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**Working Paper**

## Framework of Learning and Upgrading in Global Value Chains

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# India's Manufacturing in Global Value Chains

A Study of Its Extent, Drivers, and Impacts

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# Proposal Outline

- 1 Background
- 2 Literature Review
- 3 Research Issues
- 4 Specific Objectives
- 5 Research Methods & Data
- 6 Tentative Chapters
- 7 Appendix

# 1. Background

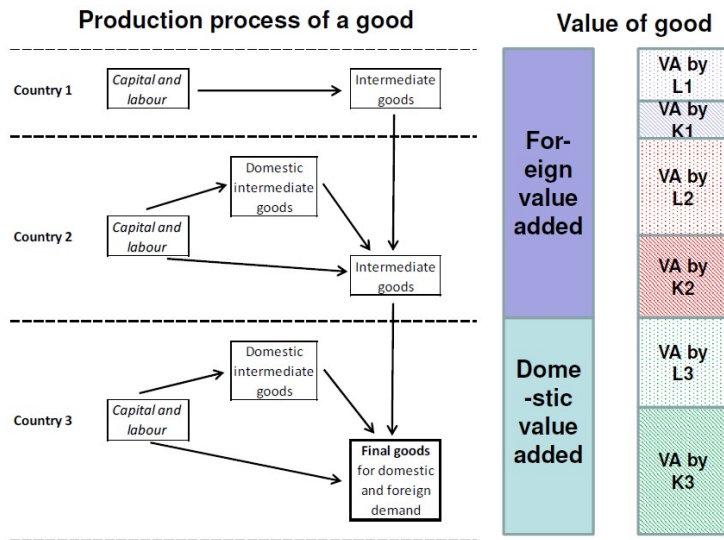
- This research is all about the workings of India's global production sharing/linkages in the context of value-added-trade (i.e. GVC Trade)
- The development of Trade in Value-Added (TiVA) database represents a fundamental step forward in practical understanding of GVC trade
  - Existing database is presented for 34 unique industrial sectors, including 16 manufacturing and 14 services sectors, as well as related aggregates (such as total manufactures and total services)
- The foundational objective (practical) is – how can India make GVCs work for development? – a sound analysis of India's participation in GVCs
- It requires a wide range of indicators and concepts. No single measure or concept can be used to determine success or failure in GVC integration
  - GVC participation measures, by country, sector, and industry
  - Network analysis of international trade (in terms of value added)
  - Firm-level measures of GVC links

# Motivation (1) – Structure of Global Production & Trade

- Deepening of trade liberalisation with continuing transportation cost reduction and the ICT revolution, as well as some recent political developments, are expanding the reach of globalisation through a gradual fragmentation of production processes across countries ([Antras 2016](#))
- Echoing ([Feenstra 1998](#)), rising trade integration has coincided with the simultaneous disintegration of production across borders
  - A breakdown in the vertically-integrated mode of production-the so-called "Fordist" production
- Firms divide their operations across the world, from the design of product and manufacturing of components to assembly and marketing, creating global production chains ([WTO, Milberg & Winkler 2013](#))
- New wave of globalisation – More and more products are "Made in the World" rather than "Made in the USA" or "Made in China" ([WTO, Antras 2016](#))

Fragmentation

# Stylized Global Value Chain (GVC)



Source: [Timmer et al. 2014](#)

## Motivation (2) – Hollowing Out & Global Production

- “Hollowing-Out” issue of India’s Manufacturing – Falling value added intensity accompanied by declining share of the sector in GDP and total exports and falling employment elasticity ([Banga 2014](#)) ASI Data
  - Dualism with respect to ‘formal’, ‘informal’, and ‘missing-middle’ along with limiting regulations pose unique challenges to the growth of manufacturing
- Indian industries have become more integrated with the global production sharing – increased use of imported inputs has caused a generalised decline in domestic value added share for merchandise and total exports ([Goldar et al. 2017](#), [Veeramani & Dhir 2017](#))
- Despite India’s output and export growth, without the increasing domestic value added, there would be no significant production related gains like employment generation, technology upgrading, and skill development
  - It requires much more value added from India’s potential productive factors and upgrading quality & quantity of those factors with a strong distributional aspect of socioeconomic opportunities and outcomes



