The Challenge of Global Value Chains:
Why Integrative Trade Requires New Thinking and New Data

Prepared for Industry Canada

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Final draft, November 20, 2008

Author Biographies

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Metrics and Indicators for Global Value Chains

Prepared for Industry Canada by
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Executive Summary

This paper has been prepared in response to a request from Industry Canada to develop recommendations for collecting data on the position of Canadian firms in global value chains (GVCs). While it is widely recognized that the global economy has become more integrated, economic statistics lag behind changes in the global economy. Key national issues like the impact of globalization on firms and workers are debated in the absence of crucial information about the firms that create (and destroy) economic wealth and jobs. Current economic statistics on trade and the activities of multinational firms reflect, and partially reveal the roles that domestic firms play in the global economy, but by and large, we lack the direct measures that are required to assess the position and performance of domestic firms in GVCs. The goal of this paper is to assist the statistical community of Canada in their ongoing efforts to fill that gap.

Our first recommendation is for Statistics Canada to collect more detail on services trade using the newly developed descriptions of services products North American Product Classification System (NAPCS) as a basis

Our second recommendation is that economic data be collected according to a set of generic business functions, such as strategic management, new product development, operations, marketing and sales, technology and process development, etc. Business functions contain activities that individual establishments may provide internally or obtain from a variety of outside sources, including other establishments owned by the same parent firm and establishments owned by legally separate firms. To understand how domestic establishments fit into GVCs, is critical to know if such input and service providers are located nearby, in more distant domestic locations, or in other countries. It is also important to know if offshore inputs and services originate in low or high wage societies. Data collected according to business function will provide researchers with a rough map the value chain, reveal the roles that domestic establishments, firms, and industries play within GVCs, and provide a unique view of the competitive pressures facing domestic firms and industries. When combined with existing data on employment, occupations, wages, worker career paths, firm performance, technology development, e-commerce, etc., data on business functions will open up important new avenues for research and policy analysis.

Collecting data according to business function, and combining the results with existing data, will allow the Canadian statistical system to provide policy makers with better insight into the following questions:

1) What business functions are Canadian establishments doing internally and externally (outsourcing)?
2) What business functions are Canadian establishments doing domestically and abroad (offshoring)?
3) What types of jobs are associated with various business functions, including employment by occupation, wages, tenure, and number and type of new hires in past 12 months?
4) What educational and training requirements are associated with different business function combinations?
5) How are the business functions that an establishment engages in related to the goods and services bought and sold (inputs and outputs)?
6) How are the business functions that an establishment engages in related to its economic performance (market share, profitability, employment) and how does its performance compare to establishments with the same and different value chain specializations?
7) How do the business functions that an establishment engages in position it within its industry, both domestically and globally (e.g., specializations, share of value added, market share)?

1 Introduction

The global economy has entered a new phase of deeper, more immediate integration that is exposing national and local economies to the winds of global competition as never before. These winds can fill the sails of domestic firms and industries, blow them away, or perhaps even worse, leave them adrift. There are two new features of the global economy that deserve our attention. The first is the fragmentation and geographic dispersal of economic activity; of work, of firms, and of entire industries. As Dean, Fung, and Wang (2007; p. 1) put it:

> "…production processes are sliced thinner and thinner into many stages, and the resulting production fragments are carried out in different locations. The production of a finished product thus involves the participation of many economies, with countries specializing in different fragments of the vertical production chain. … While the international division of labor in the global economy is nothing new, the vast scope and the intricate nature of this pattern of global production sharing seems genuinely unprecedented."

The second novel feature of the global economy is the other side of the coin, so to speak, of vertical fragmentation: rapid improvements in the functional integration of these globally dispersed fragments. Peter Dicken (1992: 5) has argued that an earlier era of 'internationalization,' characterized by the simple geographic spread of economic activities across national boundaries, is giving way to an era of 'globalization,' which involves the *functional integration* of these internationally dispersed activities. It is this functional integration that drives our growing interest in 'integrative trade,' or what has been termed 'global value chains,' or GVCs (see www.globalvaluechains.org for a summary and list of related publications).

What is it that enables greater functional integration in the global economy? While there are many forces converging to drive and enable this trend (see Sturgeon et al, 2006: 10-12 for a discussion), two of the most important differences with the past are 1) rapidly increasing industrial capabilities in developing countries, capabilities that reside both in local firms and the affiliates of multinationals, and 2) new computer-mediated approaches to real-time integration of far flung activities. These new features, even as they are typically nascent, incomplete, and extremely dynamic, nevertheless facilitate international trade in many intermediate goods and services that have not previously been sent across borders. As a result, opportunities are opening up for firms to engage with the global economy — as buyers, suppliers, sellers, distributors, contractors, producers, and service providers — in ways that were impossible even a few years ago.

These recent changes are creating new challenges and risks, as well as opportunities, for Canadian firms and industries. The growth of integrative trade has served to expand the arena of competition beyond final products to the vertical "activity segments," or "business functions" within

and across industries, raising the performance requirements for firms and workers that may have been more insulated from global competition in the past. The vertical fragmentation of value chains and the functional integration of distant fragments is the very stuff of GVCs. GVCs raise, among other things, the possibility that entire societies can become highly specialized in specific kinds of business functions. This too can have negative or positive consequences. National specialization in high- or low-value business functions, in functions that may be expanding or contracting, or in functions that initiate and direct (drive) other activities or functions that take direction emanating from other places (driven), come with consequences for wealth creation, employment, innovation, and economic development.

The implications for policy are profound. How can workers, firms, and industries be provided with the best environment for engaging with the global economy? How can we be sure that enough wealth, employment, and innovative capacity are generated at home as global integration proceeds? How much national specialization — and by extension, interdependency with other societies — is too much? These are open questions. Even if policy-makers seek few direct interventions in the areas of trade, industrial, or innovation policy, global integration can make the process of economic adjustment more difficult because it accelerates the pace of change.[1] Trade adjustment, education, taxation, investment, innovation, and infrastructure are all policy areas that need to respond to the effects of integrative trade. The problem lies in our shallow understanding of the process and its specific effects.

In this paper we argue that the rise of GVCs signals an urgent need to develop new conceptual tools and firm-level metrics to provide policy-makers with a better view of how domestic firms and industries are positioned in the global economy. Effective policy responses require a clear, detailed, and timely view of global integration and related economic changes based on solid economic data. Better economic data also provide appropriate market signals for companies, workers, students, and educational institutions. Current economic statistics, at both the national and international levels, are clearly not up to the job in service industries (for a summary of deficiencies in service sector measures in the U.S. see Lieberman, 2004; GAO, 2004, 2005a, 2005b; Sturgeon et al, 2006; NAPA, 2006; and

[1] The pace of change has emerged as a critical factor in the recent debate over the effects of global integration on advanced economies (Bardhan and Kroll, 2003; Blinder, 2005). There are three basic positions regarding how deepening integrative trade will affect developed economies such the United States and Canada. These are spelled out in very rough terms as follows: (1) Specialization and innovative leadership will continue to make developed economies rich, so no policy interventions will be required (Bhagwati, 2004). (2) Policy-makers only need to worry if developed economies hive off parts of industries in which they have comparative advantages, but these negative effects will likely be small, so all policy should aim to do is compensate losers (Samuelson, 2004). (3) It is entirely possible for developed economies to lose comparative advantages over time, so policy-makers should take steps in some instances to assist existing industries and bolster innovative capabilities (Gomory and Baumol, 2001).

Graham et al, 2007), but even in goods sectors, the collection of new kinds of economic data is urgently needed.

As a prerequisite to developing better measures, we need to restructure our thinking about mechanisms and outcomes in the global economy to include more than cross-border flows of goods and services (trade) and the activities of multinational firms (foreign direct investment). We should be concerned that the assumptions embedded in theories of comparative advantage and the multinational firm, and the trade and investment data commonly used in their analysis, will blind us to a more complex reality: that many important industries are becoming globally distributed and now co-evolve in elaborate and ever shifting cross-border ecosystems that make it unclear where control and competitive advantage truly lie. Specifically, we need to see network forms of industry organization, both embedded within and extended across national borders, as fundamental structures that drive economic development at home and abroad. The concept of GVCs encompasses these multiple dimensions of global integration: trade, multinational firms, and cross-border inter-firm business networks.

This paper is organized as follows. First, we argue that an understanding of the core dynamics of global integration requires deep qualitative knowledge of the details of cross-border integration in specific industries. But understanding how industries are changing, globally, is not enough. To allow comparability across industries, we argue that industry-neutral concepts that capture the character and dynamics of cross-border business networks are needed, and offer the "global value chains (GVC) framework," a conceptual framework drawn from extensive field research conducted in a range of global industries, as a contribution that has gained some traction among academic researchers and in international development institutions such as the World Bank, USAID, UNIDO, OECD, and ILO.

