Institutions and their effect on the organizational structure of matched-pair engineering companies

Silvia Teuber
University of Zurich, Department of Business Administration
Zurich
Switzerland

Email: silvia.teuber@business.uzh.ch
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Uschi Backes-Gellner
Professor of Business and Personnel Economics
University of Zurich, Department of Business Administration
Zurich
Switzerland

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1. Introduction

Several studies in industrial relations and political economy literatures argue that a country's national institutional setting creates competitive advantages for particular industries (Hall & Soskice, 2001; Porter, 1990; Lundvall, 1992; Nelson, 1993; Nelson & Winter, 1982). One of the most prominent approaches that analyzes institutional similarities and differences across economies, is the "Varieties of Capitalism" (VoC) approach of Peter Hall and David Soskice (2001)[1]. According to the VoC approach, the national institutional setting of coherently coordinated market economies (CMEs) such as Germany offers significant advantages for quality-oriented engineering production companies; in contrast, the national institutional setting of coherently liberal market economies (LMEs) such as the U.S. favors service-oriented or research-dominated companies (e.g., Schneider, Schulze-Bentrop & Paunescu, 2010; Haake, 2002; Unger, 2000; Hall & Soskice, 2001; Nooteboom, 2000; Soskice, 1997). Therefore, companies in different countries concentrate on different sub-sectors and products for which the particular national institutional setting is advantageous (e.g., in the biotechnology sector companies focus on the development of pharmaceuticals in the U.S. and on the invention and production of research tools in Germany; Hall & Soskice, 2001; Casper, Lehrer & Soskice, 1999; Casper & Whitley, 2004).

However, companies are not perfectly sorted according to the national institutional setting. We find large, research-intensive pharmaceutical companies in Germany (e.g., Bayer) and manufacturing companies producing turbines and machinery in the U.S. (e.g., General Electric). Given the differing competitive advantages that stem from institutional settings, the question arises as to how *matched-pair* companies that produce highly similar products and compete in the same (global) markets adapt organizationally to *different, less favorable*

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[1] The foci of other approaches include trade union behavior and strategy (e.g., Hyman, 2001), the power of organized labor, the centralization of labor and capital (e.g., Crouch, 1993), and welfare-state attributes (e.g., Esping-Andersen, 1990; Hicks & Kenworthy, 2003).

national institutional settings. In this paper, we examine the question of how organizations fit themselves into national institutional settings.

Previous comparative literature has focused on the behavior of matched-pair companies in different countries. Backes-Gellner (1996) finds, in her sample of matched-pair companies in the service and industry sectors in the UK, Luxembourg, France, and Germany, that companies adapt their training strategies to the institutional setting but end up with broadly the same stock of qualifications, which allows them to produce similar products. Focusing on organizational issues, Maurice, Sellier, and Silvestre (1986) argue that technology does not fully determine a company's organizational structure (measured by the span of control) but that national training and educational systems play an important role because they influence the qualification level of the workforce. The higher the qualification level of the workforce is ("professionalization"), the less supervisory input will be required (Maurice, Sorge & Warner, 1980; 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 responsibility than their counterparts in the UK and the U.S.

Previous literature thus suggests that the span of control is an important mechanism of adaptation to the national institutional setting. However, the literature does not take into account whether the companies are operating in a more or less favorable and a more or less coherent national institutional setting. Given that the span of control is an important mechanism of organizational adaptation, the questions arise whether the span of control differs systematically depending on the institutional setting and with which institutional configurations the span of control is associated. We examine these questions by theoretically analyzing how companies complement (available or non-available) national institutions by company-level institutions and by the span of control. We derive hypotheses about potential configurations of national- and company-level institutions, which we then test with production plant data gathered through interviews in matched-pair engineering companies in Germany, Switzerland, the UK, and the U.S. We choose this set of countries to include the VoC examples of coherent liberal and coordinated market economies (the U.S. and Germany) and two less coherent countries that combine liberal and coordinated features to different extents (the UK and Switzerland).

To reveal in detail which configuration of institutional variables is linked to the span of control, we apply the qualitative comparative analysis (QCA, Ragin, 1987) because this method has already proven useful for testing VoC propositions (e.g., Kogut & Ragin, 2006; Boyer, 2004; Schneider, Schulze-Bentrop & Paunescu, 2010). This method is also

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particularly useful for conducting cross-country comparisons (e.g., Ebbinghaus & Visser, 1999), examining strategic management questions (e.g., Greckhamer et al., 2008), and has been designed for formally analyzing qualitative evidence and small data sets.

Our results show that matched-pair engineering companies, depending on the national institutional setting, differ substantially in their span of control of their production supervisors. Production supervisors in companies producing in the highly coordinated and coherent market economy of Germany have on average, a broader span of control than those in the highly liberal and coherent market economy of the U.S. Furthermore, German companies all have a broad span of control, and U.S. companies form a consistent cluster in which all have a narrow span of control. It is only in the two less coherent countries, Switzerland and the UK that we can find both companies with a broad and companies with a narrow span of control. Based on these results, we further identify the institutional configurations at the company level that complement the national institutions.

This paper contributes to the existing literature in three ways. First, we provide answers to the question of how companies adapt to different national institutional settings with various degrees of industry-specific favorability and coherence. To define whether institutional settings are more or less coherent, we use the VoC approach and thus take 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 show 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, namely the national and the company level. Third, we show how companies react with their company-level institutional setting and their span of control to the national institutional setting and are—in contrast to previous national-level analyses (Allen, 2004)—able to link institutional variables directly to the outcomes.

