Review of International Political Economy, 2014
Vol. 21, No. 1, 157–194, http://dx.doi.org/10.1080/09692290.2013.779932

Global models of networked organization, the positional power of nations and economic development

Matthew C. Mahutga

Department of Sociology, University of California, Riverside, USA

ABSTRACT

Interdisciplinary literature on global commodity chains (GCCs)/global value chains (GVCs) and global production networks (GPNs) contends that inter-firm power differentials within globally networked forms of economic organization have implications for the developmental trajectories of nation-states. In this article, I advance these literatures in three ways. First, I bridge the two approaches by elaborating an exchange-theoretic conceptualization of inter-firm power that is latent in the two literatures. This conceptualization focuses narrowly on the determinants of inter-firm power asymmetries and is useful for explaining why actual production networks vary in terms of the relative power of buyers and producers. Second, I develop an empirical framework to advance basic research on the link between globally networked forms of economic organization and national economic development. In particular, I derive cross-nationally and temporally comparable country-level measurements of the average bargaining power of a country's resident firms using industry-specific international exchange (trade) networks. I demonstrate the validity of these indices through a historical analysis of trade networks in the transport equipment and garment industries and by analysing cross-national variations in wages in the two industries. Finally, I conclude by charting a parallel path for GCC/GVC and GPN research that implicates global models of network organization in macro-comparative analyses of economic development.

KEYWORDS

Global value chains; global commodity chains; global production networks; globalization; network analysis; economic sociology.

INTRODUCTION

Much has already been written comparing the global commodity chain (GCC)/global value chain (GVC) and global production network (GPN) approaches to global models of networked organization (for example, Bair, 2005; Coe, Dicken and Hess, 2008a; Henderson *et al.*, 2002). The approaches differ in that GPN analysts argue that the discourse of networks provides a broader lexicon with which to consider the dynamics of the globalization of production than does the linear imagery of the chain metaphor (for example, Henderson *et al.*, 2002). For example, while the GCC/GVC literature is more narrowly focused on inter-firm relations, the GPN literature is more sensitive to the impact of additional forces, such as national, regional and global institutions, labour groups and other stakeholders, and thereby draws from the Polanyian tradition of 'embeddedness' that informs the literature on comparative business systems and political economy (for example, Hall and Soskice, 2001; Whitley, 1998).[1] The network imagery in GPN discourse is thus not only more capable of providing a broader language with which to describe issues of power in inter-firm networks, it also allows for the inclusion of non-firm actors in the dynamics of production globalization.

However, these differences in language and scope obscure crucial points of convergence. First, both argue that production globalization has not only increased the extent to which economic behaviour is organized between, rather than within, firms and societies, but also that the modes of coordination through which this organization is achieved are qualitatively new. Second, both literatures tend to suggest that power differentials have implications for economic development insofar as certain actors have a disproportionate ability to set the terms under which other actors gain entry into production networks. Third, both approaches use detailed and sophisticated qualitative case studies of the linkages among firms in globally organized industry in order to understand how such linkages facilitate or impede economic development. Crucially, however, power asymmetries in globalized production networks play a central role in both approaches, but the analytical scope in which power operates and the precise determinants of power are underspecified in each.[2] And, the centrality of power portends ambiguous implications for development in theory, and the detailed qualitative case studies yield contradictory empirical findings with respect to the developmental consequences of globally networked models of economic organization.

This article thus bridges and expands the two approaches by explicating the conceptualization of inter-firm power that is latent in the two literatures, and by sketching an empirical framework to advance basic research on the link between globally networked forms of economic organization and national economic development. I begin by outlining an exchange theoretic approach to power in production networks that adopts the network language of the GPN approach and then synthesize it with insights from power-dependence theory in order to revisit the different power asymmetries that reside in buyer- and producer-driven networks.

I then logically extend this exchange theoretic conceptualization to the level of nation-states in order to derive cross-nationally and temporally comparable country-level measurements of the average bargaining power of a country's resident firms. I apply these measurement strategies to two international exchange (trade) networks known for their archetypical governance – the buyer-driven garment and producer-driven transportation equipment industries. I validate these empirics by examining the network structure of these industries in 2000, discussing the rise/fall of national industries within these structures over time and assessing the extent to which national wages in the two industries are distributed unequally across levels of positional power. I conclude by charting a *complementary* and *parallel* path of chains research that implicates globally networked models of economic organization in quantitative macro-comparative studies of economic development.

POSITIONAL POWER IN GLOBAL PRODUCTION NETWORKS: AN EXCHANGE THEORETIC CONCEPTUALIZATION OF INTER-FIRM POWER DIFFERENTIALS

Power in globalized production processes is central to both the GCC/GVC and GPN literatures, but the determinants to power and the domains in which power is exercised vary between them. The GCC/GVC articulation of inter-firm 'governance', for example, has evolved over time in terms of providing a theory for what power is and why it matters. In the original distinction between buyer and producer-driven commodity chains, leading firms varied across the two types in not only the *kind* of power they possessed, but also in the *direction in which that power was exercised* in the chain. In producer-driven chains, power derived from a unique combination of resources and capabilities internal to the lead firms, which exercised this power both 'backward' towards raw material and supplier markets and 'forward' into final consumer markets. In buyer-driven chains, power derived from less tangible resources, which included branding and supply chain management, and was directed principally 'backward' from the leading firms to the diffuse suppliers in their supply chains (for example, Gereffi, 1994; Gibbon and Ponte, 2005). The more recent formulation of GVC governance thus created a five-fold governance typology using combinations of the values (high and low) of three variables describing the production process – complexity, codifiability and supplier capability. Crucially for the present discussion, the five-fold governance types were compared in terms of the relative power of the lead firm over its (first-tier) supplier, which was conceptualized both as the 'degree of explicit coordination' achieved by a leading firm and as the level of 'power asymmetry' between a leading and subordinate firm (Gereffi, Humphrey and Sturgeon, 2005).[3]

For GPN analysts, the independent role of power is more central to the dynamics of production globalization relative to the treatment of GCCs/GVCs, and characterizes not only the relations between firms within a given production process, but also the relations between additional stakeholders in the global economy. Thus, whereas GCC/GVC analysts would suggest that the salience of power asymmetry varies according to the governance of the chain, the broader focus of the GPN construct argues instead that all the processes involved in production globalization are 'heavily laden within asymmetries of power' (Coe, Dicken and Hess, 2008b: 273). At the same time, however, GPN discussions of power that do limit themselves to the domain of inter-firm relations provide a useful point of departure to talk about inter-firm power asymmetries in general. In one of the seminal programmatic statements of the literature, for example, Henderson *et al.* (2002) state that what they term 'corporate' power is 'the extent to which the lead firm in the GPN has the capacity to influence decisions and resource allocations – vis-à-vis other firms in the network – decisively and consistently in its own interests' (450). And, a more recent programmatic statement highlights the additional analytical leverage made possible by the adoption of network imagery. While the authors did not intend to develop a systematic treatment of inter-firm power, they clearly recognize that power is relational insofar as the power of any firm depends on (1) its relationships to other firms; (2) the resource differentials between it and the firms to which it is related; and (3) its position in the network of possible ties between firms. Thus, the authors invite a dialogue with more classical treatments of positional power in networks by arguing that 'the *position* a firm develops within a GPN may well, in itself, confer significant bargaining power . . . ' (Coe, Dicken and Hess, 2008b, emphasis in original; also see Dicken *et al.*, 2001).

This interjection of a distinctly network language and attendant relational view of power by GPN analysts makes possible a conceptualization of inter-firm power that makes sense of some of the empirical descriptions of industries in the GCC/GVC literatures. Take, for example, the original GCC distinction between buyer- and producer-driven governance. Here, the crucial distinction between the two types resolves to the asymmetric power between retailers and other branded buyers on one hand, and manufacturers on the other. In buyer-driven chains, retailers and/or distributers do not engage in manufacturing, but rather in the 'intangible' phases of the production process, where profits and value capture are purportedly highest. And, while the precise mechanisms by which these big buyers achieve a degree of power over manufacturers is under-theorized, the case study literature is clear that they do possess a strong degree of power over manufacturers, both in terms of their ability to set the parameters of the production process and to dictate the price of outputs (for example, Kaplinsky, 2005; Gereffi, 1994). In producer-driven chains, the exact opposite holds – leading manufacturing firms possess a high degree of power *vis-à-vis* retailers, or might even do the retailing and distribution themselves.[4]

The most prominent explanation for why buyers have more power in buyer-driven networks and producers have more power in producer-driven networks makes reference to differences in the height of entry barriers to manufacturing across the two types. Entry barriers can include factors that are endogenous to the production process – such as capital, skill and technological intensity – as well as external factors such as government protectionism (OECD, 2007), but the key point is that they limit the entry of firms into a given economic activity and thereby lower competition for the activities they protect. Thus, buyers have more power in buyer-driven chains and producers have more power in producer-driven chains because entry barriers to manufacturing are higher in producer-driven chains than in buyer-driven ones (for example, Gereffi, 1994; Gibbon and Ponte, 2005; Mahutga, 2012). Ultimately, this explication of entry barriers is a resource view of power – 'what distinguishes lead firms from their followers or subordinates is that they control access to major resources that generate the most profitable returns in the industry' (Gereffi, 2002: 4).

However, entry barriers should also determine differences in bargaining power between chain participants along the lines suggested by the GPN literature. Compared to resource power, bargaining power is a relational concept that is a function of the autonomy and dependency that accrue to actors in different types of network positions. In power dependence theory, for example, actors in positions with high bargaining power have both (1) a large number of partners with whom it would be possible to exchange; and (2) partners who are limited in their ability to exchange with alternative partners (for example, Emerson, 1962). Resources do play a critical role in power dependency theory insofar as a firm that possesses a scarce resource is an attractive exchange partner, so that power differentials are a 'joint function of the value of the resource desired and the availability of that resource (or its equivalent) from alternative sources' (Yamagashi, Gillmore and Cook, 1988: 837). What is crucial to the operation of power in exchange networks, however, is that power differentials allow powerful firms to bargain their potential exchange partners against each other and thereby extract economic concessions.

