Rise of Global Value Chains and Trade in Value Added

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Contents

Change of trade pattern

◎ Pre-industrial Revolution:

→ The village market place

Low production technology, high transport cost, lack of information

◎ Industrial Revolution:

→ Mass-production, mass-consumption

Specialization in production, decrease of transportation cost

◎ Post-industrial Revolution:

→ Outsourcing, Fragmentation, Vertical Specialization, Global Supply Chains, Trade in tasks

Reduction of communication cost, trade barriers, flow of FDI

Simple concept of GVCs

Planning of product

R&D/Design/Testing production

Procurement of parts & component

Assembly

Final products

Marketing/sale/export

Customer service/user support

Simple concept of GVCs

Planning of product
↓
R&D/Design/Testing production
↓
Procurement of parts & components
↓
Assembly
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Final products
↓
Marketing/sale/export
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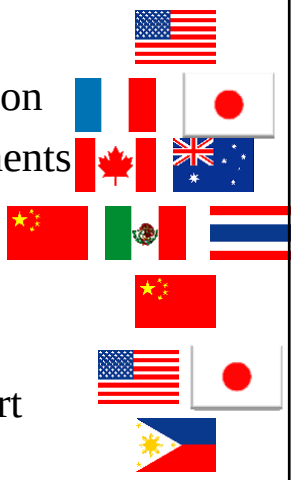
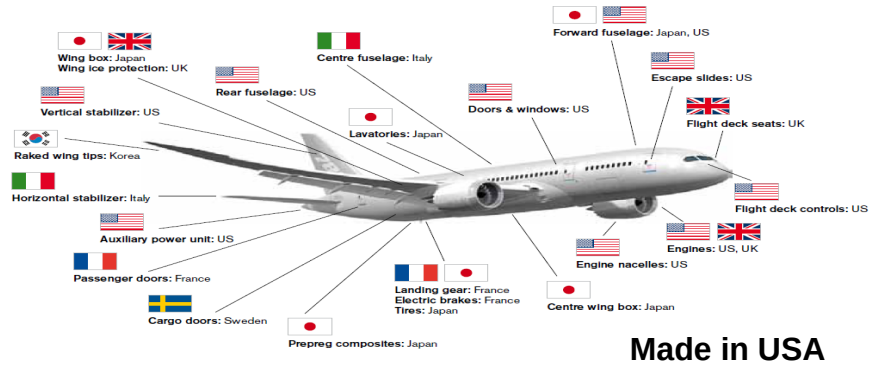
Customer service/user support



