

Capitalisms and Capitalism in the Twenty-First Century

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In memory of Marianne Risberg: a fine friend and colleague

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Varieties of Offshoring?

Spatial Fragmentation and the Organization of Production in Twenty-First Century Capitalism

Jennifer Bair and Matthew C. Malutga¹

Introduction

Scholars agree that changes in economic organization reflect political and technological developments, but disagree about the extent to which these changes foster convergence in the organization of industries, the role of institutions, and the behaviour and performance of firms across industries and institutions. One view is that the *organization of transnational production networks* is a central and distinguishing characteristic of contemporary capitalism, while others emphasize the continued, or even increased, importance of *institutional context* in producing persistent cross-country or cross-regional variation in economic organization.

Those who focus on the transnational dimension contend that the development of functionally integrated but geographically dispersed production networks is an emergent and defining feature of globalization (Gereffi 1994; Feenstra 1998). Such networks express organizational dynamics that vary systematically by sector in ways that relate to the characteristics of particular production processes and the strategies and capabilities of firms. Moreover, these dynamics cannot be reduced to nationally specific patterns of economic organization or the institutional contexts that have historically fostered them. Alternatively, those who emphasize persistent heterogeneity in the institutional landscape of the global economy argue that because patterns of internationalization carry the imprint of institutional legacies, globalization is

¹ Authors' names are listed in alphabetical order.

both not only compatible with, but may even reinforce institutional diversity by increasing the salience of institutional comparative advantage in international markets (Boyer 2004; Hall and Soskice 2001; Whitley 2007, 1999 and in this volume).

We take the institutions versus sectors debate as a point of entry into analyzing the dynamics of contemporary capitalism. On one hand, we draw from the highly influential varieties of capitalism approach most closely associated with the work of Hall and Soskice (2001) in order to derive and assess empirically a set of propositions about institutional comparative advantage, as we explain below. Although this framework has been extensively criticized over the last decade (Hollingsworth and Boyer 1997; Streeck et al. 2005; Hancke et al. 2007; Taylor 2004),² it is useful for our purposes because it lends itself to clear and testable hypotheses. Similarly, though several frameworks for analyzing global production networks have been proposed (Henderson et al. 2002; Bair 2008; Gibbon et al. 2008), we draw on Gereffi's (1994) global commodity chain approach and the subsequent global value chain governance typology elaborated by Gereffi, Humphrey, and Sturgeon (2005). Taking the varieties of capitalism (hereafter VoC) and the global commodity/value chain (hereafter GCC/GVC) approaches as indicative of the institutional and sectoral camps respectively, we formulate and evaluate hypotheses drawn from these frameworks regarding the degree to which economic organization is shaped by institutional contexts, industry logics, or both.

The focus of our discussion is spatial fragmentation in contemporary capitalism. Feenstra (1998) describes this dimension of economic organization as the 'integration of trade and the disintegration of production': it refers to the dispersion of disaggregated manufacturing processes that were previously contained within Northern economies to multiple locations, frequently in the global South. We advance the organizational/convergence versus institutional/persistent diversity debate by examining empirically at what level variation in spatial fragmentation is greater—at the industry level or at the institutional level—by developing four specific hypotheses regarding the rate of spatial fragmentation across industries and institutional settings.³ We find that rates of spatial

² For example, some argue that this approach treats firms as passive 'institution-takers' that develop strategies appropriate to the institutions that exist, failing to appreciate the extent to which organizational actors seek to create an institutional environment consistent with their goals (Alien 2004; Deeg and Jackson 2007). Other critics take issue with the static nature of Hall and Soskice's framework, though this weakness is being addressed in a vibrant subfield of comparative institutionalism focusing on institutional change (Morgan and Kubo 2005; Hall and Thelen 2009; Streeck and Thelen 2005).

³ In keeping with the varieties of capitalism model developed by Hall and Soskice, we define institutions at the national level. However, we recognize that some approaches within the comparative capitalism literature, such as Whitley's business systems (2007) and Amable's economic models (2003) do not necessarily delimit institutional contexts by national borders.

fragmentation vary more by industry than institutional type. In particular, we identify industry-specific differences in the rate of spatial fragmentation (simply measured as an increased ratio of imports to domestic value added, as we explain below) that are more or less constant across different institutional contexts. While some of our results are attributable to a degree of industry-specific variation in spatial fragmentation *within* varieties of capitalism, our findings are ultimately consistent with the expectations of the GCC/GVC perspective. We conclude by highlighting the robust analytical space within which scholars from the GCC/GVC and institutional camps can come together to understand the determinants of variation in how the spatial fragmentation that we observe is achieved.

1. Varieties of capitalism versus global chains: competing or complementary forms of economic organization?

One can trace the origin of this debate to an exchange between Gary Gereffi and Richard Whitley in a symposium about the implications of globalization for economic organization in the journal *Competition and Change*, in which the authors staked out contending positions regarding the development of new modes of inter-firm coordination in global industries. In explicating his position, Gereffi makes three claims: 1) rising economic competition has important consequences for organizational behavior and performance at the firm, national, and regional levels; 2) a key response to the problem of rising competition is the emergence of commodity chains—that is, functionally integrated, geographically dispersed production systems coordinated by Northern-based lead firms that decide how, where, and by whom activities are carried out; and 3) commodity chains vary by industry, as a result of both product and process characteristics and policies at the national and international level.

Gereffi distinguished producer-driven (e.g. autos and aircraft) from buyer-driven (e.g. apparel and footwear) commodity chains. This distinction was based on the observation that the lead firms coordinating the latter are retailers and brands that retain activities such as product development and marketing in-house but outsource most of the actual production to networks of independent suppliers located primarily in lower-wage countries. In contrast, the lead firms of producer-driven chains are primarily manufacturers that retain a greater degree of manufacturing capabilities, both in-house and in other Northern countries, than their counterparts in buyer-driven chains. This distinction between producer- and buyer-driven chains thus has implications for the organization (hierarchy versus vertical disintegration) and the geography (less versus more spatially dispersed) of production. While GCC/GVC analysts admit that national institutions shape what happens when particular

links in global commodity chains touch down, they focus on patterns of internationalization that vary by chain types. For example, Gereffi and others expect that firms having a similar position in a commodity chain will focus on similar activities in terms of the inter-firm division of labour, and will have similar relationships with other chain participants. To the extent that these sector-specific organizational patterns conflict with older, nationally specific modes of industrial organization, globalization might tend 'to diminish the influence of national origins on business systems' (1996: 427).