The GVC framework identifies new actors in the global economy (e.g., global buyers and global suppliers), three key determinants that affect the organization and power dynamics within GVCs (complexity, codifiability, and supplier competence), and characterizes three distinct business network forms (modular, relational, and captive) that lie between the classic duality of markets and hierarchies (i.e., vertically integrated firms). Qualitative industry research has been extremely helpful in developing this framework, in identifying emerging trends in GVCs, and in providing researchers and policy-makers with a vocabulary to discuss some of their key features. Nevertheless, we point out that the results of industry-specific qualitative research, and the conceptual categories that have been based on them, are of limited utility in the formulation of policy because of the non-representative nature of the research results and lack of useful metrics. Industry neutral metrics for the key features of GVCs are urgently needed to field surveys of nationally representative establishments to support appropriate policy responses to global integration.

We then discuss the limits to what current economic statistics can reveal about GVCs. Specifically, we discuss the limitations of trade statistics, even when combined with highly detailed establishment-level 'micro-data" that underlies the aggregate statistics published by government agencies. We also point to the glaring gap in detailed trade statistics in service industries, and recommend that Statistics Canada collect more detail on services trade using the newly developed descriptions of services products North American Product Classification System (NAPCS) as a basis. The main point of these discussions is to reveal the limitations of approaches that use current economic data in the realm of policy analysis, as a way to set the stage for our main recommendation: to develop and deploy a new classification scheme on business functions.

To begin to fill the gap between what has been learned in the context of qualitative field research and what can demonstrated through the analysis of representative economic statistics, we offer a new classification scheme for collecting establishment-level data on the roles that domestic firms play in global value chains. Specifically, we provide a generic classification scheme for business functions, argue its merits, and point out its limitations. Collecting data on business functions would be a modest, but important initial step in developing a broader set of GVC metrics. (Those interested in skipping directly to the discussion of business functions should proceed to page 23.)

2 Qualitative industry research: its importance and its limits

Our current understanding of trends in GVCs, in large part, has come from research that has developed deep knowledge of the forces driving change in specific industries, occupations, and geographic locations. Even with better quantitative information coming from analysis of micro-data (see below), the impact of global integration on advanced is extremely difficult to fully comprehend or respond to without a detailed view of how global integration is intertwined with other aspects of economic change, especially the automation and computerization of work and the prevailing characteristics of labor markets and corporate strategies in specific service industries and occupations. Trade statistics alone provide no information about the entities (and countries) that control and coordinate the flow of goods and services through GVCs. Even though research on the composition of trade (Lall et al, 2005; Hausmann et al, 2006) goes to great length to correlate export specialization with the competencies and economic performance of exporters, the hard truth of GVCs is that the composition of exports (in terms of technology, productivity, or any other measure) can be very weakly connected to the competence of domestic firms and industries. Even when local firms are fully engaged with GVCs, activities related to new market creation and chain governance may be compartmentalized within the chain and firmly located in other countries. The best way to learn about the interaction of these complex elements of economic change is though qualitative research on the

trade-offs that managers of individual firms and establishments in specific industries face and the choices they make. Ralph Gomory has referred to industry studies of this kind as "observational science."[2]

Over the past 20 years, grounded, qualitative, field-based research on specific industries has led investigators to a common set of questions and concerns. As industry after industry has developed deep connections beyond local and national jurisdictions, the practitioners of such "industry studies" have gravitated toward questions about how the global-scale division of labor is evolving, what specific roles firms based in different societies play in global-scale production networks, and what the implications of these differences are for the welfare and economic performance of nations, workers, and communities, whose prospects and experiences are inherently more territorially bounded.

In the 1960s through the 1980s, the multinational firm embodied the growing disjuncture between the motives of large firms and local communities. The concern was that the rise of "stateless" multinationals meant the demise of national industries and a loss of local control (Vernon, 1971). But close observation shows us that even the largest firms remain rooted in their home economies in important ways even as their operations become global in scope. We are in the midst of a profound transition nonetheless. Multinational firms have arisen in many countries, resulting in a deep interpenetration of the global economy, driven by both outward and inward investment. But it is the expansion of cross-border non-equity ties, variously referred to as 'global supply or value chains,' 'offshoring, onshoring, and nearshoring,' or 'international or global vertical production or business networks," that reveal the most novel and complex aspects of global integration.

Decisions about (re)locating business activities and sourcing inputs are inevitably made in the context of broader company strategies related to the development of new products, the pursuit of new customers and markets, the adoption of new technologies and production techniques, and the like. As a result, answering important questions about the effects of global integration, such as the employment effects of offshoring, is extremely difficult to do without speaking directly with the managers making the key decisions. Even when examining the operations of a single firm, with full cooperation from management, it can be extremely difficult, if not impossible, for researchers to precisely measure the employment effects of global integration.

For example, Dossani and Kenney (2005), in their case study of Company X, an electronic equipment and services firm with approximately 30,000 employees worldwide, showed that the geographic consolidation of service-related activities in India was accompanied by simultaneous

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[2] Ralph Gomory is President of the Alfred P. Sloan Foundation. This comment was made in the course of remarks given at the Industry Studies Annual Conference in Cambridge, Massachusetts on Dec. 15, 2005.

consolidation of business functions and information technology platforms (see Table 1). In the words of Rafiq Dossani:

> Company X took the opportunity of preparing to outsource to India to completely re-engineer the way they did their back office work. In the process of doing this they created new job descriptions and new jobs in-house, new jobs for their local outsourcing partners, and new jobs for their offshore affiliates and partners. We tried to take a very granular view, to look at job descriptions, and follow where the work was being done, but found that this was impossible to do. So, even though we had an insider to work with and full cooperation, we were unable to actually look at job content and where that content was moved. For example, if a job consists of making an entry into a computer, and now it is made on a different platform, routed differently, supervised differently, it is not the same activity any longer.[3]

Table 1. The Context for Offshoring at Company X: Functional, Technological, and Geographic Consolidation

1)	The consolidation of shared services across geographies and departments, particularly human resources, finance, engineering services and procurement, into a limited number of global hubs.
2)	The consolidation of enterprise resource planning and customer relationship management [IT] systems into common platforms using off-the-shelf technologies and minimizing the usage of legacy applications.
3)	The consolidation of geographical footprints.

Source: Dossani and Kenney, 2005, p. 25.

These methodological challenges should not lead is to abandon our efforts to use qualitative research methods to analyze GVCs, only to temper our confidence in estimations based on them. Nevertheless, in specific industries and occupations, qualitative research can provide valuable insights into the real and potential job effects of global integration.

For example, Levy and Goelman (2005) use qualitative methods to show, in contrast to a host of alarmist press reports to the contrary, that only a tiny number of radiology images taken in the U.S. are currently read outside of the country, and are convincing in the assertion that it is highly unlikely that the number will increase substantially in the future. The shift from analog to digital radiology imaging has certainly made the remote analysis of radiology images technically feasible, a fact that has spurred much hand wringing in the media about radiology jobs "moving" offshore. Tight labor markets and high salaries for radiologists, in part due to a cap on U.S. federal funding for hospital residencies, also suggest high potential for the offshore interpretation of radiology images. But

[3] Author interview with Rafiq Dossani, February 2, 2005, Stanford, CA.

because there is a need, in many cases, for close consultation between radiologist and doctors, almost all radiology images are read at or very near the site where they are taken. Moreover, the high cost of radiology imaging equipment relative to the cost of interpretation, the restriction of U.S. malpractice insurance to doctors who have done U.S. residencies and passed U.S. medical board exams, the group power of U.S. doctors to restrict competition, and Medicare reimbursement regulations, all work to keep the remote interpretation of radiology images on shore.

Because of these industry-specific technological, financial, and "institutional" factors, Levy and Goelman found that virtually all of the very small number of radiology images that are read offshore are read by radiologists who completed their residency and passed their board certification in the United States. For example, U.S. board certified radiologist in Sydney, Australia, can work days reading images generated at night in the United States. An understanding of such industry-specific factors, and their interaction, requires deep knowledge of specific industries and occupations that can only be gained through qualitative research methods.