To see how entry barriers can impact the bargaining position of firms, consider the hypothetical networks in Figure 1, which depicts the network of possible ties under three conditions. Assume that the desirability of the resources owned by the actors in Networks A–C is an inverse function of their number, and that asset specificity is such that buyers source from

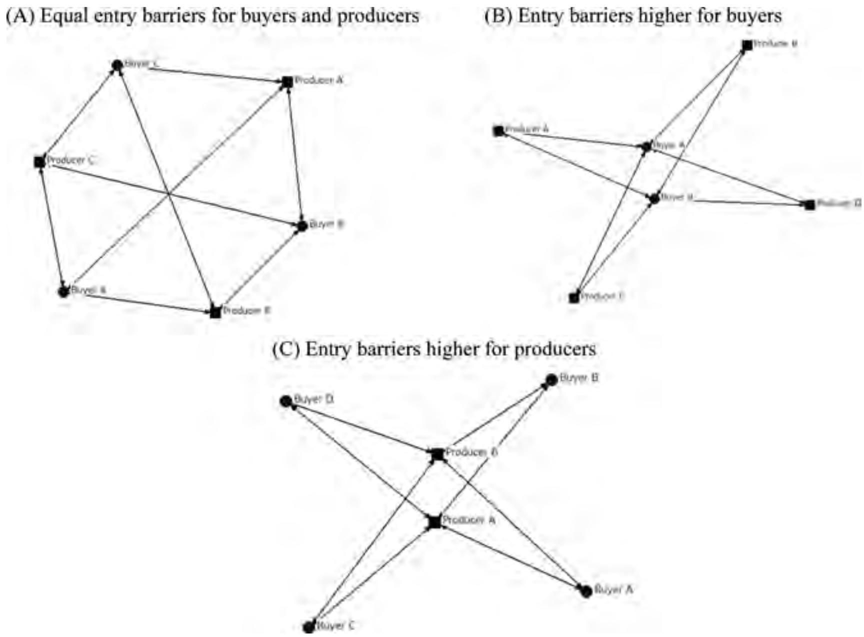

Figure 1 Network structure as a function of entry barriers. *Note:* Buyers are circles; producers are squares.

only one producer. Thus, the probability of a loss of economic output is equal to the number of redundant partners as a proportion of the total. Network A represents the situation in which buyers and producers are equal in number and all producers are equally capable of filling the orders of buyers – that is, a situation in which the entry barriers to buying and producing are equal. In Network A, neither buyers nor suppliers have any more bargaining power than the other and the two groups are perfectly interdependent. Neither buyers nor producers have a viable exit threat when negotiating the terms of the exchange with their partners.

Network B represents the situation that prevails in buyer-driven networks, where entry barriers are higher for buyers. In Network B, buyers have four possible partners, while producers have only two, which induces competition among producers to meet the demands of buyers. The network structure yields a probability of losing economic output for producers equal to .5 (2/4), and will reduce the economic output to producers most unwilling to meet the demands of buyers. Thus, buyers are in a better position to determine the price of the goods sold by producers. Network C represents the situation that prevails in producer-driven networks, in which entry barriers are higher for producers than buyers. In Network C, producers have a more favourable bargaining position than do buyers – each producer has four possible partners while buyers have only two. Failing to meet the demands of producers will result in a loss of economic output for two buyers, who have the same probability of economic loss as producers in Network B (.5). Thus, producers are in a better position to determine the price at which they sell their manufactures in Network C. In short, firms whose resources are protected by the highest entry barriers will, *ceteris paribus*, possess greater bargaining power *vis-à-vis* their exchange partners.[5]

While Figure 1 represents a hypothetical set of ideal-typical networks, both case study and theoretic research suggest that the link between barriers to entry and bargaining power hypothesized above manifests in the relations among buyers and producers in industries that embody archetypically buyer- or producer-driven governance. For example, a theoretic model that explains the returns to buying in the garment industry finds that the limited 'scope for subcontractors to raise production costs without triggering a substantial loss of output' is critical to the returns to buying because big buyers can use the exit threat to extract gains from their suppliers (Heintz, 2006: 509; also see Schrank, 2004). Similarly, case study research on the relationships between US auto manufacturers and their dealers paints the opposite picture. Manufacturers have 'more applicants who would like to be dealers than [there are] dealerships available. [Manufacturers] can either replace a particular dealer with another or even afford to lose representation in one dealer's market area without suffering a serious loss . . . ' (Macaulay, 1966: 11; also see Forehand and Forehand, 2002).

There is also a good deal of evidence that the number of manufacturing firms worldwide – a key indicator of the height of entry barriers to manufacturing in each industry – is much higher in archetypically buyer-driven industries than in producer-driven ones. Figure 2 plots the estimated number of manufacturing firms over time in the buyer-driven garment industry and producer-driven transportation equipment industries. These data come from UNIDO (2006).[6] There were already many more garment establishments in 1980 than there were transport equipment establishments. Moreover, the number of garment establishments exploded almost exponentially after 1990, while the number of transport equipment firms increased much more modestly. Indeed, there were roughly three times as many of the former by 2003. Thus, if a firm's bargaining power is an inverse function of the availability of alternatives, then transport equipment producers should have more power in their respective production networks than garment producers, and *vice versa* for buyers. In other words, the network of possible inter-firm relations among buyers and producers in the global garment industry must approximate the hypothetical Network B in Figure 1, while the network of possible inter-firm relations among

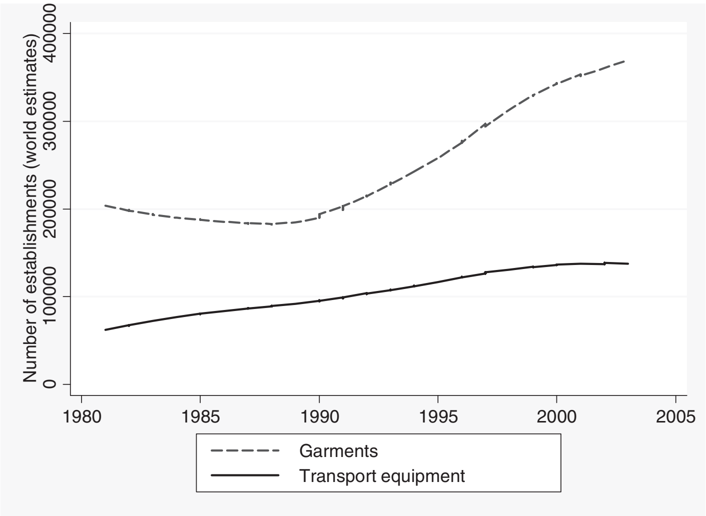

Figure 2 World estimate of the number of garment and transport equipment establishments. *Notes:* Data for garment and transport equipment firms come from UNIDO (2006). Garment firms reflect Category 322 (Wearing Apparel, except Footwear) and transport firms reflect Category 384 (Transportation Equipment).

buyers and producers in the global transport equipment industry must approximate the hypothetical Network C.

FROM FIRMS TO STATES: PRODUCTION NETWORKS, ECONOMIC DEVELOPMENT AND THE POSITIONAL POWER OF NATIONS

To recapitulate, a central theme in both the GCC/GVC and GPN literatures is that the power relations observed in production networks matter for the viability of participating firms and, by extension, the economic development of the states in which they reside (for example, Coe, Dicken and Hess, 2008a, 2008b; Gibbon and Ponte, 2005; Kaplinsky, 2005; Mahutga, 2012). Yet, the units of analysis that predominate in both GPN and GCC/GVC research – firms and the transnational networks in which they are embedded – pose a bit of a methodological challenge in drawing conclusive links between networked production and economic development, particularly when statistics on both development and economic behaviour are compiled cross-nationally, and 'development' is by definition a concept that must go beyond the performance of any single firm (for example, Bair, 2005).

Indeed, both literatures begin with the premise that the nation-state is a 'level of aggregation [that] is becoming less useful in light of the changes occurring in the organization of economic activities which increasingly tend to slice through, while still being unevenly contained within, state boundaries' (Henderson *et al.*, 2002: 437; also see Bair, 2005; Gereffi, 1996). The predominant solution to this problem is the case study, where authors provide detailed accounts of the way in which particular firms or geographical sub-regions are integrated into a larger production network. This methodology has produced a wealth of information on the organizational processes at work in the global economy. But cases of successful firm-level upgrading can be read alongside cases of failure, and even cases of successful upgrading at the level of the firm can have ambivalent implications for development in a particular location if, for example, upgrading occurs at the expense of wages and working conditions for workers or negatively impacts the viability of other domestic firms that compete for access to a given network (Bair and Gereffi, 2003; Schrank, 2004). Thus, scholars within the tradition recognize that conclusions regarding the link between production networks and economic development based on 'extrapolations from specific case studies and instances must be treated with caution . . . ' (Dicken *et al.*, 2001: 89).

As a point of departure, I pursue the GPN/GCC/GVC argument that production network dynamics matter for economic development by extending and measuring the latent exchange theoretic conceptualization of power discussed above at the level of the nation-state and proposing a parallel path of chains research that would implicate such measurements in cross-national models of development outcomes. Extending the exchange theoretic conceptualization of power in production networks up to its implications for national development requires the measurement of the aggregate positional power of resident firms according to the exchange theoretic determinants of power. Because industries vary in how they are governed, such an exercise must begin with the recognition that valid national indicators of average firm power must also vary by industry. In order to measure the positional power of resident firms across countries, then, one could measure the pattern of their exchanges with firms in other countries. Here, one could focus on buyers in the garment industry and producers in the transport equipment industry, where Nation X would have powerful firms in the garment industry if buying was concentrated among a handful of large buyers, who, in turn, sourced from a diffuse network of small producers that were dependent upon these concentrated buyers. Conversely, Nation X would have powerful firms in the transport equipment industry if production was concentrated among a handful of large producers, who, in turn, inculcated many dependent buyers (for example, Bonacich, 1987). However, 'publicly available and detailed information at the level of firms is generally lacking' (Gereffi, 2005: 169).

Given the lack of cross-nationally comparable firm-level data, I instead derive relational measures of bargaining power using the trade relations that firms forge between national economies. Indeed, despite widespread recognition that states are imperfect containers of production network activity, there is no shortage of empirical work in the GCC/GVC/GPN tradition making use of national-level statistics on industry- and sector-specific trade (for example, Bair and Gereffi, 2003; Hamilton and Gereffi, 2009; Kaplinsky, 2005; Sturgeon, Van Biesebroeck and Gereffi, 2008). The utilization of these data underscores the intuition that they reflect the way in which 'lead firms go about setting up and maintaining production and trade networks' as a given industry becomes organized via production networks over time (Gibbon and Ponte, 2005: 93). That is, because manufacturing industries are increasingly organized via production networks, national-level industrial statistics tend to reflect the way in which firms within these countries are positioned within them. I limit the measurement of national power to two industries – garment and transportation equipment manufacturing. I select these two industries because they are widely regarded as exemplifying buyer- and producer-driven governance (for example, Gibbon and Ponte, 2005; Mahutga, 2012) and, therefore, allow for a clear derivation of theoretically meaningful power relations among countries in the industry.[7]

In buyer-driven networks, the firms who capture the most value in their respective networks are buyers, rather than producers. And, consistent with empirical literature on the industry and resource dependence theory, this disproportionate value capture is a function of the scarcity of the requisite resources to buying – 'the lavish advertising budgets and promotional campaigns required to create and sustain global brands' – and the ability of big buyers to use their bargaining power to induce competition among potential suppliers and thereby reduce the unit price of manufactured inputs (Gereffi, 2002: 4; Heintz, 2006). If powerful firms in the garment industry are recognizable by their buying behaviour and have more bargaining power when they inculcate dependent producers, then the countries in which they reside occupy favourable bargaining positions in buyer-driven networks when they import from a diverse set suppliers, particularly when suppliers are dependent on them for export outlets.

In producer-driven networks, the firms that capture the most value in their respective networks are producers, rather than buyers. Value capture in producer-driven industries is also a function of the scarcity of both requisite resources and bargaining power, but the type of resources and bargaining power varies from those in buyer-driven networks. The resources that are critical to powerful firms in producer-driven networks are highly capitalized and technologically advanced production facilities as well as knowledge and technology intensive research and development operations (Gibbon and Ponte, 2005). Moreover, manufacturers – both the leading firms and many of their suppliers – have more bargaining power than their counterparts in buyer-driven networks because there are fewer alternative sources for both finished and intermediate goods. Thus, if powerful firms in the transport equipment industry are recognizable by their producing behaviour and their ability to increase the unit price of their manufactured goods by inculcating dependent buyers, then countries occupy favourable bargaining positions in producer-driven networks when they export to many countries that are dependent on them for imports.