In contrast, Whitley took issue with the claim that commodity chains 'constitute separate coordination and control systems of economic activities', arguing that for this to be true, 'they would need to establish distinctive ways of organizing firms and markets on a worldwide scale which differed significantly from purely national and regional ones' (Whitley 1996: 416). Instead, Whitley argues that there is likely to be significant variation in the way transnational coordination is occurring across distinct institutional contexts, even in the same industry. That is, variation in how firms operate in the market, organize work internally, and coordinate interactions with one another and with other actors (e.g. labour unions and financial institutions) by institutional contexts is more important to economic organization than variation across purportedly global models of industrial organization. In short, national institutional contexts are resilient to the pressures of global economic change precisely because 'distinctive ways of coordinating and controlling economic activities... developed interdependently with key institutions' (ibid: 412).

There has been relatively little change in the essential contours of this debate over the last decade and a half. There is considerable agreement among proponents of both the VoC and GCC/GVC approaches that national-level institutions do matter for many outcomes of interest to organizational scholars, and there is also growing consensus that globalization may lead to some degree of decoupling between institutional contexts and organizational dynamics. Yet there remains a fundamental disagreement about which matters more for economic organization—national (or more rarely regional) institutions or industry-specific systems of inter-firm coordination. In our view, this is both a theoretical and empirical question. Answering it requires us to develop a clearer distinction between the analytical foci of the GCC/GVC and VoC camps, as well as identifying measures of organizational behavior and performance that are more or less suited to these foci. Thus, our circumscribed goal is to more clearly delineate the outcomes that are of primary interest to the GCC/GVC approach, and juxtapose its explanation of them to those that can be drawn from the VoC perspective.

The empirical outcome in focus here is national variation in spatial fragmentation at the level of three broad industries—garments, electronics, and

transportation equipment—that were chosen because they are the most extensively studied in the GCC/GVC tradition. Following Feenstra (1998), we measure spatial fragmentation with the ratio of imports to value added in each industry, which captures the amount of industry-specific domestic production that is augmented by imports for each country. As we discuss further in the methodological section below, our particular metric is a useful indicator of global production networks but it is also an imperfect one because it does not allow us to distinguish between arm's-length imports and coordinated trade of the sort that interests us here. Nevertheless, it is preferable to alternative measures that do not capture the full range of processes through which offshored manufacturing can be coordinated.

Our empirical analysis is guided by a set of hypotheses about spatial fragmentation drawn from the VoC and GCC/GVC literatures, which we develop in the next section. Of course, spatial fragmentation is only one dimension of economic organization that scholars refer to when they claim that organizational outcomes reflect either institutional contexts or sectoral logics. Furthermore, our analysis does not allow us to speak definitively to *how* spatial fragmentation is achieved—that is either through equity-based, market-based or network-based ties. We return to this point in the conclusion because we believe that this lacuna in our analysis provides an ideal space within which institutional and GCC/GVC literatures could engage in intellectual cross-pollination.

2. Economic organization and spatial fragmentation across industries and institutions: What do the sectoral and institutional approaches suggest?

One of the central claims of Gereffi's original commodity chains framework is that the role that firms and countries play in a global division of labour is increasingly linked to the formation of producer-driven and buyer-driven commodity chains. While it was not initially clear in Gereffi's original formulation *why* functionally integrated but spatially dispersed production networks were emerging in the manufacturing sector (e.g. Gereffi 1994, 1996), over time commodity chains scholars developed a dynamic theory in which pressure generated by heightened global competition led Northern firms to respond by offloading the parts of the production process with lower barriers to entry, and thus, higher degrees of competition (Kaplinsky 2005). Indeed, the original distinction between producer-driven and buyer-driven chains reflected this logic: Lead firms in the apparel industry (e.g. retailers) retain control over brand development and marketing, but externalize to networks of independent and/or off-shore suppliers those activities characterized by the

lowest barriers to entry, the highest competition, and the lowest returns (e.g. apparel assembly). Conversely, manufacturing links in the capital intensive auto chain are protected by higher barriers to entry, which reduce the pressure on auto assemblers to externalize and/or offshore production. Thus, relative to lead firms in the apparel industry, auto companies are more likely to service the home market through domestic manufacturing operations (Mahutga 2012).

However, even the prototypically producer-driven auto industry experienced a significant degree of both organizational fragmentation (e.g. General Motors' spin-off of Delphi as an independent supplier) and spatial fragmentation in recent decades, as companies expand their production networks to include overseas component suppliers or offshore assembly plants to service both the home and foreign markets. Thus while offshore manufacturing relations may be occurring more rapidly in the apparel industry than in autos, the fact that it is occurring in both can be explained with reference to a general decline in the barriers to entry that protect manufacturing or 'tangible' activities *relative* to 'intangible' ones, such as research and development, product design, and marketing (Gereffi et al. 2001; Kaplinsky 2005). This argument about the relationship between declining barriers to entry in manufacturing and spatial fragmentation can be restated as our first hypothesis.⁴

H₁: Given declining barriers to entry in many production activities, rates of spatial fragmentation are increasing in all manufacturing industries.

While a trend toward rising spatial fragmentation across the manufacturing sector is a clear implication of the GCC/GVC approach, GCC/GVC analysts pay more attention to what they argue are *industry-specific* responses to global competition. These responses reflect the fact that 'fundamental differences exist between industries in terms of technology, competitive structures, and labor-intensity, and these play a primary role in explaining industrial governance structures and the strategies countries should pursue in order to succeed in global markets' (Gereffi 1996: 433–4). Research on global industries over the course of the 1990s provided support for this view, and in fact revealed a greater degree of variety in governance structures, thus suggesting a need to move beyond the original producer- versus buyer-driven dichotomy. Accordingly, scholars are increasingly focused on developing a more comprehensive typology of coordination mechanisms and identifying the factors producing

⁴ As the literature on multinational corporations has long emphasized, there are multiple reasons for a firm to establish a presence outside of its home country. These include, among others, market access, access to inputs such as labour or raw materials, and control of distribution channels (Dunning 2000).

particular forms of governance. In other words, if we take governance structure as the dependent variable, what are the independent variables that produce particular patterns of inter-firm coordination?

The theory of global value chain governance developed by Gereffi, Humphrey, and Sturgeon (2005) aims to provide such a specification. They develop a typology consisting of five governance structures, based on the possible combinations of three independent variables (measured 'low' or 'high'): the complexity of the transaction between firms, the codifiability of information relating to the production process, and the capabilities existing in the supply base. What is theoretically novel about this theory is that its fivefold governance typology includes three network forms between the poles of hierarchy and market: captive networks, relational networks, and modular networks. Rather than juxtapose a single mode of network coordination to both market and hierarchy as a 'third form' (Hall and Soskice 2001: 14), this elaboration suggests that there are multiple network logics, which, in turn, have distinct implications for spatial fragmentation. For example, while relational networks typically require frequent and extensive interactions between firms, modular networks do not; consequently, the latter are compatible with a greater degree of spatial fragmentation between exchange partners.⁵ Codification is a critical independent variable in this respect because it permits the exchange of complex information across space, thus mitigating the need for spatial proximity between firms in modular networks (see Tylecote in this volume).