As these examples show, industry case studies have the potential to reveal some of the deeper dynamics, and limits, of global integration. One core finding from this research is that firms from advanced industrial countries have played a central role in driving and shaping global integration. In India, firms that provide IT services interact with clients from around the world on a daily or even hourly basis to provide them with the packages of services they need (Dossani and Kenney, 2003). In horticulture, large retailers have worked closely with exporting companies in Africa and Central America to obtain products that meet their ever-increasing demands for variety, food safety and speedy delivery (Dolan and Humphrey, 2001). In autos, advanced country "global suppliers" such as Magna, Bosch, Lear, and Yazaki have set up worldwide operations to support the network of final assembly plants automakers have established to serve local markets (Sturgeon and Florida, 1999; Sutton, 2005). In electronics, lead firms such as Alcatel, Nortel, and Hewlett Packard have outsourced production to a set of huge, globally operating contract manufacturers including Celestica, Flextronics, Hon-hai, and Solectron (Sturgeon, 2002; Sturgeon and Lee, 2005). In consumer goods and apparel, foreign companies do not merely buy what China produces and then resell it to North American consumers — Wal-Mart alone imported $15 billion worth of goods to North America from China in 2003 — they actively shape the industrial transformation that has made the dramatic rise in Chinese exports possible (Gereffi, 1994; Feenstra and Hamilton, 2006). The vast majority of exporting factories in Mainland China are run by firms from other countries; from Taiwan, Korea, Australia, Europe, Japan, and the United States, and most make products according to the detailed specifications set by non-Chinese firms such as Wal-Mart, Costco, Dell, Liz Claiborne, and Nike. Clearly we need to

look beyond trade and investment statistics to find out where the power in these global-scale production arrangements lie, and how they are changing.

Julia Lane of the National Science Foundation has likened the current state of qualitative industry research to the study of the natural world in the 16th and 17th centuries.[4] Curious researchers made detailed notes and drawings of what they could see of the vastness and variety around them, but there were few mechanisms for compiling the findings of individual researchers into larger pools of knowledge that could reveal broad patterns. Comparison of results came haphazardly with personal communication between scholars and in the few forums, such as the British Royal Society, where researchers could present and debate their results. In this way classification systems gradually came into being and some of the mechanisms at work in nature were revealed.

Similarly, industry researchers have now had several decades to present, publish, and debate their research results, and more effort is now shifting to the construction of classification systems and a search for the mechanisms that work to create the variety observed in the field. These findings show that global integration is expressed differently in different industries and places. The precise patterns and effects of global integration, therefore, depend in large part on the technical and business characteristics that prevail in specific industries, and upon social and institutional characteristics of the places in which the nodes of global industries are embedded. For example, some industries, and parts of industries, are easier to fragment and globalize than others. What is needed is a generic theory to explain these different patterns and to predict the outcomes associated with them.

Because the stakes are so high, we must take global integration seriously, and develop ways of thinking that place the new and emergent features of the global economy in the foreground. The venerable intellectual approaches to such questions focus on the roles of comparative advantage and the market- and capability-seeking activities of multinational corporations in motivating and structuring international trade and investment. While these concepts have proved to be extremely robust and are still valuable, they do not emphasize the fragmentation of the value chain or the fluid, real-time integration of capabilities in advanced economies with capabilities in places that were all but outside of the global economy only two decades ago, such as China, India, Russia, and Vietnam. In fact, they emphasize the opposite: national export specialization in undifferentiated commodities, on one hand, and finished products, on the other, and the extension of existing national advantage, via multinational affiliates, to places without the domestic capabilities to effectively compete in home

[4] These remarks were made at the MIT Working Group on Services Offshoring Workshop, held in Cambridge, Massachusetts on October 28, 2005.

markets. While the rise of GVC do not render this view of the global competition completely anachronistic, it is safe to say that the picture has grown much more complex.

In this next section, we briefly present the 'global value chains' framework, a conceptual model of global integration derived from an eclectic body of theory related to questions of industry organization, that is informed by extensive field research on the global organization of specific industries.

3 How to conceptualize global industry architecture: global value chains framework

The GVC framework was first published in an article entitled 'The Governance of Global Value Chains' in the journal *Review of International Political Economy* (Gereffi, Humphrey, and Sturgeon, 2005). The article sought to both account for the recent observed changes in the organization of specific global industries and to build a more theoretically grounded approach to explaining and predicting firm-level governance patterns in geographically separate economic activities. The intention was to use cross-industry comparisons to develop a generic model useful in the analysis any industry that could in turn help to focus researchers on the industry-specific features that shape cross-border business networks under examination.

The main object of inquiry in the GVC framework is the nature and content of the link between value-added activities. For simplicity's sake, we limit our analysis to two kinds of firms, lead firms, or order makers, and suppliers, or order takers. By taking this approach, we sought to extend a long stream of academic literature that develops categories of industrial organization through an analysis of the linkages between buyers and sellers. This literature was initially motivated by the need to explain why discrete value chain activities were sometimes collected within firms (i.e., hierarchies) rather than being freely traded in markets (Coase, Williamson, 1975). Over time, researchers noted the prevalence of an intermediate "network" form of organization, where there is a significant degree of "explicit coordination" beyond simple market transactions but short of vertical integration (Granovetter, 1982; Williamson, 1985; Powell, 1990; Adler, 2001).

The results of field research on cross border business networks in a range of global industry has led us, and others (see Borrus et al, 2000; Takiashi and Fujimoto, 2001 on the national character of business networks) to an understanding that not all networks are the same. In the economics sub-field of industrial organization, transactions are conceptualized as having two variations: generic products exchanged on spot markets or customized products exchanged on the basis of "incomplete contracts" requiring relation-specific investments (asset specificity). From our point of view, this dual modality of outsourcing in the economic literature represents an impoverished view of how firms construct and maintain business linkages.

Our goal was to specify and explain the *multiple* patterns of cross-border business networks that we observed in the field. Specifically, we identified *three* types of network organization, modular, relational, and captive, situated between the two traditional modes of industry organization, markets and hierarchies. The characteristics of these five modes of industry organization, or "global value chain governance" patterns, are summarized in Table 2.

Table 2. Five Forms of Global Value Chain Governance

1. *Markets*. Markets are the simplest form of GVC governance. GVCs governed by markets contain firms and individuals that buy and sell products to one another with little interaction beyond exchanging goods and services for money. The central governance mechanism is price. The linkages between value chain activities are not very "thick" because the information that needs to be exchanged and knowledge that needs to be shared is relatively simple.
2. *Modular value chains*. This is the most market-like of three network-style GVC governance patterns. Typically, suppliers in modular value chains make products or provide services to a customer's specifications. Suppliers in modular value chains tend to take full responsibility for process technology and often use generic machinery that spreads investments across a wide customer base. This keeps switching costs low and limits transaction-specific investments, even though buyer-supplier interactions can be very complex. Linkages are necessarily thicker than in simple markets because of the high volume of information flowing across the inter-firm link, but at the same time codification schemes and the internalization of coherent realms of knowledge in value chain "modules," such as design or production, can keep interactions between value chain partners from becoming highly dense and idiosyncratic.
3. *Relational value chains*. In this second network-style GVC governance pattern we see mutual dependence regulated through reputation, social and spatial proximity, family and ethnic ties, and the like. The most obvious examples of such networks are in specific communities, or "industrial districts," but trust and reputational effects can operate in spatially dispersed networks as well. Since trust and mutual dependence in relational GVCs take a long time to build up, and since the effects of spatial and social proximity are, by definition, limited to a relatively small set of co-located firms, the costs of switching to new partners tends to be high. Dense interactions and knowledge sharing are supported by the deep understanding value chain partners have of one another, but unlike the codification schemes that enable modular networks, these "short-cuts" tend to be idiosyncratic and thus difficult and time-consuming to re-establish with new value chain partners.
4. *Captive value chains*. In this third network-style GVC governance pattern, small suppliers tend to be dependent on larger, dominant buyers. Depending on a dominant lead firm raises switching costs for suppliers, which are "captive." Such networks are frequently characterized by a high degree of monitoring and control by lead firms. The asymmetric power relationships in captive networks force suppliers to link to their customer in ways that are specified by, and often specific to a particular customer, leading to thick, idiosyncratic linkages and high switching costs all round.
5. *Hierarchy*. This governance pattern is characterized by vertical integration (i.e., "transactions" take place inside a single firm). The dominant form of governance is managerial control.

When would we expect each of these five governance forms to occur? From our field research, reading, and discussions, we identified three key variables, 1) the *complexity* of the

information exchange required to complete the transaction, the degree to which the information can be expressed formally, or its *codifiability*, and the level of competence in the supplier relative to the transaction. The three variables are summarized in Table 3.