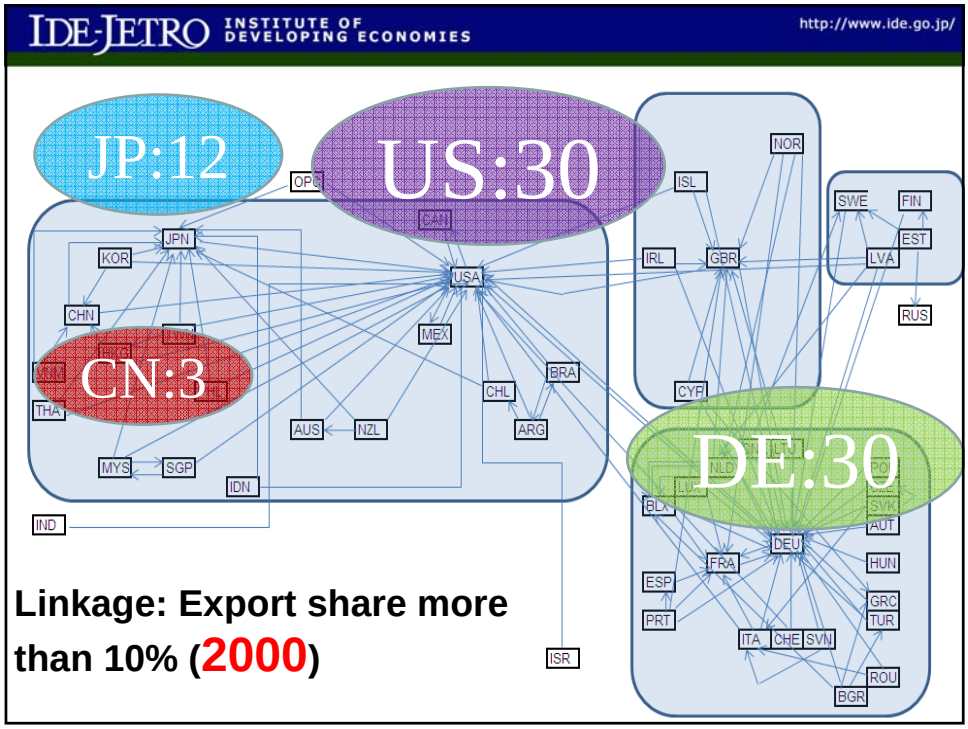
Fragmentation production

The fragmentation of production: The example of the Boeing 787 Dreamliner



Made in USA
↓
Made in the World

Source: Meng and Miroudot (2011).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JP:12
US:30
CN:3
DE:30
Linkage: Export share more than 10% (2000)
OPC
CAN
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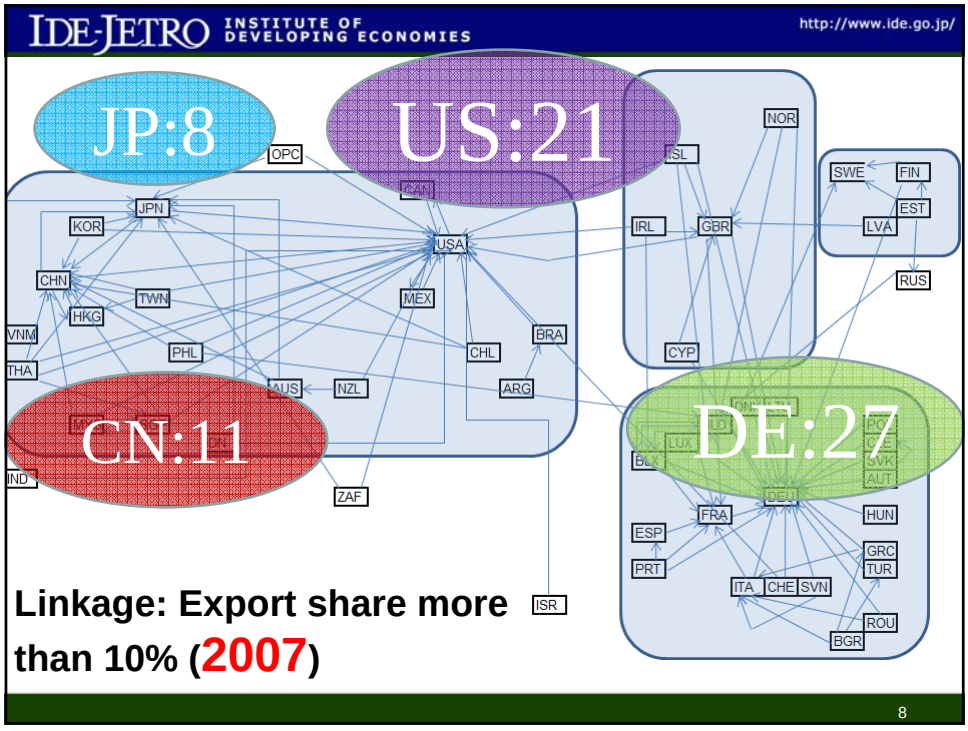
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ARG
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ZAF
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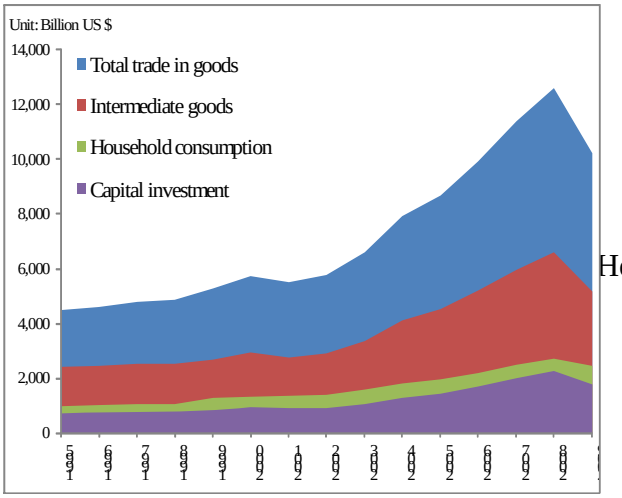
Contribution of trade in intermediate goods



Contribution rate

Before 2002 vs after 2002

Intermediate goods:

38%→54%

Household consumption:

34%→19%

Capital goods:

16%→20%

Source: calculated by Bo MENG and Norihiko YAMANO, 2011 (using OECD data, preliminary)

How to measure GVCs

Why we need measurement of GVCs：

◎Increasing complexity of GVCs

→ “What you see is No More what you get.”

◎Policy needs

→ “You can’t manage what you can’t measure.”

