International fragmented production:
conceptualization, theory and measurement across disciplines

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Abstract
International fragmented production – the de-verticalization, de-agglomeration and internationalization of firms and industries – poses serious challenges to our ability to accurately conceptualize and measure the international economy. Studied across many disciplines, including economics, geography, international business and sociology, it has generated a variety of empirical and conceptual approaches, oftentimes incongruous, and each with its own policy implications. Due to inter-disciplinary differences and infrequency of communication, there has been no explicit attempt either to delineate the principal junctures of differentiation between literatures, or the emerging areas of overlap and collaboration. This paper identifies three important analytic dimensions by which international fragmentation is differentiated in conceptualization, theory, data collection and measurement: the status of firms, industrial sector organization, and the scope of inter-firm relationships. It finds many important instances of disciplinary literatures relaxing underlying assumptions and adapting new methodologies, thereby opening important areas of unacknowledged inter-disciplinary convergence and allowing for a more complete understanding of the phenomenon.

Keywords
Globalization, global production networks, global value chains, outsourcing/offshoring, international trade, governance
Introduction

The international economy is a critical source of national development. Advanced countries often seek to export their way out of recessions, and export-oriented development and openness to long-term capital flows have long been touted as the surest paths for developing countries.

However, the international economy itself is ever-mutating, requiring periodic renewal in conceptualization and measurement. Over the past decades, the international economy has undergone one such major transformation: national production systems have fragmented as firms and industries de-verticalize, de-agglomerate and internationalize finer slices of their production processes by offshoring and outsourcing complex intermediate goods and service functions. Paradoxically, our understanding of the international economy may have deteriorated, even as the quantity and availability of data have grown.

Consider international trade data. Standard trade statistics, reflecting national production systems, measure gross imports and exports between countries, which are appropriate for an era when nearly all value-added occurred within a single country. However, fragmented production means that many intermediate inputs (Taiwanese-made semiconductors, Indian software services) are exported to another country where they are assembled or integrated into final products (Chinese-assembled computers) before being exported worldwide. This raises serious measurement problems because the semiconductor, as an intermediate input, has been *double counted* – once when it is exported from Taiwan to China, and once when it is exported (inside the computer) from China to its final market. By some estimates, 28% of total world trade is incorrectly double counted in this way (UNCTAD 2013: 125), and various estimates suggest that China’s bilateral trade surplus with the US may reduce by 30% to upwards of 50% if measured through value-added methods (IDE-JETRO and WTO 2011: 104; Johnson and Noguera,
Inaccuracies in measurement problematize conceptualization and policy prescription. For instance, in the earlier era of un-fragmented production, a country’s industrial strength and technological sophistication could be judged by the type of products it exported (Lall, 2000). With fragmentation, this no longer holds, leading thoughtful observers (Rodrik, 2006) to “very likely exaggerate” the technological sophistication of developing country exports (Koopman, Wang and Wei, 2012: 179). Furthermore, in the prior era, tariff levels and trade rules could be more easily calibrated to well-defined product categories in order to upgrade into more advanced manufacturing. With fragmentation, however, products are often “Made in the World,” making national rules of origin labeling far murkier, and with it trade rules and tariffs setting. International fragmentation also makes infant industry protectionism difficult because protecting only one slice of production (semiconductors) is likely to undermine the competitiveness of many other industrial “fragments” that depend on it. For similar reasons, exchange rate manipulations are ambiguous due to the new ways exports and imports are intertwined.

Given both the protean nature and importance of the phenomenon, most social science disciplines have extensive literatures on the topic, most heavily concentrated in economics, sociology, geography and international business, and to a lesser degree political science. As such, theoretical treatment has proliferated, resulting in dozens of names, each with distinct connotations. In this article, the term “international fragmented production” (IFP) is used as a general rubric, so that specialized terminology can be reserved for the appropriate sub-literatures.

Despite the extensive cross-disciplinary interest, there has been no explicit attempt to theorize across the disciplines. For instance, Park, Nayyar and Low (2013), in the only book-length overview of these diverse literatures, declare that the multi-disciplinary nature of the topic “result[s] in a plethora of terms fundamentally pointing to the same reality” (p.41-42), but ultimately, “a prevailing consensus on meanings has not emerged in the literature” (p.12). The lack of interdisciplinary dialogue raises important questions. What are the principle dimensions by which
these literatures differ? Are there areas of emerging overlap or convergence between disciplines, and if so, what can we learn from each other? Are disciplinary methods and theories flexible enough to incorporate outside ideas?

Unfortunately, most research still remains discipline-bound. For instance, most literature reviews and special issues focus on single sub-literatures, whether in sociology (Special Issue *Economy and Society* 2008), economics (Antras and Rossi-Hansberg, 2009; Helpman, 2011, 2014), international business (Special Issue *Journal of Management Studies* 2010), or geography (Henderson et. al., 2002; Special Issue *Journal of Economic Geography* 2008). Reviews that do cross disciplinary boundaries largely summarize each field individually, offering little in the way of explicit comparison and convergence (Park, Nayyar and Low, 2013), or are highly critical of a discipline (Milberg and Winkler, 2013). This yields multiple and often incongruous lens through which to view the phenomenon.