## Motivation (3) – Why do we care about analysing GVCs?

- Nowadays world trade is much more determined by the global strategies of MNCs to carry out their activities wherever the required skills and materials are available at competitive cost and quality across countries (OECD)
- Because of the opportunities for integrating in specific parts of the value chain, many developing countries with their large and small companies are increasing their participation in global trade and diversifying their exports (without producing a complete product)
- Data on the gross value of trade can be misleading – statistics and analyses are based on the value added in trade (data on value chains) – It has been large enough to be salient in 2-digit level industrial classification
- Tariffs, non-tariff barriers and other restrictive measures at the border are cumulative when intermediate inputs are traded across borders multiple times – impact not only on foreign suppliers, but also on domestic producers

## 2. Literature Review

- [Jones and Kierzkowski \(1990\)](#) provide a model of outsourcing to set out the factors for the production process to be more prone to international fragmentation – market size, connecting costs, and diverse factor costs
- The demand for labour becomes skewed toward higher skilled labour in the light of the respective skill standard of each economy, so the relative wages of low-skilled labour fall in both developed and developing countries ([Feenstra and Hanson 1996a, 1996b](#))
- [Grossman and Rossi-Hansberg \(2008a,b\)](#) introduced a “trade in tasks” concept to explain how an increase in offshoring feasibility affects the productivity and factor incomes of the offshoring country
- [Antras and Helpman \(2004\)](#) investigated the impact of within-sector heterogeneity in firm productivity on the firm’s globalisation decision – most productive firms undertake FDI, the next most productive firms take part in arm’s length offshoring, and so on
- [Antras and Chor \(2013\)](#) shed new light on the line of analyses by considering the type of sequentiality that characterises the production process affects the lead firm’s decision on the governance arrangements along that value chain

- Mapping global value chains by firm business records to identify the composition of inputs procurement or the sales networks of a product ([Dedrick, Kraemer, and Linden 2008](#), [Xing and Detert 2010](#))
- Mapping global value chains by input-output tables – supply-use relations between industries and across countries, which are totally absent from foreign trade statistics and it is possible to identify the vertical structure of international production sharing ([Hummels, Ishii, and Yi 2001](#), [Daudin, Riffart, and Schweisguth 2006](#), [Johnson and Noguera 2012](#), [Koopman, Wang, and Wei 2014](#))
- Accounting for within-sector heterogeneity in firm characteristics (as well as heterogeneity in labour markets) when constructing input-output tables ([Koopman, Wang, and Wei 2012](#), [Tang, Wang, and Wang 2014](#), [Ma, Wang, and Zhu 2015](#), [Timmer et al. 2014](#))
- Length model in the GVC context is to identify countries' (or industries') relative position within the global production system by comparing the pairs of forward-length and backward-length values ([Fally 2011](#), [Antras et al. 2012](#))

### 3. Research Issues

# Research Issues

- Three main factors behind the assessment of India's GVC integration and its measurements
  - **Functions in GVCs** – considering India's performance as a buyer as well as seller in global market
  - **Specialisation and domestic value-added contribution** – trends of specialisation in low or high value-added activities, and patterns of upgrading and development through GVCs
  - **Position in GVC network and type of GVC node** – hub, incoming spoke, or outgoing spoke, clustering properties, and centrality in the global network
- The multidimensionality of GVCs – relationships between flows of goods, services and flows of factors of production (workers, ideas, and investments) – going beyond value added to look at the actors in GVCs and assess the effects of GVCs on jobs and wages ([Taglioni & Winkler 2016](#)).