Main data sources used in measuring GVCs

- Firm based data（Apple, Toyota）

Micro level, but lack of global viewpoint

- Bilateral trade data（import and export）

Global, but no inter-industry information

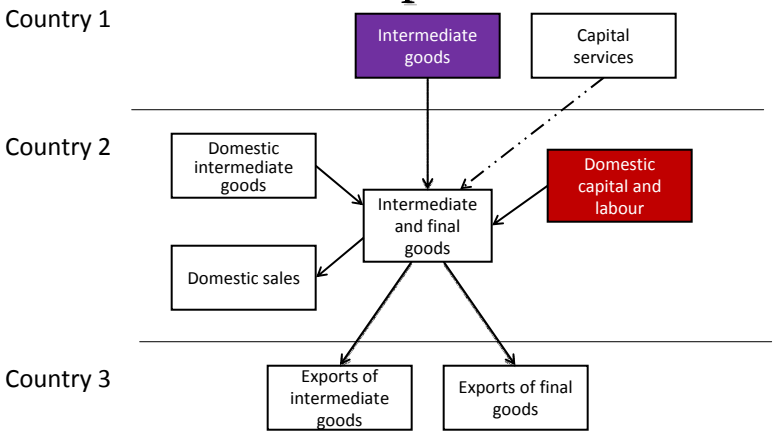
- National input-output data

Inter-industry, but lack of global aspect

- International input-output data

Inter-country, inter-industry, but time lag (almost 5 years)

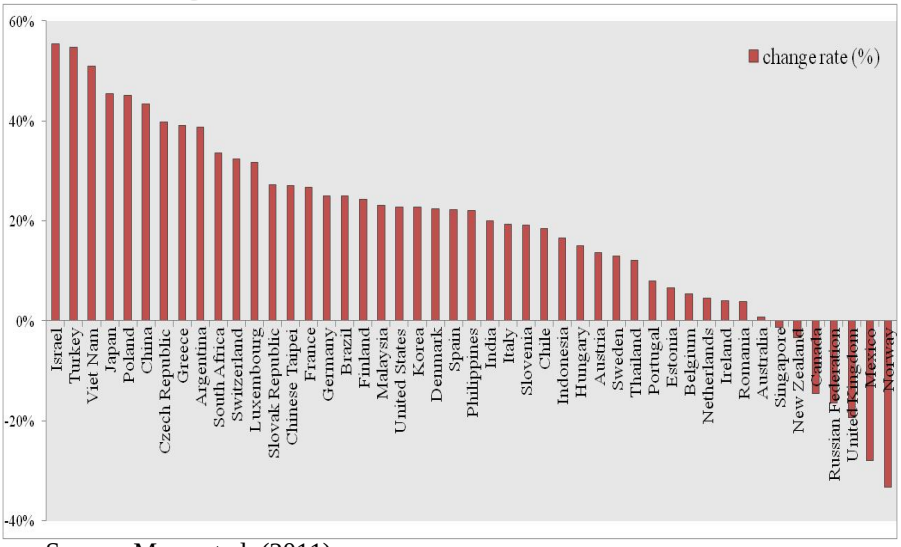
Vertical specialisation



VS share = induced intermediate imports / total exports

(=Hummels, et al. (2001) 's "Import contents of export")

The change rate of VS share between 1995 and 2005



Source: Meng et al. (2011)

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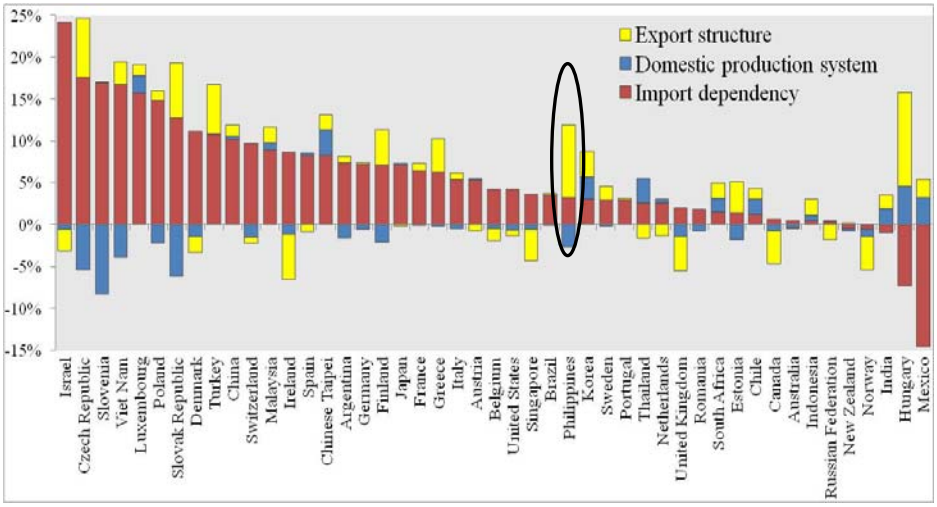
Structural decomposition analysis on vertical specialization indicator

I-O based decomposition technique =>

ΔVS share = f (Δm, ΔB, Δe)

m: import dependency,
B: domestic inter-industrial production system,
e: export structure.

