Global Production Networks and International Inequality: Making a Case for a Meso-Level Turn in Macro-Comparative Sociology

Matthew C Mahutga[1]
University of California, Riverside
matthew.mahutga@ucr.edu

Abstract

In this article, I extend recent macro-comparative empirical research on the developmental implications of global production networks. I draw from theories of commodity/value chains, global production networks and economic sociology to identify three contending theoretical perspectives for exactly how the developmental returns to network participants should be distributed—cooperation, exploitation and differential gains—and derive testable hypotheses for each. Adding to recent empirical advances for measuring the average network position of firms at the country level, I evaluate these hypotheses by way of dynamic panel regression models of hourly wage rates in the garment and transportation equipment industries. The results suggest that macro-sociological theories linking underdevelopment to the structure of the world-economy, as well as theories of the distribution of the gains from network participation, miss important variation at the industry level. Cooperation provides a poor account of the distribution of the gains from network participation. Instead, both industries appear to distribute the gains from network participation differentially across network participants. However, the extent of this inequality increases, and the garment industry transitions to exploitation, when global production networks become entrenched organizational logics. Variation in the distribution of the returns to network participation is explicable only by accounting for production-network governance as it varies across industries and over time. I conclude by highlighting the analytical utility to macro-comparative sociology of a turn toward the meso-level of global industries.

Keywords: Commodity chains, value chains, production networks, international inequality, development

[1] **Acknowledgements:** This research was supported by the University of California Institute for Global Conflict and Cooperation. The author thanks the anonymous *Journal of World-Systems Research* reviewers for challenging and insightful criticism that made the paper better. The author also thanks Andrew Schrank for coining "differential gains" after reading a draft of a related unpublished manuscript, and Jennifer Bair for an immeasurable degree of critical commentary and intellectual support for the larger project out of which this article emerges. All remaining errors of omission and commission are the sole fault of the author.

One of the more fundamental transformations taking place in the world economy is the dis-embedding of production from within the confines of vertically integrated firms, and the re-embedding of production in networks of coordinated exchange between formally independent firms. One of the most coherent and well-documented lines of inquiry on global production networks (GPNs) is the global commodity chains literature and its various offshoots. This literature suggests that a key strategy for economic development is industrial upgrading, and the first step to industrial upgrading involves integrating into GPNs as a subordinate manufacturer—that is, as a supplier to the lead firm that coordinates the network (Gereffi 1999; Bair and Gereffi 2003). However, some contend that subordinate integration may be far from optimal from the perspective of economic development (Arrighi et. al. 2003; Kaplinsky 2005; Schrank 2004). As documented recently elsewhere, the key source of the ambivalence of GPNs for economic development is a theoretical paradox: because economic activity is increasingly networked, countries must develop ways to encourage their firms to become embedded within these networks, but "the returns to these networks accrue unequally among firms…" (Mahutga 2014a: 186).

Empirical research on GPNs has done much to advance our understanding of precisely how GPNs are organized globally, and the way these organizational forms vary across industries. It also adds to the ambivalence regarding economic development insofar as "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 who compete for access to a given network (Mahutga 2014a: 165). Recent research thus draws from the empirical and theoretical literature to derive general propositions about the possible developmental consequences of GPNs, and "develop an empirical framework to advance basic research on the link between globally networked forms of economic organization and national economic development" (Mahutga 2014a: 157; also see Mahutga 2014b).

In this article, I extend this research in two distinct ways. I begin by outlining three understandings of global production relationships that follow from this more recent research. First, *cooperation* is most closely associated with conceptualizations of the "embedded network" from economic sociology. Second, *exploitation* is most closely associated with original conceptualizations of commodity chains from World-Systems analysis. Finally, *differential gains* represents an intermediate hypothesis regarding the distribution of the developmental returns to network participation. The key difference across these three understandings is that each predicts different patterns of both the *absolute* and *relative* effects of network power and subordination on economic development. I then advance the new empirical framework by deriving cross-nationally and temporally comparable measurements of the extent to which a country's firms occupy *subordinate* GPN positions; I refer to this subordinate status as "network captivity." This allows me to compare the developmental returns to network power and subordination.

To adjudicate between cooperation, exploitation and differential gains, I estimate dynamic panel models of average wages in the garment and transportation equipment industry. The results suggest that the returns to network participation vary critically by the governance of the production network in question. I conclude with an argument for a meso level turn in macro-comparative sociology in which the relevant unit of analysis shifts from the whole world economy to globalized industries.

The Returns to Global Production Network Participation: Cooperation, Exploitation or Differential Gains?

In a recent article on the relationship between global commodity/value chain/production networks (GCC/GVC/GPN) and economic development (Mahutga 2014a), I argue that "the most powerful and unique contribution of both the GCC/GVC and GPN approaches [is that] positional power matters for the developmental consequences of globalized production" (182). By "positional power," I intend an exchange theoretic understanding of power, in which the power of a focal actor depends on (1) the extent to which other actors value his/her resources, (2) the number of exchange partners available to the focal actor and (3) the number of alternative exchange partners available to the focal actor's alters. In the context of GPNs, I argue lead firms possess disproportionate degrees of bargaining power because of factors 1-3, and they use this bargaining power to build production networks that maximize their own economic returns. That is, the network structure of the *possible GPN ties* among firms in global industries is such that the "power" of lead-firms over suppliers stems from the limited exchange possibilities enjoyed by the latter relative to the former. Subordinate firms are "captive" to leading firms because, *ceteris paribus*, they face a probability of successful GPN integration equal to L/S, where L is the number of leading firms seeking partners, S is the number of capable suppliers, and L<S by orders of magnitude.[2] In these early works I do little more than speculate as to the precise distributional consequences of asymmetric inter-firm power relations in GPNs, but one can derive at least three kinds of hypotheses (e.g. Mahutga 2014a; 2014b; 2012).

I call the first kind of explanation *cooperation*, which is most closely associated with theories of the network form of economic organization from economic sociology (Granovetter 1985; Powell 1990; Uzzi 1996). For economic sociologists like Granovetter, Powell and Uzzi, the network form of economic organization is defined by a distinct governance logic characterized by "long-term cooperative relationships" that shifts actor's motivations "toward the enrichment of relationships through trust and reciprocity" (Uzzi 1996: 693; 677). In the context of GPNs, powerful leading firms do provide captive firms with access to foreign markets, and transfer technology and know-how in order to increase the quality of the final goods (Humphrey and Memedovic 2003; Gereffi and Memedovic 2003; Memedovic 2004; Kessler 1999; Gibbon 2001). Thus, cooperativists argue that initial captivity leads to "upgrading" as captive firms undergo incremental competency increases, which allows them to move into higher value-added nodes within production networks (Bair and Gereffi 2003; Gereffi 2002; 1999). Moreover, cooperativists argue that upgrading in one network can generate new competencies that allow firms to transition into new types of production networks (Gereffi 1999; Humphrey and Schmitz 2001). In short, initial captivity may be "a necessary step for industrial upgrading because it puts firms and economies on potentially dynamic learning curves" (Gereffi 1999: 39).

---

[2] This usage of the term "captive" should not be confused with that of Gereffi et al. (2005), which seems to presume a significant degree of fixed investment by the leading firm and thus a different motivation for exchange. The *ceteris paribus* interpretation here is important to bear in mind. The probability of success equals L/S if the variation in resource desirability among firms in L is equal to zero and asset specificity is such that lead-firms source a given input from just one supplier. Thus, the probability of success goes down in inverse proportion with the variability in resource desirability among the firms in L, because fewer lead firms will be sufficiently attractive exchange partners. The probability of success goes up if leading firms source a given input from more than one firm, but, holding lead-firm demand constant, this would also reduce the absolute economic output for any one successful supplier.

At the other extreme, some argue instead that leading firms in GPNs use their powerful positions to extract gains from other firms, and that the high returns to leading firms are a function of the concessions made by weaker firms (Heintz 2006). For example, dominant firms require captive manufacturers to regularly reduce the cost of the goods they supply leading firms, but simultaneously improve quality (Kaplinsky 2005; Schrank 2004; Humphrey 2000; Maxton and Wormald 2004). Others point to something of a "glass ceiling" to industrial upgrading. Andrew Schrank characterizes this process in garment production networks as follows:

"While buyers encourage and take advantage of competition in the relatively low-return preassembly, assembly, and finishing sectors, they are intolerant of competition in the highly profitable design, marketing and distribution sectors, and relegation to low-return manufacturing activity may therefore constitute the inherent price of participation in the apparel commodity chain" (Schrank 2004: 138).