Table 3. Three Key Variables in Global Value Chain Governance

1. *The complexity of transactions*. More complex transactions require greater interaction among actors in GVCs and thus stronger forms of governance than simple price-based markets. Thus, complex transactions will likely to be associated with one of the three network governance patterns (modular, relational, or captive) or integrated within a single firm (hierarchy).
2. *The codifiability of transactions*. In some industries schemes have been worked out to codify complex information in a manner in which data can be handed off between GVC partners with relative ease, often using advanced information technologies. If suppliers have the competence to receive and act upon such codified information, and if the codification schemes are widely known and widely used, then we would expect to see modular value chains emerge. If not, then lead firms might either keep the function in-house, leading to more vertical integration (hierarchy) or outsource it to a supplier that they tightly control and monitor (the captive network type) or have a dense, idiosyncratic relationship with suppliers (the relational governance type).
3. *The competence of suppliers*. The ability to receive and act upon complex information or instructions from lead firms requires a high degree of competence on the part of suppliers. Only then can the transfer of complex but codified information be achieved (as in modular networks) or intense interaction be worthwhile (as in relational networks). Where competent suppliers do not exist, lead firms either must internalize the function (hierarchy) or outsource it to suppliers that they tightly monitor and control (captive suppliers).

Furthermore, if one of these three variables changes, then value chain governance patterns tend to change in predictable ways. For example, if a new technology renders an established codification scheme obsolete, we would expect, all other thing being equal, modular value chains to become more relational, and if competent suppliers cannot be found, then captive networks and even vertical integration become more prevalent.[5] Conversely, rising supplier competence would tend to push captive governance toward the relational type and better codification schemes might prepare the ground for modular value chain governance.

The five global value chain governance types, along with the values of the three variables that determine them, are shown in Figure 1. The five types of global value chain governance are derived from ascribing binary (high or low) values to the three key variables: 1) complexity of inter-firm transactions; 2) the degree to which this complexity can be mitigated through codification; and 3) the extent to which suppliers have the necessary capabilities to meet the buyers' requirements. Each

governance type provides a different trade-off between the benefits and risks of using suppliers to provide specific inputs (goods and services). As shown in the last column of Figure 1, the five GVC governance types comprise a spectrum running from low levels of explicit coordination and power asymmetry between buyers and suppliers, in the case of markets, to high levels of explicit coordination and power asymmetry between buyers and suppliers, in the case of hierarchy.

Figure 1. The Global Value Chains Framework

Key Variable / Governance Type	Complexity of transactions	Ability to codify transactions	Capabilities in the supply-base	*Degree of explicit coordination and power asymmetry*
Market	Low	High	High	*Low*
Modular	High	High	High	
Relational	High	Low	High	
Captive	High	High	Low	
Hierarchy	High	Low	Low	*High*

Note: There are eight possible combinations of the three variables. Five of them generate global value chain types. The combination of low complexity of transactions and low ability to codify is unlikely to occur. This excludes two combinations. If the complexity of the transaction is low and the ability to codify is high, then low supplier capability would lead to exclusion from the value chain. While this is an important outcome, it does not generate a governance type *per se*.

Source: Gereffi, Humphrey, and Sturgeon, 2005; as adapted by Dicken, 2007, p. 158.

The GVC framework is not intended to support a grand theory of economic development, or even a full theory of the forces that shape global integration, but a transaction-, firm- and industry-centric theory of coordination among the firm- and establishment-level actors in the chain. As such it cannot provide a full accounting of the governance characteristics of global value chains. It can,

[5] This helps to explain why the establishments of multinational firms tend to be more specialized at home and in more developed countries, where competent suppliers are present in abundance, and more vertically integrated abroad, especially in developing countries.

however, provide a bottom-up, research-driven method for accounting for observed global value chain governance characteristics as well as those that are predicted to arise absent other factor and influences.

In this way, the GVC framework can provide researchers and policy-makers with a useful and relatively simple first-cut: if the value chain governance patterns that are predicted by the theory are not observed empirically, this provides a strong indication that forces external to the chain, such as national institutions or international trade rules, are playing a large role. The implications for policy are numerous. To provide just one example, relational value chains, or more accurately the relational segments of value chains, tend to be relatively immobile geographically, not only because they require frequent interaction to develop and exchange tacit knowledge, but because they are often governed by the shared expectations of trust and reputation developed over long periods of time. As a result, relational value chains tend to be quite stable, geographically fixed, and difficult for outsiders to participate in or emulate. Modular value chains, in contrast, because linkages are governed by standard methods for forging business relationships and sharing information, tend to have lower barriers to entry and exit (as long as firms have the competencies required) and can therefore be quite dynamic — and volatile.

These conceptual categories were derived from direct field observation in a variety of global industries, including electronics (Sturgeon, 2002), apparel (Gereffi, 1999), horticulture (Dolan and Humphrey (2000; 2004), and bicycles (Galvin and Morkel). The usefulness of the framework has been confirmed in subsequent research on motor vehicles (Sturgeon, Van Biesebroeck, and Gereffi, 2007) and electronics (Vind and Fold, 2007). The problem, from a policy point of view, is in quantifying the key GVC variables of complexity, codifiability and competence. Such concepts *can* be assigned values. For example, a level of competence might be assigned to an establishment if certain process technologies, certifications, or business systems are present. Or, a level of complexity in a given transaction might be associated with the purchase of customized software inputs containing a given number of lines of programming code. Or, a level of codifiability can be ascribed when buyers and sellers report exchanging data files using known codification schemes. The difficulty arises from the inevitable fact that the relevant indicators tend to be highly industry-specific, and cannot be used to generate the aggregate measures typically used in the formulation of national-level policies. As a result, the usefulness of GVC governance theory has so far been limited to qualitative cross-industry comparisons, geographic comparisons of specific sectors, and deep analysis of single industries.

While the development of objective, meaningful measures of the determinates of GVC governance is a laudable, long-term goal, we believe that the Canadian data community should first

address more basic concerns, such as gathering more detail on services trade and collecting data on the generic business functions that establishments do and do not do internally and domestically. We will return to these points shortly, but first, we discuss what can be leaned about GVCs using current economic statistics.

4 Using existing data to study global value chains: opportunities and limits

In this section, we examine the utility of current economic statistics for shedding light on trends and dynamics within GVCs by reviewing the findings of some of the best recent academic research that has used official statistics to examine related issues. We suggest that official statistics, as they currently exist, can only hint at the richness provided by qualitative research on GVCs. We then discuss recent research that makes use of highly detailed 'micro-data" that underlie the aggregate statistics published by government agencies. We view the use of micro-data as laudable, but believe that its usefulness is limited by the lack of statistics of any kind that can be assembled on key GVC metrics, such as business functions. If key GVC-related questions are not asked on any survey and do not exist on any administrative form, then no effort to render micro-data useful will yield adequate results. We point out the most glaring gap in the data collection regime of all countries is services trade, and we make a recommendation for deploying North American Product Classification System (NAPCS) product definitions for a vastly expanded effort to collect more detail on services trade. The main point of these discussions is to reveal the limitations of current government statistics in supporting GVC-related policy analysis. The purpose of these discussions is to set the stage for our main recommendation: the development and deployment of a new classification scheme on business functions.

4.1 What existing official statistics can reveal about GVCs.

Merchandise trade, as a share of GDP and even more so as share of domestic value added, has increased dramatically since the 1970s, far surpassing pre-World War I peaks in most OECD countries. Feenstra also notes the sectoral shift in the consumption of imports to the U.S. away from agricultural products and raw materials and toward capital and technology-intensive goods. Explanations noted by Feenstra (1997, p. 34) include trade liberalization, falling transportation costs, and equalization of GDPs among trading countries (because countries of similar size trade more than countries of disproportionate size). Of course, there are many additional possible explanations, including rising production skills and better capital stock in poor countries and speedier transportation, which opens up trade for perishable goods such as fresh vegetables as well as for goods with very volatile prices, such as computer memory. The rise of GVCs is not only enabled by these factors, but

is itself a cause of trade increases. As Feenstra (1997, p. 36) argues, the geographic fragmentation of production causes increases in trade because intermediate inputs may cross borders several times before final products are delivered to end users. Thus the trade content of an average product rises when they are produced in the context of global value chains. Feenstra uses trade statistics to show that trade in intermediate good is rising faster than overall trade.