The paper proceeds as follows. In Section 2, we use and extend the VoC approach to derive two hypotheses on national-level differences and two hypotheses on company-level differences. Section 3 describes the data. The first part of section 4 provides the results of our national-level hypotheses. The second part of section 4 provides the company-level results using QCA-analysis. Section 5 concludes with a further evaluation of our evidence, relating it back to the VoC approach and developing implications of the findings for both theory and company policy.

2. Theory and hypotheses

Our theoretical analysis of organizational adaptation and institutional configuration is based on the Varieties of Capitalism (VoC) approach. This approach was developed by Hall and Soskice (2001) and is considered to be the "state of the art of institutional analysis" (Howell, 2003). The VoC approach categorizes economies according to their institutional configurations. The two polar forms of economies are the coordinated and the liberal market economy, with the U.S. and Germany as the most coherent examples.

Companies in 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 coordinated 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).

Companies in liberal market economies (LMEs, such as the U.S.) lack mediating collective institutions and rely instead 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, weak employment protection, high (individual) investment in university training, and high stock market capitalization (Hall & Soskice, 2001: 27ff).

The different institutional settings generate different, industry-specific advantages, depending on whether the country is an LME or a CME. Companies in LMEs have competitive advantages resulting from low-cost and radical product innovations, due to weakly regulated labor markets and financial systems that impose short-term investment horizons but allow high risk taking. These institutions allow companies to dismiss labor and close plants quickly, to easily shift capital from one industry to another, and 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: 40f).

In contrast, CMEs provide advantages for industries that are based on quality, incremental innovation, and improving production processes. These advantages stem from their vocationally highly qualified employees—products of the VET systems and the long-term investment of training companies. High employment protection gives the employees

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incentives to invest in company-specific knowledge and leads to strong internal labor markets and highly skilled supervisors. As a result of the company-internal corporatism, workers are involved in planning, in troubleshooting, and in introducing the latest technologies in ways that enhance product quality and improve production processes. Therefore, industries such as car or machine tool manufacturing find a suitable and favorable environment for their production in CMEs (Hall & Soskice, 2001: 39f).

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). Complementarity in this context means that the "functioning of one depends on and enhances the functioning of others" (Campbell & Pedersen, 2007: 311). Complementarity increases with institutional coherence, meaning that all institutions have the same shape (e.g., coordinated) and thus reinforce each other. The importance of complementary institutions has been supported by several studies (e.g., Hall & Gingerich, 2009; Paunescu & Schneider, 2004, 2005; Kogut & Ragin, 2006[2]). We expect that these institutional complementarities can exist both at the national and the company level and that particular institutional configurations are associated with either a broad or a narrow span of control. Using company-level functionally equivalent institutions, companies can complement or substitute functions that are provided (or not provided) by national-level institutions. We analyze institutional configurations at the national level, as suggested by the VoC approach, and at the company level to expand the national-level literature.

Using the VoC approach, the following section analyzes which institutional configurations at the national level are theoretically associated with a broad and with a narrow span of control.

Institutions at the national level

A coherent configuration of coordinated national institutional variables, namely a VET system, coordinated wage setting, high employment protection, and employee representation is associated with a broad span of control. Each institutional variable fulfills a particular function described in the following paragraphs.

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[2] Evidence that extreme cases (degree of centralization of national bargaining systems) perform better than intermediate ones was previously provided by Calmfors and Driffill (1988). For the effects of labor market institutions on unemployment and growth, see e.g., Nickell and Layard (1999).

First, the better the VET system and thus the more skilled the employees in production are, the fewer supervisors are necessary for supporting and monitoring them. Osterman (1994) 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 VET system lays the 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[3]. 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 potential supervisors who know the company inside out and can take high responsibility. Therefore, we argue that both coordinated wage setting and high employment protections lay the skill foundation *within* the company for a broad span of control by ensuring that the highly qualified employees remain in the company at different hierarchical levels (production workers and supervisors).

Finally, the existence of and a company's cooperation with an employee representation system should increase trust and the empowerment of employees. According to Hall and Soskice (2001: 24f), works councils provide "employees with security against arbitrary lay-offs or changes to their working conditions." This security increases trust between management and production workers and contributes to a more cooperative environment. 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 strong employment representation is another foundation for a broad span of control.

As a VET system, coordinated wages, high employment protection, and works councils all apply to coherent CMEs and none of them apply to coherent LMEs, we expect a broad

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[3] 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).

span of control in coherent CMEs and a narrow span of control in coherent LMEs, in which all of the foundations for a broad span of control are missing.

Therefore, we derive hypothesis 1 as follows:

> *H1: Companies in coherent LMEs show a narrower span of control than those in coherent CMEs.*

Following the VoC approach, we measure coherent CMEs with Germany, and coherent LMEs with the U.S.

As already argued, the VoC approach emphasizes complementary relationships between various institutional variables. In less coherent countries which are neither fully coherent LMEs nor fully coherent CMEs, complementarities are not fully guaranteed. Thus, companies may react in different ways because neither a broad nor a narrow span of control is clearly favorable. Therefore, we expect to find a larger range in the spans of control of companies in less coherent countries than of companies in more coherent countries.

Therefore, we derive our hypothesis 2 as follows:

> *H2: Companies in less coherent market economies show a larger range in the span of control than companies in more coherent market economies (which show a small range of narrow or a small range of broad spans of control).*

Following previous literature (e.g., Kenworthy, 2006), we measure less coherent countries using Switzerland and the UK (see 4.1.1).