These problems are not limited to labor intensive buyer-driven industries. For example, in a case study of the Malaysian auto industry, Jason Abbot (2003) shows that the Japanese TNC Mitsubishi was instrumental in the development of the national automobile program Proton through a joint venture program. Mitsubishi's motivation remained strong as long as Proton was primarily geared toward servicing the local market for low-end passenger vehicles, because it presented Mitsubishi with an opportunity increase its share in that market. However, Mitsubishi resisted Proton's move to penetrate the export market in the ASEAN region, since it "did not want the Proton to compete with other vehicles that it produced for export elsewhere in the Asia-Pacific region" (Abbot 2003: 133). Thus, Mitsubishi was happy to joint venture with Proton in the production of lower end vehicles for the Malaysian market, but resistant to the encroachment of Proton into Mitsubishi's core market of more sophisticated vehicles.

In addition to these relational mechanisms, exploitationists also argue that the returns to captive manufacturing decline as GPNs become entrenched organizational logics, globally. One mechanism is that the rapid diffusion of the production network model to historically poor countries increases competition between captive manufacturers trying to integrate into GPNs. That is, the entrenchment of GPNs as an organizational logic "may well be devaluing the very technical and organizational assets upon which the returns to [GPN integration] have traditionally been based" (Schrank 2004: 145; see also Arrighi et al. 2003; Kaplinsky 2005).

The forgoing cooperation and exploitation hypotheses represent opposite ends of an optimism/pessimism continuum. Between these two extremes lies a third hypothesis—differential gains. Unlike the exploitation hypothesis, both leading and captive firms can gain from participating in networks. That is, the economic performance of leading firms does not come from an ability to exploit their suppliers by extracting economic concessions. However, neither does the differential gains hypothesis suggest that leading and captive firms *gain equally* from network participation. For example, leading firms build production networks by outsourcing/offshoring aspects of the manufacturing processes subject to the most competition, and thereby reduce the competitive exposure of their own assets (Mahutga 2012: 5-9). If lead firm strategy revolves partially around the externalization of activities with low and/or declining returns, "then the distribution of returns to network participation might be skewed toward the leading firms" (Mahutga 2014b: 32-33). But, this does not necessarily imply that captive firms lose *in an absolute sense* from their incorporation into GPNs. In short, the differential gains hypothesis suggests that both dominant and captive actors *can* gain from the diffusion of production networks in an absolute sense, but that leading firms will gain *more than their captive counterparts*.

Table 1. Hypothesized Absolute and Relative Effects of Cooperation, Exploitation and Differential Gains

	Network Power		Network Captivity
Cooperation	+	=	+
Differential Gains	+/–	>	+/–
Exploitation	+	>	–

To recapitulate, Table 1 summarizes the cooperation, exploitation and differential gains hypotheses in terms of their predictions for the absolute and relative gains from network participation that should accrue to actors in leading and captive GPN positions. The cooperative hypothesis depicted in the first row is "win-win" in that it suggests that both dominant and captive actors gain by participating in GPNs, and that these gains are equal. The second row in Table 1 depicts the differential gains hypothesis. Lead firms source manufacturing capability to captive firms, but the returns to these capabilities are either low or falling. The differential gains hypothesis is agnostic about the absolute gains to leading and captive positions, but suggests definitively that firms in leading network positions gain more than those in captive ones. Finally, the exploitation hypothesis is depicted in the last row of Table 1. This hypothesis is "win-lose" in the sense that firms in leading network positions gain from participating in GPNs at the expense of those occupying captive positions. Not only are relative gains to network participation greater for firms in leading network positions, but the absolute gains are negative for firms in captive positions.

A Parallel Path of GCC/GVC/GPN Research: Global Production Networks and Macro-Comparative Analyses of Economic Development

In addition to the theoretical ambivalence regarding the developmental implications of the entrenchment of GPNs as an organizational logic globally, the extant empirical literature poses "a bit of a methodological challenge in drawing conclusive links between networked production and economic development [because] statistics on both development and economic behavior are compiled cross-nationally, and 'development' is by definition a concept that must go beyond the performance of any single firm" (Mahutga 2014a: 164). GPN analysts argue convincingly that economic activity is increasingly organized via inter-firm networks that are transnational in scope. Thus, the predominant methodological strategy 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" (Mahutga 2014a: 165). While this methodological approach yields a significant degree of analytical leverage, the panoply of empirical work creates a parallel sense of ambivalence to the theoretical issues addressed above:

"…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" (Mahutga 2014a: 165).

To push this research program further, I propose a parallel path of chains research "that implicates global models of network organization in macro-comparative analyses of economic development" (Mahutga 2014a: 157). Here, I synthesize the macro-comparative tradition of network analysis with that of case-study researchers who utilize industry-specific trade data to infer the production network position of the firms located within countries. In particular, I utilize international trade data for two industries with ideal-typical governance "to measure the average positional power of resident firms for a large sample of countries in a way that is both cross-nationally and temporally comparable" (Mahutga 2014b: 17). That is, if industrial performance at the country level is a function of the network position of firms within that country, then one need simply assess the average network position of a given country's firms, and compare industrial performance across these assessments.

To facilitate the analysis, I begin with the garment and transportation equipment industries. I select these industries because they are archetypical cases of "buyer" and "producer-driven" governance, respectively (see Gereffi 1994; Gibbon and Ponte 2005; Mahutga 2012; 2014a; 2014b).[3] This allows me to draw from the organizational literature on these two industries to derive network indices of power that are high when a focal country engages in trade relations that are indicative of what one would expect of a country with many leading firms. Because leading firms perform very different functions in the two industries, the indices I derive—buyer and producer-driven power—vary computationally between industries. Through a triangulated process of validation, I demonstrate that these measures capture what they intend. They (1) correlate strongly with the actual location of leading firms in the two industries, (2) successfully explain cross-national variation in manufacturing specialization in the two industries, (3) vary over time in ways that correspond to the historical record of the rise and fall of specific national industries, and (4) correlate positively with wages in the two industries (Mahutga 2014a; 2014b).

However, testing the cooperation, exploitation and differential gains hypotheses requires not only measurements of the average degree of power among a country's resident firms, but also the average degree of subordination. Part of this previous research provides insight on how to proceed insofar as the network analyses in one paper show that "subordination at the firm level implies import/export dependency at the national level" (Mahutga 2014a: 187). Unlike the case of leading firms, subordinate firms in both industries play a similar role. First, subordinate firms are manufacturing suppliers. Second, subordinate firms are dependent upon leading firms as the sole "market" for their manufactures. Thus, while buyer- and producer-driven power accrue to countries who either import from or export to a geographically diffuse set of partners, as well as capture a significant share of the imports from or export markets of these partners, network captivity should accrue to countries who export a significant share of their manufactures *to a single partner*. Analogous to the classic "dependency" variable *export partner concentration*, then, one can begin to capture industry-specific network dependency with the percentage of industry-specific exports captured by the single largest importer. I call this variable *network captivity*.

To summarize, the theoretical ambiguity regarding the developmental consequences of GPNs congeals into three distinct hypotheses: cooperation, exploitation and differential gains. Each hypothesis has a distinct empirical expectation about the absolute and/or relative effects of network power and captivity. Building upon recent empirical work, I argue that buyer- and

[3] I have pointed out elsewhere that, according to the publication repository at Duke's Global Value Chains Initiative, publications on these two industries accounted for approximately 45% of all publications listed, even though there are 72 industrial categories within which publication could be classified (Mahutga 2014b: note 2, page 34).

producer-driven power can be combined with *network captivity* to assess the validity of each of these three hypotheses. To proceed, I employ this empirical approach of treating industry-specific wages as a key developmental indicator, because

> …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 (Mahutga 2014a: 174).

Thus, testing each of the three hypotheses is relatively straightforward in this approach: it requires comparing the wage effect (or wage premium) of network power to network captivity.

A Note on History: Periodizing Networks as Organizational Logic

In the above discussion of the possible distribution of returns to GPNs, there is a dynamic component that is implied but that should be made explicit. GPNs are historical phenomena that stand in stark contrast to the organizational structures that Chandler (1977; 1990) or even Williamson (1981) might have envisioned in the not so distant past. The process of de-verticalization, where firms separate aspects of a given production process and outsource some or all of these aspects, began sometime after the golden age of post-war growth and then increased over time. In 1980, for example, Frobel et al. published what became a classic, *The New International Division of Labor*. Here, Frobel et al. (1980) drew on data from the 1970s to document the proliferation of export platforms in the global South, and suggested that this was indicative of a new organizational trend whereby firms headquartered in the global North move manufacturing capability offshore. This "export-processing" model, in which big buyers engaged in limited amounts of manufacturing and used suppliers for simple assembly, represented an intermediate stage in the development of various models of network governance.

