperative industrial relations systems within companies, strong collective bargaining across companies, strict employment protection, nationally regulated and high-quality vocational education and training (VET) systems, a high investment in vocational (rather than university) training, and financial systems that allow for long-term investment horizons for companies (Hall & Soskice, 2001: 21ff). As employees have a high level of vocational skills, acquire firm-specific knowledge, and are involved in planning and troubleshooting, coherent CMEs provide competitive advantages for industries that are based on incremental innovation such as mechanical engineering (Hall & Soskice, 2001: 39ff).

Companies in coherently liberal market economies (LMEs) such as the U.S. rely on institutions such as markets and hierarchies. LME configurations are the reverse of the CME model: little cooperation within companies but strong management power, no (or, at most, company-based) collective bargaining, deregulated labor markets with weak employment protection, high (individual) investment in university training, and high stock market capitalization (Hall & Soskice, 2001: 27ff). Coherent LMEs provide competitive advantages for industries that rely on radical product innovations such as biotechnology and telecommunication, as companies can dismiss labor and close plants quickly and easily shift capital from one industry to another to invest in risky but potentially lucrative R&D projects in high-tech industries. The high percentage of university graduates provides a suitable workforce for these types of industries (Hall & Soskice, 2001: 40ff).

Empirical studies examine the VoC typology at the country level, either by clustering economies according to their institutional dimension (e.g. Schneider & Paunescu, 2012) or by using QCA methods (e.g. Kogut & Ragin, 2006) and links the VoC typology to the (innovation) success, mostly at the country- or industry-level (e.g., Schneider, Schulze-Bentrop & Paunescu, 2010; Akkermans et al., 2009; Hall & Gingerich, 2009; Casper &

Whitley, 2004). However, most of these studies have neglected how *companies* with the *same* products can exist in *different* institutional settings.

Some studies on matched-pair companies have taken this aspect into consideration and identified the span of control as possible mechanism of organizational adjustment. As technology does not fully determine a company's organizational structure (with span of control being one important aspect), Maurice, Sellier, and Silvestre (1986) argue that national training and educational systems play an important role because they influence the qualification level of the workforce and thereby the need for closer or looser supervision. The higher and broader the qualification level of the workforce is ("professionalization"), the less supervisory input will be required (Maurice, Sorge & Warner, 1980; Maurice, Sellier & Silvestre, 1986). Consistent with Maurice, Sorge and Warner's results, Mason (2000) shows that German supervisors have a broader span of control than their counterparts in the UK and the U.S. (see also Finegold & Wagner, 1998). However, a differentiated analysis of the influence of institutional settings on the span of control still needs to be addressed. The country classifications of the VoC in terms of more or less coherent and favorable institutional settings provide the theoretical background suitable for the analysis.

Moreover, the company-level institutional perspective needs to be considered in greater detail. Companies may have strategic leeway to adjust to the national institutional setting either via their span of control or with the shape of their company-level, functionally equivalent institutions. Backes-Gellner (1996), for example, finds in her comparative study of matched-pair companies in four countries and four industries that different but functionally equivalent training strategies exist at the company level, thus ensuring the same company-level stock of qualifications, which allows companies to produce similar products despite very different national institutional settings.

We argue that a focus on the company-level institutional setting is of special importance in hybrid national institutional settings because successful companies might need coherent institutions, be they at the national or at the company level. Coherence means that all institutions fit together (e.g., all are coordinated) and thus generate complementarities. Complementarity in this context means that the "functioning of one depends on and enhances the functioning of others" (Campbell & Pedersen, 2007: 311). According to the VoC approach, institutional complementarities are important for improving the functional capability of the institutional setting and, therefore, also for generating industry-specific comparative advantages (Hall & Soskice, 2001: 17ff). Also several empirical studies have supported the importance of coherence and complementary institutions (e.g., Hall &

Gingerich, 2009; Schneider, Schulze-Bentrop & Paunescu, 2010). We argue that these institutional complementarities can be built both at the national and the company level. Using the VoC approach, the following sections analyze theoretically which institutional configurations at the national and at the company level should be associated with a broad and with a narrow span of control.

Institutions at the national level and the span of control

Based on the VoC, we argue in this paper that the presence or absence of three functions determines the span of control of production companies: skill foundation, skill retention, and trust. Following the VoC, we analyze four national institutions—the vocational education and training (VET) system, wage coordination, employment protection, and employee representation—that fulfill three functions: laying a sound skill foundation, ensuring that skilled workers stay with the company, and making sure that workers have a trust relation with their companies and are motivated to use their skills in the interest of the company. The quality of the VET system determines whether (future) employees have the necessary production skills (function of skill foundation). Wage coordination on the labor market and the level of employment protection as part of an industrial relations system may either support or undermine a company's effort to retain the production skills in the company (function of skill retention). The national regulation on employee representation influences the relationship between the company and its production employees and thus the way employees use their skills to advance the objectives of the company (function of trust). In sum, the shape of these four national institutions determines whether the three functions skill foundation, skill retention, and trust are fulfilled and thus also the type of the span of control of a company as explained in the following.

First, the better the VET system and thus the more skilled the employees in production are, the fewer supervisors should be necessary for supporting and monitoring them. Osterman (1994), for example, found in his U.S. study of the supervision intensity of blue collar core workers that the skill level of the employees is inversely associated with the amount of supervision they receive (see also Maurice, Sellier & Silvestre, 1986). Moreover, better-qualified employees need less monitoring also because they can perform more demanding and interesting jobs and are thus more motivated. Therefore, we argue that a high-quality VET system lays the necessary skill foundation for a broad span of control.