The decomposition result of the change in VS share



Source: Meng et al. (2011)

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Decomposition of fragmentation process

Applying international I-O based decomposition technique to the fragmentation measure:

Total Fragmentation degree = VS + IDF

VS: Conventional Vertical Specialisation indicator

IDF: Indirect Fragmentation Indicator (IDF)

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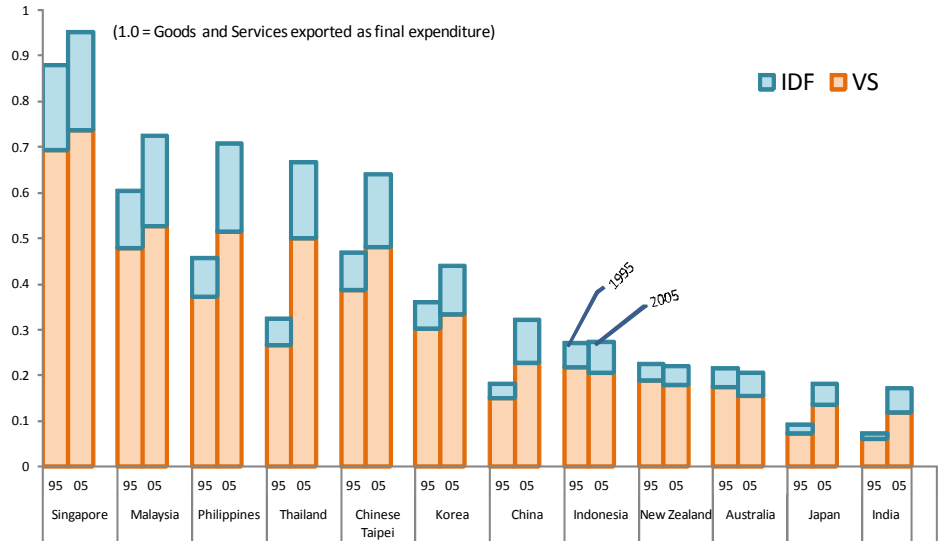
Asian fragmentation index based on international IO data (1995/2005)



Source: Meng and Yamano (2011)

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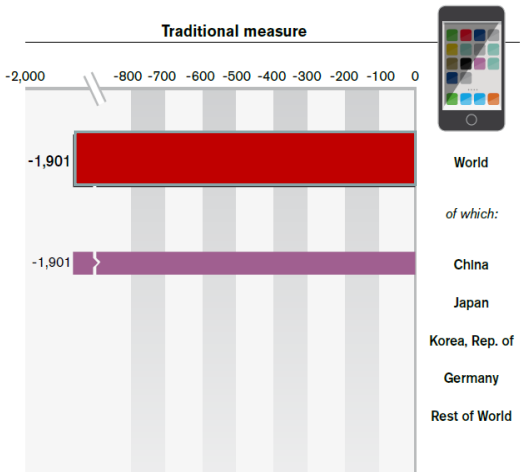
Trade in value added and its measurement

Apple sold 11.3 million iPhones in the US in 2009

Source: Based on The iPhone example (Xing and Detert, 2010)

2009 US trade balance in iPhones (in millions of US$)



Source: WTO-IDE-JETRO (2011)

How to measure Trade in Value Added

- **Single national IO based measure**

$u \bullet EX = V \bullet B \bullet EX + u \bullet M \bullet B \bullet EX$

(Total export) (domestic VA of export) (import contents of export)

- **International IO based measure**

Country R's export of value added to country S:

$VA^{RS} = V^{R} \bullet L^{RR} \bullet FD^{RS} + V^{R} \bullet L^{RS} \bullet FD^{SS}$

=>Trade balance:

$\Sigma_S VA^{RS} - \Sigma_S VA^{SR} = \Sigma_S EX^{RS} - \Sigma_S EX^{SR}$

US-China trade balance: Traditional statistics versus value added terms (in billions of US$)

Note: China's processing trade data not available for 2000.

Sources: UN Comtrade database and WTO estimates.