This paper does not purport to resolve these differences or create a single, unifying framework. Rather, it aims first, to specify important analytic dimensions by which conceptualizations of IFP are differentiated. Specifically, these include the status of firms, conceptualizations of industrial or sectoral organization, and the scope of inter-firm relationships – all concepts that both unite and distinguish scholarship to varying degrees. Second, it illustrates potential areas of convergence and cooperation across disciplines, which otherwise rarely communicate. The paper shows that when disciplinary literatures relax underlying assumptions or adopt new empirical approaches in any of the three dimensions, they create opportunities for convergence and cross-disciplinary synergies through which all disciplines can learn. Among others, one goal of the paper is to conjoin several large economic literatures with their equivalents among heterogeneous social science approaches, between which there has been little dialogue.

Two caveats are in order: first, an important focus of the paper is to compare scholarship which crosses over disciplines, especially those that infrequently communicate. This means that while there are other possible dimensions by which sub-literatures can vary, the three examined in this paper reach broadly across
disciplines and heavily draw from theoretical pieces. Second, given space constraints and to focus discussion, the paper concentrates on differences in conceptualizations of IFP alone – the industries, transnational firms and their inter-firm linkages. As such, many well-known debates, such as over multi-scalar territoriality and institutions, are given less attention.

After briefly introducing areas of common agreement across disciplines, the following three sections sequentially take up the paper’s three conceptual building blocks – status of firms, sectoral organization and inter-firm relationships, before concluding.

**Common causes of international fragmented production**

Before turning to key points of differentiation, it is important to begin with areas of implicit inter-disciplinary agreement. First, there is agreement that the information and communications technology (ICT) revolution together with broad-based liberalization of trade and investment have been critical factors enabling IFP. Called the “Second Great Unbundling” by Baldwin (2013), IFP was enabled by the ICT revolution, which dramatically reduced the costs of coordinating far-flung production tasks, allowing firms to tap into globally dispersed resources, whether lower-cost labor, production excellences or foreign R&D, without losing their ability to control, coordinate and monitor.

Second, although each utilizes different terminology, the literatures ultimately ask very similar questions, namely the effects of fragmented production on: national development and the distribution of resources between countries; the relative and absolute gains for various factors of production (especially labor); and the possibilities for firm upgrading. Due to their common interests, scholars across disciplines are also engaged in similar empirical endeavors. As discussed below, one common challenge across disciplines is to accurately measure the changing international distribution of value-added, profits, employment, skills, wages and labor conditions when production is fragmented and internationalized.

Despite common ground, however, the paper identifies three critical points of
differentiation in conceptualizations of IFP: differences regarding the *status of firms*, industry or *sectoral organization*, and the scope of *inter-firm relations*. Briefly, scholars differ over whether firms are simply epiphenomena of broad, sweeping international market forces, or whether they are independent drivers, if not *the* primary drivers, of changes in IFP. Sectoral organization concerns whether industries are classified and studied as *categorically* different, or whether they merely vary *by degrees* along a certain dimension, such as factor intensities or trade costs. Inter-firm relationships concern the scope and governance between independent firms by which the production of a final product is shared. Despite these differences, areas of cross-disciplinary convergence arise when one of these three dimensions are relaxed.

**Firms in international fragmented production: epiphenomena or independent drivers?**

*Divergence over the status of firms*

Although everyone agrees that firms are the actors which are de-verticalizing, de-agglomerating and internationalizing their production tasks, they do not agree that firms are *independent drivers* of this change, and thereby whether firms should be the primary units of empirical analysis. The relationship is circular and mutually reinforcing: the theoretical status of firms in research shapes choices over measurement and data, which influences how IFP is conceptualized; and, how it is conceptualized reinforces choices over data collection. While it is tempting to argue that the status of firms is a fundamental division between economic and non-economic approaches, in fact, there are enormous trade literatures, broadly falling under the rubrics of “firm heterogeneity,” “multiproduct firms” and “relationship-specific investments,” which take firms seriously both theoretically and empirically, and are arenas of nascent convergence and cross-fertilization between disciplines.

Nevertheless, a significant amount of scholarship on IFP published by trade
economists indeed conceptualizes it as “just trade,” and thereby largely ignores firms. For instance, in 2004, during a US presidential campaign when outsourcing was a hot-button issue, Bhagwati, Panagaria and Srinivasan (2004, p.94) sought to clear the analytic air, stating that “outsourcing is fundamentally just a trade phenomenon; that is, subject to the usual theoretical caveats and practical responses, outsourcing leads to gains from trade, and its effects on jobs and wages are not qualitatively different from those of conventional trade in goods.” The view that trade in intermediate goods and services is merely a secular deepening of international specialization and driven by sweeping market forces like relative factor endowments – “just trade” – is endorsed by many other prominent economists (Ardnt and Kierzkowski 2001; Blinder 2009; Mankiw and Swagel, 2006; Markusen, 2005). This influential school of thought is categorized as “fragmentation in otherwise neoclassical models” by two other leading trade economists (Antras and Rossi-Hansberg, 2009).