# Functions in GVCs: Buyer's and Seller's Perspectives

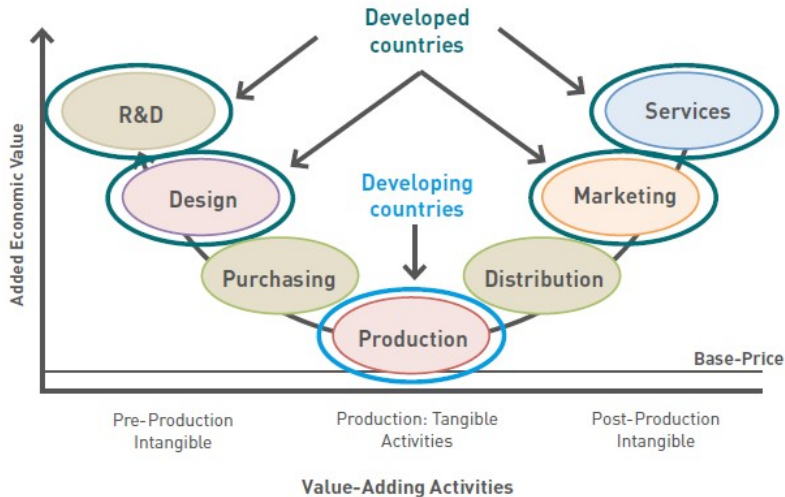
- The basic concept is "import to export" or I2E ([Baldwin & Lopez-Gonzalez 2015](#)) – two key measures of GVC participation
  - On the sourcing side (buyer's perspective), it indicates that India is buying parts from Japan in a GVC
  - On the sales side (seller's perspective), it indicates that India is using those parts in its exports to that GVC
- linked to the bilateral concepts of backward and forward vertical specialisation ([Gonzalez & Holmes 2011](#)) – "backward" refers to sourcing and "forward" to sales
- Three types of buyer roles in GVCs – input purchases (1) for the production of final exports, (2) for the production of intermediate inputs in the value chain, and (3) for assembly
- Three main seller functions – supply of (1) turnkey components, (2) primary inputs, and (3) other inputs

# Specialisation and Value Addition

- Economics of GVCs is a generation of value addition and its growth over the time – associated with the breadth, variety, and sophistication of tasks and activities in which India specialises
- Very broad range of activities in a value chain – highest value added with intangible activities (intensive in human capital and technology)
  - pre-production activities, such as basic and applied R&D and design
  - post-production activities, such as marketing, commercialisation, advertising, brand management, specialised logistics, and after-sale customer services
- Complex and fragmented production processes – economic development through industrial upgrading and densification
  - Industrial upgrading – gaining competitiveness in higher value-added processes, products, tasks, and sectors
  - Densification – engaging more local actors (firms and workers) in the GVC networks – aspect of social upgrading



# Smile Curve of High-Value Activities in GVCs



- Network analysis can trace the overall performance of India's different actors and trade links (quantified full patterns of made-here-sold-there trade), as well as its evolution
  - Strength (In-strength and out-strength) – sum of the market shares of trade inflows or outflows
  - Closeness – capturing mean distance from India to all its trade partners
  - Centrality – the location of India relative to the overall structure of the trade network through measures of "structural integration" in the network
  - Clustering – the transitivity of the network i.e. how much the neighbour countries of India are connected to each other in trade
- These can also illustrate other types of flows (for example, parts, components, services, or FDI) or flows in individual sectors or of specific products (Taglioni & Winkler 2016)

# Policy Implications: Entering, Expanding, and Sustaining

- ❶ **Entering GVCs:** attracting foreign investors and facilitating domestic firms' entry into GVCs.
  - Creating World-Class GVC Links – improved connectivity to international markets
  - Creating a World-Class Climate for Firms' Assets – assets protection and high-quality infrastructure and services
- ❷ **Expanding and strengthening GVC participation:** promoting economic upgrading and densification, and strengthening domestic firms' absorptive capacity.
  - Strengthening GVC–Local Economy Links – maximising the benefits from GVC spillovers
  - Strengthening Absorptive Capacity – including innovation capacity, which, for example, could be measured by research and development intensity
- ❸ **Turning GVC participation into sustainable development:** ensuring skill upgrading, social upgrading, and equitable distribution of opportunities and outcomes while promoting environmental sustainability.
  - Creating a World-Class Workforce – promoting skill development, social upgrading, and equitable distribution of opportunities and outcomes
  - Implementing Climate-Smart Policies and Infrastructure

## 4. Specific Objectives

# How Extensive is India's GVC Participation?

- Objective 1 proposes to examine the degree of India's GVC engagement (country-, sector- and industry-level) through informed classifications, backward integration, forward integration, overall GVC participation index, network metrics and visualisation, service integration, and firm-level measures
- The rudimentary concept of GVC trade is "import to export" or I2E ([Baldwin & Lopez-Gonzalez 2015](#)) – how much of India's export value is contributed by foreign countries and how much India is adding value to exports and final demand in third countries
- Firm-level analysis to capture the critical features of firm heterogeneity in GVC participation – multinationals' share of inputs from domestic suppliers, domestic suppliers' share of output to multinationals, domestic suppliers' share of exports, domestic producers' share of imported inputs

# What are the Determinants of India's GVC Links?

Objective 2 focuses on different drivers of heterogeneity in GVC links at the country, sector, industry and firm levels...