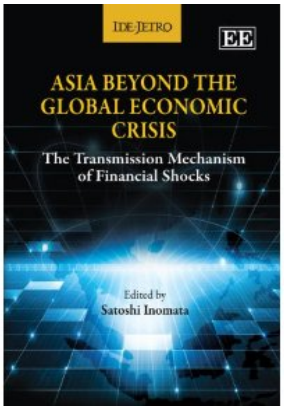
Summary

・Change of trade pattern：
Trade in goods→Trade in Tasks

・ Rise of GVCs：“Made in the world”

・ Measure of GVCs and related policy issue：“Who produces for whom?”

Reference 1



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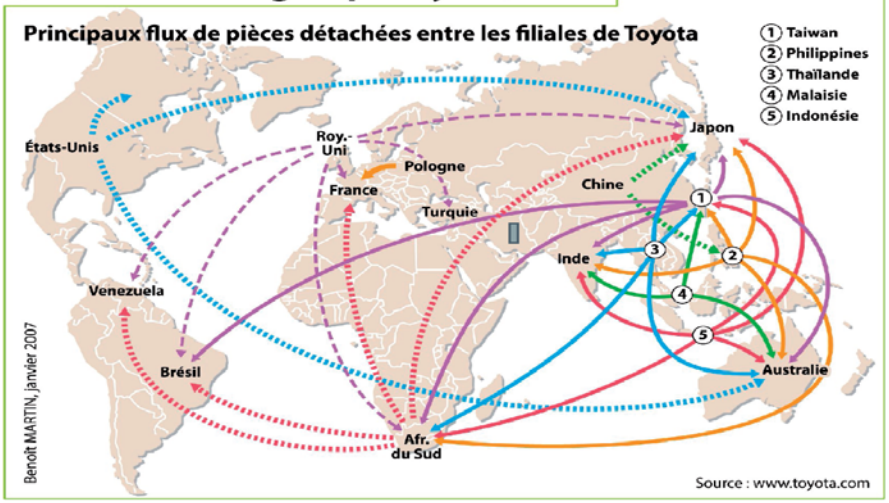
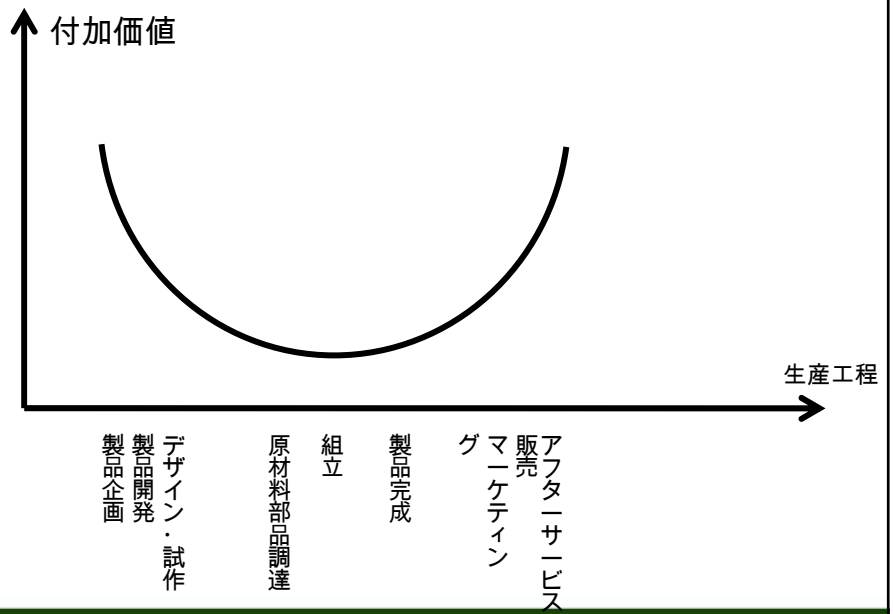
世銀： http://go.worldbank.org/R156ABXQQ0

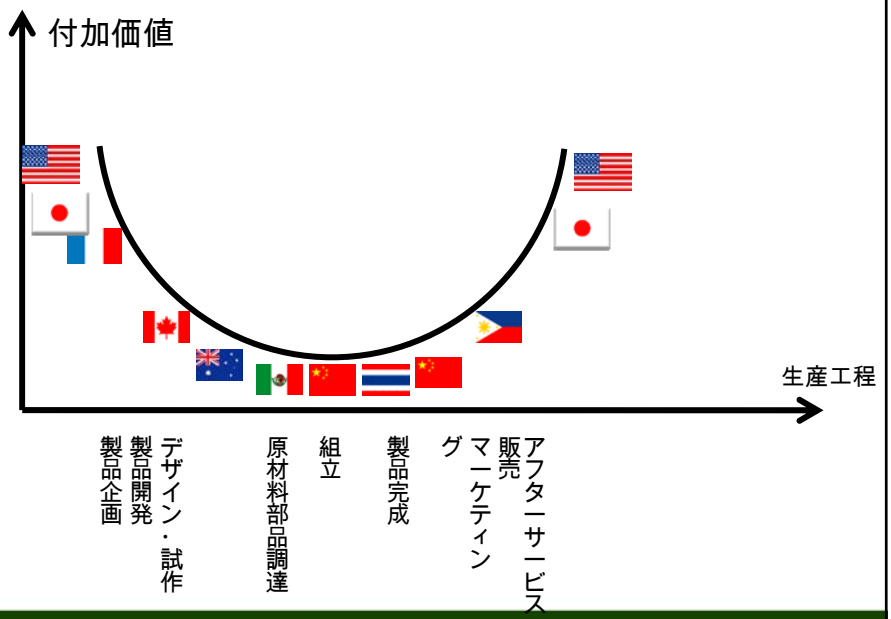
WTO: http://www.wto.org/english/res_e/statis_e/miwi_e/miwi_e.htm