Company-level measurement of institutions

Although a country's institutional setting provides an important framework, the company might still have some managerial freedom regarding how to act within that framework and how to design the institutional setting at the company level. One example would be that a company may choose to have strong internal labor markets even though the degree of a country's employment protection is low. In particular, when the institutional setting at the country level is less coherent, we expect to find functionally equivalent institutions at the company level to ensure a coherent set of complementary institutions. Since companies in less coherent countries can choose to complement either the coordinated or the liberal

institutional variables in a complementary way, we expect to find a broader range of institutional configurations in the less coherent countries than in the more coherent countries. Thus we derive a third hypothesis, as follows:

H3: Companies in less coherent market economies show more configurations of company-level institutional variables than companies in more coherent market economies.

Furthermore, we argue that coherent institutional configurations lay the foundation for either a broad or a narrow span of control. Therefore, we expect to find companies with a broad span of control if they have coherent institutional configurations of the coordinated type and we expect to find companies with a narrow span of control if they have coherent institutional configurations of the liberal type.

Thus, we derive a fourth and a fifth hypothesis:

H4: Companies with a coherently coordinated company-level institutional configuration (coordinated in all institutional variables) show a broad span of control.

H5: Companies with a coherently liberal company-level institutional configuration (liberal in all institutional variables) show a narrow span of control.

To provide empirical evidence on our five hypotheses, we use a unique set of data which is described in the following section.

3. Data set

To test our hypotheses, plant-level data is required because the span of control and the institutional configurations have to be measured at the relevant unit for the production area[4]. Since we need detailed company data, the sample size has to be small. Therefore, we decided to use a matched-pair strategy to reduce heterogeneity. To do so, we collected plant-level data for engineering companies; the data was gathered in Germany, Switzerland, the UK, and the U.S. through face-to-face interviews with personnel managers, and was supplemented with

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[4] In the following, we use the terms "plant" and "company" synonymously.

secondary data analysis and expert interviews. The interviews, which took place between April 2008 and February 2010, were combined with on-site visits to the production facilities. We identified the cases by matching companies ("matched pairs") according to their 4-digit SIC codes, which reflect product line and production technology.

Overall, 21 comparable engineering plants provided the necessary information. We chose the pumps and the turbines subsectors as the primary SICs. The limited number of engineering companies available and willing to participate in the study (particularly in the UK) led to the inclusion of additional subsectors: compressors and aero engines which resemble in their skill requirements to a great extent the pump and turbine companies. Compressors have an SIC code near to that of pumps, and the UK aircraft engine company also produces air gas turbines, which are similar to the other turbines in our sample. For an overview of the country and sector distribution, see Table 1.

Insert Table 1 about here

We also matched companies, as far as possible, according to their size (Table 2). The sample includes at least one large plant (with more than 500 employees) for each country. The remaining companies all have over 100 employees, apart from one company in the U.S. with only 87 employees.

Insert Table 2 about here

All plants have existed for several years. Regarding volume, our sample comprises different batch sizes, from small to large batches, and all plants followed a quality-oriented strategy, partly with engineered-to-order products. Therefore, we conclude that all of the companies in our sample had the strategy of "diversified quality production" (Sorge & Streeck, 1988; Streeck, 1991).

4. Variables, empirical methods, and results

Outcome variable: Span of control

To gather information on our outcome variable, i.e., the span of control in the production area, we asked "how many employees (skilled and unskilled) work in production" and "how

many supervisors and technicians work in production[5]." These questions were comparatively easy 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. Second, we study the institutional configurations and spans of control at the company level.

4.1 National-level analysis

Before we test our hypotheses, we have to define our explanatory variables.

4.1.1 Institutional variables

In measuring the institutional variables, we closely follow the original definitions of Hall and Soskice (2001) as described in section 2.

(1)   VET system

The few studies on the VoC that measure "vocational education and training" (Paunescu & Schneider, 2004, 2005; Schneider, Schulze-Bentrop & Paunescu, 2010) 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, 2009, Table A3.1/2). We 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, the relative number of tertiary academics is a little lower (1.7, 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. has almost four times (3.7) more university trained graduates (37% academic, 10% occupational).

As the first measure is consistent with the previous literature, but focuses strongly on tertiary education, we use upper secondary enrollment patterns as a "robustness check." The OECD (2009, 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

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[5] We added as "robustness check" the number of trainees in production to the production workforce, as they work productively in all countries; however, the results did not change.

Germany (57.4%) and the UK (41.4%). The U.S. has a value of 100% enrollment in academic programs[6]. Therefore, we conclude that Germany, Switzerland, and the UK are more coordinated regarding the VET system than the U.S.

(2)   Employment protection

To measure the degree of employment protection, previous literature commonly uses the OECD index of the strictness of employment protection (OECD, 2008; Schneider, Schulze-Bentrop & Paunescu, 2010; Geffen & Kenyon, 2006; Hall & Gingerich, 2004; Kogut & Ragin, 2006; Paunescu & Schneider, 2004, 2005). The 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. A high index 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 as crucial variables and use the overall protection index as additional information. 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

Consistent with previous literature, we measure both the coverage by collective bargaining agreements and the level of wage centralization (Paunescu & Schneider, 2004, 2005; Hall & Gingerich, 2009; Kogut & Ragin, 2006; Schneider, Schulze-Bentrop & Paunescu, 2010; Geffen & Kenyon, 2006).