- The first step would decompose gross export growth (selling side) into its four value-added components for detecting how much of the value added is generated at home and abroad
- Correlations of GVC integration with country-level characteristics – logistics performance, skill levels, geographical distance to knowledge centers
- Drivers of firm-level entry – firm size, firm age, foreign ownership status, as well as measures of workers' skills and productivity as determinants of GVC participation
- If firm-level data – in particular, information on GVC participation – are not available, an alternative could be to estimate the impact of the policy determinants on sector GVC participation in India

# What are the Industrial Impacts of India's GVC Links?

- Objective 3 examines the role of India's GVC links for economic or industrial upgrading – growth of GVC links and domestic value added in exports, GVC links and domestic value added, GVC participation and firm-level productivity
- The first step measures economic upgrading through various measures of GVC integration at the sector level – Whether the intensity and nature of GVC links matter for growth in domestic value added that is exported or domestic value added, taking into account the mediating role of national policy
- The second step analyses (including firm-level measures) within-industry impact of FDI and within-industry impact of structural integration
  - Assesses how foreign investor characteristics, domestic firms' absorptive capacity, and India's institutional variables influence intra- or inter-industry productivity spillovers to domestic firms from FDI
  - Analyses GVC participation of an industry on a firm's productivity by two sector measures of structural integration in GVCs

# What are the Social Impacts of India's GVC Links?

- Objective 4 addresses which GVC oriented industries have a higher demand for labour, such that integrating into GVCs in those sectors has a greater potential to create jobs and increase household income
- The first step assess the impact of the GVC-related measures listed previously on employment, wages and salaries, or the labour share, using regression analysis
- The second step is to present a more direct way to measure the link between GVC participation and labour market outcomes, by drawing on various indicators already developed in the literature, which are based on international input-output data
- The third step includes the impact of GVCs on the macro economy, as well as the links with working conditions, education and skills, other aspects of the society (for instance, poverty), and the environment.



## 5. Research Methods & Data

# Methods (1): India's GVC Links

- ❶ **GVC Participation Using Gross Trade Data** – comparing distributions of product-level exports with import values, volumes, and prices of the top traded products; informed classifications to extract information regarding meaningful clusters (value chain, technology etc.); trade flows at the sub-national level to account India's degree of value transformation within border
- ❷ **Buyer's Perspective (Methods of Backward Links)** – imported inputs embodied in gross exports (I2E in intermediate or total imports, I2E by source country, distinguishing between domestic and foreign Value added in imports); Value Added in Gross Exports (decomposition of domestic value added, full decomposition of foreign value added, length of sourcing chains)
- ❸ **Seller's Perspective (Methods of Forward Links)** – intermediates in output or gross exports; I2E trade in gross exports; domestic value added in gross exports & final demand of third countries; length of selling chains; domestic gap between buying and selling chains
- ❹ **GVC Participation (Methods from Macro to Micro)** – GVC participation index, network metrics & visualisation, role of services; exchange between MNCs and domestic suppliers, domestic suppliers' & producers' shares in trade

## Methods (2): Drivers of India's GVCs

- ① **Decomposition of Gross Export Growth** – examining the level of significance of gross export growth onto its components i.e. direct domestic value added embodied in gross exports (intra-sector), indirect (upstream) domestic value added embodied in gross exports, re-imported domestic value added, and foreign value added embodied in gross exports
- ② **Correlations of GVC Integration with Country-Level Characteristics** – initial insights can be gathered by assessing the statistical correlation between measures of GVC integration with the selected indicators (logistics performance, share of people with a tertiary education in the workforce, and geographical distance to the closest global knowledge center) at country level
- ③ **Determinants of Firm-Level GVC Entry** – following the literature on the firm-level determinants of exporting, the model includes firm size, firm age, foreign ownership status, as well as measures of workers' skills and productivity as determinants of GVC participation GVC Entry
- ④ **Determinants of Sector GVC Participation** – if firm-level data are not available, an alternative could be to estimate the impact of the policy determinants on sector GVC participation in India

# Methods (3): Industrial Impacts of India's GVC Links

## ❶ Growth of GVC Links and Domestic Value Added in Exports

- Growth of GVC Participation and Domestic Value Added Embodied in Exports
- Growth of Balanced GVC Participation and Domestic Value Added Embodied in Gross Exports
- Growth of Foreign and Domestic Value Added Embodied in Gross Exports
- Growth of Upstreamness and Domestic Value Added Embodied in Gross Exports
- Growth of Domestic Length of Sourcing Chains and Domestic Value Added Embodied in Gross Exports