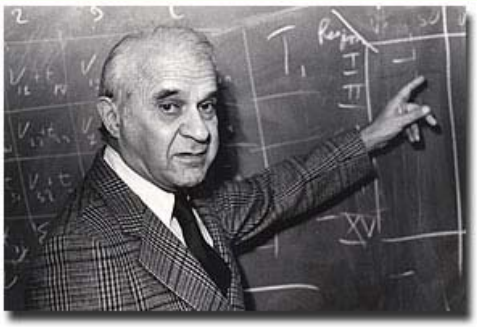
Production du groupe Toyota, 2004



in Marie-Françoise Durand, Benoît Martin, Delphine Placidi, Philippe Copinschi, *Atlas de la Mondialisation*, Presses de Sciences Po, Paris, 2008







Wassily Leontief (1906-1999). Russian economist. Nobel Prize in Economics, 1973.

Application to the measure of GVCs :

$V \bullet (I + A^1 + A^2 + A^3 + \ldots + A^n) \bullet F$

$= V \bullet (I - A)^{-1} \bullet F, \quad n \to \infty$

Source: http://www.iioa.org/leontief/Photos/photo-harvard.html

Figure 5: Layout of Asian I-O 2000

		Intermediate Demand (A)											Final Demand (F)										Export (L)				
		Indonesia	Malaysia	Philippines	Singapore	Thailand	China	Taiwan	Korea	Japan	U.S.A.		Indonesia	Malaysia	Philippines	Singapore	Thailand	China	Taiwan	Korea	Japan	U.S.A.	Export to H.Kong	Export to EU	Export to R.O.W.	Discrepancy	Total Outputs
	code	(AI)	(AM)	(AP)	(AS)	(AT)	(AC)	(AN)	(AK)	(AJ)	(AU)		(FI)	(FM)	(FP)	(FS)	(FT)	(FC)	(FN)	(FK)	(FJ)	(FU)	(LH)	(LO)	(LW)	(QX)	(XX)
Indonesia	(AI)	A^{II}	A^{IM}	A^{IP}	A^{IS}	A^{IT}	A^{IC}	A^{IN}	A^{IK}	A^{IJ}	A^{IU}		F^{II}	F^{IM}	F^{IP}	F^{IS}	F^{IT}	F^{IC}	F^{IN}	F^{IK}	F^{IJ}	F^{IU}	L^{IH}	L^{IO}	L^{IW}	Q^{I}	X^{I}
Malaysia	(AM)	A^{MI}	A^{MM}	A^{MP}	A^{MS}	A^{MT}	A^{MC}	A^{MN}	A^{MK}	A^{MJ}	A^{MU}		F^{MI}	F^{MM}	F^{MP}	F^{MS}	F^{MT}	F^{MC}	F^{MN}	F^{MK}	F^{MJ}	F^{MU}	L^{MH}	L^{MO}	L^{MW}	Q^{M}	X^{M}
Philippines	(AP)	A^{PI}	A^{PM}	A^{PP}	A^{PS}	A^{PT}	A^{PC}	A^{PN}	A^{PK}	A^{PJ}	A^{PU}		F^{PI}	F^{PM}	F^{PP}	F^{PS}	F^{PT}	F^{PC}	F^{PN}	F^{PK}	F^{PJ}	F^{PU}	L^{PH}	L^{PO}	L^{PW}	Q^{P}	X^{P}
Singapore	(AS)	A^{SI}	A^{SM}	A^{SP}	A^{SS}	A^{ST}	A^{SC}	A^{SN}	A^{SK}	A^{SJ}	A^{SU}		F^{SI}	F^{SM}	F^{SP}	F^{SS}	F^{ST}	F^{SC}	F^{SN}	F^{SK}	F^{SJ}	F^{SU}	L^{SH}	L^{SO}	L^{SW}	Q^{S}	X^{S}
Thailand	(AT)	A^{TI}	A^{TM}	A^{TP}	A^{TS}	A^{TT}	A^{TC}	A^{TN}	A^{TK}	A^{TJ}	A^{TU}		F^{TI}	F^{TM}	F^{TP}	F^{TS}	F^{TT}	F^{TC}	F^{TN}	F^{TK}	F^{TJ}	F^{TU}	L^{TH}	L^{TO}	L^{TW}	Q^{T}	X^{T}