4.2 Making opportunistic use of rich data sets to explore GVC-related questions.

Feenstra and Hanson (2003, 2005) take advantage of unique detail in trade statistics from China and Hong Kong reveal that some key elements of GVCs as they function in an increasingly important part of the global trading system. Specifically, the data contain re-export values for Hong Kong and information about factory and input ownership in China. These data allow the authors to estimate the mark-up charged by Hong Kong-based global value chain "intermediaries" such as Li and Fung, a company that branded apparel companies, such as The Limited, headquartered in Columbus, Ohio, use to set up, manage, and finance sub-contracts with apparel factories in East Asia and elsewhere around the world. The authors also use these data to calculate the share of China's exports to Hong Kong that are re-exported (45.4% in 1998), an indicator of the important coordination role that Hong Kong plays in GVCs, especially in apparel and related industries. Because the data include classifications that describe the ownership of factories exporting from China, the authors are able to show that independent suppliers working under "export processing" arrangements (i.e., suppliers that are provided with inputs by intermediaries and their customers) are much more likely to send goods through Hong Kong for re-export than exporting factories that are wholly owned by non-Chinese firms.

Feenstra and Spencer (2005) use the same Chinese data, from 1998 through 2000, to explore the relationship between outsourcing contracts (arms-length vs. contractual) and the proximity of suppliers (on-shore vs. off-shore in-house and offshore outsourced) and find that relationships vary according to the technological sophistication of the product being outsourced. Dani Rodrick, and his collaborators, (Rodrick, Haussman et al, 2006) use similar data to show that the basket of goods exported by China is of higher technological content than would be predicted by its GDP/capita (using averages for all other countries' export mixes). Despite the high quality of this work, in terms of the questions asked and methods used, and the opportunistic use of trade data enriched with additional parameters, the results nevertheless provide only dim inferences of the rich dynamics of GVCs as they connect buyers from the United States and elsewhere, in some cases through intermediaries, to a complex and diverse set of production facilities in China.

Head, Ries, and Spencer (2004) develop and empirically test a model that predicts that offshore suppliers that make transaction-specific investments will tend to operate within networks with tight linkages to buyers. The data come from disaggregated U.S. export data from 1989 through 1994, assembled and maintained by Robert Feenstra at the University of California at Davis, that reveal the value of exports according to detailed 10-digit HS product codes, combined with direct investment data for U.S. automakers, for 1991 through 1996 from the United States Automobile Manufacturers Association. The result is that, in Japan, non-Japanese suppliers have low market penetration in complex parts categories where tight linkages appear to exist. These findings are consistent with qualitative research on Japanese automobile and electronics industries (Sturgeon, 2007; Sturgeon, Van Biesebroeck, and Gereffi, 2007).

The data sources used by economists to test hypothesis related to GVCs, however, tend to be available for individual countries and for limited periods of time, because data collection is commonly phased out after the programs they were intended to support come to an end. So, while opportunistic use of especially rich data sources can reveal important aspects of GVCs, they typically provide only partial views of trends in specific places for limited time periods, and have limited scope for being expanded to multiple countries and for providing information about longer-term trends. The data limitations of this work to not stem from a lack of detail, since the trade data is reported at 8- and 10-digit HS product codes for goods. However, as with all research that relies on trade data collected according to HS products codes, services are not covered at all. We see a more fundamental limitation as well. A key feature of GVC theory is that it focuses on inter-firm networks, and most of existing datasets treat individual establishments as stand-alone entities. Thus any new data collection efforts should seek to reveal something about inter-firm links with preferred suppliers and customers, which are increasingly important with fragmented, specialized and outsourced supply chains. We believe that collecting establishment level data on the organizational and geographic location of business functions will accomplish this goal.

4.3 Using micro-data resources to understand GVCs

There are a host of government programs that collect detailed economic data. Typically there are more detailed "micro-data" that underlie the published data. While these data are typically confidential, researchers who gain security clearance and have their proposal s accepted by data collection agencies can gain acces, as along as the results are screened before the research is released to the general public. Some micro data sets have also been assembled by data agencies and released, with codifdential data removed, as public use files. The mailing lists for government surveys can also contain valuable data on the basic characteristics of individual firms and establishments. Other

government agencies collect data for the purpose of administering government programs such as tax collection, compliance with environmental protection laws, and the like. For this reason such data is typically referred to as "administrative data." Some of these data have also been made available to the research community. Over the past decade there has been a burgeoning body of research that relies on government-collected micro-data. Some of these resources have only become available recently.

One example of how administrative micro-data data has been made useful for researchers is the U.S. Census Bureau's Business Register, which is essentially the sampling frame for the Economic Census. Data included are business name, address, a unique establishment-level identifier, industry, employment, and the identity of the firm that owns the enterprise. Data about ownership allows the enterprises in the Business Register to be aggregated to the firm level. Jarmin and Miranda (2002) have assembled the Business Register into a time-series for 1976-2002, referred to as the Longitudinal Business Database (LBD). The potential of the LBD has just begun to be tapped. For example, Bernard, Jensen, and Schott (2005b) link the LBD to the universe of import and export transactions for 1993-2000, revealing a detailed picture of the characteristics of firms that do and do not trade and offering a wealth of research possibilities on how United States firms' trading activities and domestic operations are related.

Another example from the United States is the Longitudinal Research Database (LRD), which contains data on all manufacturing establishments that were in at least one U.S. Census of Manufactures since 1963 or one annual survey of manufactures since 1972. For 1992, the LRD incorporated data for over 378,000 United States manufacturing establishments (in non-census years the total is about one-sixth that amount). The LRD contains data that identify individual establishments, and a high level of detail on the manufactured inputs and products (outputs) of those establishments. Identification data include permanent plant and establishment numbers, industry codes, location, current status, and legal form of organization. Input data include total employment, number of production workers, hours worked, labor costs, materials costs, materials consumed, services and energy consumed, inventory levels, depreciable assets, and capital expenditures. Product data include receipts (value of shipments, value added, value of re-sales); production details (5- or 7-digit SIC product codes, quantities of production, value and quantity of products shipped, value and quantity of interplant transfers, and internal consumption); and exports. Research using the LRD and other micro-data resources has explored a number of issues related to global integration, including establishment dynamics, job turnover, the effects of international trade, and productivity growth. While very valuable, these studies typically study the entire manufacturing sector and have not yet delved into the dynamics present in particular industries. But critical questions related to GVCs, such as the composition of business functions that establishments do and do not perform, and where

external functions are sourced, cannot be explored because they are not asked on any current survey or contained in administrative data files.

Researchers have also creatively used microdata from more limited data sets to explore specific questions related to GVCs. Harrison and McMillan (2006) and others have used the parent and foreign affiliate micro-data from the Bureau of Economic Analysis surveys on multinational firms to examine the relationship between affiliate activity and U.S. employment. Swenson (2005) has examined the permanency of offshore assembly arrangements using extremely detailed data from United States International Trade Commission (USITC) reports. Kletzer (2002) has used micro-data from the Displaced Worker Survey to explore the experiences of workers displaced from manufacturing industries associated with increased foreign competition, and has made policy recommendations based on her findings. These studies are examples of leading-edge quantitative research on the employment effects of globalization. Because of the paucity of data collected on international trade in services, however, it is problematic to extend the methods used by these researchers to services. Information about business functions, by contrast, can be collected from any establishment, whether their main output (typically captured by the business function "operations" is services or goods, and if they are multinationals are wholly domestic firms. This last point is especially important because many wholly domestic firms are nevertheless deeply engaged in GVCs through non-equity ties.

To sum up, the use of micro-data from existing survey and administrative data is not enough. The rise in intermediate goods trade strongly suggests that we have moved beyond a situation where countries use domestic resources to develop and export products to the rest of the world. Countries and regions within countries are not responsible for making products and delivering services in their entirety, but have come to specialize in particular elements within the larger chain of value-added activities. As a result industrial output and export statistics provide a very partial view of where in the global economy value is created and where it is captured. Specifically, they provide very little, if any, insight into the critical questions of how much control firms and industries in specific places exert over the activities they and others carry out in the global economy and how this control is translated into the distribution of gains among firms, countries, and communities. Because the picture of global integration provided by trade and investment data are so incomplete, the causal links to economic welfare indicators such as employment and wages derived from macro statistics tend be weak and unconvincing.

Linking input-output data to administrative and trade data can provide a rich picture of how domestic firms and enterprises engage with the large global economy. Micro-data collected from multinational firms, when combined with data on international trade, can provide some information

about the activities that multinationals place across borders and how they use local resources in offshore locations. But even the most fine-grained analysis of existing data is limited if crucial questions are not asked at all. These include: 1) the business functions that local enterprises do, and do not engage in; 2) where inputs are sourced from, if they are not provided internally; and 3) the nature of relationships that domestic establishments and firms form with local or foreign vendors and customers. While developing metrics for the key GVC framework variables would provide answers to the third question, we recommend that the Canadian statistical community focus on the more manageable task of collecting data according to business function, which would provide answers for the first two questions. If representative data on business functions were collected at the establishment level in Canada, and more detail on services trade were collected, then all of the rich micro-data from government surveys and administrative records could be applied to its analysis by linking the data through establishment identification numbers.