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

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[6] 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).

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, according to Visser's (2009) index, 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

Although employee representation is a major variable in the VoC approach, previous studies in the VoC literature have so far not used empirical measures of company-level employee representation, a gap that generates major criticism (Allen, 2004). At a national level, we close this gap by using the comparative indexes of Visser (2009) to reflect the existence and influence of employee representation in the four countries.

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 for company economic policies (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 and Switzerland again lying somewhere in between, with a slightly stronger tendency to the liberal side in Switzerland[7].

Taking all of the institutional variables together (Table 3), two polar cases of liberal and coordinated type exist (the U.S. and Germany), which are characterized by relatively coherent institutional settings in terms of the dimensions of the VET systems, employment protection, wage coordination, and employee representation.

Insert Table 3 about here

Switzerland and the UK build the less coherent cases because both of these countries combine more coordinated with more liberal institutional dimensions. While both countries have low employment protection, Switzerland has a strong VET system, which is also existent in the UK. National figures suggest that Switzerland is more coordinated in the wage coordination dimension than the UK but has less employee representation. Therefore, we situate these two countries in the middle between the two polar cases Germany and the U.S.

4.1.2 Results

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.

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[7] In the VoC approach, the financial and ownership structures of the company play a major role. However, these variables have no direct connection to the span of control but are indirectly related via their influence on the type and extent of training. Listed companies with dispersed ownership structures (no dominant owner) are under higher pressure to maximize their short-term revenues than, for example, family-owned companies or those with a principal stockholder who can afford long-term investments that are associated with smaller short-term revenues. Therefore, listed companies with dispersed ownership make few or no investments in a sound knowledge base that improves long-term performance but diminishes short-term results. Instead, these companies offer short and low-investment on-the-job training. According to the VoC approach, companies in LMEs usually manifest this shareholder-oriented strategy. In contrast, companies that do not face strong shareholder pressure but are able to focus on all types of stakeholders can provide long-lasting and high-investment training with on- and off-the-job periods (the classic example is apprenticeship training). The VoC approach suggests that companies in CMEs are more likely to show this training behavior. Analyzing this ownership-training relationship in a German-Swiss-UK comparison, Ryan et al. (2010) show some evidence that the expected ownership effects exist for the sectors—manufacturing and retailing—that they examine. However, the effects are only moderate, in particular when compared to the influence of the skill requirements set by the product market. Given these empirical results, given that no direct effect between ownership and the span of control exists, and given that our small case number limits our ability to include a larger number of explanatory variables (see company-level analysis), we leave financial and ownership structures out of the analysis but attempt to capture their effect on the organizational structure via our training variable.

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 4, row one).

These results confirm 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.

Insert Table 4 about here

In every country, we find variation in the span of control (Table 4, rows 2 through 4). While the companies in the more coherent liberal market economy show a relatively consistent "cluster," in the sense that the span of control varies only within a range of around 10 employees more or less per supervisor (range from minimum to maximum is 10.1 in the U.S.), companies in less coherent market economies show less consistent clusters (the range from minimum to maximum is 19.5 in the UK and 24.0 in Switzerland). In the more coherent coordinated labor market economy, we find also a broad range from minimum to maximum (36.1 in Germany). However, in contrast to the companies in the more coherent labor market economies, we find in Germany no company that has a span of control which is close to the narrow spans of control of U.S. companies. Instead, we find that one German company has a span of control of even more than 50 employees per supervisor. Thus, the medium average span of control in Switzerland and the UK derives from a combination of companies that have either a broad span of control that is close to German companies or a narrow span of control that is close to U.S. companies. This pattern is shown in Figure 1, where we can see that in the less coherent countries a medium range of control spans of around 12 to 20 does not exist. Instead, all of the companies are either in the upper or the lower part.

Insert Figure 1 about here

Therefore, our results support the second hypothesis that companies in less coherent market economies (Switzerland and the UK) show more variation in the span of control than companies in more coherent market economies (the U.S. and Germany).

4.2 Company-level analysis

In the following sections, we analyze institutional configurations at the company-level. To do so, we use the modern method of qualitative comparative analysis (QCA) because more and different institutional configurations also within a country are possible that may be associated with the same type of organizational structure.

4.2.1 Methodology: Crisp-set qualitative comparative analysis

To understand the relationship between company-level institutional configurations and the span of control, one has to take into account the interplay of institutions themselves as described in the VoC. As this interplay cannot be tested using linear regression models, particularly not with a small sample, we use configurational comparative methods such as the "qualitative comparative analysis" (QCA) (Rihoux & Ragin, 2009). This type of analysis has already proven useful for testing VoC propositions and for conducting cross-country comparisons (e.g., Kogut & Ragin, 2006; Boyer, 2004; Schneider, Schulze-Bentrop & Paunescu, 2010; Ebbinghaus & Visser, 1999). The underlying principle of QCA is to define cases as combinations of attributes; thus each case is coded for having membership in a set of "causal conditions" (in this case, the conditions are the institutional variables).

As most of our institutional variables at the company level are binary (e.g., collective bargaining agreement at the industry level is existent or not), we have to use the crisp-set QCA (csQCA) method, even though we lose information with that approach. To use this method, all variables are coded dichotomously with (1, 0), which determines whether a case is "in" or "out" of a set. 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, respectively. This approach thus allows a formal analysis of qualitative information using small data sets. Moreover, csQCA allows 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 categorization of the variables that we use in the csQCA.