Second, coordinated wage setting at the industry (or higher) level—showing a high level of employer coordination and a high degree of corporatism—supports long tenure and

strong internal labor markets. The positive relationship between coordinated wages and internal labor markets occurs because employer coordination reduces the danger that skilled labor will be poached (Culpepper, 2001) and reduces employees' incentives for leaving the company as wages are equalized at "equivalent skill levels across an industry," assuring workers "that they are receiving the highest feasible rates of pay in return for the deep commitments they are making to firms" (Hall and Soskice, 2001: 25). Similarly, high employment protection decreases employees' incentive to change employers and increases their incentive to invest in company-specific knowledge (Estevez-Abe, Iversen & Soskice, 2001; Wasmer, 2006). Long tenure and strong internal labor markets ensure a set of employees with company-specific knowledge, i.e., an excellent pool of production workers and (potential) supervisors who know the company inside out and can take high responsibility. Therefore, we argue that both coordinated wage setting and high levels of employment protection fulfill the function of skill retention and thus allow a broad span of control by ensuring that highly qualified employees remain in the company at different hierarchical levels (production workers and supervisors).

Finally, the existence of an employee representation should increase trust between the management and its employees. According to Hall and Soskice (2001: 24f), works councils provide "employees with security against arbitrary lay-offs or changes to their working conditions" and this security increases trust between management and production workers. A broad stream of literature has argued for the importance of employee representation for building trust and cooperation within the company (e.g., Holland et al., 2012; for works councils, e.g., Backes-Gellner, Frick & Sadowski, 1997; Frege, 2002). Since a broad span of control requires trust between workers and their supervisors to ensure that workers use their discretion in the interest of the company, we argue that an employment representation is necessary for a broad span of control.

As a high-quality VET system, coordinated wages, high employment protection, and strong employee representations (such as works councils) all apply to coherent CMEs and none of them apply to coherent LMEs, we expect a broad span of control in coherent CMEs but not in coherent LMEs, in which all of the foundations for a broad span of control are missing. Without skill foundation, skill retention, and trust, companies will instead have to apply narrow spans of control. Therefore, we hypothesize:

Hypothesis 1: Companies in coherent LMEs show a narrower span of control than those in coherent CMEs.

Following the VoC approach in our empirical analysis, we use Germany as coherent CME, and the U.S. as coherent LME.

In mixed countries, which are neither fully coherent LMEs nor fully coherent CMEs, only few complementarities between the different institutions exist. Thus, companies may adjust either with a broad or with a narrow span of control as none of them is clearly induced by the national institutional setting. Therefore, we expect to find both companies with a broad and companies with a narrow span of control and, therefore, a larger range in the spans of control of companies in mixed countries than in coherent countries. Accordingly, we hypothesize:

Hypothesis 2: In mixed economies we expect a larger range in the span of control than in coherent market economies.

In our empirical analysis, we use Switzerland and the UK as examples for mixed economies. Even though the UK is often characterized as coherent LME (e.g. Schneider & Paunescu, 2012), we show in the variable section that the UK is mixed when focusing on the four institutions that influence directly the span of control.

Institutions at the company level and the span of control

Although a country's institutional setting provides an important framework, we argue that the company still has managerial choices about how to act within a given national framework and about how to design a coherent institutional setting at the company level. Therefore, we need to measure directly the functionally equivalent institutions at the company level.

The VET system at the national level may or may not be widely dispersed and of high quality. Companies can still choose whether to train their employees within the VET system and whether to train at a higher or lower quality. Therefore, we focus on the company-level existence and quality of the vocational training to directly measure whether the function of skill foundation is fulfilled.

Similarly, companies have alternatives to signal employment protection in case the national law does not prescribe it. We argue that companies in countries with low employment protection can build internal labor markets that provide reliable career options and employment security thus fulfilling the function of skill retention. Conversely, companies

can also have weak internal labor markets even though the national employment protection law is restrictive.

Country-level data on collective bargaining figures has become more and more a rough measure for general categorizations. Also comparatively high coverage levels by collective agreements at the national level do not necessarily mean that all industries and companies are covered by externally negotiated and wage-relevant bargaining agreements. Even the existence of an industry-level collective agreement does not automatically include binding wage regulations. The between-sector heterogeneity and the importance of exploring the contractual details thus increase the necessity to measure directly at the company-level whether an industry-wide and wage-relevant collective agreement exists.

Even though no or only weak legal regulations on employee representations may exist at the country level, still some company-level form of employee representation may exist (Gollan & Lewin, 2013) which can have a trust-increasing effect (Holland et al., 2012). We, therefore, measure directly whether some sort of company-level employee representation exists which could fulfill the trust function necessary for a broad span of control. Conversely, it may well be that companies have no employee representation such as a works council even though the company would have the necessary preconditions (Backes-Gellner, Mohrenweiser & Pull, 2011).

We particularly expect companies in mixed institutional settings to strive for company-internal solutions to build a coherent company-level institutional setting. Companies can for example substitute national institutions of liberal shape with company-level institutions of coordinated shape, thus complementing existing coordinated national institutions. Since companies in mixed countries can choose to complement either the nationally existing coordinated or liberal institutions, we expect to find a broader variation of company-level institutional configurations in mixed countries than in coherent countries. We thus hypothesize:

Hypothesis 3: For companies in mixed market economies we expect more configurations of company-level institutional settings than for companies in coherent market economies.