With this logic in mind, I estimate the average network position of resident firms on a large sample of countries in both the garment and transportation equipment industries with a modified version of Wallace, Griffin and Rubin's 'logarithmic method' (Wallace, Griffin and Rubin, 1989: 212; also see Jorgenson (2006) for a comparable analysis of economic networks and deforestation).[8] Because positional power varies by the driven-ness of the network, two versions of the logarithmic method are applied to trade networks for the buyer-driven garment and producer-driven transportation equipment industries, respectively.

In the case of buyer-driven networks, where bargaining power accrues to concentrated buyers rather than diffuse producers, I measure the positional power of countries in the garment industry with *Buyer-driven power* (P_j^B), which is defined in equation (1).

$$P_j^B = \sum_{i=1}^{n} \log(Y_{ij}/X_i \cdot +1) \tag{1}$$

In (1), Y_{ij} is the import received by country *j* from country *i* in the garment industry, $X_{i\cdot}$ is the total garment exports of the sending country *i* and *log* is the base 10 logarithm. This measure takes the value in every cell on the import columns of receiving country *j*, divides it by the total exports of each sending country, adds one to define empty cells, and then transforms these ratios with the base 10 logarithm. These transformed values are then summed down the import vector to create the *Buyer-driven power* of country *j* in the global garment industry. Countries rank high when they have many dependent import partners – that is, when they have many partners from which they import a large proportion of their total garment exports – and low when they have few, with scores increasing with the absolute dependency of each import partner thereafter.

The case of producer-driven power is the reverse. Countries are powerful in producer-driven networks when they inculcate many dependent buyers and capture a large share of their markets. Thus, I measure country *j*'s

Producer-driven power (P_j^P) with

$$P_j^P = \sum_{i=1}^{n} \log(X_{ji}/Y_i \cdot +1) \tag{2}$$

where X_{ji} is the exports from country j to country i in a producer-driven industry, $Y_i \cdot$ is the total imports of receiving country i and *log* is the base 10 logarithm. This measure operates across the rows (export vector), rather than down the columns, and normalizes by the total imports of the receiving country, rather than the sending one. Countries rank high when they have many dependent export partners – that is, when the focal country has many partners to which they export a large proportion of their partner's total transport equipment imports – and low when they have few, and increase in power with the absolute dependency of each export partner thereafter.

Trade data

The trade networks used to estimate buyer- and producer-driven power come from UNCOMTRADE and are categorized according to the Standard Industrial Trade Classification (SITC) Rev. 1 (United Nations, 2006, 1963). The data for buyer-driven power are Category 84 (Clothing) and those for producer-driven power are Category 71 (Transportation equipment). In both cases, I build the network with reported imports collected at five points in time over the 35-year period from 1965 to 2000.[9] The networks track the same sample of countries in each period in order to preclude biases owing to partner attrition/addition. The year-on-year variation in which countries report restricted the sample to the 96 listed in Table 3, which account for between 95.5 per cent and 98.6 per cent of world trade and between 92.5 per cent and 96.8 per cent of world gross domestic product (GDP) over the period.

VALIDATING BUYER- AND PRODUCER-DRIVEN POWER

While buyer- and producer-driven power as defined in Equations 1 and 2 above are logically consistent with the exchange theoretic conceptualization of positional power developed throughout, I conduct a series of validating exercises to assess the extent to which these measurements correspond with what we know of the role countries play in the two industries from case studies. The first validation exercise considers information that is internal to the measurements – the pattern of relations in the two industrial networks and in the waxing and waning of the positional power of individual nations within these industries over time.

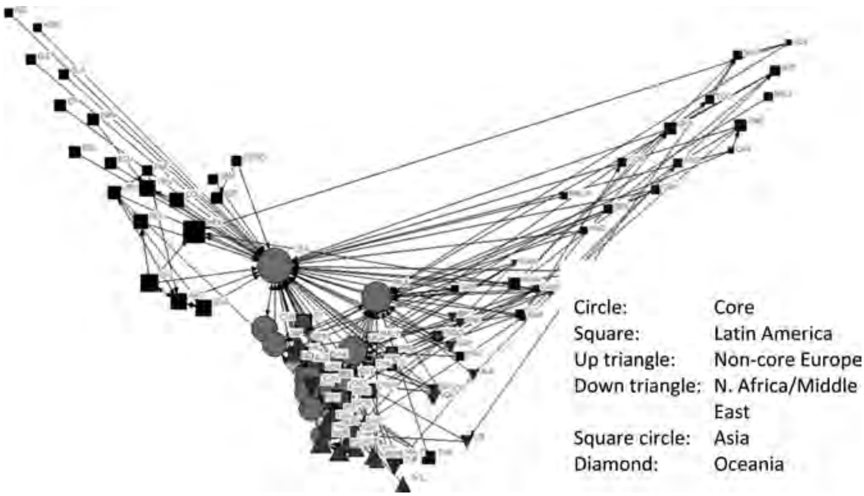

Figure 3 Correspondence analysis of garment trade network, 2000. *Notes:* Node size is a function of buyer-driven power, with a size ratio of 1:5 for the minimum to maximum value in 2000. Color and shape is geographical region. Core countries are those identified by Mahutga and Smith (2011). Directed ties indicate an import of greater than or equal to 10 per cent of an exporter's total garment exports.

Internal validity: Network structure and the rise and fall of national industries and firms

Figure 3 displays a graph of the garment trade network in 2000. The placement of countries in the graph is based on a correspondence analysis, which is a scaling technique that represents the countries in the trade network in a two-dimensional space, so that those with similar trading patterns are placed close together and those with dissimilar trade patterns are placed far apart.[10] For example, regional similarity is reflected in the clustering of countries in the same region close together – Latin America and Africa reside in the leftmost and rightmost 'periphery' of the network, respectively. 'Core' countries are clustered towards the centre, with countries from Asia, non-core Europe and Oceania clustered around them.

The size of the nodes in Figure 3 is determined by their measured level of buyer-driven power, with larger nodes connoting higher buyer-driven power. The presence of a tie in Figure 3 indicates a garment import representing at least 10 per cent or more of the *focal exporter's total garment exports*. What is particularly informative in Figure 3 from the perspective of both the GPN and GCC/GVC approaches is that the countries with the highest measures of buyer-driven power are clustered towards the 'core' of the graph. Moreover, export dependencies tend to flow from countries at the periphery of the graph with low buyer-driven power to countries at

Table 1 Top 10 countries on buyer-driven power, 1965–2000

1965		1980		2000	
USA	13.11	Germany	17.55	USA	23.18
UK	10.96	USA	17.42	France	19.87
Germany	9.41	UK	16.9	UK	19.15
Sweden	7.88	France	15.89	Germany	18.3
Canada	7.56	Italy	14.12	Canada	16.36
Switzerland	7.48	Netherlands	13.93	Spain	15.89
Netherlands	6.96	Belgium	12.45	Italy	15.7
France	6.86	Sweden	12.4	Japan	15.41
Denmark	6.4	Switzerland	12.24	Belgium	15.09
Australia	6.32	Denmark	11.62	Netherlands	14.97

the core of the graph with high buyer-driven power. The only exception to this rule is the small number of dependent and interdependent (two-way flows of exports greater or equal to 10 per cent of the exporters' total garment exports) ties that flow within regions in Figure 3. In short, there is a clear pattern of power and dependency depicted in Figure 3, where countries with powerful firms in the garment industry reside in the core of the network and inculcate dependent import relations with countries out in the periphery that contain subordinate firms.

Table 1 lists the top 10 countries from my sample according to their score on buyer-driven power in 1965, 1980 and 2000. Consistent with the literature on buyer-driven networks, the top 10 countries reside in the 'core' of the world economy. Germany is the top country in 1980, which corresponds precisely to the seminal work of Frobel, Heinrichs and Kreye (1980), who were the first to recognize the new international division of labour resulting from the outsourcing endeavours developed by Western countries, with a particular emphasis on Germany's formation of production networks in the garment industry. The placement of countries over time also corresponds closely to country case studies of the garment industry, which 'has undergone several migrations of production since the 1950s' (Gereffi, 1999: 49; also see Amsden, 2001; Gereffi and Wyman, 1990).

The first migration flowed from North America and Western Europe to Japan in the 1950s and early 1960s. Thus, Japan starts out in the middle tier of the distribution in 1965, but moves up monotonically over time to the 14th and eighth positions in 1980 and 2000, respectively, as it transitions from a container of producing firms to one of leading firms in buyer-driven production networks. According to Gereffi, the second supply shift was from Japan to Hong Kong, Taiwan and South Korea, which dominated global clothing exports in the 1970s and 1980s. Thus, one would expect these countries to ascend in the network much later than Japan and fail to achieve a central position because of their continued role in garment manufacturing. South Korea appears in the bottom quintile of the distribution in 1965, but moves into middle-range positions over time as it moves out of the initial stage of labour-intensive manufacturing to increased outsourcing, or 'triangle manufacturing' (Korea is in Position 61 in 1980 and Position 25 in 2000), while Hong Kong remains fairly stable over time in the middle tier (see also Amsden, 2001; Gereffi, 1999; Gereffi and Wyman, 1990; Mahutga, 2006).[11] This migration is also reflected in country studies of late industrializers such as Turkey, India and China (Amsden, 2001; Gereffi and Wyman, 1990). Each started their labour-intensive manufacturing later than South Korea and Hong Kong. Turkey, India and China remain in the bottom quintile through 1980, but begin their assent to the middle tier by 2000 (by 2000, China is in Position 44, India in Position 62 and Turkey in Position 34).

Figure 4 displays the results of a correspondence analysis of international trade in transportation equipment for 2000. The placement of countries is in many ways similar to that in the garment trade network – Latin America and Africa reside in the leftmost and rightmost 'periphery' of the network;

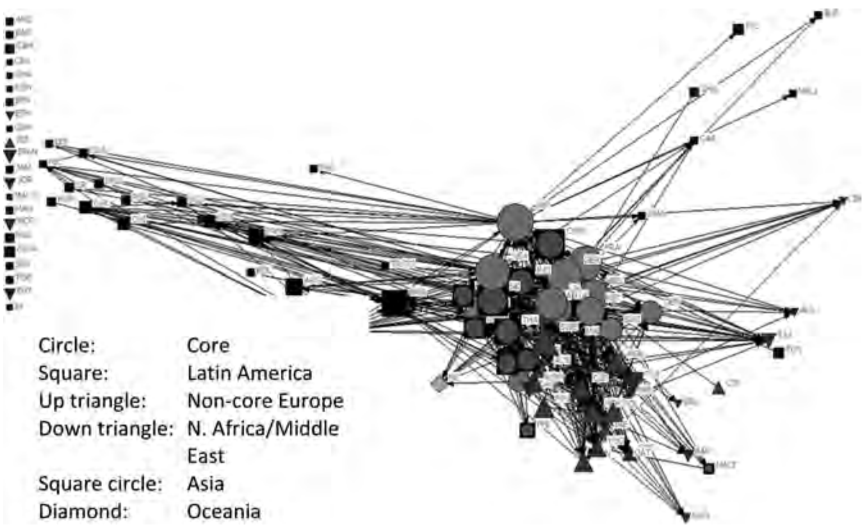

Figure 4 Correspondence analysis of transportation equipment trade, 2000. *Notes:* Node size is a function of producer-driven power, with a size ratio of 1:5 for the minimum to maximum value in 2000. Color and shape is geographical region. Core countries are those identified by Mahutga and Smith (2011). Directed ties indicate an export of greater than or equal to 10 per cent of an importer's total transport equipment imports. Isolated countries do not export at least 10 per cent of any partner's imports or receive at least 10 per cent of their imports from any one partner.