4.2.2 Coding of outcome variable and institutional variables

Outcome variable

To use the csQCA, we need to get binary values for our dependent variable. As no absolute values exist to define a broad or a narrow span of control, we cluster our data points using Ward's linkage-method which minimizes the sum of squares of any two (hypothetical) clusters that can be formed at each step. Figure 2 shows that we find a cluster with a broad span of control (from 17.6 to 53.7) and a cluster with a narrow span of control (2.9 to 13).

Insert Figure 2 about here

To analyze the relationship between company-level institutional variables and the span of control, we also need to measure and code binary the institutional setting at the company level.

Institutional variables at the company level

Even though national-level institutional configurations exist, companies may arrange for a different institutional configuration at the company level, particularly in less coherent economies. With our company data, we measure the functional equivalents to the national-level institutions (Table 5) that were described in section 4.1.1.

Insert Table 5 about here
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(1)   VET system

A VET system lays the necessary skill foundation for autonomously working and highly skilled employees and thus allows a broad span of control. Although vocational training may be widely dispersed at the national level, companies may still choose not to train their employees within the VET system or, depending on the industry and the company, the vocational training may be of low quality. Using the interview data, we code the variable apprenticeship training as 1 if the company trains young workers in a formal apprenticeship program and 0 if it does not. While all of the German, Swiss, and UK engineering companies in the sample have apprenticeship training, the U.S. companies do not.

We code UK Apprenticeship training[8] the same way as in Switzerland and Germany, although UK Apprenticeship training has been criticized for being of lower quality and not comparable to the continental variant. The quality in the UK varies depending on the sector. While Apprenticeship training in retailing is rather short (usually one year) and of low quality because of weak regulations and standards, Apprenticeship training in engineering is usually comparable to the high quality apprenticeship training found in Germany and Switzerland. The UK is therefore a mixed-case in itself in this dimension. Approximately 190 apprenticeship "frameworks" (consisting of a number of qualifications and certificates) ensure, at least formally, that apprentices have the occupational and underlying theoretical knowledge for their training occupation. Sector Skills Councils determine the Apprenticeship training content and the skill requirements. Particularly in traditional apprenticeship sectors, such as engineering, most apprentices receive off-the-job training (approximately 70%, Fong & Phelps, 2008) and receive, on average, 10 hours of off-the-job training per week (Ullman & Deakin, 2005), the exact number specified in the training contract. Although official requirements in the UK may be more lax than those in Germany or Switzerland for content and off-the-job training, some excellent examples still exist. In our UK company sample, the average amount of external training in the first year was over 75% of the training time, meaning that the apprentices received not only theoretical but also practical training from the external training provider—a result comparable to those in training centers in Germany or Switzerland. We therefore code the UK apprenticeship cases as we code the German and Swiss cases, as 1, and the U.S. as 0, because no U.S. company in our sample has either apprentices or a comparable high-quality training program for new employees.

(2)   Employment protection and internal labor markets

As high employment protection decreases employees' incentive to change employers and increases their incentive to invest in company-specific knowledge and internal careers, companies in countries with high employment protection will likely to be better able to retain skills. However, companies in countries with low employment protection may still succeed in building internal labor markets that provide security about reliable career options, ensure mutual interest in cooperative behavior and a pool of experienced supervisors.

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[8] Since the mid-1990s, the Modern Apprenticeship (MA) was introduced and reformed several times in the UK. Three different levels of Apprenticeship training exist: the (Foundation) Apprenticeships at National Vocational Qualification (NVQ) Level 2, Advanced Apprenticeship at NVQ Level 3, and Higher Apprenticeships equivalent to a university degree (NVQ Level 4). Engineering apprentices are usually at Level 3.

We therefore measure directly the strength of the internal labor markets, i.e., the recruitment behavior at the supervisory level. A closer look at 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 6).

Insert Table 6 about here

We coded all companies as 1 (= strong internal labor market) if they follow an internal strategy, i.e., when the company usually recruits the majority (over 50%) of its supervisors internally. The other companies were coded as 0 (= weak internal labor market).

(3)   Collective bargaining

Coordinated wage setting at the industry level (or higher) reflects a high level of employer coordination and corporatism, thus reducing the risk of poaching and supporting the retention of skills within the company. However, establishing a country-level categorization based on collective bargaining figures has become more difficult. Even though a country such as Germany has high coverage by collective agreements negotiated at the industry level, this categorization does not necessarily apply to each industry or company. Even the existence of an industry-level collective agreement does not automatically include wage coordination. For example, during our interviews with the two main employer associations in engineering in Switzerland, we discovered that, while negotiation at the industry level takes place, the collective agreement covers only working conditions (e.g., working hours, holidays), and not wages. Thus, from a company perspective, no formal wage coordination exists in the Swiss engineering industry. The between-sector heterogeneity and the importance of exploring the contractual details increase the necessity of analyzing the company-level institutional setting.

We therefore measure directly whether a company is covered by an external, wage-relevant collective bargaining agreement. All German companies were tariff companies with a wage-relevant collective bargaining agreement that was negotiated at the industry level. Therefore, all German companies are coded as 1 (= industry wage coordination present). None of the U.S., UK, or Swiss companies was covered by an external and wage-relevant collective bargaining agreement, so we coded all of these companies as 0 (= no formal industry wage coordination).

(4)   Employee representation

The existence of, and a company's cooperation with, an employee representation system increases trust and creates a cooperative environment ensuring that workers use their discretion in the interest of the company and allowing a broad span of control. We therefore measure directly whether an employee representation exists within the company.