If “just trade” economists apply formal, deductive trade theory, at the other end of the conceptual and empirical spectrum is the inductive theory-building of a heterogeneous group of social scientists, whose research fall under the eponymous “global production networks” (GPNs), “global value chains” (GVCs) and “global commodity chains” (GCCs) literatures. Although differences between these literatures have been well-aired, they are broadly united by sharing a view that firms, as strategic actors, are independent drivers of IFP. Empirical work is heavily qualitative, consisting of case studies and fieldwork on large “lead” firms and global suppliers in specific industries, most often studied within the context of specific countries, regions and institutional environments. This has produced a wealth of new empirical studies which reveal the diverse ecologies of global capitalism.

A leading scholar of the field justifies the qualitative fieldwork methodology as deriving from data limitations “because publicly available and detailed information at the level of firms is generally lacking” (Gereffi, 2005: 169; see also Hess and Yeung, 2006: 1201). While a dearth of firm-level data was truer a decade ago, this has been changing, and with it there are new areas of cross-disciplinary convergence and research opportunities that combine qualitative and quantitative research in
complementary ways.

Convergence over data and measurement

One important area of cross-disciplinary cooperation is the practical need to collect new data and develop novel measures. As discussed below, how IFP is conceptualized (firm-driven or not) influences decisions on data and measurement, which in turn generates different challenges to literatures, such as the requirement to ‘aggregate’ up from firm-level to broader, macro-sociological outcomes.

Ideally, researchers would track the country of origin of every intermediate good and service that comes together into a final good. While this meticulous “product-level” analysis has been conducted on a handful of well-known electronics products by physically tearing apart the gadgets and tracing their components to particular countries and firms (Dedrick, Kraemer and Linden, 2009), this methodology is unrealistic on a large-scale.

As substitute, the most widely used method integrates national input-output tables with traditional trade statistics to estimate the share of imports that likely go into a country’s exports – a method pioneered by Hummels, Ishii and Yi (2001). Currently, there are a wide range of major initiatives, many spearheaded by international organizations like the WTO, OECD, UNCTAD and IDE-JETRO, each using different sets of countries, different levels of sectoral precision in their input-output tables, and different estimation methodologies (see UNCTAD, 2013: 124).

However, because these methodologies adapt conventional trade data that only measure trade between countries, they also encourage a view of IFP as ‘just trade’ – that is, driven by sweeping international market forces that operate between countries, rather than by the strategies, power and organization of firms. That said, the correlation between how IFP is measured and conceptualized is not absolute in that country-level versus firm-level data do not dictate IFP theory-building. For instance, researchers that normally focus on firms can use “value-added” methods to estimate fragmentation at a macro scale; more fundamentally, “firm heterogeneity” trade economists (discussed below) offer a major emerging area of cross-disciplinary
convergence by utilizing firm-level data, but then integrating their insights into general trade theories, which are theories of inter-country exchange.

This type of aggregation is a major lacuna in non-economic literatures on IFP which have not resolved their own ‘micro-macro’ aggregation challenges, and can profitably learn from firm heterogeneity economists. As mentioned, because firm-level data used to be scarce, many scholars of IFP had little choice but to conduct qualitative case studies of products, firms and industries, often collected through pain-staking fieldwork. Compiled over two decades, these studies reveal the enormous diversity of IFP across innumerable industry and firm studies, well reflected in an online clearinghouse of GVC research (www.globalvaluechains.org). The research program has generated firm-level theories of IFP, some of which even aiming to fashion sophisticated causal theories of IFP (Gereffi, Humphrey and Sturgeon, 2005).

However, the literature’s exclusive reliance on case studies and fieldwork has raised methodological concerns. First, GVC scholars themselves have argued that the “case study literature may suffer from selection bias whereby researchers take up success stories rather than a random sample of value chains” (Milberg and Winkler, 2013: 23). Second, others have warned that “extrapolations from specific case studies and instances must be treated with caution” because the lack of generalizability makes valid descriptive and causal inferences very difficult (Dickens, et al., 2001: 89). Thus, unlike “just trade” economic literatures in which firms are simply assumed away as epiphenomenal to the fundamental forces of international trade, these scholars are burdened with a difficult micro-macro aggregation problem, in which inferences about national development and the global economy are made from firm-level observations.

The micro-macro aggregation problem has been voiced by many contributors, both because it is a defining feature of value chain research, and because it is not easily resolved (Bair, 2005, 2009; Bair and Gereffi 2001; Feenstra and Hamilton, 2006; Muhutga, 2014; Peters, 2008; author). As one contributor succinctly asks, there is still no clear answer to the question “how does the nature of a firm’s insertion
into a particular commodity chain map on to a country’s incorporation into the global economy?” (Bair, 2005: 166). Another worries about the “methodological challenge…when 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, 2014: 164).

Today, new sources of firm data are starting to resolve these problems. Among many resources, the principal sources are compiled through firm surveys, often collected by government agencies. For instance, oft-used firm surveys in the United States include the US Census Bureau’s Longitudinal Firm Trade Transactions Databases and their long-standing Related-Party Trade databases, and the Bureau of Economic Analysis’ Intra-firm Trade Data which records trade between US-located MNEs and their subsidiaries worldwide. Similar firm surveys have been used to study offshoring and outsourcing in many advanced countries like France and Japan (Defever and Toubal 2013), and developing countries (Clerides, Lach and Tybout 1998).

