GVC Modules and Applications

Seminar on Accounting for Global Value Chains
Wednesday, June 7, 2017

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Outline

I. What are value chains? How are they different?
II. Definitions and data sources
III. Example of GVC mapping/analysis in Costa Rica
Introduction to GVCs

- Proliferation of the term “GVC” over the last 5-10 years to describe anything pertaining to trade, firms, and countries.

- All related to production fragmentation and coordination, but different motives, approaches and definitions of GVCs

- Three groups
  - Social science & geography academics (1990s; GCC, GVC, GPN)
  - International NGOs and national governments (funders/implementers); 2000s
  - Economists & national statistics offices (~2007; multi-country I-O tables, TiVA; however also original firm-level VC approach 1980s).

- Benefits from combining (a) theoretical insights and industry experience from ‘traditional’ GVC research and (b) data and analysis from economists and statistics agencies.
What is a Value Chain?

- Input-output (supply chain of products or services*)
- Value-adding activities (services)

- Firms (establishments/enterprises), which are a composed of workers with different jobs (occupations), that perform activities that result in tangible goods (products) or provide services, that can generally be grouped together by similar activities (industries/sectors).
- These activities are rarely performed by one enterprise or country, giving rise to ‘global’ value chains.
Global Value Chain Framework: Theory

- Maximizing factors of production doesn’t fully explain why some countries and firms are successful.
- Where does power and control come from in this interrelated set of activities? What determines who makes things, where they are made, and at what price?
- Governance (firms)
- Institutions (government/policy)
- As global trade increased, researchers looking for a way to explain why things happen. Found that industries operate in similar ways.
What is GVC Analysis?

• Define an *industry* using the four variables
  • Input-output of products and services
  • Geography
  • Important firms
  • Institutions (policies)

• Determine opportunities for upgrading (and identify bottlenecks and policy recommendations)
  • Process
  • Product
  • Backward linkages
  • End market
  • Chain
  • Functional
GVC Key Point #1: A GVC is *industry or sector-specific*

- The types of jobs, technologies, standards, regulations, products, and processes are all unique. So are the ways in which buyers and suppliers interact. The importance of each element varies by stage within the chain.

- Policymakers need to understand how specific industries operate. This is particularly important when selecting industries to target and developing policies that will enhance competitiveness, ideally in a way that provides economic, as well as social and environmental benefits.
GVC Key Point #2: Need to link to classification systems

• A missing piece of presentations/chapters that would be helpful is to identify how the specific account/data source could be linked to a classification system.
• Is it linked already?
• Could it be linked by adding a question related to industries or products?
• Which countries collect data? How often? At what detail? (Even if not published).
• Data linking by an enterprise ID is needed, but this also needs to be linked back to an industry.
GVC Key Point #3: Reconfiguration of data

• A value chain spans the entire range of products, services and firms involved in this process, which crosses the traditional boundaries of how sectors or industries are defined in national accounts. A value chain includes service activities such as sourcing or back office accounting that are considered industries themselves.

• For example, the apparel manufacturing industry is just the cutting and sewing of fabric to make clothes. The apparel value chain begins with the production of fibers (part of the agriculture or chemical industry), which are transformed into yarn and then fabric by the textile industry, are assembled by apparel manufacturers, are distributed by intermediaries in the wholesale sector, and are sold to consumers by the retail industry.

• GVCs emphasizes the importance of the relationships among firms in the chain. This distinction is important because the firms responsible for the higher-value, service-related activities are often performed by different firms based in different countries than those engaged in producing the final product and its components.
Definitions and Data Sources

How to Construct a GVC
Levels of Data Collection & Primary Classification Systems

• Enterprises/establishments/business units
  • ISIC, basis of national accounts?

• Products/services
  • CPC, HS, EBOPS

• People/workers
  • ISCO

• Business functions
  • Usefulness will depend on ability to associate with other classification systems.

• All other accounts and surveys
  • How can we minimize burden by adding questions on industries or products?