Coherent institutional configurations lay the foundation for either a broad or a narrow span of control. A broad span of control needs all three functions (skill foundation, skill retention, and trust) and thus all company-level functional equivalents of a CME. Thus if a company's

institutional setting resembles a coherent institutional configuration of the coordinated type, we expect a broad span of control. If a company resembles a coherent institutional configuration of the liberal type, it will only work with a narrow span of control. Thus, we derive a fourth and a fifth hypothesis:

Hypothesis 4: For companies with a coherently coordinated company-level institutional configuration (coordinated in all institutional variables) we expect a broad span of control.

Hypothesis 5: For companies with a coherently liberal company-level institutional configuration (liberal in all institutional variables) we expect a narrow span of control.

DATA

To test our hypotheses, plant-level data is required because the spans of control and the institutional configurations have to be measured at the company level². Since we need detailed company data, the sample size is small and comprises 22 comparable engineering plants. The data was gathered in Germany, Switzerland, the UK, and the U.S. through face-to-face interviews with personnel managers, and were supplemented with secondary data analysis and expert interviews. The interviews took place between April 2008 and February 2010.

We used a matched-pair strategy to reduce heterogeneity and to ensure the similarity of the products. We identified the cases by matching companies according to their 4-digit SIC codes, which reflect the product line and production technology. We mainly chose the major group 35 to include companies that manufacture industrial machinery products and have a high-quality production process including tasks such as turning, drilling, and grinding. In particular we interviewed 13 pumps and pumping equipment producing companies, and 9 companies producing turbines, compressors and aero engines. We conducted several shop-floor tours to ensure the similarity of the products and the production process. For an overview of the country and sector distribution, see Table 1.

² In the following, we use the terms “plant” and “company” synonymously.

Table 1 Number of participating companies by sector (SIC 1987)

Sector	Subsector	SIC 1987	GER	CH	UK	U.S.
Engineering	Pumps and pumping equipment	3561	4	3	3	3
	Turbines & turbine generator sets,	3511,				
	Air & gas compressors,	3563,	2	3	2	2
	Aircraft engines & parts	3724				
All engineering subsectors			6	6	5	5

Source: GER, CH, UK, Ryan et al., 2011, Table 1; the U.S., own fieldwork

We also matched companies according to their size. Using to the EU classification (European Commission, 2005), the sample includes 14 large companies with more than 250 employees (6 in Germany, 3 in Switzerland, 4 in the UK, 1 in the U.S.) and 8 medium-sized companies between 50 and 249 employees (3 in Switzerland, 1 in the UK, 4 in the U.S.; see Ryan et al., 2011).

All plants have existed for at least 10 years. Regarding production volume and lot size, our sample comprises different batch sizes, from small to large batches. All plants followed a quality-oriented strategy, partly with engineered-to-order products.

VARIABLES, METHODS AND RESULTS

Outcome variable: Span of control

Following classic studies on the span of control (e.g., Bell, 1967; Ouchi & Dowling, 1974), we measure our outcome variable, i.e., the span of control in the production area, by asking “how many employees (skilled and unskilled) work in production” and “how many supervisors and technicians work in production.” These questions were reliable for the interviewees to answer, as they merely had to either count the employees and supervisors in the production area or transfer the hierarchical structure from their internal organizational chart.

According to our hypotheses, we divide our analysis into two parts. First, we study the institutional settings and average spans of control at a national level, as in the VoC literature, to test the first two hypotheses. Second, we study the institutional configurations and spans of control at the company level to test hypotheses three, four, and five.

National-level analysis

To test our first two hypotheses, which focus on country-specific averages and ranges of the span of control, we categorize the countries according to the national institutional settings,

identified as relevant for the fulfillment of the three functions skill foundation, skill retention, and trust: VET system, employment protection, coordinated wages, and employee representations. In measuring the institutional variables, we closely follow the original definitions of Hall and Soskice (2001) and previous empirical literature (e.g., Schneider & Paunescu, 2012; Schneider, Schulze-Bentrop, and Paunescu, 2010; Hall & Gingerich, 2009).

Explanatory variables at the national level

(1) VET system

We follow the studies on the VoC that measure “vocational education and training” (e.g., Schneider & Paunescu, 2012; Schneider, Schulze-Bentrop & Paunescu, 2010) and use the OECD “Education at Glance” data on the number of tertiary A (academic) graduates and tertiary B (occupational) graduates, each measured as a percentage of the population in the typical graduation age (OECD, 2009f, Table A3.1/2). We decided to build a ratio to obtain a better impression of the relative importance of each particular path.

Germany has more than twice (2.3) the number of general university graduates as tertiary occupational graduates (23% academic, 10% occupational); in Switzerland, ratio is with 1.7 a little lower (31% academic, 18% occupational) compared to Germany; in the UK, the ratio is a little higher (2.6, 39% academic, 15% occupational). The U.S. is much higher with 3.7 (37% academic, 10% occupational).

Although this measure gives a first impression, we argue that for the engineering industry the qualification of “intermediate” skills at the craftsmen level are as important and, therefore, complement the tertiary level indicator with an indicator for the upper secondary level. The OECD (2009f, Table C1.4) has calculated the proportion of young people pursuing academic (general) or occupational (pre-vocational and vocational) programs at the upper secondary level. Switzerland has the highest enrollment in occupational programs (64.8%), followed by Germany (57.4%) and the UK (41.4%). The U.S. has a value of 100% enrollment in academic programs³.