## ❷ GVC Links and Domestic Value Added – It focuses on the effect of GVC integration, as a buyer and a seller, on domestic value added, also taking into account the mediating role of national policy

## ❸ GVC Participation and Firm-Level Productivity – The method focuses on the within industry impact of foreign output share on domestic firm productivity and the role of mediating factors; Similarly, the analysis can be used to examine the effect of GVC participation of an industry on a firm's productivity

# Methods (4): Social Impacts of India's GVC Links

## 1 Indirect Measures of Social Upgrading

- Descriptive statistics i.e. sector averages of the number of employees, wages and salaries, wage rate (wages and salaries divided by the number of employees), or labour share (wages and salaries as a percentage of value added)
- The labour market indicators are regressed on indicators of GVC involvement while controlling for other factors, such as region and gross domestic product. The analyst can also run pooled regressions controlling for industry fixed effects to see which industries have more labour-market-enhancing outcomes conditional on GVC involvement

## 2 Direct Measures of Social Upgrading

- Labour Content of Gross Exports
- Labour Component of Domestic Value Added in Exports
- Jobs Sustained by Foreign Final Demand
- Jobs Generated by Foreign Trade in GVCs

# Data Sources

- Production data – Industry-level data, firm-level data (Enterprise surveys or other firm-level surveys)
- Gross trade data (Comtrade, WITS), categorized using informed classifications (broad economic category, parts and components, technical classifications)
- International I-O data (WIOD, TiVA, World Bank Export of Value Added database) and National I-O data
  - Based on benchmark national supply- and use-tables (A), combined with time-series on  $v$  and  $F$  from National accounts statistics, and bilateral trade data from official statistical sources (by use category)
  - Socio-economic accounts including data on hours worked and wages by 3 skill types (educational attainment levels) and capital

# An Accounting Framework for Global Value Chains

## FROM: World input-output table

			Use by country-industries						Final use by countries			Total use
			Country 1			Country M			Country 1	Country M		
			Industry 1	...	Industry N	...	Industry 1	...	Industry N			
Supply from country-industries	Country 1	Industry 1										
		...										
		Industry N										
	Country M	Industry 1										
		...										
		Industry N										
Value added by labour and capital												
Gross output												

Input cost shares of industries (A)

F

V

$$G = v(I-A)^{-1}F$$

Leontief's trick:  
compute value added in all industries associated to final demand for a specific product

## TO: GVC cost-share table

			Final products of a global value chain, identified by country-industry of completion						Value added
			Country 1			Country M			
			Industry 1	...	Industry N	...	Industry 1	...	
Value added from country-industries participating in global value chains	Country 1	Industry 1							
		...							
		Industry N							
	Country M	Industry 1							
		...							
		Industry N							
Total final output value									World GDP

Factor cost shares of final products (G)

## 6. Tentative Chapters



# Tentative Chapters

- The chapters in this PhD dissertation would contribute some research findings that shed on several key challenges, which can be addressed with the tools described in the previous sections, include the following:
  - **Chapter 1:** Multidimensional Assessment of India's GVC Linkages
    - ❶ GVC Participation Using Gross Trade Data
    - ❷ Buyer's Perspective: Methods of Backward Links
    - ❸ Seller's Perspective: Methods of Forward Links
    - ❹ GVC Participation: Methods from Macro to Micro
  - **Chapter 2:** Drivers of India's GVC Links
    - ❶ Country-level characteristics and GVC links
    - ❷ Determinants of sector (industry-level) GVC participation
    - ❸ Determinants of firm-level entry
    - ❹ Entering GVCs
  - **Chapter 3:** Impacts of GVCs on India's Economic and Social Prosperity
    - ❶ Economic Upgrading of GVC Links
    - ❷ Expanding and strengthening GVC participation
    - ❸ Social Upgrading of GVC Links
    - ❹ Turning GVC participation into sustainable development