Eventually, production networks became entrenched (and varying) organizational logics among northern firms, by which I mean that some form of globalized production became a key part of the organizational strategy of both Northern and Southern firms. In the garment industry, export processing zones led to deeper linkages between Northern buyers and Southern producers such that supplier functions became a "large enough component of [Southern] economies that they shaped the organization of the entire economy" (Hamilton and Gereffi 2009: 153). Similarly, innovations in network-based "lean production" techniques by Japanese firms quickly spread to other Northern firms, which adopted networked models in response to "systemic difficulties" brought on by a lack of competitiveness vis-à-vis Japanese rivals (Whitford 2005: 15). Thus, while it is impossible (and unnecessary) to pinpoint a precise year by which networked forms of economic organization had become entrenched organizational logics, most point to the 1980s as a critical decade. Bair suggests that, by the 1980s, "the 'denationalization' of apparel production was well underway in many higher wage economies," which in turn was driven by the activities of "retailers and branded clothing companies…" (Bair 2006: 2235). Analysts of the auto industry concur, noting that by the 1980s, this industry made a full transition "from a series of discrete national industries to more integrated global industrie[s]" (Sturgeon et al. 2008: 302). Mahutga (2012) finds that offshoring skyrocketed after 1980 in not only the garment and auto industries, but also electronics. This historical reading of GPNs is important because it highlights that networked forms of economic organization should matter for the organizational and developmental trajectories of countries "a*s production networks become the predominant organizational logic in manufacturing industries over time"* (Mahutga 2014b: 9). In the present context, this suggests that the relative and absolute wage premiums to network power and captivity should depend on the extent to which buyer- and producer-driven models of network governance have become entrenched on a global scale. In what follows, I describe the remainder of my empirical strategy.

Data and Methods

Wages

I measure hourly wages in each industry with wage and employee data I obtain from UNIDO (2006). I use variable 05 (wages and salaries paid to employees), which is equal to the total yearly wage bill, for industries 322 (Clothing) and 384 (Transportation Equipment), and divide it by variable 04 (number of employees) for the same industries, for each country. This results in the yearly wage per employee. I then divide this by a forty hour work week (40*52) to arrive at the hourly wage. This estimate of the hourly wage probably overstates the actual hourly wage in poor countries, where work weeks are often longer than 48 and thus provides a rather conservative indication of the difference in hourly wage between countries with high and low network power, which is correlated (imperfectly) with development. This transformation allows for descriptive simplicity, but has no bearing on the subsequent analysis because it is linear. In effect, the dependent variable is *yearly wage per worker*. These dependent variables were measured one year after the independent variables (1966, 1971, 1981, 1991 and 2001) and logged for skewness.

Explanatory Variables

<u>*Positional Power*</u>

Two key explanatory variables in the regressions that follow are buyer and producer-driven power, as defined in the following equations Mahutga (2014a; 2014b):

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

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

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. High ranking countries have many dependent import partners, and scores increase with the absolute dependency of each import partner thereafter. In (2), X_{ji} is the exports from country *j* to country *i* in the transport equipment industry, $Y_i \cdot$ is the total imports of receiving country *i*. High ranking countries have many dependent export partners, and scores increase with the absolute dependency of each export partner thereafter.

The trade data come from UNCOMTRADE and are categorized according to Rev.1 of the Standard Industrial Trade Classification (United Nations 2006; 1963). I employ trade in category 84 (clothing) and 71 (transportation equipment). In both cases I build the network with reported imports collected at five points in time over a thirty-five year period with a balanced set of countries to preclude biases owing to partner attrition/addition (1965, 1970, 1980, 1990 and 2000). The year-on-year variation in which countries report restricted the networks to the 96 countries listed below in Table 2, which nevertheless account for between 95.5 and 98.6 percent of world trade and 92.5 to 96.8 of world GDP over the period. Both variables were logged for skewness.

Table 2. Countries Appearing in Garment and Transport Equipment Networks

Algeria	Czechoslovakia	Jamaica	Poland
Angola	Denmark	Japan	Portugal
Argentina	Ecuador	Jordan	Qatar
Australia	Egypt	Kuwait	Romania
Austria	El Salvador	Libya	Samoa
Bahrain	Ethiopia	Madagascar	Saudi Arabia
Barbados	Finland	Malawi	Senegal
Belgium	France	Malaysia	Singapore
Benin	Gabon	Mali	South Korea
Bolivia	Gambia	Malta	Spain
Brazil	Germany	Mauritius	Sri Lanka
Brunei Darussalam	Ghana	Mexico	Sweden
Burkina Faso	Greece	Morocco	Switzerland
Cameroon	Guatemala	Netherlands	Thailand
Canada	Honduras	New Zealand	Togo
Central African Republic	Hong Kong	Nicaragua	Trinidad/Tobago
Chad	Hungary	Niger	Tunisia
Chile	Iceland	Nigeria	Turkey
China	India	Norway	UK
Colombia	Indonesia	Pakistan	Uruguay
Congo, Dem Rep	Iran	Panama	USA
Costa Rica	Ireland	Paraguay	Venezuela
Cote d'Ivoire	Israel	Peru	Yugoslavia
Cyprus	Italy	Philippines	Zambia

<u>*Network Captivity*</u>

As I describe above, network captivity is measured as the percentage of a focal country's exports captured by the single largest importer. For captivity in the garment industry, I utilize data on UNCOMTRADE category 84 (clothing). For captivity in the transport industry, I utilize data on UNCOMTRADE category 71 (transportation equipment).

Control Variables

<u>*Human Capital*</u>

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 enrollment rates, which are standard in cross-national models of economic development (Barro 1997; data from World Bank 2002). This variable was logged for skewness.

<u>*Entrenchment of the Network Form*</u>

As I discussed above, the two models of network governance became increasingly entrenched organizational logics over the latter decades of the 20th century, and the 1980s appear to be a key decade during which there is a consensus that these network forms had become globally predominant. This development constitutes a temporal "shock" that is common to all countries. 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. To test the hypothesis that the wage premium to network power and captivity depends on the extent to which the network form has become entrenched globally, I interact network power and captivity with this dummy variable. Zero-order correlations among all variables appear in Table A1.

Dynamic Panel Regression Models

In order to compare the wage premium of network power to that of network captivity, I regress average hourly wages in the garment and transport equipment industries on buyer- and producer-driven power, and network captivity. 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 countries but not over time (unit effects). Panel data such as these often result in serially correlated errors. I rejected the hypothesis that the error terms are serially uncorrelated at conventionally modest levels of significance. Some treat serial correlation as a nuisance parameter to be removed, where others see serial correlation as substantively meaningful. Treating serial correlation as a nuisance involves generalized least squares (GLS) approaches that remove the serial correlation prior to estimation, or the implementation of a variance/covariance matrix that is "robust" to serial correlation. Treating serial correlation as substantively meaningful implies modeling it with a lagged dependent variable (LDV) in a dynamic panel model context.

In the absence of definitive statistical guidance, I adopt the latter approach by estimating Arellano-Bover/Blundell-Bond dynamic panel models. This dynamic estimator is substantively strategic because it allows for the simultaneous estimation of the short (β) and long $\beta/(1-\beta_{LDV})$ term effects of network power and captivity, and corrects for the natural association between current and past wage rates cross-nationally. To eliminate the problem of unobserved time invariant country effects, the estimator applies the first difference transformation to both sides of the equation. Differencing leads to correlation between the lagged dependent variable and the unobserved country effect and thus to bias estimates of the parameter on the former. To address this source of bias, Blundell and Bond (1998) developed a Generalized Method of Moments (GMM) system estimator that uses additional moment conditions to those proposed by Arellano and Bond (1991). In the original "Arellano-Bond" estimator, the lagged dependent variable is instrumented by all available lagged levels of the dependent variable, as well as the standard instruments in the first stage regression. Blundell and Bond (1998) create a more efficient estimator by exploiting additional moment conditions—all available lagged *differences* of the lagged dependent variable are included as additional instruments in the first stage. The primary models reported below are estimated with this dynamic estimator, but I also estimate and report in reduced-form regression models that treat serial correlation as a nuisance term by implementing fixed-country effects and applying a Cochrane–Orcutt correction for first-order serial correlation in the error term (see Table A2).