In sum, the GVC theory of governance conceptualizes rising competition in the global economy as an exogenous process to which firms respond with some combination of organizational and spatial fragmentation that varies by the opportunities and constraints available to them. Because these opportunities and constraints are related to the variables identified above—entry barriers, complexity, codifiability, supplier capabilities—and because the values of these variables differ across industries, so, too, do fragmentation patterns vary by industry. In contrast to the VoC's emphasis on institutional variation across advanced industrialized countries, then, the GCC/GVCs literature emphasizes the more or less similar role that developed-country firms play in globalizing industries. Thus, rates of spatial fragmentation vary across industries in relation to the number and geographic distribution of capable suppliers as well as the complexity of the production process. Specifically, fragmentation will be highest when capabilities are high and complexity is

⁵ It is important to note here that the modular networks elaborated in the GVC theory of governance draws from Sturgeon's (2002) work on modularity in the electronics industry, and specifically how the development of standards affects inter-firm relations between OEMs and suppliers. There is a large literature on modularity, and some of it uses the term 'modular' more in a general way (i.e. to refer to production systems that feature subassemblies, as in autos) (Baldwin and Clark 2000; Sako 2003).

low. In industries characterized by more complex production processes, fragmentation will increase with the codifiability of product and process technology.

In terms of the three specific industries we examine here, lead firms in the garment industry would be expected to organize their manufacturing via internationally diffuse sourcing networks because apparel manufacturing is characterized by low barriers to entry and low complexity, while the capabilities of the supply base in the global South are high. Alternatively, lead firms in the transport equipment industry would be expected to internalize a larger share of the manufacturing activity than those in the garment industry because of higher barriers to entry in manufacturing. Moreover, when outsourcing does take place, auto firms should coordinate relational networks with a smaller and less globally dispersed set of sourcing partners because the complexity of the production process is high, its codifiability is low, and supplier capabilities in the global South are modest (Sturgeon, Biesebroeck, and Gereffi 2008). Finally, the electronics industry is typically conceptualized as having a modular governance structure. In this industry, spatial fragmentation is expected to be intermediate because, although the production process is more complex than in the garment industry, this complexity can be managed across long distances through codification, which is higher in the electronics industry than in the auto industry. Moreover these industry-specific governance structures apply regardless of the institutional context in which firms are embedded (Sturgeon 2009),⁶ which leads us to our second hypothesis:

H₂: Industry-specific rates should rank as follows: garments, electronics, transportation equipment.

While the VoC literature and related institutional perspectives comprise a voluminous and diverse body of work, we are particularly interested in the argument that a coupling dynamic exists between institutions and organizations. According to this view, the configuration of institutions that exists in a given political economy favours certain organizational capabilities and behaviours over others. For example, some institutional environments encourage high-risk, high-reward strategies, while others facilitate longer-term investments by cultivating patient capital, which reduces pressure on firms to generate immediate returns to shareholders.

⁶ While institutions are formally exogenous to this framework, it is possible that institutional dynamics are important for determining the value these variables take in a given context, as suggested by the large literature on the development of international industry standards, since such standards clearly affect the 'codifiability' measure (Greenstein and Stango 2007; Langlois 2004).

Similarly, firms that conduct business in institutional environments that provide the capacity for '(i) the exchange of information among actors, (ii) the monitoring of behavior, and (iii) the sanctioning of defection from cooperative endeavors', environments that include 'powerful business or employer associations, strong trade unions, extensive networks of cross-shareholding, and legal or regularity systems designed to facilitate information sharing and collaboration', should enjoy a competitive advantage in forms of industrial organization that rely upon thick relational networks among domestic firms, rather than either vertical integration or arm's-length market ties (Hall and Soskice 2001: 10).

The relationship between institutional context and organizational capability is the basis for Hall and Soskice's claim that institutional diversity is a source of comparative advantage for firms of different national origins competing in global markets: 'the institutional structure of a particular political economy provides firms with advantages for engaging in specific types of activities there. Firms can perform some types of activities, which allow them to produce some kinds of goods, more efficiently than others because of the institutional support they receive for those activities in the political economy', which vary across nations (2001: 37). In this sense, globalization, far from eroding institutional vitality, may actually reinforce it; 'nations often prosper, not by becoming more similar, but by building on their institutional differences' (ibid: 60).

While the best procedure for identifying unique institutional regimes and the placement of particular countries within any classificatory scheme has been a subject of debate with this literature, Hall and Soskice propose a typology that divides most of the advanced, industrialized countries of the OECD into one of two categories: liberal market economies (LME) and coordinated market economies (CME). In the former, 'firms coordinate their activities primarily via hierarchies and competitive market arrangements', whereas in the latter 'firms depend more heavily on non-market relationships to coordinate their endeavors with other actors and to construct their core competencies... In contrast to liberal market economies, where the equilibrium outcomes of firm behavior are usually given by demand and supply conditions in competitive markets, the equilibria on which firms coordinate in coordinated market economies are more often the result of strategic interaction among firms and other actors' (Hall and Soskice 2001: 8-9). These distinct institutional settings shape firm competencies and inter-firm coordination in such a way as to either encourage specialization in particular industries, and/or specialization in particular kinds of inter-firm organization across industries (Casper and Whitley 2004; Amable 2003; Casper in this volume; cf. Crouch, Schröder and Voelzkow 2009).

According to the VoC literature, the CMEs feature institutions that foster long-term, trust-based relationships between firms, including 'extensive systems for what might be termed "network reputational monitoring"' (Hall and Soskice 2001: 23). By fostering communication and repeat exchange among firms, say between lead firms and suppliers, this institutional context enables firms to work collaboratively in the pursuit of the kind of incremental innovation that is important for success in industries such as car manufacturing (cf. Herrigel and Wittke 2005). Thus, firms in CMEs are more likely to use non-market ties such as long-term relational contracting, while LMEs should have a higher degree of vertical integration and/or arm's-length ties among firms. In other words, the dominant form of economic organization in the LMEs is presumed to be a mix of hierarchy and market, while the institutional milieu of CMEs is thought to encourage inter-firm coordination via relational networks.