³ Though apprenticeship training exists in the U.S., it is not reflected in the statistics because “U.S. registered apprenticeship training programs” usually begin after graduation from upper secondary education (Crosby, 2002; Glover & Bilginsoy, 2005; Bilginsoy, 2003). Overall, registered apprenticeship training programs show only low enrollment figures. Approximately 449,000 apprentices were registered at the end of 2003—reflecting the entire apprenticeship population of several cohorts—as opposed to one cohort of 2.7 million high school graduates in 2003 (Bennici, 2004; Bureau of Labor Statistics, 2004).

As the VoC approach regards a strong VET system as a typical feature for a CME, we conclude that Germany, Switzerland, and the UK are more coordinated in terms of the VET system than the U.S.

(2) Employment protection

To measure the degree of employment protection, we follow previous literature which commonly uses the OECD index of the strictness of employment protection (OECD, 2008; e.g., Schneider, Schulze-Bentrop & Paunescu, 2010; Hall & Gingerich, 2009). The overall OECD index is comprised of three variables: protection of permanent workers against dismissal, regulation of temporary forms of employment, and specific requirements for collective dismissal. Index values range between 0 (least stringent) to 6 (most restrictive). A high index value represents strong barriers to (or high costs of) staff reduction through the termination of employment contracts.

As manual workers in the manufacturing industry are usually permanent (which is also the case in our sample), we use the index values that measure the protection of permanent workers and provide the overall protection index as additional information as previous studies often used it. The protection index values, both for permanent workers and overall, show a clear gap between Germany (2.85/2.63) on the one side and the U.S., the UK, and Switzerland on the other (0.56/0.85, 1.17/1.09, 1.19/1.77). Thus, we conclude that the U.S., the UK, and Switzerland are clearly more liberal than Germany regarding employment protection.

(3) Collective bargaining

We measure collective bargaining by taking into account the coverage by collective bargaining agreements and the level of wage centralization, again following closely previous literature (e.g., Schneider, Schulze-Bentrop & Paunescu, 2010; Hall & Gingerich, 2009).

The majority of employees in Germany are covered by collective bargaining (63% in 2007, Visser, 2009), and the predominant level of bargaining centralization is at the sectoral or regional level—with additional local- and company-level bargaining (Visser, 2009). In contrast, in the U.S., wage bargaining takes place predominantly at the plant level, and the coverage by collective agreements is very low, with only 13.5% coverage in 2007. The UK and Switzerland take the middle positions. In Switzerland, 48% of employees were covered by collective bargaining in 2007. The dominant level of bargaining is at the sectoral or regional level—with additional local- and company-level bargaining, as it is the case in Germany. In the UK, wage bargaining at the plant level dominates, and the coverage by

collective agreements was approximately 35% in 2007 (Visser, 2009). In sum, we categorize Germany as coordinated, the U.S. as liberal, and Switzerland and the UK as lying in between.

(4) Employee representation

To measure employee representation, we cannot follow previous empirical VoC-literature, as this variable has not been included yet. We, therefore, decided to, use the comparative indexes of Visser (2009), which reflect the existence and influence of employee representation at the national level.

The first index measures whether an employee representation at the enterprise, firm, or establishment level (above a threshold of 50 employees) is mandatory by law or by agreements between the central organizations of trade unions and employers' associations; the index also reflects the coverage of employee representation.

In Germany and the UK, employee representation is, according to Visser (2009), assured by law or agreement; the coverage, however, is higher in Germany (75% or more of eligible firms, index value of 2) than in the UK (less than 75% of eligible firms, index value of 1). According to Visser's index (2009), the employee representation in the U.S. and Switzerland is absent or voluntary, existing only in some sectors and firms (coverage of less than 25%, index value of 0).

The second index of Visser (2009) measures the influence and rights of employee representations. While German employee representations have the most influence, with their codetermination rights (index value 3), employee representations in the UK have only information rights (index value 1). The U.S. and Switzerland both have the lowest index value (0) because employee representations are either nonexistent or have no rights at all.

Therefore, we again find Germany and the U.S. at polar ends, with the UK again lying somewhere in between and with a strong tendency to the liberal side in Switzerland.

Taking all four institutional variables together (Table 2), two polar cases of liberal and coordinated shape exist (the U.S. and Germany), which are characterized by coherent institutional settings in terms of the dimensions of the VET systems, employment protection, wage coordination, and employee representation. Switzerland and—in contrast to previous literature (e.g., Kenworthy, 2006; Schneider & Paunescu, 2012)—the UK build the less coherent cases because both of these countries combine more coordinated with more liberal institutions relevant for the span of control. While both countries have low employment protection, Switzerland has a strong VET system, which is also existent in the UK (at least numerically, quality differences are discussed below). Switzerland is more coordinated in the

wage coordination dimension than the UK but has less employee representation. Therefore, we situate these two countries as mixed cases between the two polar cases Germany and the U.S.