Because of missing data and the application of the first-difference transformation, less than the full set of countries appearing 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 and the first-difference transformation reduced this to 267 and 263 country-year observations in the garment and transport equipment industry models, respectively. All regressions were carried out with Stata 11.0.

Results

Table 3 reports bivariate correlation coefficients summarizing the relationship between network power and captivity in each industry. Our knowledge about the organization of global production networks in the garment and transportation industry should lead us to expect a negative association between network power and captivity. That is, on average, countries containing subordinate firms should contain few leading firms. The negative and significant correlations in Table 3 are consistent with this expectation.

Table 3. In-sample Correlation between Network Power and Captivity

	Buyer-Driven Power	Producer-Driven Power
Network Captivity	-.229***	-.525***

Note: Only countries appearing in subsequent models included.

Figure 1. Garment Wages by Buyer-Driven Power before and After the Entrenchment of the Network Form

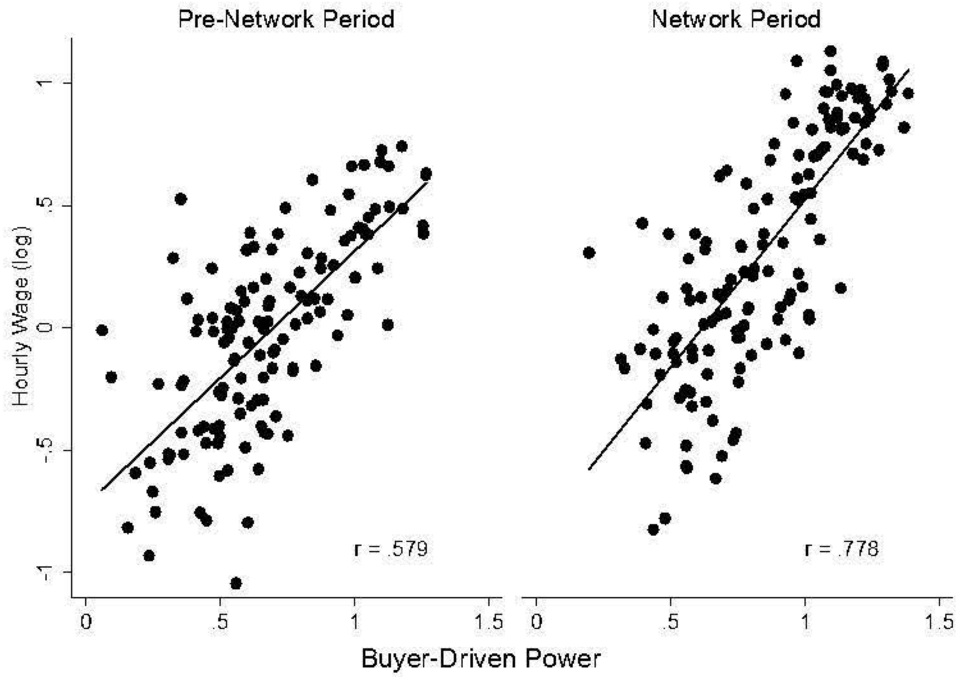


Figure 1 displays the bivariate association between buyer-driven power and the hourly wage in the garment industry across the two broad periods discussed above. Clearly, hourly wages are distributed unequally across network positions characterized by different levels of buyer-driven power in both periods. However, the association is much larger in the post 1980 "network" period than in previous periods. Figure 2 displays the bivariate association between network captivity and the hourly wage in the garment industry across the two periods. Similarly, and consistent with expectations, the association is negative in both periods. However, the association is much stronger in the network period, when it almost quadruples in size. Together, the scatterplots displayed in Figures 1 and 2 are least consistent with the cooperation hypothesis and most consistent with the exploitation hypothesis of garment production networks. On average, countries in powerful positions not only have higher than average wages, but those in captive positions have below average wages. Does this conclusion hold in the context of dynamic panel models that correct for time-invariant country-level unobservables and conventional correlates of wages?

Figure 2. Garment Wages by Network Captivity before and After the Entrenchment of the Network Form

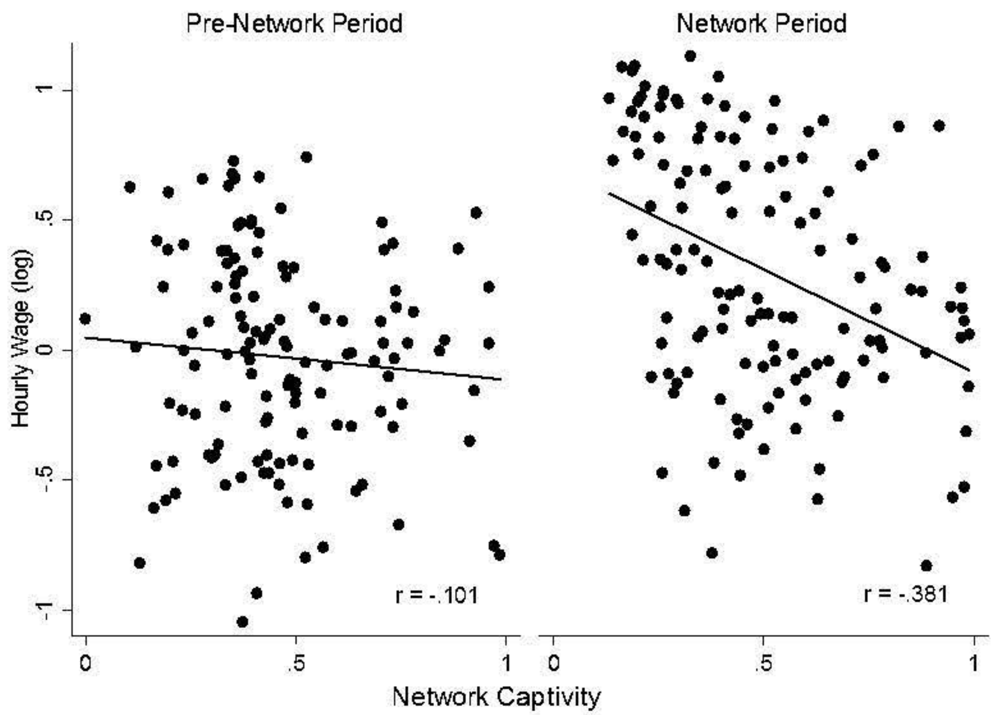


Table 4 reports unstandardized coefficients from the dynamic panel analysis of wages in the garment industry. Model 1 includes both buyer-driven power and network-captivity with secondary education and the fixed period effect. Unsurprisingly, secondary education enrollment is positive and highly significant—human capital boosts wages even in relatively unskilled production processes. Consistent with the graphics in Figures 1 and 2, the effect of buyer-driven power is positive while that for network captivity is negative. Model 2 tests the hypothesis that the wage-premium of buyer-driven power increases as buyer-driven production networks become an entrenched organizational logic world-wide. The interaction between buyer-driven power and the network period is both positive and significant. Model 3 tests the corollary hypothesis with respect to network captivity. Similarly, the interaction term is both negative and significant. In fact, the coefficient on the uninteracted network captivity covariate becomes non-significant—network captivity had no independent effect on hourly wages before the buyer-driven network form became the predominant organizational logic in the garment industry. Model 4 includes each of the covariates introduced in models 1-3. Model 4 provides rather unique and definitive evidence in support of the exploitation hypothesis. Here, the interaction term on buyer-driven power remains positive but is no longer significant, while that on the interaction term involving network captivity is both negative and significant. When comparing these results to those in models 2 and 3, model 4 suggests that *network captivity mediates the effect of buyer-driven power*. Put differently, the increasingly larger-than-average wages that prevail in countries occupying powerful positions are explained by the lower-than-average hourly wages that prevail in countries occupying captive positions in the garment industry.

Table 4. Arellano-Bover/Blundell-Bond Dynamic Panel Regression Models of Average Hourly Wage in the Garment Industry.

	(1)	(2)	(3)	(4)
Lagged Dependent	0.360***	0.384***	0.428***	0.367***
	(6.727)	(7.164)	(7.612)	(6.985)
Buyer Driven Power	0.531***	0.430***		0.470***
	(5.378)	(3.490)		(3.835)
Buyer-Driven Power * Network Period		0.177*		0.076
		(1.987)		(0.820)
Network Captivity	-0.236**		-0.132	-0.076
	(-2.940)		(-1.198)	(-0.744)
Network Captivity * Network Period			-0.323*	-0.297*
			(-2.423)	(-2.295)
Secondary Education	0.447***	0.447***	0.712***	0.435***
	(4.091)	(4.009)	(6.749)	(3.964)
Network Period	-0.025	-0.180*	0.114	0.057
	(-0.783)	(-2.453)	(1.572)	(0.511)
Constant	-0.874***	-0.908***	-0.961***	-0.883***
	(-5.029)	(-5.238)	(-5.102)	(-5.117)
N	267	267	267	267

Notes: Unstandardized coefficients, standard errors in parentheses. *p<.05; **p<.01; ***p<.001 (two-tailed tests).