One implication that Hall and Soskice draw from the link between institutional context, organizational competencies, and the dominant mode of inter-firm coordination found in an economy is that 'firms based in LMEs may be more inclined to move their activities abroad to secure cheaper labor than companies based in CMEs, because the former already coordinate their endeavors using the market structures that less developed nations usually provide, while the latter often pursue corporate strategies that rely on high skills and institutional infrastructure difficult to secure elsewhere' (2001: 57). The claim here is simply that, across all industries, firms in LMEs rely more heavily than firms in CMEs on market-based inter-firm relations that are easier to reproduce in developing countries than the kind of collaborative inter-firm ties that predominate in CMEs. Thus, relative to their counterparts in CMEs, firms in LMEs can more easily shift production to lower-wage locations, while firms from CMEs will 'continue to invest in their home CME even when other investment opportunities in low-cost, less-developed countries exist' (Allen 2004: 101-2). Accordingly, our third hypothesis is as follows:

H₃: Across all industries, rates of fragmentation are higher in LMEs than CMEs.

The institutional comparative advantage framework developed by Hall and Soskice is also consistent with expectations of cross-national patterns of industry-specific specialization, because certain types of industries are more compatible with the institutions that predominate in one VoC versus another. Firms in CMEs are competitive in industries based on diversified quality production, with German auto firms representing the classic example of institutional-organizational coupling for this model (Streeck 2009). Diversified quality production, which characterizes capital goods such as machine

tools, consumer durables, and transportation equipment, is based on incremental innovation that improves an established product line, while securing 'continuous improvements in the production process in order to improve quality control and hold down costs' (Hall and Soskice 2001: 39). In contrast, firms in LMEs are expected to excel in industries that are based less on incremental improvements in process technology and more on radical innovation (e.g. creating entirely new product lines or making significant changes to extant products or processes). Examples include segments of the electronics industry (e.g. semiconductors, software development), telecommunications, and services such as corporate finance or entertainment.

How might we evaluate empirically the VoC claim that there is a coupling between, on the one hand, institutional configurations, organizational capabilities, and the types of innovation characterizing particular industries, and, on the other, firm performance and sectoral specialization? If patterns of internationalization reflect comparative advantage, and if the latter is shaped partially by the resources that different institutional regimes provide, then we would expect firms to be competitive in those industries that are commensurate with the VoC in which they are embedded. Where firms can draw on the comparative advantage provided by the institutional contexts within which they operate, domestic production in the context of highly embedded relational production networks should present itself as a viable functional substitute to offshoring.

For example, because CME countries should be more competitive in industries characterized by incremental innovation, and because collaborative inter-firm networks facilitate this kind of innovation, we expect spatial fragmentation to be lower in these industries. Similarly, LME countries should experience less spatial fragmentation in industries characterized by radical innovation. Thus, we derive a set of hypotheses about variation in rates of industry-specific fragmentation within and across the two institutional systems described by Hall and Soskice as coordinated and liberal market economies. Generally, we would expect that rates of fragmentation vary between LMEs and CMEs such that fragmentation is lowest in those industries for which there is a comparative institutional advantage, as the following two hypotheses suggest.

H_{4a}: Within the CME category, rates of fragmentation should be lower in the transportation equipment industry than in the electronics or apparel industries.

H_{4b}: Rates of fragmentation in the transportation equipment industry should be lower for the CME countries than for the LME countries.

3. Using spatial fragmentation to evaluate sectoral and institutional explanations: variation across and within industries and capitalisms

Data

SPATIAL FRAGMENTATION

Our dependent variable is a country-level measure of spatial fragmentation, which following Feenstra (1998) we calculate by computing the ratio of imports to value added in the garment, electronics, and transportation equipment industries and in the manufacturing sector as a whole. Our measure is one of three types of trade-based measures of spatial fragmentation; others include ratios of component to final goods trade, and two-way trade. Although the use of any one may be more or less appropriate, depending on the researcher's particular interest, none are without limitations. For example, measures of the ratio of component to final goods trade and two-way trade are either incomplete insofar as they only reflect a particular type of offshoring arrangement (i.e. trade in intermediate component imports as opposed to 'full package' offshoring), or prone to measurement error because standard trade statistics do not differentiate between components and final goods, and it is therefore impossible to accurately differentiate between them post-hoc. On the other hand, ratios of imports/exports to value added may conflate offshoring with other causes of trade (see Antras and Rossi-Hanberg 2009 for a fuller discussion of all three types).

Although not subject to the first two sources of bias, our measure of spatial fragmentation is problematic for the third reason because we cannot determine the degree to which imports (whether they be components or assembled goods) are produced within chains coordinated by resident lead firms (either domestic firms or foreign subsidiaries). That is, our measure of spatial fragmentation is compatible with two scenarios in which lead firms are coordinating imports—1) the importation of intermediate components, which is the modal strategy in electronics and transport equipment and 2) the importation of final goods that were made offshore to specifications provided by lead firms which is the modal strategy in the garment industry. It is also sensitive to a third scenario in which imports are not being coordinated by firms in the importing country, as when firms exit an industry entirely, leaving the domestic market to import penetration from foreign firms. Because the primary goal of our analysis is to compare fragmentation rates across industries and VoCs we could ignore the possible conflation of scenarios 1 and 2 with 3 if we could assume the error was evenly distributed across industries and countries. Since the (in)validity of this assumption is impossible to know, our results should be read with some caution.

The trade data comes from the United Nations Commodity Trade Statistics Database (UN comtrade), and is measured at the two-digit (industry) level according to the standardized international trade classification (SITC). We use the first classificatory system (Revision 1), because it extends the farthest back in time. The categories we use for our three specific industries include 84 (wearing apparel), 73 (transport equipment); and 72 (electrical machinery). We use the sum of categories 6 (manufactured goods classified chiefly by material), 7 (machinery and transport equipment) and 8 (miscellaneous manufactured articles) for the manufacturing sector as a whole (UN 2006). The value-added data come from the United Nations Industrial Development Organization's (UNIDO) Industrial Statistics Database (UNIDO 2006), categorized according to the International Standard Industrial Classification (ISIC) system, Revision 2. We use categories 322 (Clothing), 383 (Electrical Machinery) and 384 (Transport Equipment) and 300 (Total Manufacturing) for the garment, electronics, transport equipment industries, and all manufacturing respectively.

Two of the three industry-specific categories—transport equipment and electrical machinery—are perhaps less disaggregated than would be ideal. For example, transport equipment includes autos, airplanes, bicycles, ships, and trains. Electrical machinery includes state-of-the-art computers along with more standardized office equipment and appliances. All categories include both finished goods and intermediate components. However, this level of aggregation provides the greatest comparability to the value-added data, and many of the particular commodities included in these two categories are organized in similar ways, and thus approximate the ideal-typical patterns we discuss above (see Kimura 2007 for aircraft and Sturgeon and Kawakami 2010 for electronics). Thus, if we assume incorrectly that there is less variation within these categories than between them in terms of the modal GCC/GVC governance mechanisms responsible for their organization, the error of our estimates of industry-specific fragmentation rates would increase, which would increase proportionately the likelihood of insignificant industry comparisons. In other words, the possibility of measurement error in these aggregate industry categories makes it more difficult to identify significant differences in fragmentation rates across industries and thereby yields rather conservative estimates of inter-industry variation in spatial fragmentation.