Table 2 Overview of national-level institutions

	liberal	coordinated
VET system		
Graduation tertiary level (ratio academic/occupational)	U.S. 3.7	UK 2.6 GER 2.3 CH 1.7
Enrolment pattern secondary level (% enrolment in vocational programs)	U.S. 0	UK 41 GER 57 CH 65
Employment protection		
Permanent workers (index)	U.S. 0.56	UK 1.17 CH 1.19 GER 2.85
Overall (index)	U.S. 0.85	UK 1.09 CH 1.77 GER 2.63
Collective bargaining		
Level of bargaining	U.S./UK. company	GER/CH sector
Collective bargaining coverage (%)	U.S. 14	UK 35 CH 48 GER 63
Employee representation		
Existence of employee representation (index)	U.S./CH 0	UK 1 GER 2
Rights of employee representation (index)	U.S./CH 0	UK 1 GER 3

Graduation tertiary level: Ratio of tertiary A (academic) graduates (measured as a percentage of the population in the typical graduation age) and tertiary B (occupational) graduates (measured as a percentage of the population in the typical graduation age)

Enrollment pattern secondary level: Percentage of young people pursuing occupational (pre-vocational and vocational) programs at the upper secondary level.

Employment protection permanent workers: Dismissal protection of workers with regular contracts incorporates (i) procedural inconveniences that employers face when starting the dismissal process, such as notification and consultation requirements; (ii) notice periods and severance pay, which typically vary by tenure of the employee; and (iii) difficulty of dismissal, as determined by the circumstances in which it is possible to dismiss workers, and the repercussions for the employer if a dismissal is found to be unfair (such as compensation and reinstatement), scale from 0 (least stringent) to 6 (most restrictive)

Employment protection overall: Compiled from 21 items covering three different aspects of employment protection: Individual dismissal of workers with regular contracts, additional costs for collective dismissals, and regulation of temporary contracts equivalent workers in the user firm, which can increase the cost of using temporary agency workers relative to hiring workers on permanent contracts, scale from 0 (least stringent) to 6 (most restrictive)

Level of bargaining: Dominant level at which wage bargaining takes place

Collective bargaining coverage: Employees covered by collective pay bargaining as a percentage of those with the right to coverage

Existence of employee representation: Employee representation (at enterprise, firm, or establishment levels, above the threshold of 50 employees) is assigned a rating as follows: 2, mandatory, based on public law, and/or assured on the basis of an enforceable central or basic agreement between the central organizations of the trade unions and the employers' associations, and coverage of eligible firms is 75% or more; 1, is mandatory, based on public law, and or assured on the basis of an enforceable central or basic agreement between the central organizations of trade unions and employers' associations, but coverage is lower than 75% of eligible firms; 0, is absent or voluntary, and covers only some sectors or firms (less than 25% of firms above 50 employee threshold)

Rights of employee representation: 3, codetermination of company economic policies; 2, major consultation rights over social policies; 1, information rights; 0, no representation or no rights

Sources: OECD (2009f), OECD (2008), Visser (2009)

Results at the national level

The analysis at the national level of the matched-pair engineering plants in the four countries shows that the average span of control differs between the four countries. While our U.S. companies show the narrowest average span of control with, on average only 7.1 employees per supervisor in the production area, German companies have on average the broadest span of control with 26 employees per supervisor (Table 3, row one). These results support our first hypothesis that companies in a coherently liberal market economy have a narrower span of control than those in a coherently coordinated market economy. It also supports the findings of previous comparative studies that the span of control is an important mechanism of adjustment to different institutional settings (e.g. Maurice, Sorge & Warner, 1980; Maurice, Sellier & Silvestre, 1986).

Table 3 Span of control in matched-pair engineering companies in the U.S., Germany, the UK, and Switzerland

country	U.S.	UK	CH	GER
average span of control	7.1	10.3	13.6	26.0
max	13.0	23.6	29.5	53.7
min	2.9	4.1	5.5	17.6
range (max-min)	10.1	19.5	24.0	36.1

Note: Span of control is defined as number of employees per supervisor in production
Source: own calculation

In every country, we find variation in the span of control (Table 3, rows 2 and 3). In companies in the coherent LME, the span of control varies only within a range of around 10 employees per supervisor (range from minimum to maximum is 10.1 in the U.S.). In companies in mixed market economies, the range is much broader and varies between 19.5 in

In sum, the cluster analysis shows that in Germany no company has a span of control, which is close to the spans of control of U.S. companies (U.S. companies are in the first row and are all on the left hand side; German companies are in the fourth row and are all on the right hand side). The medium average spans of control in Switzerland and the UK derive from a combination of companies that have either a span of control that is close to German companies (CH-5, CH-4, UK-5). Or they have a span of control that is close to U.S. companies (all other companies on the left hand side). Therefore, our results support the second hypothesis that companies in mixed market economies (Switzerland and the UK) show more variation in the span of control than companies in coherent market economies (the U.S. and Germany). The different spans of control (broad and narrow) *within* the same country give a first hint that companies have a strategic choice in adjusting to mixed national institutions with their company-level institutions.

Company-level analysis

We expect that companies have different possibilities of how to adjust to national institutional settings with their company-level institutions to achieve a coherent configuration of institutions. We, therefore, need a method that allows the identification of complete configurations (combinations) of institutions. As traditional regression methods cannot—or only in a limited way via interaction effects—take into account different configurations, we use the method of qualitative comparative analysis (QCA).