Figure 3 displays the bivariate association between producer-driven power and wages in the transport equipment industry. Similar to the relationship in Figure 1, the association between producer-driven power and hourly wages is strongly positive in both periods. Moreover, the association becomes stronger in the post 1980 network period, even though the change is less dramatic than is the case with respect to buyer-driven power and wages in the garment industry. Figure 4 displays the bivariate association between network captivity and hourly wages in the transport equipment industry. The association is negative but fairly weak in both periods, despite a slight increase across periods. On balance, the scatter plots in Figures 3 and 4 appear least consistent with the cooperation hypothesis and most consistent with the differential gains hypothesis of transport production networks. The wage premium to producer-driven power is positive and larger than that to network captivity. But, on average, those in captive positions have only slightly below average wages. To evaluate this conclusion further, I turn now to the results of the dynamic panel regression models.

Figure 3. Transport Wages by Producer-Driven Power before and After the Entrenchment of the Network Form

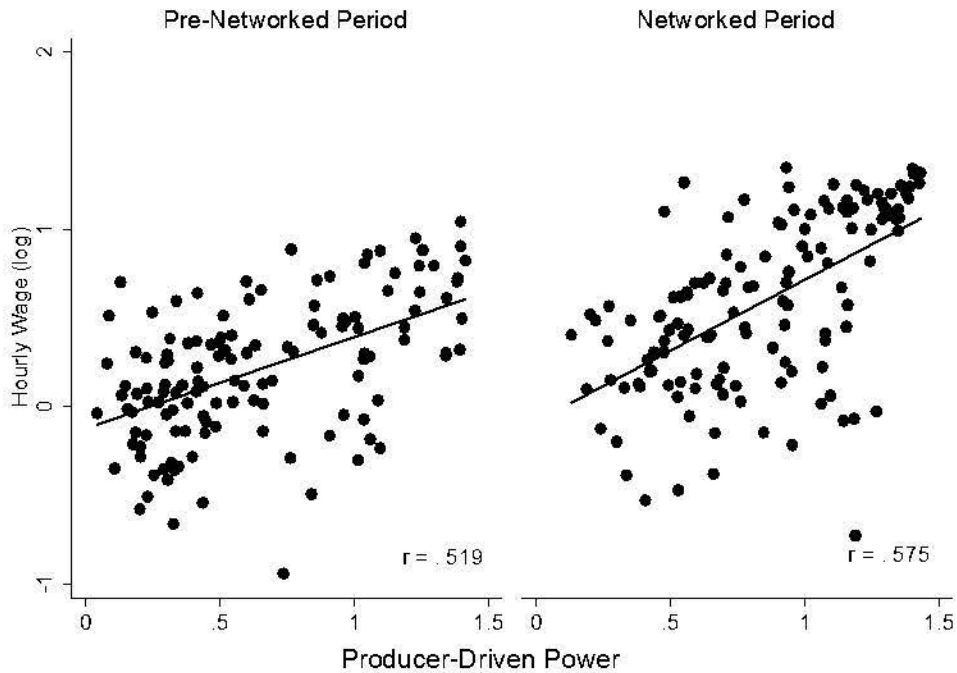
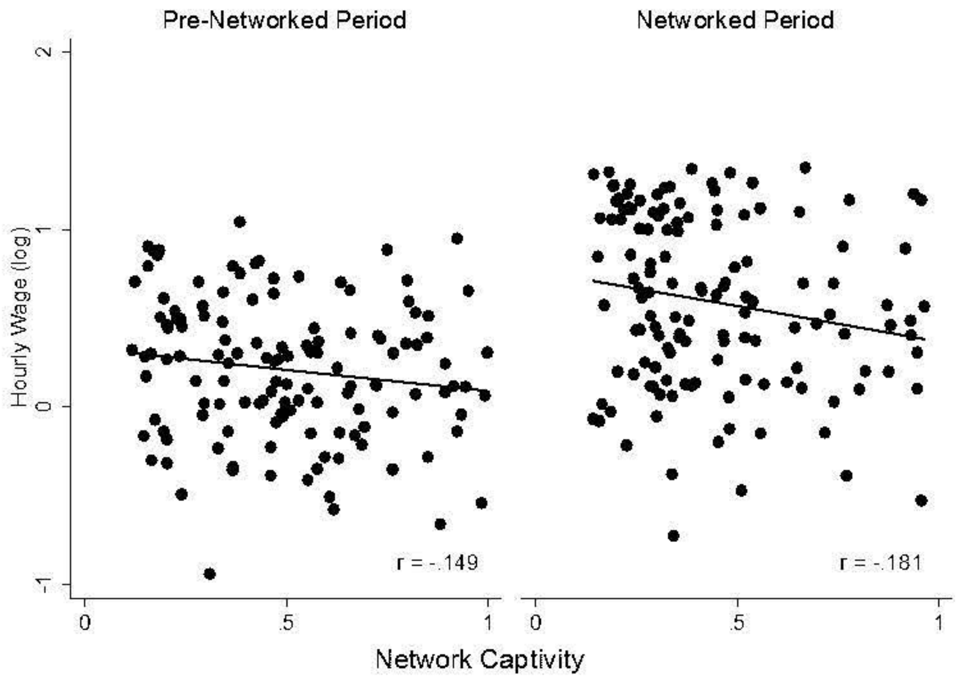


Table 5 reports unstandardized coefficients from the dynamic panel analysis of wages in the transport equipment industry. Model 1 includes both producer-driven power and network-captivity with secondary education and the fixed period effect. Similar to the results in Table 4, secondary education has a positive and robust effect on wages. And, consistent with the differential gains hypothesis, the effect of producer-driven power is positive while that for network captivity is positive but non-significant. Model 2 tests the hypothesis that the wage-premium of producer-driven power increases as producer-driven production networks become an entrenched organizational logic world-wide. The interaction between producer-driven power and the network period is both positive and significant. Model 3 introduces the interaction term between network captivity and the network period, which is negative but non-significant at conventional thresholds.[4] Model 4 includes each of the covariates introduced in models 1-3. Model 4 provides additional evidence in support of the differential gains hypothesis. Here, the interaction term on producer-driven power remains positive, while that on the interaction term involving network captivity becomes positive but remains non-significant. When comparing these results to those in models 2 and 3, model 4 suggests that the effect of producer-driven power is largely orthogonal to network captivity in that it changes only slightly (in a *positive* direction) *vis-à-vis* model 2. In short, the positive wage-premium of producer-driven power is not a function of a reduced wage-premium to network captivity in the industry.

[4] Even when evaluating this coefficient with a one-tailed test, the p-value is greater than .05.

Figure 4. Transport Wages by Network Captivity before and After the Entrenchment of the Network Form



In contrast to theories of the network form of economic organization drawn from the new economic sociology, the results in Table 4 and Table 5 provide no support to the cooperation hypothesis of global production networks. But, the results suggest different conclusions about the two remaining hypotheses of the distribution of the gains from network participation: exploitation (garment industry) and differential gains (transport equipment industry). Recall that the exploitation hypothesis requires (a) positive effect of power, (b) a negative effect of captivity and (c) a larger effect of power than captivity. The differential gains hypothesis requires only (c). The results in Tables A and B are less than definitive—they support propositions (a) for both industries and (b) for the garment industry, but say nothing about proposition (c). Thus Table 6 reports additional analyses of the results in Tables A and B that allow us to assess propositions a-c, before and after the two network forms became predominant organizational logics.

Table 5. Arellano-Bover/Blundell-Bond Dynamic Panel Regression Models of Average Hourly Wage in the Transport Equipment Industry

	(1)	(2)	(3)	(4)
Lagged Dependent	0.298***	0.253***	0.356***	0.256***
	(5.947)	(5.102)	(6.639)	(5.098)
Producer-Driven Power	0.690***	0.564***		0.600***
	(5.956)	(5.131)		(5.150)
Producer-Driven Power * Network Period		0.295***		0.302***
		(4.784)		(4.138)
Network Captivity	0.104		0.076	0.062
	(1.380)		(0.778)	(0.626)
Network Captivity * Network Period			-0.187	0.038
			(-1.618)	(0.308)
Secondary Education	0.451***	0.461***	0.975***	0.446***
	(3.469)	(3.653)	(8.900)	(3.519)
Network Period	0.016	-0.193***	0.088	-0.217*
	(0.548)	(-3.698)	(1.332)	(-2.104)
Constant	-0.998***	-0.885***	-1.380***	-0.914***
	(-5.438)	(-5.066)	(-6.967)	(-4.885)
N	263	263	263	263

Notes: Unstandardized coefficients, standard errors in parentheses.
*p<.05; **p<.01; ***p<.001 (two-tailed tests).