VARIETIES OF CAPITALISM

In order to understand the extent to which rates of spatial fragmentation vary systematically across varieties of capitalism, we introduce indicator (dummy) variables for two varieties of capitalism. We follow Soskice and Hall (2001) in classifying countries as either coordinated market economies (CME) or liberal market economies (LME), and include only the set of advanced capitalist

countries that fit neatly into one or the other category as recorded in Table 11.1.⁷

Methods

We begin by constructing five-year average levels of fragmentation for each country in each industry between the years 1963 and 2002 to smooth out any idiosyncratic year on year variation. This yields a total of eight possible observations per industry and thirty-two per country. We then pool these five-year averages across industries and countries, which yields a total of 512 possible observations. Because some countries were missing data on either trade or value added, the total number of observations was reduced to 456 in the regression models. We then regress the five-year fragmentation rates on (1) a linear time-trend, (2) indicator variables for the garment, transportation, and electronics industries, (3) the VoCs identified in Table 11.1, and (4) interactions between the three sources of variation. These regressions are ideally suited to test hypotheses involving industry and VoC specific explanations, as well as control for each in testing the other, because they allow for direct hypothesis tests of all three sources of variation from within the same model.⁸

However, interpreting regressions involving two and three-way interactions can be difficult without a careful consideration of the conditional implication of interaction terms (Kam and Franzese 2007). Thus, in order to simplify the presentation of our hypothesis tests, we report the full interaction models in Table 11.3 in the methodological appendix at the end of the chapter and confine our discussion to Table 11.2, which reports combinations of the estimated coefficients along with their variance and covariance that are relevant to our hypothesis tests. These combinations are detailed in the methodological appendix. We first test hypotheses about fragmentation rates across VoCs ignoring variation by industry. We then test hypotheses across industries ignoring variation by VoC. We conclude by testing industry-specific fragmentation hypotheses within and between VoCs.

⁷ We include 18 of the 34 OECD countries in our dataset. As do Soskice and Hall, we exclude Turkey, Mexico, and the Central and Eastern European countries. We also exclude those (primarily southern) European countries (Greece, Spain, Italy, Portugal, and France), which correspond to neither the CME nor LME categories. Some studies in the VoC tradition include these western European countries, or some subset of them, as a third 'mixed' variety of capitalism (e.g. Rueda and Pontusson 2000). We restricted our analysis to the CME and LME categories because we did not feel confident formulating clear hypotheses about the relationship between economic organization and institutional context for other varieties.

⁸ The regression parameters reported below are obtained with ordinary least-squares regression: except that the standard errors have been adjusted to account for the clustering of the error term within the repeated country observations (Rogers 1993). The industry-country-year levels of fragmentation were logged with the base 10 logarithm prior to the analysis to adjust for skew.

Table 11.1. Country by variety of capitalism (VoC)

Country	VoC
Austria	CME
Belgium/Luxembourg*	CME
Denmark	CME
Finland	CME
Germany	CME
Japan	CME
Netherlands	CME
Norway	CME
Sweden	CME
Switzerland*	CME
Australia	LME
Canada	LME
Ireland	LME
New Zealand	LME
United Kingdom	LME
United States	LME

Notes: Categorization from Hall and Soskice (2001). *Belgium and Luxembourg's trade data has been reported at the aggregate level until only very recently. We maintained this aggregation because it is impossible to disaggregate backward in time. Switzerland is missing value-added data systematically and is excluded.

Results

Figure 11.1 displays fragmentation trends by industry using a locally weighted scatterplot smoother (LOWESS), where the level of fragmentation is logged with the base-10 logarithm and averaged across the CME and LME groups. By the second half of the period under investigation, all three of our industries—garments, electronics, and transport equipment—are more fragmented than the manufacturing sector as a whole. The fragmentation rate is highest for the garment industry, but it is difficult to identify real differences in the fragmentation rate between the transportation and electronics industries, except that the former seems to slow while the latter increases toward the end of the period. The fragmentation rate for manufacturing as a whole seems more or less constant throughout the period. In short, there appears to be a trend toward increased fragmentation across all these industries over time, but it is unclear exactly how this rate varies by industry.

Do the apparently positive industry-specific trends in Figure 11.1 together constitute a statistically significant trend toward fragmentation on average across all these industries? The first coefficient in Table 11.2 tests our first hypothesis (H₁) that rates of spatial fragmentation are increasing across all manufacturing industries, regardless of VoC type. The positive coefficient on the linear time trend in Model 1 supports this hypothesis, suggesting that the average rate of increase in the manufacturing sector as a whole is roughly 9.6

Table 11.2. Hypothesis Tests for fragmentation rates conditional on VoC, industry, and VoC-industry interactions (from Table 11.3), 1963–2002

	Model 1		Model 2		Model 3		Model 4	
	All	CME ^a	LME ^a	CME—LME ^a	All ^b	CME ^c	LME ^c	CME—LME ^c
Industry Trends								
All	0.096*** (0.009)	0.086*** (0.010)	0.112*** (0.016)	—	—	—	—	—
Garments	—	—	—	—	0.193*** (0.013)	0.200*** (0.011)	0.186*** (0.016)	—
Electronics	—	—	—	—	0.075*** (0.016)	0.057** (0.016)	0.102** (0.029)	—
Transport	—	—	—	—	0.059*** (0.014)	0.040** (0.011)	0.087** (0.026)	—
Difference between industry-specific fragmentation trends within VoCs								
Garments—Electronics	—	—	—	—	0.117*** (0.023)	0.143*** (0.016)	0.084* (0.038)	—
Garments—Transport	—	—	—	—	0.134*** (0.021)	0.160*** (0.016)	0.098** (0.031)	—
Electronics—Transport	—	—	—	—	0.016 (0.013)	0.017 (0.013)	0.015 (0.027)	—
Difference in industry-specific fragmentation trends between VoCs								
All	—	—	—	-0.027 (0.016)	—	—	—	—
Garments	—	—	—	—	—	—	—	0.014 (0.026)
Electronics	—	—	—	—	—	—	—	-0.045 (0.033)
Transport	—	—	—	—	—	—	—	-0.047 (0.028)

Notes: Coefficients are conditional unstandardized regression coefficients. Standard errors adjusted for clustering at the country level in parentheses. * p < 0.05; ** p < 0.01