Many assumptions are made in the literature reviewed in this section about the range of options that firms face. The literature extends the make vs. buy decision to include making offshore (FDI) and buying offshore. On the one hand, complex goods are more likely to be contracted domestically or produced offshore in the affiliates of multinationals. On the other hand, global integration "thickens" markets, in effect giving firms a larger pool of suppliers, which makes outsourcing less hazardous. As Spencer notes (2005, p. ?), there is no agreement on how production is likely to be organized in GVCs. Spencer, in her review of the 36 articles connecting organizational form to international trade, notes that only seven employ empirical analysis. Most of this is based on trade statistics. In a few instances, intermediate goods in a specific industry have been assigned values associated with complexity (e.g., engineering content), but no general measures have been developed.

For this reason we recommend the development of a simple yet broadly applicable classification scheme for measuring and geographically locating the business functions that comprise GVCs. It is especially important that business function definitions be developed in a way that they remain independent of sector and country. This will allow research to be extended to establishments engaged in the provision of services. None of the studies cited so far include coverage of services. The following section will explore this point more deeply.

5 The need to collect more detailed data on services trade

It is quite troubling that import and export data are collected for only 28 service product categories by Statistics Canadian (see Table 4). What is happening in the other service product categories that have been mentioned as moving offshore, such as the wide variety of back-office functions like accounting, customer support, and software programming? What about the

interpretation of radiology images, market and legal research, and research to support financial services? Are customized software services staying onshore while only basic software coding is moving offshore, or is higher-skilled work and work related to innovation and new product creation also being imported? Because very few questions are asked, very little detail is collected, leaving policy-makers and researchers with extremely thin data on services trade. Contrast the twenty-eight descriptive categories for traded services with the 8,000 product codes for goods available for 200 countries in the United Nations COMTRADE database and the magnitude of the data gap becomes clear. It is clearly infeasible to collect as much product detail on services trade as is generated by the customs forms filled out when goods are shipped across borders. But much more detail could and should be collected.

Table 4. The twenty-eight product categories collected by Statistics Canada for traded services

Communications services Postal and courier services (1) Telecommunications services (2)	Insurance services Primary life and non-life insurance Reinsurance, life (3) Reinsurance, non-life (4) Reinsurance commissions (5)	Computer and information services Computer services (6) Information services (7)
Construction services (8)	Other financial services (9)	Non-financial commissions (10)
Royalties and license fees Patents and industrial design (11) Trademarks (12) Franchises (13) Copyrights and related rights (14) Software and other royalties (15)	Equipment rentals (16)	Management services Legal services (17) Other management services (18)
Advertising and related services (19)	Research and development (20)	Audio-visual services (21)
Architectural, engineering, and other technical services Architectural and eng. services (22) Other technical services Environmental services (23) Other tech services not envrnmtl. (24)	Miscellaneous business services Commercial education and training (25) Other misc. business services (26) Tooling and other misc. services (27)	Personal, cultural & recreational serv. (28)

Data on international trade in physical goods and material is available in exquisite detail, on-line, in the United Nations Statistical Division's Commodity Trade Statistics Database (known as UN COMTRADE). This database contains detailed imports and exports statistics reported by the statistical authorities of nearly 200 countries, from 1962 to the most recent year, currently 2005.[6] Because these data are collected from many different national statistical agencies, they vary in quality and coverage. Nevertheless, the COMTRADE database provide information on imports and exports by value and in some cases by the number of units or volume shipped, according to seven different commodity lists,

[6] See http://unstats.un.org/unsd/comtrade/

the most detailed being the 2002 Harmonized Tariffs Code (HTC) list, which at the six-digit level includes more than 8,000 product descriptions. As far as we know, COMTRADE is the only comprehensive, highly detailed, globally harmonized economic dataset that is available on any subject. There is nothing of similar scope in the areas of employment, wages, or domestic output. The United States data, published by the Department of Commerce, is available at the ten-digit HTC level, which includes more than 16,000 product descriptions.

These data have been used to reveal trade flows at the global level, and allowed researchers to estimate, with a high degree of specificity, how international trade affects firms and workers in individual industries. The availability of these data has, understandably, tilted research on international trade towards the goods sector. While this work has contributed greatly to our understanding of international trade and its impacts on various national economies and industries, the lack of similar detail or global coverage in statistics on international trade in services trade has created a significant knowledge gap.

Until quite recently, the lack of attention paid to data collection in services, along with the difficulties inherent in enumerating and valuing many service activities, have resulted in very general categories for the collection of data on service industries, products, and occupations. This helps to explain why data on services trade contain so few product categories. But recent progress has been made. In the spring of 2006, Statistics Canada, in collaboration with its counterpart agencies in the United States and Mexico, completed the development of 99 detailed product lists that identify and define the significant products produced by about 370 service industries. Work to date has focused on the products produced by service industries in 12 2-digit NAICS sectors (48-49 through 81). In all, more than 3,500 individual service products have been defined. This work has taken place under the auspices of the North American Product Classification System (NAPCS), a joint, multi-phase initiative to develop a comprehensive demand-oriented product classification. To provide a flavor of the detail that these new product lists contain, we provide a sample from the provisional product list for Software Publishers, Internet Service Providers, Web Search Portals, and Data Processing Services (NAICS industries 5112, 518, 54151) in Table 3. What is important about these product definitions is that they are extremely detailed in terms of what they do, and in many cases do not, include. This level of detail, if fully deployed in our statistical system, would go a long way toward filling the data gap in services trade.

Although the product descriptions in NAPCS are provisional and have not yet been developed into a full-blown, hierarchical product code system, and have so far only been assigned reference codes for use by the NAPCS working group, they represent a significant step in the direction of defining the characteristics of services for data collection purposes. **The main task, therefore, is to**

fully develop and deploy these new NAPCS product descriptions across the Canadian statistical system. This does not mean that all respondents should have to choose among 3,500 product definitions. As with the product codes for goods, the survey questions will need to be tailored to the specific products typically produced (outputs), consumed (inputs), and traded by firms operating in specific industries.

Table 5. Sample Descriptions from the North American Product Classification System (NAPCS); Provisional Service Product List, Samples from the Software Publisher, Internet Service Provider, Web Search Portal, and Data Processing Services Industries

Working Group Code	Product Title	Product Definition
1.2.1.1	Customization and integration of packaged software	Adapting (modifying, configuring, etc.) and installing an existing application so that it is functional within the clients' information system environment. This service may include custom programming and training. Excludes: service contracts where this service is bundled with the hosting and management of the application on an on-going basis are classified to the appropriate sub-category of the Hosting and IT Infrastructure provisioning services under 1.3, Hosting and information technology (IT) infrastructure provisioning services.
1.2.1.2	Database design and development services	Designing the structure and content of a database and/or of writing the computer code necessary to create and implement a database (data warehouse). Excludes: service contracts where the design and development of a database is bundled with the on-going management of the data holdings are in 1.3.6, Data management services.
1.2.1.3	Custom programming services, except web sites, database, and packaged software integration	Designing the structure and writing the computer code as necessary to design, develop, and implement a custom software application, other than programming for websites, databases, or packaged software integration.
Continued…		82 additional definitions in these three industry categories (1 of 99 lists).
Total		3,500 definitions in 370 service industry categories in 99 lists.

Source: United States Census Bureau, Provisional Product List for NAICS 5112, 518, 54151: Software Publishers, Internet Service Providers, Web Search Portals, and Data Processing Services, http://www.census.gov/eos/www/napcs/napcs.htm.

Our first recommendation, therefore, is for Statistics Canada to lower the thresholds for mandatory reporting by services establishments, implement the North American Product Classification System (NAPCS) for the collection of product detail for traded services, and continue to use the North American Industrial Classification System (NAICS) for reporting industry detail, with more detail collected and reported. The collection instruments for affiliated and unaffiliated trade should be made consistent and more resources should be made available for

maintaining mailing lists. These data should be collected at the establishment level (as they are in the manufacturing sector), rather than using firm-level collection instruments, because this provides a much more precise view of the sectoral and geographic characteristics of economic activity.