Columns 1 and 3 in Table 6 report the unstandardized long-term coefficients for the network power and captivity covariates in each industry, conditional on time period. Long-term effects are calculated by dividing the conditional coefficient on either network power or captivity (β) by 1-the coefficient on the lagged dependent variable ($1-\beta_{LDV}$), and are expressed over the standard error that obtains from this non-linear combination ($\beta/(1-\beta_{LDV})$. The conditional long-term coefficients in column 1 apply to the pre-networked period, and suggest that both buyer and producer-driven power have positive and significant effects, while those for network captivity are non-significant. The conditional –long-term coefficients in column three suggest that network power has a positive and significant effect in both industries during the network period, while network captivity has a negative and significant effect only in the garment industry. Returning to propositions (a) and (b), then, we can conclude that these necessary conditions for the exploitation hypothesis are met only in the garment industry, and only during the period when buyer-driven governance became an entrenched organizational logic, globally. Contrarily, "differential gains" is the only possible hypothesis left to explain the distribution of gains to network participation in both the pre-networked garment industry and the transport equipment industry in both periods. The differential gains hypothesis for the remaining industry/periods now hinges critically on proposition (c).

Table 6. Conditional Long-Term Coefficients, T-tests for Equality in the Long-Term Wage-Premium to Power and Captivity and T-tests for the Equality of Change in the Long-Term Wage-Premium to Power and Captivity Across Governance Periods.

	Pre-Networked		Networked		Change
	β [a]	t test [b]	β [a]	t test [b]	t test [c]
Garment Industry					
Buyer-Driven Power	.741***	.861***	.862***	1.450***	.589**
	(.192)	(.225)	(.156)	(.211)	(.213)
Network Captivity	-.120	---	-.589***	---	---
	(.160)		(.167)		
Transport Industry					
Producer-Driven Power	.807***	.724***	1.213***	1.080***	.355**
	(.152)	(.165)	(.160)	(.164)	(.136)
Network Captivity	.083	---	.134	---	---
	(.133)		(.127)		

Notes: [a] Long-term conditional coefficients. Long-term conditional effect is estimated with $\beta/(1-\beta_{LDV})$. Conditional standard errors in parentheses. [b] T-tests for null hypothesis that $\beta_P = \beta_C$ on long-term conditional coefficients. Standard error of the difference in parentheses. [c] T-test of the null hypothesis that $\beta^{P}_{pre-network} - \beta^{C}_{pre-network} - \beta^{P}_{network} - \beta^{C}_{network} = 0$, which reduces algebraically to $\beta_{power*network\,period} - \beta_{captivity*network\,period} = 0$. Standard error of the difference in parentheses. *p<.05; **p<.01; ***p<.001 (two-tailed tests).

To evaluate proposition (c), columns 2 and 4 test the null hypothesis that the long-term coefficient on power is equal to that on captivity. Column 2 reports these tests for the pre-networked period. Clearly, the wage-premium to power is larger than that to captivity in both periods, as the test statistics are both positive and highly significant. Column 4 tests the hypothesis in the networked period, and provides identical conclusions. The evaluation of propositions (a)-(c) thus suggests that the exploitation hypothesis applies only to the garment industry, and only during the period when buyer-driven governance became entrenched. The differential gains hypothesis applies to both the pre-networked garment industry, and to the transport equipment industry in both periods. However, column 5 engages in an exercise of future casting by assessing the trajectory of change in proposition (c). That is, column 5 tests the null hypothesis that the difference in wage premium to network power and captivity in the pre-networked period is equal to the same difference in the networked period. The results are rather definitive for both industries: as the two network forms of economic organization become entrenched organizational logics, the magnitude of the difference in wage premium to network power and captivity increases in both industries. Still, the pattern of change in the long-term coefficients on network power and captivity in the two industries suggest that this rising gap is driven by different dynamics in the two industries. In the garment industry, the rising gap is attributable more to the declining wage premium to (or increasingly negative effect of) captivity than it is to the rising wage premium to (or increasingly positive effect of) power. The exact opposite holds in the transport equipment industry.

Sensitivity Analyses

The consistency of the estimated coefficients in Table 4 and Table 5, and of the estimated long-term conditional coefficients in Table 6, depends on whether or not an assumption of the Arellano-Bover/Blundell-Bond estimator holds—that there is no second-order serial correlation in the error term. I tested this hypothesis after each of the models in Table 4 and Table 5, and found that it did not always hold. The consistency problem that may arise is particularly acute for the parameter on the lagged dependent variable, which influences directly the long-term estimates that includes this parameter in the denominator. Thus, Table A2 and A3 reproduce the analysis in Table 6. In Table A2, the conditional coefficients are estimated by way of an AR(1) corrected fixed-effects regression model. In Table A3, the coefficients are the short-term conditional coefficients that obtain from the coefficients reported in Table 4 and Table 5, which do not depend on the possible inconsistent estimates of the coefficient on the lagged dependent variable in the same way as the estimates of the long-term coefficients. Comparing the coefficients reported in Table A2 to those in Table A3 thus give a sense of the amount of bias in the estimates from the Arellano-Bover/Blundell-Bond estimator—it is proportional to the variability in the coefficients in columns 1 and 3 between Tables A2 and A3. The bias does not appear terribly large. In fact, I compared these estimates systematically by way of the Hausman test. The only parameters that were significantly different across estimators were those for the garment industry. Still, Tables A2 and A3 make plain that despite some numerical differences in the parameter estimates across the two estimators, the results are nevertheless *substantively* identical: the garment industry is explicable in terms of the differential gains hypothesis prior to the entrenchment of the network form, and by the exploitation hypothesis afterward. The transport equipment industry is explicable in terms of the differential gains hypothesis in both periods. And, the wage premium to network power is increasing over time in both industries.

Two anonymous JWSR reviewers asked that I include additional control variables. One reviewer did not suggest any specific covariates to include.[5] The other observed that it would be ideal to control for FDI in each industry, which has been shown to matter for wages in the manufacturing sector as a whole (Villarreal and Sakamoto 2011). Unfortunately, these data do not exist. This reviewer also suggested that female labor force participation in these industries might also matter for wages. To address these concerns, I conducted two additional analyses (available upon request). In the first, I include industrial production growth and export concentration in each industry. I measure the former with the Index of Industrial Production

[5] However, this reviewer did suggest an interesting line of future research. Quite understandably, GCC/GVC/GPN analysts are increasingly interested understanding the way that local, national or regional variation in institutional practices and regulations might affect inter-firm relations and/or the developmental consequences of these relations. Mahutga (2014a) argues that macro-comparative analyses are capable of incorporating covariates that capture this variation into models of the relation between GPN integration and development. But, in the absence of a-priori knowledge about precisely what kinds of institutional/regulatory practices should matter, one could adopt a recent empirical approach in environmental sociology. Here, scholars ask to what extent the temporal association between various aspects of development and environmental degradation vary by region (e.g. Jorgenson 2014). Even in the absence of a-priori expectations for *how* these associations should vary across regions, these studies are useful because they identify regions with above and below average associations (i.e. regions that pollute more/less than would be predicted by their level of development), which could then point to comparative cases that might illuminate the institutional/regulatory practices in these regions that explain this variation. In the present case, one might use a similar approach to identify countries/regions that have above/below wage premiums to network captivity as a way to identify comparative cases with which to illuminate the institutional/regulatory practices that give rise to this variation.

(UNIDO 2006), and the latter with the ratio of garment or transport equipment exports to total exports (UNCOMTRADE 2006). The addition of these covariates reduced the sample size to 218 in each industry model. Results from the Arellano-Bover/Blundell-Bond estimator were substantively identical to those reported here, and second-order serial correlation was negligible.