Need to be able to compare data across classification systems and countries
Four Parts of Value Chain Model

SUPPLY CHAIN STAGES

Raw Materials | Components | Final Products | Distribution & Sales | Markets

Agriculture, Forestry & Fishing (A)
Mining & Quarrying (B)

Manufacturing (C)

Wholesale & Retail Trade (G)
Transport & Storage (H)
Admin & Support service activities (N)

END MARKETS/Buyers & Supporting Industries

Universities & Education (P)
Utilities (D, E)
Financial and insurance activities (K)
Information and communication (J)
Professional, scientific and technical activities (M)

Describe by type of market or industry; use ISIC divisions

Source: Frederick, S. (2014). Represents ISIC 4 sections

KEY VALUE-ADDING ACTIVITIES
Business Functions

Top row: Non-manufacturing activities that account for most “value-added”
ISIC and National Account Limitations

• Codes represent a mix of GVC concepts (business functions, supply chain position, markets)

• Codes do not provide adequate level of industry-specific detail beyond sections A, B & C

• Why? Because ISIC was developed before enterprises ‘unbundled’ manufacturing and services, and the span of ‘services’ that add value to a product was relatively nascent.
Electronics GVC based on ISIC4

GVCs cover multiple sectors

Manufacturing
Chemicals, Machinery

Primary

Components/Inputs

Electronic Components: 2610
Software: 5820
Metal
Plastic

Manufacturing, Services (Software)

Final Products

Computers: 2620
Communication Equipment: 2630
Consumer Electronics: 2640
Industrial Equipment: 2651
Medical, Optical: 2660, 2670

Wholesale

Intermediaries (B2B) & Lead Firms

Computers: 4651

Retail

Lead Firms & Retailers: B2C

Computers: 4652

4741, 4742

Assigned based on primary source of value-added (or employment?)
Apparel GVC based on ISIC4

GVCs cover multiple sectors

Agriculture and Manufacturing (Chemicals, Machinery)

Manufacturing

Wholesale

Retail

In buyer-driven chains, this segment is very important. Several layers just here can be involved.
Data/Process to Construct GVC

• Define the industry/value chain by market research and firms
• Define template GVCs using classification systems of codes (ISIC, CPC, HS, ISCO);
  • Start with ISIC C (manufacturing); 24 total and narrow down; case studies so far: Apparel (or textiles/apparel): 14, automotive (29), electronics (26), medical (other mfg. 325)
• Use definitions to build a global and country-level picture
• National level industrial data
• Trade data
• Linking data by enterprise
• Interviews/review secondary data to validate
Key Points

• Most of the accounts discussed are not useful for doing GVC studies because not industry-specific, or connected to a classification system, BUT

• The ‘raw data’ collected as part of the annual surveys, trade data; and linking these together at the firm-level are more useful for GVC studies than national accounts.

• SUTs and input-output tables, but primarily for mapping the industry-specific flow of goods and services.

• To make it a GVC based on data, must define codes in each classification system and use this to benchmark.

• More detailed data and codes are needed for wholesale, management, transportation, R&D OR, if determined that all firms labeled in manufacturing, the business function survey will help.

• Occupation data at the firm-level is the main piece of information not collected that would be helpful.
Costa Rica Example

Medical Devices: Examples on how trade, industrial statistics and SUTs can be layered in

Electronics and Services: Classification Issues in Practice
Medical Devices Global Value Chain

Research & Product Development
- Prototype
- Process Development
- Regulatory Approval
- Process Development
- Sustaining Engineering

Components Manufacturing
- Software Development
- Electronics/Electrical Components
- Precision Metal Works
- Plastics Extrusion & Molding
- Weaving/Knitting Textiles

Assembly
- Assembly
- Packaging
- Sterilization

Distribution
- Final Products
  - Capital Medical Equipment
  - Therapeutic Devices
  - Surgical & Medical instruments
  - Disposables
- Market Segments
  - Cardiovascular
  - Orthopedics
  - Infusion Systems
  - Others

Marketing & Sales
- Consulting
- Maintenance, Repair
- Training

Input Suppliers
- Resin
- Metals
- Chemicals
- Textiles

Buyers
- Wholesale distributors
- Doctors & Nurses
- Hospitals (Public/Private)
- Individual Patients

Source: Bamber & Gereffi (2013). Costa Rica in the Medical Devices GVC. Fig. 1, p. 9. Duke CGGC Report for COMEX.
Medical Device Dynamics