6 Collecting data on business functions

Our second, and main, recommendation is that establishment-level economic data be collected according to a set of generic business functions, such as strategic management, new product development, operations, marketing and sales, technology and process development, etc. We present a list of business functions, along with their definitions, in Table 6. Business functions contain activities that individual establishments may provide internally or obtain from a variety of outside sources, including other establishments owned by the same parent firm and establishments owned by legally separate firms. To understand how domestic establishments fit into GVCs, is critical to know if such input and service providers are located nearby, in more distant domestic locations, or in other countries. Of course, testing would be needed to develop appropriate cut-offs for collecting data on linkages to affiliates and outside vendors, since establishments typically obtain inputs (goods and services) from multiple sources. Whether data would be collected on the most important supplier, the two most important suppliers, or in more detail is something that would need to be worked out in practice. It is also important to know if offshore inputs and services originate in low or high wage societies. Again, the appropriate level of detail on the location of externally sourced business functions (e.g., type of country, country, or sub-national region, or exact address) is something that will need to be worked out in practice.

Data collected according to business function will provide researchers with a rough map of the value chain, allow researchers to derive the roles that domestic establishments, firms, and industries play within GVCs, and provide a unique view of the competitive pressures facing domestic firms and industries. When combined with existing data on employment, occupations, wages, worker career paths, firm performance, technology development, e-commerce, etc., data on business functions will open up important new avenues for research and policy analysis. Because business functions are generic with respect to industry, they will allow researchers to aggregate results and make comparisons across industries.

Table 6. Twelve generic business functions and their definitions

Business function	Definitions
Core business functions	
1) Strategic management	Activities that support the setting of product strategy (i.e., deciding what "new product development" works on), choosing when and where to make new investments and acquisitions, or sales of parts of the business, and choosing key business partners (e.g., suppliers and service providers).
2) Product development	Activities associated with bringing a new product or service to market, including research, marketing analysis, design, and engineering.
3) Marketing, sales and account management	Activities to inform buyers including promotion, advertising, telemarketing, selling, retail management.
4) Intermediate input and materials production	The fabrication or transformation of materials and codification of information to render them suitable for use in operation
5) Procurement and purchasing	Activities associated with choosing and acquiring purchased inputs
6) Operations (industry code)	Activities that transform inputs into final outputs, either goods or services. This includes the detailed management of such operations. (In most cases, operations will equate with the industry code of the establishment or the activity most directly associated with the industry code.)
7) Transportation, logistics, and distribution	Activities associated with transporting and storing inputs, and storing and transporting finished products to customers.
Support business functions	
8) Corporate governance	Activities associated with the administration of the organization, including legal, finance, public affairs, government relations, accounting, and general management.
9) Human resource management	Activities associated with the recruiting, hiring, training, compensating, and dismissing personnel.
10) Technology and process development	Activities related to maintenance, automation, design/redesign of equipment, hardware, software, procedures and technical knowledge.
11) Firm infrastructure (e.g., building maintenance. and IT systems)	Activities related to building maintenance, and ITC systems
12) Customer and after-sales service	Support services to customers after purchase of good or service, including training, help desks, customer support for guarantees and warranties.

Source: Adapted from U.S. Bureau of Labor Statistics, Mass Layoff Survey Program.

Effective policy responses to the changes wrought by globalization will require a clear and timely view of the process based on solid economic data. In large part, as we have argued in the paper so far, such data do not currently exist. On the other hand, collecting data on the full range of key GVC variables (power in the chain, complexity and codifiability of exchanged information, competence), on a global basis, is too great a task to undertake as an initial step. Nevertheless, better data are urgently needed and most importantly, the data must provide the detail required to support policies that are supple enough to be implemented when and where they are needed.

The collection of detailed economic statistics requires detailed categories for collecting and publishing data. Classification systems that are standardized across data collection programs managed by different government agencies, both within Canada and internationally, vastly increase the comparability of official statistics and ease the matching of the "micro-data" generated. Because globalization has been occurring at the same time that firms are fragmenting and re-bundling their value chains, **we recommend that Statistics Canada collect establishment-level data according to a set of generic business functions**. Establishment-level data provides maximum flexibility: it can be aggregated to the firm level, and also aggregated with unaffiliated establishments to provide metropolitan-level estimates and, if similar data is collected in other countries, aggregated and compared internationally. Nationally representative surveys should ask which business functions are performed by internally at the establishment, which are done by another part of the parent firm, and which are done by outside suppliers. A further, critical step is to ask where each business function is located, whether it is performed at the establishment, or by the parent firm, or by an outside vendor. These data will provide a unique view of the roles that Canadian establishment and their workers play in global value chains.

Business function data, by itself, can provide only a dim picture of the role that establishments play in global value chains. Asking if business functions are done, or not done, within an establishment, without somehow quantifying the activities that take place within each function, will be provide very limited utility. How would collecting data according to business function reveal how Canadian firms and enterprises are situated within GVCs? For demonstration purposes, we have invented some false business function data for three "ideal type" enterprises of equivalent size, each employing 220 people. The first is a "traditional firm," with all business functions in-house. The second is a "contract manufacturer" that provides manufacturing services for other firms. This firm has more workers in manufacturing and none in product development, marketing, or after sales service. The third firm is a "design only" firm that has few workers in operations but large numbers in procurement (for parts used by contract manufacturers), product design, and after-sales service. The traditional firm represents a vertically integrated firm, while the contract manufacturer and design only firm may each specialize in a specific bundle of business functions, and work together to produce a complete product. The invented employment and wage figures for each type of firm are shown in Table 7. Employment is displayed graphically in Figure 2.

We have also taken the liberty of inventing average wages for workers in each business function, again purely for demonstration purposes. Because we have assumed that employment in the contract manufacturing firm is weighted toward lower paying jobs in operations, and away from higher paying job associated with technical functions, the contract manufacturer has a lower total wage

bill than the traditional manufacturing firm. The design only firm, however, has a higher wage bill that the traditional manufacturing firm because we have assumed its business function mix to be the opposite the contract manufacturer.

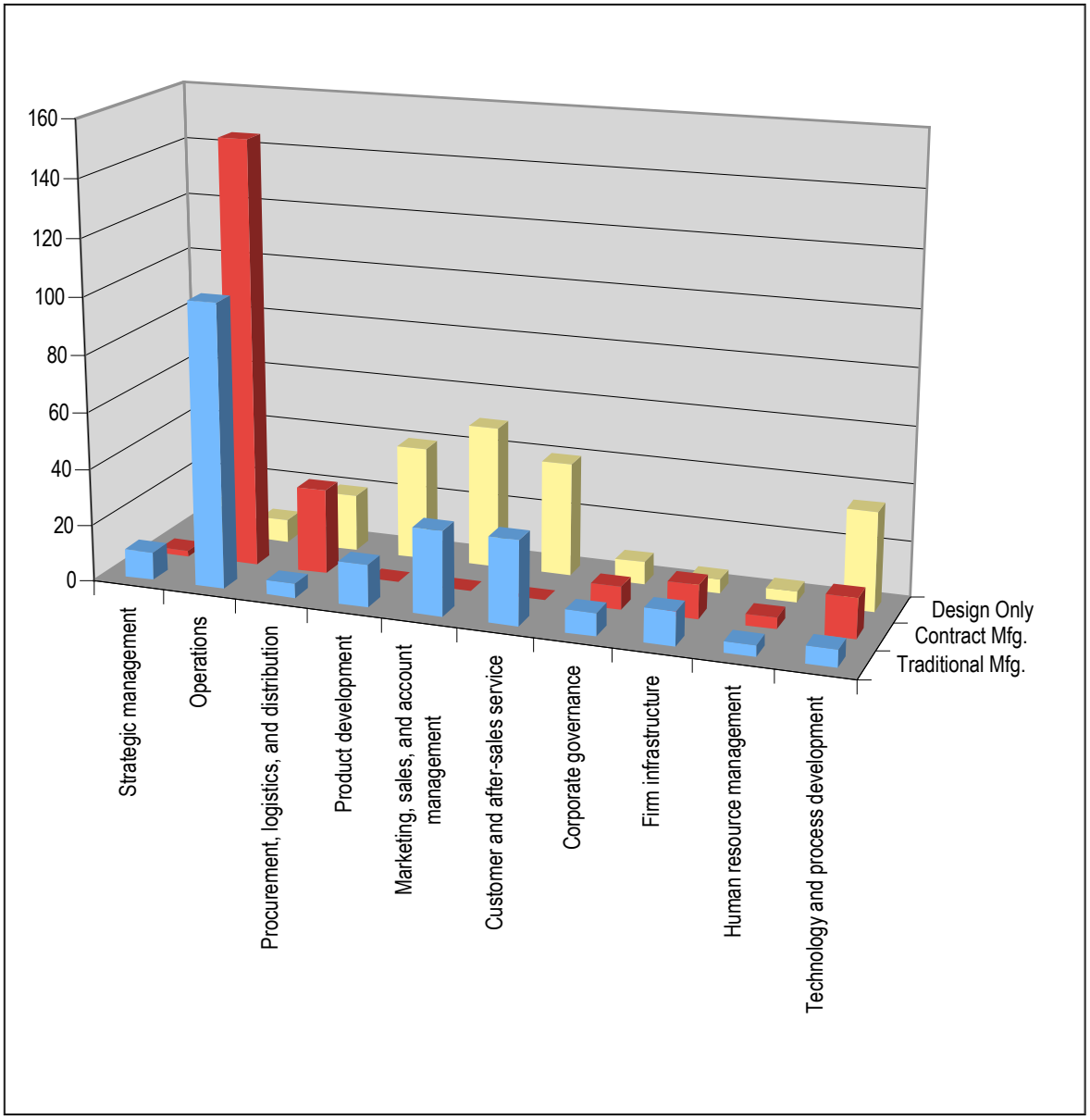
Table 7. Hypothetical employment and wage data according to business function for three types of firms