Methodology: fuzzy-set qualitative comparative analysis

To reveal in detail which configuration of institutional variables is linked to a broad or narrow span of control, we apply the configurational method “qualitative comparative analysis” (QCA, Ragin, 1987; Rihoux & Ragin, 2009). This method has already proven useful for testing VoC propositions (e.g., Kogut & Ragin, 2006; Schneider, Schulze-Bentrop & Paunescu, 2010). It is also particularly useful for conducting cross-country comparisons (e.g., Ebbinghaus & Visser, 1999), has been used to analyze strategic management questions (e.g., Greckhamer et al., 2008), and has been designed for formally analyzing qualitative evidence and small data sets.

The underlying principle of QCA is to treat every observation as a configuration, i.e. a combination of well-defined institutional variables. To use this method, the dependent and independent measures are calibrated into sets by defining full membership (value of 1), full nonmembership (value of 0), and a crossover point (value of 0.5) of maximum ambiguity

regarding membership. This information is then summarized in a truth table and reduced with Boolean logic. The resulting statements indicate whether single or combinations of variables are necessary and sufficient. This approach thus allows a formal analysis of qualitative information using small data sets. Moreover, fsQCA gives insights into whether multiple configurations (combinations of institutional variables) are associated with the same outcome (equifinality; Fiss, 2007) and allows the measurement of “coverage” (the relative importance of different paths to an outcome) and “consistency” (the proportion of cases consistent with the pattern). The following subsection describes the calibration of the variables that we use in the fsQCA.

Calibration of the outcome variable

To use the fsQCA, we need to calibrate our dependent variable between 0 and 1. In addition, we need a crossover point between a broad and a narrow span of control. No predefined values exist, neither for a “fully broad” or a “fully narrow” span of control nor for the crossover point. Therefore, we use our cluster analysis results and define the crossover point at the value of 15.3, the middle between the borders of the two clusters “broad span of control” and “narrow span of control” (Figure 1). The value for being fully in the set of a broad span of control is 53.7, the value for being fully out of the set of a broad span of control is 2.9.

Institutional variables at the company level and their calibration

We also need to calibrate the data on company-level institutions that are used to ensure skill foundation, skill retention, and trust. In the following, we describe how we measure (Table 4) and calibrated these company-level variables between 0 and 1.

Table 4 Functionally equivalent institutions at the national and the company level

Function	Variables measured at the national level	Variables measured at the company level
Skill foundation	Relative importance of vocational training system (OECD graduation and enrolment data)	High-quality vocational training provided by the company
Skill retention	Employment Protection (OECD indexes)	Share of supervisors internally recruited
	Coverage and centralization of wage bargaining (Visser, 2009)	Covered by an external and wage-relevant collective bargaining agreement
Trust	Existence and rights of employee representation (Visser, 2009)	Strong employee representation at the plant level

(1) High-quality vocational training

We measure directly the existence and quality of the vocational training within the company and calibrate the variable between 0 and 1 by defining four categories:

- fully in the set of high-quality vocational training (value of 1) are companies that train their young workers in a way comparable to a high-quality apprenticeship program which is regulated by high and externally-set standards, takes several years of training (3.5 years or more) and includes both school- and company-based training, as existent in Germany and Switzerland.
- in the set of high-quality vocational training but not “fully in” (value of 0.66) are companies that provide their young workers a vocational training which shows not all but at least many characteristics of the Germanic style of apprenticeship training. In the UK, for example, Apprenticeship training in the traditional apprenticeship sectors such as engineering is in several aspects comparable to the high quality apprenticeship training found in Germany and Switzerland: Sector Skills Councils determine the Apprenticeship training content and the skill requirements, the Advanced Apprenticeship takes around 3 years, and apprentices receive both college- and company-based training
- out of the set of high-quality vocational but not “fully out” (value of 0.33) are companies that provide their young workers only short (usually only a few

weeks), on-the-job, and only company-specific vocational training as usually the case in the U.S.

- fully out of the set of high-quality vocational training (value of 0) are companies that do not train at all their young workers

(2) Employment protection and internal labor markets

With our interview data, we measure directly the strength of the internal labor markets using the shares of internal promotion to the supervisory level. A closer look at the recruitment behavior at the supervisory level in all four countries illustrates that some companies, even in countries with low employment protection (e.g., the U.S.), recruit the majority (more than 50%) of their supervisors internally (Table 5).

Table 5 Percent of supervisor positions filled by internal candidates

U.S.	UK	CH	GER
US-1 100	UK-1 96	CH-1 25	GER-1 80
US-2 35	UK-2 90	CH-2 0	GER-2 80
US-3 99	UK-3 90	CH-3 50	GER-3 90
US-4 5	UK-4 80	CH-4 90	GER-4 80
US-5 100	UK-5 85	CH-5 60	GER-5 80
		CH-6 20	GER-6 60

Data source: GER, CH, UK, Ryan et al., 2011, Table 14; the U.S., own fieldwork

The question for the general recruitment strategy was: “How do you typically fill your vacancies for production supervisors?”

To categorize companies according to their degree of employment protection, we calibrate companies with strong internal labor markets, thus a 100 percent share of internal promotions, as full membership in strong internal labor markets (value of 1). If none of the supervisors is recruited internally, we code this as full nonmembership in strong internal labor markets (value of 0). Companies with a 50 percent share of internal promotions receive the crossover point value of 0.5.