In our sample, no U.S. company reported having established something like an employee representation, a finding that is consistent with the national categorization. Conversely, all German manufacturing companies had a works council. In the UK, only one company had employee representation, and in Switzerland, four out of five companies reported having one, a finding contradicting the national categorization. Under Swiss labor law, more precisely the "*Mitwirkungsgesetz*" (law on participation) of 1993, employee representation plays a more minor role than under German law. However, Swiss employee representations still have the right to be informed about company issues (Article 9) and there are special participation rights provided for employee protection and security, change of ownership, financial security measures, and mass layoffs (Article 11). As mentioned previously, weaker employee representations than German works councils can still contribute to a cooperative environment, particularly if they have certain rights regarding employee protection. Therefore, we code the presence of employee representation as 1, and its absence as 0.

4.2.3 Results

Table 7 summarizes the institutional configurations in our sample. In contrast to the measurements of institutional variables at the national level, company-level measurement allows us to indentify various configurations of institutional variables also within countries.

Insert Table 7 about here

Overall, we have seven different configurations in our sample. All six German companies show the same configuration of institutional variables (Table 7, row one). We find variation in one variable in the U.S. (three U.S. companies have strong internal labor markets, two have weaker ones, Table 7, rows three and five) and the UK (one company has employee representation, Table 7, row 2), and variations in two variables in Switzerland (in the employee representation variable and the internal labor market variable, Table 7, rows two, six, and seven).

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 consistent institutional configurations (Table 8, rows one and two) are associated with a broad span of control.

Insert Table 8 about here

After reduction using Boolean algebra (see Table 9), the results suggest that one institutional configuration is associated with a broad span of control: apprenticeship training, employee representation, and high internal recruitment of supervisors.

Insert Table 9 about here

The configuration of the three institutional variables represents all three functions that were identified in section 2 and suggests that the complementary existence of all three functions is necessary to end up with a broad span of control. Apprenticeship 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, they appear to increase trust and employee motivation, thus reducing the need for tight supervision.

We therefore cannot reject our fourth hypotheses that only companies with a coherently coordinated company-level institutional configuration show a broad span of control. Moreover, companies in less coordinated national-level institutional settings can end up with a broad span of control when they use the coordinated institutions that are available and compensate for national-level liberal institutions with company-level coordinated institutions. Thus, companies in less coherent market economies can compensate for low employment protection, non-existent formal wage coordination, and legally non-required employee representations by having strong internal labor markets and a company-level employee representation.

To test our fifth hypothesis, we analyze the configurations of company-level institutional variables that are associated with a narrow span of control. Five consistent combinations are associated with a narrow span of control (Table 10, rows one to five).

Insert Table 10 about here

Again, these configurations can be reduced by Boolean algebra (see Table 11) with the result that two configurations are associated with a narrow span of control: a) apprenticeship training, non-existent wage coordination, and weak internal labor markets and b) non-existent employee representation and non-existent wage coordination.

Insert Table 11 about here

The results suggest that not all company-level institutional variables need to be liberal to end up with a narrow span of control. When the function of skill retention is missing, even the existence of apprenticeship training and, therefore, the possession of the necessary skill foundation is not associated with a broad span of control. Moreover, the absence of a trust-building employee representation is associated with a narrow span of control.

Regarding our fifth hypothesis, we therefore find no evidence that all company-level institutional variables need to have a liberal shape to be associated with a narrow span of control. Instead the absence of one function seems to be already enough to end up with a narrow span of control.

5. Discussion and conclusion

This paper analyzes the question of how matched-pair engineering companies adapt their organizations to more or less favorable and more or less coherent national institutional settings of Germany, Switzerland, the UK, and the U.S.

We find that matched-pair engineering companies differ substantially in the span of control of production supervisors depending on the national-level institutional variables. Production supervisors in companies in a coherently coordinated market economy (Germany) have, on average, a broader span of control than production supervisors in companies producing in a coherently liberal market economy (the U.S.). These results are consistent with the argument of the VoC approach, which argues that, while U.S. companies fit the

institutional setting by relying on hierarchies and rules, German companies fit the institutional setting by relying on cooperation.

In less coherent countries (the UK and Switzerland), companies show a broader range in the span of control variable than their counterparts in the more coherent countries. In Germany, companies build a cluster with a broad span of control; in the U.S., companies build a consistent cluster with a narrow span of control. In the less coherent countries, we find companies that have either a broad or a narrow span of control. By measuring the functionally equivalent institutions at the company level, we are able to identify different institutional configurations within a country. 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 a coherent set of institutional variables that has a coordinated shape, thus supporting the complementarity argument of the VoC. Apprenticeship training, strong internal labor markets, and employee representations ensure the skill foundation, skill retention, and trust between management and employees that are all necessary conditions for a broad span of control. For a narrow span of control, not all institutional variables need to have a liberal shape.

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 apprenticeship training, even though "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

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of tasks, which is influenced by technology. By matching companies by product and thus by production technology, we aimed to reduce technological influences.