China	(AC)	A^{CI}	A^{CM}	A^{CP}	A^{CS}	A^{CT}	A^{CC}	A^{CN}	A^{CK}	A^{CJ}	A^{CU}		F^{CI}	F^{CM}	F^{CP}	F^{CS}	F^{CT}	F^{CC}	F^{CN}	F^{CK}	F^{CJ}	F^{CU}	L^{CH}	L^{CO}	L^{CW}	Q^{C}	X^{C}
Taiwan	(AN)	A^{NI}	A^{NM}	A^{NP}	A^{NS}	A^{NT}	A^{NC}	A^{NN}	A^{NK}	A^{NJ}	A^{NU}		F^{NI}	F^{NM}	F^{NP}	F^{NS}	F^{NT}	F^{NC}	F^{NN}	F^{NK}	F^{NJ}	F^{NU}	L^{NH}	L^{NO}	L^{NW}	Q^{N}	X^{N}
Korea	(AK)	A^{KI}	A^{KM}	A^{KP}	A^{KS}	A^{KT}	A^{KC}	A^{KN}	A^{KK}	A^{KJ}	A^{KU}		F^{KI}	F^{KM}	F^{KP}	F^{KS}	F^{KT}	F^{KC}	F^{KN}	F^{KK}	F^{KJ}	F^{KU}	L^{KH}	L^{KO}	L^{KW}	Q^{K}	X^{K}
Japan	(AJ)	A^{JI}	A^{JM}	A^{JP}	A^{JS}	A^{JT}	A^{JC}	A^{JN}	A^{JK}	A^{JJ}	A^{JU}		F^{JI}	F^{JM}	F^{JP}	F^{JS}	F^{JT}	F^{JC}	F^{JN}	F^{JK}	F^{JJ}	F^{JU}	L^{JH}	L^{JO}	L^{JW}	Q^{J}	X^{J}
U.S.A.	(AU)	A^{UI}	A^{UM}	A^{UP}	A^{US}	A^{UT}	A^{UC}	A^{UN}	A^{UK}	A^{UJ}	A^{UU}		F^{UI}	F^{UM}	F^{UP}	F^{US}	F^{UT}	F^{UC}	F^{UN}	F^{UK}	F^{UJ}	F^{UU}	L^{UH}	L^{UO}	L^{UW}	Q^{U}	X^{U}
Freight and Insurance	(BF)	BA^{I}	BA^{M}	BA^{P}	BA^{S}	BA^{T}	BA^{C}	BA^{N}	BA^{K}	BA^{J}	BA^{U}		BF^{I}	BF^{M}	BF^{P}	BF^{S}	BF^{T}	BF^{C}	BF^{N}	BF^{K}	BF^{J}	BF^{U}					
Import from H. Kong	(CH)	A^{HI}	A^{HM}	A^{HP}	A^{HS}	A^{HT}	A^{HC}	A^{HN}	A^{HK}	A^{HJ}	A^{HU}		F^{HI}	F^{HM}	F^{HP}	F^{HS}	F^{HT}	F^{HC}	F^{HN}	F^{HK}	F^{HJ}	F^{HU}					
Import from EU	(CO)	A^{OI}	A^{OM}	A^{OP}	A^{OS}	A^{OT}	A^{OC}	A^{ON}	A^{OK}	A^{OJ}	A^{OU}		F^{OI}	F^{OM}	F^{OP}	F^{OS}	F^{OT}	F^{OC}	F^{ON}	F^{OK}	F^{OJ}	F^{OU}					
Import from the R.O.W.	(CW)	A^{WI}	A^{WM}	A^{WP}	A^{WS}	A^{WT}	A^{WC}	A^{WN}	A^{WK}	A^{WJ}	A^{WU}		F^{WI}	F^{WM}	F^{WP}	F^{WS}	F^{WT}	F^{WC}	F^{WN}	F^{WK}	F^{WJ}	F^{WU}					
Duties & Import Taxes	(DT)	DA^{I}	DA^{M}	DA^{P}	DA^{S}	DA^{T}	DA^{C}	DA^{N}	DA^{K}	DA^{J}	DA^{U}		DF^{I}	DF^{M}	DF^{P}	DF^{S}	DF^{T}	DF^{C}	DF^{N}	DF^{K}	DF^{J}	DF^{U}					
Value Added	(VV)	V^{I}	V^{M}	V^{P}	V^{S}	V^{T}	V^{C}	V^{N}	V^{K}	V^{J}	V^{U}																
Total Inputs	(XX)	X^{I}	X^{M}	X^{P}	X^{S}	X^{T}	X^{C}	X^{N}	X^{K}	X^{J}	X^{U}																