Table 2 Top 10 countries on producer-driven power, 1965–2000

1965		1980		2000	
UK	23.89	Japan	24.81	Japan	25.90
Germany	23.53	Germany	23.91	Germany	24.55
USA	22.99	USA	23.86	USA	24.10
France	21.39	UK	23.01	France	23.38
Italy	19.79	France	22.84	UK	21.78
Japan	18.02	Italy	20.99	South Korea	21.16
Netherlands	14.09	Sweden	18.70	Italy	20.83
Sweden	13.88	Netherlands	16.95	Spain	20.04
Belgium	12.83	Spain	16.49	Belgium	19.85
Canada	11.97	Belgium	16.43	China	19.44

Note: Values reflect equation 2 applied to transport equipment trade data defined above.

'core' countries are in the centre, and countries from Asia, non-core Europe and Oceania are clustered around them. The size of the nodes in Figure 4 is a function of the measured level of producer-driven power. However, the presence of a tie in Figure 4 indicates a transport equipment export representing at least 10 per cent or more of the *focal importer's total transport equipment imports*. Thus, the substantive implication in terms of the direction of dependency depicted in Figure 4 is similar to that in Figure 3, even though the arrows flow in the opposite direction. Countries with low producer-driven power at the periphery of the graph are dependent on those with high producer-driven power at the core of the graph. There are a smaller number of dependent ties within peripheral regions and a larger number of interdependent (two-way flows of exports greater or equal to 10 per cent of the exporters' total garment exports) ties between countries in the centre of Figure 4.

Table 2 lists the top 10 countries according to their score on producer-driven power. Much like the rankings in Table 1, those in Table 2 correspond to global trends in the transportation industry. In 1965 and 1980, the top 10 countries are all developed Western countries. The early global dominance of the transportation industry of the UK auto firms is also reflected in their top standing in 1965, as is their subsequent decline through 2000. The UK remains in the top five in 2000 because it is a preferred destination for Japanese transplants (Maxton and Wormald, 2004; Todd, Simpson and Humble, 1985). Furthermore, the rising prominence of Japanese transport firms is apparent in Japan's ascent to the top position by 1980, which reflects not only the status of Japanese auto firms, but also shipbuilding firms (Maxton and Wormald, 2004; Todd, 1985, 1991). The top four positions also correspond precisely to expert analyses of the automotive industry, which suggest that Japan, Germany, the US and France are 'the core countries of the world automotive industry' (Maxton and Wormald, 2004: 99).[12]

The rank ordering of producer-driven power also reflects some remarkable developments in less developed countries. By 1980, Brazil (12) and Spain (9) move from the middle up to the top quintile, reflecting the development of their auto industries (Evans, 1979, 1995; Shapiro, 1994; Biggart and Guillen, 1999). The ascendance of South Korean firms is remarkable, as Korea occupies the sixth position in 2000, corresponding to the boom of Hyundai, Kia and Daewoo (Green, 1992; Maxton and Wormald, 2004) as well as its dominant ship-building firms (Amsden, 1989; Todd, 1985, 1991). Likewise, the high placement by 2000 of China (10), India (14) and Thailand (15) is also exceptional and reflects the rapid growth of these countries' own auto industries (Abbot, 2003), their ability to capture a large share of the intermediate component market for lead auto firms, and shipbuilding prowess in the case of China (Maxton and Wormald, 2004; Todd, 1991; Yang, 1995).

External validity: Positional power and wages in the garment and transport equipment manufacturing industries

The information communicated in Figures 3 and 4 and Tables 1 and 2 suggests that buyer- and producer-driven power capture important characteristics of the distribution of national power in two industries that are known for distinct kinds of network governance. First, countries ranking high on buyer-/producer-driven power are known containers of the leading firms in the two industries. Second, the observed pattern of dependent trade ties is in keeping with what we know about the organization of the two industries, where countries that contain the lead firms inculcate dependent relations with those that do not. Finally, they also capture the changes that these archetypical industries underwent over the past 35 years. On one hand, they tend to reflect the continued dominance of firms in developed, Western countries. On the other, there has been a small, but important, degree of change over time, wherein certain countries – such as South Korea and Japan – ascended the ranks of buyer-/producer-driven power because they became containers of globally prominent leading firms in the two industries. Thus, Figures 3 and 4 and Tables 1 and 2 provide some internal validity to buyer and producer power as measures of the extent to which a country's firms occupy powerful positions in globally organized production networks.

However, these exercises in internal validity make no attempt to assess the nature of the link between positional power and development outcomes of interest to GCC/GVC/GPN scholars. Thus, as a first step toward charting a parallel path of empirical research on the production network–economic development link, I examine the distribution of a key developmental outcome across levels of positional power. To reiterate the crux of the argument in GPN/GCC/GVC literatures, the emergence and consolidation of production networks means that the viability of national economies is increasingly a function of the bargaining position of the firms located within them. And, if inter-firm power differentials impact the distribution of the gains in globally organized production networks, we should expect these gains to accrue disproportionately to the countries in which leading firms locate, or, in other words, the countries with high positional power. While there are an infinite number of developmental outcomes amenable to this line of inquiry, in what follows, I consider the distribution of industry-specific wage rates.

First, wages are a key indicator of economic development insofar as they capture not only the gains to an individual firm or industry, but also the workers who engage in productive activity in these firms/industries. Moreover, rising wages increase demand for goods and services produced domestically and, therefore, have tremendous implications for economic development economy-wide. Indeed, wages are of keen interest to GCC/GVC and GPN analysts who explore the implications of chain/network dynamics for economic development (Schrank, 2004). Second, an analysis of wages provides for a theoretic dialogue with world-system analysis, which was a key theoretic antecedent to the commodity chain concept, out of which evolved theories of value chains (Bair, 2005). In particular, an underlying premise of the world-systems perspective is that the boundary between 'core', 'semiperipheral' and 'peripheral' positions in the world-system is a function of the extent to which a given country contains the powerful nodes in commodity chains (for example, Chase-Dunn and Grimes, 1995; O'Hearn, 1994; Smith and Mahutga, 2009; Wallerstein, 2009). And this spatial concentration of powerful commodity chain nodes in core countries is one of several explanations for wage inequality across world-system zones, which includes differential processes of class formation, unequal exchange in and declining terms of trade between core and non-core zones, and the greater institutional power of core working classes *vis-à-vis* those in the periphery (Arrighi and Drangel, 1986; Prebisch, 1949; Chase-Dunn, 1998). Thus, I control for the world-system position a country occupies by assessing the association between positional power and wages, which allows for an assessment of how much any observed wage differentials between world-system zones can be accounted for by positional power in commodity chains.

DATA AND STATISTICAL PROCEDURES

Dependent variables

Wages. The dependent variables in the models that follow are wages in the garment and transport equipment industries, which I obtained from UNIDO (2006). In order to measure the average hourly wage for each country, I take variable 05 (Wages and salaries paid to employees) for industries 322 (Clothing) and 384 (Transportation equipment), and divide it by variable 04 (Number of employees) for the same industries, for each country. I then divide this yearly wage per worker by a constant 40-hour work week to arrive at the hourly wage. To the extent that work weeks vary systematically in length by positional power, this probably provides a rather conservative estimate of wage differentials because work weeks are probably longer in countries with less powerful firms. These dependent variables were measured in 1966, 1971, 1981, 1991 and 2001 and logged for skewness.

Explanatory variables

Positional power. The key explanatory variables in the regressions that follow are buyer- and producer-driven power, as defined in Equations 1 and 2, using the trade data for the garment and transport equipment industries described above. Both variables were logged for skewness.

World-system zone. Each country was assigned to the core, semi-periphery or periphery using the categories detailed in Mahutga and Smith (2011), which derive from a longitudinal analysis of multiple trade networks. In the regressions that follow, the core is the excluded category for world-system position. Table 3 shows which countries are in which world-system zones.

Control variables.

Human capital. Standard economic explanations for wage differentials evoke differences in human capital. Workers with higher levels of education possess greater stocks of knowledge, which increases productivity (Becker, 1993). Thus, I control for secondary education enrolment rates, which are standard in cross-national models of economic development (Barro, 1997; data from World Bank, 2002). This variable was logged for skewness.

Index of Industrial Production. I also control for growth in industrial output with the Index of Industrial Production in the garment and transport equipment industries (UNIDO, 2006). UNIDO's Index of Industrial Production measures output growth by indexing output in a base year. Wages should be correlated cross-nationally with rising industrial output, which reflects increases in labour productivity, international competitiveness, or both. This variable was logged for skewness.

Table 3 Countries by world-system zone

	World-system zone				World-system zone		
	1965–70	1980–90	2000		1965–70	1980–90	2000
Algeria #%	3	3	3	Jamaica	3	3	3
Angola	3	3	3	Japan #%	1	1	1
Argentina #%	2	2	2	Jordan #%	3	3	3
Australia #%	2	2	2	Kuwait #%	3	3	3
Austria #%	2	2	2	Libya	3	3	3
Bahrain	3	3	3	Madagascar #%	3	3	3
Barbados #%	3	3	3	Malawi #	3	3	3
Belgium #%	1	1	1	Malaysia #%	2	2	2
Benin	3	3	3	Mali	3	3	3
Bolivia #%	3	3	3	Malta #%	3	3	3
Brazil #%	2	2	2	Mauritius #%	3	3	3
Brunei Darussalam	3	3	3	Mexico #%	2	2	2
Burkina Faso	3	3	3	Morocco #%	2	2	3
Cameroon #%	3	3	3	Netherlands #%	1	1	1
Canada #%	1	1	1	New Zealand #%	2	2	2
Central African Republic%	3	3	3	Nicaragua	3	3	3
Chad	3	3	3	Niger	3	3	3
Chile #%	3	2	2	Nigeria #%	2	3	3
China #%	2	2	2	Norway #%	2	2	2
Colombia #%	3	2	3	Pakistan #%	2	3	3
Congo, Dem. Rep.%	3	3	3	Panama #%	3	2	3
Costa Rica #%	3	3	3	Paraguay	3	3	3
Cote d'Ivoire #%	3	3	3	Peru #%	3	3	3
Cyprus #%	3	3	3	Philippines #%	2	2	2
Czechoslovakia #	2	2	2	Poland #%	2	2	2
Denmark #%	2	2	2	Portugal #%	2	2	2
Ecuador #%	3	3	3	Qatar #	3	3	3

Egypt #%	2	3	3	Romania #%	2	2	2
El Salvador #%	3	3	3	Samoa	3	3	3
Ethiopia	3	3	3	Saudi Arabia #%	3	3	2
Finland #%	2	2	2	Senegal #%	3	3	3
France #%	1	1	1	Singapore #%	2	2	2
Gabon #	3	3	3	South Korea #%	2	2	2
Gambia	3	3	3	Spain #%	2	2	1
Germany #%	1	1	1	Sri Lanka #%	3	3	3
Ghana #%	3	3	3	Sweden #%	1	1	2
Greece #%	2	2	2	Switzerland	1	2	2
Guatemala #%	3	3	3	Thailand #%	2	2	2
Honduras #%	3	3	3	Togo	3	3	3
Hong Kong #%	2	2	2	Trinidad/Tobago #%	3	3	3
Hungary #%	2	2	2	Tunisia #%	3	3	3
Iceland	3	3	3	Turkey #%	2	3	2
India #%	2	2	2	UK #%	1	1	1
Indonesia #%	2	2	2	Uruguay #%	3	3	3
Iran #%	3	3	3	USA #%	1	1	1
Ireland #%	2	2	2	Venezuela #%	3	3	3
Israel #%	2	2	2	Yugoslavia	2	2	2
Italy #%	1	1	1	Zambia #%	3	3	3

Notes: Group 1 = Core; Group 2 = Semi-periphery; Group 3 = Periphery. # appears in garment wage model; % appears in transport wage model.