The exploitation of these data sources has opened up a brand new and now massive branch of trade theory in economics, called “firm heterogeneity,” with insights complementary to non-economic approaches to IFP, but mutually unacquainted with each other’s work. It originally began as empirical insights examining the trade behavior of US firms (Bernard and Jensen, 1995). Over time, research has found that trade is extremely skewed at the firm-level in that the vast majority of exports and imports are: concentrated in the largest 1% of firms, conducted by the most productive firms which pay higher wages, are more skill- and capital-intensive, and export more diversified products to a wider range of countries (Bernard, Jensen, Redding and Schott, 2007; Helpman 2014). These insights have been formalized into important new trade theories that model previously unappreciated gains from trade through inter-firm resource allocations (Melitz, 2003).

This is a truly fundamental change in trade theory because scholars are able to show that gains from trade do not derive as much from inter-industry resource reallocation as the centuries-old comparative advantage would have it; rather, they
derive more from intra-industry resource reallocations through firms, in that the most productive ones enter into and grow through trade while the least productive ones shrink, exit trade or die. Despite the trade theory orientation of the literature, there is enormous potential for cross-fertilization in that many of their principal findings are supportive of GPN, GVC and GCC research, including the key role played by “giant” firms, a method of resolving the micro-macro aggregation problem, and the utilization of large-scale and detailed firm surveys. Non-economists can learn much from this large literature.

Non-economists are also exploring firm surveys that combine firm-level analysis with a macro-sociological perspective. For instance, a new and innovative survey approach focuses on “business functions,” a method which also gives greater focus to the under-studied trade in intangible services (Sturgeon, Nielsen, Linden, Gereffi and Brown 2013). This is especially useful because services have traditionally been very poorly measured by national statistical agencies, despite their increasing tradeability and bundling with manufacturing. Business function surveys ask managers the share of value-added, employment, wages and profits which derive from what managers self-define as their “core” business function, along with various “support services” – including R&D, marketing, back office, logistics, IT, management, among others. One advantage of business functions research is that it asks about the decomposition of value-added into profits, wages, depreciation and natural resource rents. This potentially fills a major lacuna in IFP research which generally focuses on distributions between countries, whereas the relative returns to capital versus labor in IFP is one distributional dimension that remains understudied.

A second approach utilizes transactional trade data (TTD). Unlike conventional trade data which records trade flows between countries, TTD record every import and export transaction, together with rich firm-level information. In economics, these data are used to study “multiproduct firms” – the export and import diversification by firms across foreign markets and product categories, which economists call the “extensive margins” of trade (Bernard, Redding and Schott, 2011) – a concept similar to the ‘final markets’ literature among non-economists (Gereffi 2014; Kaplinsky,
Differences in advanced country regulation and firms, and the increasing consumption in emerging markets have pushed GVC scholars to closely consider differences in ‘final markets’ in offering upgrading opportunities to developing country firms. One important difference between these literatures is that economists see market and product diversification alone as indicative of firm strength; by contrast, non-economists consider differences between final markets (e.g. advanced versus developing country or US versus Europe) as most salient – a deeper insight that can enrich the multi-product firm literature in economics.

TTD have also been used to advance theory and measurement techniques of inter-firm governance mechanisms in GVC scholarship by empirically differentiating ‘pure market’ and ‘relational’ trade channels, like modular, relational and captive linkages (author publication). These ideas were originally developed by GVC scholars through case study methods, but they have the potential to profoundly influence mainstream trade economics, which lacks an appreciation of trade as composed of heterogeneous trade ‘channels’ governed by distinct inter-firm relationships.

As a general rule, literatures which collect data and develop measurements at the firm-level also understand them as actors capable of independently shaping IFP. This focus on firm agency is partly because across the ‘firm heterogeneity,’ ‘multiproduct firms,’ GPN, GCC or GVC literatures, there is a tendency to focus on the largest firms, whether these are powerful ‘lead’ firms and global first-tier suppliers (Appelbaum 2008; Merk 2014), or simply the most productive, diversified and capital- and skill-intensive firms, as studied in firm heterogeneity literatures.

However, despite these areas of convergence across disciplines, a major area of disagreement between firm-centric literatures concerns the role of exporting in ‘firm upgrading’ – a central concept across many literatures. On the one hand, leading scholars of firm heterogeneity definitively conclude that “results from virtually every study across industries and countries confirm that high productivity precedes entry into export markets…[and] most studies also find little or no evidence of improved
productivity as a result of beginning to export” (Bernard, et al., 2007). This means that already productive firms “self-select” into exporting. This directly contradicts much of the enormous literature on firm upgrading among non-economists, which argues for both a “learning by doing” pathway to firm upgrading, as well as acknowledging that major global buyers and partners in relational contracting often provide product designs, technical assistance and transfer tacit and even proprietary knowledge to exporter-suppliers. Why are these findings so divergent?