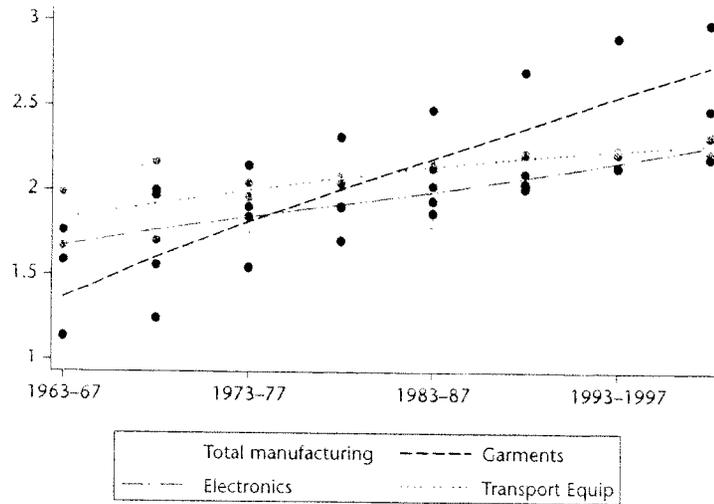


Figure 11.1. Average level of fragmentation by industry, 1963–2002
 Notes: Fragmentation levels are logged with the base 10 logarithm and averaged across the CME and LME countries. Time trend fit with a LOWESS smoother.

(100×0.096) per cent every five years, a trend that is significantly different from zero.

Figure 11.2 displays the same trends as in Figure 11.1, but disaggregated by variety of capitalism. The positive trend for all industries in Figure 11.1 seems to hold for both VoC groups, as do the relative fragmentation rates across industries. However, it is difficult to ascertain whether or not industry-specific fragmentation rates differ systematically between industries or across VoCs on the basis of a visual inspection of Figure 11.2. Thus, we turn now to the regression models to test the hypotheses we elaborated above. The first tests appear in columns 2–4 of Table 11.2 (Model 2). The second and third columns of Table 11.2 report the average fragmentation rate across all industries for the CME and LME categories, respectively. The fragmentation rate is 8.6 (100×0.086) per cent every five years in the CMEs and 11.2 (100×0.112) per cent every five years in the LMEs, for a difference of 2.7 per cent between the two varieties. The fourth column tests our third hypothesis (H_3)—namely, that rates of fragmentation are higher in LMEs than in CMEs. The difference of 2.7 per cent in the rate of fragmentation between the two VoC groups is in the expected direction—LMEs fragment faster than CMEs—but is not significant. Thus, the evidence does not support the third hypothesis that rates of fragmentation are systematically higher in LMEs across all industries.

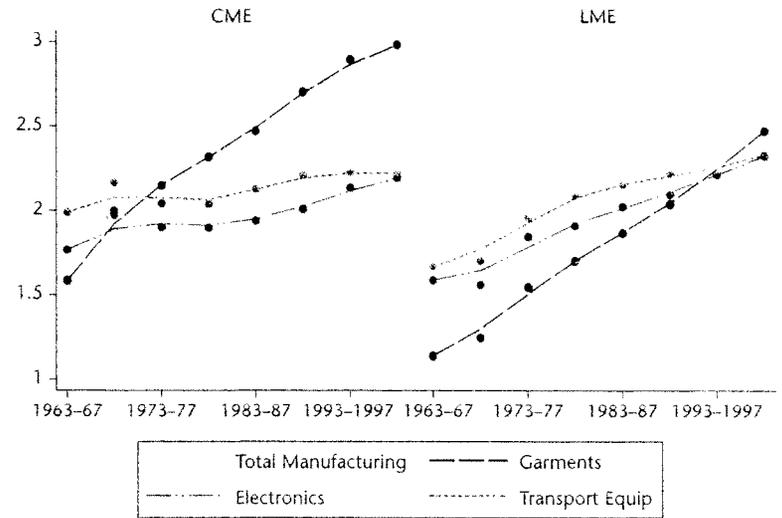


Figure 11.2. Average level of fragmentation by industry and VoC, 1963–2002
 Notes: Fragmentation levels are logged with the base 10 logarithm and averaged by the CME and LME countries. Time trend fit with a LOWESS smoother.

The fifth column in Table 11.2 (Model 3) addresses our second hypothesis (H_2) that rates of fragmentation vary systematically across industries. This hypothesis tests the claim that fragmentation will be highest when the capabilities of suppliers are high and complexity is low, and otherwise increase with the codifiability of product and process technology. In terms of our three industries, this means that fragmentation is highest in the garment industry (low complexity, high capabilities) and lowest in the auto industry (high complexity, low codifiability), with the electronics industry constituting an intermediate case (high complexity, high codifiability).

The second through fourth rows in column 5 (Model 3) report the industry-specific trends. Each industry has a positive and statistically significant rate of fragmentation. Moreover, the rates of fragmentation across industries appear to vary in a manner consistent with our second hypothesis—the rate of fragmentation is highest in the garment industry (19.3 per cent every five years), where complexity is low and capabilities are high. It is intermediate in the electronics industry (7.5 per cent every five years), where both complexity and codifiability are high. Finally, the fragmentation rate is lowest in the transport equipment industry (5.9 per cent every five years), where complexity is high and codifiability is low.

Are these apparent industry-specific differences in fragmentation rates statistically significant? The fifth through seventh rows in column 5 (Model 3) address this question. The fifth row compares the garment and electronics industry, and suggests that the garment industry fragments 11.7 per cent faster than electronics, which is statistically significant. The sixth row compares the garment and transport equipment industry, and suggests that the garment industry fragments 13.4 per cent faster than the transport equipment industry, which is also statistically significant. Finally, the seventh row tests the same hypothesis for the electronics and transportation equipment industries, suggesting that the electronics industry fragments 1.6 per cent faster than the transport equipment industry, but the difference is not significant.

In short, the significantly higher rate of fragmentation in the garment industry supports our second hypothesis that fragmentation rates are highest in the garment industry, where complexity is low and capabilities are high. However, the insignificant difference in the rate of fragmentation between electronics and transport equipment may call into question the theory of GVC governance insofar as it expects spatial fragmentation to increase with codifiability, which is higher in electronics than autos. That is, the lack of a statistically significant difference between autos and electronics in Model 3 suggests that the difference between modular and relational modes of governance may be inconsequential for spatial fragmentation.

Model 4 in Table 11.2 allows us to test hypotheses comparing the VoC and GCC/GVC literatures by addressing the extent to which the between-industry variation in fragmentation rates identified above holds across VoC types, and whether or not industry-specific fragmentation rates vary across VoCs. In rows 2–4 of columns 6 and 7 in Table 11.2, we report the results of Model 4, which shows trends in industry-specific fragmentation in the CMEs and LMEs, respectively. Each industry shows a positive and statistically significant rate of fragmentation in each VoC category. In the CMEs, the five-year rate of fragmentation is 20 per cent for garments, 5.7 per cent for electronics, and 4 per cent for transportation equipment. In the LMEs, the five-year rate of fragmentation is 18.6 per cent for garments, 10.2 per cent for electronics, and 8.7 per cent for transportation equipment. These positive trends are also significantly different from zero in both varieties. Moreover, and similar to the analysis of all countries in column 5 (Model 3), the industry rank ordered fragmentation rates in both the CMEs and LMEs are consistent with the expectations of the GCC/GVC approach, where garments fragment the fastest, followed by electronics and then transport equipment.