Periodization of the network form. The emergence of global models of network organization was an historical phenomenon that got consolidated in the latter part of the twentieth century. For example, Sturgeon, Van Biesebroeck and Gereffi (2008) suggest that the 1980s were a crucial decade for the auto industry, in which it truly 'went global'. Mahutga (2012) finds similarly that offshoring skyrocketed after 1980 for the garment, electronics and auto industries. Thus, I control for the period when these two network forms became the predominant organizational logics in the industries with a dummy variable that = 1 in 1990 and 2000, and zero otherwise. In addition, I interact positional power with this dummy variable to test the hypothesis that the link between positional power and wages gets stronger during the network period.

Panel regression models. In order to gauge the distribution of industry-specific wage rates across levels of buyer- and producer-driven power, I regress average hourly wages in the garment and transport equipment industries on buyer- and producer-driven power. The data are pooled across the five time periods in which the independent variables were observed: 1965, 1970, 1980, 1990 and 2000. Pooling these data allows me to account for omitted variables that vary across units, but not over time (unit effects). Because world-system position is nearly time invariant, I employ the fixed effects vector decomposition model (FEVDM). In practice, the FEVDM model proceeds in three stages. In the first stage, a baseline model is estimated including the fixed effects. The first stage excludes the time invariant or nearly invariant variables and ends when the fixed unit effects are estimated and saved for the second stage. In the second stage, the fixed unit effects are regressed on the time invariant or nearly invariant variables and the residual values are saved for the third stage. In the third stage, the dependent variable is regressed on all independent variables along with the residual decomposed vector of fixed effects from the second stage. Substantively, this decomposed vector of fixed effects is interpreted as a part of the fixed unit effects that are uncorrelated with the time invariant or nearly invariant predictors.[13]

Because of missing data on wages, secondary educational enrolment rates and industrial production, fewer than the 96 countries that appear in the trade networks also appear in the regression models. The panels are also unbalanced, with countries yielding a varying number of observations across time. The maximum number of observations is 480 for each model, but missing data reduced this to 288 and 271 country-year observations in the garment and transport equipment industry models, respectively. Table 3 identifies the countries that appear in either model. All regressions were carried out with Stata 11.0.

RESULTS

Table 4 reports the coefficients from the FEVDM of wages in the garment industry. Model 1 includes world-system position and a dummy variable for the years, 1990 and 2000, when the two network forms of organization became the predominant organizational logic in the industry. Controlling for variation in wages across world-system zones, the average wage in the garment industry increased by roughly \$3.18 (10ˆ.502) an hour. The coefficients on the semi-periphery and periphery dummy variables indicate that semi-peripheral and peripheral garment wages are, on average, \$2.72 and \$5.57 dollars less, respectively, than wages in the core. Model 2 introduces secondary education enrolment, which has a positive and significant impact on wages in the garment industry. The substantive impact of secondary education appears fairly large when judged by its t statistic and the change in BIC′ relative to Model 1.[14] Moreover, the average wage differential *vis-à-vis* the core falls by 22.7 and 63.9 per cent, respectively, for the semi-periphery and periphery. Model 3 includes the Index of Industrial Production, which also has a strong positive effect on wages in the garment industry when judged by its BIC′ and t statistics. The wage differential *vis-à-vis* the core falls by about 8.5 and 26.4 per cent, respectively, for the two zones.

Model 4 introduces buyer-driven power, which yields an effect that is larger than both education and industrial production in the industry when judged by the change in the BIC′ and its t statistic. Moreover, the wage differentials between the core and both zones are no longer significant, suggesting that these inter-zonal wage differentials are explained almost entirely by positional power. Model 5 includes all three covariates simultaneously. The size of each coefficient attenuates slightly controlling for the others, which suggests some redundancy among them. Still, both buyer-driven power and secondary education enrolments remain positive and highly significant and the BIC′ statistic prefers this model over the previous four by a good margin. The core/non-core wage differentials remain insignificant. Finally, Model 6 introduces the interaction term between buyer-driven power and the network period, which tests the hypothesis that the link between wage rates and buyer-driven power becomes more important as the buyer-driven model becomes the predominant organizational logic in the industry. The interaction term is positive and highly significant, and the BIC′ statistic indicates a significantly improved fit relative to Model 5.

Table 5 reports coefficients for models of wages in the transport equipment industry. Similar to what we observed in Table 4, there are significant wage gaps between core and non-core zones equal to roughly \$2.72 and \$5.07, respectively, for the semi-periphery and periphery. The coefficients in Model 2 also corroborate with the same coefficients in Table 4, where

Table 4 Unstandardized coefficients from regression of hourly wages in the garment industry in select independent variables

	(1)	(2)	(3)	(4)	(5)	(6)
Buyer-driven power				1.104***	0.926***	0.607***
				(7.732)	(6.305)	(3.435)
Buyer-driven power* Network period						0.567***
						(3.901)
Industrial production in garments			0.311***		0.112	0.204*
			(3.551)		(1.320)	(2.328)
Secondary education		0.848***			0.517**	0.607***
		(4.843)			(2.940)	(3.531)
Semi-periphery	−0.436***	−0.322**	−0.396***	−0.019	−0.001	−0.013
	(−4.243)	(−3.179)	(−4.071)	(−0.199)	(−0.016)	(−0.145)
Periphery	−0.660***	−0.304*	−0.613***	−0.035	0.097	0.119
	(−6.463)	(−2.504)	(−6.409)	(−0.325)	(0.853)	(1.066)
Network period	0.502***	0.315***	0.459***	0.274***	0.181***	−0.274*
	(12.797)	(5.871)	(11.539)	(6.429)	(3.851)	(−2.363)
Constant	0.308***	−1.250***	−0.304	−0.845***	−1.829***	−1.939***
	(3.365)	(−3.775)	(−1.585)	(−5.219)	(−6.775)	(−7.422)
N	288	288	288	288	288	288
R^2	0.794	0.833	0.817	0.858	0.880	0.895
BIC′	−190.228	−214.020	−202.577	−234.303	−250.439	−264.682

Notes: 2–5 observations on 74 countries account for the sample size. VDFE is not reported. T statistics in parentheses. *p < .05; **P < .01; ***P < .001. Core is the excluded category for world-system zone.

Table 5 Unstandardized coefficients from regression of hourly wages in the transport equipment industry on select independent variables

	(1)	(2)	(3)	(4)	(5)	(6)
Producer-driven power				1.056***	0.559*	0.576*
				(6.948)	(2.544)	(2.579)
Producer-driven power*						0.453***
Network period						(3.675)
Industrial production in transport			0.422***		0.193†	0.118
			(4.941)		(1.886)	(1.121)
Secondary education		0.983***			0.547**	0.672**
		(5.666)			(2.649)	(3.161)
Semi-periphery	−0.434***	−0.281**	−0.405***	0.069	−0.069	0.020
	(−4.417)	(−2.862)	(−4.246)	(0.588)	(−0.556)	(0.156)
Periphery	−0.705***	−0.314**	−0.726***	0.252	0.010	0.250
	(−7.169)	(−2.745)	(−7.633)	(1.513)	(0.050)	(1.253)
Network period	0.552***	0.335***	0.434***	0.305***	0.247***	−0.175
	(13.329)	(6.396)	(9.934)	(6.057)	(5.129)	(−1.517)
Constant	0.563***	−1.243***	−0.181	−0.716***	−1.460***	−1.663***
	(6.386)	(−3.822)	(−1.033)	(−3.532)	(−5.194)	(−5.926)
N	271	271	271	271	271	271
R^2	0.796	0.846	0.844	0.861	0.880	0.897
BIC′	−179.791	−210.450	−208.931	−222.511	−234.944	−250.490

Notes: 2–5 observations on 73 countries account for the sample size. VDFE is not reported. †p < .10; *p < .05; **P < .01; ***P < .001. T statistics in parentheses. Core is the excluded category for world-system zone.

secondary education has a large, positive impact on wage rates, and explains 35.2 and 55.4 per cent wage gap between the core and the semi-periphery and periphery, respectively. Industrial production also has a large, positive impact on wages in the transportation equipment industry, but does not have an appreciable impact on inter-zonal wage gaps. Model 4 introduces producer-driven power, which has a large positive impact on average wages in the industry and, much like the results in Table 5, renders insignificant the inter-zonal wage gaps.

Model 5 includes each of the three covariates and, much like the same results in Table 4, indicates some redundancy among them. However, all three covariates remain positive and at least marginally significant. The BIC′ statistic prefers this model over the previous four, and the core/non-core wage differentials remain insignificant. Finally, Model 6 introduces the interaction term between producer-driven power and the network period to test the hypothesis that network power matters more after the producer-driven model became predominant in the industry, and suggests that the wage premium to residing in countries with high producer-driven power increases considerably during the network period.

The results in Tables 4 and 5 imply that positional power matters for wage differentials in these two industries, and increasingly so as the two network forms become the predominant organizational logics in the industries. But just how much does positional power matter relative to the standard explanans of human capital and output growth? In order to answer this question, Table 6 reports the results of a counterfactual analysis that assesses how semi-peripheral and peripheral wages would differ from what we observe if they had the average level of secondary education, industrial output and positional power as the core. The first two columns provide the starting point for the analysis by reporting the observed average wage for each zone in each industry decomposed across the two periods, as well as the observed gap between each non-core zone and the core in each period. The observed average wage gaps are substantial, varying from $1.08 between core and semi-peripheral garment wages in the earlier period to $13.45 between the core and peripheral transport equipment wages in the more recent period.