A key difference is their conceptualizations of firms. For firm heterogeneity scholars, the critical dimensions that differentiate firms are firm size, productivity, capital- and skill-intensity and product or export-country diversification. Otherwise, firms are homogeneous and thus equally comparable within or across industries. By contrast, for GPN, GVC, and GCC researchers, firms are heterogeneous because they vary according to their function or role within an industry. Examples of firm types include global buyers of various kinds, contract manufacturers ranging from OEM to ODM, service contractors, licensees, buyer- and producer-driven lead firms, among others. In these ways, firms are differentiated according to their specific roles within a broader industrial ecosystem – this paper’s second dimension. Thus, where firm heterogeneity sees roughly comparable “large” firms, the other literatures consider a hierarchy based on functional roles, and hence under certain conditions the possibility for inter-firm learning. Uncovering these conditions has been a critical goal of these literatures, and one that can influence the pessimism of economists.

Overall, economists could benefit by considering a wider palette of heterogeneity among firms beyond size and productivity, such as those studied by non-economists, like the functional type of firms, their final markets and diverse trade channels. Non-economists would benefit by studying firm heterogeneity literatures which have theorized how firm heterogeneity aggregates up to macro-sociological outcomes.

**Sectoral organization: by category versus by degrees**

Although only some IFP literatures focus on firms as independent actors, all literatures collect data and theorize IFP at the level of “industries” or “sectors” (used
synonymously). For those that ignore firms, sectors serve as the critical level of analysis, especially for empirical analysis: data is collected on industries, and theory testing is often aimed at studying inter-industry changes induced by IFP. The influence of comparative advantage—*inter-sectoral* trade of cloth for wine—casts its long shadow in these literatures. By contrast, for firm-centered scholars, the empirical and theoretical importance of sectors is more variable, depending on whether firms dominate the analysis or whether *in addition* to firms, sectors also possess independent analytic importance.

Similar to the status of firms, there is a fundamental difference between conceptualizations of sectors. For some scholars, *categorical* differences in industrial organization serve as the major driver of analysis. For them, sectoral modes of organization are based upon differing underlying principles, creating divergent industrial dynamics and by extension distinct *types* of IFP. This approach markedly diverges from sectoral analysis based upon trade costs, returns to scale or factor intensities, such as labor-, capital-, or knowledge-intensiveness, which differentiate sectors by *matters of degree* (see Helpman, 2011).

This distinction is important for whether sectors are independent drivers of IFP. For instance, for literatures in which sectors vary categorically, the sectoral logic itself constitutes a critical pillar of how IFP operates. Furthermore, and similar to the status of firms, this division is *not* reducible to differences between economic and non-economic approaches, illustrated below by the “snakes and spiders” conceptualization of IFP in economics.

Sectoral scholarship based on categorical differences is frequently misinterpreted. It is neither sufficient that the research generically declares that “sectors matter,” nor a belief that “sectors differ” across some continuum, nor that comparative sectoral analysis is central to the empirical investigation. Rather, there must exist an explicit theoretical framework which classifies sectors into *categorically different* groupings according to a particular sectoral logic. This means that different sectors possess a degree of “incommensurability,” such that each category of sectors operates in fundamentally different ways. This is true of both the “snakes and spiders” literature
developed by economists, and GCC and GVC scholarship developed by sociologists and geographers.

The status of sectors is very different for scholars that conceptualize industries as differing by *matters of degree* and thus are rankable according to a particular dimension, such as their factor intensities, differences in returns to scale and trade costs. Of course, much economic trade theory is built around these attributes, at least since Ricardo’s and later Heckscher-Ohlin’s insights on trade. In this scenario, analysis is more unified because it lacks fundamental ruptures by sectors, that require distinct theorizing.

Although factor endowments and inter-sectoral analysis are central to the “just trade” literatures, recent scholarship in international economics has begun to take seriously the implications of sectoral *organization* for standard trade theory, offering another important area of inter-disciplinary convergence. For instance, Baldwin and Venables (2013) argue for a fundamental differentiation in sectoral production processes, between “spider” and “snake” industries: spider industries (like automobiles or electronics) are engineered such that distinct sub-systems of the production processes converge upon a centralized final assembler. These are categorically different from snake industries (like textiles, steel or chemicals), in which each stage of production must be done in sequence, one after another. They find that spider and snake organizational differences create distinct IFP dynamics, namely: as trade and “unbundling” (fragmentation) costs change, the international locations of production and trade patterns can shift extremely rapidly and discontinuously, varying between spiders and snakes. These predictions differ sharply from “just trade” IFP, in which factor intensities and trade costs change only gradually, and hence affect production and trade patterns incrementally. Thus although Baldwin and Venables and others (Costinot, Vogel and Wang, 2013; Levine, 2012) are similar to “just trade” scholars by ignoring firms as primary drivers of change, they simultaneously converge with non-economic approaches like GCC and GVC by placing the organization of categorically different sectors at the center of analysis, and thereby offer very different predictions regarding IFP and the role of
comparative advantage.

Sectoral organization also differentiates the sub-literatures on global production networks (GPNs) of the Manchester school of geographers, from the global value chains (GVCs) and global commodity chains (GCC) literatures. These three literatures are generally thought of as close relatives given their extensive scholarly communication. Nevertheless, GPN scholarship has been critical of GCC and GVC for their “weakly developed and undertheorized” geography, and their “hijacking” of institutional analysis by governance analysis (Hess and Yeung, 2006: 1196). Geography and institutions are important differences and indeed these are valid criticisms, however, in terms of IFP itself – the firms and industries undergoing fragmentation – it is their conceptualizations of sectoral organization which most differentiate them. GCC and GVC literatures share a sectoral orientation and methodology, which GPN self-consciously rejects – an important difference over the mechanics of IFP that has been overshadowed by disputes over interscalar geography and institutions.