Nevertheless, the possibility exists that the companies we studied vary in the type of work organization they use. 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 team work or lean production could influence organizational structure. For example, German companies might have fewer supervisors because they have introduced more team work 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 team work does not lead to a significant reduction in the number of shopfloor-based supervisory positions (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 to the existing literature by providing, for the first time, evidence addressing the question of how companies adapt their organizations to different national institutional settings that have various degrees of favorability and coherence. A striking, and at first glance surprising, implication is that an institutional setting that is more coordinated than that seen in the U.S. can provide more options to a company. Companies (e.g., in less coherent countries) can use the coordinated national-level institutions and then complement them with their own company-level coordinated institutions, which compensate for national-level liberal institutions. Our results add to real option theory literature (Dunning, 1999, 2009), in which researchers find mixed results for the option value of institutional variables such as wage coordination, unions, employment protection, and co-determination (e.g., Cooke, 1997; Cooke & Noble, 1998, Coughlin, Terza & Arromdee, 1991; Traxler & Woitech, 2000; Pull, 2008).

Our results have practice-relevant implications, because they show possible reactions of companies that produce in less favorable institutional settings. Multinational companies, for example, that originate in a country with a strong apprenticeship tradition and wish to expand their production to the U.S. face a major problem in how to deal with the lack of a skilled workforce. An example is the Siemens turbine plant in Charlottesville, VA, which needs to recruit over 1000 skilled production workers but is facing difficulties finding them (Financial

Times, March 29, 2011, "Siemens to Challenge U.S. Workforce"). Our results show that Siemens' reaction needs to be organizational in nature, through introducing a narrow span of control. The company appears to be following that route, by cooperating with local universities to educate and recruit employees at the supervisory level.

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	2	3	3
	Turbines & turbine generator sets, Air & gas compressors, Aircraft engines & parts	3511, 3563, 3724	2	3	2	2
	All engineering subsectors		**6**	**5**	**5**	**5**

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

Table 2: Distribution of plant sizes (measured as number of employees)

Size class	small	medium	large	sum
Number of employees	N<100	100<N<500	N>500	
GER	0	3	3	6
CH	0	4	1	5
UK	0	3	2	5
U.S.	1	3	1	5

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

Table 3: 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 (2009), OECD (2008), Visser (2009)

Table 4: 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**	**15.3**	**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

Table 5: 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)	Apprenticeship training provided by the company (yes=1, no=0)
Skill retention	Employment Protection (OECD indexes)	Majority of supervisors internally recruited (yes=1, no=0)
	Coverage and centralization of wage bargaining (Visser, 2009)	Covered by an external and wage-relevant collective bargaining agreement (yes=1, no=0)
Trust	Existence and rights of employee representation (Visser, 2009)	Employee representation at the plant level (yes=1, no=0)

Table 6: 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
						GER-6	60

Data source: Ryan et al., 2011, for Germany, Switzerland, and the UK
The question for the general recruitment strategy was: "How do you typically fill your vacancies for production supervisors?"

Table 7: Company-level institutional configurations in the sample

Configurations of company-level institutional variables	Apprenticeship Training	Internal Recruitment of Supervisors	Wage Bargaining	Empl. Represen-tation	Number of companies	Number of companies in countries			
						U.S.	UK	CH	GER
1	1	1	1	1	6				6
2	1	1	0	1	3		1	2	
3	0	1	0	0	3	3			
4	1	1	0	0	4		4		
5	0	0	0	0	2	2			
6	1	0	0	1	2			2	
7	1	0	0	0	1			1	

Table 8: Truth table company analysis—institutional configurations associated with a broad span of control

Configurations of company-level inst. variables	Apprenticeship Training	Internal Recruitment of Supervisors	Wage Bargaining	Empl. Represen-tation	N	Outcome Broad span of control	raw consistency
1	1	1	1	1	6	1	1.0
2	1	1	0	1	3	1	1.0
3	0	1	0	0	3	0	0.0
4	1	1	0	0	4	0	0.0
5	0	0	0	0	2	0	0.0
6	1	0	0	1	2	0	0.0
7	1	0	0	0	1	0	0.0

Table 9: Results QCA analysis at the company level – broad span of control

	Broad span of control
Apprenticeship training	●
Internal recruitment of supervisors	●
Wage coordination at industry level	
Employee Representation	●
Consistency	1.0
Raw/Unique Coverage	1.0/1.0
Solution Coverage/Consistency	1.0/1.0

● = 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

Table 10: Truth table company analysis—institutional configurations that are associated with a narrow span of control

Configurations of company-level inst. variables	Apprenticeship Training	Internal Recruitment of Supervisors	Wage Bargaining	Empl. Represen-tation	N	Outcome Narrow span of control	raw consistency
1	1	0	0	0	1	1	1.0
2	1	1	0	0	4	1	1.0
3	0	1	0	0	3	1	1.0
4	1	0	0	1	2	1	1.0
5	0	0	0	0	2	1	1.0
6	1	1	0	1	3	0	0.0
7	1	1	1	1	6	0	0.0

Table 11: Results of QCA analysis at the company level – narrow span of control

	Narrow span of control	
	Configuration 1	Configuration 2
Apprenticeship training	●	
Internal recruitment of supervisors	○	
Wage coordination at industry level	○	○
Employee Representation		○
Consistency	1.0	1.0
Raw/Unique Coverage	0.25/0.16	0.83/0.75
Solution Coverage/Consistency	1.0/1.0	