(3) Wage coordination

We measure directly whether a company is covered by an external, wage-relevant collective bargaining agreement. For the calibration of wage coordination between 0 and 1, we use three categories:

- fully in the set of wage coordination (value of 1) are companies with a wage-relevant collective bargaining agreement that was negotiated at the industry level

- out of the set of high-quality vocational but not “fully out” (value of 0.33) are companies that are covered by collective agreements at the industry level which do not include (binding) wage agreements
- fully out of the set of wage coordination (value of 0) are companies that are not covered by externally negotiated wage agreements

(4) Employee representation

Finally, we measure directly whether an employee representation exists within the company. For employee representation, we chose three categories to calibrate the variable between 0 and 1:

- fully in the set of employee representation (value of 1) are companies whose employee representations have legally binding codetermination rights, such as German works councils
- in the set of employee representation but not “fully in” (value of 0.66) are companies that have an employee representation that participate informally or have information rights
- fully out of the set of employee representation (value of 0) are companies that have no employee representation at all

Results at the company level

Table 6 summarizes the company-level institutional configurations in our sample. In contrast to the measurements of institutional variables at the national level, company-level measurement allows us to identify various configurations of institutional variables also within countries.

Table 6 Company-level institutional configurations in the sample

configuration	High-Quality Vocational Training	Internal Recruitment of Supervisors	Wage Bargaining	Empl. Representation	N	Number of companies in countries			
						U.S.	UK	CH	GER
A	1	1	0	1	3		1	2	
B	1	1	1	1	6				6
C	1	0	0	0	1			1	
D	0	0	0	0	2	2			
E	1	1	0	0	4		4		
F	1	0	0	1	3			3	
G	0	1	0	0	3	3			

Data source: GER, CH, UK, Ryan et al., 2011, Table 14; the U.S., own fieldwork

Overall, we find seven different configurations in our sample. All six German companies show the same configuration of institutional variables, namely high-quality vocational training, strong internal labor markets, wage coordination and employee representations (Table 6, configuration B). All U.S. companies have no high-quality vocational training, no wage coordination and no employee representation. We find variation in the internal labor market variable, three U.S. companies have strong internal labor markets (Table 6, configuration G), two have weaker ones (Table 6, configuration D). In the UK, all companies have high-quality vocational training, strong internal labor markets, and no wage coordination. Again, we find variation in one variable. One company has an employee representation (Table 6, configuration A). Finally, we find variation in two variables in Switzerland. While all companies have a high-quality vocational training and no wage coordination, we find companies with (Table 6, configurations A and F) and without employee representation (Table 6, configuration C) and companies with (Table 6, configuration A) and without a strong internal labor market (Table 6, configurations C and F). Therefore, we cannot reject our third hypothesis that companies in less coherent market economies show more company-level institutional configurations than companies in more coherent market economies.

To analyze our fourth hypothesis that only a coherently coordinated configuration of institutional variables is associated with a broad span of control, we now use the QCA analysis. According to the truth table, two institutional configurations (Table 7, configurations A and B) are consistently associated with a broad span of control.

Table 7 Truth table company analysis—institutional configurations associated with a broad span of control

Configurations of company-level inst. variables	High-quality Vocational Training	Internal Recruitment of Supervisors	Wage Bargaining	Empl. Representation	N	Outcome Broad span of control	raw consistency	PRI consistency
A	1	1	0	1	3	1	0.8498	0.8031
B	1	1	1	1	6	1	0.8101	0.7376
C	1	0	0	0	1	0	0.3408	0.1020
D	0	0	0	0	2	0	0.3357	0.0000
E	1	1	0	0	4	0	0.2802	0.1359
F	1	0	0	1	3	0	0.2037	0.1063
G	0	1	0	0	3	0	0.1584	0.0553

Data source: GER, CH, UK, Ryan et al., 2011, Table 14; the U.S., own fieldwork

After reduction using Boolean algebra (see Table 8), the results suggest that one institutional configuration is associated with a broad span of control: high-quality vocational training, employee representation, and high internal recruitment of supervisors.

Table 8 Results QCA analysis at the company level – broad span of control

Broad span of control	
High-quality vocational training	●
Internal recruitment of supervisors	●
Wage coordination at industry level	
Employee Representation	●
Consistency	0.826
Raw/Unique Coverage	0.853/0.853
Solution Coverage/Consistency	0.853/0.826

● = Condition present

⊗ = Condition absent

Notes:

Raw coverage measures the proportion of memberships in the outcome explained by each term of the solution.

Unique coverage measures the proportion of memberships in the outcome explained solely by each individual solution term (memberships that are not covered by other solution terms).

Consistency measures the degree to which membership in each solution term is a subset of the outcome.

Solution coverage measures the proportion of memberships in the outcome that is explained by the complete solution.

Solution consistency measures the degree to which membership in the solution (the set of solution terms) is a subset of membership in the outcome

The configuration of the three institutional variables represents all three functions that were theoretically identified and suggests that the complementary existence of all three functions is necessary to be able to work with a broad span of control in a company. High-quality vocational training ensures the necessary skill foundation for a broad span of control. Strong internal labor markets ensure a high stock of company-specific knowledge and the retention of skills within the company. Finally, employee representation increases trust between management and employees. Even when these employee representations are weak compared to, for example, German works councils, as they have no legal co-determination rights, they appear to increase trust, thus reducing the need for tight supervision. We, therefore, cannot reject our fourth hypothesis that only companies with a coherently coordinated company-level institutional configuration show a broad span of control. The presence or absence of the institution “wage coordination” has no influence on the result.