On the one hand, GCC analysis adopts an industrial economics approach to sectors as it focuses on the market power of lead firms located in “the more concentrated segments of an industry characterized by high barriers to entry” (Gereffi, 1994: 104) – the retail link in “buyer-driven” chains and the manufacturing link in “producer-driven” chains. However, the critical question of why industries become one or the other was never explored – a lacuna that GVC analysis tries to fill (Ponte and Sturgeon 2014: 202).

Theoretically drawing from transaction-cost economics, Penrose’s resource-based view of the firm, and trust and embeddedness in sociology and geography, the GVC framework (Gereffi, Humphrey and Sturgeon, 2005) creates five distinct categories of inter-firm governance, including pure “markets and hierarchies,” along with three intermediary outsourcing categories – modular, captive and relational inter-firm governance. The five governance modes derive from different combinations of three fundamental variables which shape coordination and the balance of power between transacting firms. These include complexity, codifiability and capabilities: the degree
of complexity of transactions, the degree of codifiability of transactional complexity, and the level of capabilities of supplier firms.

GVC scholars seem to distance themselves from sectoral analysis, by carefully noting that their framework is “not static or strictly associated with particular industries;” however, their empirical work illustrates that the five inter-firm governance mechanisms do neatly map onto particular industrial sectors (Gereffi, Humphrey and Sturgeon 2005: 96 and Section 4). This seeming contradiction is in fact not one at all. The reason they reject associating governance forms with specific sectors is because they seek “to explain and predict” change in sectoral organization (Sturgeon, 2009: 123). However, at particular moments in time, critical linkages within sectors take on categorically distinct governance modes. Thus, in both GCC and GVC research, sectoral theorizing is of central importance.

By contrast, the GPN framework has a very different approach to industrial sectors. GPN analysis is a complex, multi-dimensional approach to understanding the intersection of global production and development. It seeks to be truly holistic by incorporating multiple conceptual categories, including “value generation/capture,” “power” (corporate, collective and institutional) and “embeddedness” (territorial and network), which are then made concrete through several empirical dimensions (firms, sectors, networks and institutions). Unlike GCC/GVC research, however, GPN analysis intentionally gives no special status to sectoral analysis, stating that “we must avoid privileging specific organizational loci of analysis,” – though at the same time they admit that firms operating in the same sector “have some degree of similarity.” (Dicken, et al., 2001: 91; Henderson, et al., 2002: 454). This delicate balancing act is well illustrated by Peter Dicken’s Global Shift (2015) which is predominantly organized along industrial sector lines, though he never formulates an explicit sectoral theory.

Although territoriality and institutions have dominated the debate between GPNs and GVC/GCC, when it comes to IFP itself (firm and industry dynamics), it is the privileging of sectoral analysis by GVC/GCC and more importantly, GVC’s ambitions to “predict change” in inter-firm linkages that most starkly separate the literatures –
something under-appreciated in their ongoing dialogue.

**The scope of inter-firm relations: dyadic versus network**

A final analytic dimension that crosses over disciplinary research on IFP is the scope of relationships between firms jointly engaged in IFP. Some research closely examines the dyadic inter-firm relationships in IFP, while other IFP research considers the extended networks of firms – something long-studied in business literatures (Ghoshal and Bartlett, 1990). How do dyadic and network perspectives differ?

Dyadic perspectives have several general attributes. They tend to adopt a *transaction-level* view in which the decision-making of a firm largely consists of *discrete decisions*, and they apply *microeconomic theory* to firm behavior which often focuses on efficiency or cost-minimizing outcomes, rather than strategy and power. Its great virtue is substantially to simplify the analysis, and allow for better empirical predictions – a methodological choice.

By contrast, a network perspective is *extensive* in terms of its scope and is more likely to understand firm decisions as highly *interdependent*, meaning that a firm arranges one particular dyadic relationship dependent upon how it affects the broader network through which a final product is made. Furthermore, a network approach tends to emphasize *strategic* considerations and the *power* of lead firms more. A major tension between the two approaches is a trade-off between the greater descriptive realism but analytic complexity of network approaches, compared to the predictive, if simplifying, promise of dyadic perspectives. Again, however, there are important areas of cross-disciplinary overlap.

*Dyadic inter-firm relationships*

Neither dyadic nor network approaches strictly obey disciplinary boundaries. At first glance, trade economists like Antras or Helpman share little in common with GVC scholars, who rarely reference each other’s work. In reality, they have much in common: a dyadic (or ‘linkage’) approach to fragmentation, similar ambitions to aggregate from dyadic inter-firm analysis to national outcomes, and foundations in
similar, if competing, microeconomic theories.