• Lead firms are in the U.S. and Europe
• Ultimate buyers are institutions/B2B (not consumer market)
• Outsourcing and offshoring relatively uncommon
• Why? High level of risk; standards/certifications required; limited capabilities in the supply base
• When the lead firm is the ‘brand’ or manufacturer in the home country, it makes mapping easier.
Costa Rica in the Medical Device Global Value Chain, 2012: Mapping based on Secondary Analysis and Firm Interviews

Sources: Duke CGGC 2012 Report: Costa Rica in the Medical Device GVC. Number of firms based on interviews with key stakeholders and a secondary review of the literature. Trade data from UNComtrade.
Costa Rica in the Medical Device Global Value Chain, 2014/15: Number of Firms

Define in terms of an ISIC code

# of firms: 28
Employment: 1,400
Turnover
Output
Taxes paid
Value-added

Data used in national accounts, but also other data points.

Assembly / Production

Medical Devices (AE080/ISIC 3250): 28 establishments

Data Sources: BCCR, Costa Rica
### Define by ISIC and Link to HS/CPC

<table>
<thead>
<tr>
<th>Product Sector</th>
<th>HS Codes</th>
<th>CPCv2</th>
<th>Incl. based on ISIC4 (325)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>9019, 9020</td>
<td>48160</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Disposables</td>
<td>9018.3, 50, 90</td>
<td>48150</td>
<td>Yes</td>
<td>Would consider 901850, 90 to be with instruments.</td>
</tr>
<tr>
<td>Instruments</td>
<td>9018.41, 49</td>
<td>48130</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Therapeutics</td>
<td>9021.10 - 39</td>
<td>48171</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Therapeutics</td>
<td>90214, 5, 9</td>
<td>No</td>
<td>Electronic medical devices</td>
<td></td>
</tr>
<tr>
<td>Capital Equip.</td>
<td>90181, 90182, 9022</td>
<td>No</td>
<td>Electronic medical devices</td>
<td></td>
</tr>
<tr>
<td>Sterilizers</td>
<td>841920</td>
<td>48140</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Glasses</td>
<td>9004</td>
<td>48312</td>
<td>Yes</td>
<td>Only 900490 900410 (sunglasses, not typically a medical device)</td>
</tr>
<tr>
<td>Glasses</td>
<td>9003.11, 19</td>
<td>48313</td>
<td>Yes</td>
<td>Not entirely for medical devices (sunglasses)</td>
</tr>
<tr>
<td>Lenses</td>
<td>9003.90</td>
<td>48352</td>
<td>Yes</td>
<td>Not entirely for medical devices (sunglasses)</td>
</tr>
<tr>
<td>Furniture</td>
<td>900130, 40, 50</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Furniture</td>
<td>9402</td>
<td>48180</td>
<td>Yes</td>
<td>Do not agree, but needs further evaluation</td>
</tr>
</tbody>
</table>

- ISIC category 3250 which covers "manufacturing of medical and dental instruments and supplies".
- ISIC and HS code definitions of industries will not always line up. In Costa Rica they did, but is a small country without intermediaries. In China, only half of apparel trade was by apparel manufacturers. Alignment in ‘producer-driven’ chains better than ‘buyer-driven.’
Costa Rica in the Medical Device Global Value Chain, 2015: Share of Medical Exports: UNComtrade

Assembly / Production


- Disposables-44% US$934 million
- Instruments-32% US$680 million
- Therapeutics-20% US$423 million
- Capital Equip.4% US$81 million
- Other. < 1% US$1 million

In GVC terms, can be used to show product upgrading or diversification

Data Sources: Trade data: UNComtrade.
Ability to Compare/Benchmark to Other Countries

Ireland's Medical Exports by Product Category: 1998-2015

Mexico's Medical Exports by Product Category: 1998-2015
Costa Rica in the Medical Device Global Value Chain, 2015: Share of Medical Exports and Number of Exporters: UNComtrade and Establishment-Level Export Data of ISIC-based Firms

Of the 28 firms, able to put 22 into a more specific sector using export data. Two were not primarily exporters of correlated HS codes, and four exported similar shares in multiple sectors.