Moreover, we find that companies in mixed national-level institutional settings can end up with a broad span of control when they use the coordinated institutions that are available and substitute national-level liberal institutions with company-level coordinated institutions. Thus, companies in mixed market economies can compensate for low employment protection and legally non-required employee representations by having strong internal labor markets and a company-level form of employee representation.

DISCUSSION AND CONCLUSION

This paper analyzes the question of how matched-pair engineering companies adjust to more or less favorable and more or less coherent national institutional settings. We argue that the span of control is an important mechanism of adjustment. The presence of three functions, namely skill foundation, skill retention, and trust is associated with a broad span of control and the shape of the national institutional setting determines whether these three functions are fulfilled.

Using the U.S. and Germany as examples for coherent national institutional settings, we find that matched-pair engineering companies adjust their span of control of production supervisors to the national-level institutional setting. Production supervisors in companies in a coherent CME (Germany) have, on average, a broader span of control than production supervisors in companies producing in a coherent LME (the U.S.). These results are consistent with the argument of the VoC approach, that U.S. companies fit the institutional setting by relying on hierarchies and rules, and German companies fit the institutional setting by relying on cooperation (Hall & Soskice, 2001).

In mixed national institutional settings (the UK and Switzerland), companies show a broader range in the span of control than their counterparts in the more coherent countries. Companies in Germany and the U.S. build relatively consistent clusters of a broad and a narrow span of control, respectively. In less coherent countries, however, we find companies that have either a broad or a narrow span of control. Therefore, we argue that companies have not only the span of control as mechanism of adjustment but also the strategic choice of how to shape the company-level institutional setting. Using company-level functionally equivalent institutions, companies can complement or substitute functions that are provided by national-level institutions and are thus able to end up with either a broad or a narrow span of control, depending on the company-level institutional setting.

By measuring the functionally equivalent institutions at the company level, we are able to identify the strategic choice of companies and the institutional diversity that is hidden beneath the macro-institutional evidence (Schneider, Schulze-Bentrop & Paunescu, 2010). With the QCA analysis, we link the company-level institutional variables to the span of control. The results suggest that a broad span of control is only associated with the presence of high-quality vocational training, strong internal labor markets, and employee representation as only this configuration ensures the functions of skill foundation, skill retention, and trust

between management and employees. One or more missing functions result in a narrow span of control.

Our study is, of course, limited by the small number of cases within each country. While we address the problems of size with a method suitable for small numbers and rich contexts, our results could be driven by limited diversity. The result that wage coordination at the industry level is not necessary for a broad span of control seems plausible, as the wage-equalizing effects of tariff agreements seem, even in Germany, weaker than theory implies (also tariff companies can and do pay higher wages than agreed). However, the importance of non-existent wage coordination for a narrow span of control is likely due to the limited diversity in our sample because this is the only variable that strictly separates the German cases from the cases in the other countries.

We also cannot provide representative evidence for all engineering companies in each country. For example, our company sample does not include a U.S. company with high-quality vocational training, even though high-quality programs such as “registered apprenticeship training programs” exist in the U.S. engineering industry (Crosby, 2002; Glover & Bilginsoy, 2005; Bilginsoy, 2003). Future research should include these types of cases to analyze whether registered apprenticeship is associated with a broad span of control in U.S. companies.

A further limitation could be that we do not consider additional factors that could explain—according to economic and organizational literature—the span of control. An example is the complexity of tasks, which is influenced by technology. By matching companies by product and production technology, we aimed to reduce technological influences. Nevertheless, the possibility exists that the companies we studied vary in the type of work organization. A wider span of control is associated with, among other things, stable and routine work and subordinates who perform similar work tasks (e.g., Woodward, 1965; Burns & Stalker, 1961; Mintzberg, 1979). Moreover, the introduction of teamwork or lean production could influence organizational structure. For example, German companies might have fewer supervisors because they have introduced more teamwork than their foreign counterparts. Previous literature, however, shows that a change in work organization has only a limited effect on the number of supervisors. While supervisors’ tasks by themselves may change, the introduction of e.g., teamwork does not necessarily lead to a significant increase of the span of control of supervisors, again the level of “skill foundation” is of relevance here (Mason, 2000). Furthermore, the possibility of introducing routine work is limited in companies that rely on engineering-to-order. The solution for these companies would be to

introduce a large number of supervisors who break down job tasks for their subordinates. The narrow span of control in the U.S. companies supports this explanation.

Though various limitations exist, this paper contributes both to the theoretical and empirical literature on organizational adjustment strategies to national institutional settings. The theoretical section of this paper integrates different strands of literature on macro-level political economy and micro-level organizational designs. We derive theoretically that companies can adjust via their span of control and that three functions are relevant for the span of control. Besides showing that the span of control is indeed an important adjustment mechanism, we provide evidence that companies are not fully dependent on whether the national institutional fulfills the three functions. Instead companies have some strategic leeway in terms of their company-level institutional setting thus being able to determine the presence of the three functions. Therefore, our results have also practice-relevant implications. Multinational companies, for example, that originate in a country with a strong apprenticeship tradition and wish to expand their production to countries without a high-quality vocational training system face a major problem in how to deal with the lack of a skilled workforce. Our results show that the company's adjustment strategy could be either to follow the national institutional setting and to implement of a narrow span of control or to create a company-level institutional setting with high-quality vocational training combined with strong internal labor markets and trust-building institutions thus ending up with a broad span of control.

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