	Traditional Mfg.	Contract Mfg.	Design Only	Annual wage
Strategic management	10	2	10	$200,000
Operations	100	150	8	$50,000
Procurement, logistics, and distribution	5	30	20	$75,000
Product development	15	0	40	$100,000
Marketing, sales, and account management	30	0	50	$100,000
Customer and after-sales service	30	0	40	$50,000
Corporate governance	8	8	8	$120,000
Firm infrastructure	12	12	5	$75,000
Human resource management	4	4	4	$75,000
Technology and process development	6	14	35	$100,000
Total employment	220	220	220	
Total wages	$16,135,000	$13,710,000	$20,035,000	

Of course, in the real world, wages within the same business function often differ in different firms and locations, and design only firms tend to have fewer employees. This simple example, with wages by business function held constant across firms of identical size, demonstrates only a small part of what could become a very rich data set. In addition to employment and wage data, occupation and education could be parsed according to business function. Because the business functions are generic in respect to industry, they can be aggregated to provide an overall view of organizational changes and GVC linkages in the Canadian economy. Different business function mixes could be examined for complementarities, and the path of vertical re-bundling could be traced in various industries.

Geographic data and firm-level organization data could easily be included in an establishment-level data collection effort on business functions. Respondents could be asked where complimentary business functions are located, both geographically (by country or sub-region within or outside of Canada) and organizationally (within the firm or outsourced). It is this combination of organizational and geographic data that could begin to shed light on the extent and character of Canada's GVC linkages with the rest of the world. The long-term goal should be to use the Canadian data collection effort as proof-of-concept, with the long term goal of rolling the data collection effort out to OECD countries and beyond. Comparative country data would go a long way toward revealing the role of national industries within larger GVCs.

Figure 2. Hypothetical employment according to business function for three types of firms



Specifically, collecting data according to business function, and combining the results with existing data, will allow the Canadian statistical system to provide policy makers with better insight into the following questions:

1) What business functions Canadian establishments are doing internally and externally (outsourcing)?
2) What business functions are Canadian establishments doing domestically and abroad (offshoring)?.

3) What types of jobs go with various business functions, including employment by occupation, wages, tenure, and number and type of new hires in past 12 months?
4) What educational and training requirements are associated with various business function combinations?
5) How do the business functions that an establishment engages in relate to the goods and services bought and sold (inputs and outputs)?
6) How do the business functions that an establishment engages in relate to its economic performance (market share, profitability, employment) and how does this compare to establishments with the same and different value chain specializations?
7) How do the business functions that an establishment engages in position it within its industry, both domestically and globally (e.g., share of value added, market share)?

7 Conclusions

The emergence of global value chains is being driven by vertical fragmentation, where firms specialize in providing specific bundles of goods and services to a larger network of firms. This bundling and packaging of functions by suppliers lowers barriers to global sourcing yet further, setting in motion a cycle of increased supply-base competence and increased outsourcing and offshoring that we clearly have not seen the end of. The "co-evolutionary" view of global-scale economic integration (Sturgeon and Lee, 2005) that is embedded in the GVC framework emphasizes that existing patterns of globalization work to alter future patterns. For example, we must consider the possibility that the pace of globalization observed in manufacturing industries since the 1970s will be a poor indicator of what is likely to happen in services. The offshoring of computer hardware production began at a time when the firms in societies receiving this new business had few capabilities. International communications systems were slow, unreliable, of limited functionality, and very costly to use. Services offshoring, by contrast, is expanding with the infrastructure, firm capabilities, and business models that have been established, tested, and refined in support of global manufacturing already in place. Integrative trade in services, then, will flow down the well-trodden avenues in the global economy that were put in place largely to support global-scale goods production: across highly functional and low-cost broadband communications systems, through cross-border business relationships that have now been in place for decades, according to business models regarding outsourcing and offshoring that have been worked out in exquisite detail, and through firms with huge, well established multinational operations. Looking to the future, we cannot and should not pretend to know precisely how much or what kind of economic activity will flow across these pathways, but we

cannot afford to be complacent. The long-term prospects for any country may be less certain given the vastly altered playing field on which global integration is unfolding.

The lessons for research and policy are numerous. New thinking is needed to develop useful insights into the character and implications of our increasingly globally integrated national economies. Long cherished notions and responses may need to be set aside, to be replaced or at least supplemented with new theoretical frameworks, data collection efforts, and policy initiatives. Perhaps the most pressing need is for new kinds of data to be collected, data that sheds light on the position of domestic firms, establishments, and workers in global value chains. We have suggested two initial remedies in this paper, to collect more detail on services trade and to deploy a new classification scheme on business functions, but there are many additional efforts that could, and should be made. The task is large, and very urgent.

Almost all serious scholars of economic development agree that trade and geographic specialization have been sources of wealth creation, at the aggregate level, for thousands of years. At the same time, few disagree that specific communities, occupations, and demographic groups can suffer disproportionately in this process. It seems self-evident (to us, at least) that government programs are needed to ameliorate this suffering. At the same time, it is quite clear that innovation can create new sources of wealth in excess of what's been lost through import competition. In other words, comparative advantage is dynamic.

Gomory and Baumol (2001), we can call them the trade skeptics, for lack of a better term, have tried to launch a different debate. They ask if it's *theoretically possible*, in a near or distant future, for trade to harm national economies at the aggregate national level, and conclude that it is, under certain conditions. Similarly, Alan Blinder's view is that shifts in comparative advantage, if rapid enough, can overwhelm the adjustment mechanisms of individual nations; that tipping points can be reached, even in extremely innovative, flexible and dynamic economies like the US and Canada (Blinder, 2005; Wall Street Journal, 2007). These are reasonable hypotheses, posed by excellent scholars, yet the trade policy debate is continually framed simplistically: Is globalization always good or always bad?

There is a reason that the globalization debate remains so impoverished. The data that economists use to argue their positions, one way or another, are outmoded. They are based almost entirely on assumptions of unitary national economies trading finished physical products at arms-length. The shift to services and services trade, digitization of business processes, the spike in intermediate goods trade, and the "compression" of development in places like China and India — all either symptoms or enablers of global value chains — have changed the rules of the game, and our data regime has not kept up. As a result, economic models are stretched too thin. Proxies are

substituted for real data too often. Proxies carry assumptions, and assumptions carry ideologies. The policy debate becomes less scientific, more ideological, and largely unproductive. But the problem is larger than shrill and unproductive policy debates. As the global economy changes and our data collection regimes do not, our economic vision begins to dim. The upshot is that even if there was consensus that negative aggregate outcomes from international trade are *theoretically possible*, policy-makers would have no way to monitor the situation and act appropriately, from a policy standpoint, if the need were to arise.

When mainstream trade economists dismiss the trade skeptics' arguments (Wall Street Journal on-line, 2007), and even their questions, and in effect say, "don't worry, what's been true in the past will be true in the future," they inadvertently derail any unanimous call to update our data regimes. Their reticence is understandable. Given scarce resources, it seems that significant new investment in improving our data resources will only come if the alarm is raised, for example by admitting that it is at least *theoretically possible* for trade to have negative aggregate outcomes for specific countries. The fear is that such an admission will open the door to blunt protectionism, which almost certainly would retard economic growth. While this is a real dilemma, we need the muster the courage, intellectual curiosity, and political will to act. If trade and deeper global engagement is always good, then better data and the application or more nuanced conceptual tools will bear this out. If not, at least we'll be able to act, and act appropriately, before it is too late.

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