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Appendix1
IO based Factor decomposition technique

VS share = u•m•L•EX/u•EX = u•m•L•e,

ΔVS share=VS share1 - VS share0=u(m1•L1•e1 - m0•L0•e0)

= u•Δm• (2L0•e0 +2L1•e1+ L0•e1+ L1•e0)/6

+ u• (2m0•ΔL•e0 + 2m1•ΔL•e1 + m0•ΔL•e1 + m1•ΔL•e0)/6

+ u• (2m0•L0 + 2m1•L1 + m0•L1 + m1•L0) •Δe /6.

Δm: the change in import dependency,

ΔL: the change in domestic backward linkage,

Δe: the change in export structure.

Appendix 2
Decomposition of fragmentation process

Total intermediate trade (3-country international I-O model):

A X=A (I-A)-1 F= A B F

Trade induced by country 1's exports of final goods(EX^1_{fd}):

$$u \cdot A \cdot (I - A)^{-1} \cdot EX^1_{fd}$$

$$= u \begin{pmatrix} 0 & 0 & 0 \\ A^{21} & 0 & 0 \\ A^{31} & 0 & 0 \end{pmatrix} \cdot B \cdot \begin{pmatrix} EX^1_{fd} \\ 0 \\ 0 \end{pmatrix} + u \begin{pmatrix} 0 & A^{12} & A^{13} \\ 0 & 0 & A^{23} \\ 0 & A^{32} & 0 \end{pmatrix} \cdot B \cdot \begin{pmatrix} EX^1_{fd} \\ 0 \\ 0 \end{pmatrix} + u \begin{pmatrix} A^{11} & 0 & 0 \\ 0 & A^{22} & 0 \\ 0 & 0 & A^{33} \end{pmatrix} \cdot B \cdot \begin{pmatrix} EX^1_{fd} \\ 0 \\ 0 \end{pmatrix}$$

$$= \Phi^1 + \Phi^2 + \Phi^3$$

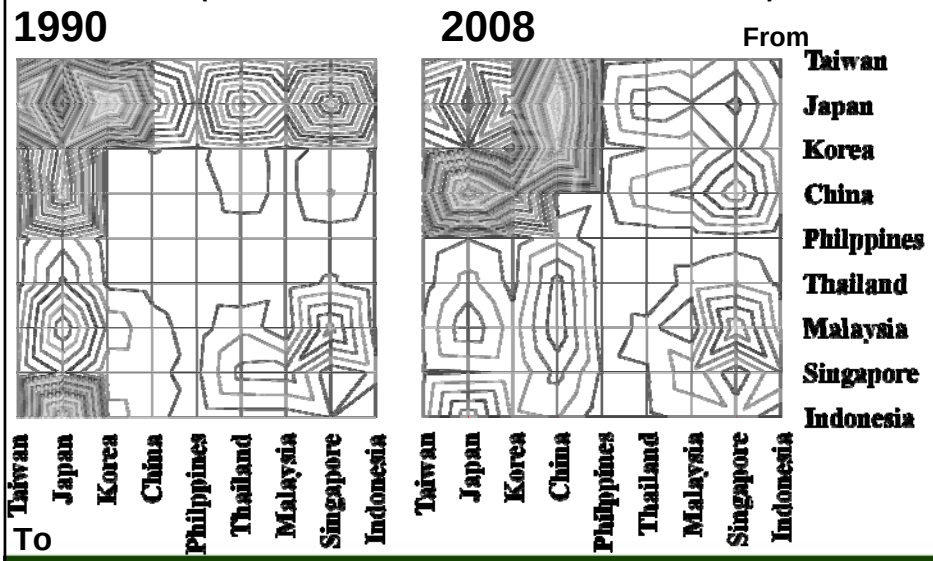
Φ1: VS based on single I-O table

Φ2: Indirect Fragmentation (IDF) index

Φ1 + Φ2: Total Fragmentation(TF) index

Φ3: induced intra-country transaction

Trade Structure and its Change in Asian Region
(Based on the trade in Intermediate Goods)



Inter-country backward linkages in Asian Region (Based on International Leontief Inverse)