Data Sources: Trade data: UNComtrade
Number of assembly companies: based on my analysis of companies in AE080 and product sectors based on HS codes.
Manufactured inputs account for 64% of intermediate purchases.

We can also do this for services (which account for the remainder of purchases), but these are the segments where we can compare with the trade data by HS codes.

Data Sources: 2014 SUT for AE080
Table 1: Cuadro de Oferta y Utilizacion Detallado, Oferta de Productos a Precios Basicos y su Utilizacion a Precios de Comprador
Number of assembly companies: based on my analysis of companies in AE080 and product categories based on HS codes.
Number of establishments in medical devices: BCCR, Costa Rica
Costa Rica in the Medical Device Global Value Chain, 2014/15: SUT for Medical Devices to Identify Intermediates Consumed

Can further divide this into primary and processed.

Data Sources: 2014 SUT for AE080
Table 1: Cuadro de Oferta y Utilizaction Detallado, Oferta de Productos a Precios Basicos y su Utilizacion a Precios de Comprador
Number of companies in the free zones in 2014 within each category (an ‘upper bound’). This can be redone with # of companies outside the special regime, however MOST export-oriented firms make very few purchases outside the zones. Knowing the number would provide economic developers with a target of companies that could upgrade capabilities to become suppliers.

Data Sources: Number of component companies in the Special Regime, 2014, from BCCR.
Trade data: UNComtrade
Number of assembly companies: based on Stacey’s analysis of companies in AE080 and product categories based on HS codes.
Upgrading potential backward linkages

Different products require different intermediate products

Could also be done with underlying data to create SUT

Can be further used to make proxy for technology-intensity

Costa Rica in the Medical Device Global Value Chain, 2014/15: Establishment-Level Import Data of Exporters

Data Sources: Import data (2014) of medical device (AE080) companies primarily exporting medical devices (26/28)
Costa Rica in the Medical Device Global Value Chain, 2014/15

• Use the SUT data to also map purchases of services (about 36% in 2014), of which:
  • Royalties (AE118): 20%
  • Admin/office support activities (AE123): 4.5%
  • Public services: 3%
  • Other: 8%

Data Sources: 2014 SUT for AE080
Table 1: Cuadro de Oferta y Utilización Detallado, Oferta de Productos a Precios Basicos y su Utilización a Precios de Comprador
Costa Rica in the Medical Device Global Value Chain, 2014/15: Layering in Employment and Wages

- Disposables account for largest share of employment (and exports), but avg. wages/worker are lower.
- Within a GVC, ideally want to be able to move into sectors that offer higher-paying jobs or more skill-intensity (but difficult to do with available data)
- Occupation data would be better
What Else?

Other Points

• Trade and investment is with the United States (branch plants of MNEs).

• Costa Rica has continued to increase exports, employment, backward linkages and value-added in medical devices, and acquire FDI in presumably more skill-intensive sectors.

What GVC Theory Tells Us

• However facilities are still branch plants of MNEs.

• The ability to take on the tasks the MNEs do in the U.S. is limited.

• The first activities outsourced tend to be sourcing and logistics-related.
What’s Not Available

• What the workers do; the ability for a company or a country to improve largely relates to skills and occupations.
  • This type of data is not collected at the enterprise level (if collected, often in household surveys)
  • Recommendations and benefits to policymakers were mostly in this area

• ISIC code of establishments that import products from Costa Rica (where linking country data would be useful).
Example: Costa Rica and Electronics

• Provides an example of how reporting under one code and accounting practices miss the ability to separate service and manufacturing activities.

• Manufacturing company initially set up an assembly plant in the country. However, over time shifted back office services (captive) and R&D/testing to the country as well. Workers in these positions accounted for one-third of the overall workforce, but no indicator of this in statistics. Observable in wages/worker only.

• Wages increased as a larger share of workers were in services instead of manufacturing.

• When manufacturing ceased, reclassified into a service code with no connection to electronics. However half of the firm’s operations were doing the same thing as in the past.

• **Question**: based on existing systems, how would this be recorded? If the service activities were treated a secondary activity and entity from an accounting standpoint, they would have no connection to the electronics industry (which is the case now).