● = Condition present   ○ = Condition absent

Notes: see Table 9

Figure 1: Span of control in the participating companies
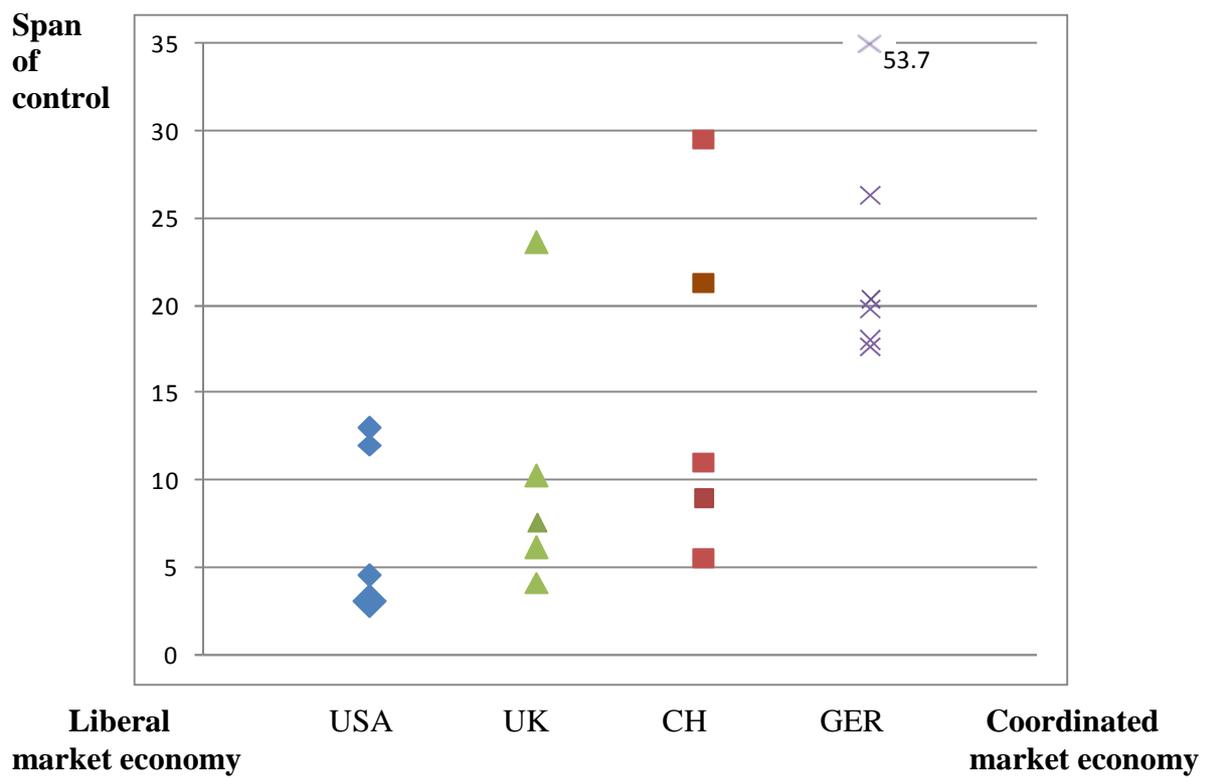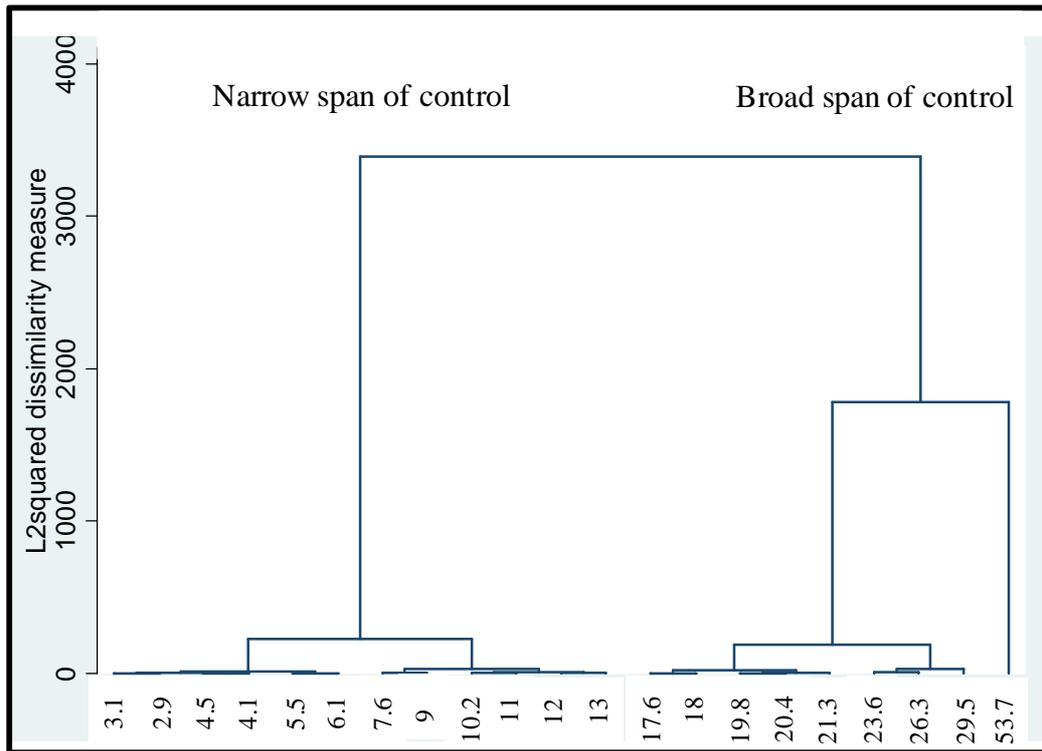
Figure 2: Cluster analysis of control spans

Source: own calculation

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