For some prominent trade economists, the lack of firm-level analysis in “just trade” IFP has prompted them to consider the microeconomic problem of “incomplete contracts” in international outsourcing (Antras and Helpman, 2004, 2008). That is, they consider the effects on trade of the relationship between suppliers and headquarter (HQ) firms when “relationship-specific investments” (RSI) are required between them. RSI are co-investments by two firms in intermediate inputs in which there are few “outside options” to sell the inputs ex post, if the relationship soured (called the “hold-up” problem). Similar to GVC, this can happen because the complexity of transactions makes inter-firm contracting “incomplete” – either non-enforceable or non-contractible in the first place. The dilemma requires HQ firms either to bear the added costs of internalization, or to incentivize the suppliers with a larger share of the pie to tap their specialized capabilities, encourage their innovation and minimize their shirking, which ideally increases the size of the pie for both parties.

This literature is based upon a “property rights” approach to the firm which differs from GVC’s “transaction cost” approach in arguing first, that problems with incomplete contracts and opportunism continue even when a firm is vertically integrated and second, that relationship-specific investments are often required by both parties (Antras, 2014). These two modifications create a more complex bargaining scenario since integration is no longer the default solution, and there is a double hold-up problem. Using various measures of RSI, some empirical tests show that an increase in RSI (or non-contractibility) is associated with increased outsourcing; in other words, better contractibility between firms leads to more HQ internalization (Antras and Helpman, 2008, Nunn and Trefler, 2013) – a result contrary to transaction-cost predictions used by GVC scholarship.

Despite their foundations in dyadic microeconomic theories, RSI and GVC literatures diverge in the degree to which external factors beyond dyadic linkages are incorporated into their analyses – “expansive” in GVC, and “restrictive” in RSI. For instance, in order to arrive at their results, an important condition of the RSI model is
to restrict “outside options” for utilization of sunk-cost investments, thereby limiting the bargaining to a dyadic inter-firm contract. By contrast, despite its declaration as a “modest theory of linkages” (Sturgeon 2009: 123), GVC is actually more liberal in allowing for external influences beyond the dyadic relationship itself. For instance, two of their three critical independent variables – transactional complexity and codifiability – that determine the mode of inter-firm governance are often built-in features of the broader industry and its current state of production technology, rather than derived from the dyadic relationships themselves. Because of this difference, RSI tends to focus more on simpler make-or-buy decisions and contractual opportunism between buyers and suppliers, while GVC focuses on a multitude of inter-firm outsourcing linkages and the harnessing of capabilities of suppliers by buyers. In sum, dyadic approaches across disciplines share much in common and are based on similar micro-foundations, but they arrive at different outcomes depending on how the underlying foundational theory is applied – another area of unexplored overlap across disciplines.

Network inter-firm relationships

Some criticize the reductionism of dyadic governance, and instead promote network analyses (Bair, 2005, Special Issue Environment and Planning A, 2006). This is supported by the fact that over the past decades, firms increasingly have pursued flexible, network organizational forms, such that the boundaries of firms have become fuzzy, leading to conceptualizations of “modular,” “boundaryless,” “virtual,” and “federated” firm organizations (Hatonen and Eriksson, 2009).

Network analyses of IFP generally differ from dyadic studies in that they focus on the capacity of lead firms to act in more strategic ways by deriving benefit from the overall network, not from stand-alone, dyadic transactions. By considering the entire production process, lead firms can strategically position themselves at the most advantageous fragments of the value chain, from which they can define the roles of other firms or even the broader industrial environment, and hence gain the greatest advantage over rivals. In dyadic approaches, supplier opportunism, transaction costs,
the loss of intellectual property or other strategic resources constitute conundrum for firms in outsourcing. However, from a network perspective, all of these “problems” may very well be tolerable, even strategically encouraged, so long as a firm’s overall competitiveness is enhanced.

Predicted empirical outcomes between dyadic and network approaches often can hinge on subtle differences in conceptualization of inter-firm relations, which I illustrate by returning to Baldwin and Venables’ (2013) “snake and spider” conceptualization. Although they consider the broader production processes (spiders and snakes), they limit their analysis to the immediate up- or downstream links in spiders and snakes, which is a dyadic and cost minimization approach that leaves little room for firms strategically to transform their industrial environment.

Consider two commonly-studied types of spider industries, electronics and automobile manufacturing, which might be labeled “modular” spiders and “integral” spiders respectively, but are otherwise morphologically identical – both spiders. Despite their similar production structure, however, lead firm strategy in governing their supply bases critically differentiates them. For instance, it is well known that starting in the 1990s, US electronics manufacturers standardized the interfaces by which different components of a final product interconnected, allowing for rapid international fragmentation (Borrus, Ernst and Haggard, 2000). This “modularization,” which has many advantages for rapid product and process innovation (Sturgeon, 2002), means that electronics manufacturing might be thought of as networked “spiders-within-spiders” in which the “legs” of the final product spider are themselves second-tier modular spiders in their own right.

The automobile industry can equally be thought of as “spiders-within-spiders,” in which distinct sub-systems (interior, engine, drivetrain, electronics) have the potential to be finely modularized. However, research shows that lead firms like Ford, Toyota or VW, have resisted modularization, which means that product innovation must be continually and intimately co-developed between assemblers and first-tier suppliers, maintaining the latter’s dependency and affecting the industry’s geography and trajectory of innovation (Frigant and Lung 2002; Sturgeon, Biesbroeck and Gereffi,
Thus, lead firm network strategy is the critical determining factor.