In the second, I include the percent female employees in each industry (UNIDO 2006). Unfortunately, this reduced the sample size dramatically (~60%) to 90 observations, which makes both the Arellano-Bover/Blundell-Bond and AR(1) corrected estimator untenable (because they reduce sample size further). Thus, I estimated the coefficients in this model with a fixed-effects model and standard errors that are robust to serial correlation and heteroskedasticity. These results were substantively identical with the exception of the garment industry in the pre-networked period, where the wage premium to buyer-driven power was not significantly larger than that to network captivity. This could imply that, net of cross-national variation in the percent of female employment, the global garment industry was characterized by cooperation in the pre-networked period. However, this deviation from the models reported above is due instead to the dramatic reduction in sample size—coefficients that obtain in a model restricted to cases without missing data on percent female employment, but excluding female employment, were virtually identical to those that included female employment. The coefficient on female employment was negative but non-significant, probably owing to the small sample size. Thus, while some caution is warranted, we should be more confident in results that utilize more information and future research should very much consider the effect of female labor, which clearly matters in other contexts (e.g. Villarreal and Yu 2007).

Concluding Discussion

In the preceding analysis, I show that (a) the wage premium to network power is larger than that to network captivity in both industries, (b) this difference in wage premium increases as the two network forms become the predominant organizational logic in the industry, but (c) network captivity reduces the prevailing wage rate only in the garment industry, and only after the buyer-driven network form became the predominant organizational logic. For macro-comparative scholars interested in the way in which the structure of the world-economy distributes the returns to economic behavior, the implications are clear: the answer varies across industries and with temporal changes in the organizational logic of globalizing industries. In these concluding remarks, I would therefore like to contextualize these findings within this broad macro-comparative literature on international inequality, and illustrate the theoretical utility of the inter-industry variation observed here.

Many credit Hopkins and Wallerstein (e.g. 1986) for introducing the commodity chain construct. In its infancy, the commodity chain construct became to world-systems analysis what natural selection is to the theory of evolution—it provided a mechanism by which the world-system generates inequality between countries, as well as an explanation for the reproduction of the structure of the world-system itself (also see Arrighi and Drangel 1986). To commodity chains, one could also add the "feudal interaction structure" (Galtung 1971), the exchange of finished products for raw materials that led to declining terms of trade for producers of the latter (Frank 1969), or the "unequal exchange" embedded in wage differentials between core and periphery (Emmanuel 1972; Amin 1980). Crucially, none of these mechanisms anticipate that inequality mechanisms might vary across industries within the manufacturing sector. At most, the returns to participation in the world economy vary by sector. They are also incapable of illuminating the behavior of the agents "below" the nation state who actually engage in economic activity. For the typical macro-comparative scholar, then, international inequality is driven by one of a handful of homogenous state/system level mechanisms that explain why peripheral countries remain poorer than core countries.

Quantitative macro-comparative research reflects this approach. Here, scholars use network-analysis to operationalize world-system structure, and examine the variation in developmental returns within this structure. Beginning with the seminal work of Snyder and Kick (1979), and proceeding through the work of Van Rossem (1996), Clark (2010) and Mahutga and Smith (2011), scholars used data on various kinds of inter-state relations to assign countries to world-system positions and compare the developmental outcomes across these positions. And the conclusions that can be drawn from this work are not entirely clear: "coreness" sometimes has a positive (Snyder and Kick 1979), sometimes a null (Van Rossem 1996), and sometimes a non-linear (Mahutga and Smith 2011) effect on growth. Moreover, what emerges in more recent research is the sense that world-system *mobility* seems to be more important for growth than is world-system position (Clark 2010; Mahutga and Smith 2011).

In contrast to the standard macro-comparative approaches to international inequality, the analysis presented here investigates a new unit of analysis—the globalizing *industry*. Turning to this new unit of analysis suggests an immediate point of departure: globalizing industries do not generate international inequality to the same degree or by the same mechanisms. To understand why, we must look beneath the world-economy and even the nation state. We must explain why *firms* shed certain types of economic activity (and not others), how they utilize networks of inter-firm relations to shed these activities, and why both processes vary dramatically across industries. To explain these, we must theorize *network governance* as it varies across industries and over time.

Much has already been said about chain/network governance, and there is no use recapitulating it here (e.g. Bair 2005; Gereffi 1999; Gereffi et al 2005; Mahutga 2012). What is important for the present purposes is illuminating how network governance explains the divergent findings across industries. To explain why firms externalize some activities and not others, Mahutga (2012) and others (Gibbon and Ponte 2005) evoke the notion of barriers to entry. Entry barriers come in many forms, but they all limit the number of firms participating in a given economic activity. When the number of competitor firms is reduced, so is the amount of economic competition with respect to the focal economic activity. Lead firms externalize economic activities subject to low and/or declining barriers to entry because doing so protects them from competition. And, because entry barriers restrict the number of competitor firms, they also yield a significant degree of bargaining power to lead firms, which they can use in negotiations with suppliers. In short, economic activities protected by low barriers to entry get externalized by a lead firm. Those that are protected by high barriers to entry often correspond to a scarce resource that makes a leading firm attractive to potential suppliers, and also yield a disproportionate degree of bargaining power to lead firms in their negotiations with suppliers. To explain why garment networks have become exploitative, while transport equipment networks lead only to differential gains, one must explain where barriers to entry are highest in the two networks, how this leads to different kinds of inter-firm relations between networks, and why these relations matter for the returns to network participation.

In the garment industry, entry barriers are lowest around the manufacturing functions and leading firms thus engage in almost zero manufacturing. Instead, manufacturing is carried out by geographically diffuse suppliers. In the transportation equipment industry, entry barriers are relatively high around manufacturing functions. Thus, leading firms engage in a significant amount of manufacturing, and rely on suppliers for a smaller (if growing) proportion. However, the number of potential suppliers available to leading firms in the garment industry is much larger than that available to the leading firms in the transport equipment industry (Mahutga 2014a). Moreover, because of issues related to process complexity and supplier capability, suppliers in the garment industry are more likely to reside in the global South than are suppliers in the transport equipment industry (Mahutga 2012; 2014). Because there are fewer transport-equipment than garment suppliers, and because transport-equipment suppliers often work in close collaboration on issues of design and engineering with leading firms (often in the same country), "linkages between lead and subordinate firms appear 'thicker' and suppliers less expendable in producer-driven networks than in buyer-driven ones" (Mahutga 2014b: 31). Leading firms in the garment industry appear willing and able to extract harsher concessions from their suppliers than do those in the transport-equipment industry, which leads to exploitation in the former and differential gains in the latter. And, while the entrenchment of the two forms of network governance facilitated exploitation in the garment industry and differential gains in the transport equipment industry, it actually increased, to a very modest degree, the returns to network captivity in the latter (see Table 6).

In fact, Tables 6, A1 and A2 provide (tentative) evidence that inter-industry variation in network governance matters for the developmental implications of these networks. The relative wage premium to both network power and captivity is significantly larger in the transport equipment industry than in the garment industry after the two network forms become predominant organizational logics. That is, we can reject the null hypotheses that $\beta_{P^b} = \beta_{P^p}$ and $\beta_{C^b} = \beta_{C^p}$in the network period, where P is power, C is captivity, b is buyer-driven and p is producer-driven, and the standard error of the difference is equal to the square root of the sum of the variance of each parameter. This suggests that not only are the gains from network participation distributed unequally across positions *within* GPNs, but the wage premium to both power and captivity may vary by the mode of governance *between* GPNs. Larger returns to both power and captivity in the transportation equipment industry could be explicable by the greater degree of interdependence that characterizes the inter-firm linkages. In turn, this would suggest that the degree of cooperation in networks does matter for the developmental returns to network participation, even in the presence of enduring (and increasing) inequality.

By way of summary, macro-comparative analyses of international inequality appear increasingly incapable of grasping the distributional dynamics at work in a global economy where production networks link firms together across space in ways that pay little attention to national borders and vary dramatically across industries. Because manufacturing is increasingly embedded within globalized production networks, we must understand how these networks work if we are to understand how they contribute (or not) to international inequality. And it is clear that these networks contribute in different ways—totalizing theories of exploitation in the world-economy simply will not do. Instead, I advocate a unit of analysis that is more modest than the whole world economy—*the globalizing industry*. While such a transition in focus would leave open a space for theories at the level of the whole world economy, it would also provide a more expedient set of analytical tools to do so. That is, if we can make progress in understanding globalizing industries one at a time and comparatively, theorizing at the macro level becomes an exercise in meta-analysis. Shifting to the global industry as a unit of analysis may thus reduce the opacity of macro-comparative theories of international inequality.

References

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

Amin, Samir. 1980. "The Class Structure of the Contemporary Imperialist System." *Monthly Review* 31(8):9-26.

Arrighi, Giovanni and Jessica Drangel. 1986. "The Stratification of the World Economy." *Review* 10(1):9-74.