**Thank You!**

## 7. Appendix

# The role of foreign and domestic value added in exports

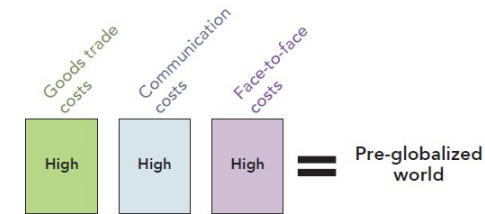
- The foreign content of India's exports has increased significantly from 10% in 1995 to 24.0% in 2011 – the second highest rate, after China, amongst BRIICS economies
  - Industries of highest foreign value added shares in 2011 were Coke & petroleum, Other manufacturing and Basic metals with 56.6%, 42.4% and 42.1% respectively, significantly higher than the shares in 1995 (26.6%, 16.3% and 18.5%)
- Of India's total exports of domestic value-added in 2011, 56.9% reflected exports of intermediates, significantly higher than in 2009 (47.4%), and in 1995 (46.9%); below the OECD average of 61.5%
- Industries of greatest sources of domestic value added in 2011 was Wholesale, retail & hotels industry with 12.6% of the total value added of exports, Business services (11.7%), Transport & telecoms (10.5%) and Coke & petroleum (4.8%)
- Of the total value of India's imports of intermediate products and services, just 27.5% was subsequently embodied in exports, lower than the OECD average (39.3%) but higher than in 2009 (23.5%) – Other manufacturing, ICT & electronics and Other transport, at 48.3%, 37.7% and 36.0% respectively

# The destination of domestic value added produced in India

- Of the total domestic value added produced by the manufacturing sector in India, 27.1% reflected foreign final demand in 2011, higher than 2009 (23.8%) and 2008 (26.3%) – Amongst BRIICS economies India had the third highest level of export orientation, above China, Brazil, and Indonesia
- At the total economy level, 18.6% of India's domestic value added was driven by foreign final demand, but significant differences exist across industries
  - Other manufacturing (63.0%) and Mining (39.9%) had the highest level of export orientation in India, with the lowest shares in Non-metallic minerals (8.3%) and Agriculture (8.8%)
- Looking only at exports of intermediates goods and services in value-added terms, India's major export destinations in 2011 were: China (12.7%), the United States (12.1%) the United Kingdom (5.9%), and Germany (4.6%)

# The importance of services

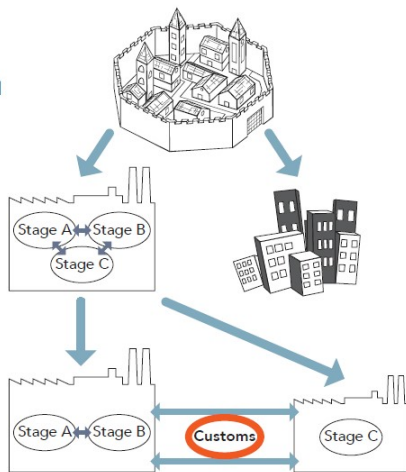
- In 2011 the service content of total exports in India was 57.5%, above the OECD average of 54.3%
  - At the individual sectoral level, the services content of exports was below the OECD average in most industries. The highest shares were in the Other manufacturing (55.0%), Textiles & apparel (43.7%) and ICT & electronics (39.4%) industries
- For exports of manufactured goods alone, just over one-third (33.8%) of the total value reflected services sector value-added, below the OECD average (36.9%)
  - Of this share, the Wholesale, retail & hotels sector accounted for 14.6% of total gross exports, with Transport & telecoms and Finance & insurance accounting for 7.0% and 6.1% respectively
- The origin of domestic consumption – In 2011, 16.2% of India's total final domestic consumption reflected foreign content, of which Europe contributed 3.5 percentage points, NAFTA 2.1 pp, East and Southeast Asia 4.4 pp, South and Central America 0.4 pp and other regions 5.9 pp