The third and fourth columns report what wages in each industry would have been in the semi-periphery and periphery if each zone had the average rate of secondary education enrolment as the core, controlling for all other factors in Model 6 of Tables 4 and 5. Under this hypothetical scenario, garment wages in the semi-periphery would increase by roughly 23 per cent and 9 per cent and the garment wage gap with the core would decrease by roughly 19 per cent and 5 per cent, respectively, in the two periods. Similarly, average transportation equipment wages would increase by roughly 29 per cent and 23 per cent, respectively, in the two periods and the gap in average wages with the core would fall by roughly 36 per

Table 6 Counterfactual analysis of average wages in the global garment and transport equipment industry

	Observed wage/gap		If core education		If core output growth		If core positional power	
	1965–80	1990–2000	1965–80	1990–2000	1965–80	1990–2000	1965–80	1990–2000
Garments								
Core	$1.76	$7.79	—	—	—	—	—	—
Semi-periphery	$0.68	$2.63	$0.89	$2.89	$0.80	$2.46	$1.25	$6.36
% increase over observed	—	—	23.01%	8.83%	14.90%	−7.27%	45.29%	58.61%
wage gap with core	($1.08)	($5.15)	($0.87)	($4.90)	($0.96)	($5.33)	($0.51)	($1.42)
% reduction in gap	—	—	18.98%	4.95%	11.13%	−3.46%	52.59%	72.39%
Periphery	$0.53	$1.15	$0.97	$1.98	$0.57	$1.22	$1.03	$6.44
% increase over observed	—	—	45.54%	42.24%	6.23%	6.12%	48.25%	82.22%
wage gap with core	($1.23)	($6.64)	($0.78)	($5.80)	($1.19)	($6.57)	($0.73)	($1.35)
% reduction in gap	—	—	36.11%	12.61%	2.87%	1.12%	40.28%	79.74%
Transport equipment								
Core	$3.20	$15.51	—	—	—	—	—	—
Semi-periphery	$1.25	$5.30	$1.77	$6.92	$1.34	$5.95	$2.82	$13.14
% increase over observed	—	—	29.28%	23.32%	6.83%	10.78%	55.61%	59.63%
wage gap with core	($1.95)	($10.21)	($1.43)	($8.59)	($1.85)	($9.57)	($0.38)	($2.37)
% reduction in gap	—	—	26.64%	15.81%	4.72%	6.28%	80.57%	76.78%
Periphery	$0.89	$2.06	$1.91	$3.71	$0.94	$2.19	$3.49	$15.31
% increase over observed	—	—	53.26%	44.58%	4.68%	6.02%	74.39%	86.56%
wage gap with core	($2.30)	($13.45)	($1.28)	($11.80)	($2.26)	($13.32)	$0.30	($0.20)
% reduction in gap	—	—	44.25%	12.30%	1.91%	0.98%	112.82%	98.48%

Notes: The counterfactual wage estimates are estimated by two equations (one for each period) for each world-system zone using the coefficients in Model 6 of Tables 4 and 5 under three scenarios. In columns 3–4, I replace the observed peripheral and semi-peripheral average education level with that of the core; in columns 5–6, I replace the observed peripheral and semi-peripheral average output growth with that of the core; in columns 7–8, I replace the observed peripheral and semi-peripheral average positional power level with that of the core. I otherwise use the observed zonal averages.

cent and 13 per cent. A similar story holds for the periphery: garment wages would rise by roughly 46 per cent and 42 per cent and the wage gap with the core would fall by roughly 36 per cent and 13 per cent, respectively, in the two periods. Transport equipment wages would rise by 53 per cent and 45 per cent and the transport equipment wage gap with the core would fall by 44 per cent and 12 per cent, respectively, in the two periods.

The fifth and sixth columns engage the same thought experiment by changing semi-peripheral and peripheral industrial output to that observed in the core. Somewhat surprisingly, such a change would increase garment wages in the semi-periphery (by 15 per cent) and decrease its average wage gap with the core (by 11 per cent) only in the first period, which is because output growth in garments was (unsurprisingly) higher in the semi-periphery than the core in the second period. On the other hand, if the semi-periphery had the same industrial output growth in transport equipment as the core, its wages would rise by 6.8 per cent and 10.8 per cent, respectively, in each period and its average transport equipment wage gap with the core would fall by 4.7 per cent and 6.3 per cent. The story is largely the same for the periphery. Average garment wages would increase roughly by 6 per cent in each period, and the average garment wage gap with the core would fall by only 2.9 per cent and 1 per cent, respectively, in each period. Average transport equipment wages would increase by roughly 4.7 per cent and 6 per cent, respectively, in each period, while the transport wage gap with the core would decrease by only 1.9 per cent and 1 per cent, respectively, in each period.

Finally, Columns 6 and 7 engage the same thought experiment with respect to positional power. The wage gain that would occur if the semi-periphery and periphery had the average level of positional power as the core is striking. Semi-peripheral garment wages would rise by roughly 45 per cent and 59 per cent and the wage gap with the core would fall by 53 per cent and 72 per cent, respectively, in each period. Semi-peripheral transport wages would rise by roughly 56 per cent and 60 per cent and its average wage gap with the core would decline by roughly 81 per cent and 77 per cent in each respective period. Similarly, peripheral garment wages would increase by 48 per cent and 82 per cent and the peripheral wage gap with the core would decline by 40 per cent and 80 per cent, respectively, in the two periods. The impact of increased positional power on peripheral transport equipment wages is even more striking – the average wage would rise by 74 per cent and 87 per cent, respectively, and the peripheral wage gap with the core would close entirely in the first period (average peripheral wages would be roughly 13 per cent higher than the core) and nearly close in the second with a roughly 98 per cent reduction. In short, positional power is *much* more important for cross-national variation in industry-specific wage rates than are human capital and output growth, and it accounts for the vast majority of wage inequality between world-system zones in both industries.

CONCLUDING DISCUSSION

Both the GCC/GVC and GPN approaches to production globalization argue that global models of networked organization are integrating firms into production networks characterized by power asymmetry between participating firms, and that these power asymmetries have implications for economic development in the countries where these firms are located. This article contributes to this project in three ways. First, I articulate an exchange theoretical conceptualization of positional power in global production networks that is latent in the two sets of literatures. Here, inter-firm power differentials are a function of the scarcity of resources possessed by lead firms and, more importantly, by the ability of leading firms to exercise bargaining power in negotiations with other firms in their networks. This inter-firm differential in bargaining power should matter for economic development because it allows leading firms to extract economic concessions from their network partners.

Second, in order to bring new evidence to bear on the link between production networks and economic development, I extend this exchange theoretical conceptualization to the nation-state by developing cross-nationally comparable indices of buyer- and producer-driven power in the garment and transport equipment industries, respectively. I validate these indices internally through a historical analysis of the network structure of these industries and the rise/fall of nations within them. I validate these indices externally by showing that (1) industry-specific wage rates are distributed unequally across levels of positional power and increasingly so over time; (2) cross-national variation in positional power explains nearly all of the observed differences in wage levels between core and non-core zones of the world-system; and (3) semi-peripheral and peripheral wages in the two industries would increase dramatically if these countries had just the average positional power of the core.

Third, the model of cross-national wage inequality illustrates the promise of forging a parallel path of basic research on the implications of globally networked forms of economic organization for the foundational explanandum driving the literature – economic development. As I've argued throughout, the extant literature is ambivalent about the link between production network formation and economic development. While part of this ambivalence is based on divergent empirical findings, the more fundamental source is theoretic. On one hand, scholars of global production networks agree that '[i]n order for countries to succeed in today's international economy, they need to position themselves strategically within . . . global networks and develop strategies for gaining access to the lead firms . . . '

(Gereffi, 2001: 32). That is, because an increasing proportion of manufacturing activity is coordinated within global production networks, countries need to develop ways of encouraging their firms to become embedded within these networks or risk exclusion from the global manufacturing economy altogether. At the same time, we also assume what the analysis in Tables 4–6 suggest empirically – production networks tend to operate in such a way that the returns to network participation vary by the position in which a firm (and, by extension, a country) is located (for example, Bair, 2005; Gereffi, 1994; Dicken *et al.*, 2001). If a country's only hope for development is to encourage its firms to integrate into global production networks as subordinate producers, and the returns to these networks accrue unequally among firms, then new entrants really are stuck between a 'rock and a hard place' (Kaplinsky, 2005).

Thus, the key kinds of empirical questions confronting the literature involve determining exactly how hard the hard place is, for which there are at least two possibilities. First, countries with firms in subordinate positions may develop more quickly by integrating into production networks than they would if their firms remained outside these networks even though they might gain less than the countries containing the leading firms. Indeed, while subordination might be a clear consequence of integrating into production networks, there is well documented evidence that leading firms transfer a significant amount of knowledge and technology to subordinate firms, either through direct interaction with subordinate firms, rigorous certification programmes, or indirectly through intermediate sub-assembly producers (Humphrey and Memedovic, 2003; Gereffi and Memedovic, 2003; Memedovic, 2004; Kessler, 1999; Gibbon, 2001). Thus, subordinate integration may put 'firms and economies on potentially dynamic learning curves' (Gereffi, 1999: 39). That is, even though leading firms extract concessions from other firms in their networks, subordinate firms benefit from dynamic 'learning by doing' so that the returns to networked production are positive for both lead and subordinate positions and the returns may become more equally distributed over time. However, a second possibility emerges if (1) the productivity gains to learning by doing are small; (2) lead firms resist the encroachment of subordinate firms into higher value capturing activities. Under this scenario, subordinate firms become 'stuck' in network positions 'associated with declining terms of trade, and hence with worsening of relative and/or real incomes' (Kaplinsky, 2000: 132). That is, not only might subordinate firms gain less than their leading firm counterparts, but their returns might approach zero or less than zero and the differential may increase over time. Adjudicating between these two possibilities is relatively straightforward – one need simply compare the developmental returns to network participation across countries whose firms occupy different network positions, and make these comparisons over time.

The GCC/GVC discussion of governance also suggests a third theoretic possibility: the developmental disparities between countries with dominant and subordinate firms may depend on the way in which a particular network is governed. That is, if the level of power asymmetry among lead and subordinate firms varies by governance type (Gereffi, Humphrey and Sturgeon, 2005), then the differentials in the returns to these firms – and the countries in which they are embedded – should vary accordingly. Such variance seems to operate across the buyer- and producer-driven networks in focus here, insofar as the linkages between lead and subordinate firms appear 'thicker' and suppliers less expendable in producer-driven networks than in buyer-driven ones (for example, Bair and Gereffi, 2001; Humphrey, 2000; Kimura, 2007; Rothstein, 2005; Schrank, 2004). In short, the GCC/GVC/GPN approach to economic globalization not only calls for the comparison of economic gains across countries with firms in powerful and subordinate network positions, but also comparisons of the magnitude of these differences across networks with different forms of governance (for example, Bair and Mahutga, 2011).

Efforts to answer questions about developmental differentials across positions *within* production networks or in the size of the differentials *between* differentially governed production networks, along the lines developed here, require measurements of subordinate network positions at the level of the nation-state.[15] Figures 3 and 4 provide insights insofar as subordination at the firm level implies import/export dependency at the national level. Such measurements would allow for direct comparisons of the developmental returns to network participation across countries with firms in different network positions, as well as comparisons of the returns to countries with firms in similar positions across networks with varying governance. Moreover, I have bracketed entirely the role of local, national and supra-national institutions in theorizing the link between network integration and development in order to emphasize what I see as the most powerful and unique contribution of both the GCC/GVC and GPN approaches – *positional power matters* for the developmental consequences of globalized production. However, the kinds of quantitative macro comparative assessments I advocate above are entirely capable of introducing institutional variations to better understand how institutions can mediate the link between production networks and development (for example, Bair and Mahutga, 2012). The sky is indeed the limit.