Arrighi, Giovanni, Beverly J. Silver, and Benjamin D. Brewer. 2003. "Industrial Convergence, Globalization, and the Persistence of the North-South Divide." *Studies in Comparative International Development* 38(1):3-31.

Bair, Jennifer L. 2006. "Regional Trade and Production Blocks in a Global Industry: Toward a Comparative Framework for Research." *Environment and Planning A* 38: 2233-2252.

_______. 2005. "Global Capitalism and Commodity Chains: Looking Back, Going Forward." *Competition and Change* 9(2):153-180.

Bair, Jennifer and Gary Gereffi. 2003. "Upgrading, Uneven Development, and Jobs in the North American Apparel Industry." *Global Networks* 3(2):143-169.

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: University of Chicago Press

Blundell, Richard and Stephen Bond. 1998. "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models." *Journal of Econometrics* 87:115-143.

Chandler, Alfred D. 1977. *The Visible Hand: The Managerial Revolution in American Business*. Cambridge: Harvard University Press.

_______. 1990. *Scale and Scope: The Dynamics of Industrial Capitalism*. Cambridge: Harvard University Press.

Clark, Rob. 2010. "World-System Mobility and Economic Growth, 1980 – 2000." *Social Forces* 88:1123–1152.

Emmanuel, Arghiri. 1972. *Unequal Exchange: A Study of the Imperialism of Trade*. Monthly Review Press.

Frank, Andre G. 1969. *Latin American: Underdevelopment or Revolution*. New York: Monthly Review.

Galtung, Johan. 1971. "A Structural Theory of Imperialism." *Journal of Peace Research* 2:81-117.

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

_______. 1999 "International Trade and Industrial Upgrading in the Apparel Commodity Chain." *Journal of International Economics* 48(1):37-70.

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

Gereffi, Gary and Olga Memedovic. 2003. *The Global Apparel Value Chain: What Prospects for Upgrading by Developing Countries*. Vienna: United Nations Industrial Development Organization.

Gibbon, Peter. 2001. "Upgrading Primary Production: A Global Commodity Chain Approach." *World Development* 29(2):345-363.

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

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

Hamilton, Gary G. and Garry Gereffi. 2009. "Global Commodity Chains, Market Makers, and the Rise of Demand-Responsive Economies." Pp 136-162 in *Frontiers of Commodity Chains Research*, edited by J. Bair. Stanford: Stanford University Press.

Heintz, James. 2006. "Low-Wage Manufacturing and Global Commodity Chains: A Model in the Unequal Exchange Tradition." *Cambridge Journal of Economics* 30:507-520.

Hopkins, Terrance and Immanuel Wallerstein. 1986. "Commodity Chains in the World Economy Prior to 1800." *Review* 10(1):157-170.

Humphrey, John. 2000. "Assembler-Supplier Relations in the Auto Industry: Globalization and National Development." *Competition and Change* 4(2):245-271.

Humphrey, John and Olga Memedovic. 2003. *The Global Automotive Industry Value Chain: What Prospects for Upgrading by Developing Countries*. Vienna: United Nations Industrial Development Organization.

Humphrey, John and Hubert Schmitz. 2001. "Governance in Global Value Chains." *IDS Bulletin* 32(3):401-420.

Jorgenson, Andrew K. Forthcoming in 2014. "Economic Development and the Carbon Intensity of Human Well-Being." *Nature Climate Change* 4:186-189.

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.

Mahutga, Matthew C. 2014a. "Global Models of Networked Organization, the Positional Power of Nations and Economic Development." *Review of International Political Economy* 21(1):157-194.

_______ 2014b. "Production Networks and the Organization of the Global Manufacturing Economy." Forthcoming in *Sociological Perspectives*. *https://www.academia.edu/3295418/Production_Networks_and_the_Organization_of_the_Global_Manufacturing_Economy*

_______. 2012. "When Do Value Chains Go Global? A Theory of the Spatialization of Global Value Chains." *Global Networks* 12(1):1-21.

Mahutga, Matthew C. and David A. Smith. 2011. "Globalization, the Structure of the World-Economy and Economic Development." *Social Science Research* 40(1):257-272.

Maxton, Graeme P. and John Wormwald. 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: United Nations Industrial Development Organization.

Powell, Walter. 1990. "Neither Market Nor Hierarchy: Network Forms of Organization." *Research in Organizational Behavior* 12:295-336.

Schrank, Andrew. 2004. "Ready-to-Wear Development? Foreign Investment, Technology Transfer, and Learning by Watching in the Apparel Trade" *Social Forces* 83(1):123-156.

Snyder, David and Edward L. Kick. 1979. "Structural Position in the World System and Economic Growth, 1955-1970: A Multiple-Network Analysis of Transnational Interactions." *American Journal of Sociology* 84(5):1096-1126.

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

United Nations. 2006. COMTRADE. New York: United Nations

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

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

Uzzi, Brian. 1996. "The Sources and Consequences of Embeddedness for the Economic Performance of Organizations: The Network Effect." *American Sociological Review* 61(4):674-698.

Villarreal, Andrés and Arthur Sakamoto. 2011. "Bringing the Firms into Globalization Research: The Effects of Foreign Investment and Exports on Wages in Mexican Manufacturing Firms." *Social Science Research* 40:885-901.

Villarreal, Andrés and Wei-hsin Yu. 2007. "Economic Globalization and Women's Employment: The Case of Manufacturing in Mexico." *American Sociological Review* 72:365-389.

Van Rossem, Ronan. 1996. "The World-System Paradigm as General Theory of Development: A Cross-National Test." *American Sociological Review* 61(3):508-527.

Whitford, Josh. 2005. *The New Old Economy: Networks, Institutions, and the Organizational Transformation of American Manufacturing*. Oxford: Oxford University Press.

Williamson, Oliver E. 1981. "The Economics of Organization: the Transaction Cost Approach." *American Journal of Sociology* 87(3):548–577.

World Bank. 2002. *EdStats*. Washington DC: World Bank.

Appendix

Table A1. Zero-Order Correlation Coefficients

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1)	Transport Equipment Wages							
(2)	Garment Wages	0.963						
(3)	Buyer-Driven Power	0.756	0.769					
(4)	Producer-Driven Power	0.595	0.580	0.776				
(5)	Captive Garment Production	-0.191	-0.196	-0.229	-0.322			
(6)	Captive Transport Equipment Production	-0.204	-0.203	-0.307	-0.525	0.263		
(7)	Secondary Education	0.563	0.569	0.652	0.645	-0.106	-0.261	
(8)	Network Period	0.402	0.376	0.316	0.275	0.054	-0.128	0.345

Table A2. First-Order (AR(1)) Serial Correlation Corrected Fixed Effect Estimator Conditional Coefficients, T-tests for Equality in the Wage-Premium to Power and Captivity and T-tests for the Equality of Change in the Wage-Premium to Power and Captivity Across Governance Periods.

	Pre-Networked		Networked		Change
	β [a]	t test [b]	β [a]	t test [b]	t test [c]
Garment Industry					
Buyer-Driven Power	.451***	.491***	.633***	.891***	.400***
	(.115)	(.136)	(.107)	(.137)	(.123)
Network Captivity	-.040	---	-.258**	---	---
	(.083)		(.098)		
Transport Industry					
Producer-Driven Power	.572***	.524***	.824***	.741***	.217*
	(.118)	(.123)	(.129)	(.132)	(.083)
Network Captivity	.048	---	.084	---	---
	(.068)		(.073)		

Note: These statistics are derived from a serial-correlation corrected fixed effects estimator, but are otherwise identically estimated to those in Table 6. See notes to Table 6.

Table A3. Conditional Short-Term Coefficients, T-tests for Equality in the Short-Term Wage-Premium to Power and Captivity and T-tests for the Equality of Change in the Short-Term Wage-Premium to Power and Captivity Across Governance Periods.

	Pre-Networked		Networked		Change?
	β [a]	t test [b]	β [a]	t test [b]	t test [c]
Garment Industry					
Buyer-Driven Power	.470***	0.545***	.546***	0.919***	0.373**
	(.122)	(3.750)	(.099)	(7.140)	(2.850)
Network Captivity	-.076	---	-.373***	---	---
	(.102)		(.103)		
Transport Industry					
Producer-Driven Power	.600***	0.539***	.902***	0.803***	0.264*
	(.117)	(4.310)	(.122)	(6.080)	(2.550)
Network Captivity	.062	---	.099	---	---
	(.099)		(.093)		

Note: See notes to Table 6.