Are these industry-specific fragmentation rates significantly different within each of the VoCs? The fifth through seventh rows of columns six and seven test whether the between-industry differences for all countries in Model

2 hold for each variety of capitalism. The results are identical to the same comparisons in column 5 for all countries. In CMEs, the garment industry fragments significantly faster than both the electronics (14.3 per cent) and transportation equipment (16 per cent) industries, but the difference between the transportation and electronics industries (1.7 per cent) is not significant. Likewise in the LMEs, the garment industry fragments significantly faster than both the electronics (8.4 per cent) and transport equipment (9.8 per cent) industries, but again the difference between the transportation and electronics industries (1.5 per cent) is not significant.

On one hand, this is consistent with hypothesis 4a (H_{4a}), which predicts that rates of fragmentation in the transportation equipment industry should be lower than those for the garment industry in countries with coordinated market economies. On the other hand, the insignificant difference between the fragmentation rate in the electronics and transport equipment industries within the CME group, coupled with the identical pattern of industry-specific rank ordered fragmentation rates in the LME group, might suggest that the low rates of fragmentation for the transport industry in the CMEs is a not function of the institutional advantage that firms in these economies enjoy but rather the industry-specific governance patterns predicted by the GCC/GVC literature. Thus, we find only mixed support for H_{4a} .

However, a cursory comparison across rows two through four in columns 6 and 7 may suggest that industry-specific rates of fragmentation vary significantly across VoCs because the estimate of the garment fragmentation rate is higher for the CMEs, while that for the electronics and transport equipment industries are lower. Significant differences in industry-specific fragmentation rates across VoCs would be consistent with hypothesis 4b (H_{4b}) which, drawing from the VoC theory of comparative institutional advantage, predicts that rates of fragmentation in the transport equipment industry should be lower in the CMEs than the LMEs. In other words, perhaps there is significant variation in fragmentation rates across VoCs once industry differences are controlled—that is, within the same industry. Thus, the final three rows in column 8 test the null hypothesis that the industry-specific fragmentation rates do not vary across VoCs. The signs on these comparisons are consistent with H_{4b} . The fragmentation rate is slower in the CMEs than the LMEs in both transport equipment (4.7 per cent) and electronics (4.5 per cent). However, none of these between-VoC differences are significantly different from zero.

While the results above indicate that the variation in spatial fragmentation across institutional types is not significantly larger than that within them, part of this might be attributable to variation within the VoC categories. Indeed, there is no shortage of criticisms regarding either the placement of particular countries in either the CME or LME camps or the need for additional categories beyond the CME and LME models. One of the more developed critiques

focuses on classification of Japan and Germany within the same category. Critics point out that while these political economies are indeed distinct from those comprising the LME category, they also differ from each other in terms of how they organize relations, both with their suppliers and with their employees. For example, the industrial organization of the Japanese auto industry has long been based on very low levels of vertical integration. Historically, Japanese assemblers outsourced most of their component production to independent suppliers, who also played a major role in product development and testing. In contrast, competitor firms in Germany retained more parts manufacturing and R&D/design activities in-house (Kwon 2005). Similarly, the Japanese industrial relations system is less centralized and relies more heavily on internal labour markets at the company level than the German one (Thelen and Kume 1999).

One implication of this literature is that Japan's institutional context gives domestically co-located but vertically disintegrated firms a competitive advantage versus companies that rely more on offshore suppliers. If this is the case, we would expect lower rates of spatial fragmentation in Japanese industries than those in other CMEs like Germany. However, this outcome would not emerge from the analysis we conducted above, since we do not differentiate among the CMEs. In other words, it is possible that there is a relationship between institutional context and organizational fragmentation, but that one has to look *within* the CME group to find it, a possibility to which we now turn.

Figure 11.3 displays the industry-specific spatial fragmentation rates in both Japan and Germany. Much like the pattern in Figure 11.2, there are clear similarities across Japan and Germany: in both countries, the garment industry has the steepest slope and the electronics industry has a fairly flat slope until the early 1990s. However, Japan's transport equipment industry has a fairly flat slope that never rises above the level of spatial fragmentation for the manufacturing sector as a whole, whereas Germany's looks similar to the CME average in Figure 11.2. Thus, it is possible that Japan's institutional context allows its firms to substitute a higher degree of domestically based vertical disintegration for the relatively higher level of offshoring observed in Germany and the LMEs. In order to test this hypothesis, we conducted unreported analyses that are complementary to Table 11.2 but limited to comparisons between Japan and Germany, rather than the CME and LME groups. In both countries, all industries had a significantly positive rate of fragmentation, the garment industry fragmented significantly faster than the other two, and the fragmentation rate in the garment and electronics industry did not vary across the two countries. However, Japan's transport equipment industry did fragment significantly slower than Germany's, which is consistent with the expectations of the institutional foundations of the Japanese business system discussed above.

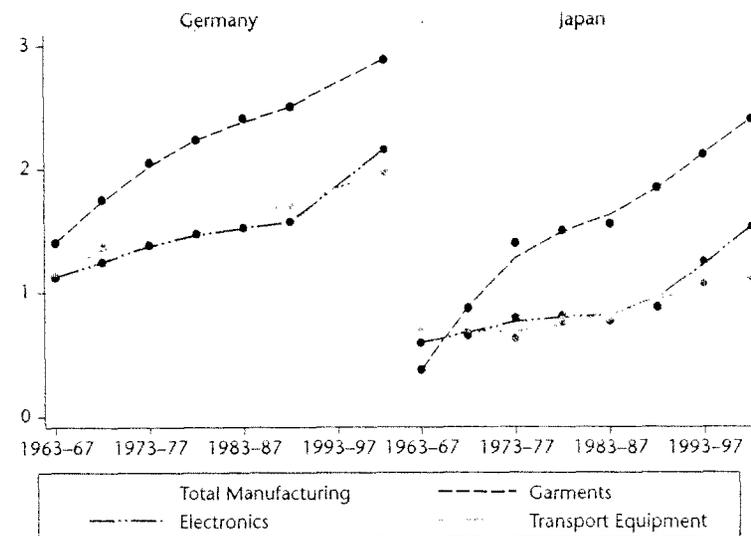


Figure 11.3. Average level of fragmentation by industry in Germany and Japan, 1963–2002

Notes: Fragmentation levels are logged with the base 10 logarithm. Time trend fit with a LOWESS smoother.