Let me conclude by reiterating that the vision for scholarly examinations of production networks cast here should be seen as a *parallel path* to the extant literature. It provides a *new type* of evidence with which to advance basic research on the link between production network dynamics and economic development. While this parallel path holds promise for providing new kinds of evidence, it cannot supplant the qualitative case studies that allow for the quantification of production network dynamics in the first place. Nor does it anywhere near exhaust the range of industries and governance structures amenable to this kind of inquiry. As one of the earliest scholars of production networks admonishes, our community is 'measuring indirectly and imperfectly a total phenomenon that we cannot see directly no matter what we do... it [therefore] requires imagination and audacity along with rigor and patience. The only thing we have to fear is looking too narrowly' (Wallerstein, 2009: 89).

ACKNOWLEDGEMENTS

This research was funded by a grant from the University of California Institute for Global Conflict and Cooperation. I would like to thank the participants of the Workshop on the Future of Global Value Chain and Production Networks at the National University of Singapore in December 2011 for insightful feedback and a great time in Singapore. I am also grateful to Scott V. Savage and the anonymous *RIPE* reviewers for exceptionally thorough and helpful commentary.

NOTES

1 Another difference rarely commented upon is that the GCC/GVC approach is more nomothetic than the GPN approach. This epistemological variance is most evident in the discussion of GVC governance, where different forms of governance are a function of the combination of the three variables characterizing a production process – complexity, codifiability and supplier capability – that allow not only for an understanding of the differentiation of governance across value chains, but also for the evolution from one form of governance to another within a given value chain. In contrast, GPN analysts treat production network dynamics as the result of a broader set of place-bound processes and actors, where 'the precise nature and articulation of GPNs are deeply influenced by the concrete socio-political, institutional and cultural "places" within which they are embedded' (Coe, Dicken and Hess, 2008b: 279). Thus, the GCC/GVC scheme is a variable based and probabilistic theory of chain governance that would allow for predictions of chain governance that transcend space, whereas the GPN scheme is a place-bound ideographic theory that envisions infinite variations across geographic space.

2 In GCC/GVC treatments, for example, power tends to operate primarily at the dyadic level of the link between a lead and a subordinate firm (for example, Gereffi, Humphrey and Sturgeon, 2005; c.f. Sturgeon, Van Biesebroeck and Gereffi, 2008). On the other hand, power operates on multiple levels in GPN discussions, including firms, states, interest groups and supra-national institutions (for example, Coe, Dicken and Hess, 2008b; Henderson *et al.*, 2002; Smith *et al.*, 2002).

3 While this conceptualizion of power is clearly relational insofar as it reflects the power of a leading firm *vis-à-vis* its supplier, it also breaks down a bit (for example, Gibbon and Ponte, 2005: Ch. 1). For example, 'hierarchy' is the governance type in which 'the degree of explicit coordination and power asymmetry' was highest. While it is clearly the case that a single firm has complete control over

a production process when it is entirely internal to the firm, it is not entirely clear what 'power asymmetry' means in the context of a single firm – who has power over whom? The five-fold governance scheme also creates something of a problem for those who would like to draw a clear boundary between what is and is not a value chain or production network insofar as it appears to include everything from a vertically integrated firm to spot market transactions between firms, and thereby represents a serious point of departure from the conceptualization of network forms of organization in management studies and economic sociology (for example, Granovetter, 1985; Powell, 1990).

4 Much of the GVC literature now focuses on the link between lead firms in producer-driven industries such as automobiles and their suppliers, rather than retailers, but the point nevertheless remains.

5 This exchange theoretical conceptualization problematizes Gereffi, Humphrey and Sturgeon's (2005) characterization of 'markets' as low in terms of the level of power asymmetry alluded to above. What was crucial to Gereffi, Humphrey and Sturgeon's claim that power asymmetries are low in 'markets' was the claim 'that the costs of switching to new partners are low for both parties' (83). Yet, the conditions that prevail in the production processes that should be governed by 'markets' – low transaction complexity, high transaction codifiability and a large number of capable suppliers – should also prevail in any production process with low barriers to entry (for example, Bair and Mahutga, 2012; Mahutga, 2012; Schrank, 2004). And, since this situation is most closely approximated by Network B in Figure 1, it would seem that the costs of switching are decidedly higher for producers than buyers – there is a significant degree of power operating in 'markets'.

6 These are estimates because they are based on an unbalanced panel of countries over time. I first estimate the trend in the average number of firms per country in a given year using all available countries in each year. I then multiply this average by a constant panel of 116 countries in each year to yield a world estimate of the total number of firms.

7 To be sure, I make no claim that these two ideal-typical governance types exhaust the full range of governance types observed empirically, nor that all industries fit neatly into the buyer/producer-driven dichotomy. However, these industries are convenient because there is an adequate amount of empirical evidence that the garment and transport equipment industries are governed in ways that conform to the buyer- and producer-driven archetypes, respectively (for example, Gereffi, 1994; Gibbon and Ponte, 2005; Kimura, 2007; Mahutga, 2012; Schrank, 2004).

8 Buyer- and producer-driven power are modifications of Wallace, Griffin and Rubin's logarithmic method because they employ slightly different normalizing procedures. Buyer-driven power is analogous to Wallace, Griffin and Rubin's (1989) 'receive vector', or 'upstream power', except that each entry in country j's receiving vector is divided by the total exports of the sending country i, rather than an attribute of country j. Similarly, producer-driven power is analogous to Wallace, Griffin and Rubin's (1989) 'supply vector', or 'downstream power', except that each entry in country j's export vector is divided by the total imports of the receiving country i, rather than an attribute of country j. In both cases, this reflects the power-dependency principal that the power of actor j over i is a function of the dependency of i on j (for example, Cook, 1977; Thompson, 1967).

9 Given an N by N matrix, where cell *ij* represents the export from actor *i* to *j*, one can use either actor *i*'s reported exports, or actor *j*'s reported imports to

measure the flow. It has been shown that reported imports tend to be slightly more accurate because of the care taken by state agencies to record imports for the purpose of tariffs (Durand, 1953).

10 The correspondence analysis used here is standard, except that the diagonal entries were transformed with the approach of Boyd *et al.* (2010). I refer the interested reader to Weller and Romney (1990) for the technical details.

11 Data for Taiwan are unavailable because the United Nations does not recognize that country's sovereignty.

12 France's high position also reflects the global dominance of its national firm, Airbus.

13 The most conservative approach for addressing unmeasured unit effects is the fixed effects model (FEM), which is equivalent to OLS estimates that include a series of dummy variables for N-1 countries. However, the FEM estimator cannot identify coefficients on world-system position, which is almost perfectly collinear with the fixed effects. The alternative random effects model (REM) is capable of producing estimates for world-system position, but the consistency of REM estimates hinges crucially on the validity of the assumption that the country-specific error term is uncorrelated with the right-hand covariates. Diagnostic (Hausman) tests show that this assumption is violated by these data (Halaby, 2004; Wooldridge, 2002). Monte Carlo simulations suggest the FEVDM is preferable to the REM model when the assumption of uncorrelated unit effects is not met, and to FE models when the between case variation is sufficiently large relative to the within variance, as is the case here (Plumper and Troeger, 2007).

14 BIC′ measures the improvement in model fit of additional covariates for 'nested' models. Smaller BIC′ scores are better. Thus, BIC′ reductions of 0–2 indicate weak evidence; 2–6 indicate positive evidence; 6–10 indicate strong evidence and >10 indicates very strong evidence (Raftery, 1995).

15 These questions could also be pursued on smaller scales with firm-level studies. At minimum, a researcher maps out the relations between lead firms and their entire network of subordinates and then compares firm-level outcomes across lead and subordinate positions. Ideally, we would want to make these comparisons across networks with different types of governance and over time.

REFERENCES

Abbot, Jason P. (2003) *Developmentalism and Dependency in Southeast Asia*, London: Routledge Curzon.

Amsden, Alice (1989) *Asia's Next Giant: South Korea and Late Industrialization*, Oxford: Oxford University Press.

Amsden, Alice (2001) *The Rise of 'The Rest': Challenges to the West from Late-Industrializing Economies*, Oxford: Oxford University Press.

Arrighi, Giovanni and Drangel, J. (1986) 'The Stratification of the World Economy', *Review*, 10, (1): 9–74.

Bair, Jennifer (2005) 'Global Capitalism and Commodity Chains: Looking Back, Going Forward', *Competition and Change*, 9(2): 153–80.

Bair, Jennifer and Gereffi, Gary (2003) 'Upgrading, Uneven Development, and Jobs in the North American Apparel Industry', *Global Networks*, 3(2): 143–69.

Bair, Jennifer and Gereffi, Gary (2001) 'Local Clusters in Global Chains: The Causes and Consequences of Export Dynamism in Torreon's Blue Jeans Industry', *World Development*, 29(11): 1885–903.

Bair, Jennifer L. and Mahutga, Matthew C. (2012) 'Varieties of Offshoring? Spatial Fragmentation and the Organization of Production in 21st Century Capitalism', in Richard Whitely and Glen Morgan (eds) *Capitalisms and Capitalism in the 21st Century*, Oxford: Oxford University Press, pp. 270–97.

Bair, Jennifer and Mahutga, Matthew C. (2011) 'Beyond the Relational Network: Fragmentation and the Organization of Production in the Global Economy.', Paper presented at teh annual meeting of the American Sociological Association, Caesar's Palace, Las Vegas, Aug 19th. http://www.allacademic.com/meta/p507919_index.html.

Barro, Robert J. (1997) *Determinants of Economic Growth: A Cross-country Empirical Study*, Cambridge, MA: MIT Press.

Becker, Gary S. (1993) *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*, Chicago, IL: University of Chicago Press.

Biggart, Nicole Woolsey and Guillen, Mauro F. (1999) 'Developing Difference: Social Organization and the Rise of the Auto Industries of South Korea, Taiwan, Spain, and Argentina', *American Sociological Review*, 64(5): 722–47.

Bonacich, Phillip (1987) 'Power and Centrality: A Family of Measures', *American Journal of Sociology*, 92(5): 1170–82.

Boyd, John, Fitzgerald, William, Mahutga, Matthew C. and Smith, David A. (2010) 'Computing Continuous Core/Periphery Structures for Social Relations Data Using MINRES SVD', *Social Networks*, 32(2): 125–37.

Chase-Dunn, Christopher and Grimes, Peter (1995) 'World-Systems Analysis', *Annual Review of Sociology*, 21: 387–417.

Coe, Neil M., Dicken, Peter and Hess, Martin (2008a) 'Introduction: Global Production Networks – Debates and Challenges', *Economic Geography*, 8(3): 267–9.

Coe, Neil M., Dicken, Peter and Hess, Martin (2008b) 'Global Production Networks: Realizing the Potential', *Economic Geography*, 8(3): 271–95.