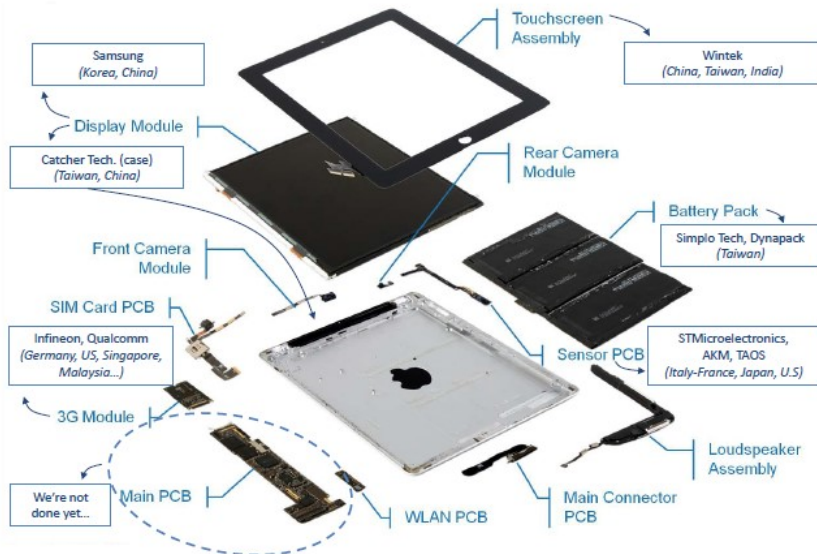


Steam revolution



Information and communication technology revolution







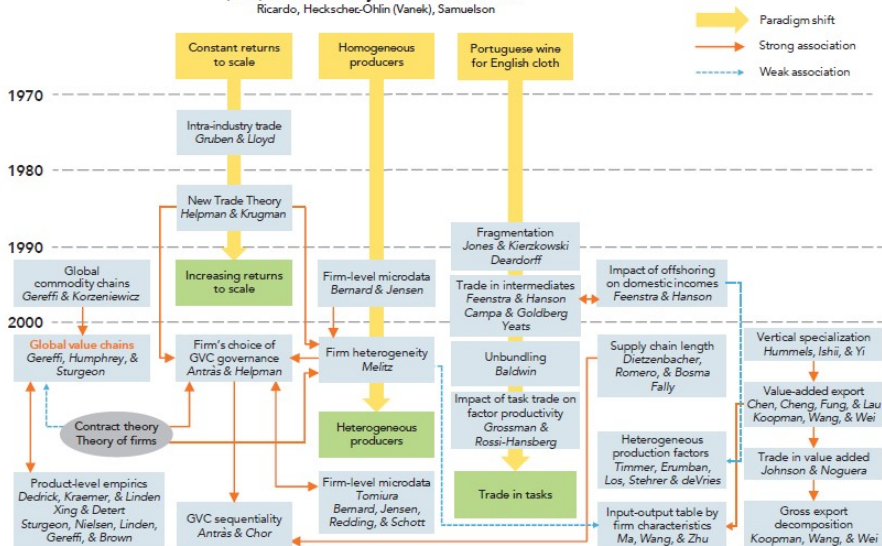
	Average Annual Growth of Real Value Added in the 1990s	Average Annual Growth in in Real Value Added in 2000-08
Furniture and other manufacturing nec	29.7	13.0
Electrical machinery and apparatus, nec	15.8	12.3
Wearing apparel, dressing and dyeing of fur	15.5	9.0
Textiles products	12.8	8.0
Machinery and equipment nec	14.0	7.1
Non-metallic mineral products	9.5	7.1
Chemicals and chemical products	10.1	3.8
Basic metals	17.5	3.3
Radio, television and communication equipment	14.8	1.8
Tobacco and related products	7.7	-1.4
Rubber and plastic products	8.5	-2.0
Others	10.1	8.5
Total manufacturing	11.5	8.7

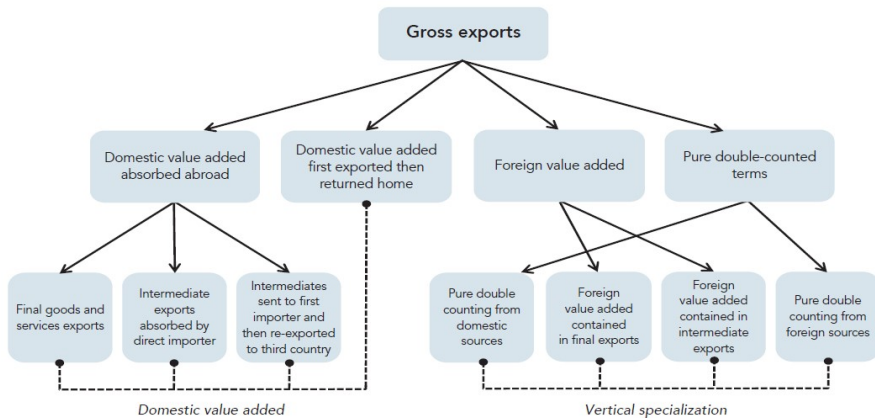
Average annual growth rates of value added are calculated from the Annual Surveys of Industries. Double deflation method is used. 2000s is 2000-01 to 2008-09.