4. Conclusion

We identified two sets of hypotheses regarding the rate of spatial fragmentation in manufacturing. One set (H_1 and H_2) focuses upon the GCC/GVC literatures, and predicts significant variation in fragmentation between industries, which reflects more or less sector-specific, global models of industrial organization. Another set (H_3 and H_{4a}/H_{4b}) focuses on institutional variation between countries, and suggests instead that both overall and industry-specific rates of fragmentation should vary by institutional context. Our analysis suggests that the spatial fragmentation rate in manufacturing among advanced capitalist countries appears to vary more by industry than institutional context. We believe this is because firms in the advanced capitalist countries that are the focus of the VoC literature play similar roles in globalizing industries (i.e. as 'lead firms', in the language of GCC/GVC analysis), and because particular characteristics of these industries transcend the institutional configurations of the political

economies in which these firms are located, leading firms to make similar decisions regarding the spatial organization of their manufacturing processes. Indeed, the only significant variation we observe across institutional types was in spatial fragmentation rates for transport equipment between Japan and Germany. If institutional variation is significant for spatial fragmentation, one may have to go beyond the VoC categories developed by Hall and Soskice to identify it.

Because we focus narrowly on spatial fragmentation, our findings cannot explain *how* firms across advanced capitalist countries with varying institutional types achieve spatial fragmentation. Indeed, this is a central concern of institutional perspectives and presents one possible complementarity between the GCC/GVC and VoC approaches. We highlight two recent pieces that advance the debate in this direction. First, Herrigel and Wittke (2006) argue that the auto industries in both the United States (LME) and Germany (CME) are evolving toward a type of vertical disintegration (organizational fragmentation) in which leading firms 'save time and resources, diversify exposure to risk and enhance flexibility [by concentrating] on so-called "core competence" areas—that is, on particular functions... for which they hold a competitive advantage or have valuable, difficult to replicate expertise', and rely on suppliers 'in all other areas' (313; also see Thelen and Kume 1999: 492). Moreover, and consistent with our discussion of the GCC/GVC approach outlined above, they find that vertical disintegration is being achieved via a markedly similar type of 'contingent collaboration' in both countries, where the links between purchasing and supplying firms oscillate between moments of conflict and cooperation. They conclude by underscoring the degree of autonomy and creativity these firms possess with respect to their national institutions, which allows them to 'respond to challenges posed by the competitive environment in ways that appear to neither be systematically constrained nor encouraged by the institutional architecture in which they are embedded' (Herrigel and Wittke 2006: 344).

On the other hand, similar comparative research on the garment industry finds some convergence in offshoring behaviour between clothing firms in the United Kingdom (LME) and Germany (CME), but a significant degree of variation between them in terms of how this offshoring is achieved. Those in the UK pursue more arm's-length, market-based ties with suppliers, and those in Germany pursue more equity-based vertical links with offshore subsidiaries (Lane 2008). Thus, both studies are consistent with our own research as far as it goes—organizational fragmentation is characterized by a higher degree of spatial fragmentation in the garment (Lane 2008) than the auto (Herrigel and Wittke 2006) industry. However, one study argues for the emergence of a modal type of inter-firm coordination in the auto industry

across institutional varieties (Herrigel and Wittke 2006), while the other finds persistent diversity in inter-firm coordination across institutional varieties in the same industry (Lane 2008). This variance is a puzzle—why would institutional variation matter more in the garment industry than the auto industry, especially when the latter would seem to be more heavily impacted by national institutions than the former (Sturgeon et al. 2008)? Future research on the organization of inter-firm relations, both across institutional varieties and across industries, is needed to explicate the conditions under which firms respond to global competition through similar organizational fixes, or rather by exploiting the institutional environment that exists in their home or a foreign country.

Methodological Appendix

Table 11.3. Interaction models of five-year average level of fragmentation within and between industries and varieties of capitalism, 1963–2002

Constituent Terms	1	2	3	4
Year	0.096*** (0.009)	0.112*** (0.016)	0.057*** (0.009)	0.068*** (0.016)
CME * year		-0.027 (0.019)		-0.018 (0.019)
Garments * Year			0.136*** (0.016)	0.118*** (0.025)
Electronics * Year			0.018 + (0.009)	0.034* (0.014)
Transport * Year			0.002 (0.010)	0.019 (0.020)
CME * Garments * Year				0.032 (0.028)
CME * Electronics * Year				-0.027 (0.017)
CME * Transport * Year				-0.029 (0.021)
Constituent Terms				
CME		0.297 (0.245)		0.189 (0.232)
Garments			-0.251 + (0.119)	-0.454 + (0.213)
Electronics			0.099 (0.058)	0.096 (0.094)
Transport			0.307*** (0.067)	0.270* (0.118)
CME * Garments				0.331 (0.233)

(continued)

Table 11.3. Continued

Constituent Terms	1	2	3	4
CME * Electronics				0.005 (0.117)
CME * Transport				0.061 (0.139)
Constant	1.557*** (0.131)	1.378*** (0.173)	1.519*** (0.116)	1.406*** (0.175)
R ²	0.161	0.192	0.279	0.358
N	456	456	456	456

Notes: Coefficients are unstandardized regression coefficients. Standard errors adjusted for clustering at the country level in parentheses.

+ p(0.10);

*p(0.05);

**p(0.01);

***p(0.001).

In the annotations to Table 11.2 that follow, the 'conditional' standard errors vary by the particular industry, VoC or industry-VoC comparison being drawn, and the equations are therefore too cumbersome to reproduce here. See Kam and Franzese 2007 for a discussion of their derivation.

a. The fragmentation trend in CME countries is obtained by adding the coefficient for the interaction between time and CME with the linear term and dividing the sum by the conditional standard error. The trend for LME is equal to the coefficient on the linear term.

The difference between the trend in the CME and LME is just the interaction term.

All of these come from Model 2 in Table 11.3.

b. The industry-specific fragmentation trend is obtained by adding the coefficient for the interaction between time and the focal industry to the coefficient on the linear term.

The difference between industry trends is obtained by subtracting the coefficients on the industry-time interaction terms across the focal industries and dividing that by the standard error of the difference.

All of these come from Model 3 in Table 11.3.

c. The industry-specific fragmentation trends within the CME are obtained with the sum of the coefficients on the linear term, the interaction between the focal industry and time, the three-way interaction between the focal industry, time, and the CME group, and the interaction between time and the CME group, and is expressed over the relevant conditional standard error.

The industry-specific trends in the LME group are obtained with the sum of the coefficients on the linear term and the interaction between the focal industry and time, expressed over the relevant conditional standard error.

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