While ‘snakes and spiders’ is a predictive theory, many scholars of firm network approaches offer descriptive realism but lack predictive power compared to dyadic approaches. For instance, in GCC research, there is a generic sense in which networks of suppliers are formed around lead firms – producer-driven and buyer-driven – but there is little systemic theorization of drivers of sectoral change over time. Similarly, most GPN scholars promote some kind of network approach, such as “action-network theory” (Dicken, et al., 2001), but they readily admit that “we still do not have a systematic set of methodological tools to operationalize the framework” (Hess and Yeung, 2006: 1201). That said, its holism and theoretical pluralism is both its distinctive feature, and is a fully self-conscious choice, as it “attempts to encompass all relevant sets of actors and relationships,” so as to avoid “constrain[ing] one’s worldview…[and] explanatory power.” (Coe, Dicken and Hess, 2008: 272, 291).

In most cases, IFP scholarship fails to explicitly define and then measure the firm network boundaries and the power exerted over suppliers as rigorously as dyadic scholars do. As such, descriptions of international networks are a good start, but a predictive theory of macro socio-economic outcomes from a network-strategic perspective remains elusive, though perhaps possible through more systematic application of social network analysis methodologies.

Conclusion

IFP challenges our conceptualizations and measurements of the international economy, and most academic disciplines have taken note, leading to numerous perspectives and methodologies that have never been explicitly compared. This paper delineates three critical dimensions – the status of firms, sectoral organization, and inter-firm relationships – which differentiate disciplinary approaches to IFP in conceptualization, theory and measurement. It highlights many important areas of inter-disciplinary convergence in the hopes of fostering dialogue and cooperation.

In terms of the status of firms, there is already unacknowledged convergence
between disciplines, most clearly seen in a mutual emphasis on large firms and convergence in data usage, such as business function surveys and transactional trade data literatures. Furthermore, because most scholars are not solely interested in firm upgrading, but rather the implications of firms for development, literatures usually seek (implicitly or explicitly) to aggregate up from firm-level observations. Non-economists could learn from economists as the latter have been more successful in integrating firm heterogeneity insights into their general theories. That said, with new data sources, non-economists have a golden opportunity to profoundly influence economics literatures by illustrating how insights derived from fine-toothed case and fieldwork studies have macro-sociological implications that markedly diverge from mainstream trade and IFP theories.

Currently, the starkest point of disagreement is the causal pathway of firm upgrading, with economists convinced that already productive firms self-select into becoming powerful exporters, whereas non-economists are equally convinced of a learning-by-doing pathway, especially through deep relationships with lead firms. Ultimately, the causality may be circular by combining both insights: slightly more productive firms enter exports, then learn quickly in the process of exporting. Regardless, this is an area where dialogue could enrich both sides.

Sectoral organization also shows signs of convergence, illustrated by the ‘snakes and spiders’ framework which finds that industry organization generates far more turbulent and discontinuous shifts in trade patterns than that predicted by the incrementalism of traditional comparative advantage and New Trade theory. Although very close to non-economists, the primary difference is that non-economists theorize a more diverse range of consequential sectoral organizations, beyond just snakes and spiders.

Finally, for theories based on microeconomic theories of inter-firm behavior, there is a clear area of dialogue over the choice of theory – property rights and transaction costs. However, RSI and GVC differ in terms of the parsimony of their theories, with RSI opting for ‘restrictiveness’ and GVC opting for an ‘expansive’ theory that also considers industrial dynamics beyond dyadic linkages. This is partly
an intellectual choice over degrees of theoretical parsimony and whether causality is the ultimate goal of research. If so, then network approaches, especially GPN literatures, need to resolve their lack of “a systematic set of methodological tools to operationalize” their framework (Hess and Yeung 2006: 1201); however, as the brief comparison of autos and electronics illustrates, their insights are profound and deserve more rigorous application.

In addition to convergence across disciplinary theories, the implications of interdisciplinary cooperation in data and measurement are also potentially quite profound. First, new sources of large-scale data, such as business function surveys and transactional trade data, can be used in highly complementary ways with existing case study research. For instance, firm-level data can be used to contextualize case studies by empirically ‘locating’ them within the larger population of a country’s or a sector’s firms. They are also useful for initial case selection. Second, with more work, they also have the potential to advance GCC, GVC and GPN theories by illustrating the generalizability of their findings. Even though scholars have developed very sophisticated theories of governance between firms, there still is no way to make some simple estimates, such as the share of total international trade that flows through different types of firm-governed trade channels. As such, we do not know the prevalence of the phenomenon, and hence its full implications. Finally, if qualitative and quantitative research is appropriately combined, they could provide fresh insight into existing trade theories in economics, by illustrating the implications of categorical differences in sectoral organization and heterogeneity across firm-organized trade. By broadening the dialogue in economics, a firm and organizational approach to the international economy could have a profound influence on development theory and practice.
Notes

1 A partial list of commonly used names, each with corresponding literatures, includes: international or global production networks, vertical specialization, slicing up the value chain, multistage production, fragmentation, disintegration of production, global value chains, global commodity chains, wintelism, global production sharing, offshore outsourcing, integrative trade, international supply chains, among others.

References


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