Source: [Banga 2014](#) [Hollowing Out](#)

# (Neo) classical theory of international trade

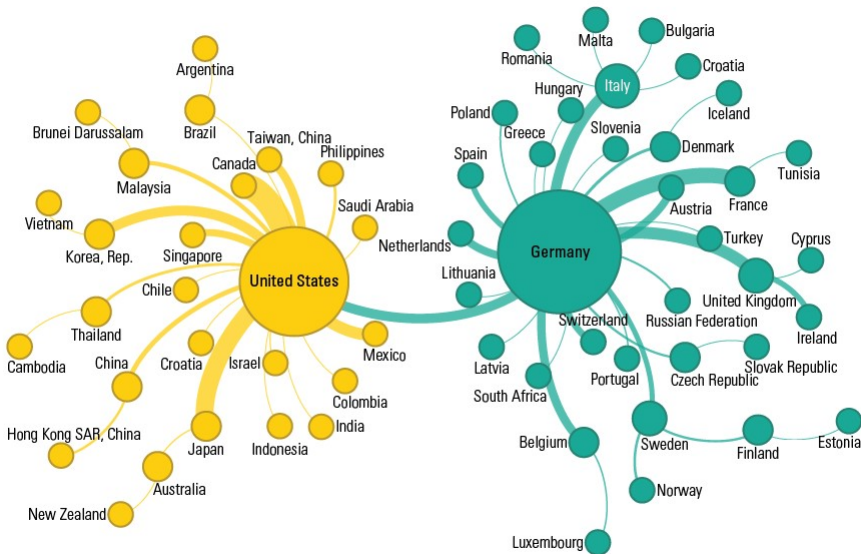
Ricardo, Heckscher-Ohlin (Vanek), Samuelson





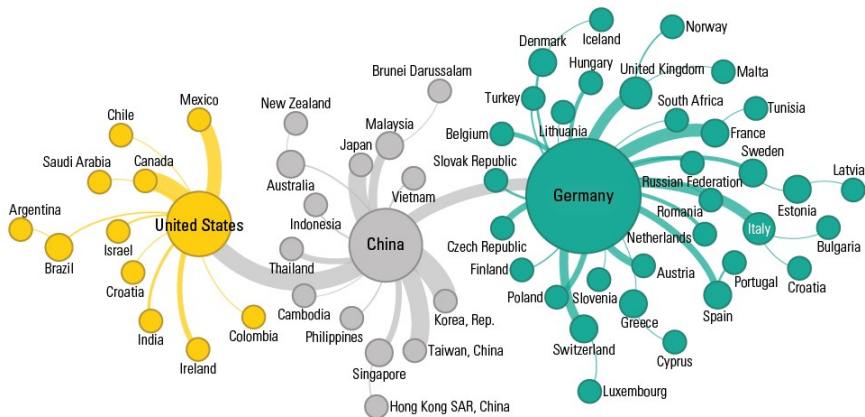
Source: [Koopman et al. 2016](#) Empirical Literature

In 1995, Germany and the United States were at the core of the network



Source: [Santoni and Taglioni 2015](#)

In 2011, Germany, China, and the United States were at the core of the network



Source: [Santoni and Taglioni 2015](#) GVC Network

## Determinants of Firm-Level GVC Entry

$$P(gvc_{it} = 1) = P(R_{it} > c_{it} + S(1 - gvc_{it-1})) \quad (1)$$

$$P(gvc_{it} = 1) = P(\pi_{it} = \beta firm_{it} + \gamma policy_{st} + S(1 - gvc_{it-1}) > 0) \quad (2)$$

$$gvc_{it} = \alpha_0 + \beta firm_{it} + \gamma policy_{st} + D_i + D_s + D_t + \epsilon_{it} \quad (3)$$

$$gvc_{it} = \alpha_0 + \beta_1 lnemp_{it} + \beta_2 lnage_{it} + \beta_3 fdi_{it} + \beta_4 lnwage_{it} + \beta_5 lntfp_{it} \\ + \gamma policy_{st} + D_i + D_s + D_t + \epsilon_{it} \quad (4)$$

$$gvc_{it} = \alpha_0 + \beta_1 lnemp_{it} + \beta_2 lnage_{it} + \beta_3 fdi_{it} + \beta_4 lnwage_{it} + \beta_5 lntfp_{it} \\ + \gamma_1 epz_{st} + \gamma_2 open_{st} + \gamma_3 connect_{st} + \gamma_4 competitive_{st} + \gamma_5 invest_{st} \\ + \gamma_6 domest_{st} + D_i + D_s + D_t + \epsilon_{it} \quad (5)$$