Cook, Karen S. (1977) 'Exchange and Power in Networks of Interorganizational Relations', *The Sociological Quarterly*, 18(Winter): 62–82.

Dicken, Peter, Kelly, Philip F., Olds, Kris and Yeung, Henry Wai-Chung (2001) 'Chains and Networks, Territories and Scales: Toward a Relational Framework for Analyzing the Global Economy', *Global Networks*, 1(2): 1470–2266.

Durand, Edward D. (1953) 'Country Classification', in Roy George, Douglas Allen and J. E. Ely (eds) *International Trade Statistics*, New York, John Wiley, pp. 117–29.

Emerson, R. M. (1962) 'Power-Dependence Relations', *American Sociological Review*, 27(1): 31–40.

Evans, Peter (1979) *Dependent Development: The Alliance of State, Multinational and Local Capital in Brazil*, Princeton, NJ: Princeton University Press.

Evans, Peter (1995) *Embedded Autonomy: States and Industrial Transformation*, Princeton, NJ: Princeton University Press.

Forehand, Walter E. and Forehand, John W. (2002) 'Motor Vehicle Dealers and Motor Vehicle Manufacturers: Florida Reacts to Pressures in the Marketplace', *Florida State Law Review*, 29(3): 1057–107.

Frobel, Folker, Heinrichs, Jurgen and Kreye, Otto (1980) *The New International Division of Labor*, Cambridge: Cambridge University Press.

Gereffi, Gary (1994) 'The Organization of Buyer-Driven Global Commodity Chains: How US Retailers Shape Overseas Production Networks', in Gary Gereffi and Korczenewics, Miguel (eds) *Commodity Chains and Global Capitalism*, Westport, CT: Praeger Press, pp. 95–122.

Gereffi, Gary (1996) 'Global Commodity Chains: New Forms of Coordination and Control among Nations and Firms in International Industries', *Competition and Change*, 1(1): 427–39.

Gereffi, Gary (1999) 'International Trade and Industrial Upgrading in the Apparel Commodity Chain', *Journal of International Economics*, 48(1): 37–70.

Gereffi, Gary (2001) 'Beyond the Producer-driven/Buyer-driven Dichotomy: The Evolution of Global Value Chains in the Internet Era', *IDS Bulletin*, 32(3): 30–40.

Gereffi, Gary (2002) 'The International Competitiveness of Asian Economies in the Apparel Commodity Chain', ERD Working Paper No. 5, Asian Development Bank.

Gereffi, Gary (2005) 'The Global Economy: Organization, Governance and Development.'', in Neal Smelser and Richard Swedberg (eds) *The Handbook of Economic Sociology*, 2nd Edition, Princeton: Princeton University Press, pp. 75–122.

Gereffi, Gary, Humphrey, John and Sturgeon, Timothy (2005) 'The Governance of Global Value Chains', *Review of International Political Economy*, 12(1): 78–104.

Gereffi, Gary and Memedovic, Olga (2003) *The Global Apparel Value Chain: What Prospects for Upgrading by Developing Countries?*, Vienna: UNIDO.

Gereffi, Gary and Wyman, Donald L. (eds) (1990) *Manufacturing Miracles: Paths of Industrialization in Latin America and East Asia*, Princeton, NJ: Princeton University Press.

Gibbon, Peter (2001) 'Upgrading Primary Production: A Global Commodity Chain Approach', *World Development*, 29(2): 345–63.

Gibbon, Peter and Ponte, Stefano (2005) *Trading Down: Africa, Value Chains, and the Global Economy*, Philadelphia, PA: Temple University Press.

Granovetter, Mark (1985) 'Economic Action and Social Structure: The Problem of Embeddedness', *American Journal of Sociology*, 91(3): 481–510.

Green, Andrew E. (1992) 'South Korea's Automobile Industry: Development and Prospects', *Asian Survey*, 32(5): 411–28.

Halaby, Charles (2004) 'Panel Models in Sociological Research: Theory into Practice', *Annual Review of Sociology*, 30: 507–44.

Hall, Peter and Soskice, David (2001) 'An Introduction to Varieties of Capitalism', in Peter Hall and David Soskice (eds) *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*, Oxford: Oxford University Press, pp. 1–69.

Hamilton, Gary and Gereffi, Gary (2009) 'Global Commodity Chains, Market-makers, and the Rise of Demand-responsive Economies', in Jennifer Bair (ed.) *Frontiers of Commodity Chain Research*, Palo Alto, CA: Stanford University Press, pp. 136–61.

Heintz, James (2006) 'Low-wage Manufacturing and Global Commodity Chains: A Model in the Unequal Exchange Tradition', *Cambridge Journal of Economics*, 30(4): 507–20.

Henderson, Jeff, Dicken, Peter, Hess, Martin, Coe, Neil and Yeung, Henry Wai-Chung (2002) 'Global Production Networks and the Analysis of Economic Development', *Review of International Political Economy*, 9(3): 436–64.

Humphrey, John (2000) 'Assembler-Supplier Relations in the Auto Industry: Globalization and National Development', *Competition and Change*, 4(2): 245–71.

Humphrey, John and Memedovic, Olga (2003) *The Global Automotive Industry Value Chain: What Prospects for Upgrading by Developing Countries?* Vienna: UNIDO.

Jorgenson, Andrew K. (2006) 'Unequal Ecological Exchange and Environmental Degradation: A Theoretical Proposition and Cross-national Study of Deforestation, 1990–2000', *Rural Sociology*, 71(4): 685–17.

Kaplinsky, Raphael (2000) 'Globalization and Unequalization: What Can Be Learned from Value Chain Analysis?', *Journal of Development Studies*, 37(2): 117–46.

Kaplinsky, Raphael (2005) *Globalization, Poverty and Inequality*, Cambridge: Polity Press.

Kessler, Judi (1999) 'The North American Free Trade Agreement, Emerging Apparel Production Networks, and Industrial Upgrading: The Southern California/Mexico Connection', *Review of International Political Economy*, 6(4): 565–608.

Kimura, Seishi (2007) *The Challenges of Late Industrialization: The Global Economy and the Japanese Commercial Aircraft Industry*, Hampshire: Palgrave Macmillan.

Macaulay, Stewart (1966) *Law and the Balance of Power: The Automobile Manufacturers and Their Dealers*, New York: Russell Sage Foundation.

Mahutga, Matthew C. (2006) 'The Persistence of Structural Inequality? A Network Analysis of International Trade, 1965–2000', *Social Forces*, 84(4): 1863–89.

Mahutga, Matthew C. (2012) 'When Do Value Chains Go Global? A Theory of the Spatialization of Global Value Chains', *Global Networks*, 12(1): 1–24.

Mahutga, Matthew C. and Smith, David A. (2011) 'Globalization, The Structure of the World Economy and Economic Development', *Social Science Research*, 40(1): 257–72.

Maxton, Graeme P. and Wormwald, John (2004) *Time for a Model Change*, Cambridge: Cambridge University Press.

Memedovic, Olga (2004) *Inserting Local Industries in Global Value Chains and Global Production Networks*, Vienna: UNIDO.

OECD (Organisation for Economic Co-operation and Development) (2007) 'Competition and Barriers to Entry', OECD Competition Division Policy Brief, OECD Observer, Paris: OECD.

O'Hearn, Dennis (1994) 'Innovation and the World-system Hierarchy: British Subjugation of the Irish Cotton Industry, 1780–1830', *American Journal of Sociology*, 100(3): 587–621.

Plumper, Thomas and Troeger, Vera E. (2007) 'Efficient Estimation of Time-Invariant and Rarely Changing Variables in Finite Sample Panel Analyses with Unit Fixed Effects', *Political Analysis*, 15(2): 124–39.

Powell, Walter (1990) 'Neither Market Nor Hierarchy: Network Forms of Organization', *Research in Organizational Behavior*, 12: 295–336.

Raftery, Adrian E. (1995) 'Bayesian Model Selection in Social Research', *Sociological Methodology*, 25: 111–63.

Rothstein, Jeffery (2005) 'Economic Development Policymaking Down the Global Commodity Chain: Attracting an Auto Industry to Silao, Mexico', *Social Forces*, 84(1): 49–69.

Schrank, Andrew (2004) 'Ready-to-Wear Development? Foreign Investment, Technology Transfer, and Learning by Watching in the Apparel Trade', *Social Forces*, 83(1): 123–56.

Shapiro, Helen (1994) *Engines of Growth: The State and Transnational Auto Companies in Brazil*, Cambridge: Cambridge University Press.

Smith, Adrian, Rainnie, Al, Dunford, Mick, Hardy, Jane, Hudson, Ray and Sadler, David (2002) 'Networks of Value, Commodities and Regions: Reworking Divisions of Labour in Macro-Regional Economies', *Progress in Human Geography*, 26(1): 46–63.

Sturgeon, Timothy, Van Biesebroeck, Johannes and Gereffi, Gary (2008) 'Value Chains, Networks and Clusters: Reframing the Global Automotive Industry', *Journal of Economic Geography*, 8(3): 297–321.

Thompson, James D. (1967) *Organizations in Action*, New York: McGraw-Hill.

Todd, Daniel (1985) *The World Shipbuilding Industry*, London: Croom Helm.

Todd, Daniel (1991) *Industrial Dislocation: The Case of Global Shipbuilding*, London: Routledge.

Todd, Daniel, Simpson, Jamie and Humble, Ronald (1985) *Aerospace and Development: A Survey*, Winnipeg, Canada: Department of Geography, The University of Manitoba.

UNIDO (United Nations Industrial Development Organization) (2006) *Industrial Statistics Database: 3-digit Level of the ISIC Code, Revision 2*, Vienna: Statistics Unit, UNIDO.

United Nations (1963) 'Commodity Indexes for the Standard International Trade Classification, Revision 1', Statistical Papers M: 38(II), New York: United Nations.

United Nations (2006) *COMTRADE*, New York: United Nations.

Wallace, Michael, Griffin, Larry J., and Rubin, Beth A. (1989) 'The Positional Power of American Labor, 1963–1977', *American Sociological Review*, 54(2): 197–214.

Wallerstein, Immanuel (2009) 'Protection Networks and Commodity Chains in the Capitalist World Economy', in Jennifer Bair (ed.) *Frontiers of Commodity Chains Research*, Stanford, CA: Stanford University Press, pp. 83–9.

Weller, Susan C. and Romney, A. Kimball (1990) *Metric Scaling: Correspondence Analysis*, Volume 75 of Quantitative Applications in the Social Sciences Series, Newbury Park, CA: Sage.

Whitley, Richard (1998) 'Internationalization and Varieties of Capitalism: The Limited Effects of Cross-national Coordination of Economic Activities on the Nature of Business Systems', *Review of International Political Economy*, 5(3): 445–81.

Wooldridge, Jeffrey M. (2002) *Econometric Analysis of Cross Section and Panel Data*, Cambridge, MA: MIT Press.

World Bank (2002) *EdStats*, Washington, DC: World Bank.

Yamagashi, Toshio, Gillmore, Mary R. and Cook, Karen S. (1988) 'Network Connections and the Distribution of Power in Exchange Networks', *The American Journal of Sociology*, 93(4): 833–51.

Yang, Xiaohua (1995) *Globalization of the Automobile Industry: The United States, Japan and the People's Republic of China*, London: Praeger.